ROYAL HASKONING

Halcrow

Cell 1 Regional Coastal Monitoring Programme
Update Report 1: 'Partial Measures' Survey 2009

Scarborough Borough Council
Final Report

June 2009

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
m	metres
ODN	Ordnance Datum Newlyn

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (mODN)			
	River Tyne to Frenchman's Bay	Frenchman's Bay to Souter Point	Souter Point to Chourdon Point	Chourdon Point to Hartlepool Headland
1 in 200 year	3.41	3.44	3.66	3.91
HAT	2.85	2.88	3.18	3.30
MHWS	2.15	2.18	2.48	2.70
MLWS	-2.15	-2.12	-1.92	-1.90

Water Level Parameter	Water Level (mODN)			
	Hartlepool Headland to Saltburn Scar	Skinningrove	Hummersea Scar to Sandsend Ness	Sandsend Ness to Saltwick Nab
1 in 200 year	3.87	3.86	4.1	3.88
HAT	3.25	3.18	3.15	3.10
MHWS	2.65	2.68	2.65	2.60
MLWS	-1.95	-2.13	-2.15	-2.20

Water Level Parameter	Water Level (mODN)			
	Saltwick Nab to Hundale Point	Hundale Point to White Nab	White Nab to Filey Brigg	Filey Brigg to Flamborough Head
1 in 200 year	3.88	3.93	3.93	4.04
HAT	3.10	3.05	3.05	3.10
MHWS	2.60	2.45	2.45	2.50
MLWS	-2.20	-2.35	-2.35	-2.30

Source: *River Tyne to Flamborough Head Shoreline Management Plan 2*. Royal Haskoning, February 2007.

Glossary of Terms

Term	Definition
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Downdrift	Direction of alongshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Fetch	Length of water over which a given wind has blown that determines the size of the waves produced.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks, also known as the intertidal zone.
Geomorphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Sea Level (MSL)	Average height of the sea surface over a 19-year period.
Offshore zone	Extends from the low water mark to a water depth of about 15 m and is permanently covered with water.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300 km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire.

The main elements of the Cell 1 Regional Coastal Monitoring Programme involve:

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- walk-over surveys

The beach profile surveys, topographic surveys and cliff top recession surveys are undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09	June 09 (*)	-

(*) The present report is **Update Report 1** and provides an analysis of the 2009 Partial Measures survey for Scarborough Borough Council's frontage. It is intended as a brief update of the key findings from this survey to maintain an understanding of ongoing changes.

1. Introduction

1.1 Study Area

Scarborough Borough Council's frontage extends from Staithes Harbour to Speeton (Filey Bay). For the purposes of this report, it has been sub-divided into eight areas, namely:

- Staithes
- Runswick Bay
- Sandsend Beach, Upgang Beach and Whitby Sands
- Robin Hood's Bay
- Scarborough North Bay
- Scarborough South Bay
- Cayton Bay
- Filey Bay

1.2 Methodology

Along Scarborough Borough Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
    - Beach profile surveys along 20 no. transect lines
    - Topographic survey at Runswick Bay
    - Topographic survey along the Sandsend to Whitby frontage
    - Topographic survey at Robin Hood's Bay
    - Topographic survey at Scarborough North Bay
    - Topographic survey at Scarborough South Bay
    - Topographic survey at Cayton Bay
    - Topographic survey at Filey Bay (Two surveys: Town and Bay coverage)

- Partial Measures survey annually each spring comprising:
    - Beach profile surveys along 20 no. transect lines
    - Topographic survey at Runswick Bay
    - Topographic survey at Robin Hood's Bay
    - Topographic survey at Filey Bay (Town coverage)

- Cliff top survey bi-annually at:
    - Staithes
    - Cayton Bay
    - Filey

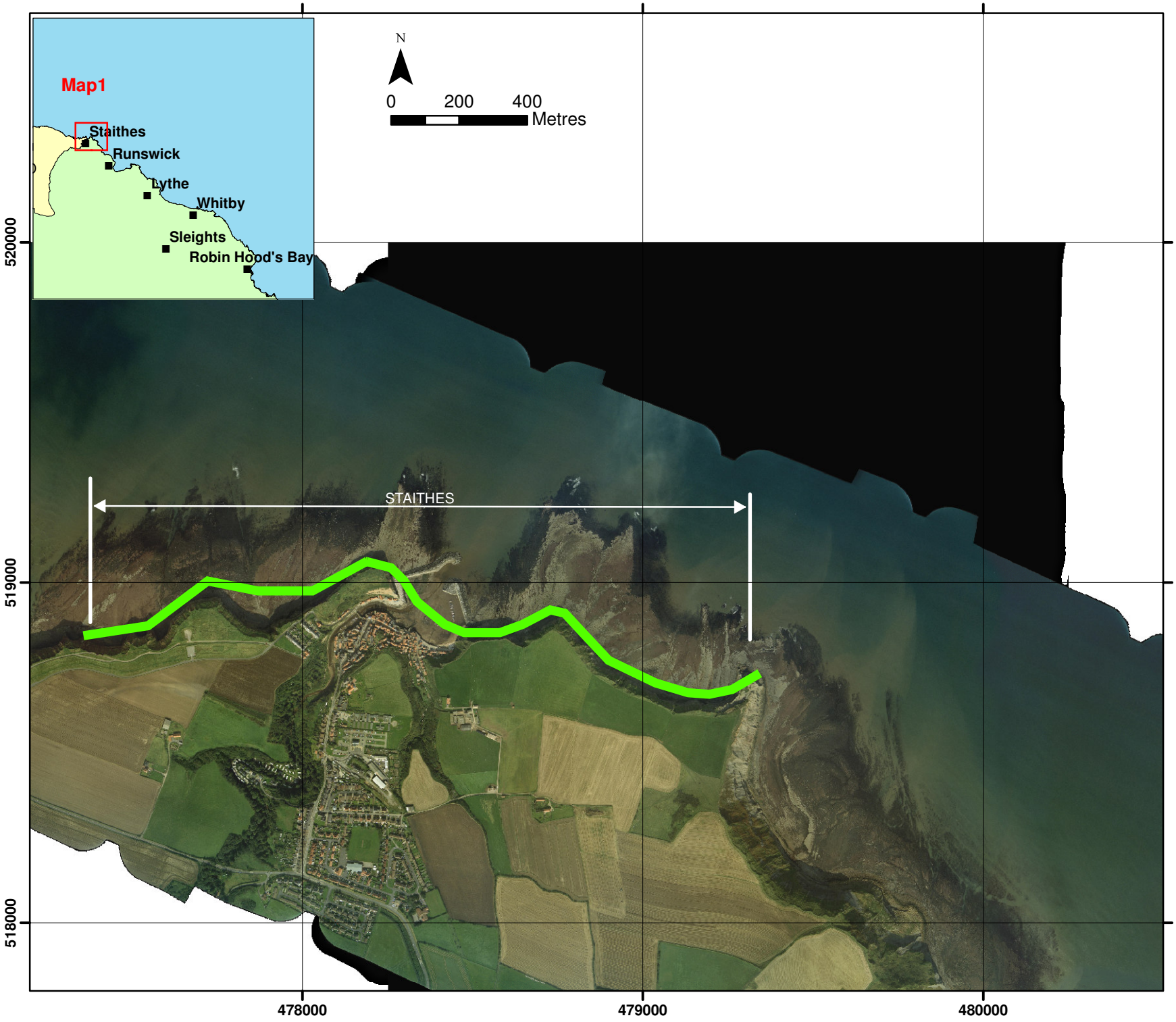
The location of these surveys is shown in Figure 1. Also enclosed on the accompanying CD-rom is a file which can be opened in Google Earth showing the locations of the surveys.

The Partial Measures survey was undertaken along this frontage in April 2009, when weather conditions were fine/ sunny and the sea state was calm (Staithes, Runswick Bay, Sandsend to Whitby frontage, Robin Hood's Bay, Scarborough North & South Bays, Filey Bay). In contrast the survey at Cayton Bay experienced wet weather and a calm sea.

The Update Report presents the following:

- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance its outputs (Section 4); and
- providing key conclusions and highlighting any areas of concern (Section 5).

Data from the present survey are presented in a processed form in the Appendices.



SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 1 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4

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Checked by:	RJ	Date: 28/05/2009
Approved by:	RJ	Date: 28/05/2009

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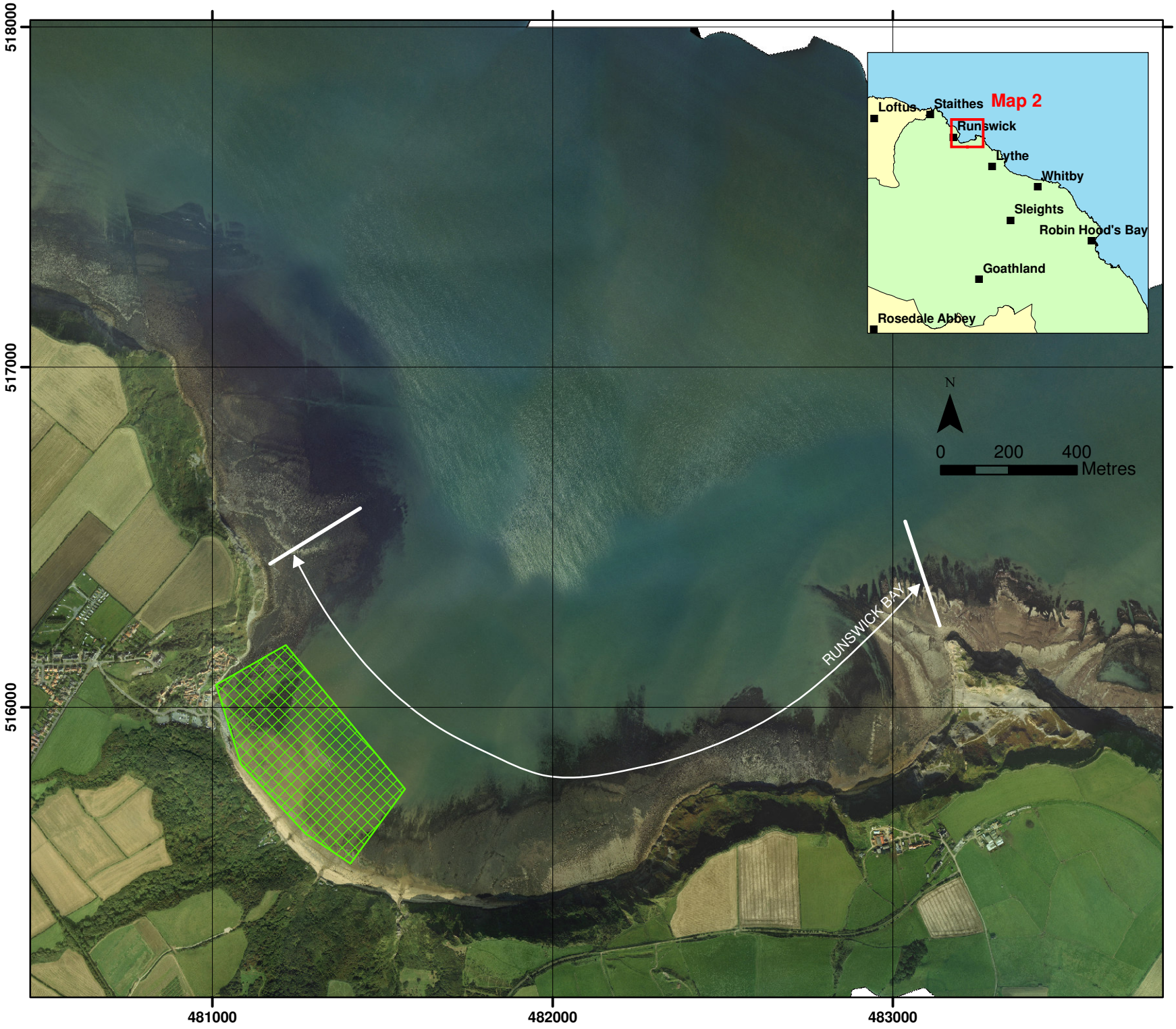

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

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Figure 1 - Map 2 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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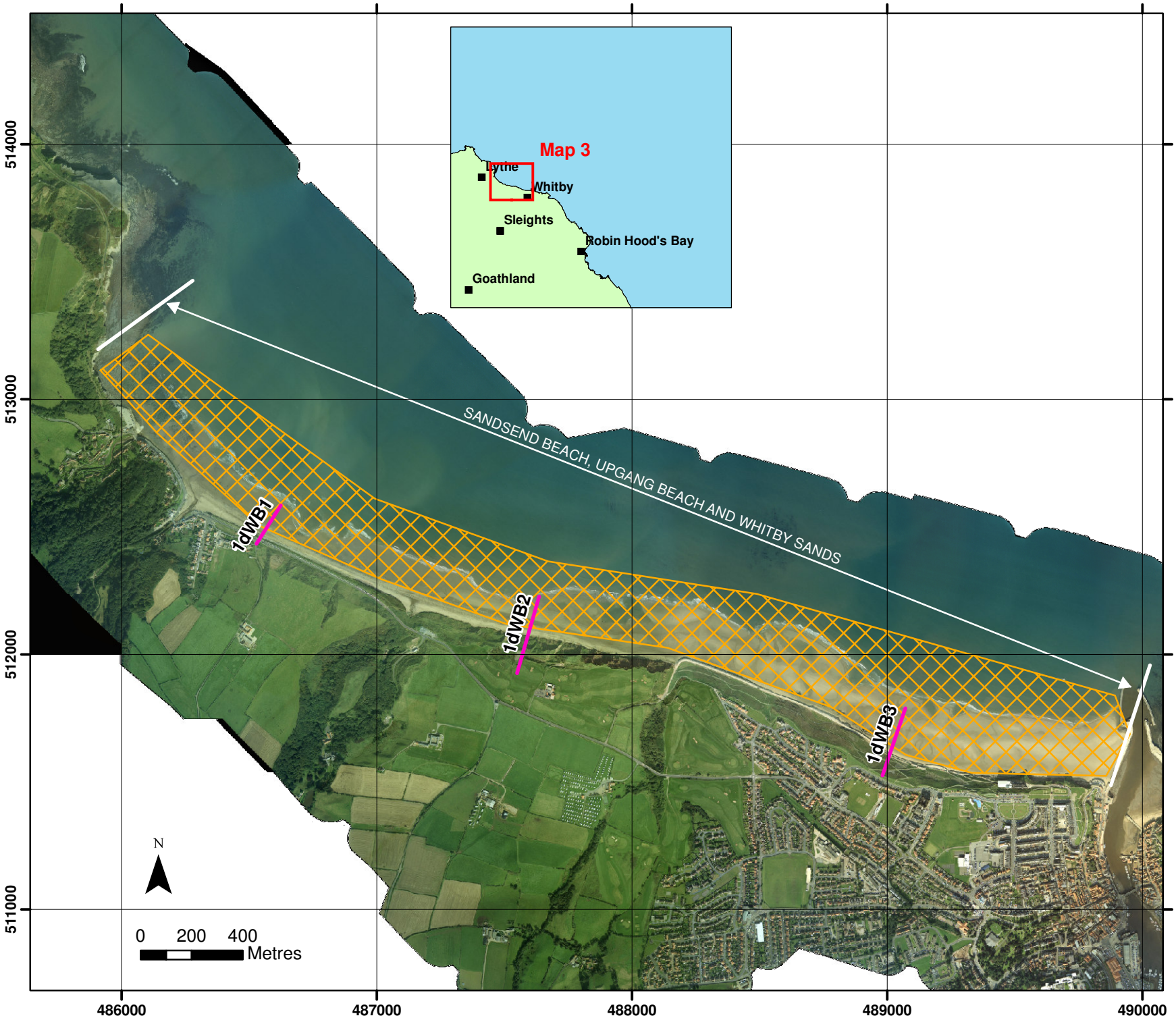

SURVEY LOCATIONS

Topographic Profiles
- Annual
- Bi-Annual

Topographic Surveys
- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs
- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 3 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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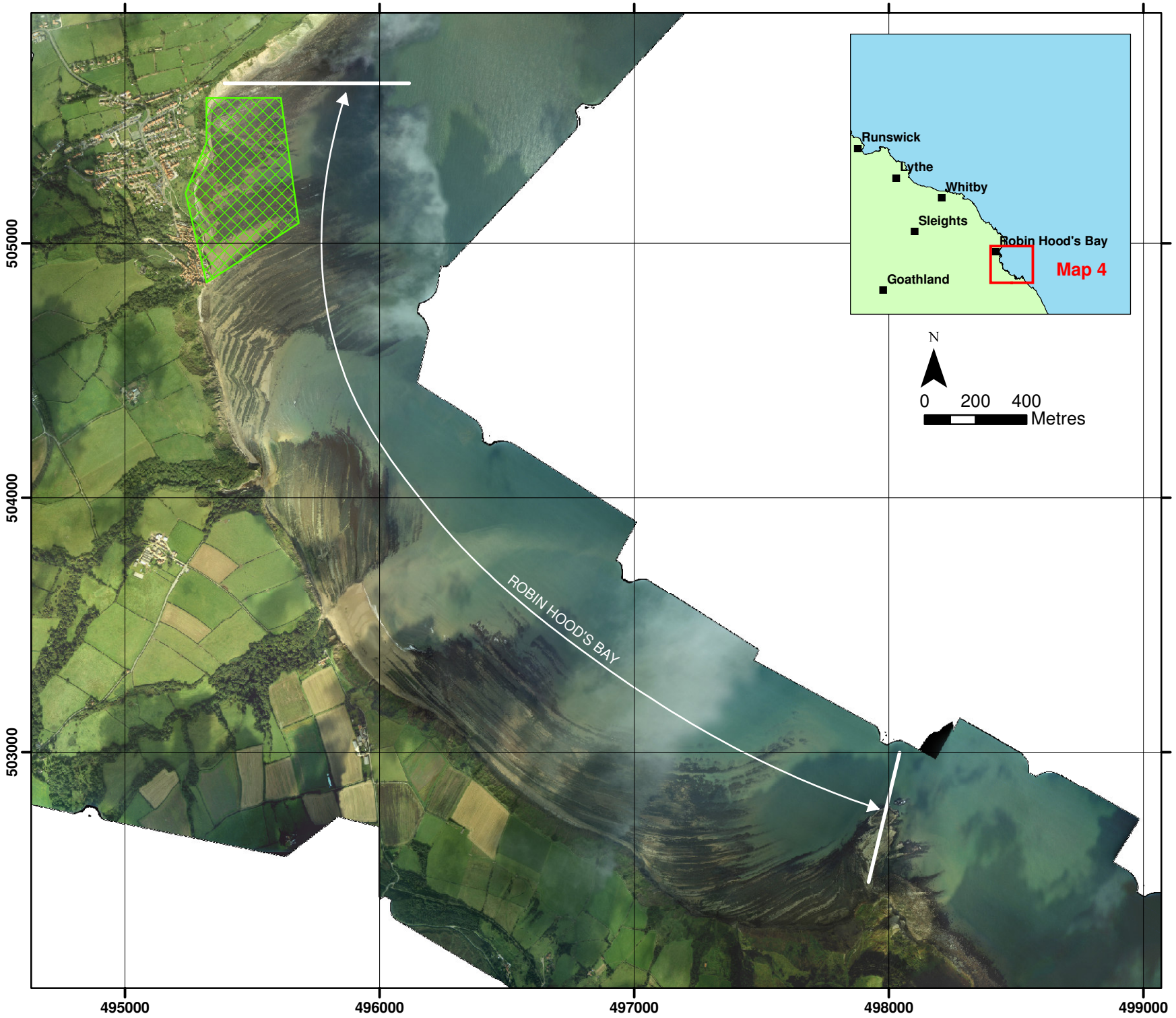

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 4 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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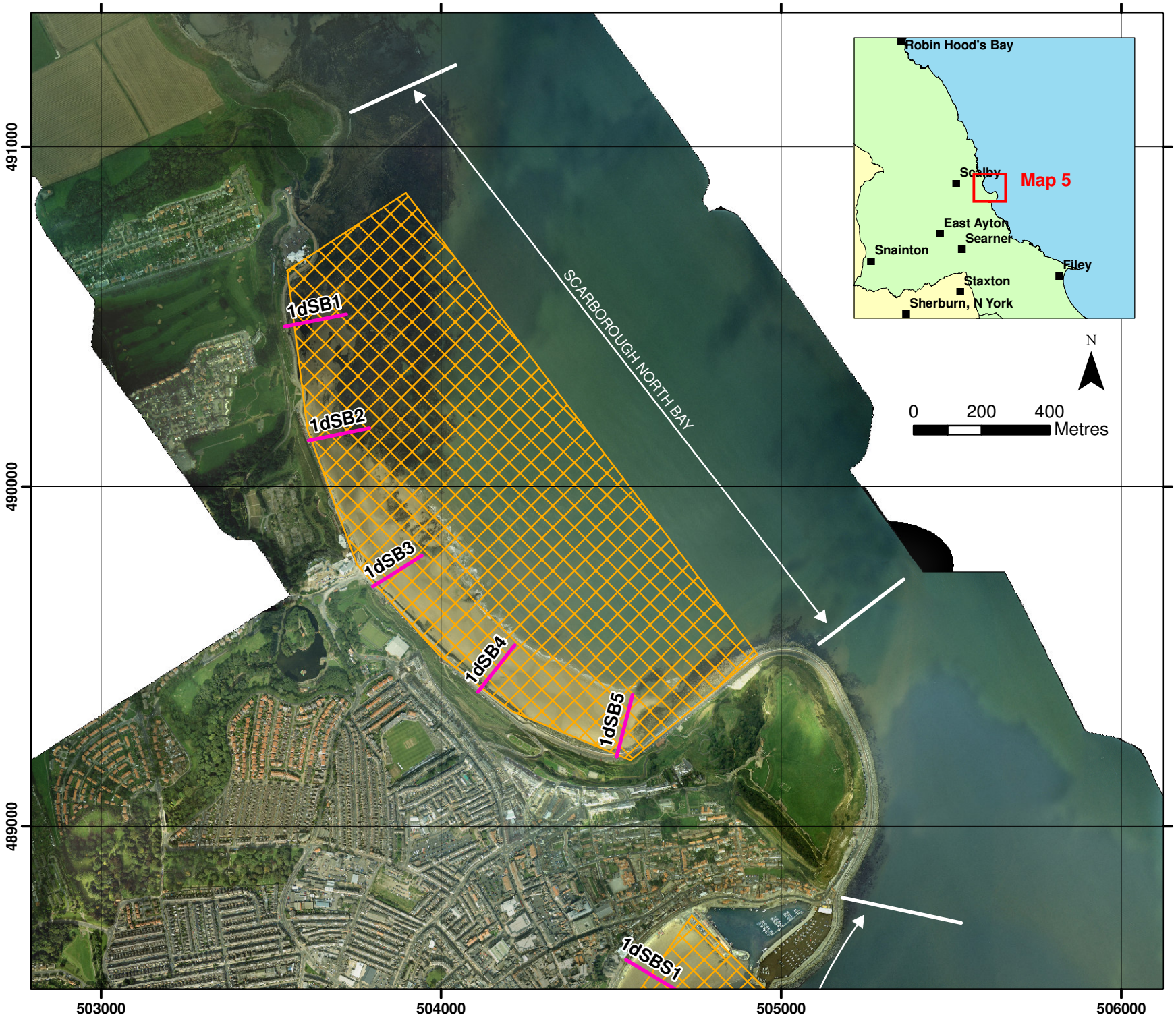

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 5 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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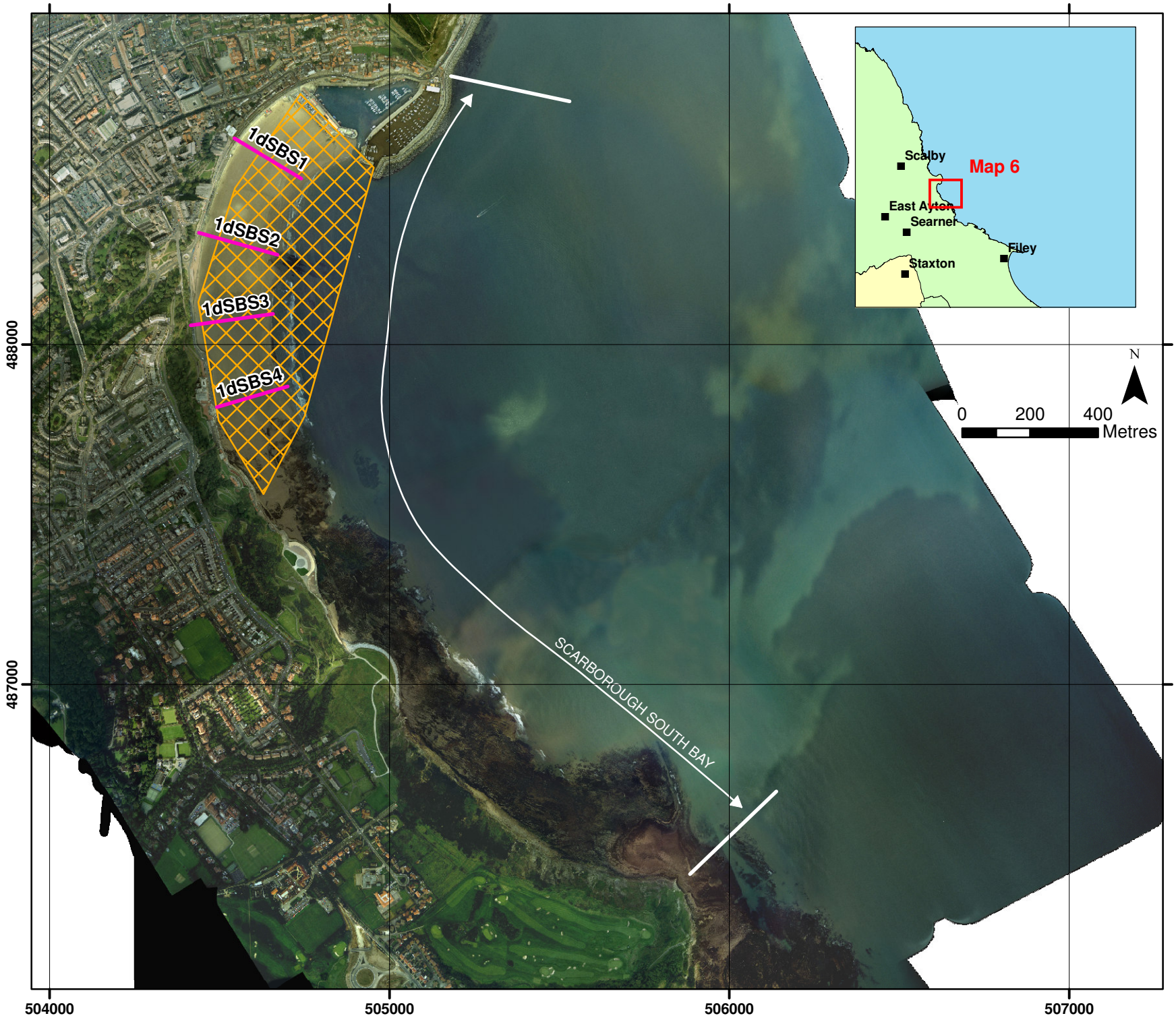

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 6 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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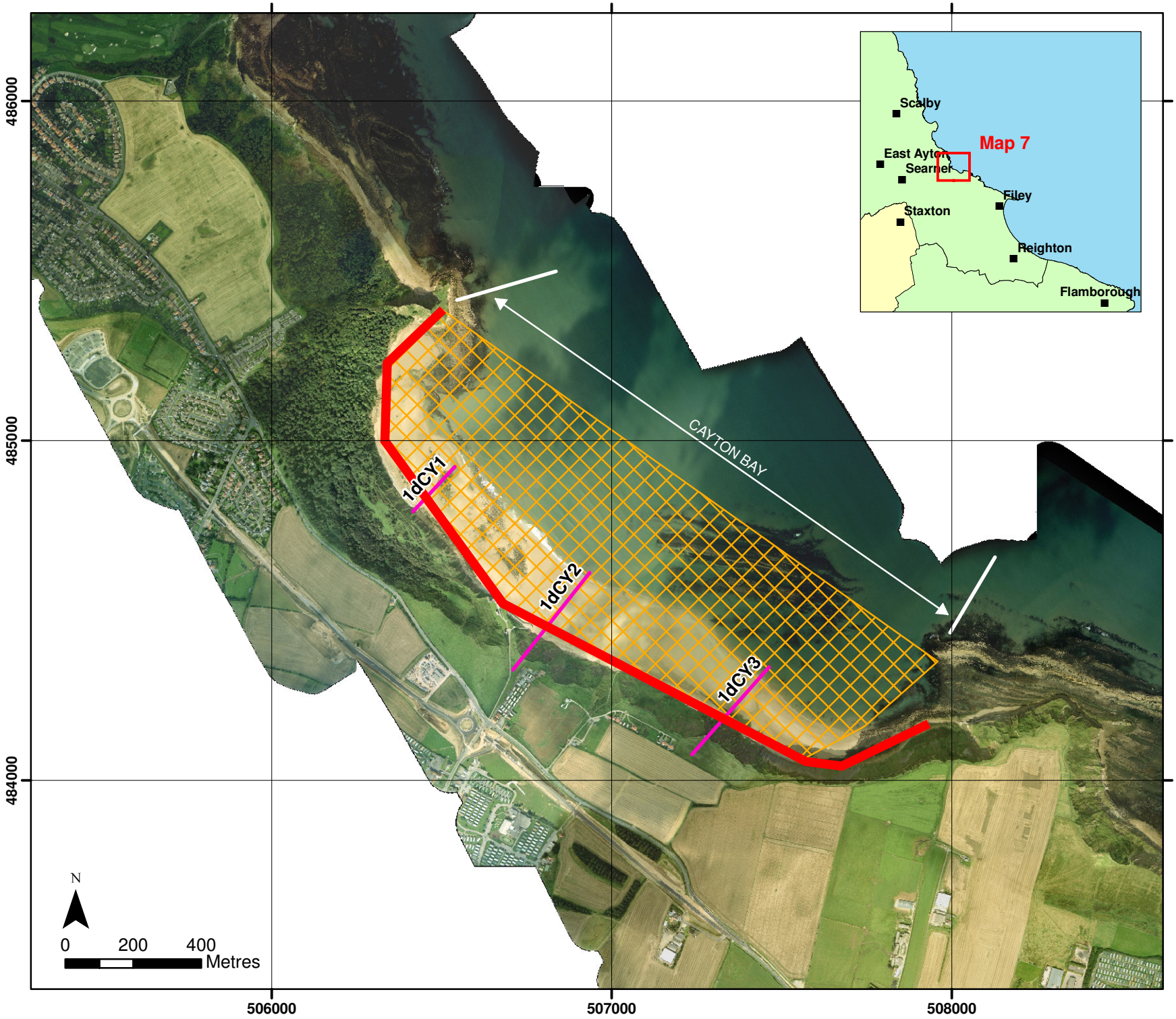

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 7 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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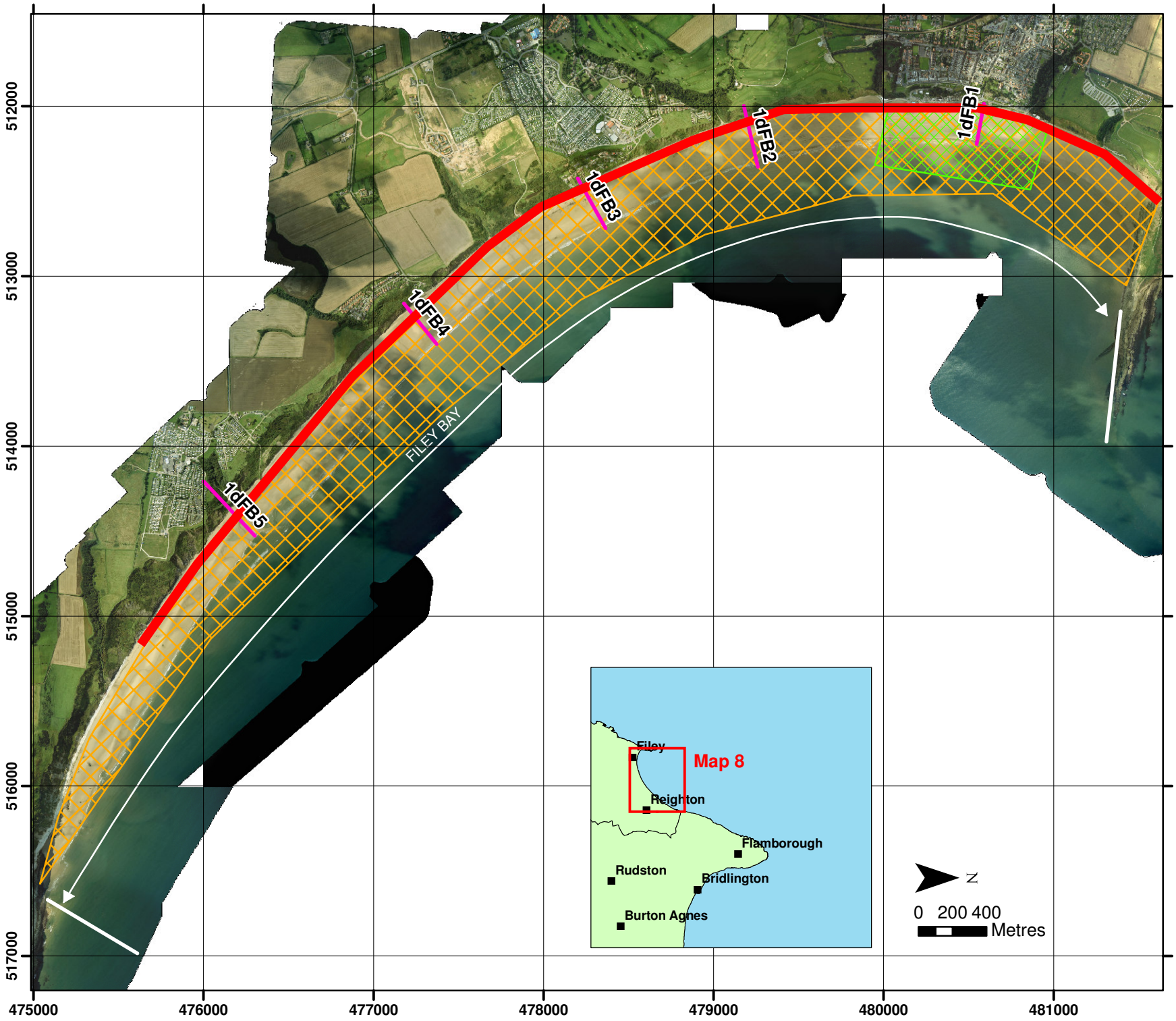

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

Cliff Top Monitoring Pegs

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 8 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

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2. Analysis of Survey Data

2.1 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Cliff Top Survey:** Twenty ground control points have been established at Staithes for the purposes of cliff top monitoring. The separation between any two points is typically around 100 m (although occasionally less). The cliff top surveys at Staithes are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing. Appendix C provides results from the April 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.	When survey accuracy is taken into consideration, six of the twenty points have shown no change since the November 2008 survey, indicating local stability of the cliff face. Eight locations (points 1, 2, 4, 5, 9, 13, 14, 20) have shown cliff line recession ranging 0.2- 0.6 m (±0.1 m due to survey accuracy). The specific processes responsible for this would need to be determined by field inspection. Six locations (points 3, 10, 12, 15, 17, 19) have shown an increase in distance to the cliff edge (0.2- 0.7 m); whilst possibly representing a toppling failure, the more likely scenario is different interpretation of the cliff edge between successive surveys. Future surveys will reveal longer-term trends in the dynamics of this cliff line.

2.2 Runswick Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Topographic Survey:** Runswick Bay is covered by a 6-monthly topographic survey focussing on Runswick Sands, between the village of Runswick Bay and Hob Holes. Data have been used to create a DGM (Appendix B - Map 1). The current DGM (April 2009) is compared to the baseline DGM (November 2008), with 15 m raster grids reflecting the resolution of the parent field survey data. This difference model (Appendix B- Map 2) highlights areas of accretion (gain) and erosion (loss), in 0.1 m elevation bands. Survey error is anticipated to be c. ± 0.1 m, so indicated changes of this magnitude may not be real but instead a product of survey error. The difference model shows erosion in the centre of Runswick sands, and less change at the terminal ends of the survey associated with the rocky foreshore outcrops. Erosion is most marked along the head of the beach and at the most seaward extent. A smaller erosion hotspot is found immediately north of the rock armour defences at Runswick village, which may in time undermine these structures if this erosion continues. The current DGM will be used as a baseline against which future topographic surveys will be compared to identify areas of new accretion and erosion.	The beach at Runswick Bay over the 2008-2009 winter period has experienced typical seasonal change tending between the previous summer (swell) profile, to that of a winter (storm) profile.

2.3 Sandsend Beach, Upgang Beach and Whitby Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Beach Profiles:** The frontage spanning Sandsend Beach, Upgang Beach, and Whitby Sands is covered by three beach profile lines, spaced between Sandsend and Whitby West Cliff (Appendix A). WB 1- The underlying sandy beach has shown an overall increase in gradient to 0.077 m m^{-1} (previously: 0.053 m m^{-1}). This change comprises accretion between c. 30-60 m chainage, by up to 0.8 m, either side of MHWS (2.6 m ODN), and HAT (3.1 m ODN). Beach erosion (maximum 0.66 m) has occurred between c. 70-100m chainage. WB 2- The apparent changes in profiles between c. 55 and 140 m are a function of improved survey resolution in April 2009 - where the track cutting and cliff face have been captured in more detail. The beach shows localised redistribution of sediment, with the overall gradient being maintained (Nov. 2008: 0.048 m m^{-1}, April 2009: 0.049 m m^{-1}). Small changes have occurred in the upper beach either side of MHWS (2.6m ODN), including erosion immediately below the cliff toe (up to 0.5 m), and the building of a berm (chainage 165-190 m, up to 0.5 m). WB 3 – The stabilised face of Whitby West Cliff demonstrates negligible change, other than that anticipated with field survey positioning. One exception is at chainage c. 20-25 m, where a convex step in the profile becomes concave- whether this is a real change, or a data or interpretative error is unknown. The beach shows progressive accretion down profile (beneath MHWS), with gain up to 0.83m by 196m. Consequently the beach gradient has reduced from 0.036 m m^{-1} (November 2008) to 0.023 m m^{-1} by April 2009. The 2009 survey also reveals a large extent of the foreshore including ridge and runnel morphology (as seen on survey photographs).	WB 1- This redistribution of sediment to the upper beach is beneficial to protecting the toe of the seawall. It is however, likely to represent dynamic change at this locality, so future down profile (seawards) sediment transfer is entirely plausible. WB 2- The more detailed cliff profile will be useful to assess future changes in this partly active till cliff face. The erosion at the cliff toe may represent the loss of slope or beach deposits. The small changes to the beach profile are typical of this dynamic environment. WB 3- The accretion of the beach may suggest along- or on-shore sediment transfer, and may point to a seasonal realigning of the beach. Future surveys will be able to confirm or deny this.

2.4 Robin Hood's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Topographic Survey:** Robin Hood's Bay is covered by a 6-monthly topographic survey focussing on an area immediately fronting the village of Robin Hood's Bay (c. Dungeon Hole to East Scar). Data have been used to create a DGM (Appendix B- Map 3). The current DGM (April 2009) is compared to the baseline DGM (November 2008), with 15 m raster grids reflecting the resolution of the parent field survey data. This difference model (Appendix B- Map 4) highlights areas of accretion (gain) and erosion (loss), in 0.1 m elevation bands. Survey error is anticipated to be c. ± 0.1 m, so indicated changes of this magnitude may not be real but instead a product of survey error. Appendix B- Map 4 shows this frontage is largely of static elevation, with the exception of one area of heavy erosion at the southern end of the survey area. This stasis may reflect thin sediment accumulation over the rocky (resistant) foreshore. Areas of change are isolated, with erosion corresponding to the pocket beaches at Ground Wyke Hole and Ground Wyke. Areas of deposition are less extensive and are typically near the cliff toe, or upon rock outcrops. The current DGM will be used as a baseline against which future topographic surveys will be compared to identify areas of new accretion and erosion.	The stasis of foreshore elevation over the period of observation is probably a consequence of both the relative erosional resistance of the rock platforms, allied with limited sediment supply. In contrast, erosional hotspots correspond to local sandy deposits in-between outcrops of the platform.

2.5 Scarborough North Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Beach Profiles:** Scarborough North Bay is covered by five beach profile lines, spaced between the Oceanarium at Scalby Mills to Clarence Gardens (Appendix A). SB 1- The whole profile has experienced accretion since the baseline survey, with the whole profile lying below MHWS (2.45 m ODN). Between c. 10-95 m chainage, the beach surface has risen by up to 0.7m; below this point the beach profile is all but the same as existing in November 2008. SB 2- As with SB 1, accretion has occurred across the entirety of the measured profile, greatest on the upper beach where, between chainage 7.5- 50 m, there has been a maximum gain of c. 0.8 m. This deposition largely occurs beneath MHWS (2.45 m), although the beach surface now exceeds this elevation adjoining the seawall at 2.95 m ODN. The lower beach has experienced accretion of around 0.1- 0.2 m. Collectively this deposition has smoothed the beach profile. The new survey also identifies seaweed covered shore platforms/ boulders beyond 100 m chainage. SB 3- Has experienced both erosion and accretion in different areas along its length, resulting in minimal change to the prevailing beach gradient (November 2008: 0.038 m m^{-1}, April 2009: 0.040 m m^{-1}). Three zones can be described, (1) chainage c. 13-60 m, with erosion of c. 0.6 m (maximum), which has exposed a greater extent of the seawall, with the beach head now at 3.08 m ODN (still above MHWS). (2) chainage c. 60-105 m, with accretion of c. 0.2 m (maximum). (3) chainage > 105 m, with erosion up to c. 0.8 m. SB 4- Has experienced both erosion and accretion in different areas along its length. Between chainage 35-40 m and 50 m the uneven topography is that of rock platform and boulder deposits (see survey photos), which were not picked up by the November 2008 survey. The overall beach gradient is slightly steeper (November 2008: 0.008 m m^{-1}, April 2009: 0.012 m m^{-1}). Two principal zones can be described, (1) chainage c. 26-100 m, with accretion of c. 0.4 m (maximum), with the beach head now at -0.01 m ODN. (2) chainage c. 100-135 m, with erosion of c. 0.3 m (maximum).	SB 1- Shows significant accretion immediately abutting the seawall, which may aid protection of the seawall. SB 2- Shows significant accretion immediately abutting the seawall, which lends support to this function. SB 3- Shows a typical seasonal shift, removing sediment seawards during the winter, i.e. the transition from a swell to storm beach profile. In doing so this has exposed a grater extent of the seawall toe. SB 4- Shows accretion immediately abutting the seawall, albeit the change is negligible. SB 5- Shows accretion immediately adjacent to the rock armour, and a more significant down beach sediment loss. Wave energy impacting the sea defences could therefore increase.

Survey Date	Description of Changes Since Last Survey	Interpretation
	SB 5- Shows a difference in the position of the seawall - this is likely to be a product of survey orientation offset rather than real change. A vertical incision (of c. 1 m elevation) is depicted in the area of the rock armour; this is likely to be surveyor interpretation over this irregular surface. The beach profile change is largely erosional, with an overall increase in gradient (November 2008: 0.014 m m^{-1}, April 2009: 0.018 m m^{-1}). Two principal zones (both below MHWS) can be described, (1) chainage c. 35-60 m, with accretion of c. 0.2 m (maximum). (2) chainage c. 60-120 m, with erosion of c. 0.7 m (maximum), although with this zone a beach ridge has now formed.	

2.6 Scarborough South Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Beach Profiles:** Scarborough South Bay is covered by four beach profile lines, spaced between South Sands adjacent to the Old Harbour to The Spa Complex (Appendix A). SBS 1- A large wedge of sand has been removed at the toe of the wall (between c. 2.2 and 3.4 m ODN, largely above MHWS of 2.45 m ODN). Surveyor's photos show the presence of plant (excavator and transporters) at this location, hence this may be an artificial modification of the beach profile. More information about recent beach recycling activities would aid this interpretation. Erosion between chainage 50-125 m is less dramatic (maximum c. 0.3 m). Following 125m the beach surface has been built up (maximum c. 0.8m). The beach profile has flattened since the baseline survey (November 2008: 0.030 m m^{-1}, April 2009: 0.021 m m^{-1}). SBS 2- The beach profile has changed little over the comparison period, with maximum difference in beach level of 0.2m, except at the toe of the beach, where a small area (c. 15m) has experienced accretion of up to 0.5m. Beach gradient is largely the same (November 2008: 0.028 m m^{-1}, April 2009: 0.026 m m^{-1}). SBS 3- A large wedge of sand has been deposited at the toe of the wall (between c. 2.0 and 3.2 m ODN, either side MHWS of 2.45 m ODN). Surveyor's photos show the presence of plant (bulldozer) at this location artificially reworking the upper beach. Between 40 and 185 m chainage the beach shows erosion of c. 0.3 m (maximum). Beach gradient shows little change (November 2008: 0.022 m m^{-1}, April 2009: 0.025 m m^{-1}). SBS 4- Excepting a small ridge of sand underlying the seawall toe, the beach shows increasing erosion seawards (c. 0.5 m maximum) towards the beach toe. Overall beach gradient has steepened slightly (November 2008: 0.015 m m^{-1}, April 2009: 0.017 m m^{-1}).	SBS 1- Shows overall reduction of gradient, but artificial excavation of the upper beach may have increased wave contact. Erosion overall. SBS 2- No notable change, but tending towards erosion. SBS 3- Shows artificial accretion immediately abutting the seawall, which lends support to this defence. A longer extent of the beach profile is subject to erosion, although this lowering may be a result of human intervention. SBS 4- Shows erosion of this profile

2.7 Cayton Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Beach Profiles:** Cayton is covered by three beach profile lines, spaced between Tenants' Cliff and the south of Cayton Sands (Appendix A). CY 1- Now incorporates partial survey of the Tenants' Cliff undercliff. Surveyor's photos show this profile crosses an active face with fresh rockfall, which is building a cone of debris at the cliff toe. Between surveys the beach shows successive zones of accretion (c. 85-105 m, around 0.4 m) and erosion (up to c. 70 m chainage, around 0.35 m; 130-150 m chainage, around 0.4 m). Some reflect changes in the sandy beach, and others the improved survey resolution capturing rocky outcrops (125- 130 m chainage) CY 2- Has slightly improved survey resolution of the seacliff. The cliff top shows no recession between surveys. The beach profile shows negligible change, excepting the accretion of a sandy berm at the rear of the beach (c. 0.85 m gain, maximum elevation: 3.04 m ODN, i.e. 0.6 m above MHWS (2.45 m ODN)). Overall beach gradient has changed little (November 2008: 0.022 m m^{-1}, April 2009: 0.026 m m^{-1}). CY 3- The survey of the cliff face remains interpolated. The cliff top is static, and the cliff toe may have receded inland by c. 2.8 m. The lower beach generally shows limited change (c. 200-255 m chainage), although greater erosion (< 1.0 m) occurs between c. 260- 280m chainage. Whereas as the upper beach profile shows both erosion (c. 125-150 m chainage, up to c. 0.4 m) and accretion (c. 150-195 m chainage, upto c. 0.3 m). Overall beach gradient is not dissimilar (November 2008: 0.022 m m^{-1}, April 2009: 0.026 m m^{-1}).	CY 1- Shows active rockfall (cliff recession) at the rear of the beach and a fluctuating beach surface. CY 2- Alike CY1 has an improved survey of the seacliff. It also shows limited change in the beach profile. CY 3- Shows minor change in the upper beach profile, with slight lowering of the upper beach potentially exposing the cliff toe to greater wave energy.

Survey Date	Description of Changes Since Last Survey	Interpretation
	Cliff Top Survey: Eight ground control points have been established within Cayton Bay for the purposes of cliff top monitoring. The separation between any two points is typically around 300 m. The cliff top surveys at Cayton Bay are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing. Appendix C provides results from the April 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.	When survey accuracy is taken into consideration, five of the eight points have shown no change since the November 2008, indicating general stability of the cliff face amongst the surveyed localities. Two locations (points 1 & 7) have shown cliff line recession ranging 0.2- 0.3 m (±0.1 m due to survey accuracy). The specific processes responsible for this would need to be determined by field inspection. One location (point 4) has shown an increase in distance to the cliff edge (0.2 m); whilst possibly representing a toppling failure, the more likely scenario is different interpretation of the cliff edge between successive surveys. Future surveys will reveal longer-term trends in the dynamics of this cliff line.

2.8 Filey Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
04-2009	**Beach Profiles:** Filey Bay is covered by five beach profile lines, spaced between Filey Sands and Speeton Sands (Appendix A). FB 1 There has been very little change in the beach profile since the baseline survey. The beach shows elevation shifts generally much less than 0.3 m. Excepting the beach immediately fronting the seawall (up to 40 m chainage) most of the profile until c. 190 m chainage is slightly erosional. The overall beach gradient shows no change (0.018 m m^{-1}). FB 2 The survey of the cliff face remains interpolated. The cliff top is static, and the cliff toe may have receded inland, although this may be differential interpretation of landforms between surveys (photographs from both epochs reveal similar features, i.e. eroded cliff toe and gravel berm). The sandy/ gravel beach shows minor accretional and erosional shifts up to 220 m chainage. Whereas between 220-280 m chainage more distinct erosion (up to 0.25m depth) occurs. The overall beach gradient shows little change (November 2008: 0.018 m m^{-1}, April 2009: 0.017 m m^{-1}). FB 3 The cliff remains largely as was (the apparent cliff advance, is likely to reflect survey rather than real change). The beach from c. 32-95 m chainage has changed very little. More apparent is the development of ridge and runnel topography seaward of chainage 100 m (c. +0.5 m, -0.7 m, maximum). The overall beach gradient (when including the upper gravel berm) remains unchanged (November 2008: 0.024 m m^{-1}, April 2009: 0.024 m m^{-1}). FB 4 The survey of the cliff face remains interpolated, and at this coarse level shows no change. The beach shows notable change. Between c. 25 and 170 m chainage there is a substantial increase in sediment (up to 0.7 m), where as following c. 170 m chainage, erosion up to 0.85 m occurs. The overall impact is a steepening beach gradient (November 2008: 0.023 m m^{-1}, April 2009: 0.033 m m^{-1}).	FB 1 The profile shows negligible change, and the increasing wedge of sand beneath the seawall (and below MHWS (2.50 m ODN) is likely to be insufficient to alter exposure to wave attack. FB 2 This shows little change in the beach profile FB 3 The overall beach has remained similar, with the development of ridge and runnel topography. Here this may reflect the seasonal transition between summer (swell) and winter (storm) profiles. FB 4 shows a beach steepening, with accretion of the upper beach and erosion on the lower beach. Superimposed on this is ridge and runnel development. FB 5 shows a beach steepening with ridge and runnel development.

Survey Date	Description of Changes Since Last Survey	Interpretation
	FB 5 The current (April 2009) cliff top survey prior to the seacliff is less detailed than that obtained in November 2008, as it now excludes the axis of the tributary fluvial valley, accounting for the apparent (and false) infilling. The top of the seacliff is shown to be both lower and seaward of that in November 2008. This is likely to reflect survey positioning rather than real change. The beach has developed a ridge and runnel morphology, which can be separated into three zones. (1) Chainage c. 220-250 m shows erosion (c. <0.5 m), especially below MHWS (2.5 m ODN). (2) chainage c. 250- 310 m is a new ridge (accretion) of c. 0.4m. (3) An extensive lower beach area of erosion from c. 310 m onwards, with lowering of up to 0.95 m. The overall beach gradient increased slightly (November 2008: 0.025 m m^{-1}, April 2009: 0.028 m m^{-1}).	
	Topographic Survey:	
	Filey Bay is covered by an annual topographic survey, providing continuous survey of Filey Sands, Muston Sands, Hunmanby Sands, Reighton Sands and Speeton Sands. During the partial measures, only the Filey frontage is surveyed (i.e. Filey Sands). Data have been used to create a DGM (Appendix B - Map 5).	
	The current DGM (April 2009) is compared to the baseline DGM (November 2008), with 15 m raster grids reflecting the resolution of the parent field survey data. This difference model (Appendix B - Map 6) highlights areas of accretion (gain) and erosion (loss), in 0.1 m elevation bands. Survey error is anticipated to be c. ± 0.1 m, so indicated changes of this magnitude may not be real but instead a product of survey error. Appendix B - Map 6 shows this frontage is largely loosing elevation (of small magnitude). A trough of erosion occurs around 130 m seaward of the seawall. A small area of linear accretion occurs to the north-east of the survey area.	The beach at Filey Sands over the 2008-2009 winter period has minor change which may reflect the seasonal transition between summer and winter profiles.
	The current DGM will be used as a baseline against which future topographic surveys will be compared to identify areas of new accretion and erosion.	

Survey Date	Description of Changes Since Last Survey	Interpretation
	Cliff Top Survey: Twenty-three ground control points have been established within Filey Bay for the purposes of cliff top monitoring. The maximum separation between any two points is nominally 300 m. The cliff top surveys at Filey Bay are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing. Appendix C provides results from the April 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.	When survey accuracy is taken into consideration, fifteen of the twenty-three points have shown no change since the November 2008, indicating general stability of the cliff face amongst the surveyed localities. Seven locations (points 1, 5, 9, 10, 14, 17, 23) have shown cliff line recession ranging 0.2- 3.5 m (±0.1 m due to survey accuracy). The specific processes responsible for this would need to be determined by field inspection. One location (point 3) has shown an increase in distance to the cliff edge (0.3 m), whilst possibly representing a toppling failure; the more likely scenario is different interpretation of the cliff edge between successive surveys. Future surveys will reveal longer-term trends in the dynamics of this cliff line.

3. Problems Encountered and Uncertainty in Analysis

Artificial modification of beach profiles
The use of plant to move beach sand adjacent to sea defences (e.g. Scarborough South Bay) makes the derivation of natural beach change more difficult. A record of significant management interventions throughout a year would assist the interpretation of future data.

Survey accuracy of beach profiles
- The resolution between successive surveys at a given location is variable. For example, on some occasions rock platforms are included, but not on others; or the number of data points along a profile is significantly different; or they provide differential coverage of cliff faces. Therefore post-survey interpretation has to be carefully conducted to best isolate real change versus that derived from differential survey resolution. A consistent, high-resolution survey would reduce the occurrence of this issue.
- The profile orientation may be slightly offset in a few cases, as shown by apparent shifts in seawalls, which are more than likely to be static. Duplication of exact survey orientation between successive surveys is of high importance to accurately determine beach change.

Cliff top erosion errors
The cliff top surveys at Staithes, Cayton Bay and Filey Bay are assumed to have a limit of accuracy of ± 0.1m due to the techniques used. At a number of locations apparent cliff advance is calculated, which is highly unlikely excepting a toppling mechanism of failure. It is more likely that this is due to a different point being identified as the edge of the cliff, especially with different seasonal vegetation covers. This problem occurs mostly at Staithes, which may reflect a particular site condition, which requires further investigation.

4. Recommendations for 'Fine-tuning' the Monitoring Programme

Further to the recommendations outlined by the Analytical Report 1 (May 2009), the following are suggested:

- Compile a record of beach management interventions prior to data reporting; this will require co-ordination with the relevant Operating Authorities;
- Perform beach profile measurements to a consistent and high-resolution, with careful attention to profile orientation;
- Consider and implement measures to improve the accuracy of cliff top survey data capture. Photography at the time of each survey (alike beach profiles) and a site visit by a geomorphologist would increase understanding and value of these data at all sites.

5. Conclusions and Areas of Concern

- The Staithes frontage has shown areas of localised cliff top stasis, advance (erroneous survey), and recession. Hotspots for cliff top retreat at this time are to the west adjacent to Cowbar Lane, the cliff backing Penny Steel, and also at Old Nab.

- The small beach at Runswick Bay shows erosion in the centre of the survey area, and also fronting the rock armour defences. The patterns of beach profile change probably represent a typical seasonal transition between swell (summer) and storm (winter) conditions.

- The Sandsend to Whitby frontage shows dynamic shifts in the beach profile with zones of accretion and erosion. No consistent up- or down profile shifts occurs amongst all three profile locations.

- Robin Hood's Bay shows a largely stable foreshore, especially in areas dominated by rock platforms. Small erosional hotspots coincide with pocket beaches, most especially at Ground Wyke Hole.

- Scarborough North Bay shows no real change to the sea defences, and a trend towards upper beach accretion, and increased beach gradient exists. The exception is profile 1dSBN3 (fronting the SANDS development) which shows a classic winter sediment transfer offshore. Sea defences in the south of North Bay could be subject to increased wave energy.

- Scarborough South Bay shows that, in general terms, the beach to the north has decreased in gradient, and increased to the south. Small magnitude erosional shifts are dominant amongst all profiles. However, it should be noted that artificial modification of the upper beach makes it more difficult to decipher natural beach changes.

- Cayton Bay shows dynamic shifts in the beach profile with zones of accretion and erosion, possibly tending towards a down beach transfer of sands as it typical during the winter season, with slightly increased gradients. In respect of cliff tops, surveying from ground control points establishes a largely stable frontage, with areas of localised retreat. These data of course exclude known instability at Cayton Cliff further north.

- Filey Bay shows similar beach profiles to the north (FB 1-2), tending to minor erosion, which is confirmed by the beach topographic survey. In contrast, change in the south of Filey Bay is of greater magnitude, including the development of ridge and runnel morphology, corresponding with down beach sediment transfer and increasing gradient. The cliff top survey general shows positional stasis, although a number of locations display recession, particular hotspots are the undefended cliff immediately south of the Filey seawall (location 5), and Hunmanby Moor (location 14).

Appendices

Appendix A

Beach Profiles

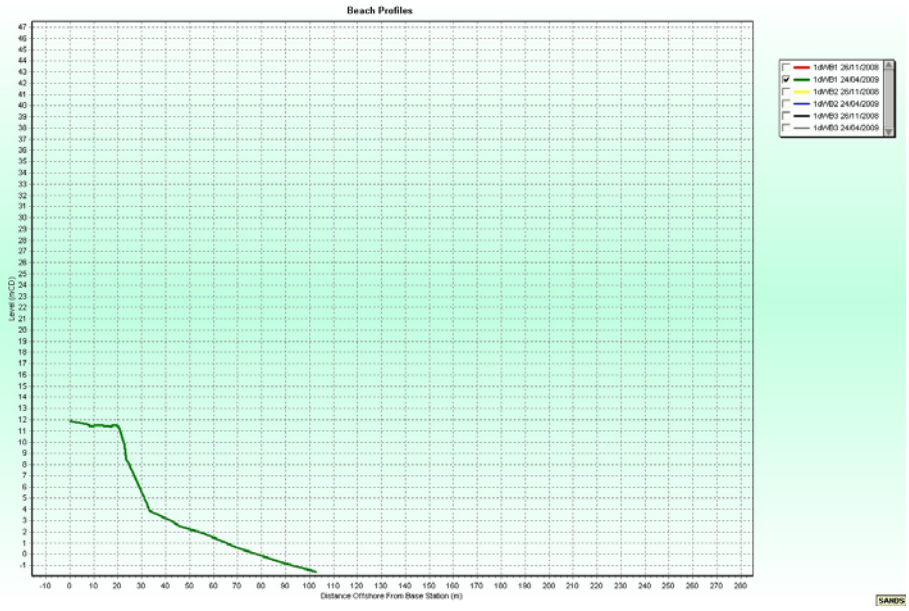
Beach Profile

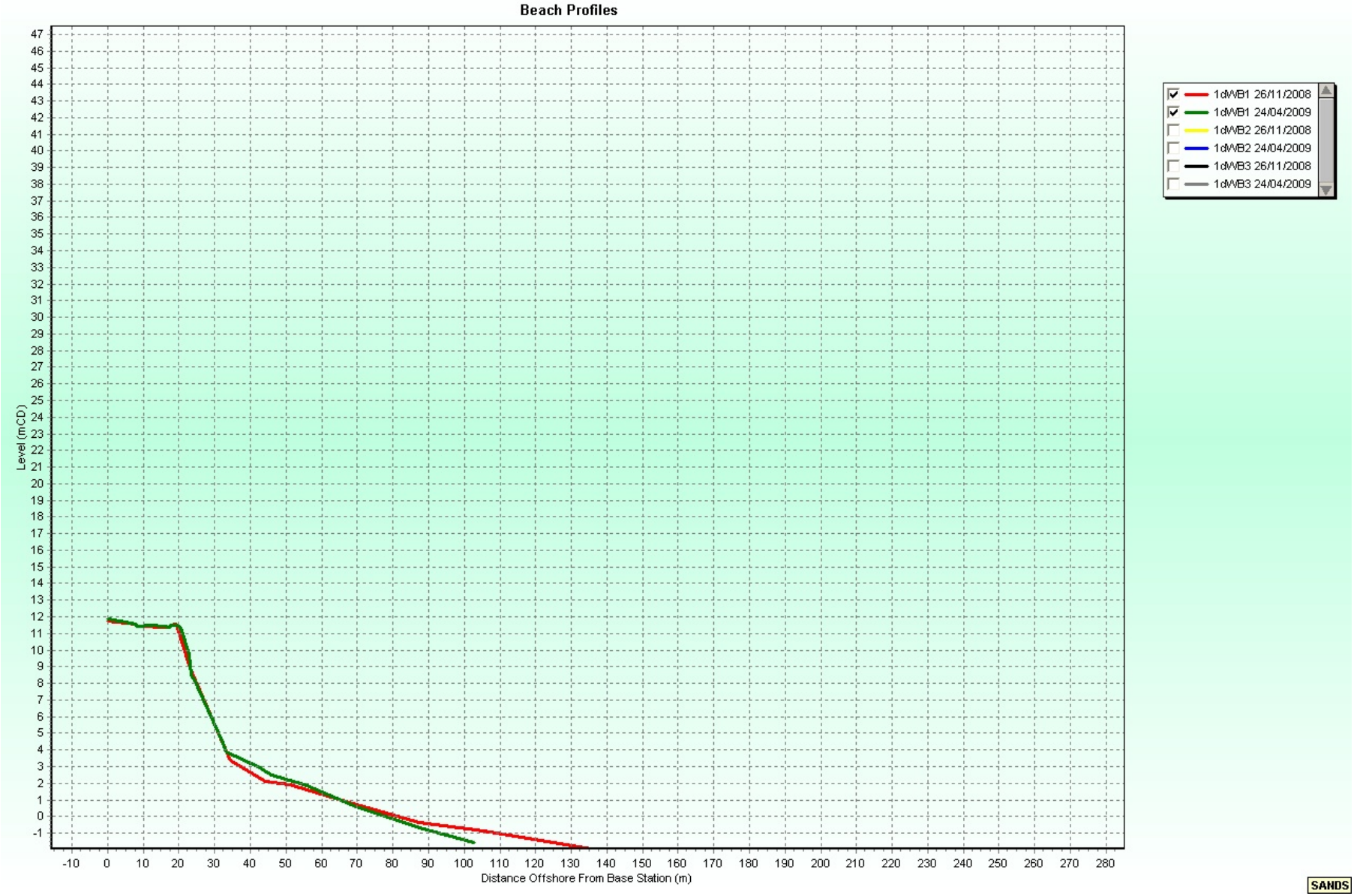
1dWB1

Date 24/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1001
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 486535.075 **Northing** 512437.797 **Bearing** 32

Chainage	Level
0	
0.01	11.849
6.59	11.603
8.01	11.57
8.09	11.458
12.05	11.505
15.74	11.443
17.41	11.377
17.46	11.5
19.23	11.496
20.49	11.367
22.87	9.736
23.53	8.544
24.22	8.182
32.06	4.594
33.06	3.856
42.7	2.909
45.95	2.465
55.01	1.91
69.13	0.672
87.24	-0.656
102.85	-1.539




Beach Profiles
Level (mCD)
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-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280
Distance Offshore From Base Station (m)
1dWB1 26/11/2008
1dWB1 24/04/2009
1dWB2 26/11/2008
1dWB2 24/04/2009
1dWB3 26/11/2008
1dWB3 24/04/2009
SANDS

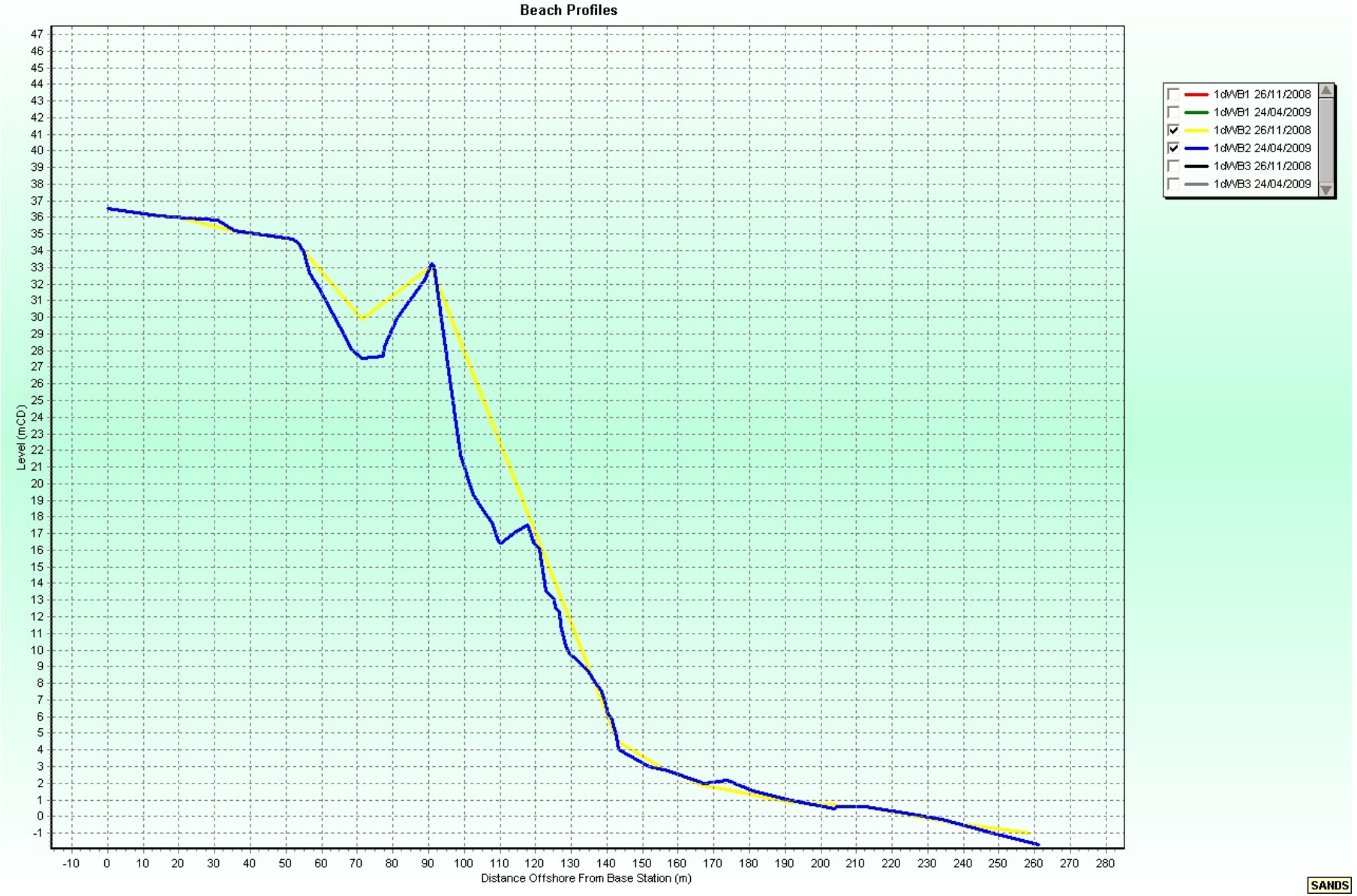
Beach Profile

1dWB2

Date 24/04/2009 **nspector** **Low Tide (m)** **LowTideTime** 1001
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 487550.221 **Northing** 511927.902 **Bearing** 16

Chainage	Level
0	
0.04	36.534
14.23	36.085
30.69	35.828
35.64	35.177
51.88	34.73
53.57	34.42
55.06	33.851
56.52	32.668
59.66	31.641
66.24	28.946
68.45	28.047
71.27	27.561
77.26	27.692
77.63	28.223
81.27	29.947
88.84	32.207
90.99	33.261
91.41	33.083
98.91	21.735
102.55	19.377
105.66	18.26
107.81	17.649
109.01	16.92
109.54	16.531
110.38	16.462
114.73	17.142
117.86	17.523
119.29	16.527
121.1	16.049
122.74	13.599
125.17	13.004
125.42	12.586
126.65	12.344
127.08	11.52
128.5	10.219
129.57	9.734
131.48	9.466
134.66	8.744
136.4	8.102
138.69	7.5
139.82	6.686
140.29	6.082
141.36	6.003
142.67	4.776
143.34	4.023
151.96	3.005
157.1	2.749
166.32	2.069
167.29	1.996
173.72	2.156
180.98	1.57
191.63	0.947
204	0.478
204.7	0.584
212.59	0.575
225.15	0.17
233.98	-0.192
249.25	-1.08
261.15	-1.715


Beach Profiles
Level (mCD)
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Distance Offshore From Base Station (m)
1dWB1 26/11/2008
1dWB1 24/04/2009
1dWB2 26/11/2008
1dWB2 24/04/2009
1dWB3 26/11/2008
1dWB3 24/04/2009
SANDS

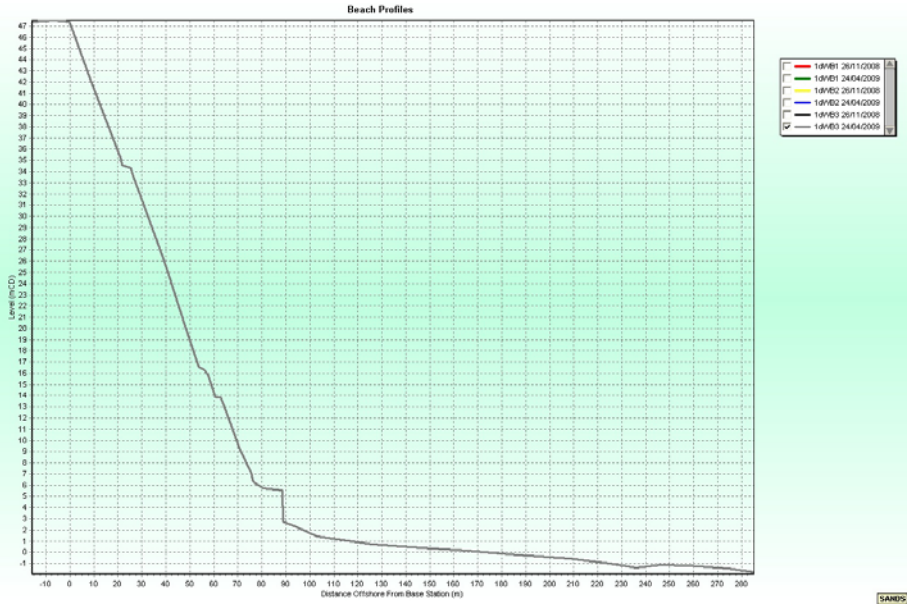
Beach Profile

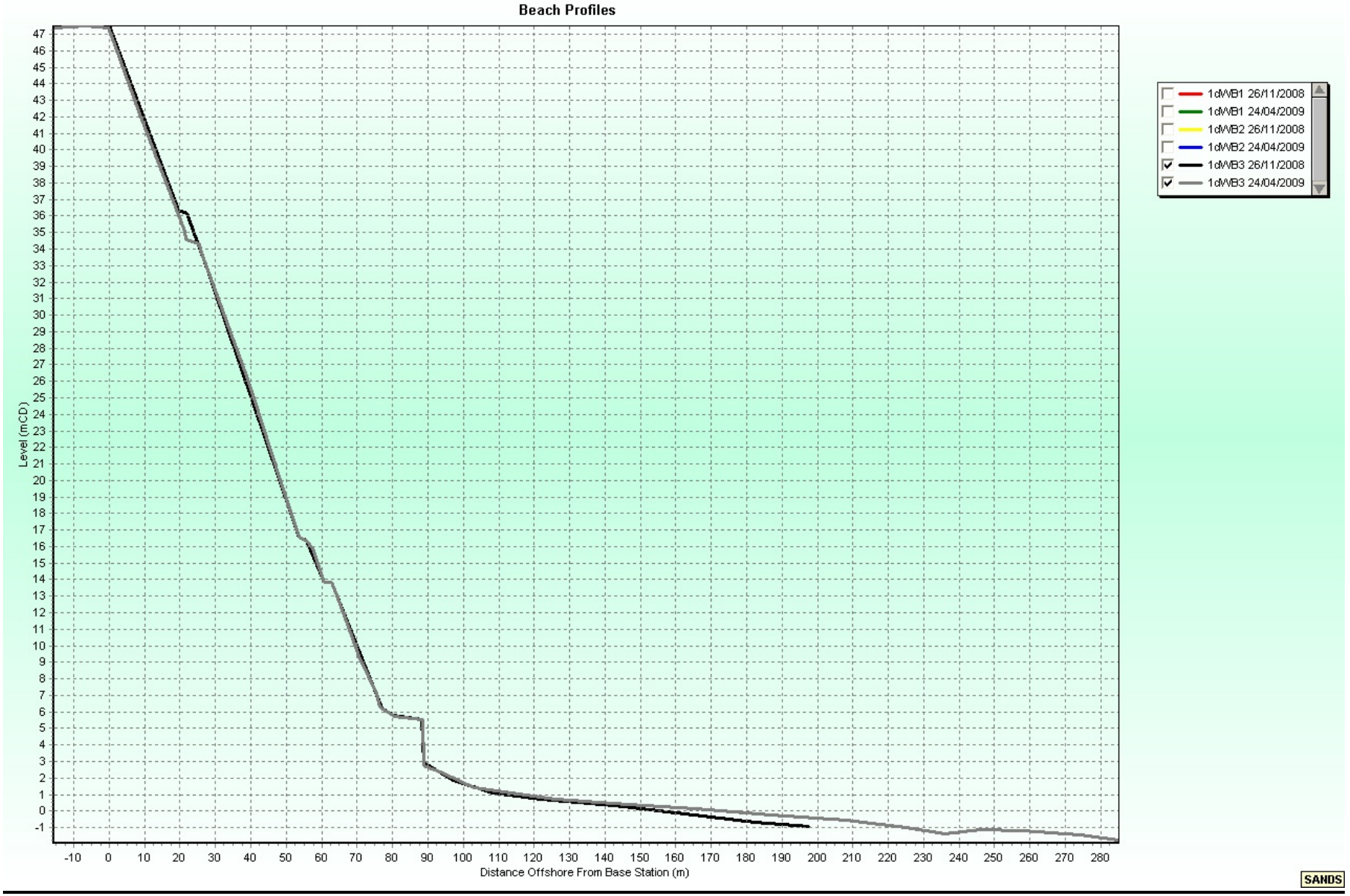
1dWB3

Date 24/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1001
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 488983.6 **Northing** 511527.0 **Bearing** 19

Chainage	Level
-15.66	47.296
-15.54	47.395
-11.03	47.461
-6.5	47.497
-0.39	47.38
0	
1.23	46.54
9.01	42.01
21.3	35.063
21.77	34.57
25.36	34.35
25.72	33.958
31.46	30.673
39.27	25.931
47.1	20.835
53.58	16.584
55.97	16.312
57.52	15.84
60.61	13.82
62.85	13.843
63.86	13.231
66.84	11.52
70.9	9.209
75.37	7.103
76.31	6.314
80.44	5.753
88.51	5.542
88.92	2.743
94.21	2.312
102.93	1.411
111.55	1.129
126.03	0.703
146.7	0.424
165.46	0.127
186.78	-0.262
208.09	-0.549
224.93	-1.017
235.87	-1.358
245.97	-1.105
257.83	-1.162
274.12	-1.425
285.09	-1.78




Beach Profiles
Level (mCD)
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-1
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280
Distance Offshore From Base Station (m)
1dWB1 26/11/2008
1dWB1 24/04/2009
1dWB2 26/11/2008
1dWB2 24/04/2009
1dWB3 26/11/2008
1dWB3 24/04/2009
SANDS

Beach Profile

1dSB1

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 503543.363 **Northing** 490470.74 **Bearing** 79

Chainage	Level
0	
0.11	4.15
3.33	4.045
7.78	3.972
7.89	3.902
8.26	1.552
8.96	1.554
8.98	1.165
9.62	1.114
9.65	0.835
10.25	0.808
10.27	0.57
11.39	0.664
18.5	0.612
26.02	0.402
38.99	-0.119
49.89	-0.649
59.39	-0.886
74.04	-1.156
78.58	-1.244
91.65	-1.132
106.93	-1.136
122.67	-1.163
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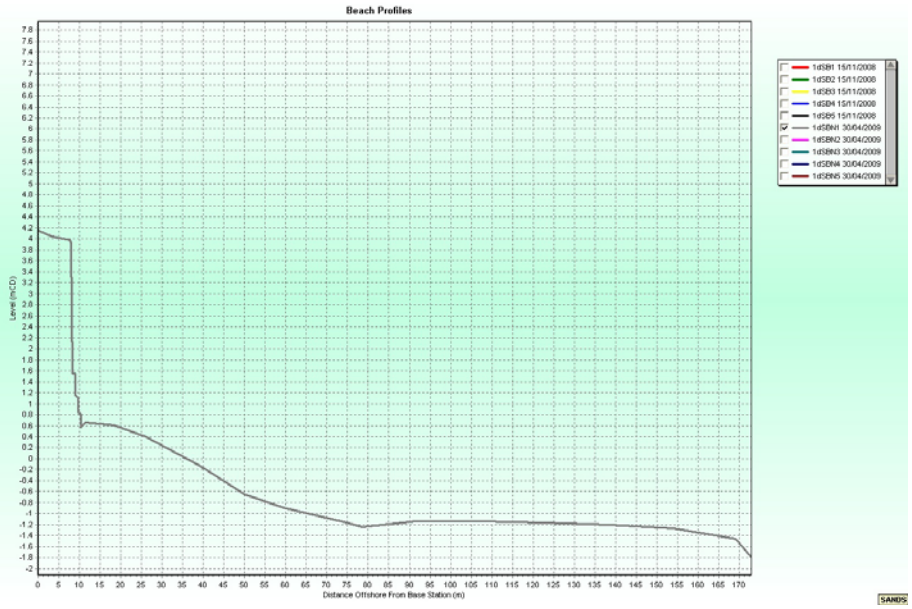
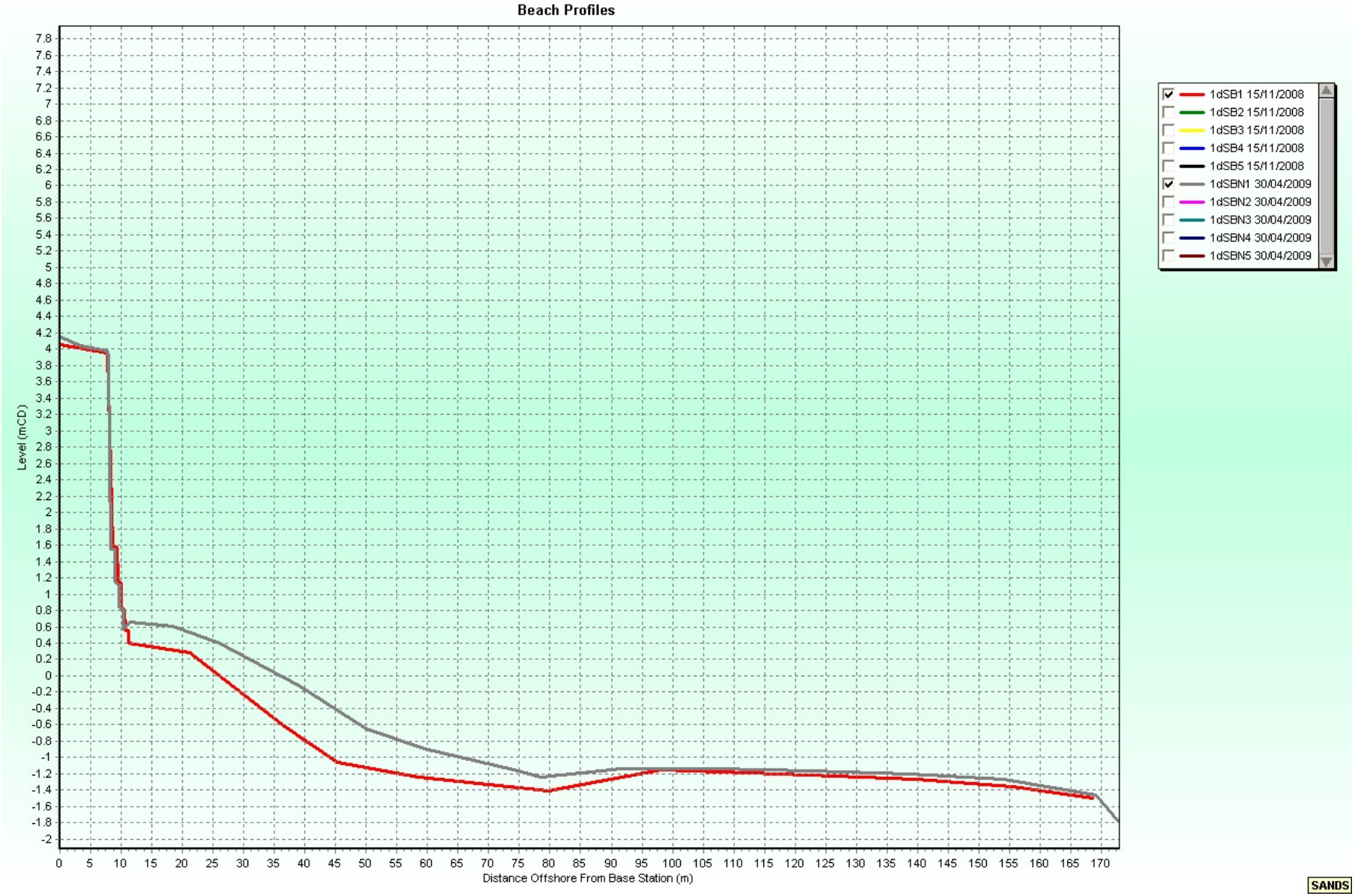
153.99	-1.262
169.18	-1.456
172.93	-1.798




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSB1 15/11/2008
1dSB2 15/11/2008
1dSB3 15/11/2008
1dSB4 15/11/2008
1dSB5 15/11/2008
1dSBN1 30/04/2009
1dSBN2 30/04/2009
1dSBN3 30/04/2009
1dSBN4 30/04/2009
1dSBN5 30/04/2009
SANDS

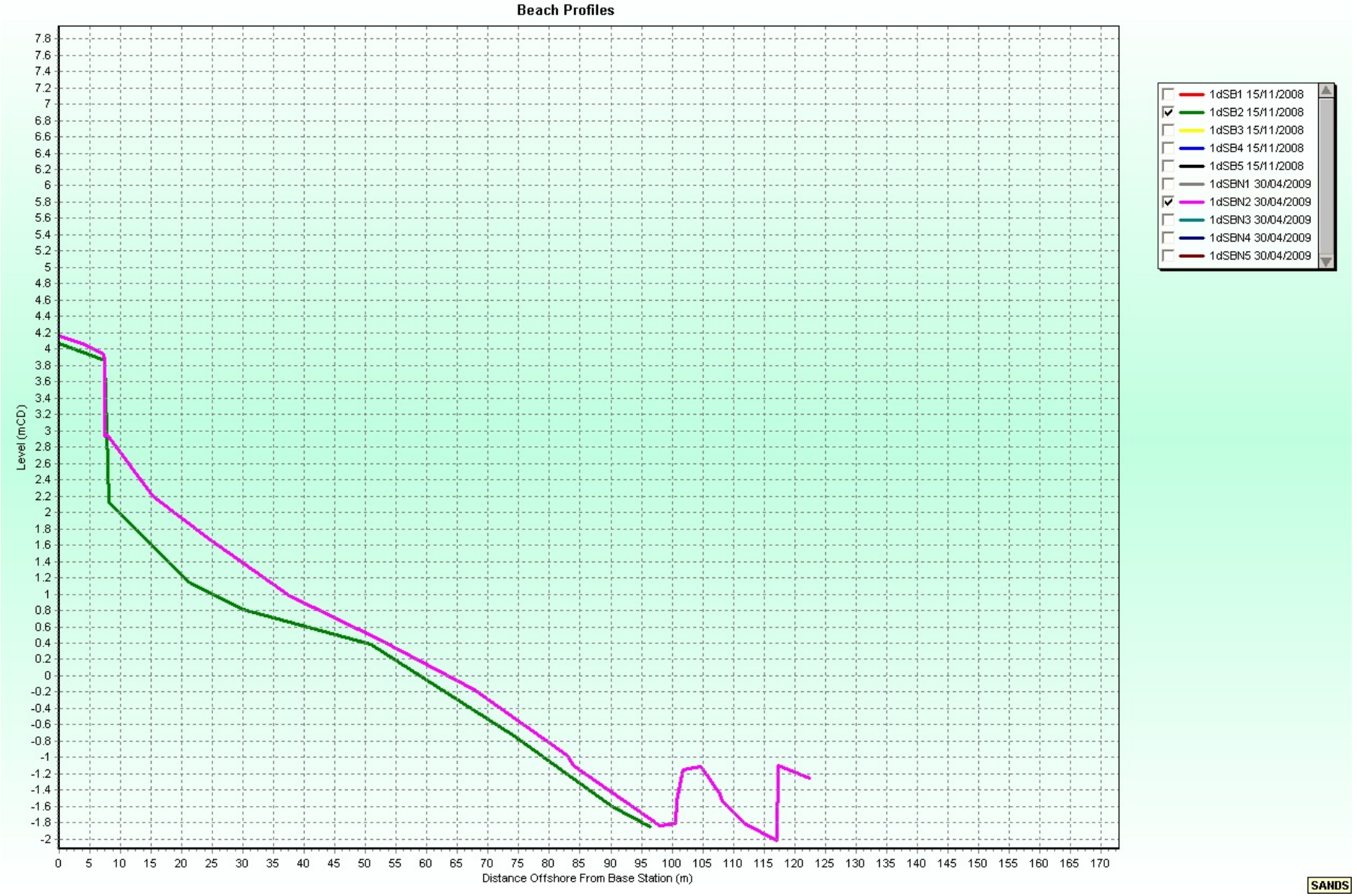
Beach Profile

1dSB2

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 503616.346 **Northing** 490135.674 **Bearing** 78

Chainage	Level
0	
0.02	4.156
3.74	4.075
7.3	3.943
7.4	3.862
7.47	2.936
7.67	2.952
15.36	2.19
24.66	1.66
37.6	0.987
52.67	0.426
67.75	-0.174
83.07	-0.982
83.92	-1.102
98	-1.833
100.52	-1.807
100.68	-1.534
101.85	-1.146
104.64	-1.11
107.84	-1.441
108.15	-1.543
112.1	-1.821
117.04	-2.02
117.29	-1.1
122.42	-1.258


Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSB1 15/11/2008
1dSB2 15/11/2008
1dSB3 15/11/2008
1dSB4 15/11/2008
1dSB5 15/11/2008
1dSBN1 30/04/2009
1dSBN2 30/04/2009
1dSBN3 30/04/2009
1dSBN4 30/04/2009
1dSBN5 30/04/2009
SANDS

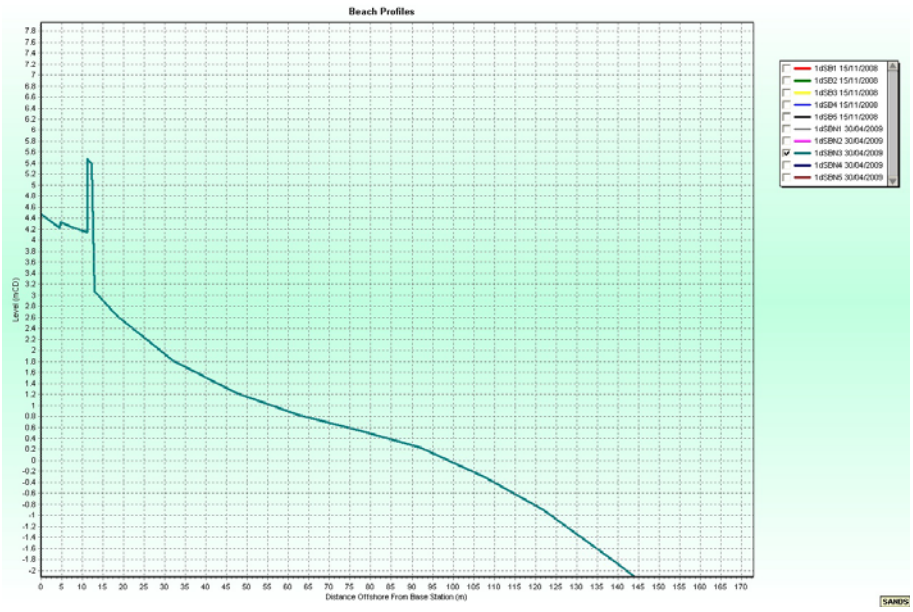
Beach Profile

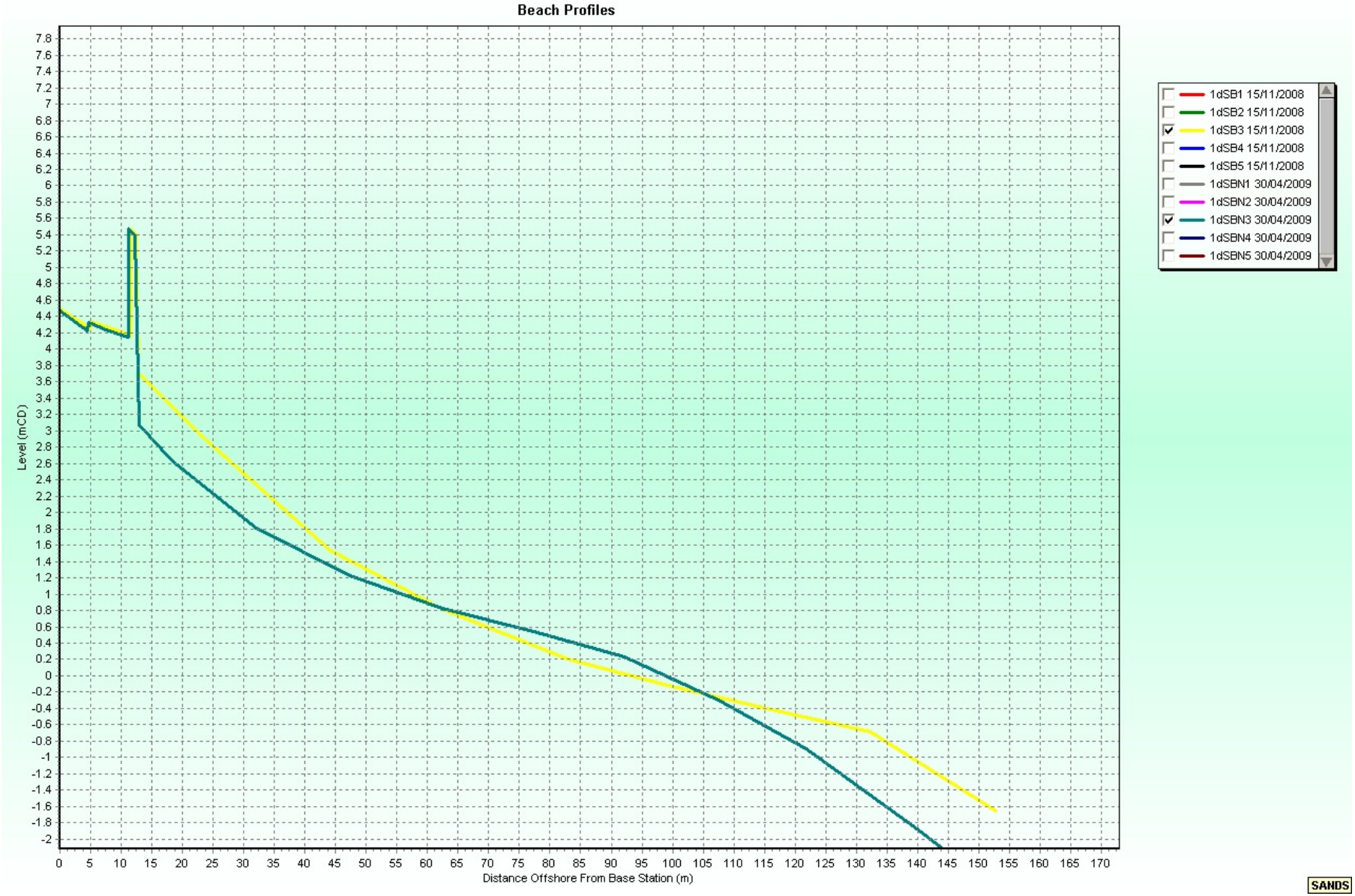
1dSB3

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 503803.958 **Northing** 489708.315 **Bearing** 58

Chainage	Level
0	
0.02	4.464
4.55	4.229
4.59	4.325
7.85	4.228
11.22	4.141
11.28	5.473
12.21	5.389
12.9	3.08
18.25	2.633
32.06	1.813
47.36	1.223
62.39	0.83
77.33	0.547
92.18	0.233
107.45	-0.293
121.69	-0.886
139.19	-1.839
144.21	-2.119




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSB1 15/11/2008
1dSB2 15/11/2008
1dSB3 15/11/2008
1dSB4 15/11/2008
1dSB5 15/11/2008
1dSBN1 30/04/2009
1dSBN2 30/04/2009
1dSBN3 30/04/2009
1dSBN4 30/04/2009
1dSBN5 30/04/2009
SANDS

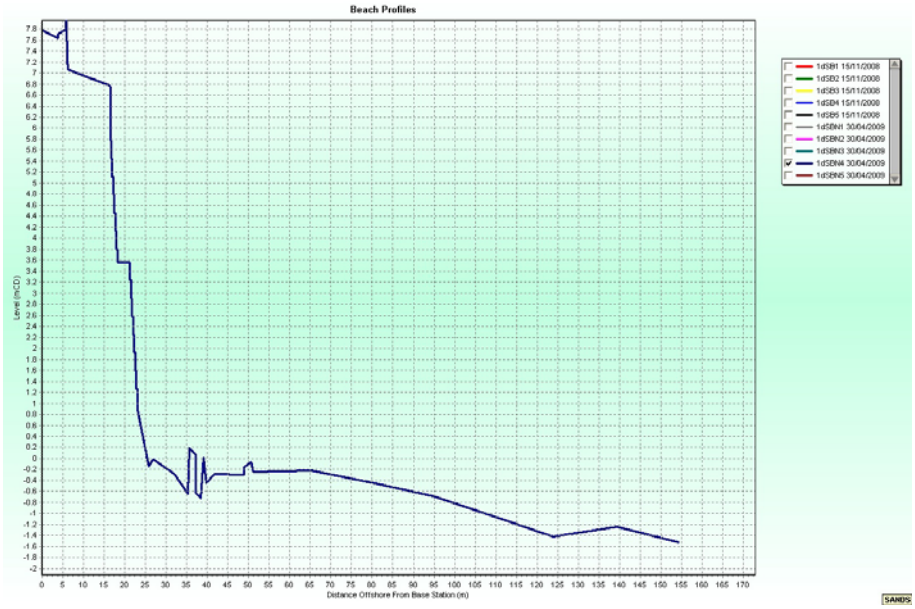
Beach Profile

1dSB4

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 504111.79 **Northing** 489397.699 **Bearing** 38

Chainage	Level
0	
0.01	7.781
3.74	7.638
3.79	7.717
5.61	7.784
5.69	7.945
5.91	7.94
6.03	7.239
6.11	7.246
6.22	7.072
11.02	6.929
16.16	6.776
16.47	6.757
16.48	5.781
16.68	5.78
16.68	5.45
16.93	5.45
16.93	5.12
17.18	5.12
17.18	4.79
17.43	4.79
17.43	4.46
17.68	4.46
17.68	4.13
17.93	4.13
17.93	3.8
18.18	3.8
18.18	3.57
21.23	3.57
21.23	3.24
21.48	3.24
21.48	2.91
21.73	2.91
21.73	2.58
21.98	2.58
21.98	2.25
22.23	2.25
22.23	1.92
22.48	1.92
22.48	1.59
22.73	1.59
22.73	1.26
23	1.26
23.01	0.873
25.84	-0.148
26.93	-0.011
32.06	-0.289
35.36	-0.64
35.61	0.188
37.12	0.062
37.19	-0.615
38.47	-0.723
39.11	0.009
39.86	-0.453
41.65	-0.285
48.85	-0.294
48.96	-0.153
50.7	-0.069
51.21	-0.246
65.08	-0.22
79.87	-0.44
94.7	-0.691
110.85	-1.091
123.81	-1.422
139.38	-1.24
154.35	-1.528




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSB1 15/11/2008
1dSB2 15/11/2008
1dSB3 15/11/2008
1dSB4 15/11/2008
1dSB5 15/11/2008
1dSBN1 30/04/2009
1dSBN2 30/04/2009
1dSBN3 30/04/2009
1dSBN4 30/04/2009
1dSBN5 30/04/2009
SANDS

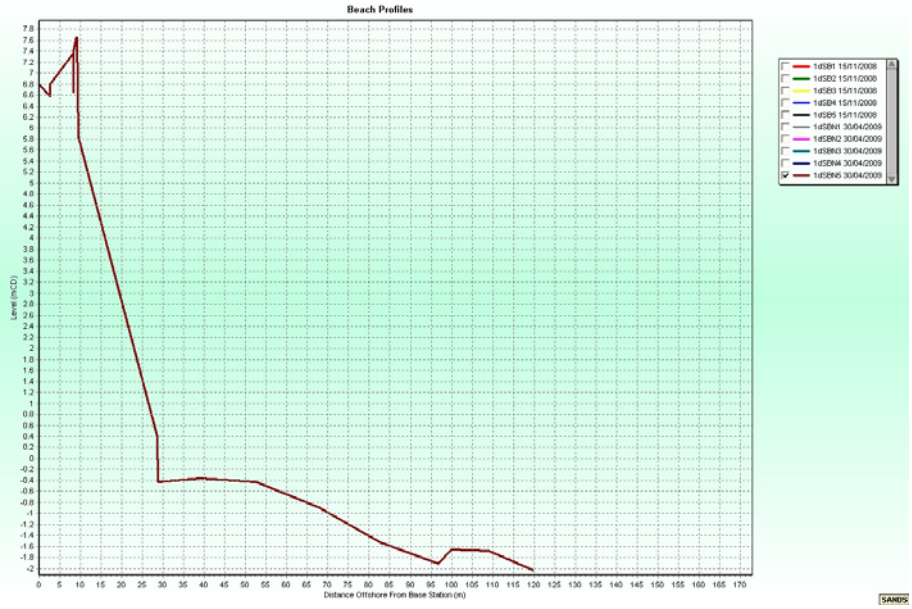
Beach Profile

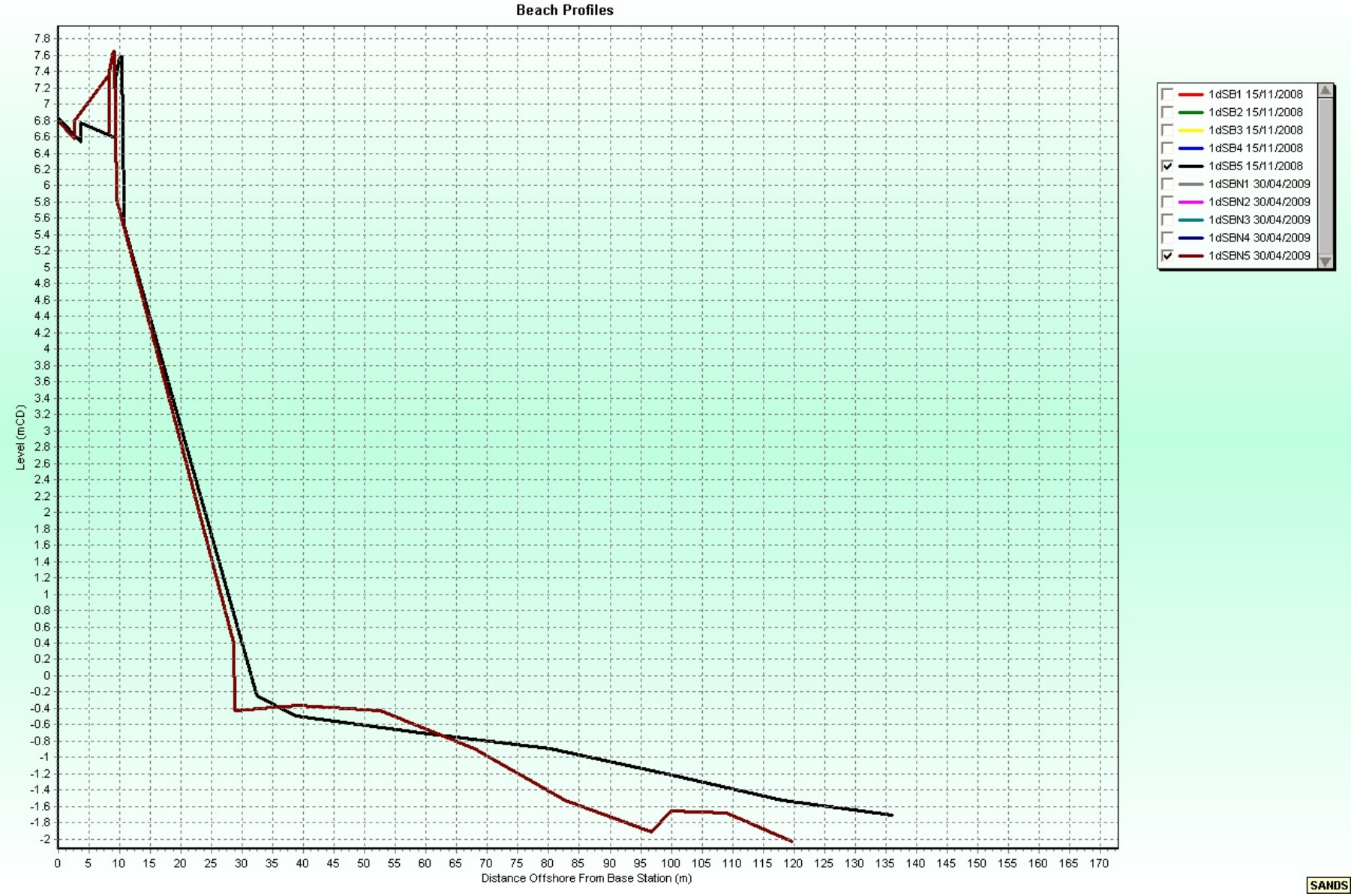
1dSB5

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 504515.599 **Northing** 489205.723 **Bearing** 14

Chainage	Level
0	
0	6.793
2.5	6.58
2.58	6.796
8.23	6.646
8.23	6.652
8.23	7.361
8.28	7.397
8.99	7.645
9.16	7.645
9.49	5.833
28.66	0.401
28.76	-0.433
39.11	-0.36
52.53	-0.421
67.86	-0.895
82.67	-1.52
96.85	-1.914
99.86	-1.66
108.98	-1.68
119.78	-2.028




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSB1 15/11/2008
1dSB2 15/11/2008
1dSB3 15/11/2008
1dSB4 15/11/2008
1dSB5 15/11/2008
1dSBN1 30/04/2009
1dSBN2 30/04/2009
1dSBN3 30/04/2009
1dSBN4 30/04/2009
1dSBN5 30/04/2009
SANDS

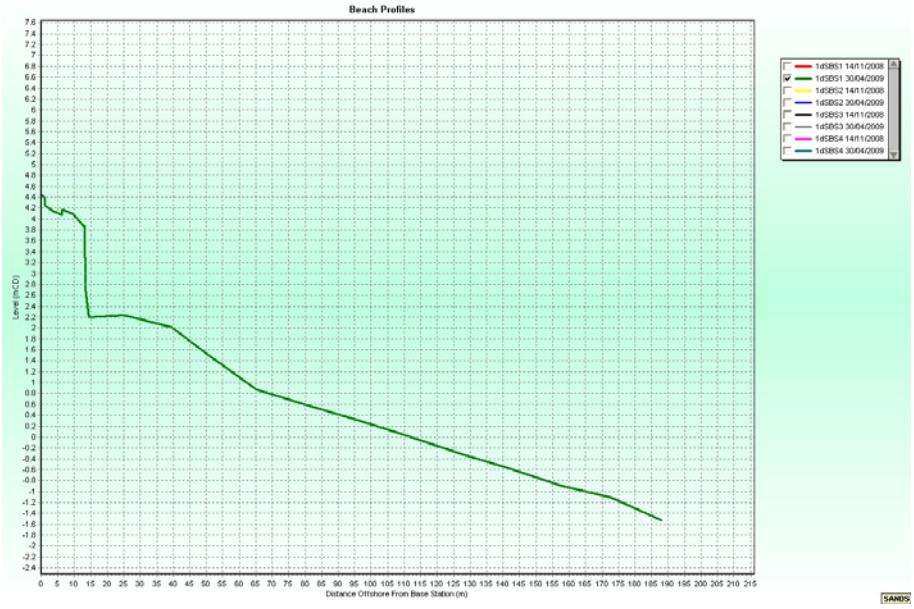
Beach Profile

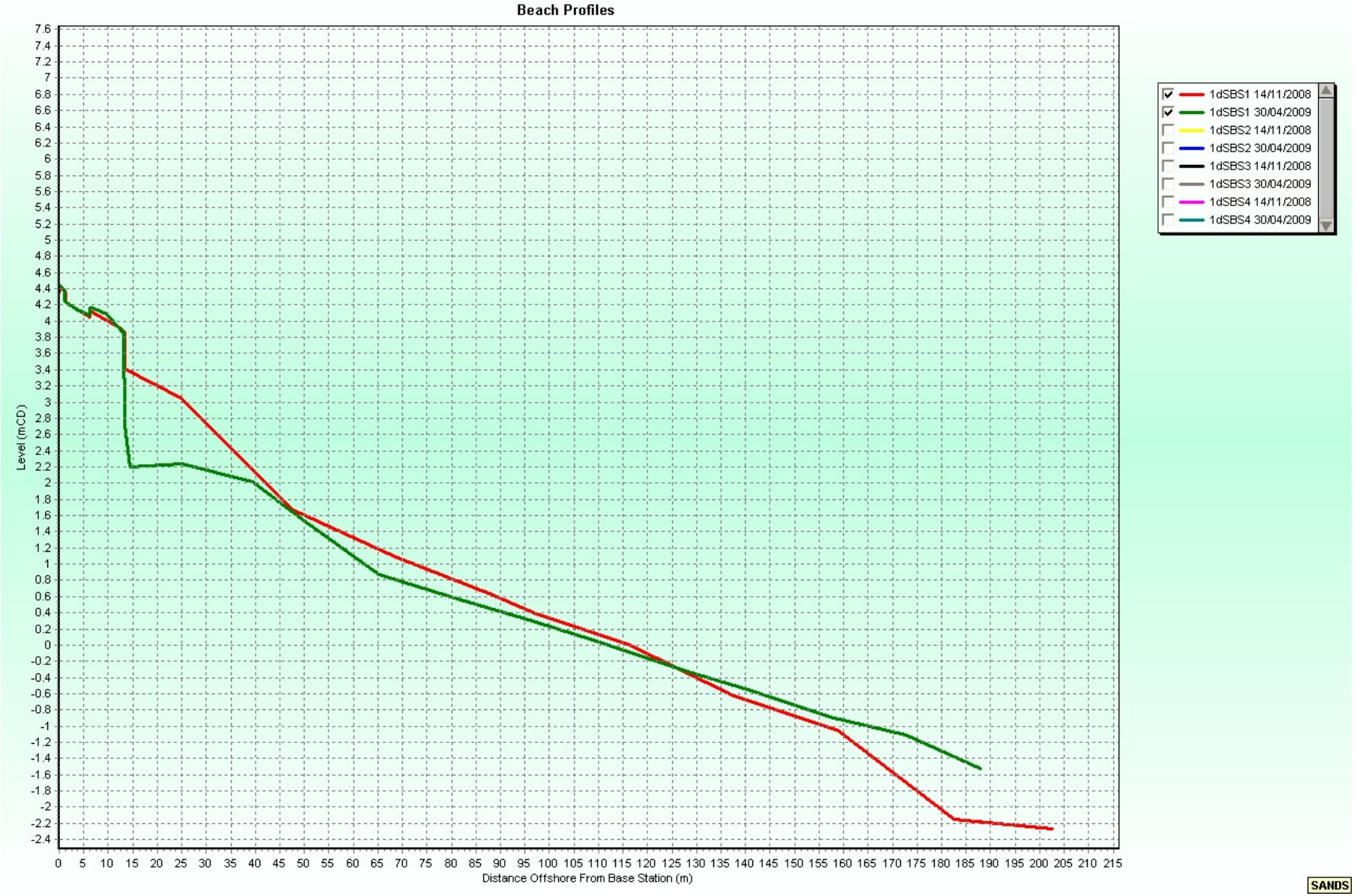
1dSBS1

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 504544.727 **Northing** 488604.814 **Bearing** 120

Chainage	Level
0	
0	4.435
1.11	4.385
1.15	4.239
3.75	4.136
6.33	4.08
6.35	4.168
6.64	4.162
9.63	4.082
12.54	3.895
12.87	3.858
13.16	3.882
13.33	2.724
14.44	2.201
24.96	2.24
39.43	2.022
49.92	1.541
65.18	0.869
80.49	0.591
95.76	0.307
110.3	0.04
126.77	-0.299
141.86	-0.579
157.17	-0.881
172.69	-1.11
188.04	-1.527




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSBS1 14/11/2008
1dSBS1 30/04/2009
1dSBS2 14/11/2008
1dSBS2 30/04/2009
1dSBS3 14/11/2008
1dSBS3 30/04/2009
1dSBS4 14/11/2008
1dSBS4 30/04/2009
SANDS

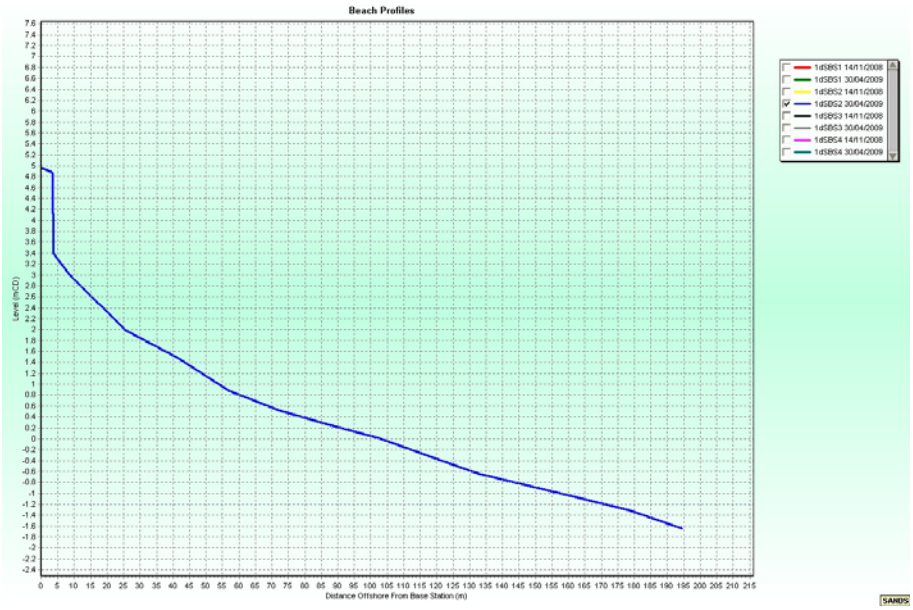
Beach Profile

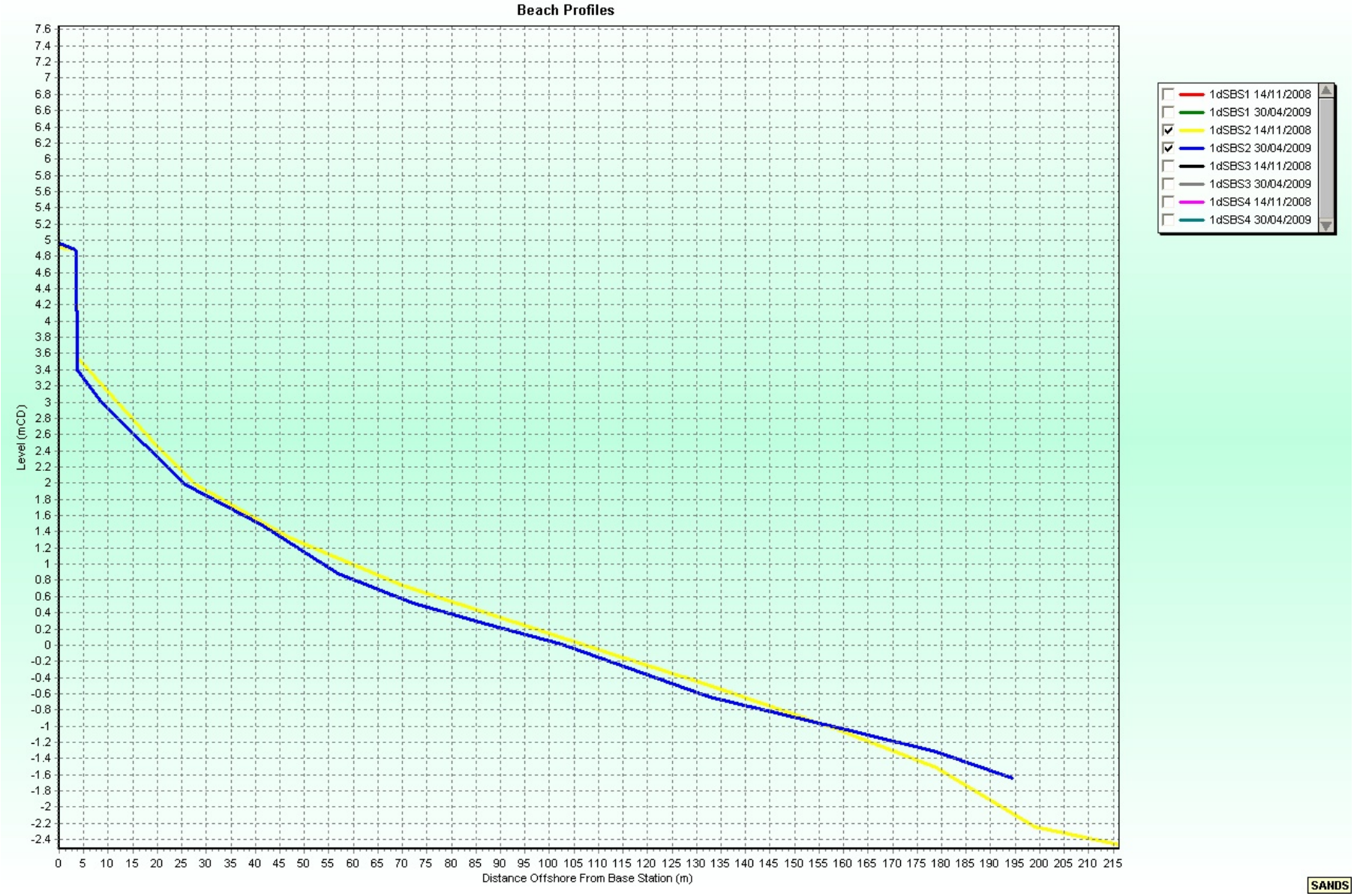
1dSBS2

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 504443.218 **Northing** 488326.371 **Bearing** 105

Chainage	Level
0	
0.05	4.962
3.15	4.887
3.48	4.871
3.67	3.392
8.87	2.983
25.86	1.983
41.44	1.489
56.77	0.886
72.08	0.52
87.26	0.264
102.41	0.013
117.46	-0.315
132.71	-0.637
147.92	-0.86
163.23	-1.079
178.92	-1.32
194.53	-1.646




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSBS1 14/11/2008
1dSBS1 30/04/2009
1dSBS2 14/11/2008
1dSBS2 30/04/2009
1dSBS3 14/11/2008
1dSBS3 30/04/2009
1dSBS4 14/11/2008
1dSBS4 30/04/2009
SANDS

Beach Profile

1dSBS3

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 504423.086 **Northing** 488057.66 **Bearing** 83

Chainage	Level
0	
0.01	6.745
2.46	6.673
2.49	6.698
4.29	6.633
4.43	7.579
4.52	7.644
4.77	7.425
5.64	3.227
13.07	2.579
25.65	1.725
40.71	1.172
55.78	0.688
70.9	0.454
86.15	0.174
101.63	-0.091
116.96	-0.311
132.1	-0.626
148.1	-1.034
163.66	-1.332
179.42	-1.495
187.89	-1.468
203.42	-1.764


Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dSBS1 14/11/2008
1dSBS1 30/04/2009
1dSBS2 14/11/2008
1dSBS2 30/04/2009
1dSBS3 14/11/2008
1dSBS3 30/04/2009
1dSBS4 14/11/2008
1dSBS4 30/04/2009
SANDS

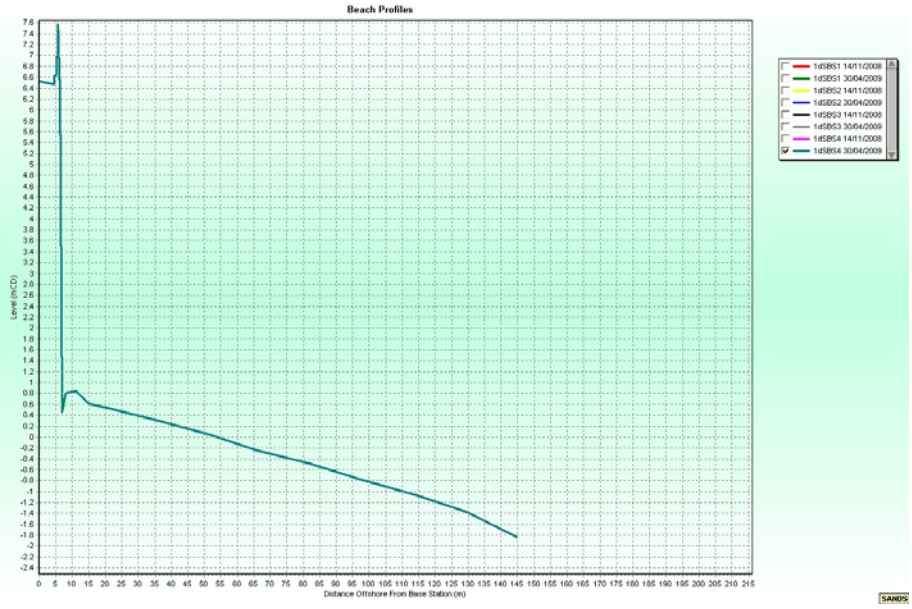
Beach Profile

1dSBS4

Date 30/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1425
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 504494.785 **Northing** 487816.983 **Bearing** 74

Chainage	Level
0	
0.02	6.523
4.44	6.474
4.49	6.627
5.08	6.64
5.12	6.979
5.53	6.982
5.56	7.51
5.63	7.563
5.91	7.359
5.98	6.552
6.21	6.56
6.86	0.461
7.99	0.812
11.23	0.847
15.13	0.614
20.76	0.538
36.12	0.298
51.23	0.055
66.42	-0.254
81.73	-0.482
96.92	-0.766
113.63	-1.056
129.5	-1.365
144.99	-1.835




Beach Profiles
Level (mCD)
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215
Distance Offshore From Base Station (m)
1dSBS1 14/11/2008
1dSBS1 30/04/2009
1dSBS2 14/11/2008
1dSBS2 30/04/2009
1dSBS3 14/11/2008
1dSBS3 30/04/2009
1dSBS4 14/11/2008
1dSBS4 30/04/2009
SANDS

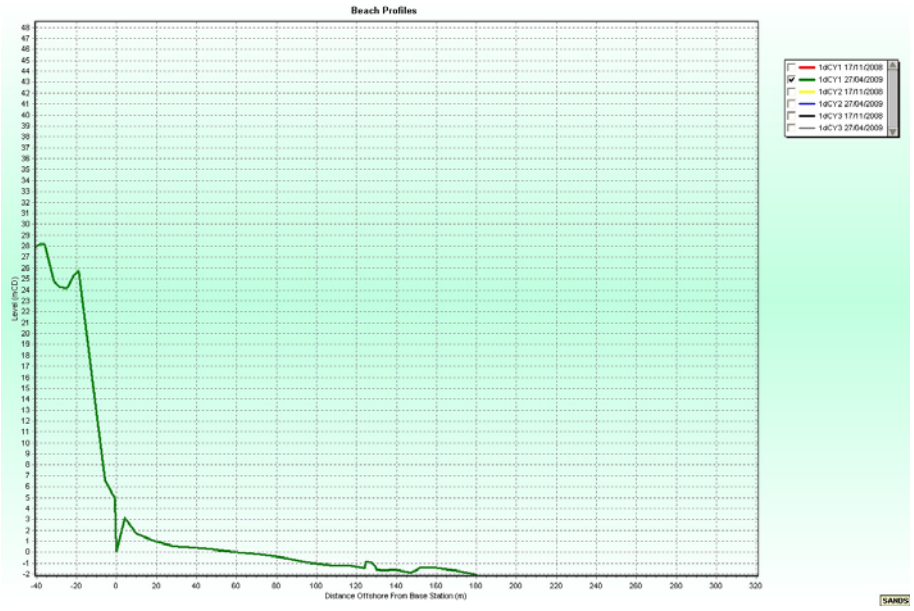
Beach Profile

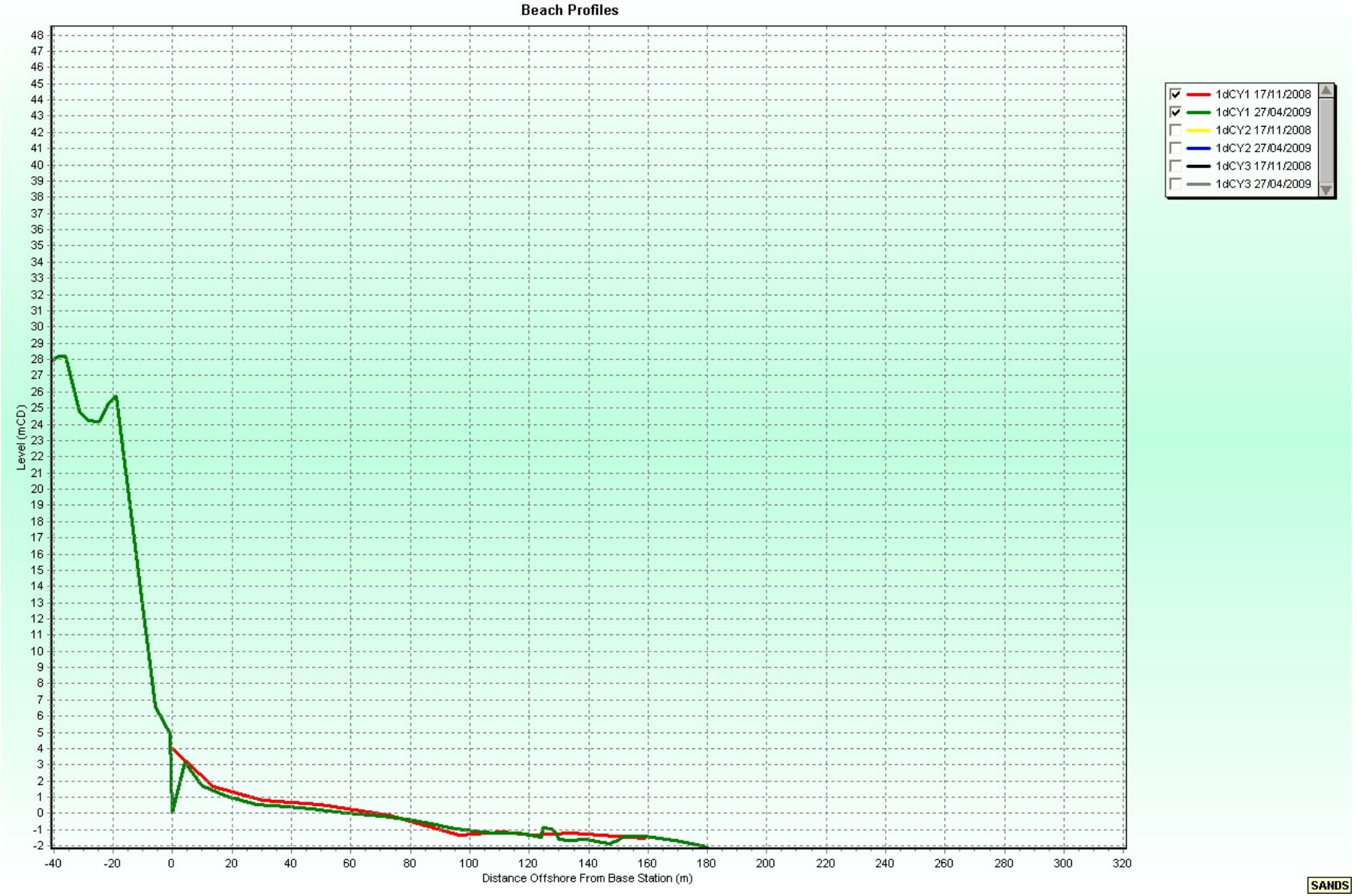
1dCY1

Date 27/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Ok **Rain** Yes
Summary

Easting 506420.411 **Northing** 484793.941 **Bearing** 43

Chainage	Level
-40.61	27.937
-38.08	28.189
-36.11	28.186
-35.47	27.959
-31.29	24.843
-28.38	24.22
-24.74	24.147
-21.26	25.336
-19.12	25.716
-5.93	6.578
-0.68	4.902
0	
4.04	3.125
9.85	1.691
18.06	1.065
28.13	0.58
38.72	0.418
46.69	0.266
54.86	0.123
62.75	-0.01
70.69	-0.164
78.74	-0.391
86.78	-0.643
94.91	-0.97
108.09	-1.21
116.54	-1.198
124.17	-1.454
124.55	-0.872
127.48	-0.928
129.51	-1.292
129.76	-1.599
133.31	-1.645
139.12	-1.576
144.87	-1.8
147.4	-1.843
149.63	-1.63
152.01	-1.378
158.84	-1.42
169.11	-1.684
179.81	-2.064




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dCY1 17/11/2008
1dCY1 27/04/2009
1dCY2 17/11/2008
1dCY2 27/04/2009
1dCY3 17/11/2008
1dCY3 27/04/2009
SANDS

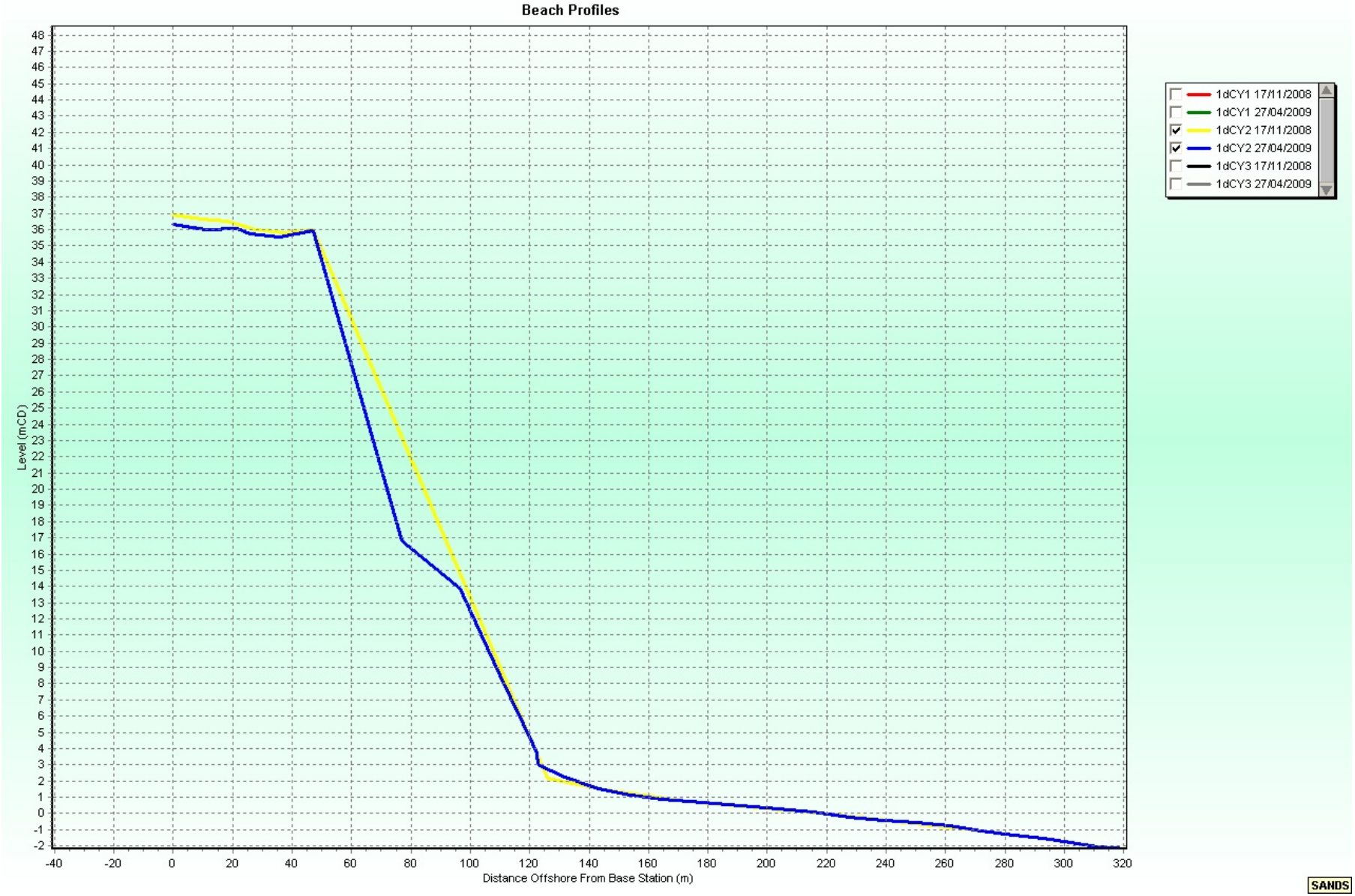
Beach Profile

1dCY2

Date 27/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Ok **Rain** Yes
Summary

Easting 506712.583 **Northing** 484325.966 **Bearing** 38

Chainage	Level
0	
0.03	36.302
10.89	36.025
21.51	36.048
25.81	35.758
35.91	35.562
47.06	35.918
76.79	16.82
96.42	13.913
111.19	8.103
116.51	6.077
122.43	3.754
122.73	3.037
131.05	2.309
143.15	1.527
153.87	1.133
164.85	0.898
178.09	0.653
190.87	0.457
203.59	0.27
215.31	0.067
227.48	-0.204
239.15	-0.402
250.33	-0.565
261.27	-0.776
272.01	-1.059
283.07	-1.313
292.79	-1.509
302.18	-1.792
311.08	-2.046
320.96	-2.181


Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dCY1 17/11/2008
1dCY1 27/04/2009
1dCY2 17/11/2008
1dCY2 27/04/2009
1dCY3 17/11/2008
1dCY3 27/04/2009
SANDS

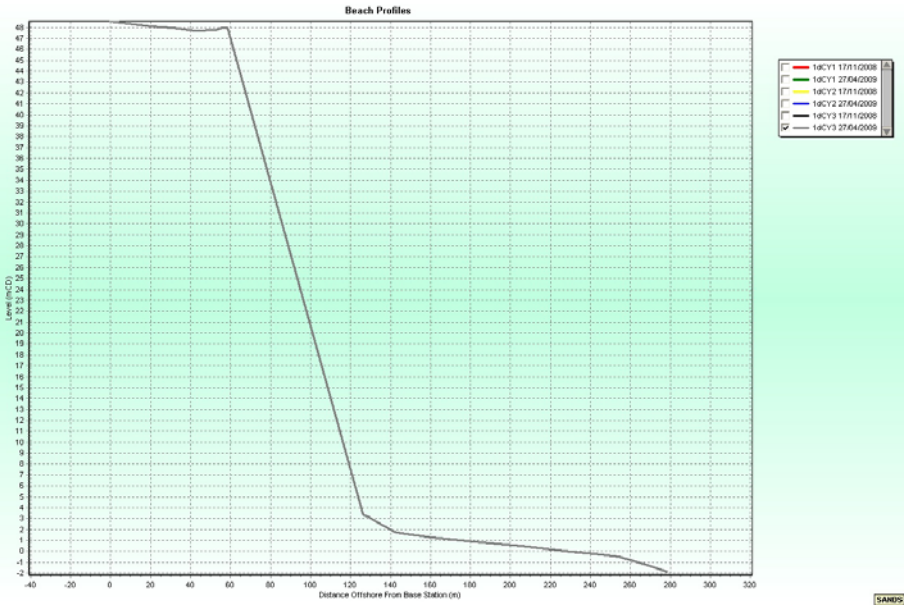
Beach Profile

1dCY3

Date 27/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Ok **Rain** Yes
Summary

Easting 507242.203 **Northing** 484080.896 **Bearing** 42

Chainage	Level
0	
0.05	48.561
8.87	48.347
20.12	48.101
31.02	47.972
42.06	47.734
52.8	47.753
55.97	47.992
58.52	47.977
126.3	3.318
129.01	3.131
131.2	2.911
141.78	1.818
145	1.634
160.75	1.26
171.36	1.04
181.93	0.871
193.67	0.682
205.45	0.459
217.43	0.218
230.18	-0.011
242.06	-0.231
254.06	-0.466
266.3	-1.145
278.29	-1.854




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dCY1 17/11/2008
1dCY1 27/04/2009
1dCY2 17/11/2008
1dCY2 27/04/2009
1dCY3 17/11/2008
1dCY3 27/04/2009
SANDS

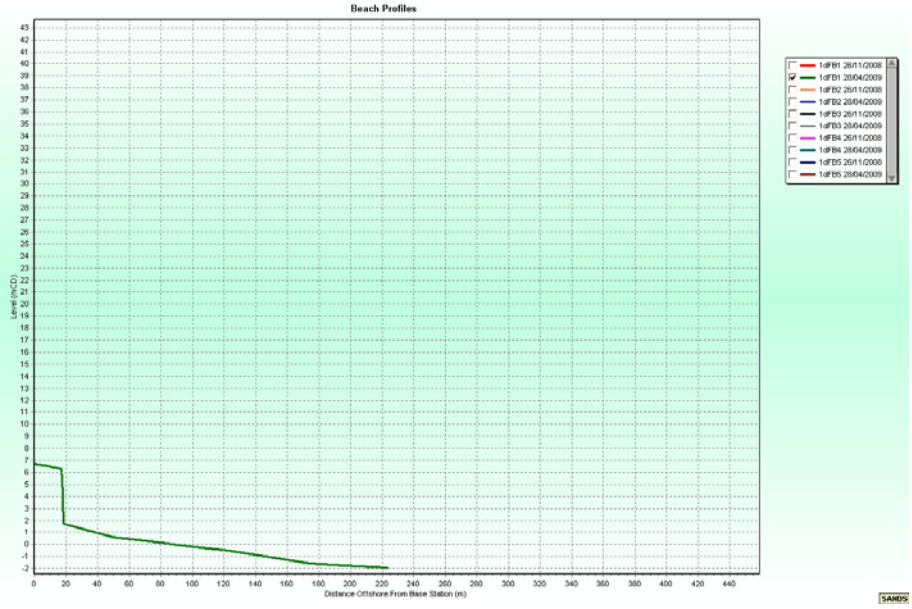
Beach Profile

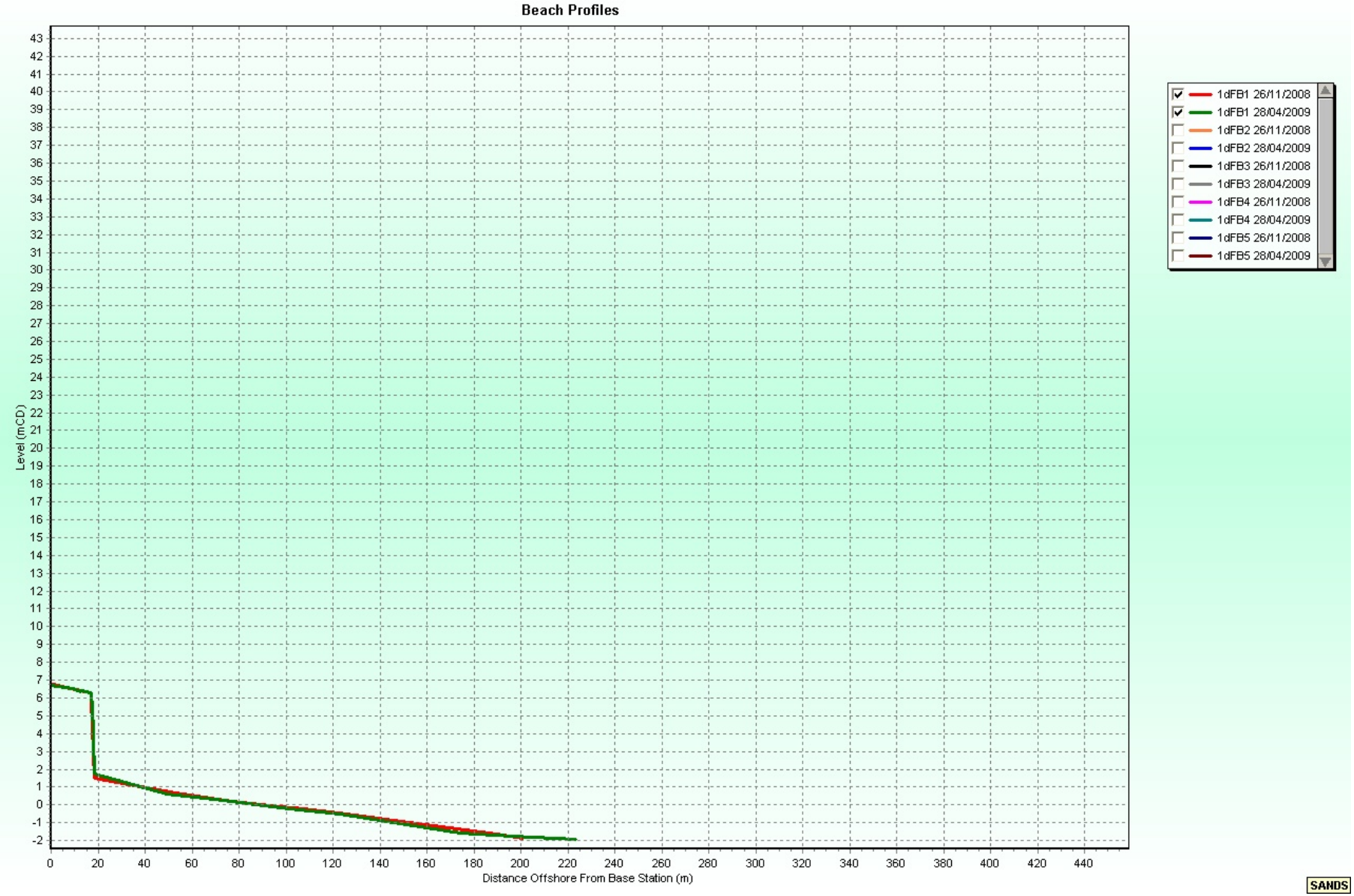
1dFB1

Date 28/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 511989.528 **Northing** 480590.964 **Bearing** 100

Chainage	Level
0	
0.17	6.707
6.06	6.59
9.32	6.538
12.64	6.368
13.06	6.427
15.39	6.373
16.61	6.314
17.05	6.293
17.18	5.916
17.25	6.204
17.29	5.872
17.39	5.774
18.35	1.717
49.23	0.603
69.59	0.302
101.52	-0.236
123.29	-0.525
151.34	-1.077
174.17	-1.577
196.38	-1.768
223.18	-1.95




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dFB1 26/11/2008
1dFB1 28/04/2009
1dFB2 26/11/2008
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1dFB3 26/11/2008
1dFB3 28/04/2009
1dFB4 26/11/2008
1dFB4 28/04/2009
1dFB5 26/11/2008
1dFB5 28/04/2009
SANDS

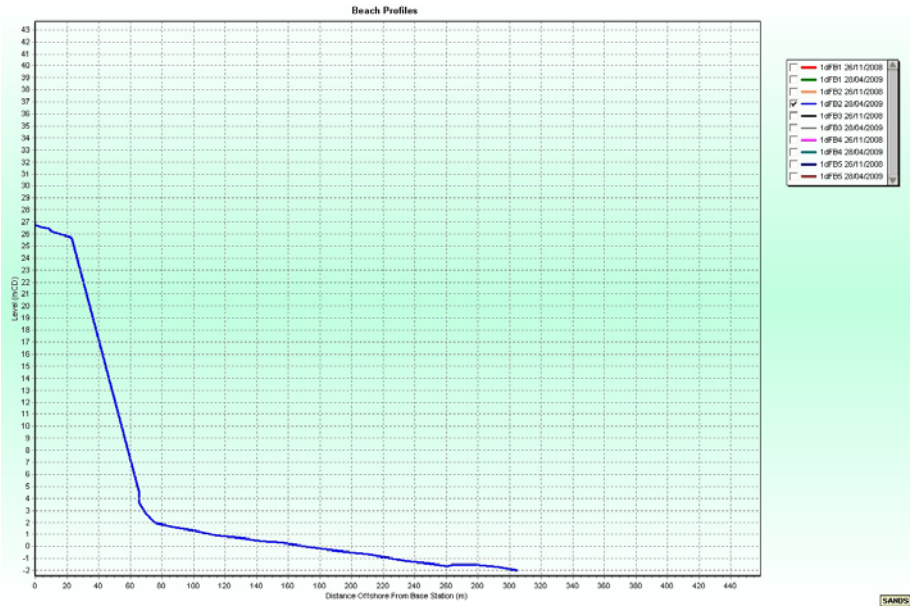
Beach Profile

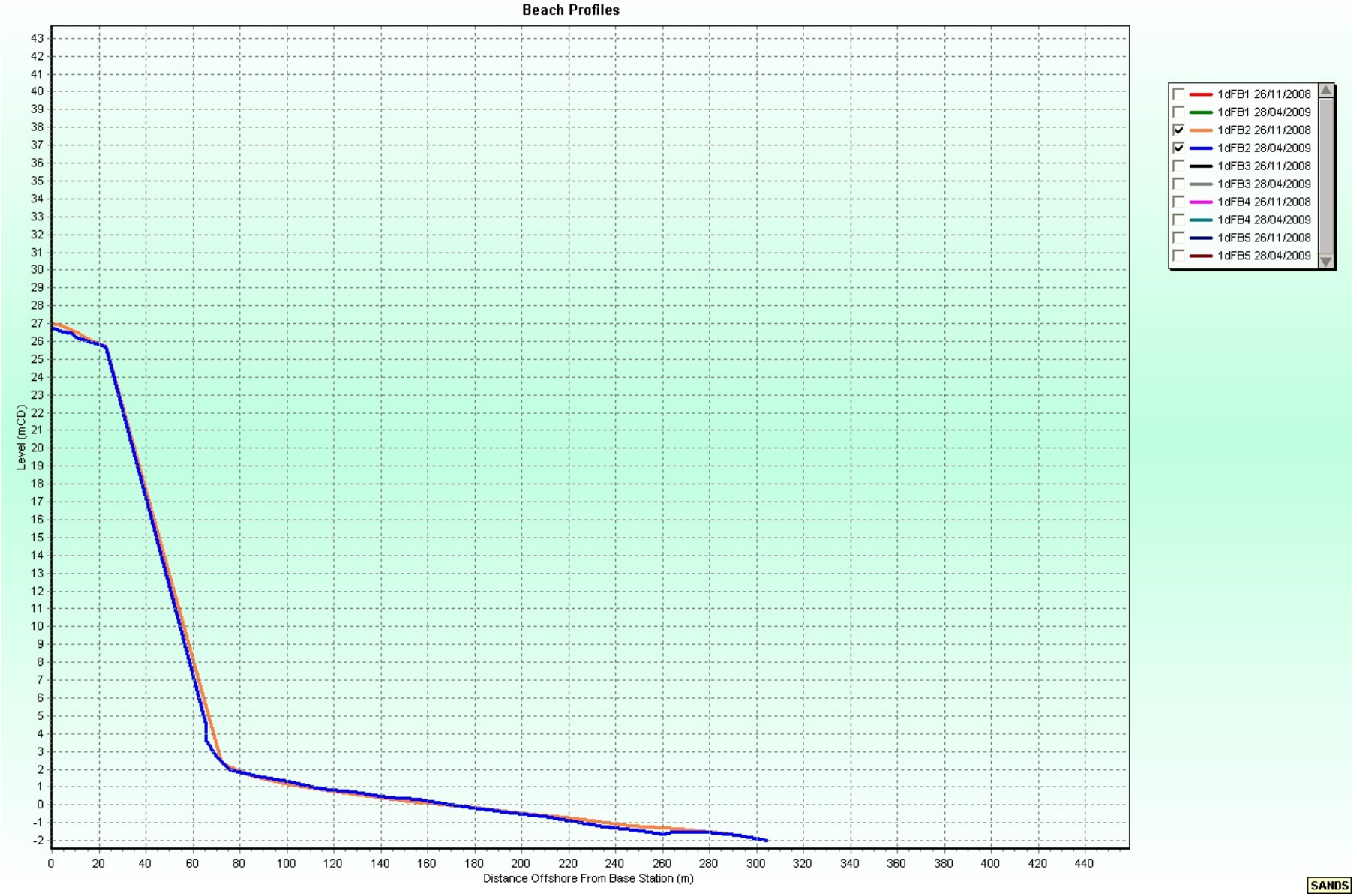
1dFB2

Date 28/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 512005.759 **Northing** 479181.619 **Bearing** 77

Chainage	Level
0	
0	26.776
4.51	26.559
8.52	26.479
8.8	26.332
11.31	26.158
23.08	25.677
65.61	4.498
65.74	3.656
70.31	2.597
76.13	1.972
87.24	1.625
100.52	1.332
114.57	0.926
128.58	0.725
143.05	0.453
156.1	0.293
169.55	0.022
182.32	-0.205
196.27	-0.434
209.18	-0.631
222.21	-0.946
234.93	-1.197
247.81	-1.413
260.78	-1.629
264.08	-1.523
278.49	-1.512
291.92	-1.719
304.65	-2




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dFB1 26/11/2008
1dFB1 28/04/2009
1dFB2 26/11/2008
1dFB2 28/04/2009
1dFB3 26/11/2008
1dFB3 28/04/2009
1dFB4 26/11/2008
1dFB4 28/04/2009
1dFB5 26/11/2008
1dFB5 28/04/2009
SANDS

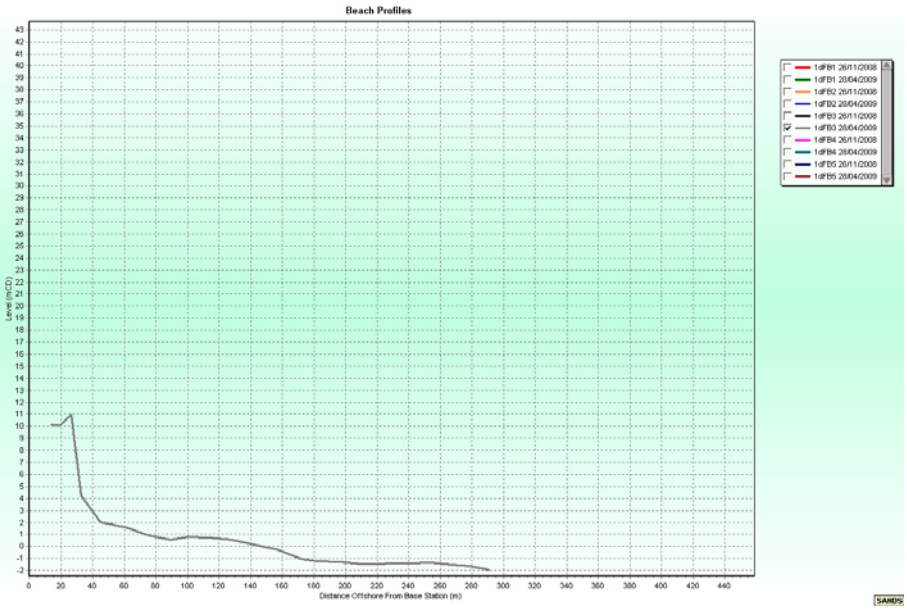
Beach Profile

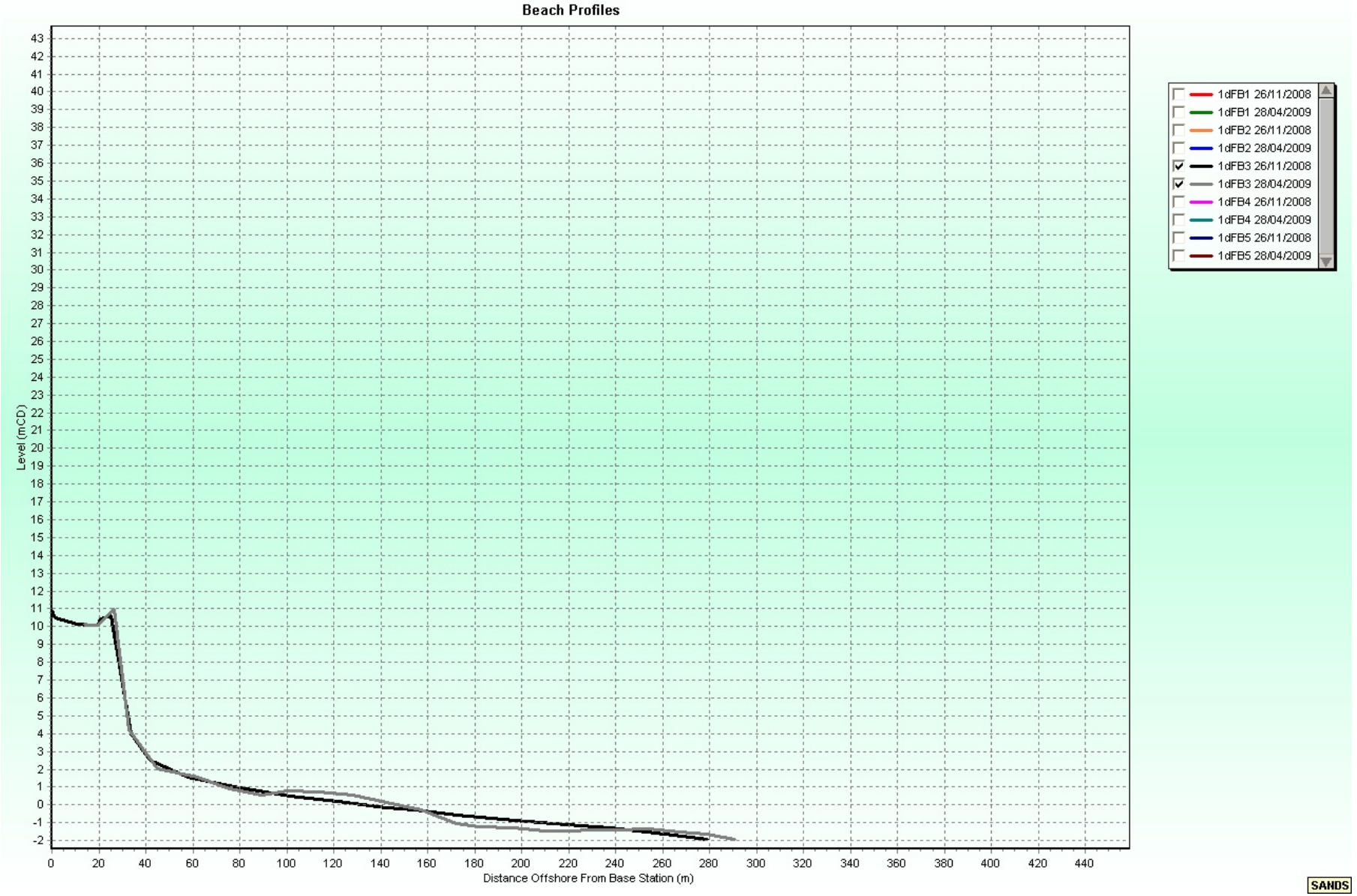
1dFB3

Date 28/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 512429.303 **Northing** 478202.148 **Bearing** 61

Chainage	Level
0	
13.76	10.125
16.3	10.064
19.87	10.061
26.47	10.985
32.95	4.22
45	2.01
62.21	1.543
75.42	0.901
89.26	0.545
100.32	0.788
113.77	0.701
128.09	0.539
142.4	0.162
157.26	-0.283
172.25	-1.062
181.87	-1.237
196.21	-1.293
209.86	-1.467
240.19	-1.426
253.7	-1.37
267.53	-1.495
278.61	-1.61
290.47	-1.938




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
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1dFB1 28/04/2009
1dFB2 26/11/2008
1dFB2 28/04/2009
1dFB3 26/11/2008
1dFB3 28/04/2009
1dFB4 26/11/2008
1dFB4 28/04/2009
1dFB5 26/11/2008
1dFB5 28/04/2009
SANDS

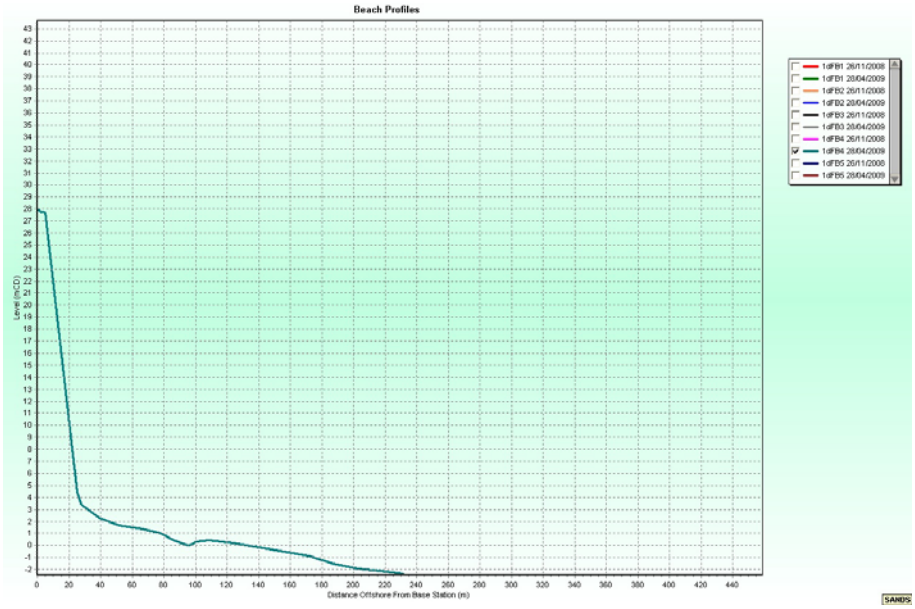
Beach Profile

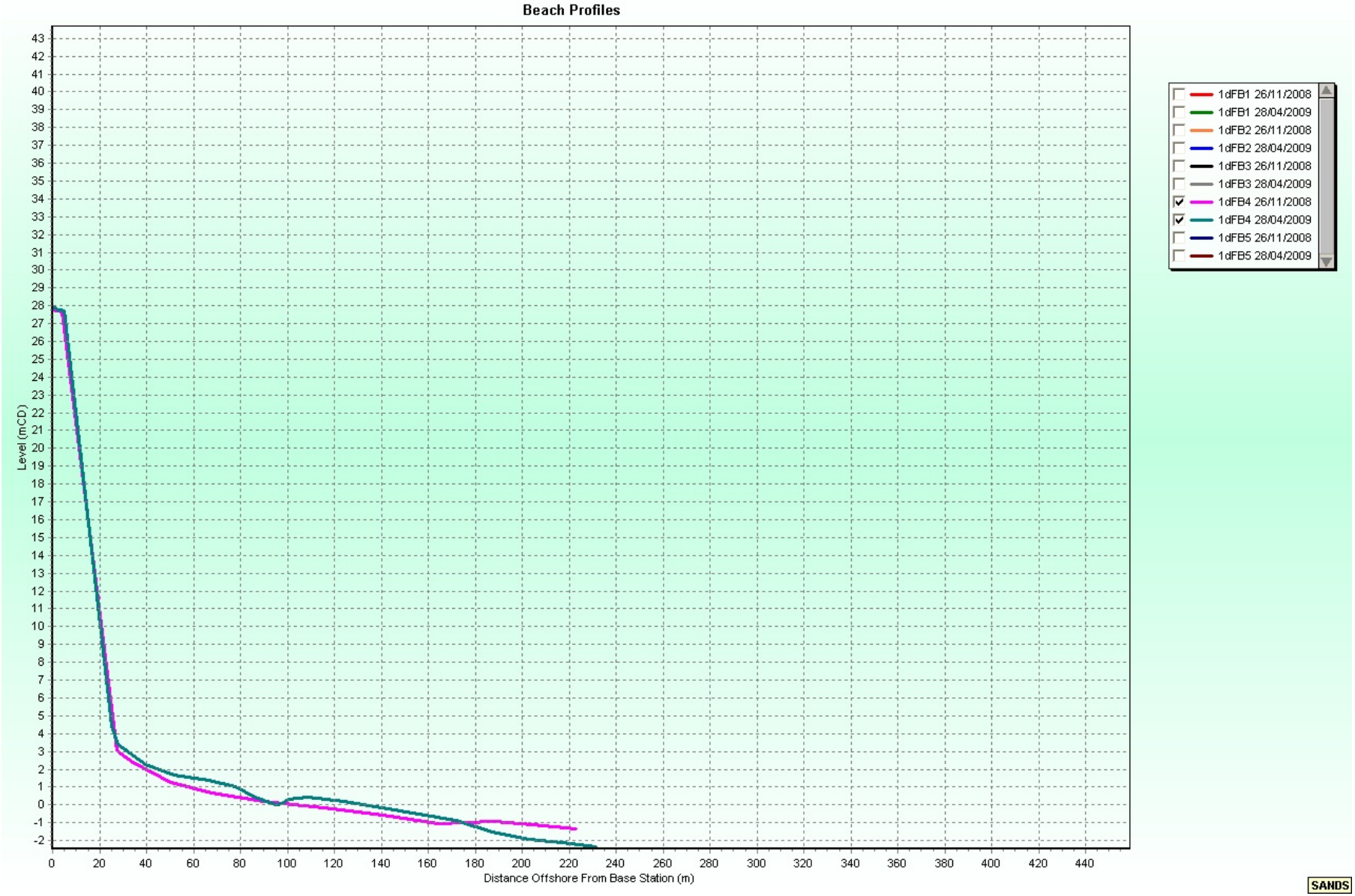
1dFB4

Date 28/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 513165.53 **Northing** 477182.418 **Bearing** 51

Chainage	Level
0	
0.03	27.957
1.66	27.827
2.15	27.71
3.55	27.79
4.82	27.737
25.2	4.428
27.8	3.4
39.55	2.292
51.64	1.705
66.43	1.368
77.86	1.035
86.19	0.431
93.51	0.079
95.69	-0.007
97.39	0.084
100.84	0.328
108.55	0.418
124.04	0.176
140.21	-0.173
155.88	-0.499
171.49	-0.856
187.42	-1.549
203.13	-1.938
216.84	-2.131
231.51	-2.333




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
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1dFB1 28/04/2009
1dFB2 26/11/2008
1dFB2 28/04/2009
1dFB3 26/11/2008
1dFB3 28/04/2009
1dFB4 26/11/2008
1dFB4 28/04/2009
1dFB5 26/11/2008
1dFB5 28/04/2009
SANDS

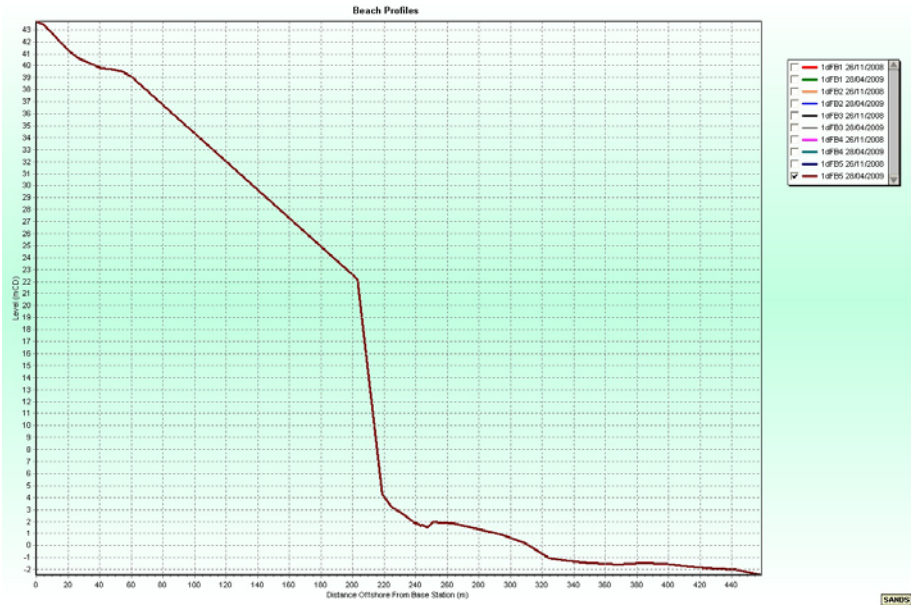
Beach Profile

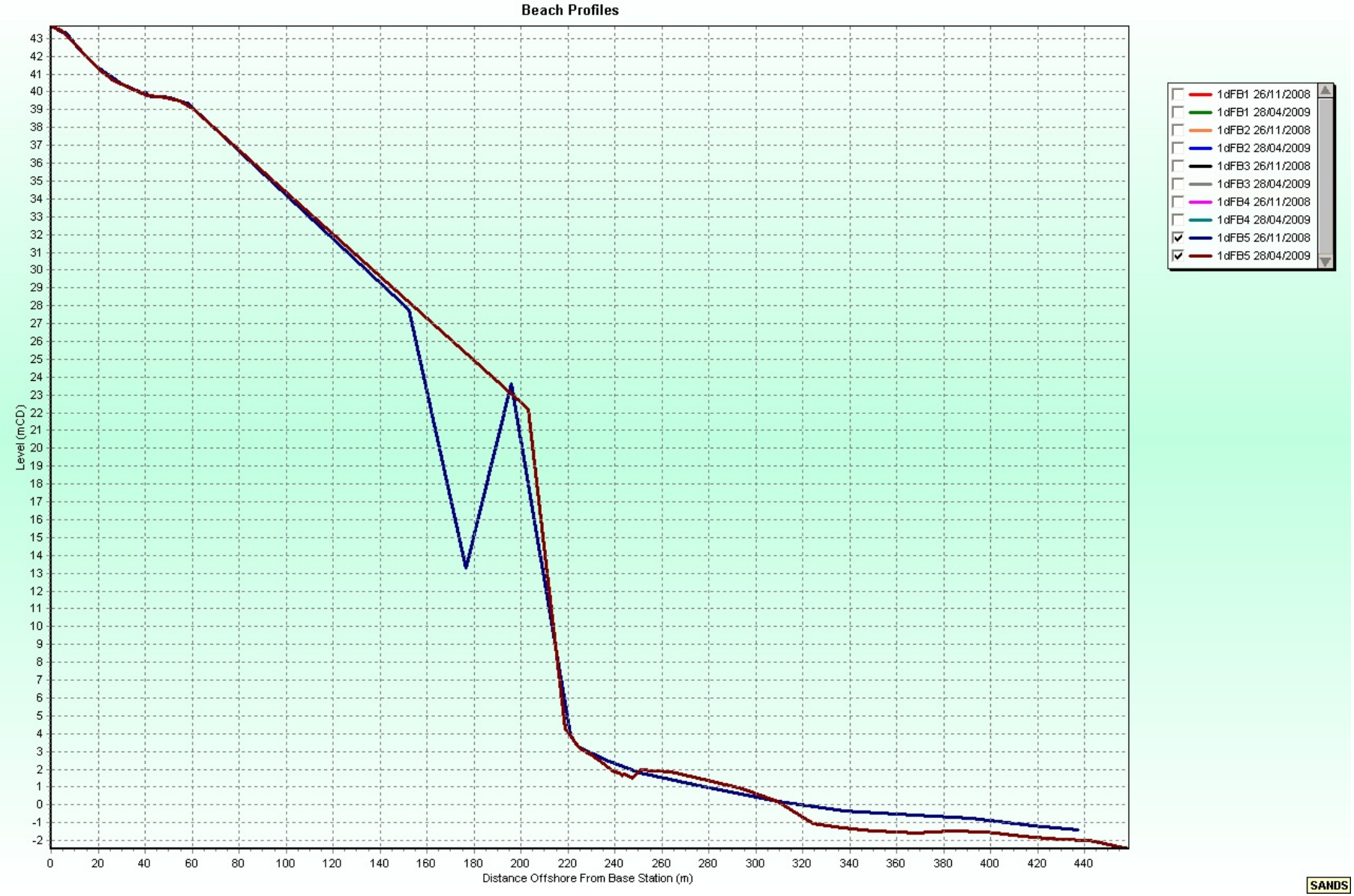
1dFB5

Date 28/04/2009 **Inspector** **Low Tide (m)** **LowTideTime** 1157
Wind **Sea State** Calm **Visibility** Good **Rain** No
Summary

Easting 514207.792 **Northing** 476001.334 **Bearing** 47

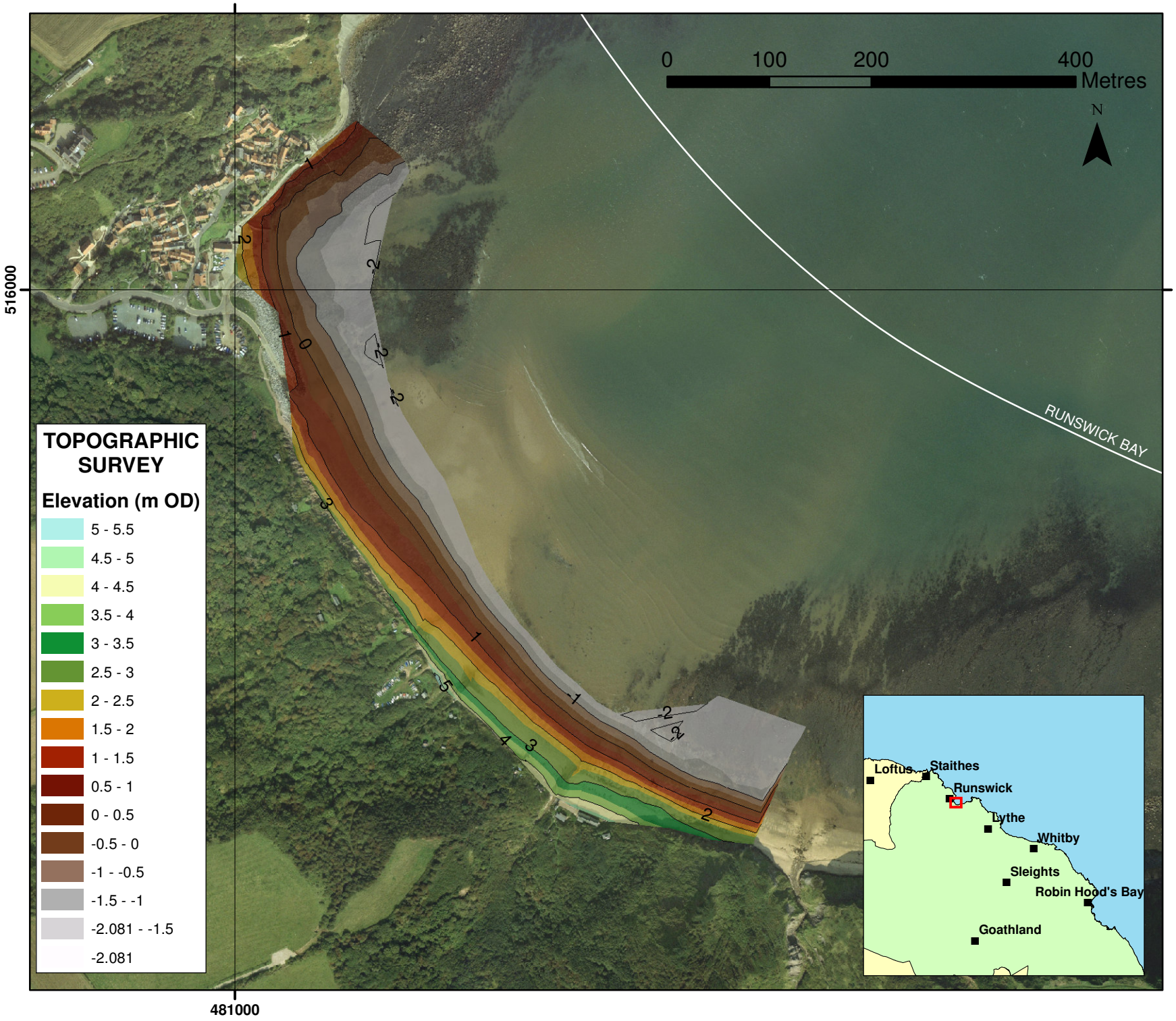
Chainage	Level
0	
0.06	43.685
5.16	43.378
12.48	42.362
19.69	41.35
26.03	40.65
33.55	40.232
40.95	39.818
46.57	39.752
54.64	39.515
60.46	39.024
203.07	22.205
218.92	4.299
225.21	3.171
229.91	2.815
235.12	2.321
238.85	1.94
242.41	1.744
243.25	1.598
243.74	1.753
247.62	1.511
248.97	1.676
250.66	1.962
263.88	1.837
279.6	1.361
294.08	0.901
308.93	0.171
324.26	-1.018
336.83	-1.295
349.76	-1.443
360.88	-1.523
367.89	-1.559
382.64	-1.445
398.01	-1.524
413.48	-1.745
430.07	-1.93
442.06	-1.979
458.69	-2.467




Beach Profiles
Level (mCD)
Distance Offshore From Base Station (m)
1dFB1 26/11/2008
1dFB1 28/04/2009
1dFB2 26/11/2008
1dFB2 28/04/2009
1dFB3 26/11/2008
1dFB3 28/04/2009
1dFB4 26/11/2008
1dFB4 28/04/2009
1dFB5 26/11/2008
1dFB5 28/04/2009
SANDS

Appendix B

Topographic Survey



Topographic Contours at 1 metre interval

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 1 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:5,000 at A4

Drawn by:	ES	Date: 03/06/2009
Checked by:	RJ	Date: 03/06/2009
Approved by:	RJ	Date: 03/06/2009

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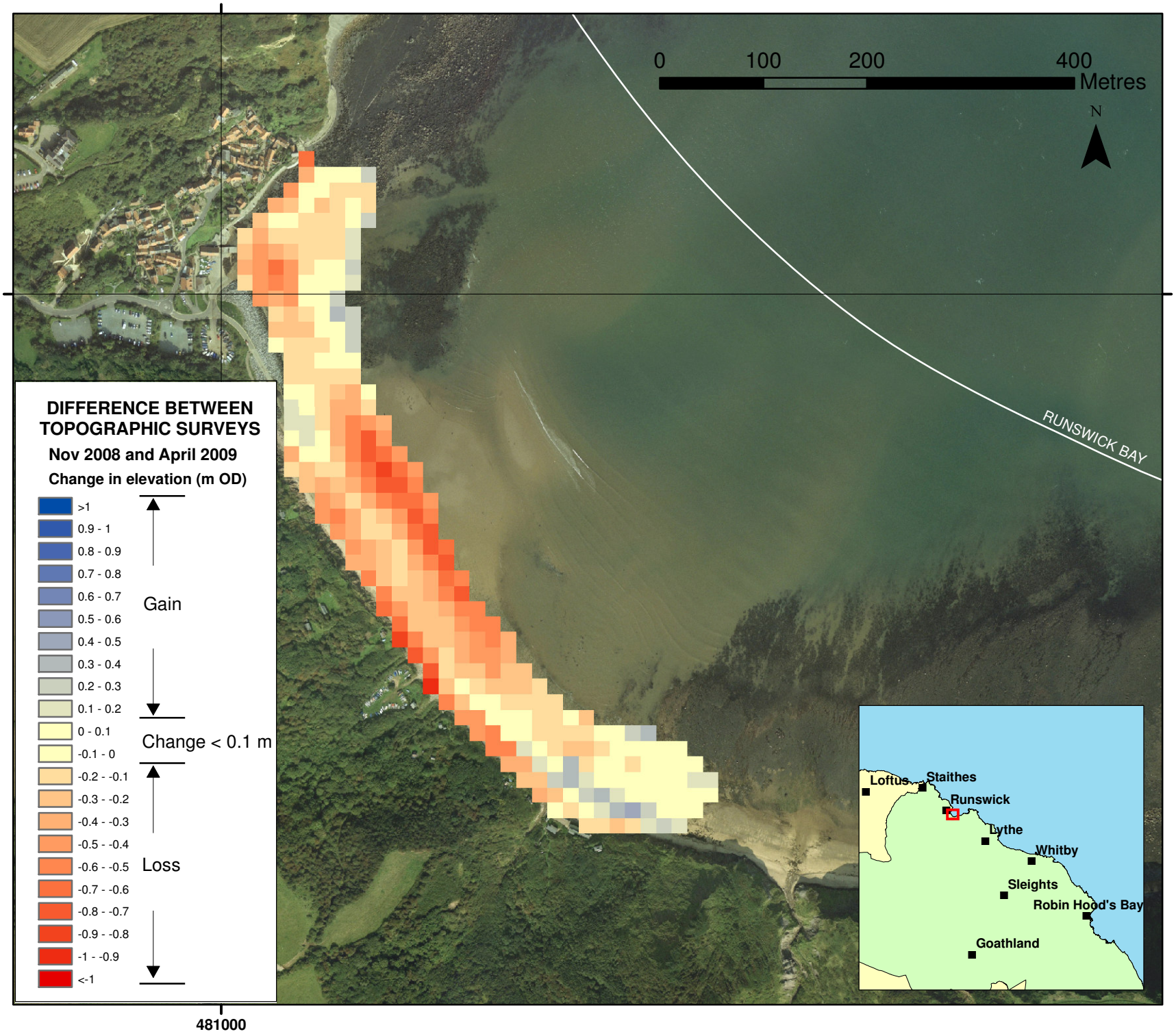

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 2 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:5,000 at A4

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Approved by:	RJ	Date: 03/06/2009

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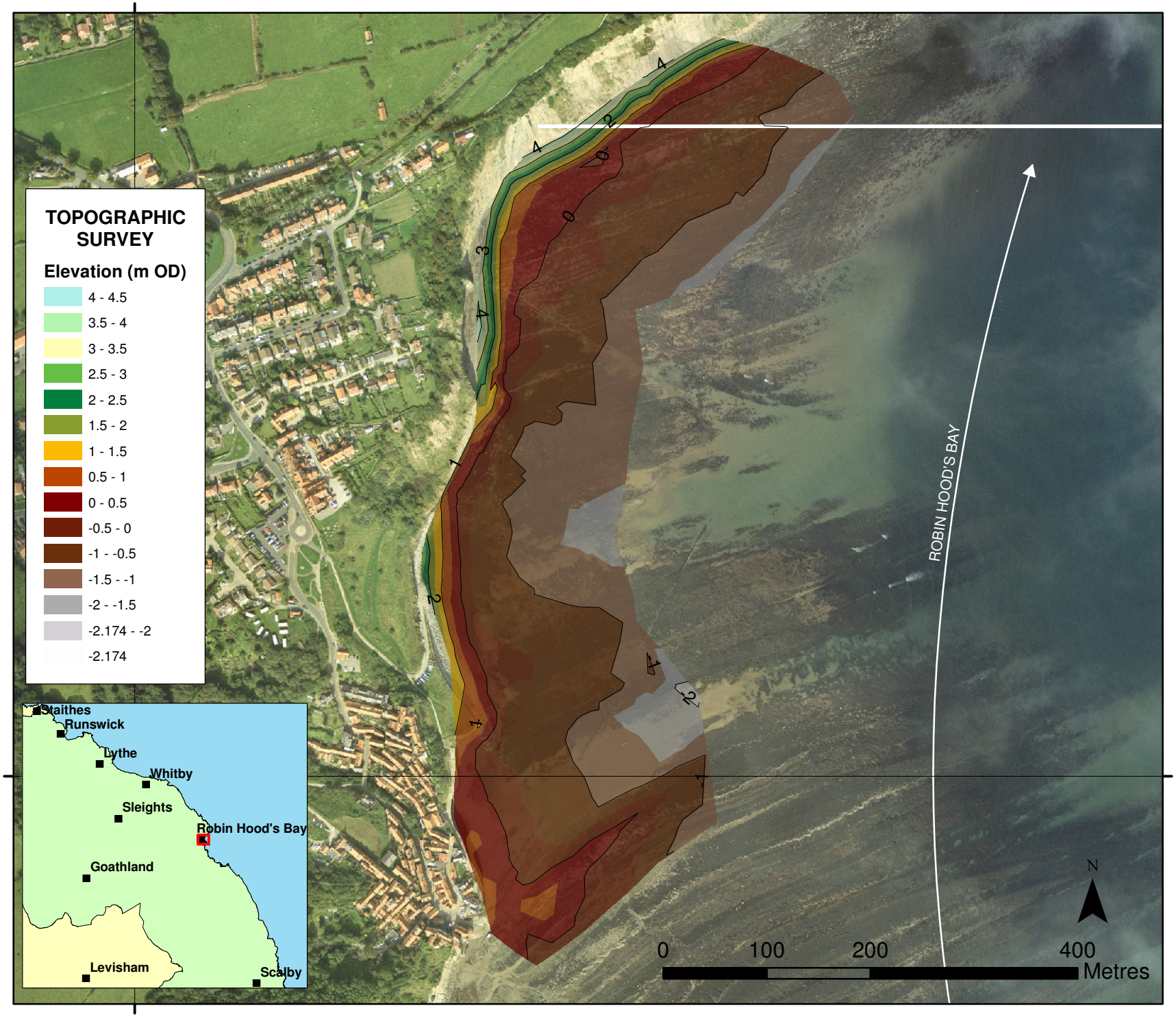

Topographic Contours at 1 metre interval

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 3 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:5,000 at A4

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Approved by:	RJ	Date: 03/06/2009

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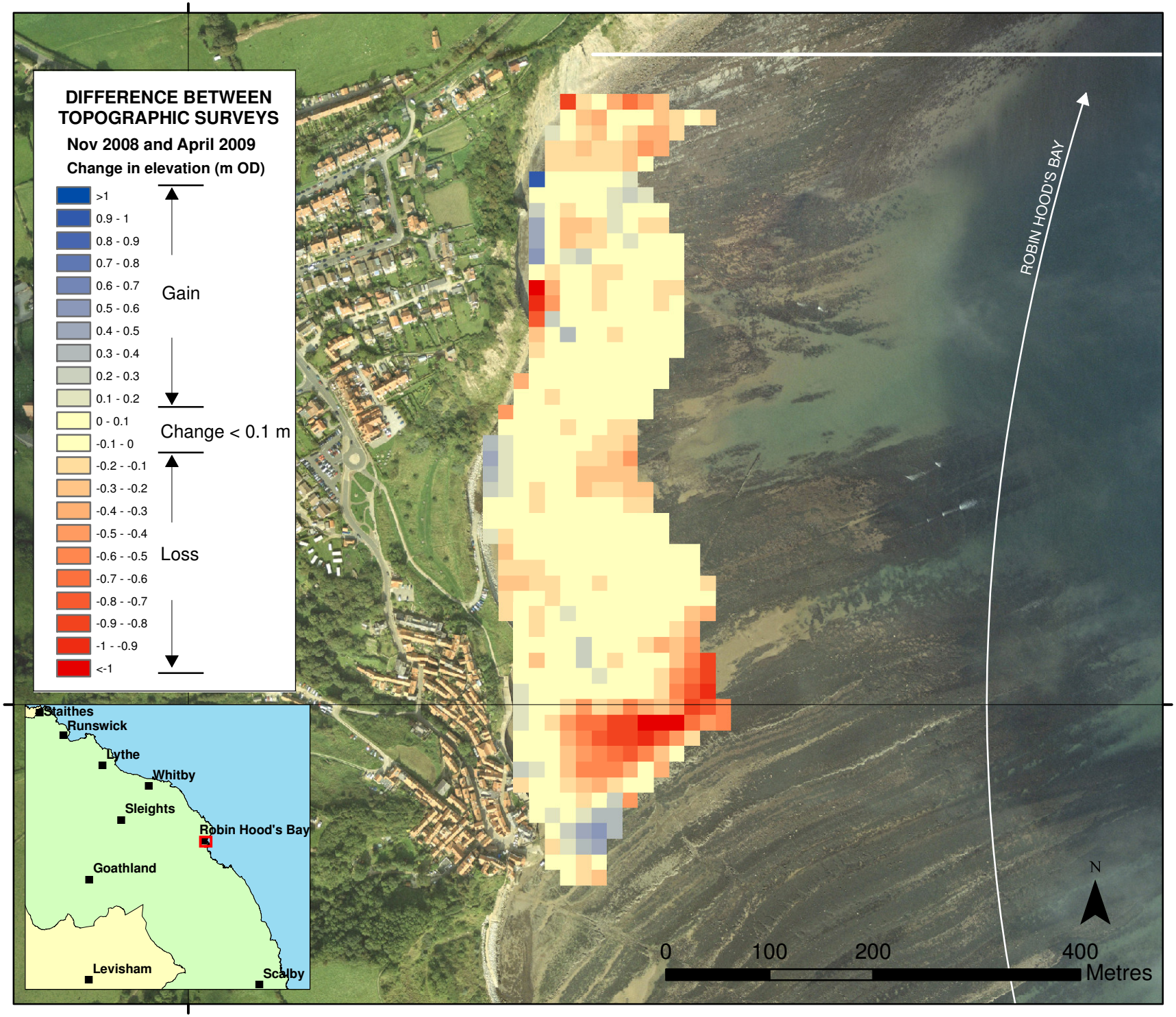

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 4
Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:5,000 at A4

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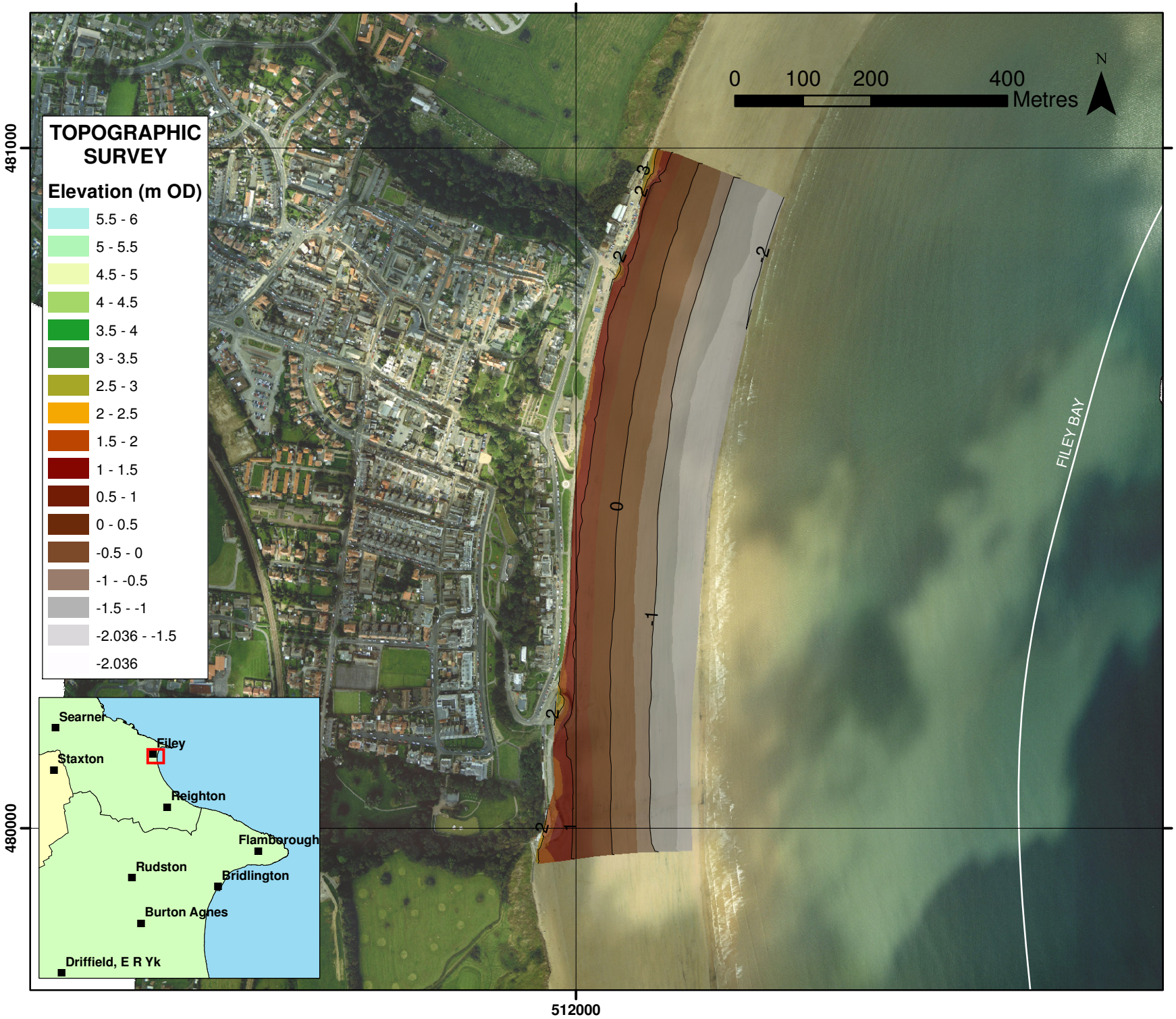

Topographic Contours at 1 metre interval

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 5 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:7,500 at A4

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Approved by:	RJ	Date:	03/06/2009

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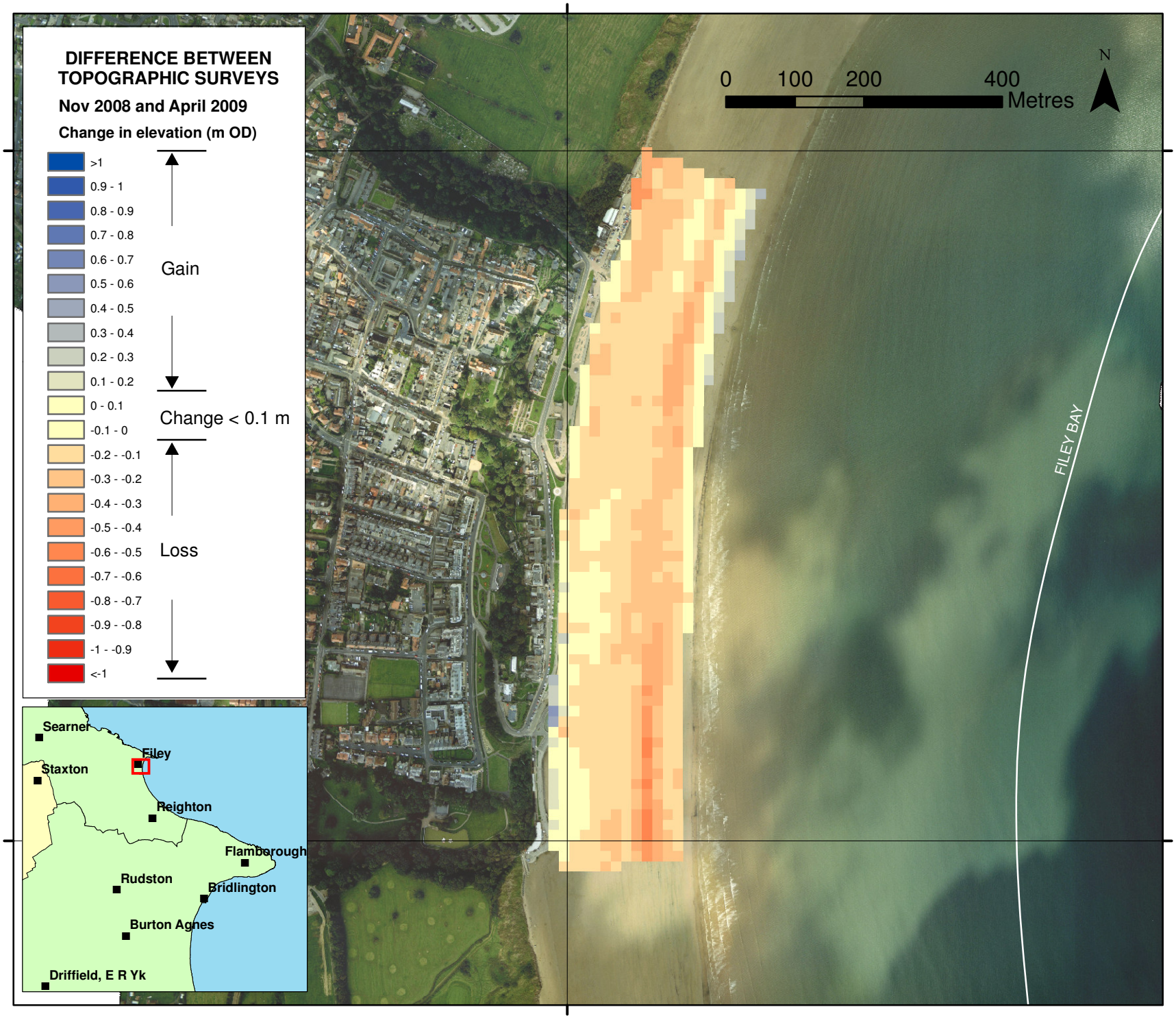

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 6
Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:7,500 at A4

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Approved by:	RJ	Date: 03/06/2009

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Appendix C

Cliff Top Survey

Staithes

Twenty ground control points have been established at Staithes (Appendix C- Map 1). The maximum separation between any two points is nominally 100 m.

The cliff top surveys at Staithes are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the April 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.

Table C1 – Cliff Top Surveys at Staithes

Ground Control Point Details					Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Level (mODN)	Bearing (º)	Baseline Survey (Nov 2008)	Previous Survey (Nov 2008)	Present Survey (April 2009)	Baseline (Nov 2008) to Present (April 2009)	Previous (Nov 2008) to Present (April 2009)	Baseline (Nov 2008) to Present (April 2009)
1	477228	518769	60.587	320	1.9	1.9	1.7	-0.2	-0.2	-0.5
2	477334	518798	57.543	0	10.9	10.9	10.6	-0.3	-0.3	-0.7
3	477487	518789	54.861	350	7.1	7.1	7.8	+0.7	+0.7	-
4	477594	518801	53.636	340	5.9	5.9	5.6	-0.3	-0.3	-0.7
5	477683	518911	48.371	350	8.4	8.4	7.8	-0.6	-0.6	-1.4
6	477792	518867	47.422	30	8.6	8.6	8.5	-0.1	-0.1	-0.2
7	477891	518828	44.602	60	7.7	7.7	7.6	-0.1	-0.1	-0.2
8	477959	518873	39.974	350	8.7	8.7	8.7	0	0	0
9	478088	518950	37.281	350	7.6	7.6	7.3	-0.3	-0.3	-0.7
10	478191	519023	42.655	340	8.4	8.4	8.6	+0.2	+0.2	-
11	478237	519007	39.990	60	6.9	6.9	6.8	-0.1	-0.1	-0.2
12	478213	518988	37.169	150	6.1	6.1	6.7	+0.6	+0.6	-
13	478501	518809	50.260	15	11.4	11.4	10.9	-0.5	-0.5	-1.2
14	478624	518807	55.345	20	7.5	7.5	7.00	-0.5	-0.5	-1.2
15	478737	518858	56.017	60	6.1	6.1	6.8	+0.7	+0.7	-
16	478823	518757	50.237	60	8.0	8.0	8.1	+0.1	+0.1	0
17	478944	518671	46.764	30	9.3	9.3	9.5	+0.2	+0.2	-
18	479052	518630	47.026	20	9.2	9.2	9.1	-0.1	-0.1	-0.2
19	479147	518610	47.108	0	14.2	14.2	14.4	+0.2	+0.2	-
20	479274	518618	44.243	20	11.4	11.4	11.2	-0.2	-0.2	-0.5

Note: It is assumed that the accuracy of cliff top monitoring using this technique is ±0.1m. Therefore observed changes have been altered by this amount prior to calculation of an erosion rate. Erosion rates are not calculated where the cliff line shows advance. This is likely to be the product of differing survey interpretation, and far less likely to be a toppling cliff edge.

Cliff Top Survey

Cayton Bay

Eight ground control points have been established within Cayton Bay (Appendix C- Map 2). The maximum separation between any two points is nominally 300m.

The cliff top surveys at Cayton Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C2 provides baseline information about these ground control points and results from the April 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.

Table C2 – Cliff Top Surveys at Cayton Bay

Ground Control Point Details					Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Level (mODN)	Bearing (º)	Baseline Survey (Nov 2008)	Previous Survey (Nov 2008)	Present Survey (April 2009)	Baseline (Nov 2008) to Present (April 2009)	Previous (Nov 2008) to Present (April 2009)	Baseline (Nov 2008) to Present (April 2009)
1	506325	484850	32.079	50	4.0	4.0	3.7	-0.3	-0.3	-0.7
2	506459	484716	28.227	65	5.0	5.0	4.9	-0.1	-0.1	-0.2
3	506597	484539	28.204	65	5.0	5.0	5.1	+0.1	+0.1	-
4	506778	484345	38.944	21	9.0	9.0	9.2	+0.2	+0.2	-
5	507019	484222	38.816	342	7.7	7.7	7.7	0.0	0.0	0
6	507242	484122	46.544	2	7.4	7.4	7.4	0.0	0.0	0
7	507518	484008	69.549	25	7.5	7.5	7.3	-0.2	-0.2	-0.5
8	507819	484006	80.135	1	5.5	5.5	5.6	+0.1	+0.1	-

Note: It is assumed that the accuracy of cliff top monitoring using this technique is ±0.1m. Therefore observed changes have been altered by this amount prior to calculation of an erosion rate. Erosion rates are not calculated where the cliff line shows advance. This is likely to be the product of differing survey interpretation, and far less likely to be a toppling cliff edge.

Cliff Top Survey

Filey Bay

Twenty-three ground control points have been established within Filey Bay (Appendix C- Map 3a & 3b). The maximum separation between any two points is nominally 300 m.

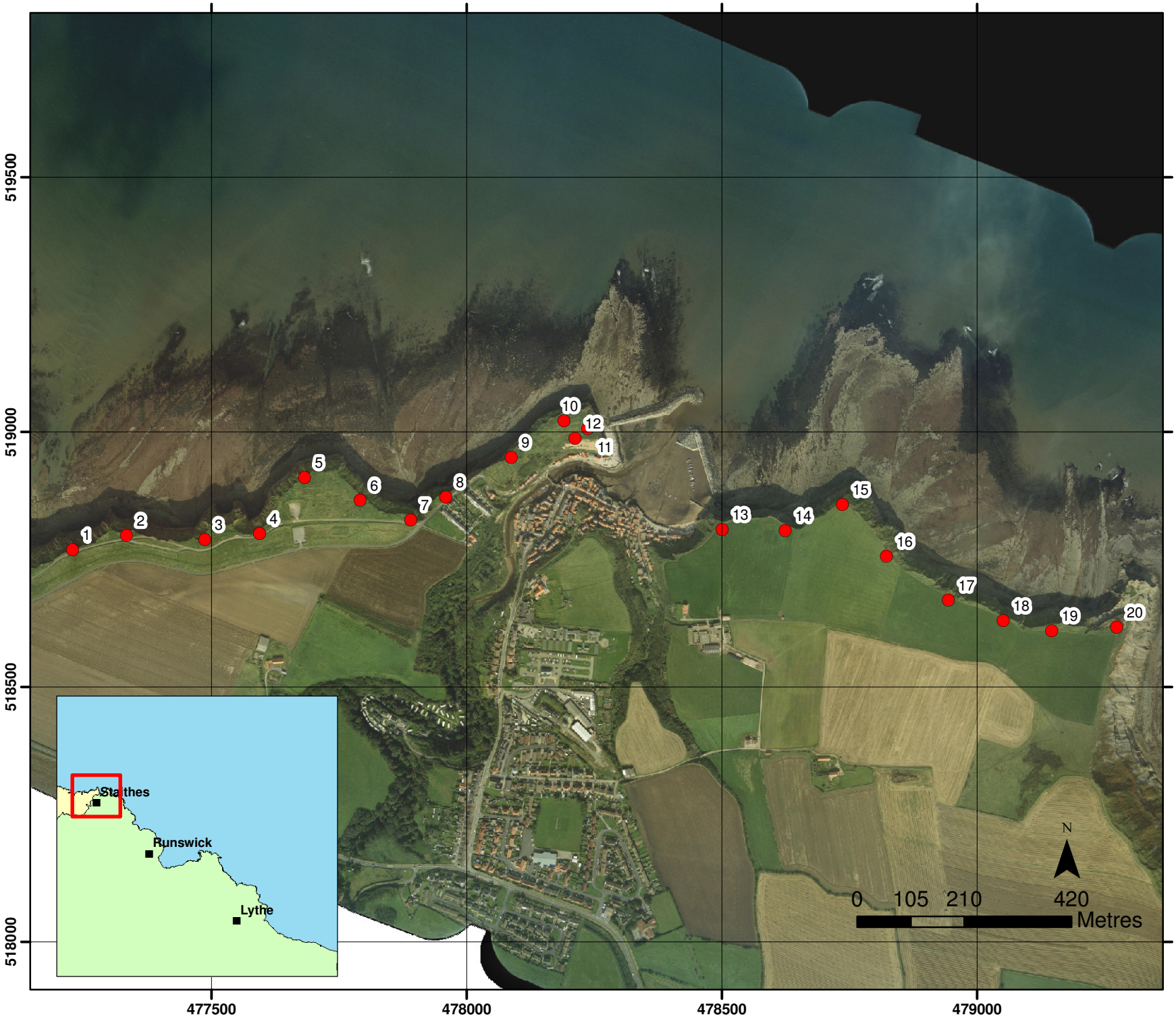
The cliff top surveys at Filey Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C3 provides baseline information about these ground control points and results from the April 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.

Table C3 – Cliff Top Surveys at Filey Bay

Ground Control Point Details					Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Level (mODN)	Bearing (º)	Baseline Survey (Nov 2008)	Previous Survey (Nov 2008)	Present Survey (April 2009)	Baseline (Nov 2008) to Present (April 2009)	Previous (Nov 2008) to Present (April 2009)	Baseline (Nov 2008) to Present (April 2009)
1	512445	481631	42.536	130	8.7	8.7	8.5	-0.2	-0.2	-0.5
2	512307	481490	37.536	144	7.6	7.6	7.5	-0.1	-0.1	-0.2
3	512154	481235	34.607	122	8.3	8.3	8.6	+0.3	+0.3	-
4	512029	480960	33.034	112	7.4	7.4	7.5	+0.1	+0.1	-
5	511895	479888	28.755	89	7.1	7.1	3.6	-3.5	-3.5	-8.4
6	511908	479597	31.804	48	6.7	6.7	6.8	+0.1	+0.1	-
7	511991	479310	29.201	69	6.7	6.7	6.7	0	0	0
8	512083	478981	27.177	66	10.2	10.2	10.3	+0.1	+0.1	-
9	512121	478786	30.903	76	8.3	8.3	8.1	-0.2	-0.2	-0.5
10	512226	478548	32.958	74	7.5	7.5	7.3	-0.2	-0.2	-0.5
11	512471	478153	11.301	53	6.6	6.6	6.6	0	0	0
12	512559	477902	20.254	66	7.7	7.7	7.6	-0.1	-0.1	-0.2
13	512698	477719	20.216	34	4.2	4.2	4.2	0	0	0
14	512939	477401	31.736	66	8.0	8.0	7.3	-0.7	-0.7	-1.7
15	513157	477193	27.613	51	5.2	5.2	5.2	0	0	0
16	513299	477025	27.972	30	7.7	7.7	7.6	-0.1	-0.1	-0.2
17	513508	476821	36.784	34	10.7	10.7	10.5	-0.2	-0.2	-0.5
18	513721	476602	39.676	31	7.2	7.2	7.2	0	0	0
19	513917	476354	48.852	51	6.6	6.6	6.5	-0.1	-0.1	-0.2
20	514175	476179	41.826	32	7.0	7.0	6.9	-0.1	-0.1	-0.2
21	514472	475966	43.232	66	7.6	7.6	7.5	-0.1	-0.1	-0.2
22	514656	475729	56.553	101	8.1	8.1	8.2	+0.1	+0.1	-
23	514889	475538	68.497	60	9.1	9.1	8.9	-0.2	-0.2	-0.5

Note: It is assumed that the accuracy of cliff top monitoring using this technique is ±0.1m. Therefore observed changes have been altered by this amount prior to calculation of an erosion rate. Erosion rates are not calculated where the cliff line shows advance. This is likely to be the product of differing survey interpretation, and far less likely to be a toppling cliff edge



Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix C - Map 1 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:10,000 at A4

Drawn by:	ES	Date:	03/06/2009
Checked by:	RJ	Date:	03/06/2009
Approved by:	RJ	Date:	03/06/2009

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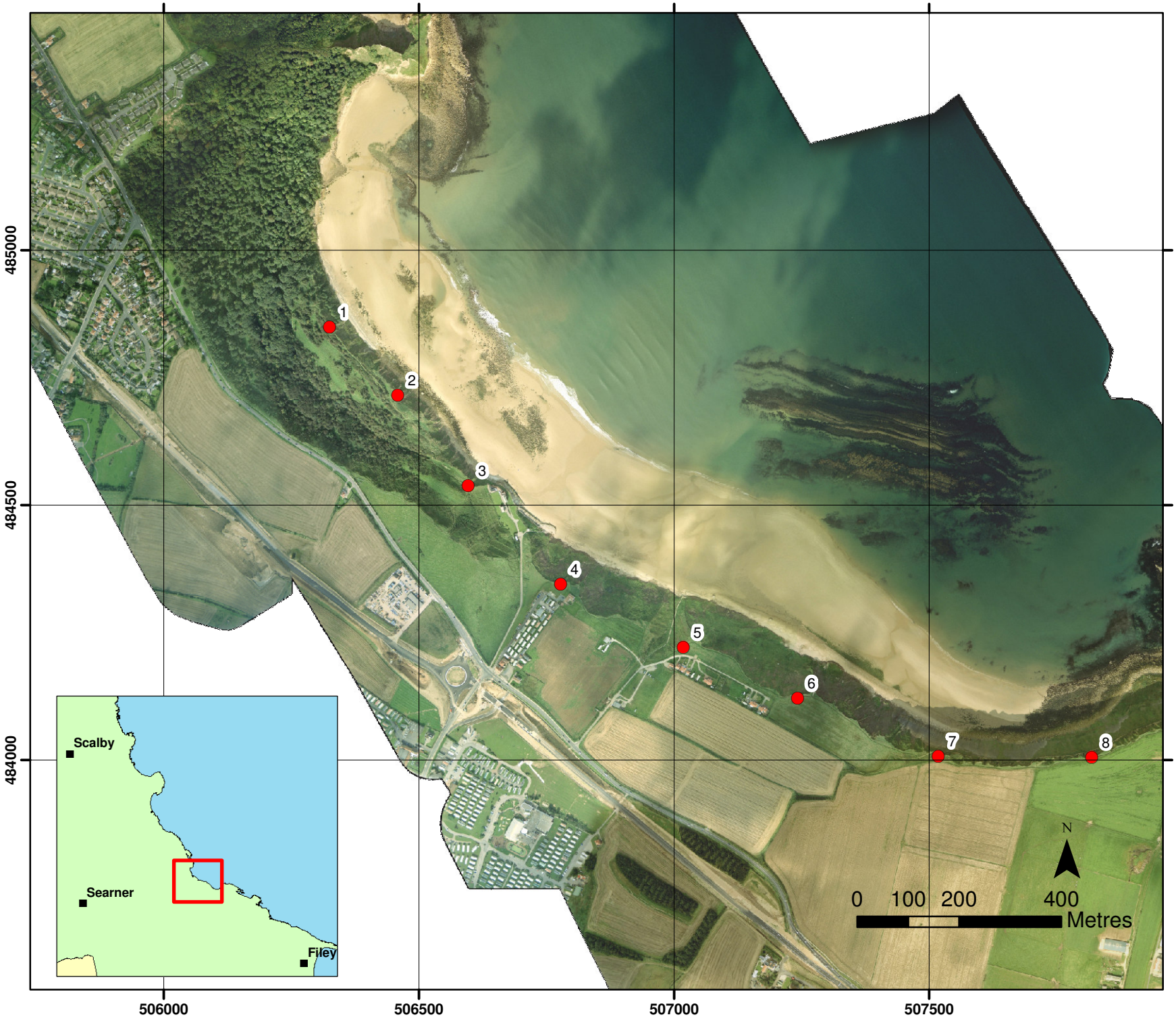

Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix C - Map 2 Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:10,000 at A4

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Approved by:	RJ	Date:	03/06/2009

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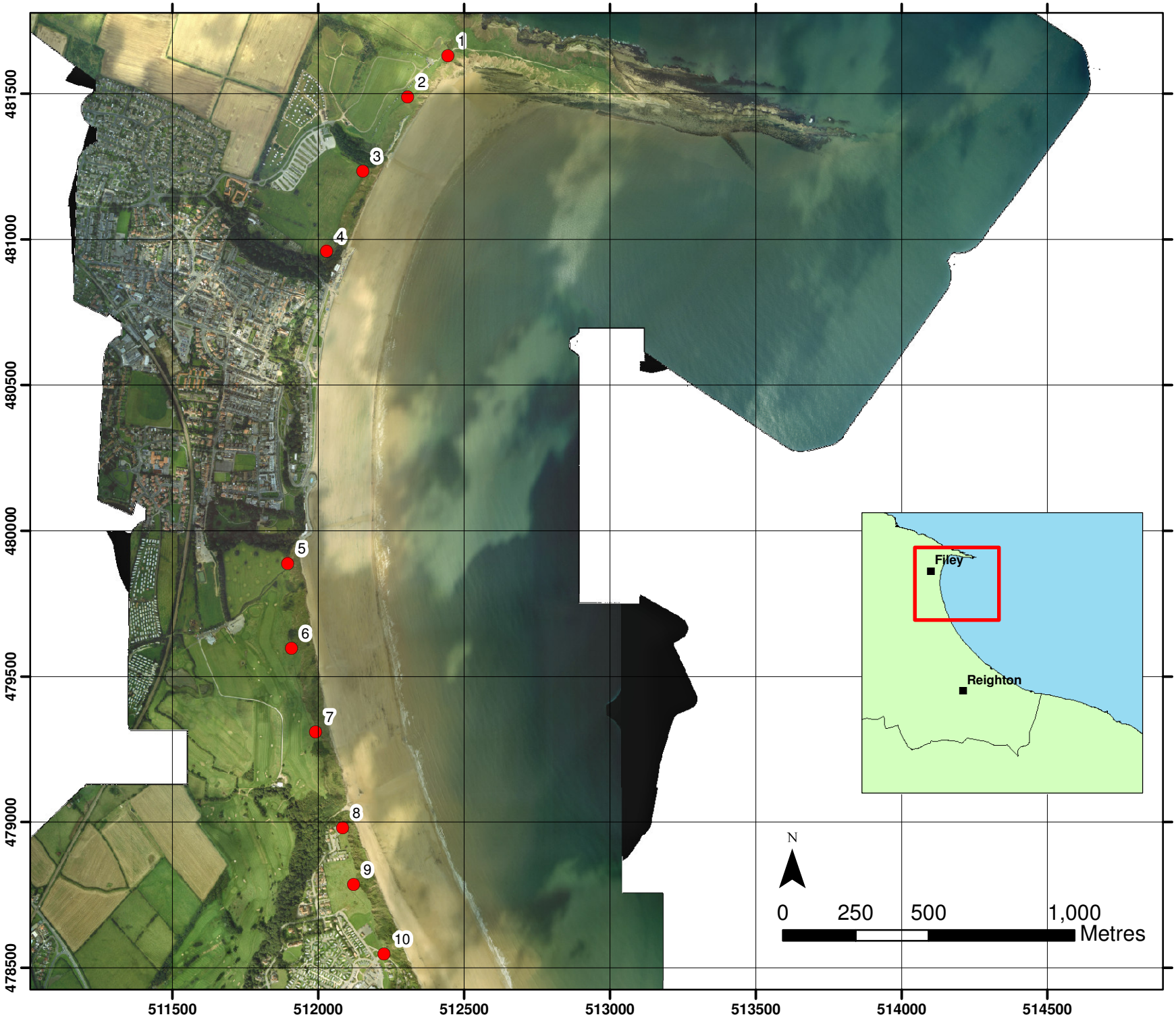

Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix C - Map 3a Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:17,500 at A4

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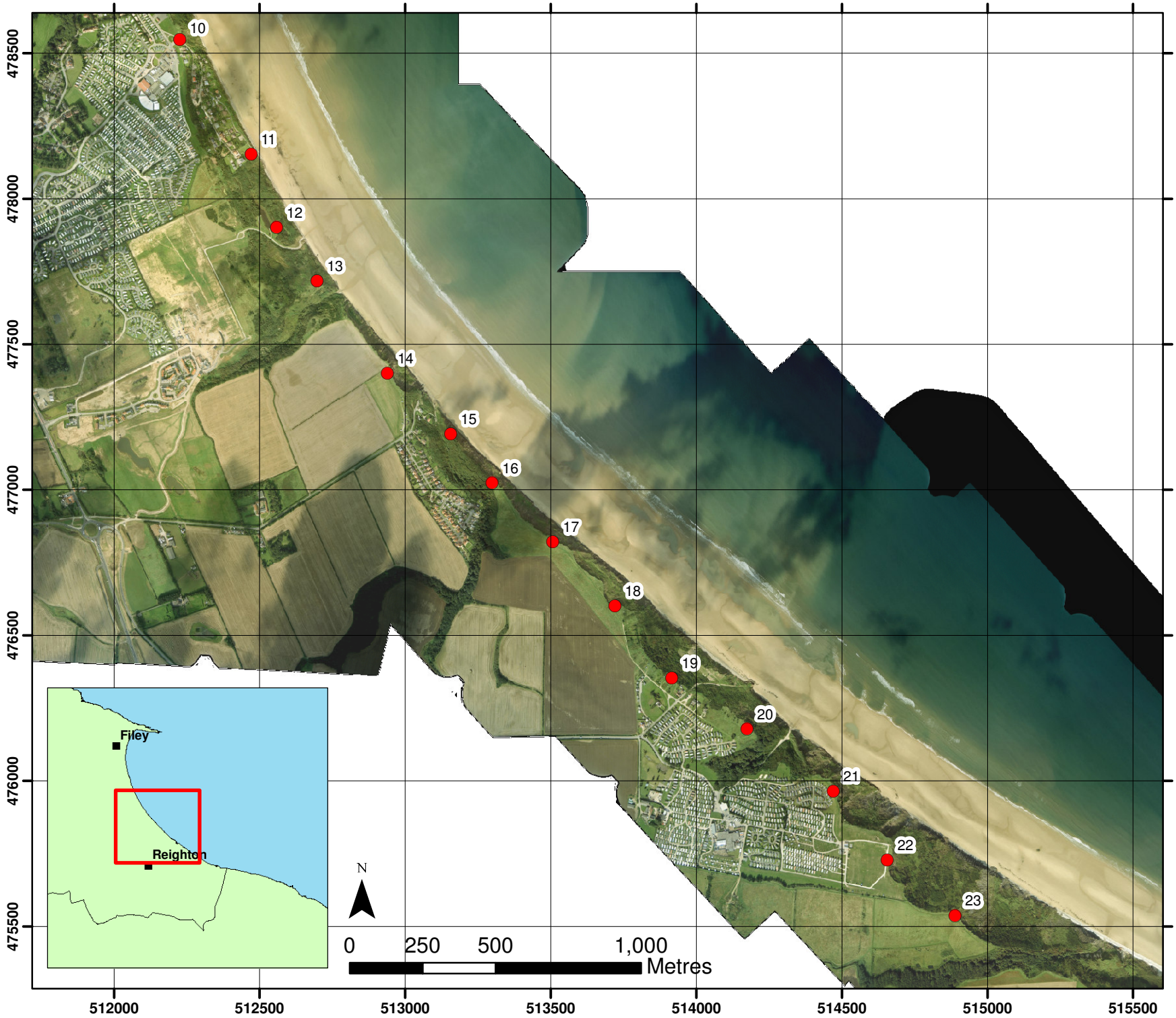

Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix C - Map 3b Scarborough Borough Council Frontage

Update Report 1
'Partial Measures' Survey 2009

Drawing Scale 1:17,500 at A4

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