

**Umgeni to Umhlanga
Beach Monitoring
Program**

Technical Report 82

July 2014



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1. Introduction

Environmental Mapping and Surveying (EMS) was commissioned by eThekweni Municipality's Coastal Engineering, Stormwater and Catchment Department to conduct regular beach monitoring surveys of the Durban North to Umhlanga stretch of coastline. The study area extends from the north bank of the Umgeni Estuary in the south, to 640m south of the Umhlanga Lighthouse in the north. Surveys have been conducted along this stretch of coast since February 2007.

Initially, topographic surveys were conducted of 6 high resolution blocks (Blocks 1-6) and regularly spaced profiles (Profiles 1- 30, Profiles X1-X5), however, since October 2011 complete beach survey coverage has been achieved by using a mobile Lidar system.

The aim of this monitoring program :

- Provide baseline topographic data of the beach state.
- To quantify sediment dynamics (natural & anthropogenic) along this stretch of coastline.

2. Methods

The beach topographic survey is conducted using Sick LMS 291 Laser scanner integrated with a NOVATEL RTK (Real Time Kinematic) GPS and an Xsens MTi-G motion reference unit. The NOVATEL RTK GPS yields real time horizontal and vertical accuracy of 0.05 m.

The LMS scanner operates by measuring the two way travel time of laser light pulses that are reflected back from an object. The returned beams are recorded as a range and bearing and are later post-processed into true coordinates and orthometric heights by integration of the RTK GPS and motion reference data (correct for pitch and roll).

All this equipment is mounted on an all-terrain vehicle (ATV) from which a mobile LIDAR survey of the beach is conducted.

Sediment samples are regularly taken at three positions along a profile (swash zone, mid- and back beach) at sampling sites A to L. Sites are spaced regularly along the coastline.

3. Technical Notes

Date of Survey:

14 July 2014

Survey Personnel:

Rio Leuci

Zane Thackeray

Equipment Used:

Novatel RTK GPS

Sick LMS 291 Lidar

Suzuki King Quad 4x4 ATV

Benchmark:

Trignet Durban Base

Vertical Datum:

Mean Sea Level (MSL)

Mapping Coordinates:

UTM 36 South on WG84 spheroid

Beach Sediment Volume:

Volumes calculated from 0 MSL

Beach Area:

Areas calculated from 0 MSL

Area below Profile:

Area below Profile calculated from 0 MSL

4. Locality Maps – Survey Area & Profile Positions

Original Survey Plan - Umgeni to Umhlanga

Survey Blocks

- Mgeni North - Block 1
- Rocket Hut - Block 2
- Beachwood - Block 3
- Virginia - Block 4
- La Lucia - Block 5
- Umhlanga - Block 6

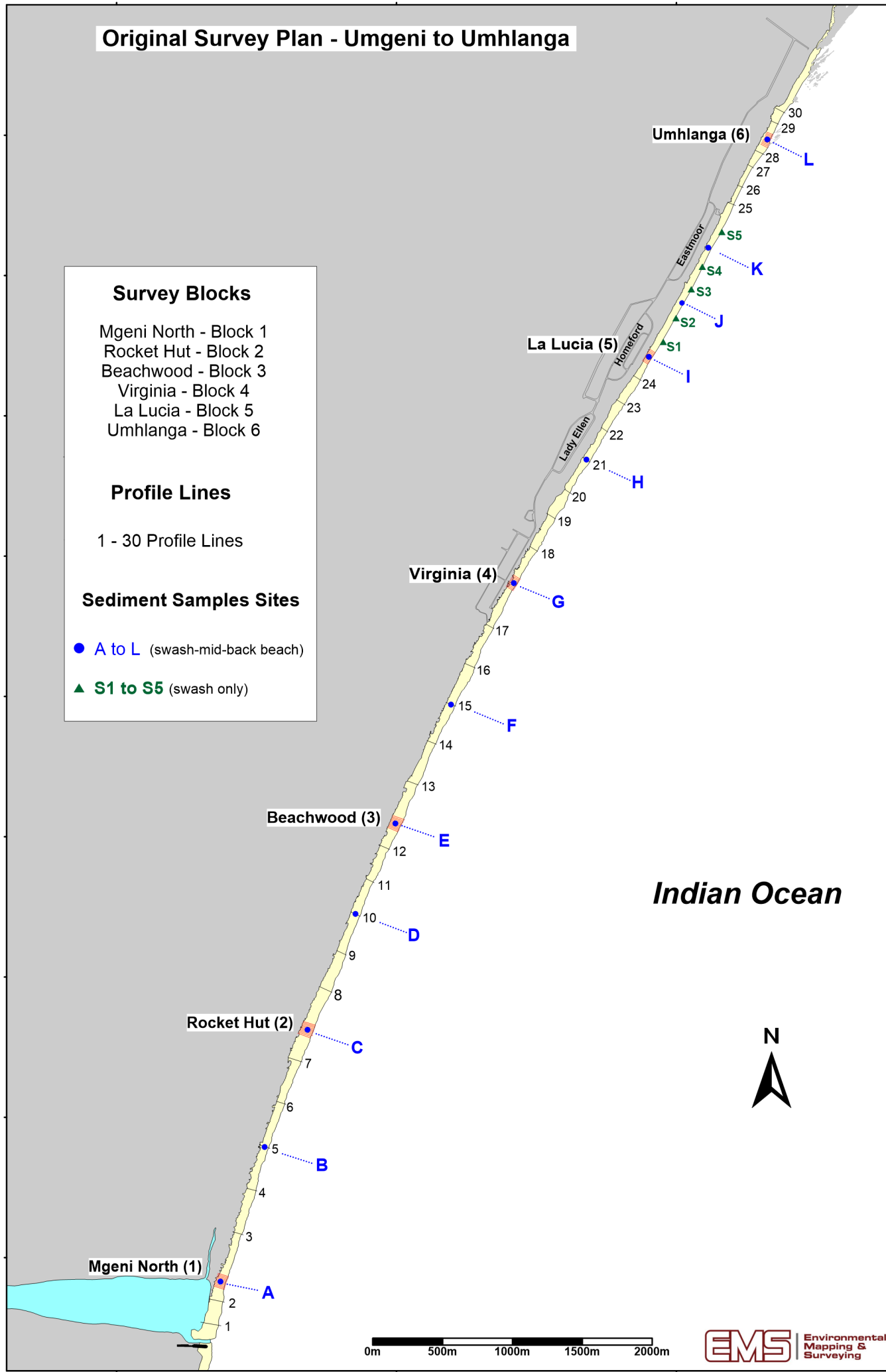
Profile Lines

1 - 30 Profile Lines

Sediment Samples Sites

- A to L (swash-mid-back beach)
- ▲ S1 to S5 (swash only)

6703000
6708000
6707000
6706000
6705000
6704000
6703000
6702000
6701000



Mgeni North (1)

Rocket Hut (2)

Beachwood (3)

Virginia (4)

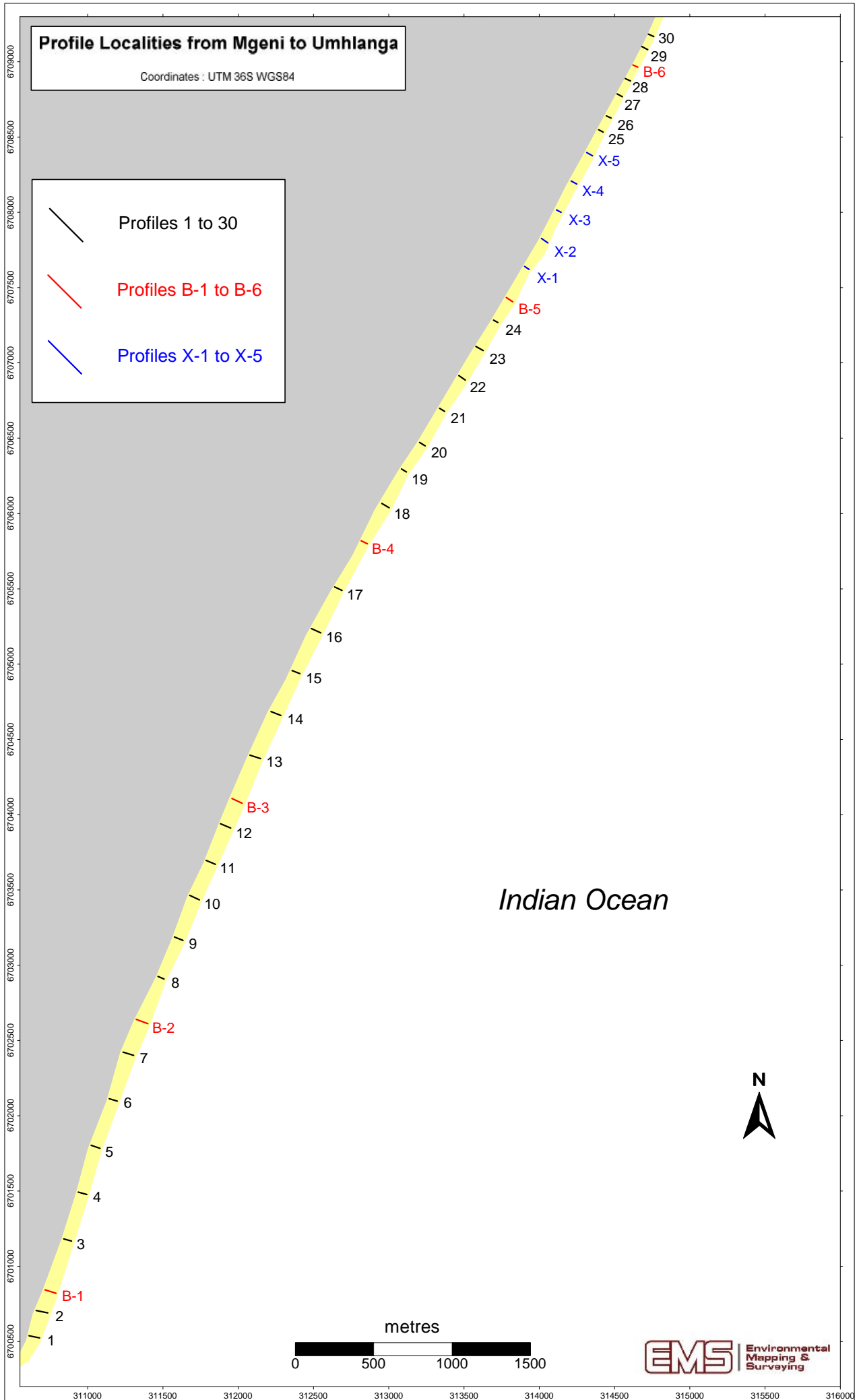
La Lucia (5)

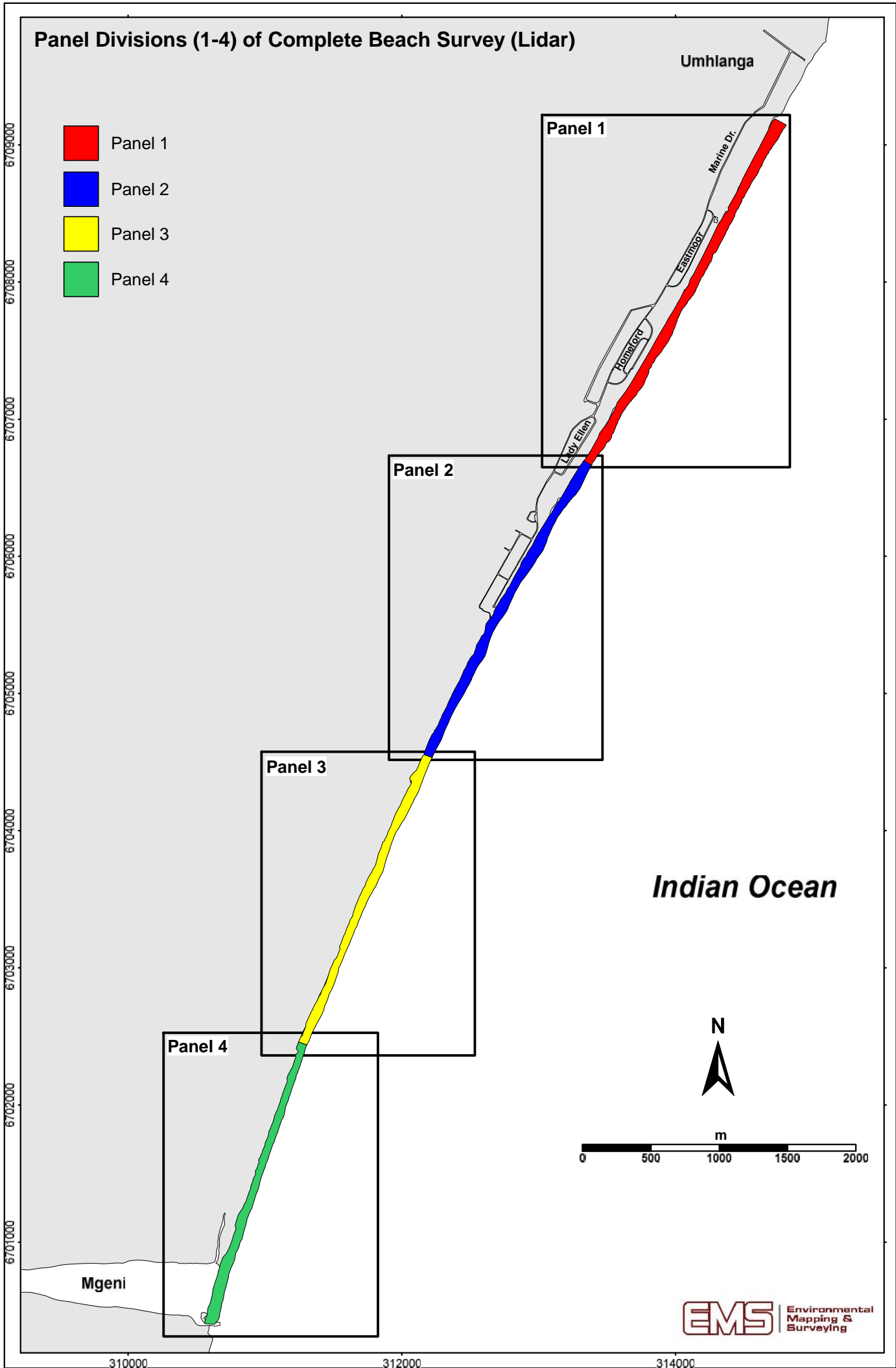
Umhlanga (6)

Indian Ocean

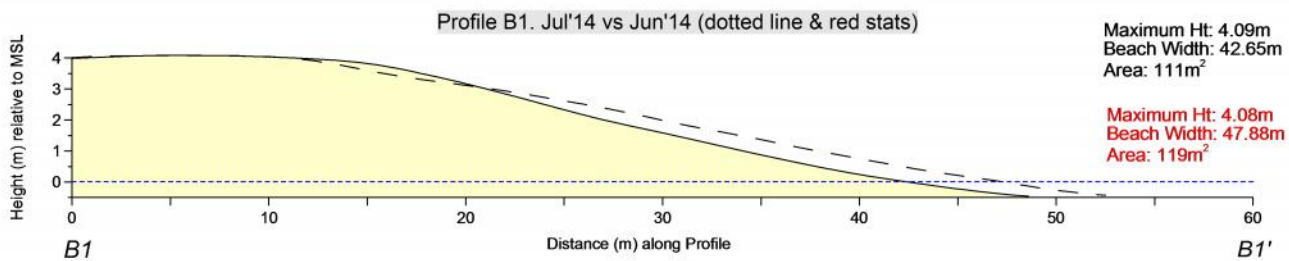
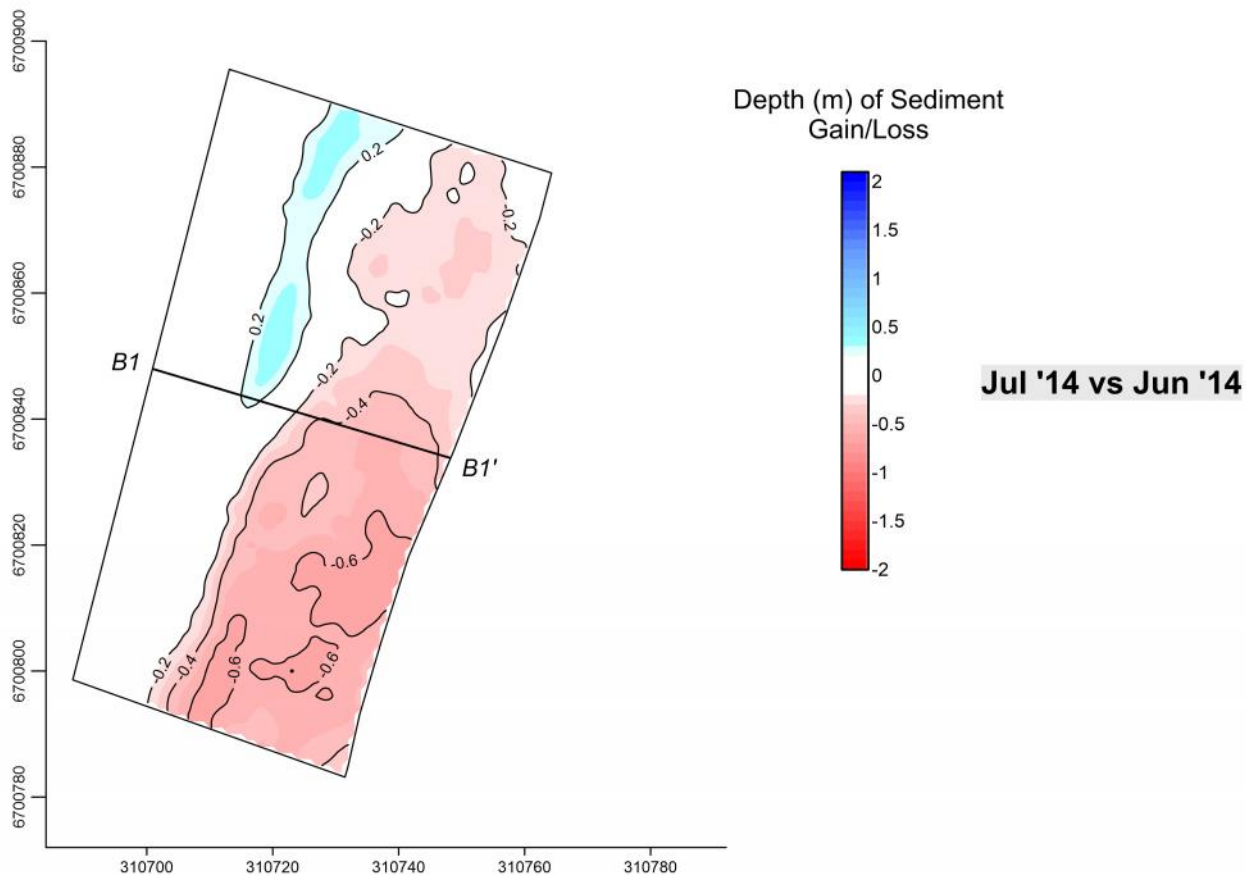
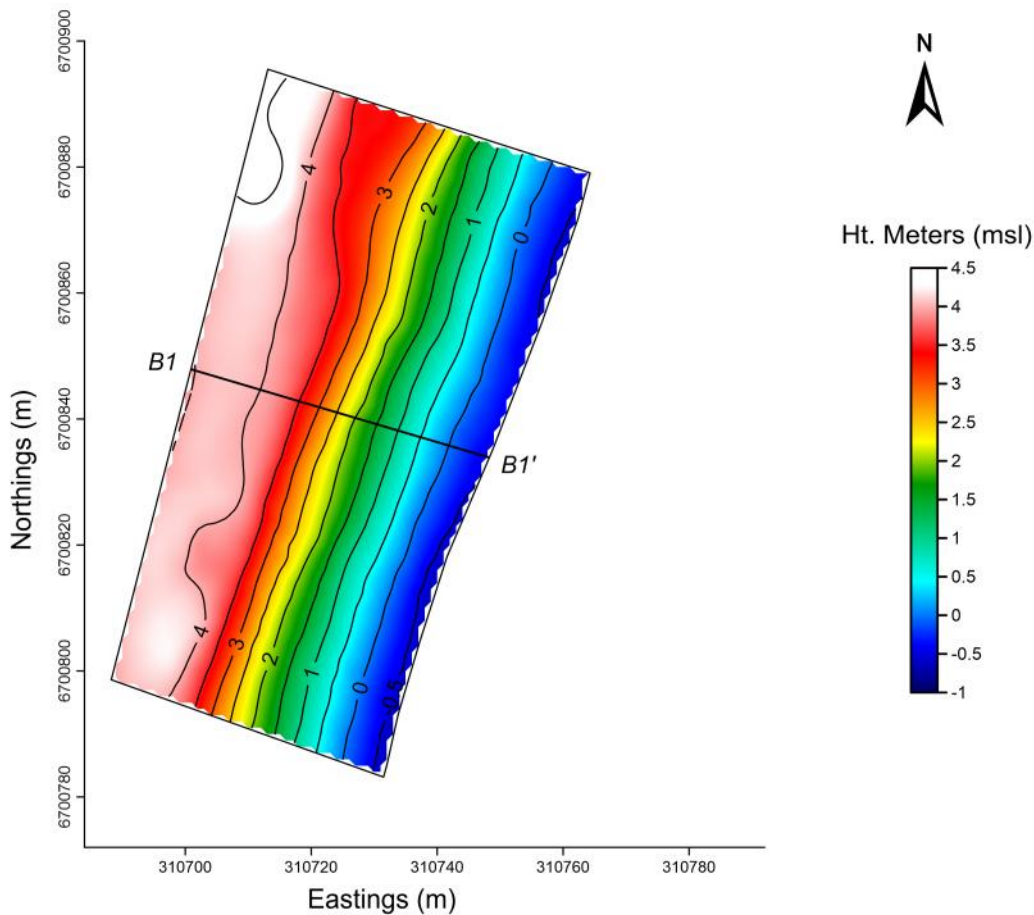


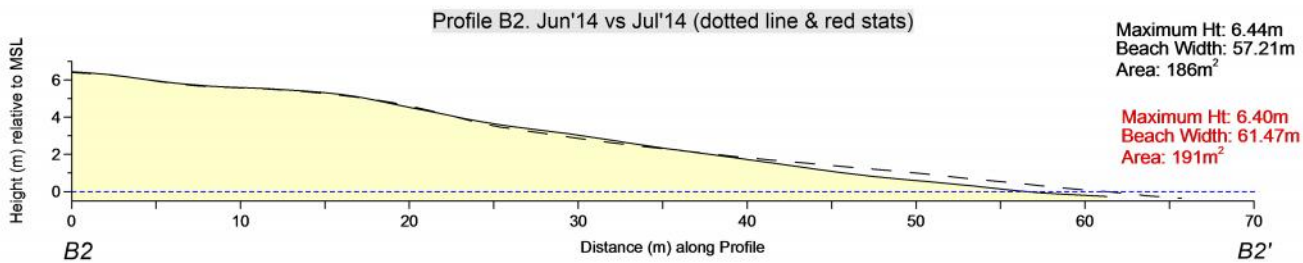
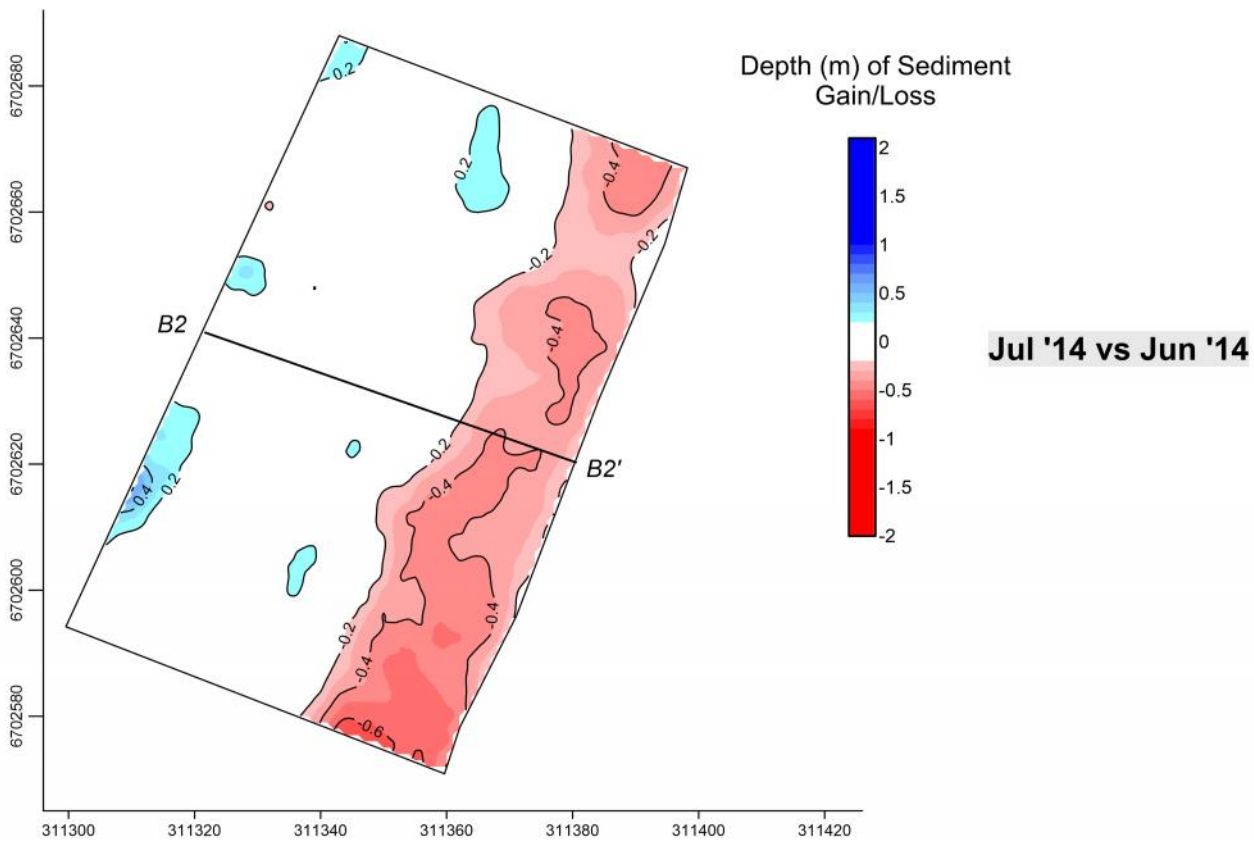
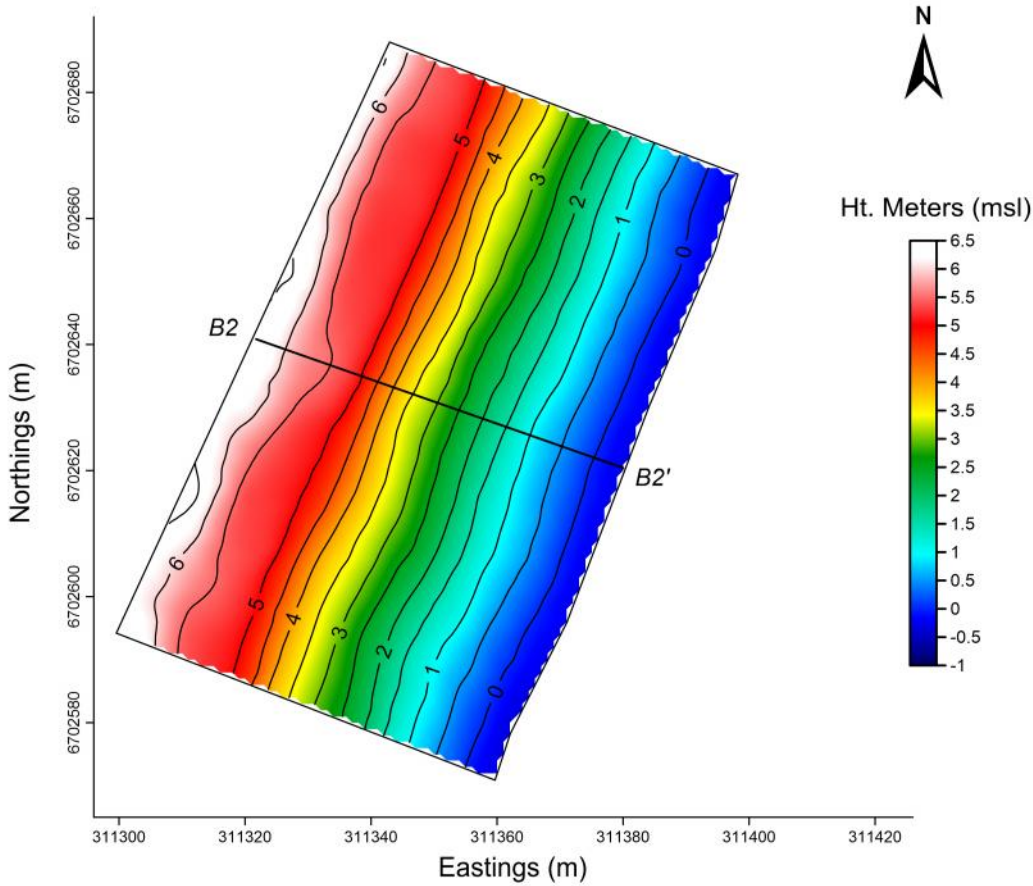
310000 312000 314000

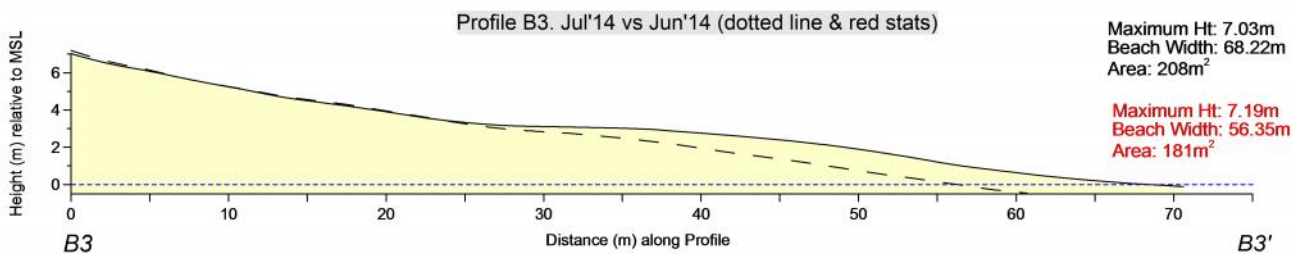
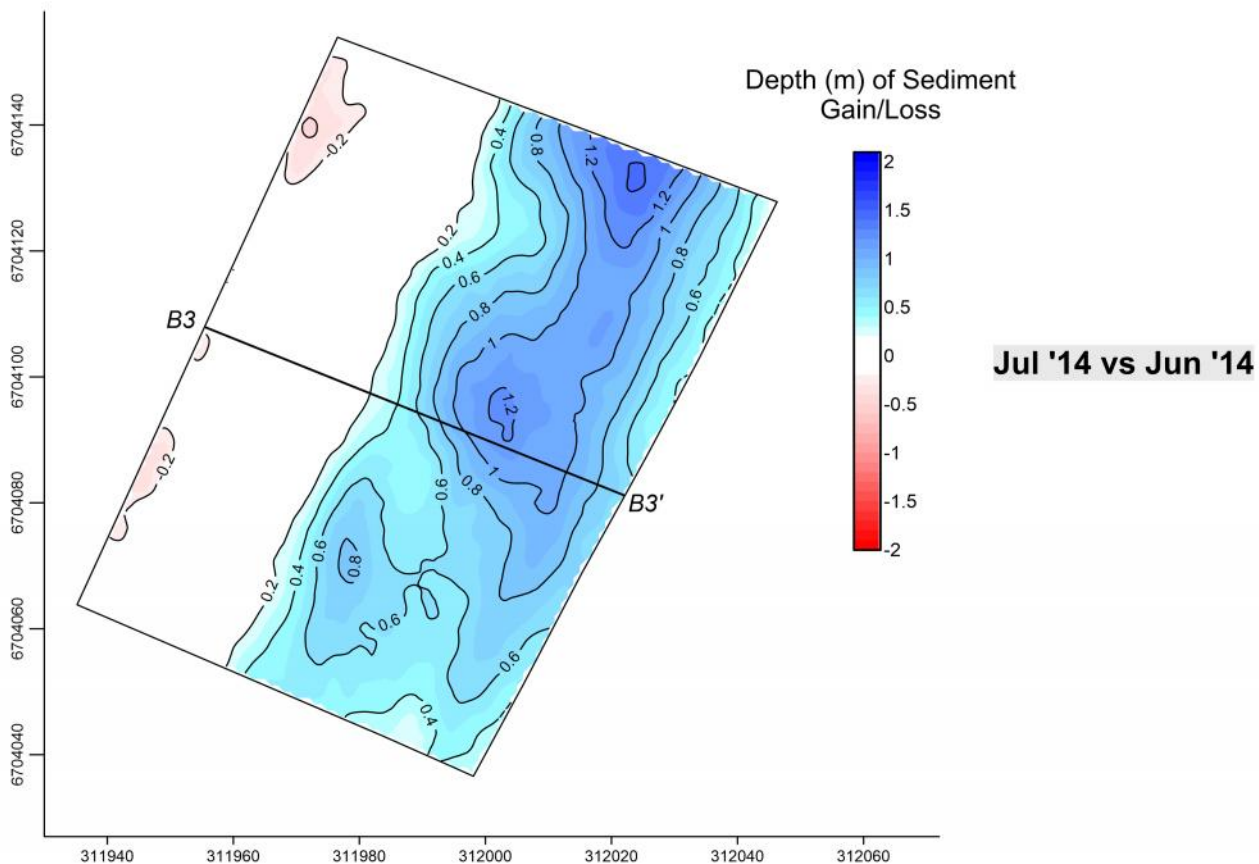
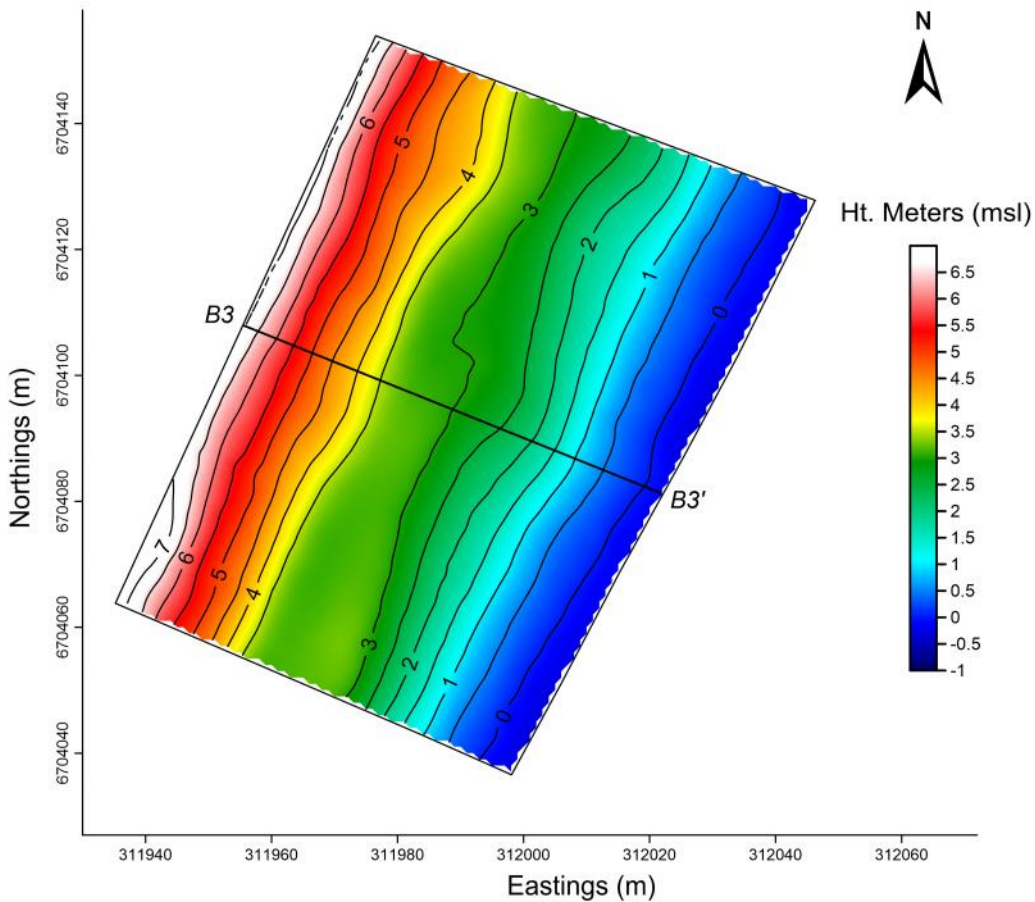


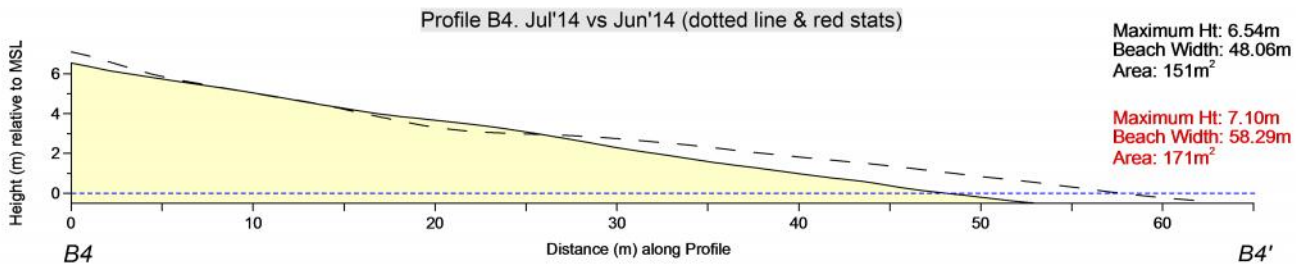
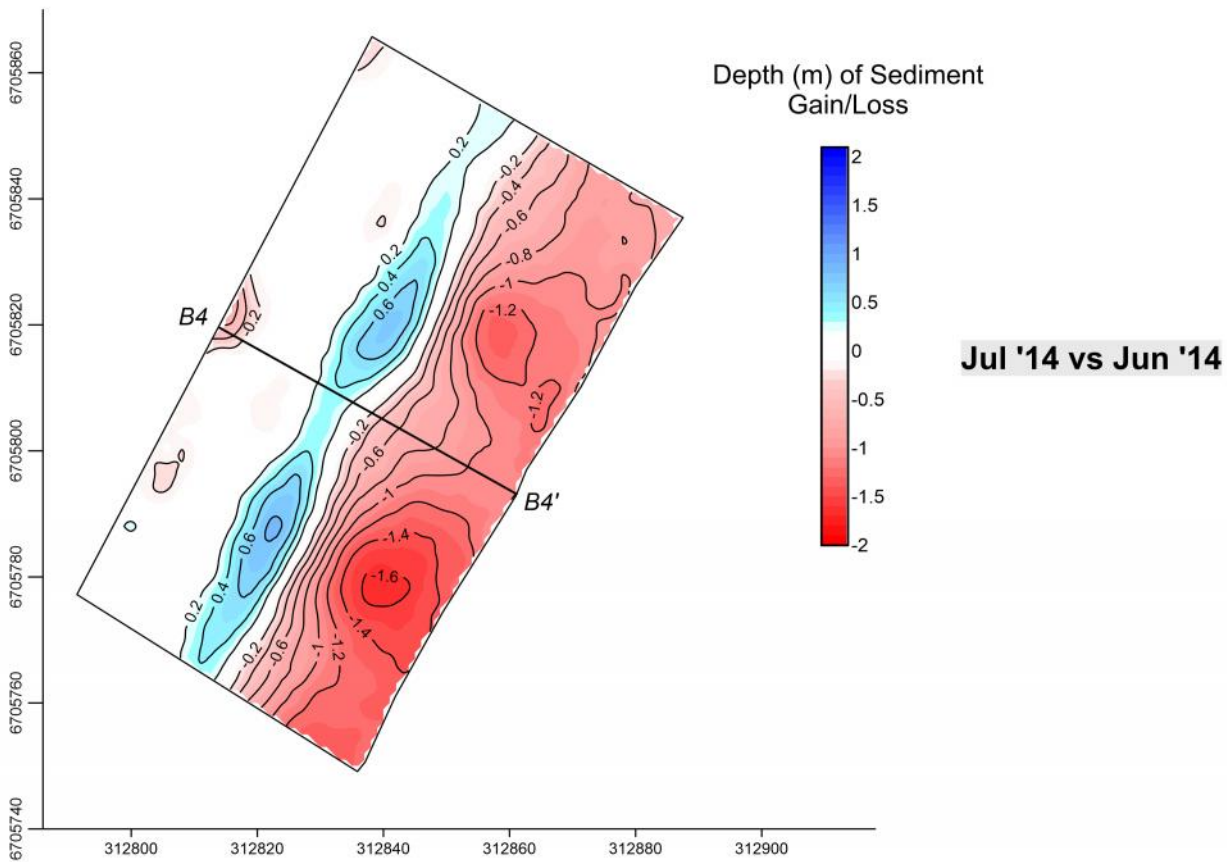
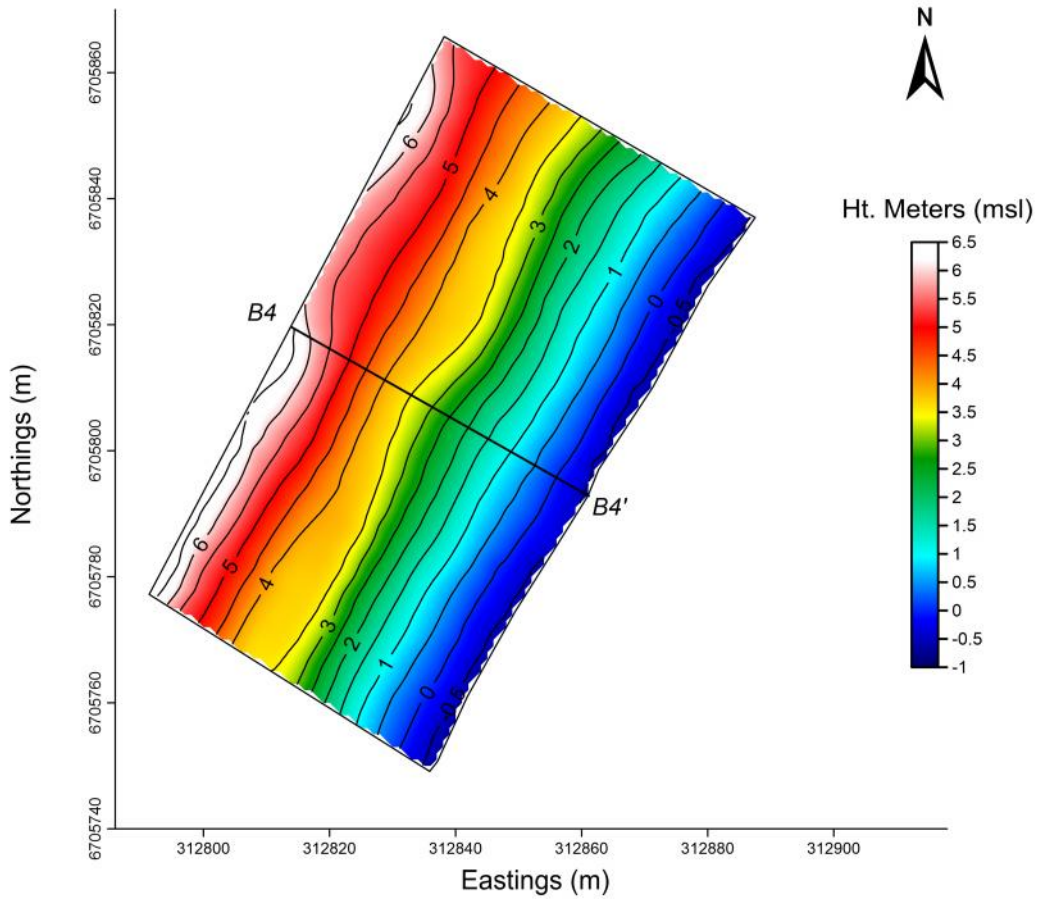


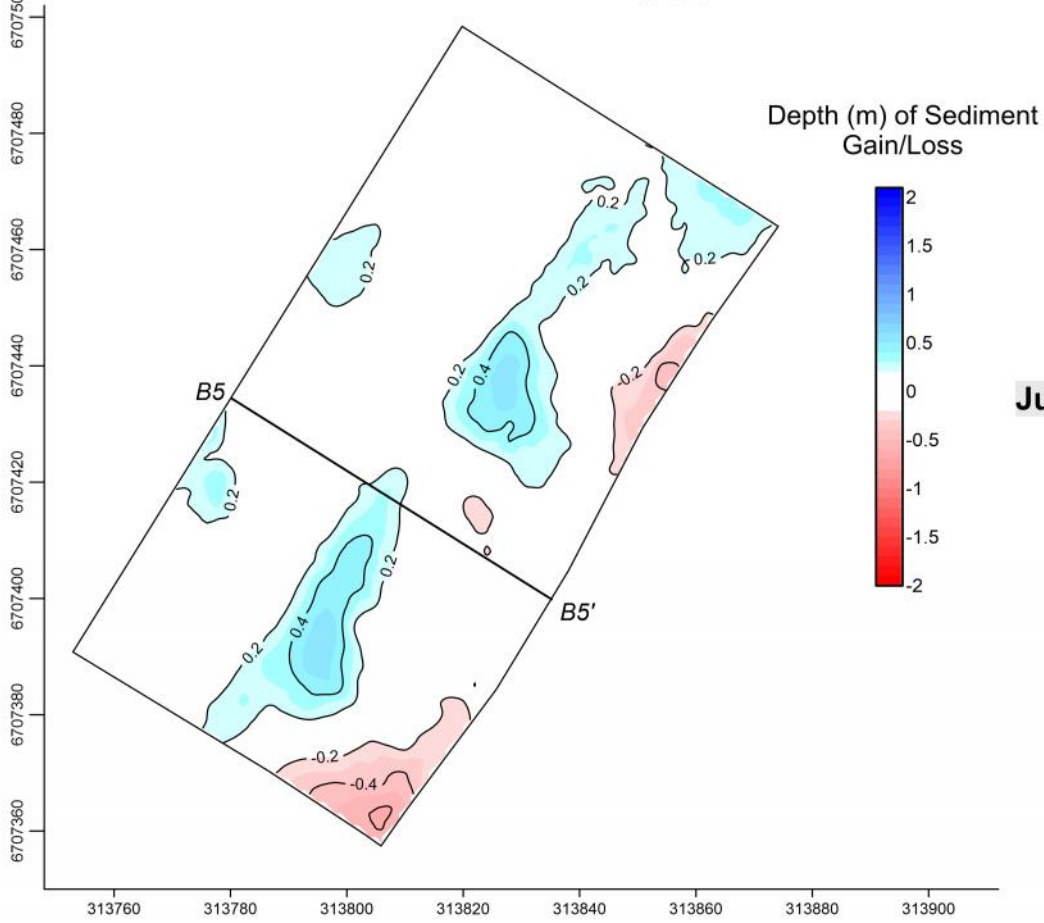
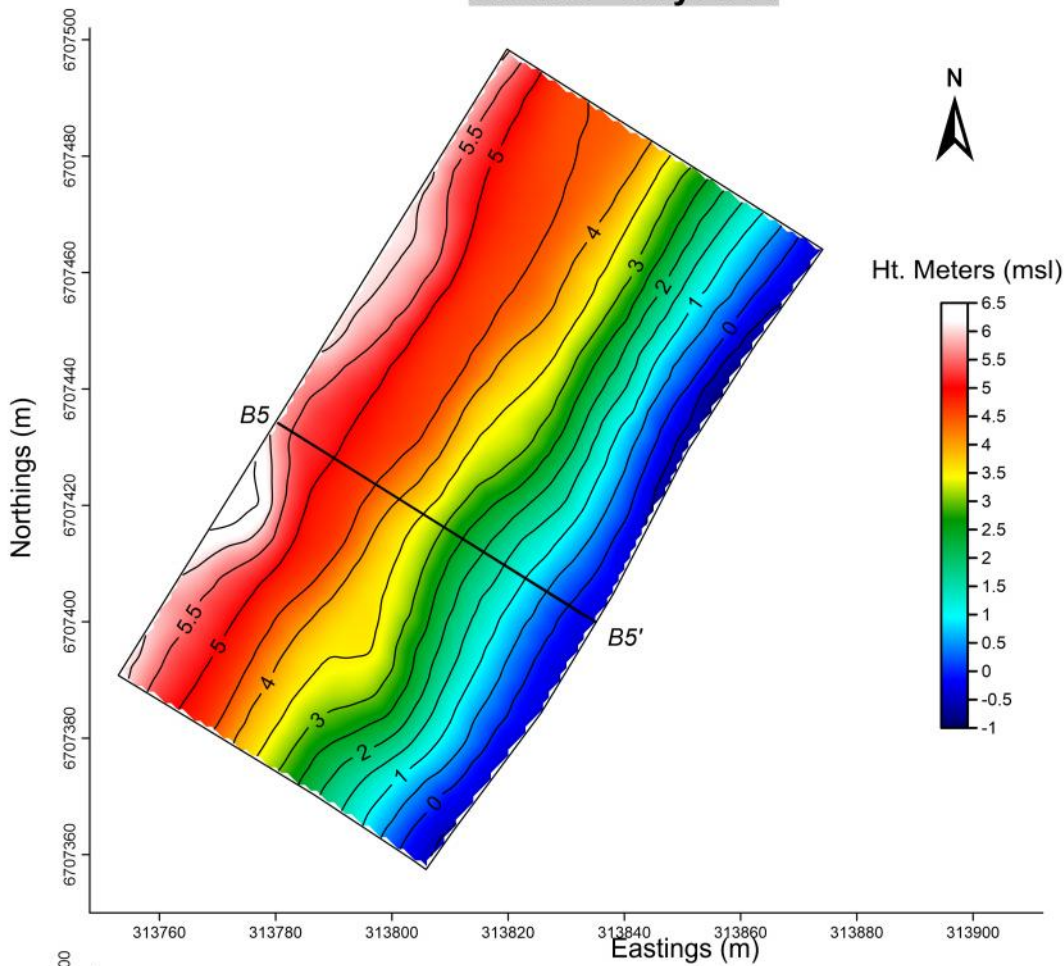
5. Topographic & Change Maps – Blocks 1 to 6



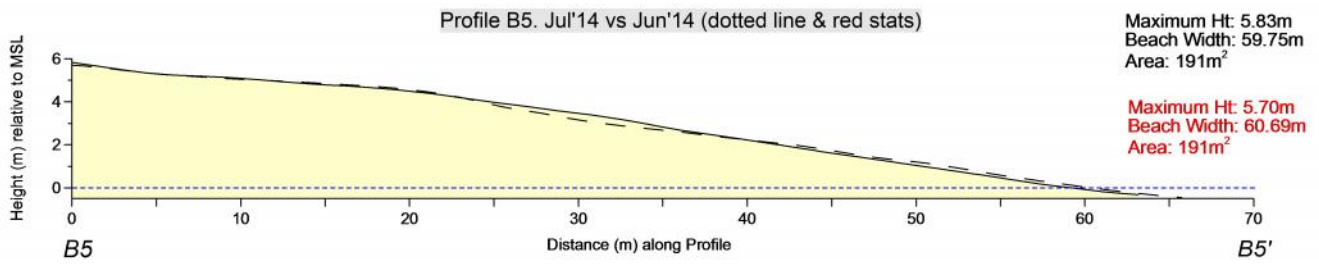


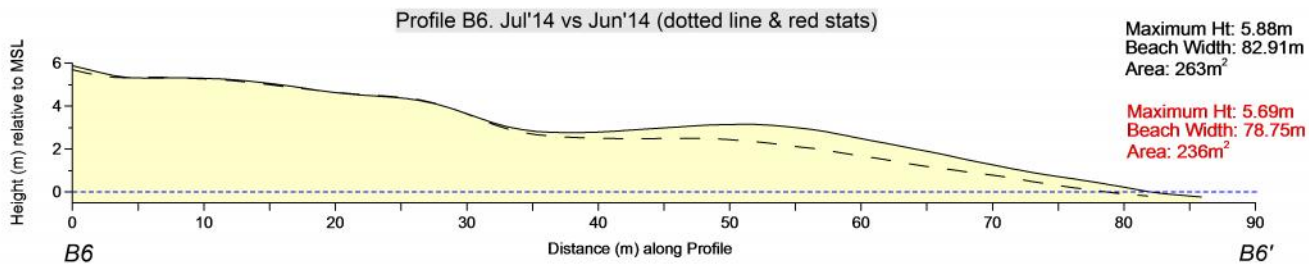
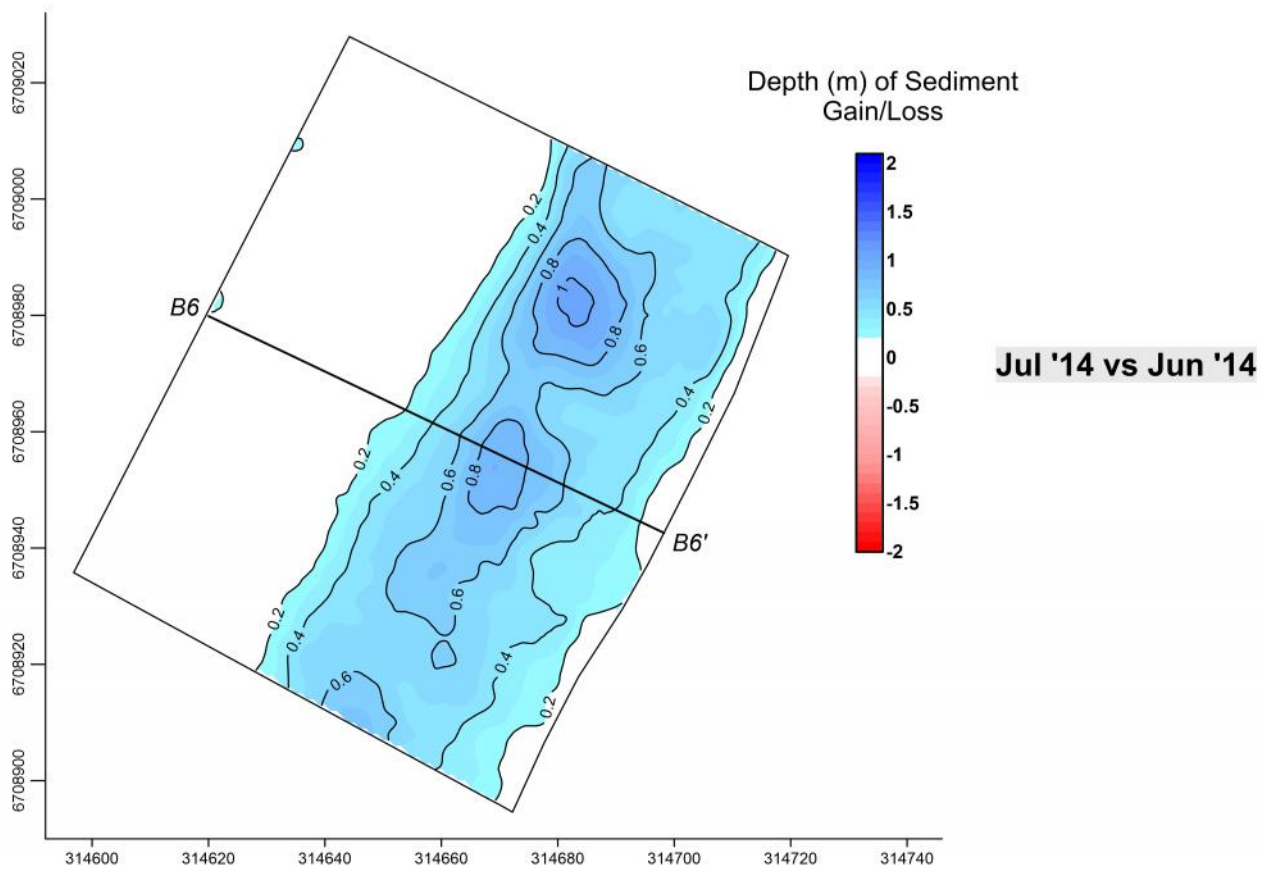
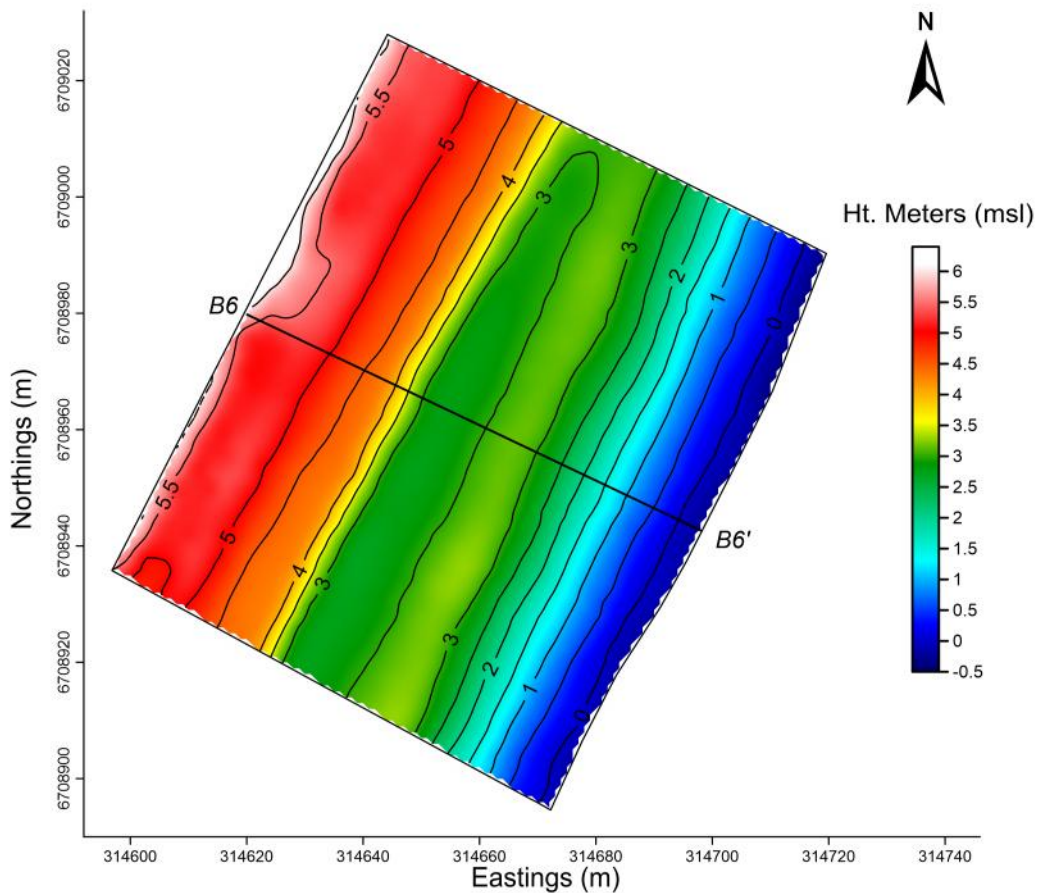






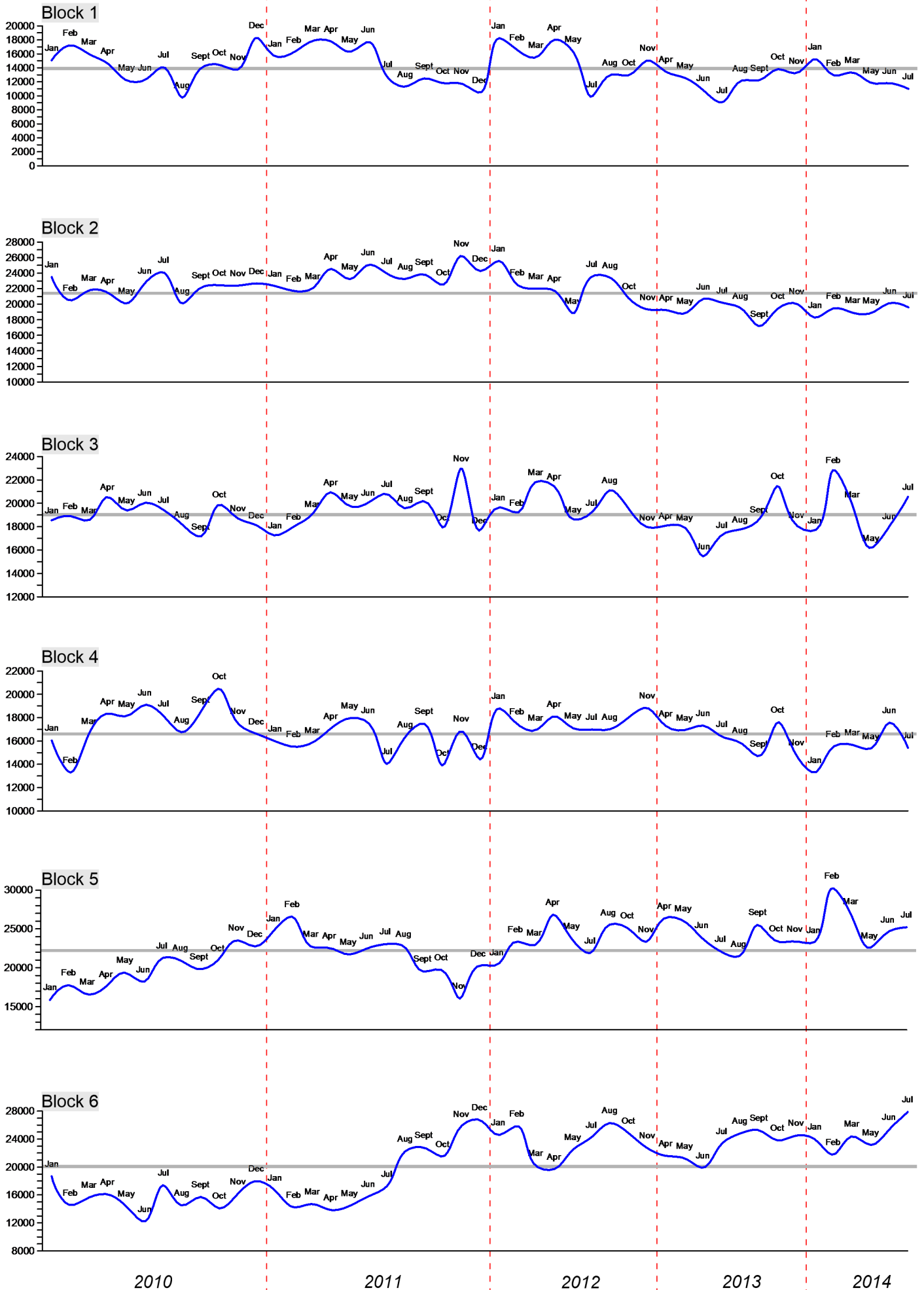
Jul '14 vs Jun '14





6. Beach Volume – Blocks 1 to 6

Beach Sediment Volume for Survey Blocks 1-6 (Jan '10 to July '14)



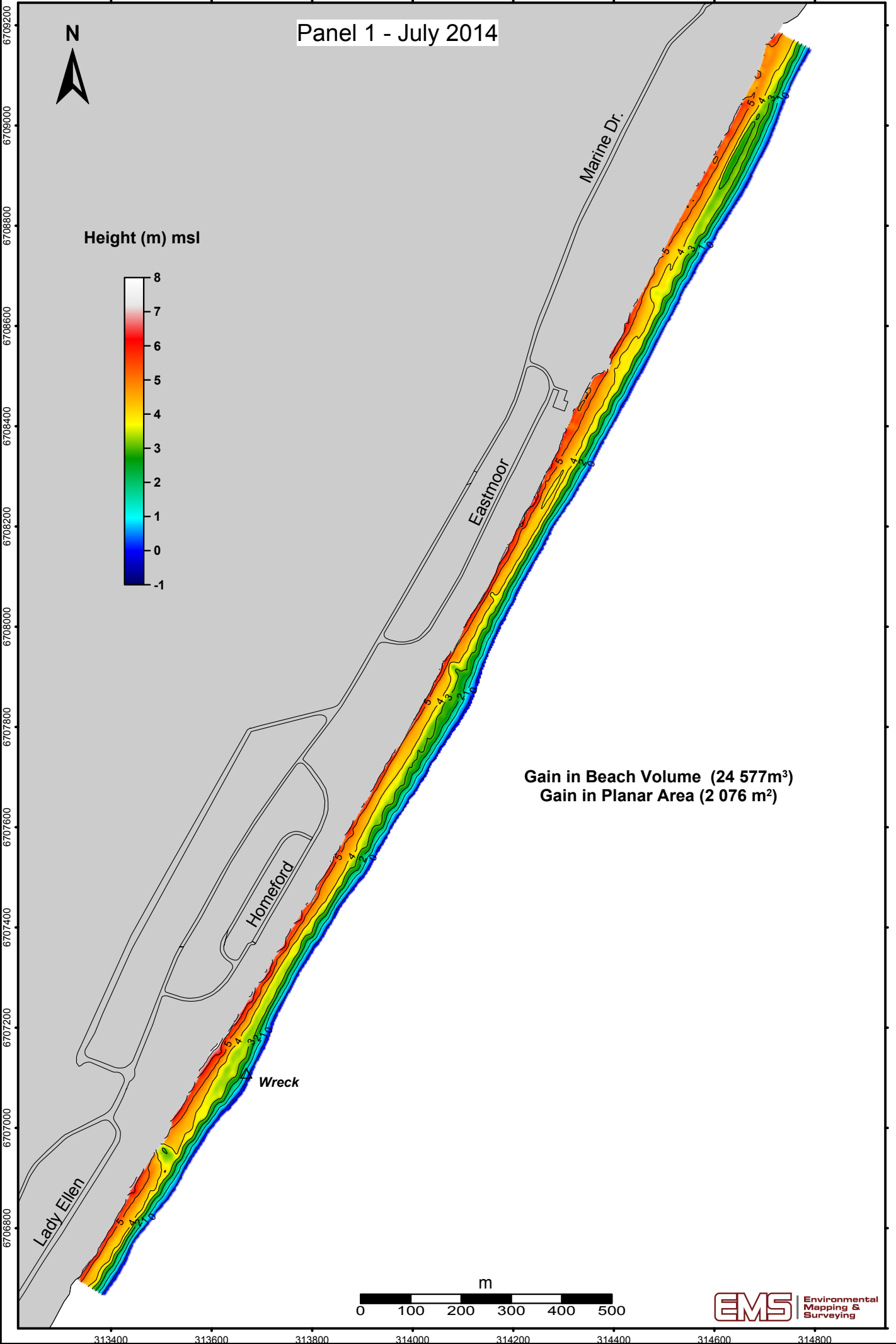
Note: Volumes (m³) calculated from 0msl and above.
Average beach volume = Grey line

7. Topographic & Change Maps – Panels 1 to 4

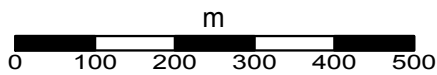
Panel 1 - July 2014



Height (m) msl



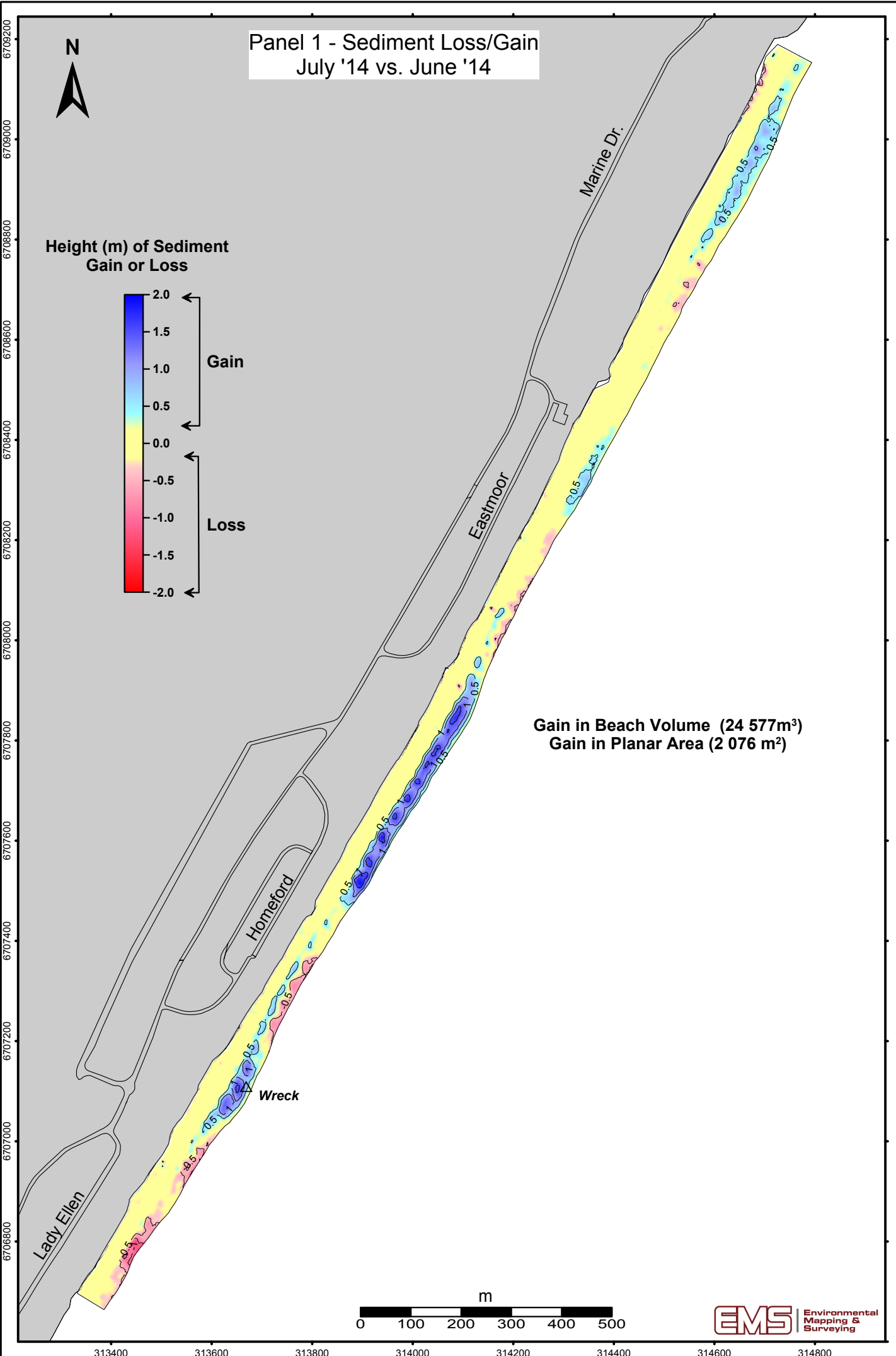
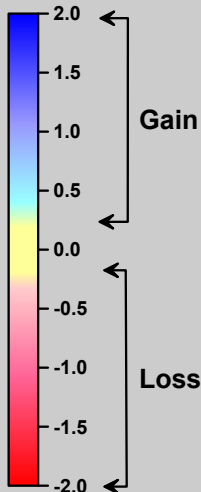
Gain in Beach Volume (24 577m³)
Gain in Planar Area (2 076 m²)



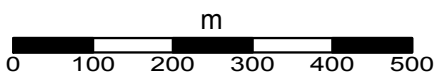
Panel 1 - Sediment Loss/Gain
July '14 vs. June '14



Height (m) of Sediment
Gain or Loss



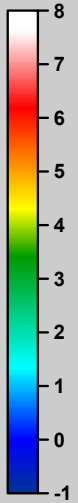
Gain in Beach Volume (24 577m³)
Gain in Planar Area (2 076 m²)



Panel 2 - July 2014

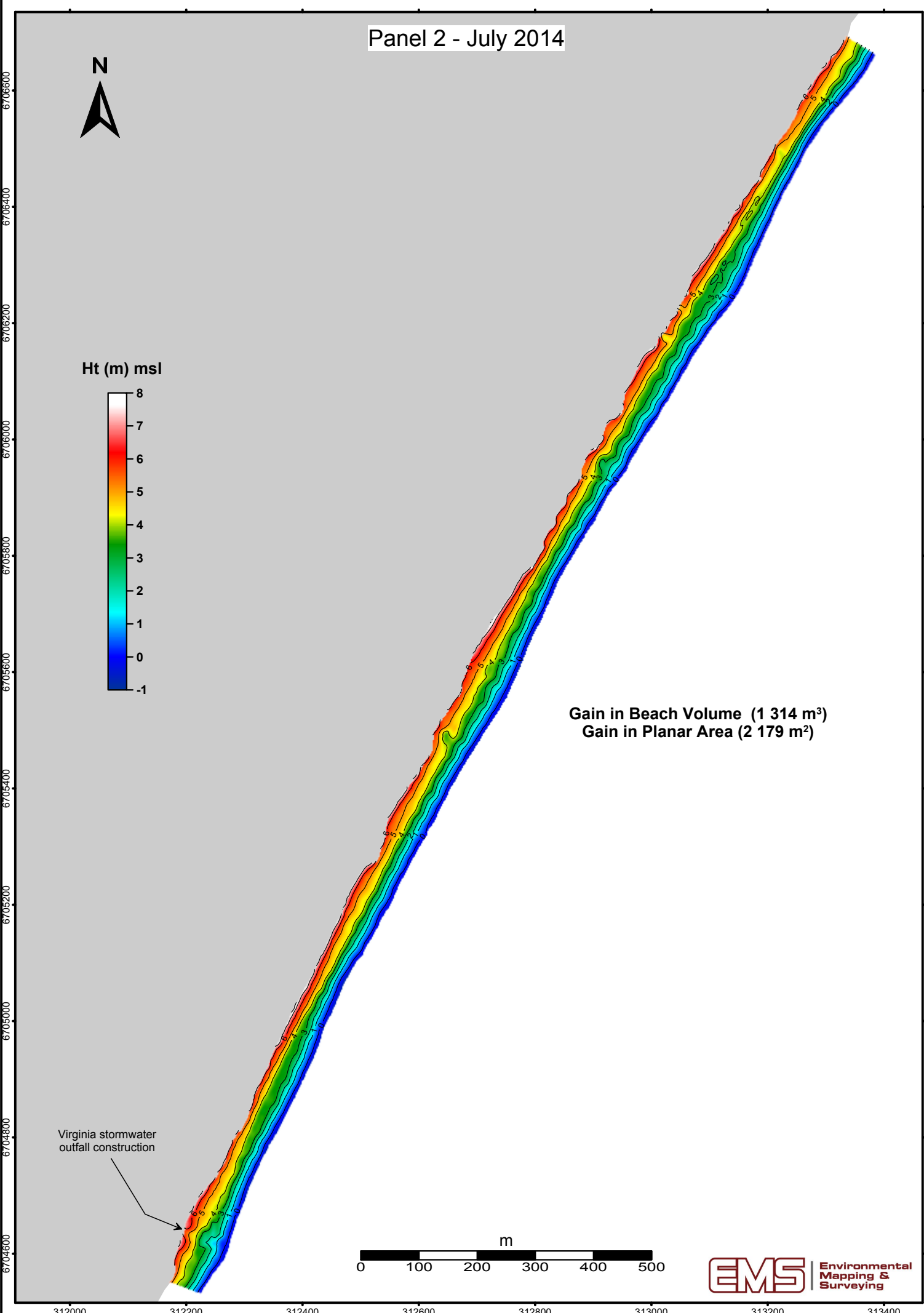
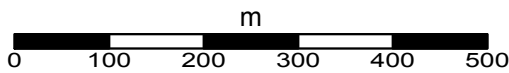
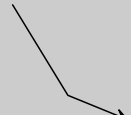


Ht (m) msl



Gain in Beach Volume (1 314 m³)
Gain in Planar Area (2 179 m²)

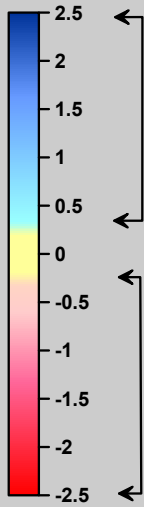
Virginia stormwater
outfall construction



Panel 2 - Sediment Loss/Gain
July '14 vs. June '14



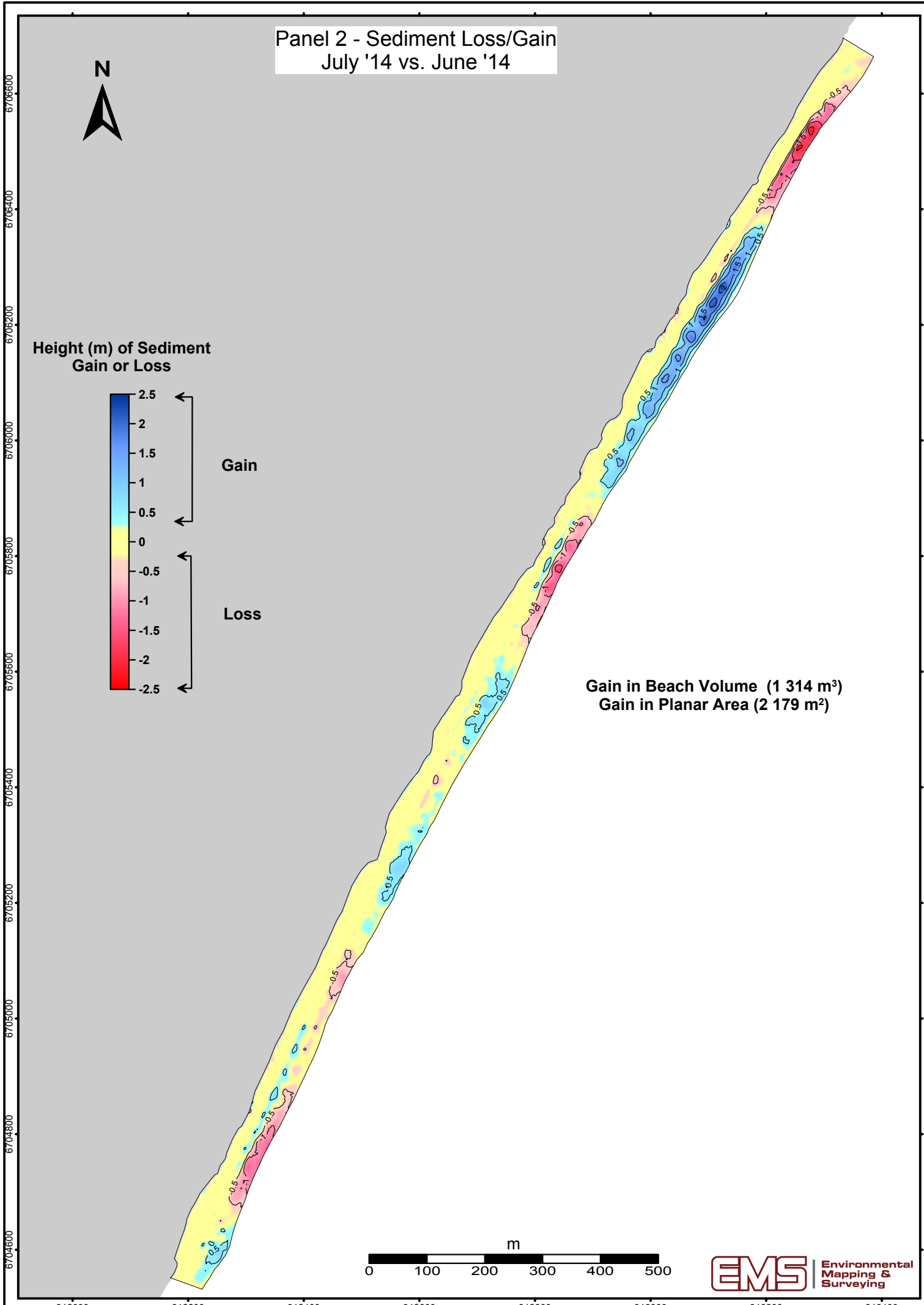
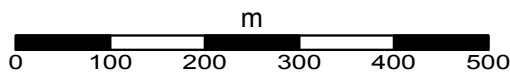
Height (m) of Sediment
Gain or Loss



Gain

Loss

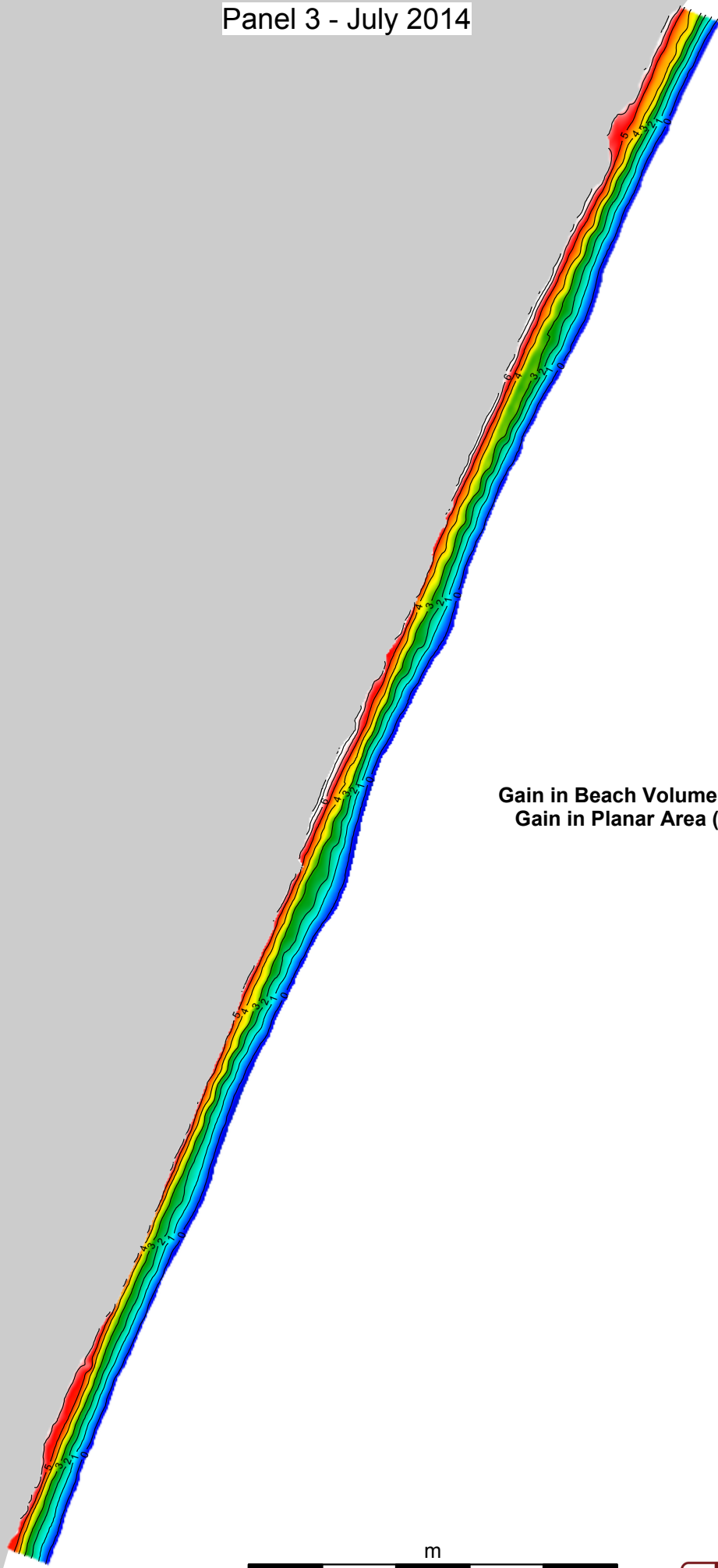
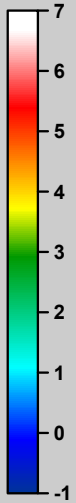
Gain in Beach Volume (1 314 m³)
Gain in Planar Area (2 179 m²)



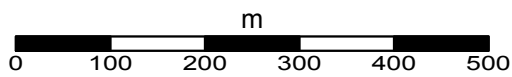
Panel 3 - July 2014



Ht (m) msl



Gain in Beach Volume (6 033 m³)
Gain in Planar Area (4 651 m²)



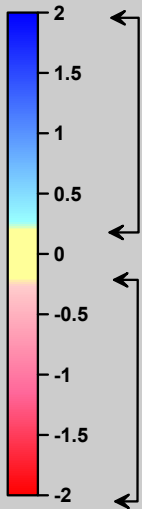
6704400
6704200
6704000
6703800
6703600
6703400
6703200
6703000
6702800
6702600
6702400

311000 311200 311400 311600 311800 312000 312200 312400

Panel 3 - Sediment Loss/gain
July '14 vs June '14



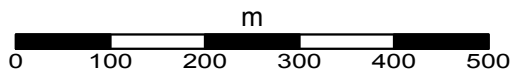
Height (m) of Sediment
Gain or Loss



Gain

Loss

Gain in Beach Volume (6 033 m³)
Gain in Planar Area (4 651 m²)



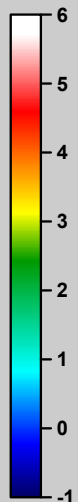
6704400
6704200
6704000
6703800
6703600
6703400
6703200
6703000
6702800
6702600
6702400

311000 311200 311400 311600 311800 312000 312200 312400

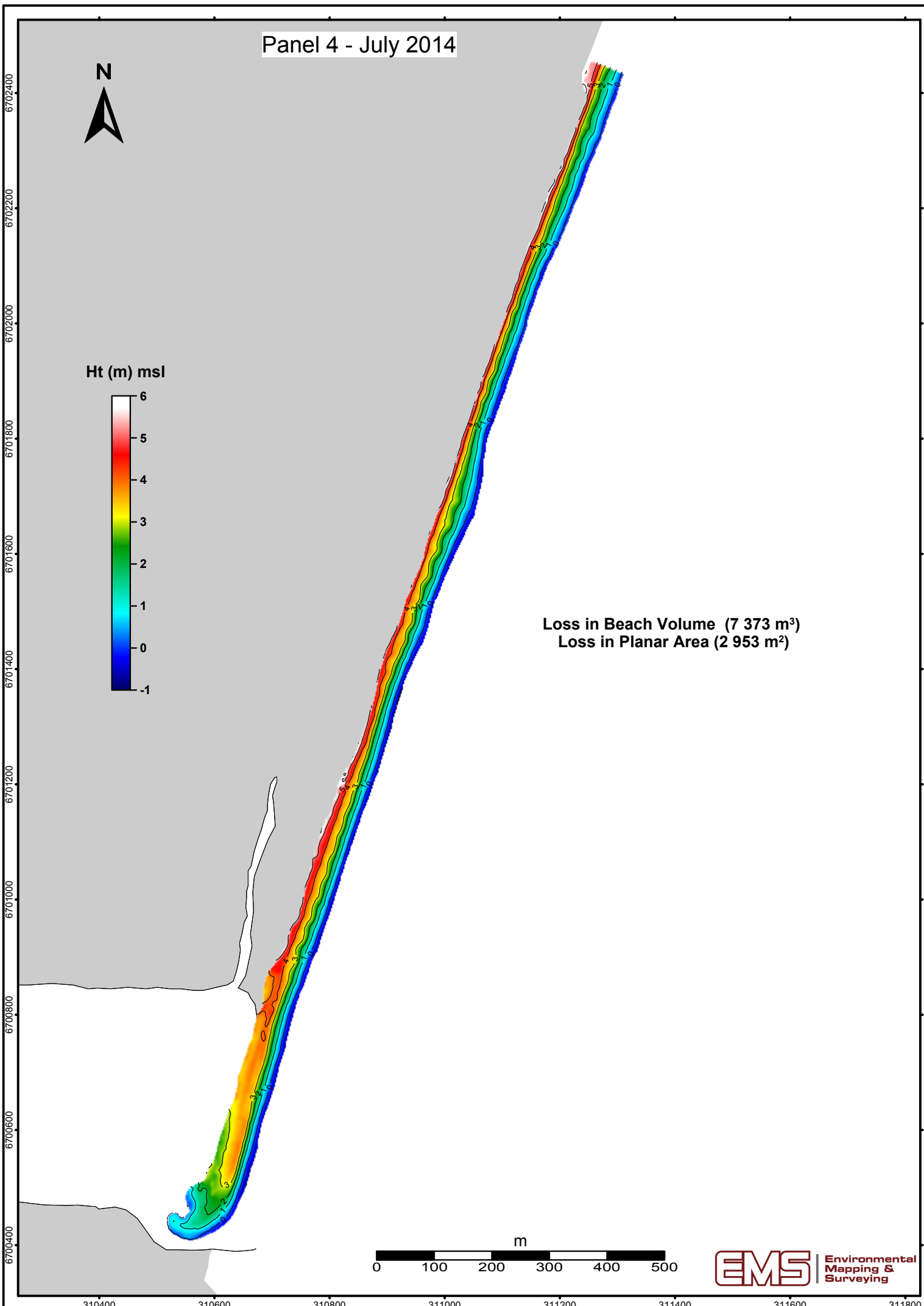
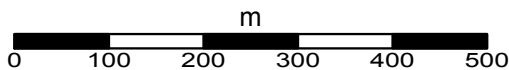
Panel 4 - July 2014



Ht (m) msl



Loss in Beach Volume (7 373 m³)
Loss in Planar Area (2 953 m²)

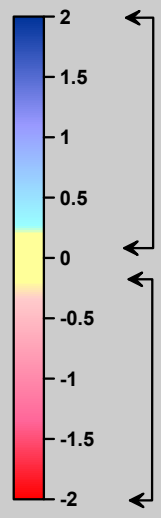


Panel 4 - Sediment Loss/Gain
July '14 vs June '14



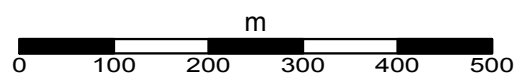
6702400
6702200
6702000
6701800
6701600
6701400
6701200
6701000
6700800
6700600
6700400

Height (m) of Sediment
Gain or Loss



Gain
Loss

Loss in Beach Volume (7 373 m³)
Loss in Planar Area (2 953 m²)



310400 310600 310800 311000 311200 311400 311600 311800

8. Beach Volume & Area – Panels 1 to 4

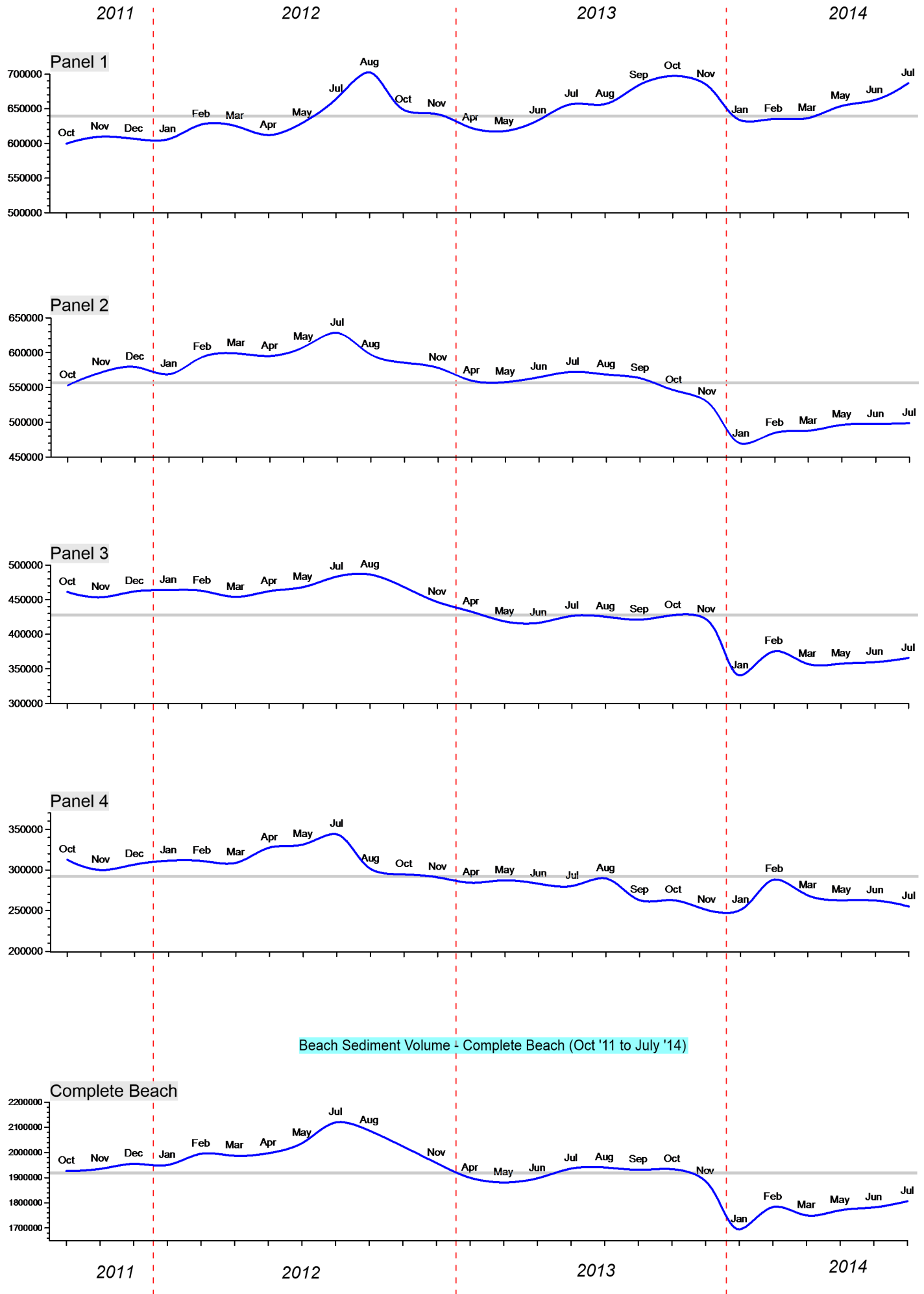
Beach Volume & Area – Panels 1 to 4 (Complete Beach)

(Vol. & Area 0msl)

												Total Beach Vol. & Area		
Date:	Panel 1	Vol. (m³)	Area (m²)	Panel 2	Vol. (m³)	Area (m²)	Panel 3	Vol. (m³)	Area (m²)	Panel 4	Vol. (m³)	Area (m²)	Total Vol. (m³)	Total Area (m²)
Oct-11	Panel 1	599799	168093	Panel 2	552984	147329	Panel 3	461188	126617	Panel 4	312594	119840	1926565	561879
Nov-11		609676	178521		571813	153084		453499	128338		299899	116648	1934887	576591
Dec-11		606778	174860		579529	156840		462005	129630		306717	122254	1955029	583584
Jan-12		605802	169966		569002	149455		463907	131300		311385	121002	1950096	571723
Feb-12		627343	181389		593974	158505		462758	130604		311028	127079	1995103	597577
Mar-12		625408	175021		598988	160433		454080	132692		308677	124853	1987153	592999
Apr-12		612118	168172		595253	154162		462287	133060		327508	124246	1997166	579640
May-12		629537	181509		607918	162472		468100	141859		331241	129556	2036796	615396
Jul-12		663947	187829		628557	167813		483307	144305		343896	127802	2119707	627749
Aug-12		702527	192356		597186	157534		486339	136966		301423	112520	2087475	599376
Oct-12		648760	180907		No Data	No Data		No Data	No Data		294530	111330	No Data	No Data
Nov-12		642350	175831		578268	150448		446577	132311		290976	123227	1958171	581817
Apr-13		622785	177041		559749	155075		432774	134040		284267	122042	1899575	588198
May-13		617682	184549		557715	159205		418545	128656		287345	117188	1881287	589598
Jun-13		633208	187858		564864	160352		416478	130215		283089	109298	1897639	587723
Jul-13		656723	190531		572554	159742		426626	130149		280413	110645	1936316	591067
Aug-13		656860	193163		568707	159871		425373	133788		289668	116515	1940608	603337
Sep-13		684203	198891		563407	159242		421099	127563		262786	110204	1931495	595900
Oct-13		697258	200885		546166	152050		427622	126718		262887	105710	1933933	585363
Nov-13		684780	206856		529283	156598		421295	136329		250790	107036	1886148	606819
Jan-14		633658	185315		469333	137263		340427	115016		250952	112969	1694370	550563
Feb-14		635306	181537		484708	138183		375380	120293		288316	115021	1783710	555034
Mar-14		636388	179573		487885	138451		357115	114293		268725	106895	1750113	539212
May-14		653856	194972		496305	144340		357555	118206		262793	105160	1770509	562678
Jun-14		662358	198467		497442	143600		359701	118825		262453	104732	1781954	565624
Jul-14		686935	200543		498756	145779		365734	123476		255080	101779	1806505	571577
Ave.		643694	185178		554814	153113		425991	129010		289594	115598	1913692	583241

Loss/Gain	red values = loss												Total Beach Vol. & Area	
	Panel 1	Vol. Loss/Gain	Area Loss/Gain	Panel 2	Vol. Loss/Gain	Area Loss/Gain	Panel 3	Vol. Loss/Gain	Area Loss/Gain	Panel 4	Vol. Loss/Gain	Area Loss/Gain	Total Vol.Loss/Gain	Total Area Loss/Gain
Nov-11		9877	10428		18829	5755		-7689	1721		-12695	-3192	8322	14712
Dec-11		-2898	-3661		7716	3756		8506	1292		6818	5606	20142	6993
Jan-12		-976	-4894		-10527	-7385		1902	1670		4668	-1252	-4933	-11861
Feb-12		21541	11423		24972	9050		-1149	-696		-357	6077	45007	25854
Mar-12		-1935	-6368		5014	1928		-8678	2088		-2351	-2226	-7950	-4578
Apr-12		-13290	-6849		-3735	-6271		8207	368		18831	-607	10013	-13359
May-12		17419	13337		12665	8310		5813	8799		3733	5310	39630	35756
Jul-12		34410	6320		20639	5341		15207	2446		12655	-1754	82911	12353
Aug-12		38580	4527		-31371	-10279		3032	-7339		-42473	-15282	-32232	-28373
Oct-12		-53767	-11449		no data	no data		no data	no data		-6893	-1190	no data	no data
Nov-12		-6410	-5076		no data	no data		no data	no data		-3554	11897	no data	no data
Apr-13		-19565	1210		-18519	4627		-13803	1729		-6709	-1185	-58596	6381
May-13		-5103	7508		-2034	4130		-14229	-5384		3078	-4854	-18288	1400
Jun-13		15526	3309		7149	1147		-2067	1559		-4256	-7890	16352	-1875
Jul-13		23515	2673		7690	-610		10148	-66		-2676	1347	38677	3344
Aug-13		137	2632		-3847	129		-1253	3639		9255	5870	4292	12270
Sep-13		27343	5728		-5300	-629		-4274	-6225		-26882	-6311	-9113	-7437
Oct-13		13055	1994		-17241	-7192		6523	-845		101	-4494	2438	-10537
Nov-13		-12478	5971		-16883	4548		-6327	9611		-12097	1326	-47785	21456
Jan-14		-51122	-21541		-59950	-19335		-80868	-21313		162	5933	-191778	-56256
Feb-13		1648	-3778		15375	920		34953	5277		37364	2052	89340	4471
Mar-14		1082	-1964		3177	268		-18265	-6000		-19591	-8126	-33597	-15822
May-14		17468	15399		8420	5889		440	3913		-5932	-1735	20396	23466
Jun-14		8502	3495		1137	-740		2146	619		-340	-428	11445	2946
Jul-14		24577	2076		1314	2179		6033	4651		-7373	-2953	24551	5953

Beach Sediment Volume for Panels 1-4 (Oct '11 to July '14)



Note: Volumes (m³) calculated from 0msl and above.
Average beach volume = Grey line

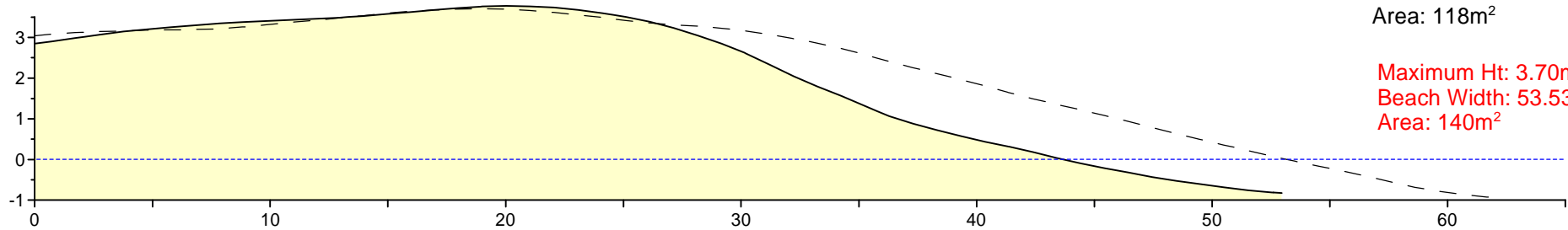
9. Profiles 1 to 30 & X-1 to X-5

Jul 2014 vs Jun '14

Profile 1

Maximum Ht: 3.78m
 Beach Width: 44.42m
 Area: 118m²

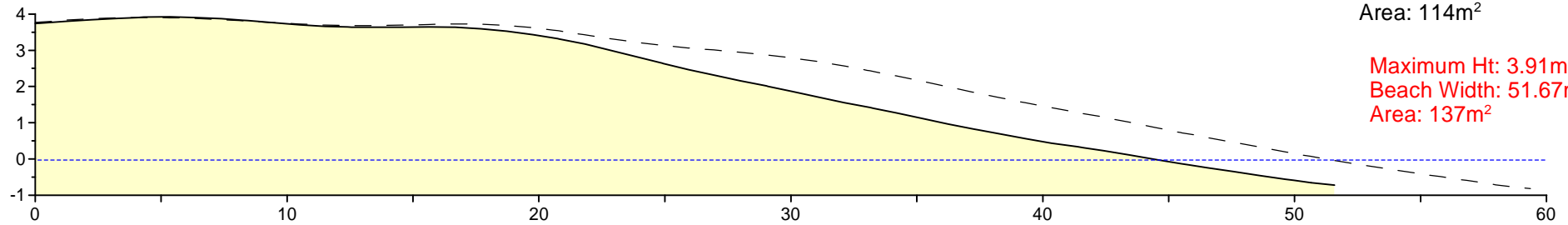
Maximum Ht: 3.70m
 Beach Width: 53.53m
 Area: 140m²



Profile 2

Maximum Ht: 3.92m
 Beach Width: 44.48m
 Area: 114m²

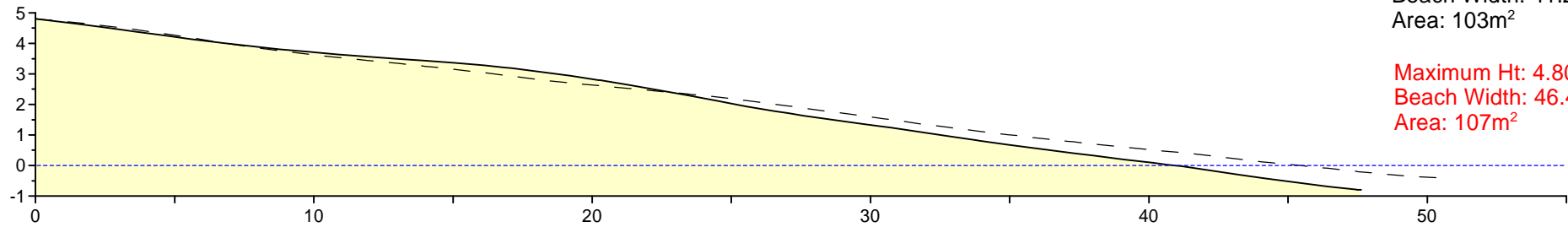
Maximum Ht: 3.91m
 Beach Width: 51.67m
 Area: 137m²



Profile 3

Maximum Ht: 4.80m
 Beach Width: 41.21m
 Area: 103m²

Maximum Ht: 4.80m
 Beach Width: 46.43m
 Area: 107m²



Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

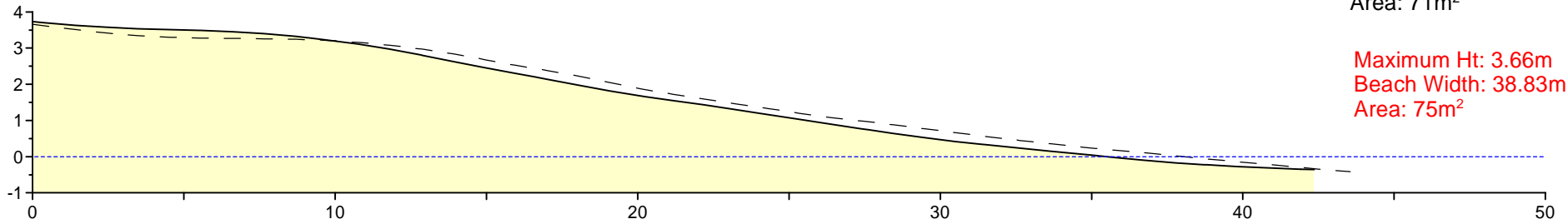


Jul 2014 vs Jun '14

Profile 4

Maximum Ht: 3.74m
 Beach Width: 35.68m
 Area: 71m²

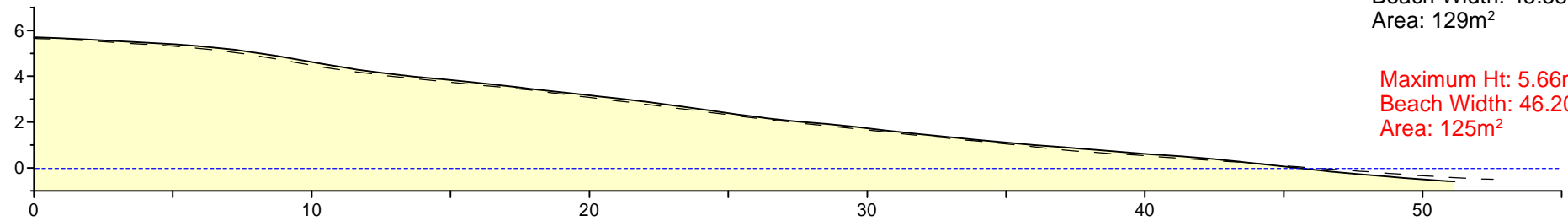
Maximum Ht: 3.66m
 Beach Width: 38.83m
 Area: 75m²



Profile 5

Maximum Ht: 5.70m
 Beach Width: 45.58m
 Area: 129m²

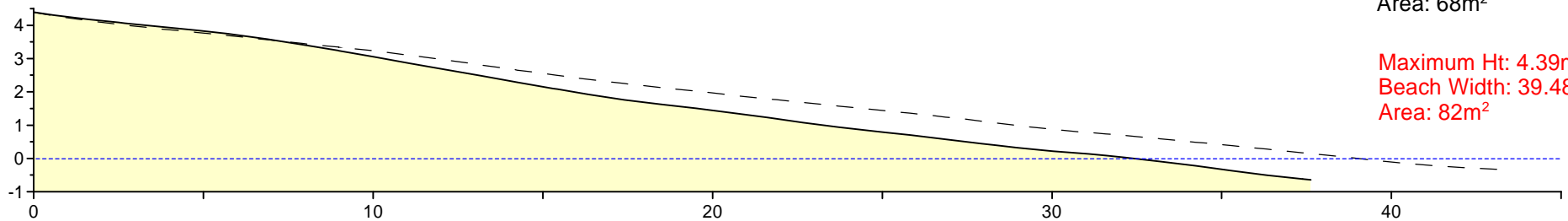
Maximum Ht: 5.66m
 Beach Width: 46.20m
 Area: 125m²



Profile 6

Maximum Ht: 4.39m
 Beach Width: 33.18m
 Area: 68m²

Maximum Ht: 4.39m
 Beach Width: 39.48m
 Area: 82m²



Distance (m) along Profile

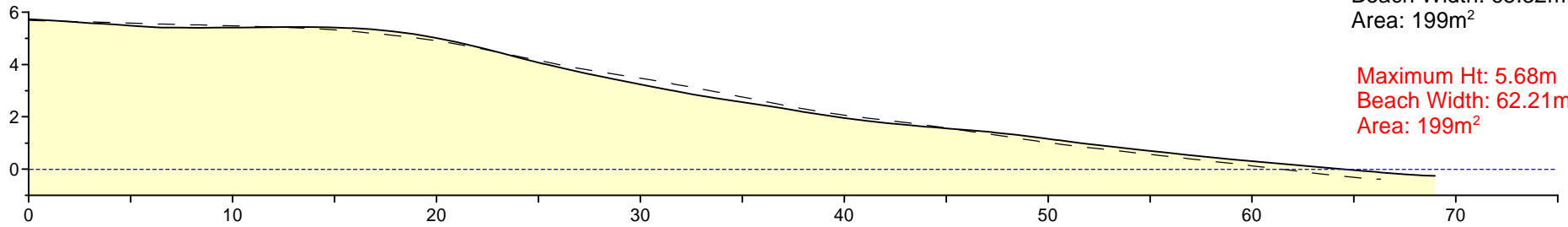
Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

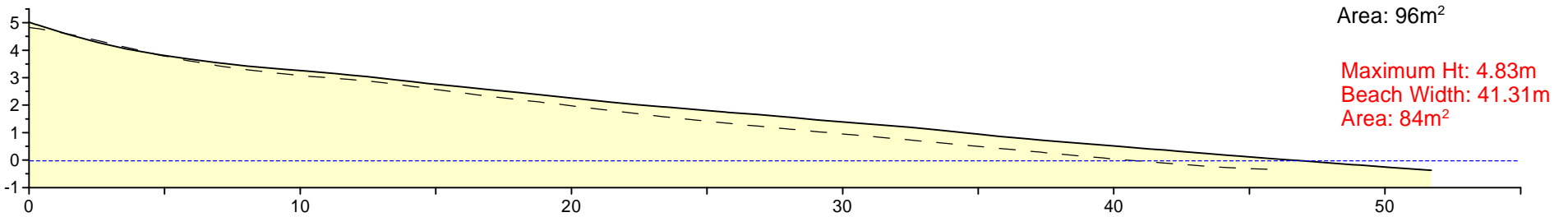


Jul 2014 vs Jun '14

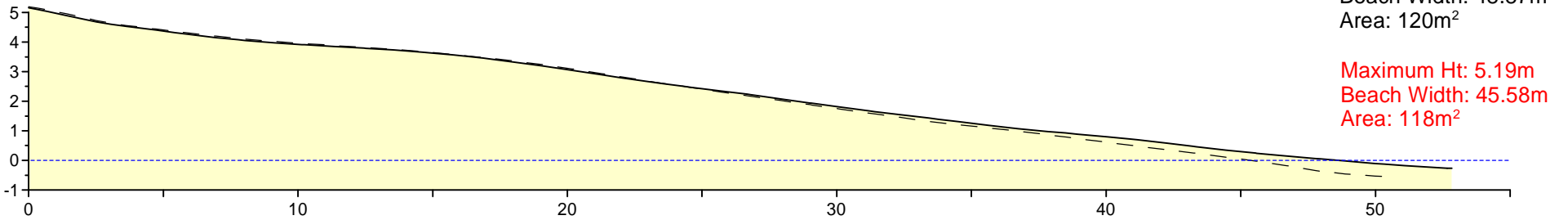
Profile 7



Profile 8



Profile 9



Height (m) relative to Mean Sea Level Datum

Distance (m) along Profile

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

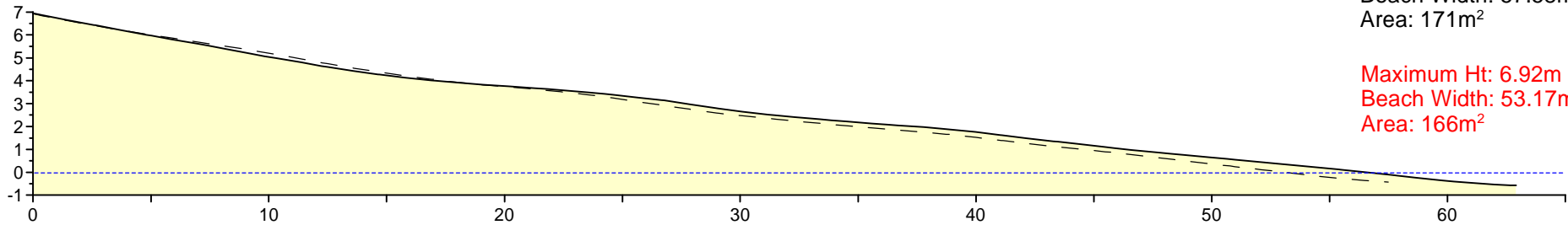


Jul 2014 vs Jun '14

Profile 10

Maximum Ht: 6.95m
 Beach Width: 57.58m
 Area: 171m²

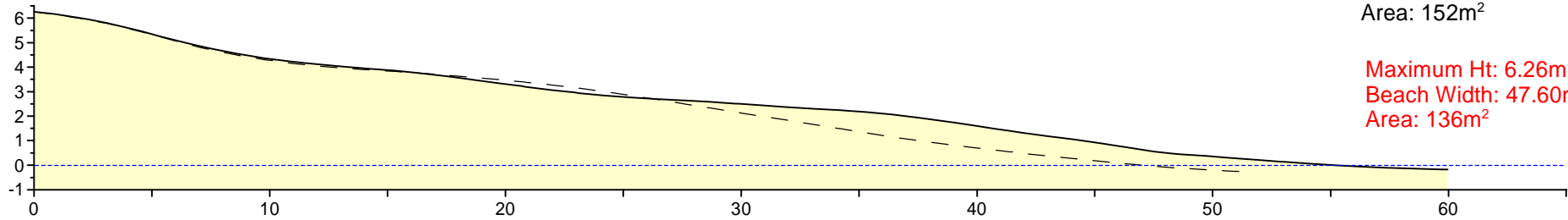
Maximum Ht: 6.92m
 Beach Width: 53.17m
 Area: 166m²



Profile 11

Maximum Ht: 6.27m
 Beach Width: 55.13m
 Area: 152m²

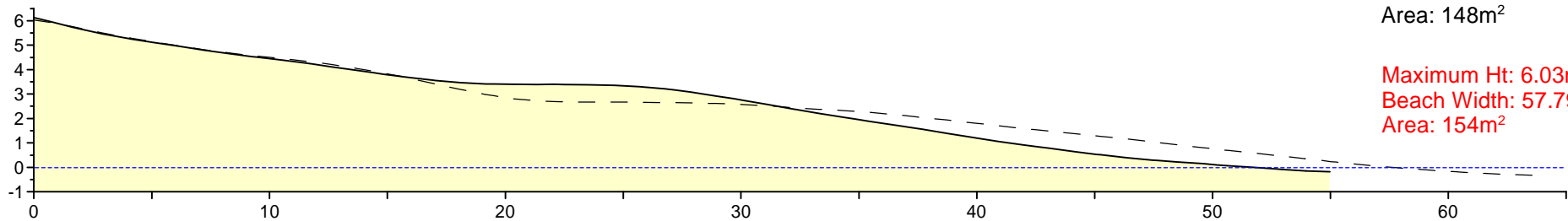
Maximum Ht: 6.26m
 Beach Width: 47.60m
 Area: 136m²



Profile 12

Maximum Ht: 6.14m
 Beach Width: 51.78m
 Area: 148m²

Maximum Ht: 6.03m
 Beach Width: 57.79m
 Area: 154m²



Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

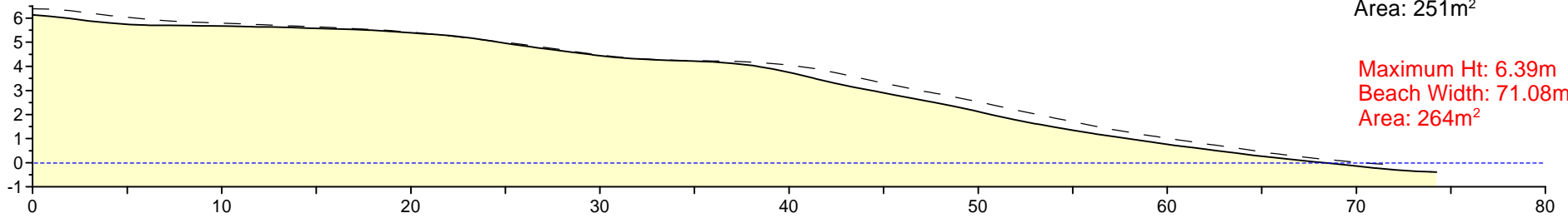


Jul 2014 vs Jun '14

Profile 13

Maximum Ht: 6.13m
 Beach Width: 68.91m
 Area: 251m²

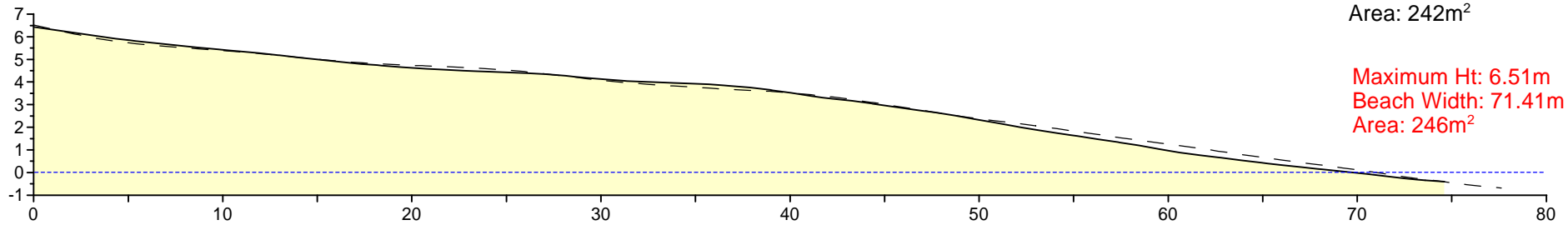
Maximum Ht: 6.39m
 Beach Width: 71.08m
 Area: 264m²



Profile 14

Maximum Ht: 6.43m
 Beach Width: 70.35m
 Area: 242m²

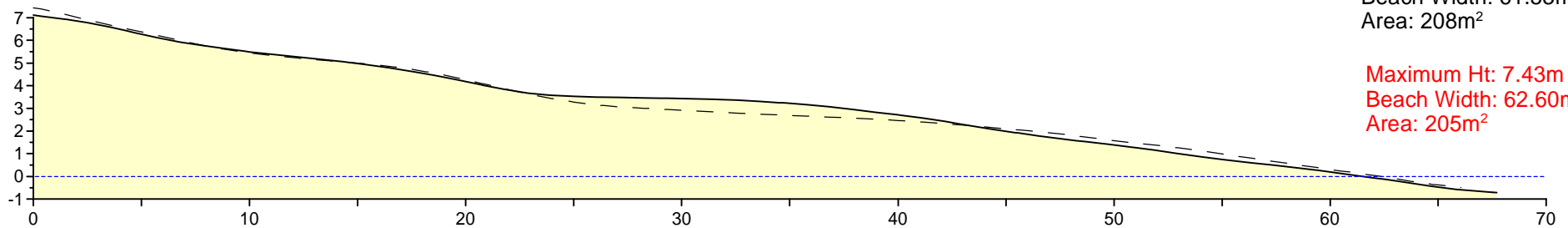
Maximum Ht: 6.51m
 Beach Width: 71.41m
 Area: 246m²



Profile 15

Maximum Ht: 7.11m
 Beach Width: 61.53m
 Area: 208m²

Maximum Ht: 7.43m
 Beach Width: 62.60m
 Area: 205m²



Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

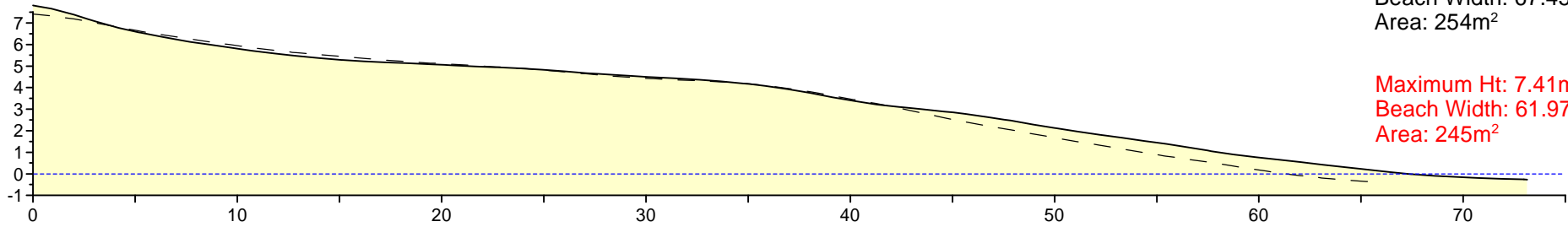


Jul 2014 vs Jun '14

Profile 16

Maximum Ht: 7.81m
Beach Width: 67.45m
Area: 254m²

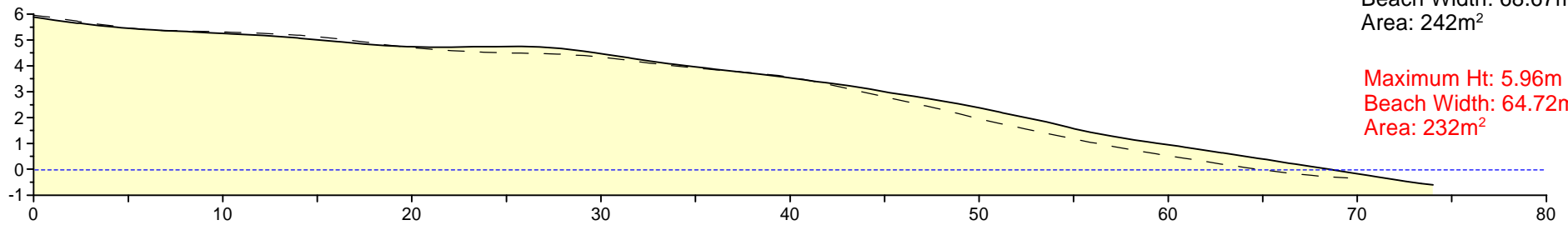
Maximum Ht: 7.41m
Beach Width: 61.97m
Area: 245m²



Profile 17

Maximum Ht: 5.89m
Beach Width: 68.67m
Area: 242m²

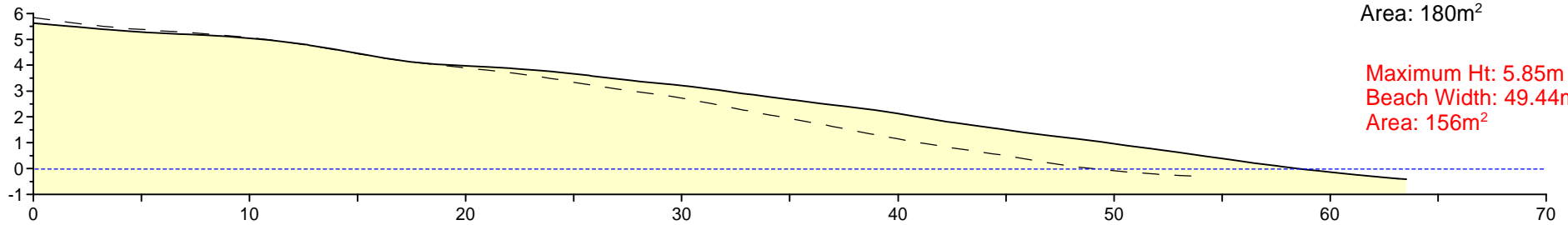
Maximum Ht: 5.96m
Beach Width: 64.72m
Area: 232m²



Profile 18

Maximum Ht: 5.62m
Beach Width: 58.88m
Area: 180m²

Maximum Ht: 5.85m
Beach Width: 49.44m
Area: 156m²



Height (m) relative to Mean Sea Level Datum

Distance (m) along Profile

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
Previous survey = dotted line & red stats

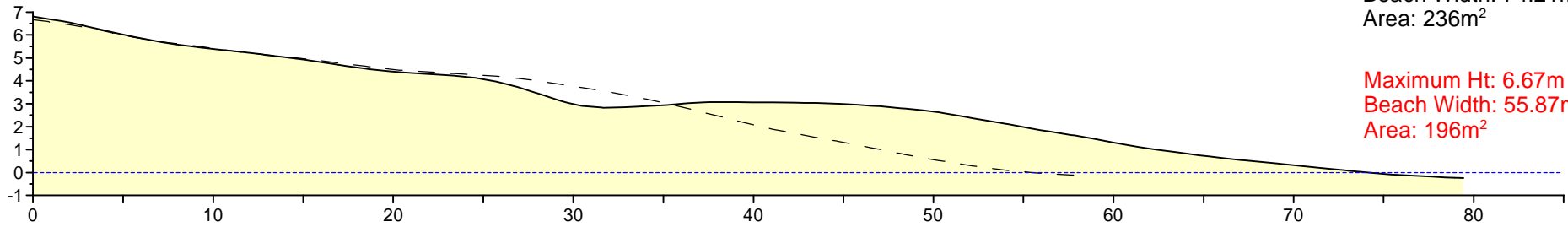


Jul 2014 vs Jun '14

Profile 19

Maximum Ht: 6.81m
 Beach Width: 74.21m
 Area: 236m²

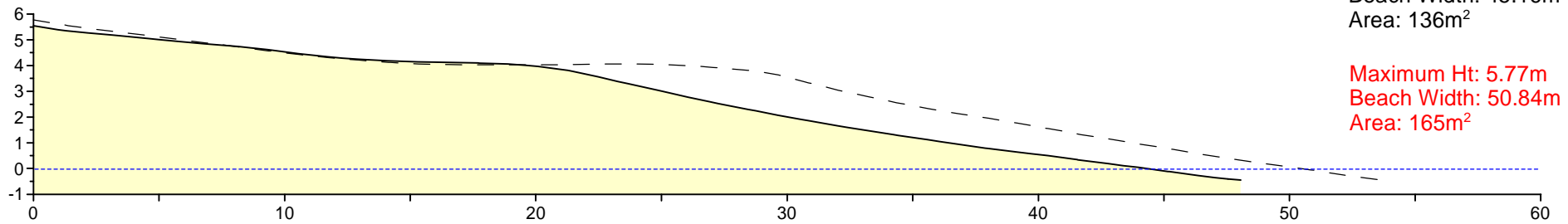
Maximum Ht: 6.67m
 Beach Width: 55.87m
 Area: 196m²



Profile 20

Maximum Ht: 5.54m
 Beach Width: 45.16m
 Area: 136m²

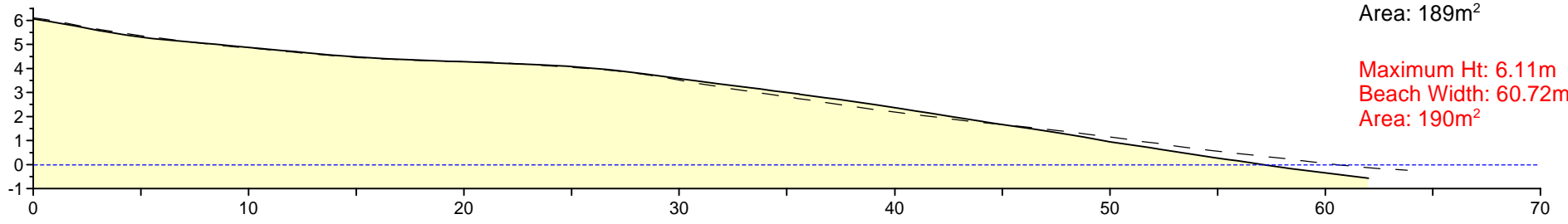
Maximum Ht: 5.77m
 Beach Width: 50.84m
 Area: 165m²



Profile 21

Maximum Ht: 6.06m
 Beach Width: 57.20m
 Area: 189m²

Maximum Ht: 6.11m
 Beach Width: 60.72m
 Area: 190m²



Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

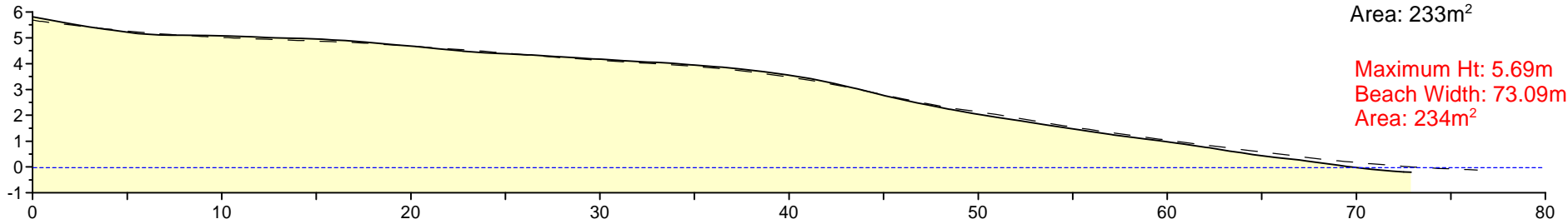


Jul 2014 vs Jun '14

Profile 22

Maximum Ht: 5.81m
 Beach Width: 70.67m
 Area: 233m²

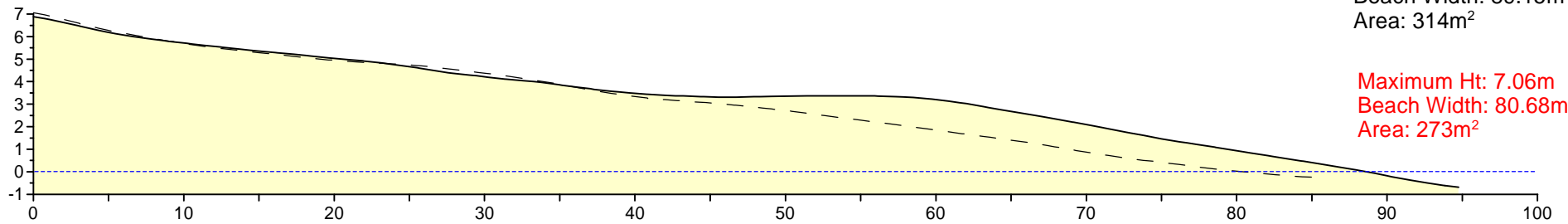
Maximum Ht: 5.69m
 Beach Width: 73.09m
 Area: 234m²



Profile 23

Maximum Ht: 6.89m
 Beach Width: 89.15m
 Area: 314m²

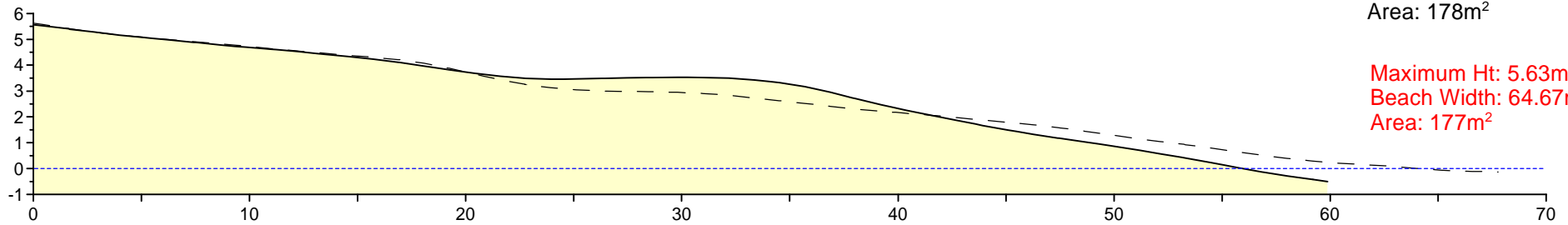
Maximum Ht: 7.06m
 Beach Width: 80.68m
 Area: 273m²



Profile 24

Maximum Ht: 5.56m
 Beach Width: 56.85m
 Area: 178m²

Maximum Ht: 5.63m
 Beach Width: 64.67m
 Area: 177m²



Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

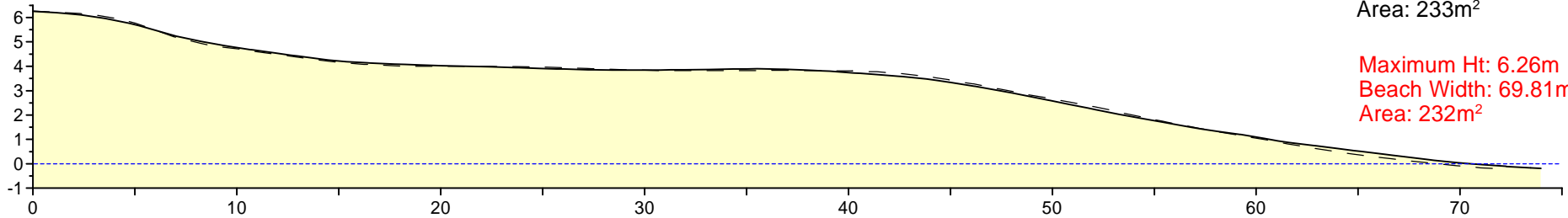


Jul 2014 vs Jun '14

Profile 25

Maximum Ht: 6.25m
 Beach Width: 71.09m
 Area: 233m²

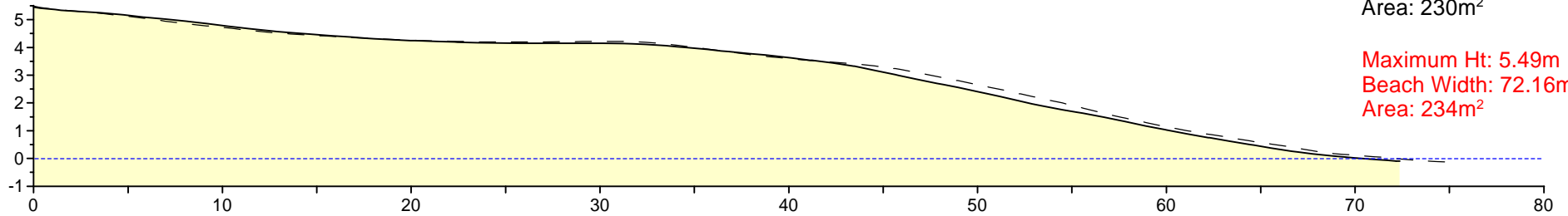
Maximum Ht: 6.26m
 Beach Width: 69.81m
 Area: 232m²



Profile 26

Maximum Ht: 5.45m
 Beach Width: 71.06m
 Area: 230m²

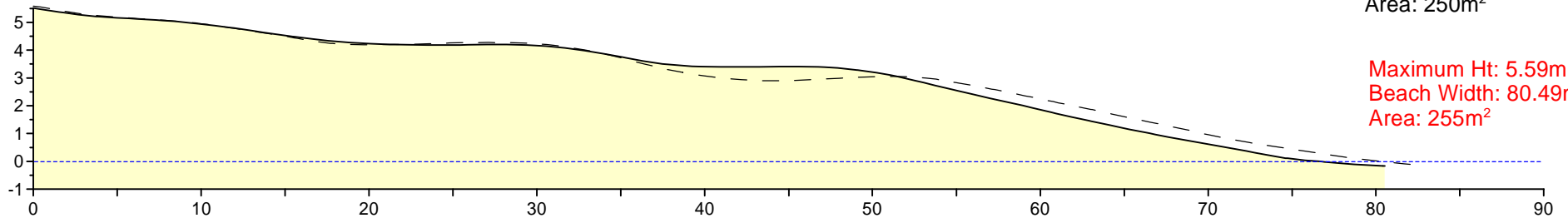
Maximum Ht: 5.49m
 Beach Width: 72.16m
 Area: 234m²



Profile 27

Maximum Ht: 5.52m
 Beach Width: 76.70m
 Area: 250m²

Maximum Ht: 5.59m
 Beach Width: 80.49m
 Area: 255m²



Height (m) relative to Mean Sea Level Datum

Distance (m) along Profile

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

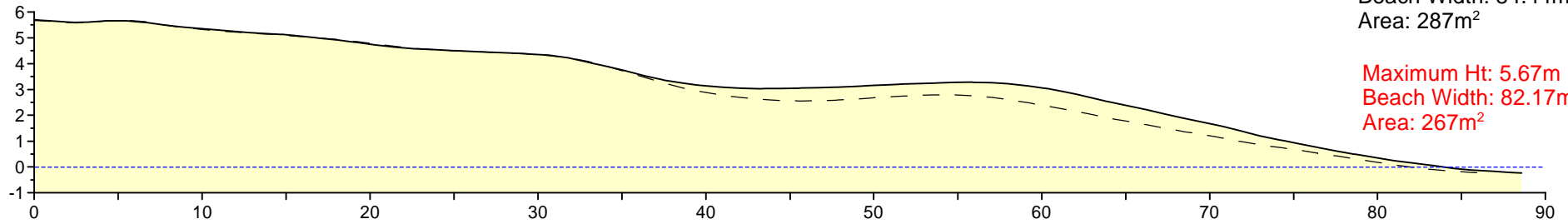


Jul 2014 vs Jun '14

Profile 28

Maximum Ht: 5.71m
 Beach Width: 84.44m
 Area: 287m²

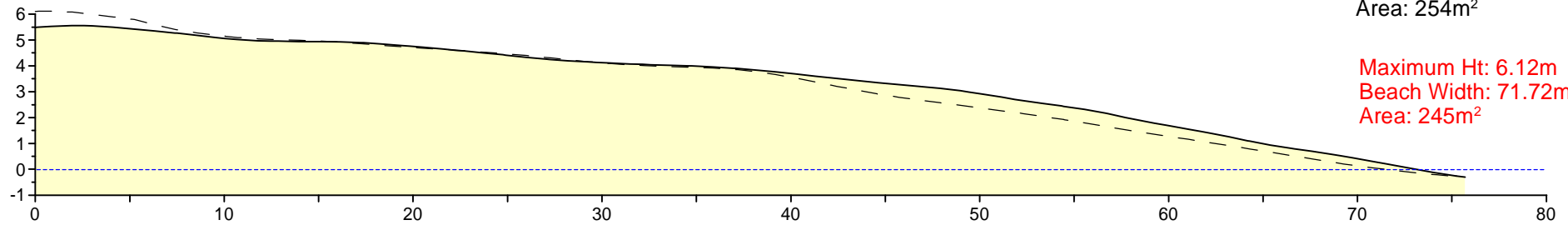
Maximum Ht: 5.67m
 Beach Width: 82.17m
 Area: 267m²



Profile 29

Maximum Ht: 5.56m
 Beach Width: 74.04m
 Area: 254m²

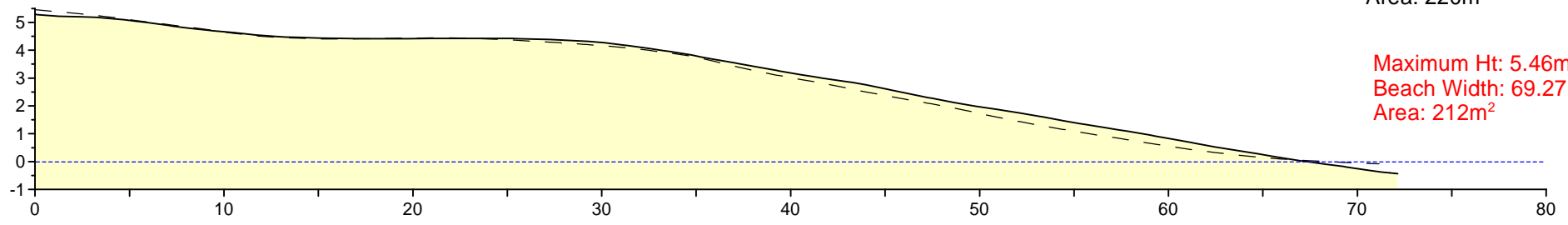
Maximum Ht: 6.12m
 Beach Width: 71.72m
 Area: 245m²



Profile 30

Maximum Ht: 5.29m
 Beach Width: 67.27m
 Area: 220m²

Maximum Ht: 5.46m
 Beach Width: 69.27m
 Area: 212m²



Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats

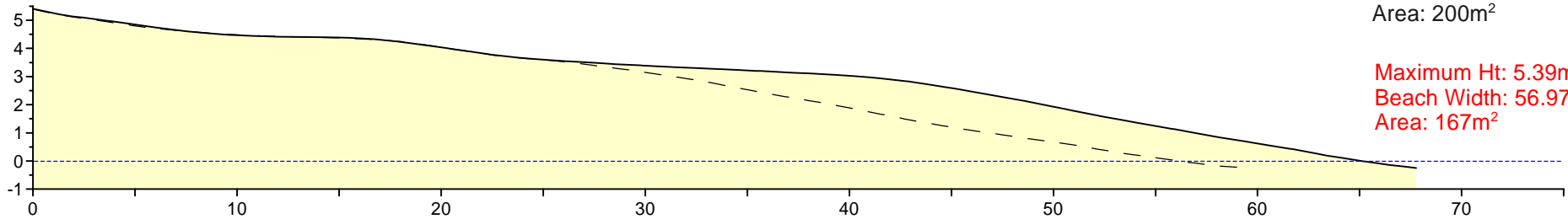


Jul 2014 vs Jun '14

Profile X-1

Maximum Ht: 5.41m
 Beach Width: 65.26m
 Area: 200m²

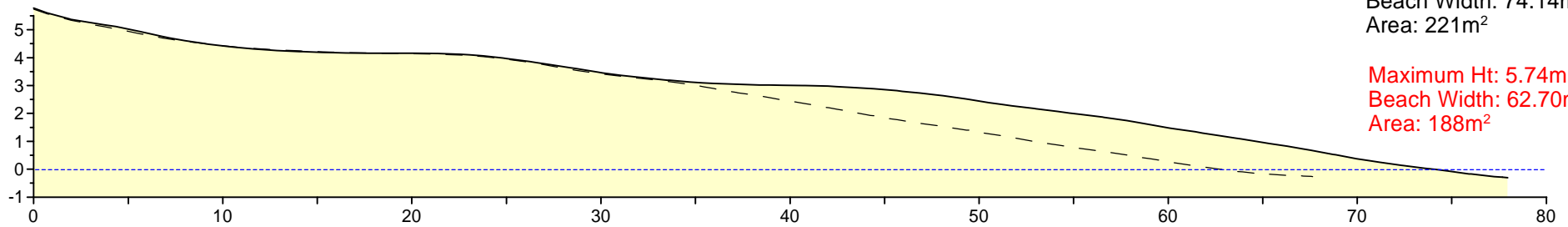
Maximum Ht: 5.39m
 Beach Width: 56.97m
 Area: 167m²



Profile X-2

Maximum Ht: 5.78m
 Beach Width: 74.14m
 Area: 221m²

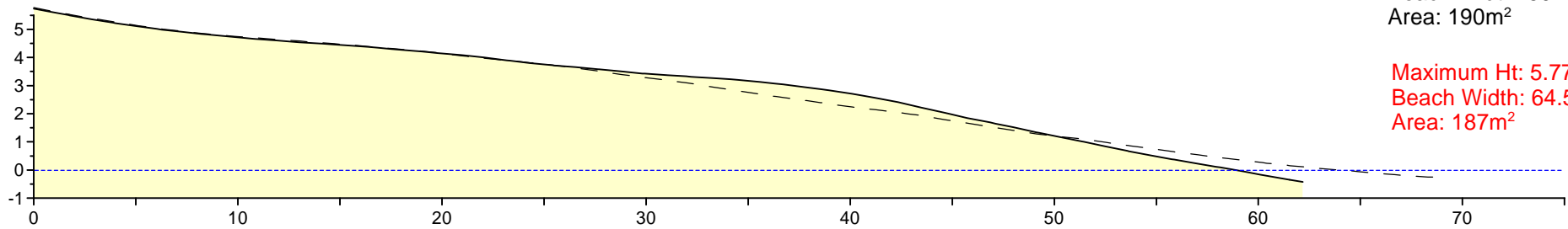
Maximum Ht: 5.74m
 Beach Width: 62.70m
 Area: 188m²



Profile X-3

Maximum Ht: 5.74m
 Beach Width: 59.26m
 Area: 190m²

Maximum Ht: 5.77m
 Beach Width: 64.52m
 Area: 187m²



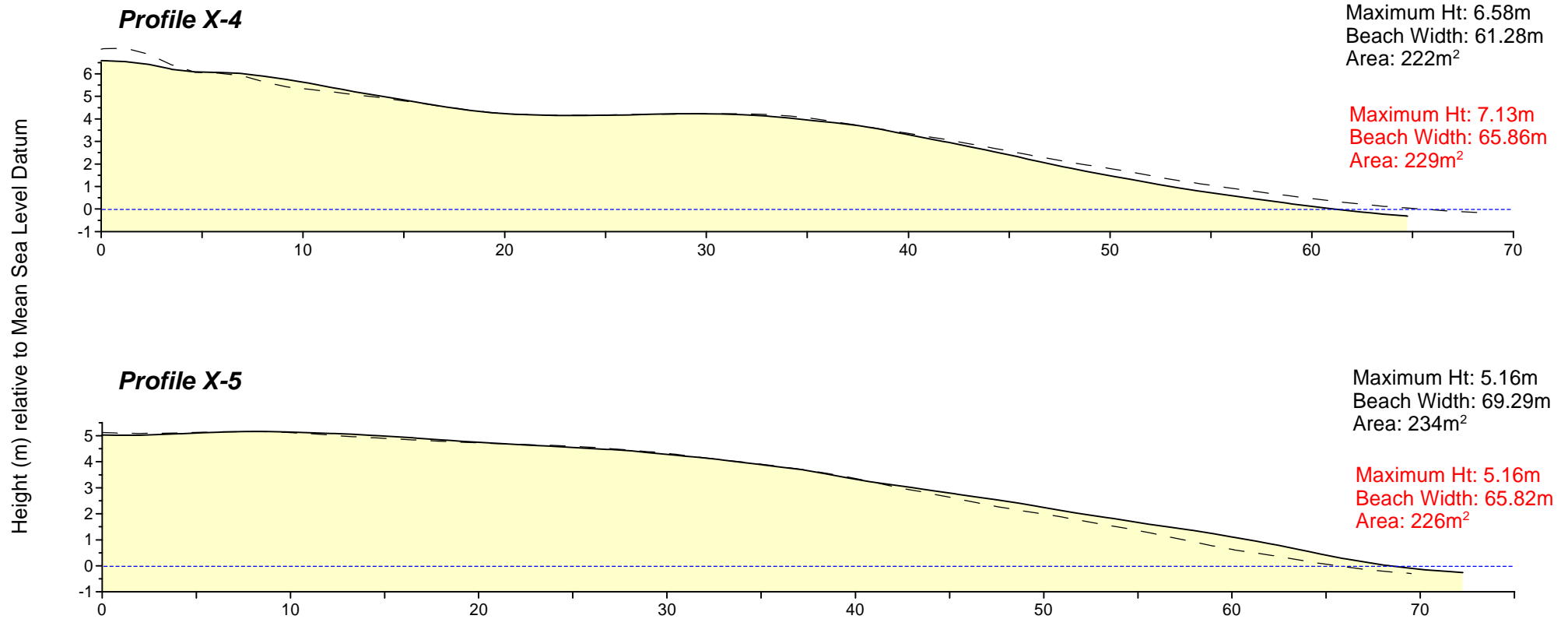
Distance (m) along Profile

Height (m) relative to Mean Sea Level Datum

Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
 Previous survey = dotted line & red stats



Jul 2014 vs Jun '14



Note: Beach width measured from start of profile to point where the profile intersects the msl line. The area under the profile is calculated to 0 msl.
Previous survey = dotted line & red stats



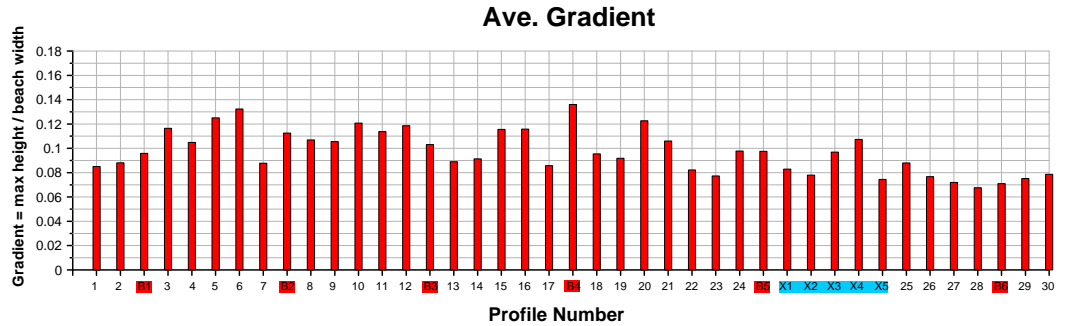
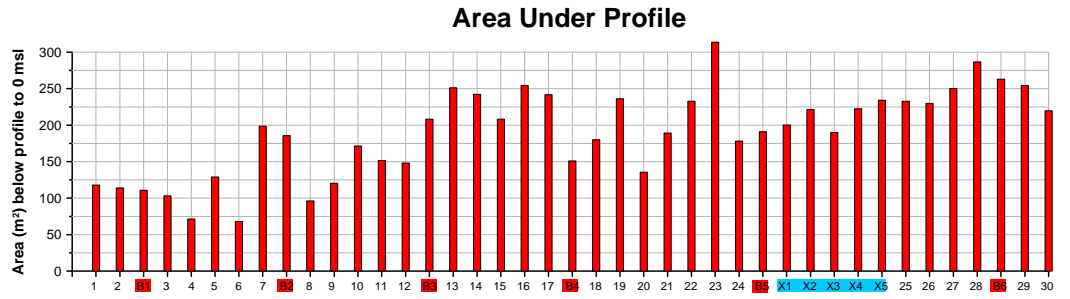
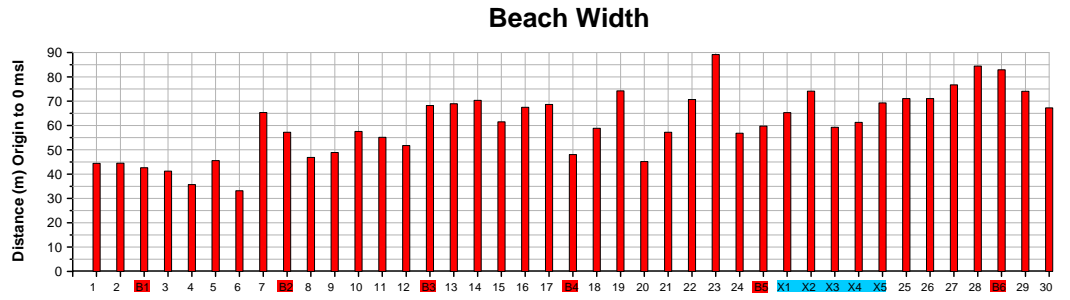
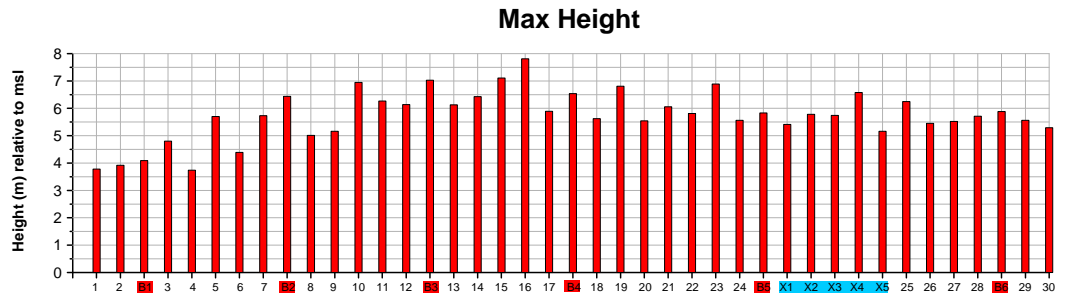
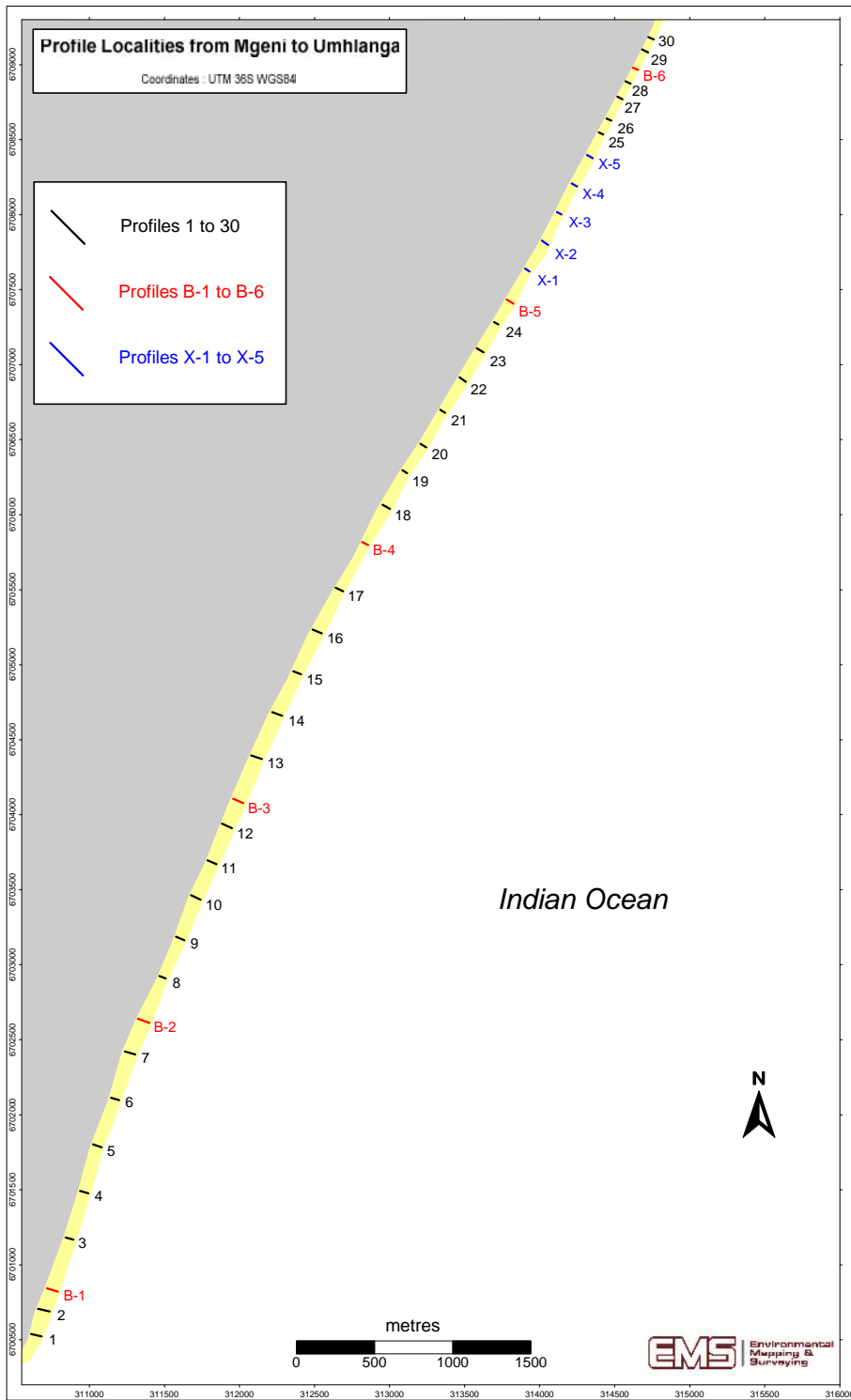
**Table 1. Physical data from profiles surveyed on beaches from Mgeni River to Umhlanga
- July 2014**

Profile No.	Max Ht: (m above msl)	Beach Width (m)	Area: (m ² to 0msl)	Ave. Gradient: Max Ht/Beach Length
1	3.78	44.42	118	0.09
2	3.92	44.48	114	0.09
B-1	4.09	42.65	111	0.10
3	4.80	41.21	103	0.12
4	3.74	35.68	71	0.10
5	5.70	45.58	129	0.13
6	4.39	33.18	68	0.13
7	5.73	65.32	199	0.09
B-2	6.44	57.21	186	0.11
8	5.01	46.85	96	0.11
9	5.16	48.87	120	0.11
10	6.95	57.58	171	0.12
11	6.27	55.13	152	0.11
12	6.14	51.78	148	0.12
B-3	7.03	68.22	208	0.10
13	6.13	68.91	251	0.09
14	6.43	70.35	242	0.09
15	7.11	61.53	208	0.12
16	7.81	67.45	254	0.12
17	5.89	68.67	242	0.09
B-4	6.54	48.06	151	0.14
18	5.62	58.88	180	0.10
19	6.81	74.21	236	0.09
20	5.54	45.16	136	0.12
21	6.06	57.20	189	0.11
22	5.81	70.67	233	0.08
23	6.89	89.15	314	0.08
24	5.56	56.85	178	0.10
B-5	5.83	59.75	191	0.10
X-1	5.41	65.26	200	0.08
X-2	5.78	74.14	221	0.08
X-3	5.74	59.26	190	0.10
X-4	6.58	61.28	222	0.11
X-5	5.16	69.29	234	0.07
25	6.25	71.09	233	0.09
26	5.45	71.06	230	0.08
27	5.52	76.70	250	0.07
28	5.71	84.44	287	0.07
B-6	5.88	82.91	263	0.07
29	5.56	74.04	254	0.08
30	5.29	67.27	220	0.08
Min:	3.74	33.18	68	0.07
Max:	7.81	89.15	314	0.14
Ave:	5.74	60.77	190	0.10

Note: The beach width is measured from the start of the profile, to the point where the profile intersects the msl line.

The area under the profile is calculated to 0 msl

The ave gradient is calculated from the beach width and the beach height.

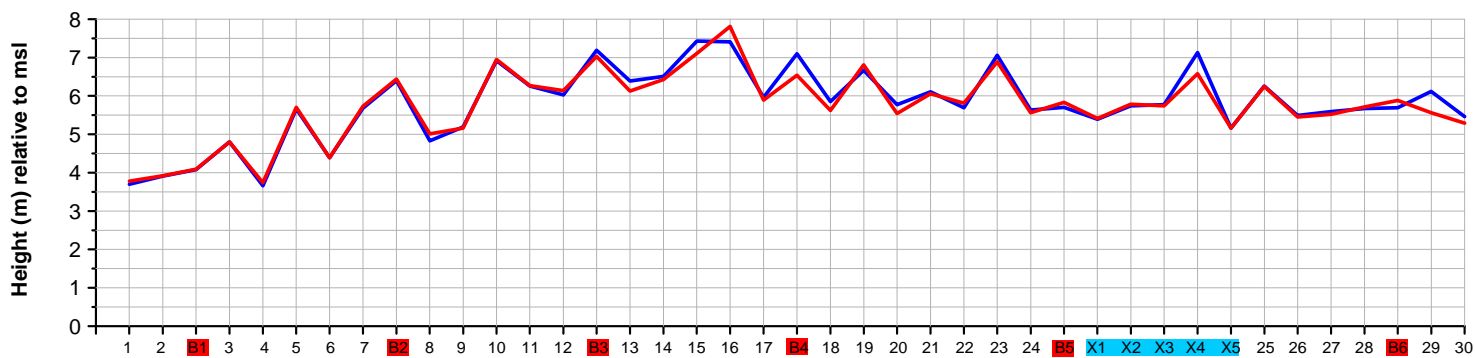


July 2014

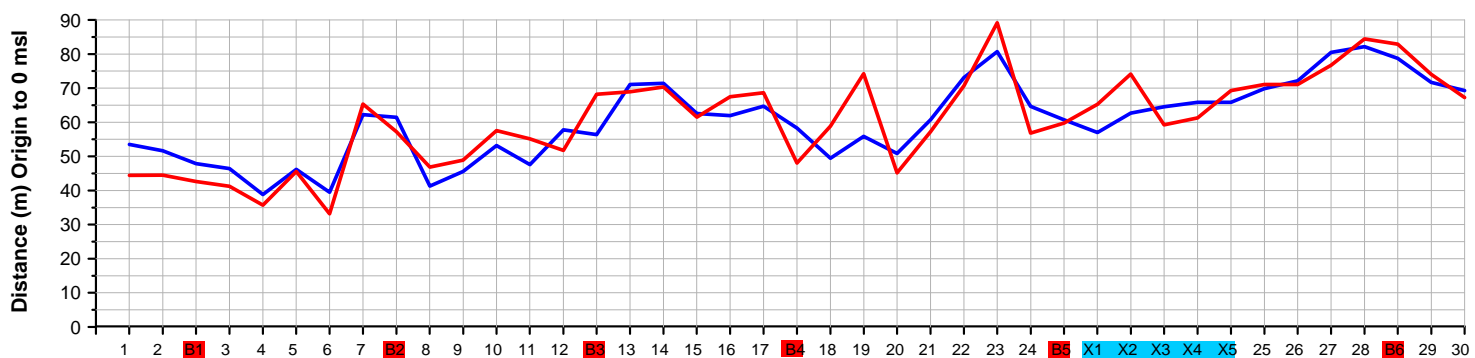
Beach width is measured from start of profile, to the point where the profile intersects 0 msl.
Area under the profile is calculate to 0 msl.
Ave. gradient is max height/beach width



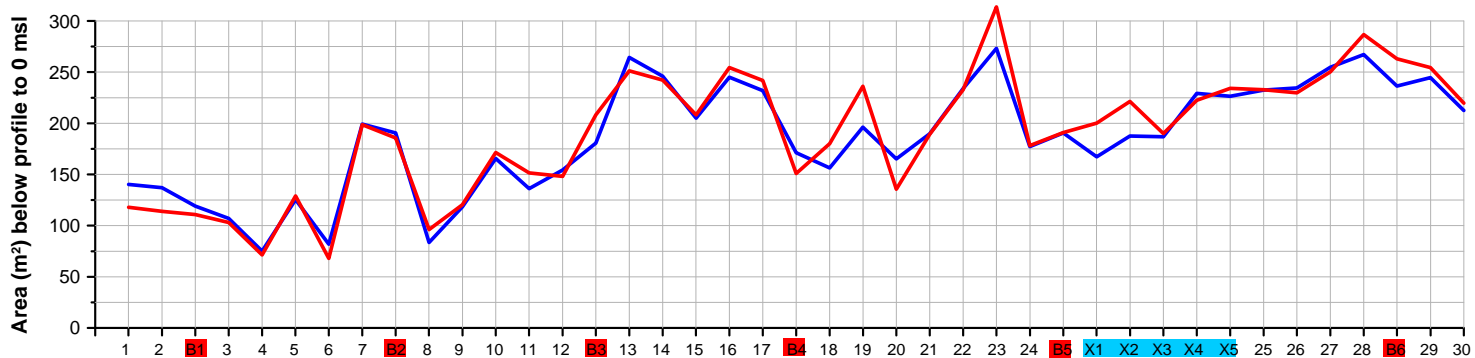
Max Height



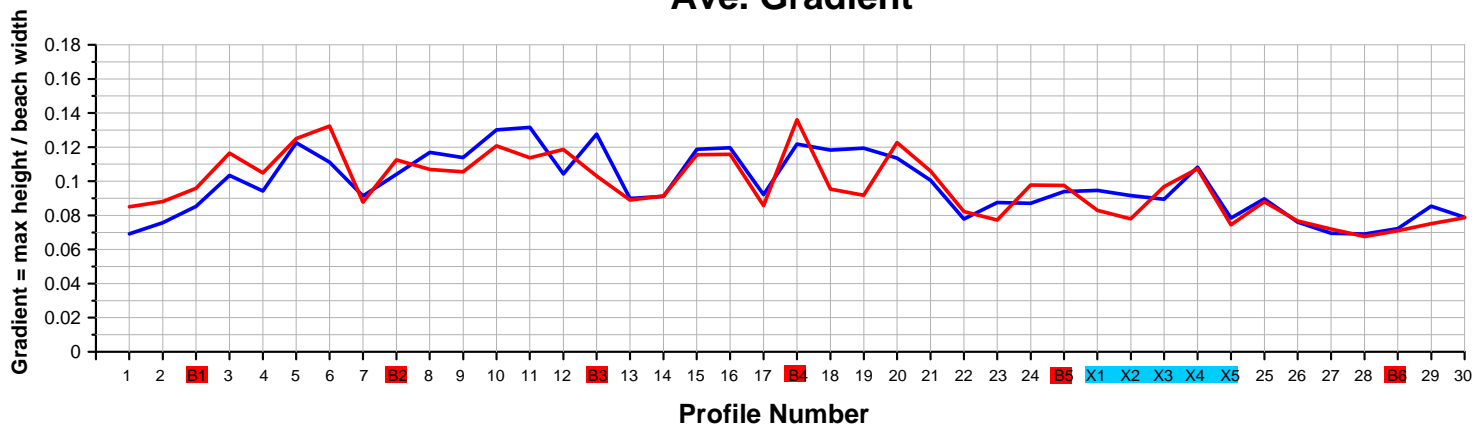
Beach Width



Area Under Profile



Ave. Gradient



— July 2014

— June 2014

