Cyfoeth Naturiol Cymru
Natural Resources Wales

Kenfig Phase 2
Dune Rejuvenation Works
Topographic Survey Report

Kenneth Pye & Simon J. Blott

Kenneth Pye Associates Ltd

Report No: 92

Date: May 2013

About Natural Resources Wales

Natural Resources Wales is the organisation responsible for the work carried out by the three former organisations, the Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales. It is also responsible for some functions previously undertaken by Welsh Government.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, used and enhanced, now and in the future.

We work for the communities of Wales to protect people and their homes as much as possible from environmental incidents like flooding and pollution. We provide opportunities for people to learn, use and benefit from Wales' natural resources.

We work to support Wales' economy by enabling the sustainable use of natural resources to support jobs and enterprise. We help businesses and developers to understand and consider environmental limits when they make important decisions.

We work to maintain and improve the quality of the environment for everyone and we work towards making the environment and our natural resources more resilient to climate change and other pressures.

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Natural Resources Wales is an evidence based organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

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Contract Manager:	Dr. Emmer Litt
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Author(s):	**Prof. Kenneth Pye & Dr. Simon J. Blott**
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Contents

1. Job Summary

KPAL Job No:	130513
Report Date:	29/05/2013
Client:	Natural Resources Wales
Client Job Title:	Kenfig Dune Rejuvenation Works – Phase 2
Survey conducted:	13th May 2013
Instruments used:	Leica ATX1230 SmartRover mounted on GLS30 pole (2 m) Leica GX1230 RTK base station mounted on GST20-9 tripod Leica RX1250XC and RX1210T Field Controllers Pacific Crest ADL Vantage radio transceiver (430-470 MHz)
No. of data points:	1531
RTK Control Station:	Wooden post surveyed-in using Leica Smartnet GPRS: Easting: 278274.567 m Northing: 182438.361 m Height: 10.846 m OD
Summary report compiled by:	Simon J. Blott BSc MRes PhD FGS
Checked by:	Kenneth Pye ScD PhD MA CGeol FGS
Date:	29 May 2013

2. Error Checking

Table 1. Average quality control for all 1531 data points

	1-D (height) quality control	**2-D (position) quality control**
Average	21.5 mm	12.9 mm
StDev	9.9 mm	6.9 mm

Table 2. Measured location of Benchmark 2 (wooden post set in dunes)

	Easting	**Northing**	**Height**
Surveyed with Smartnet corrections	278262.704	182449.124	8.543
Surveyed with base & rover (start) Error:	278262.735 +31 mm	182449.102 -22 mm	8.540 -3 mm
Surveyed with base & rover (end) Error:	278262.719 +15 mm	182449.127 +3 mm	8.521 -22 mm
Closing error (start to finish)	-16 mm	+25 mm	-19 mm

3. Monitoring Results

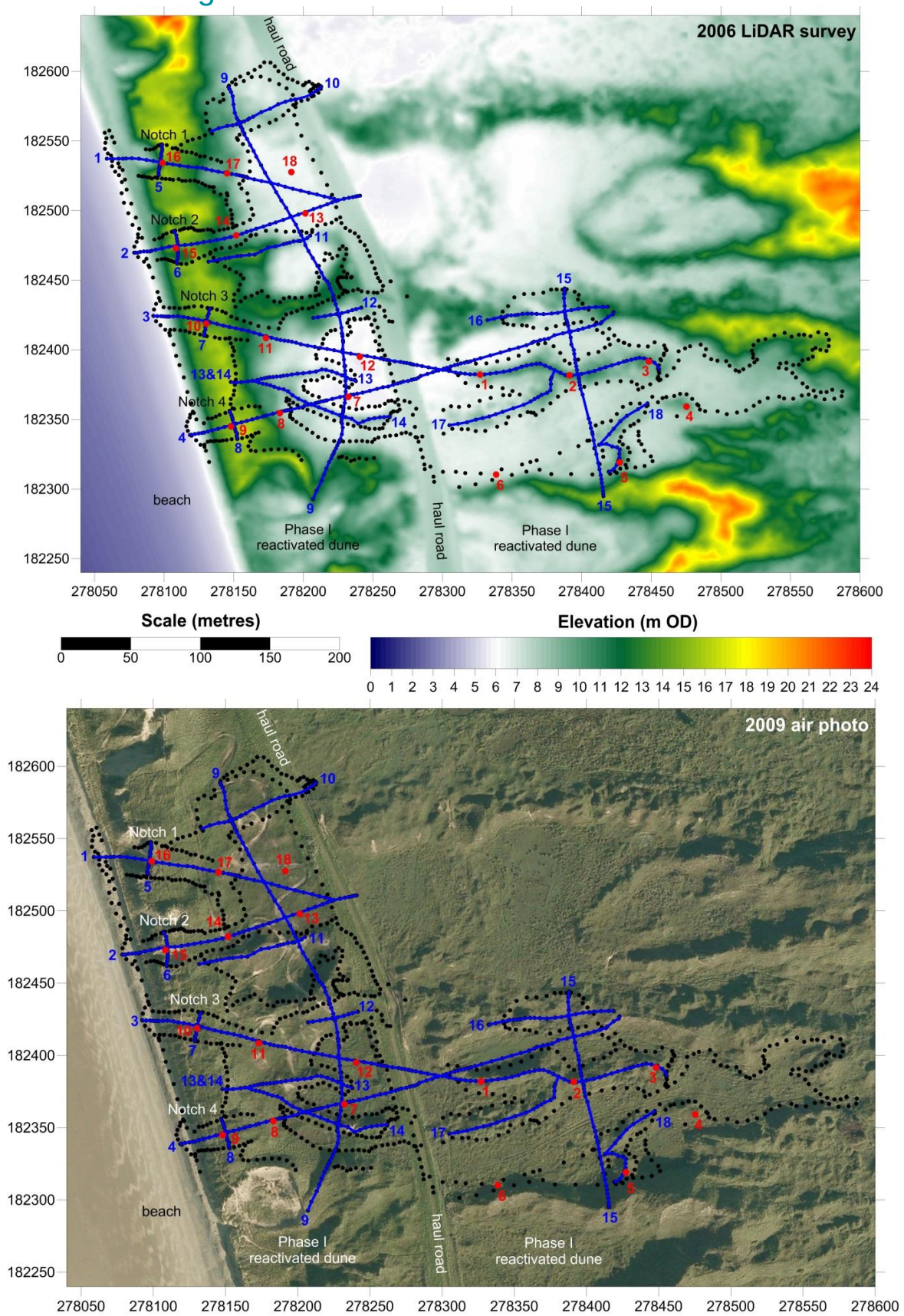


Figure 1. Locations of data points (black dots), sediment samples (red dots) and cross-profiles (blue lines), overlaid on 2006 LiDAR and 2009 air photographs.

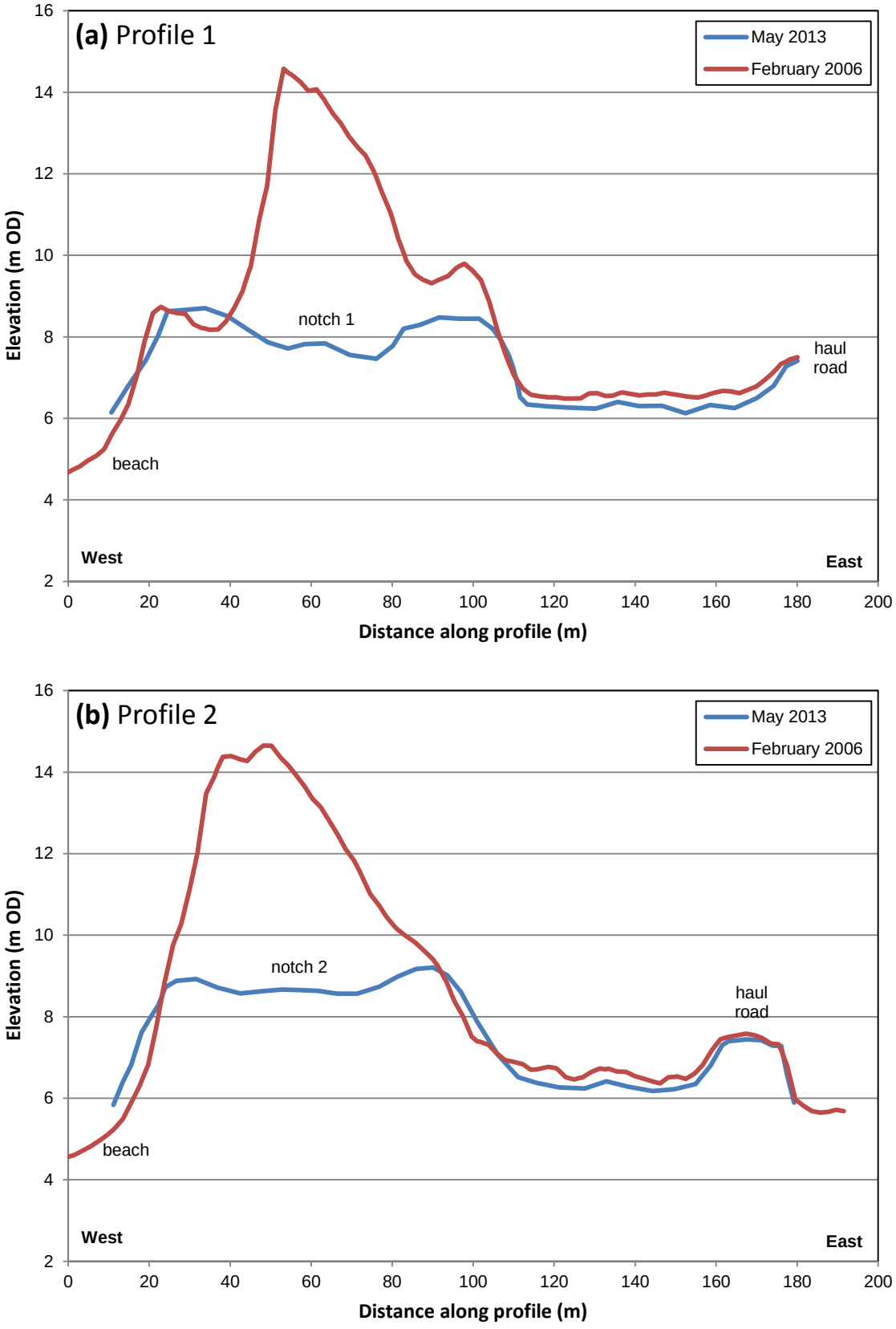
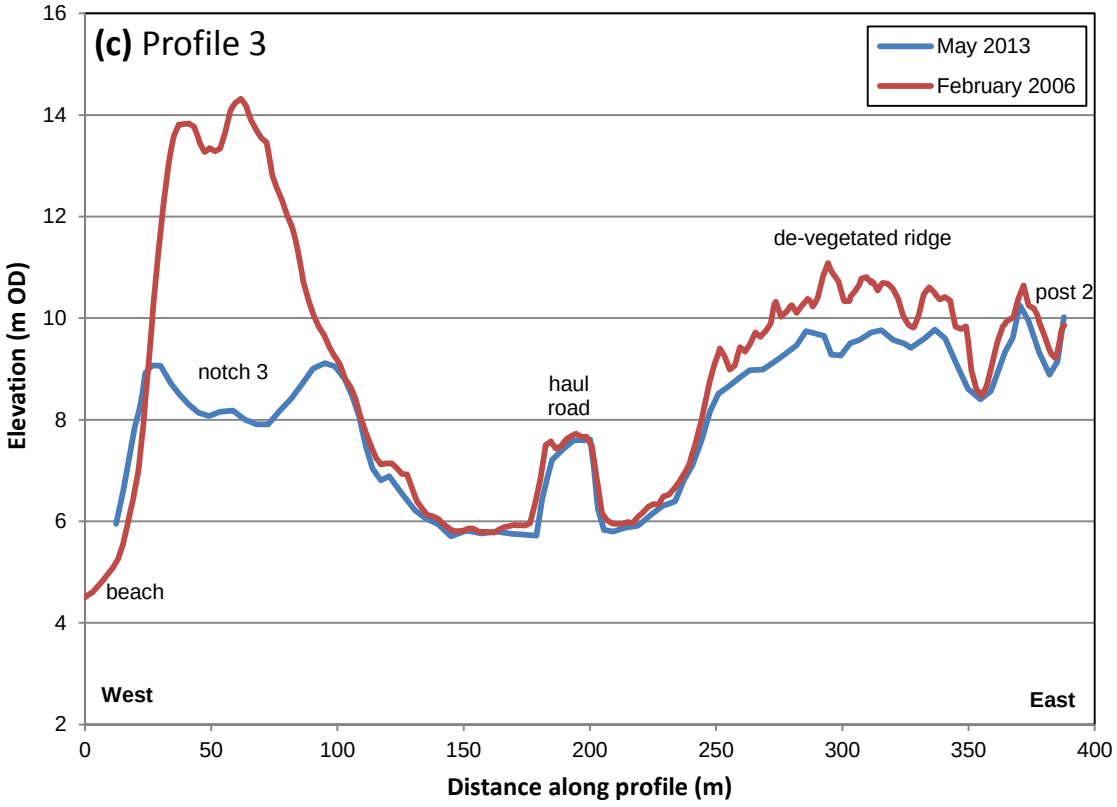
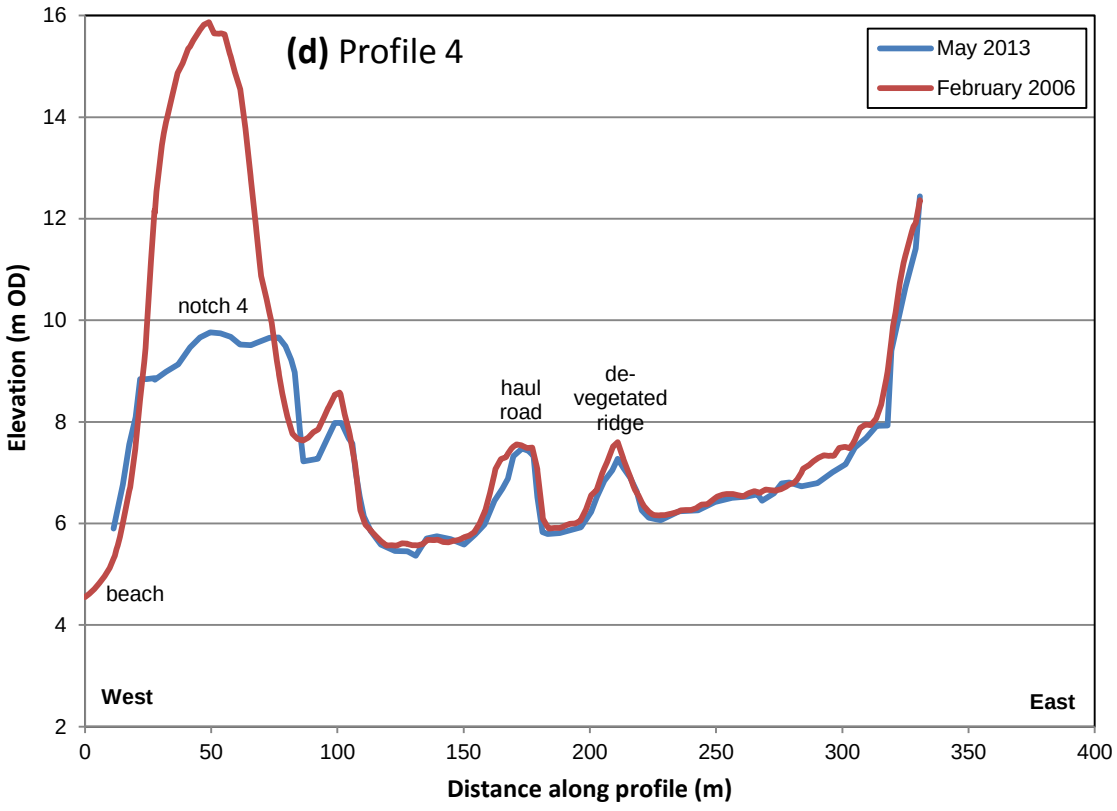


Figure 2. Cross-profiles, at the locations indicated in Figure 1, measured from the ground survey on 13 May 2013, and LiDAR aerial survey in February 2006. Note that the horizontal and linear scales vary considerably.





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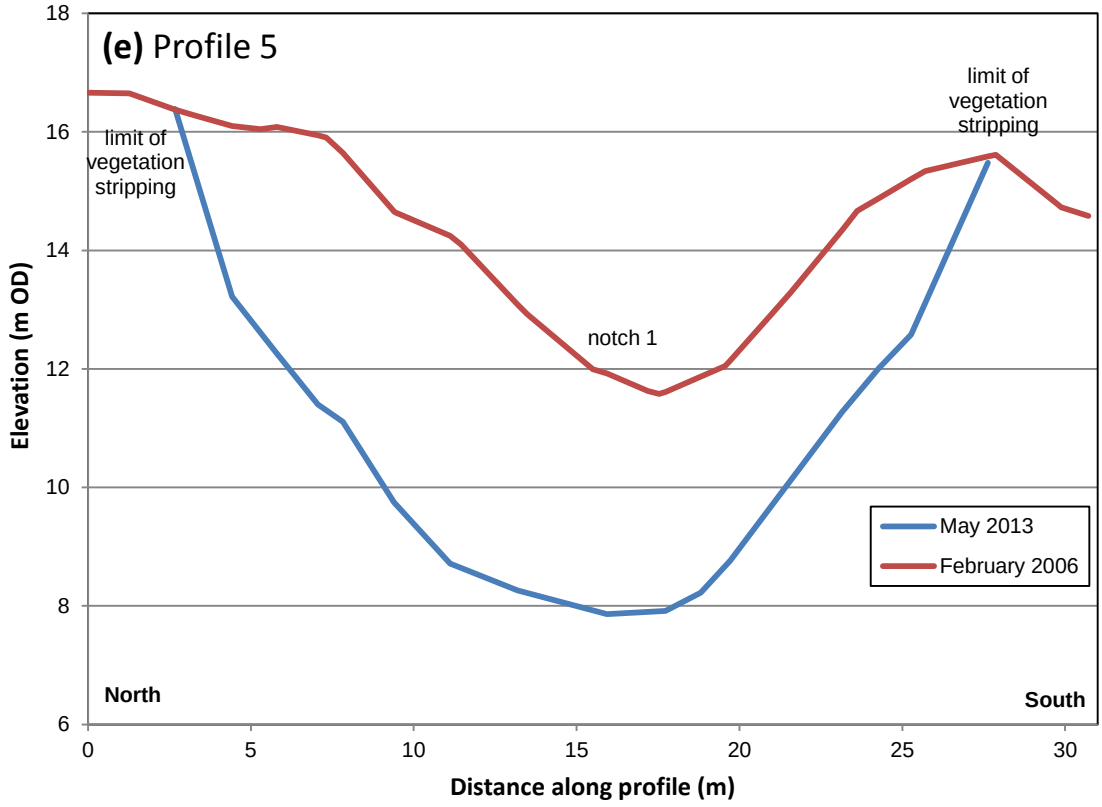

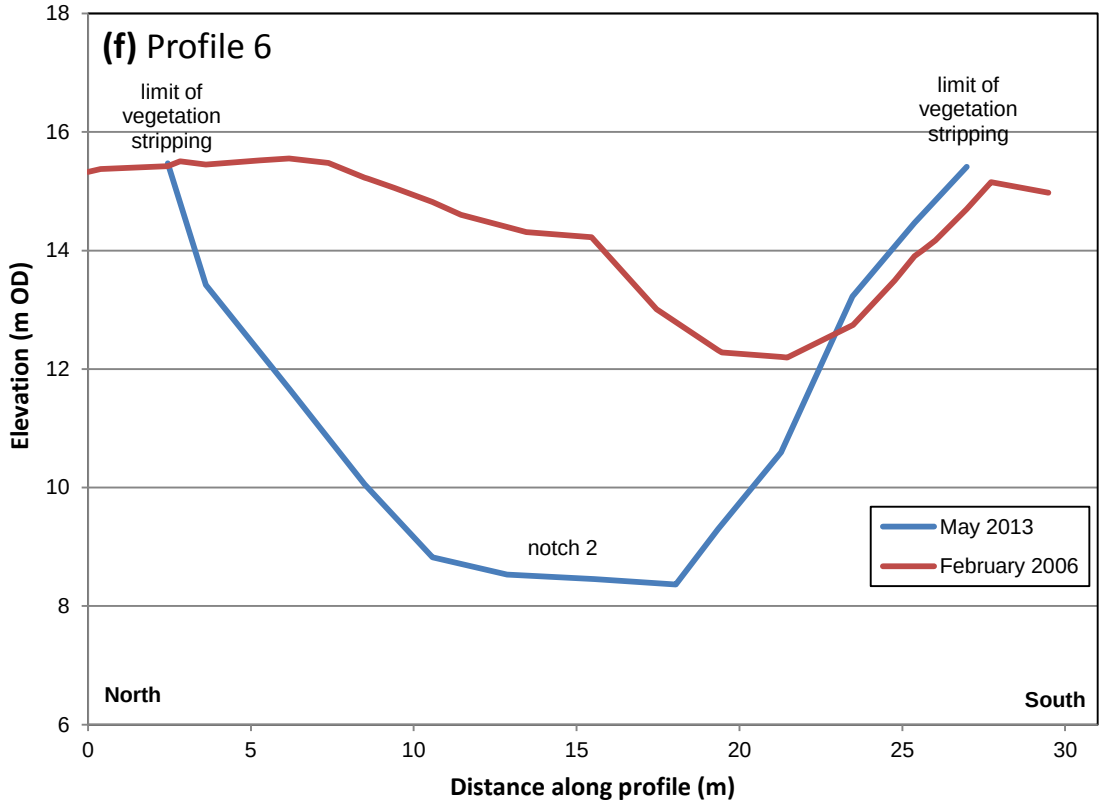

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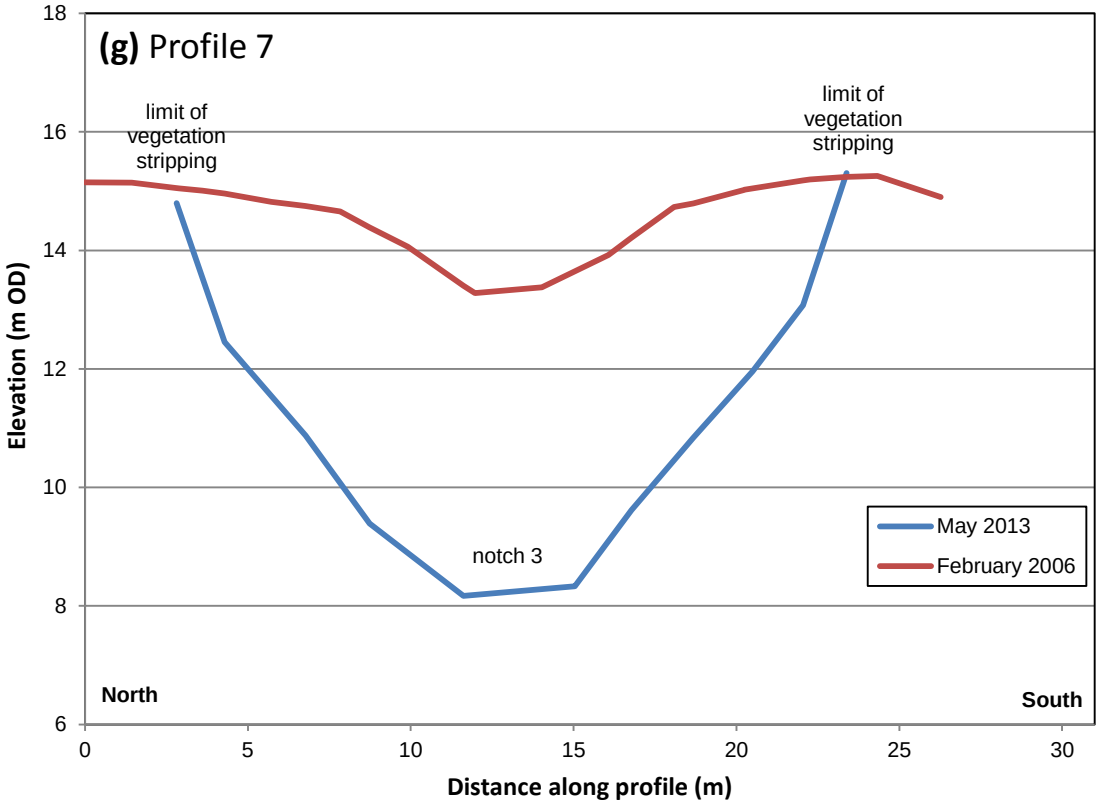

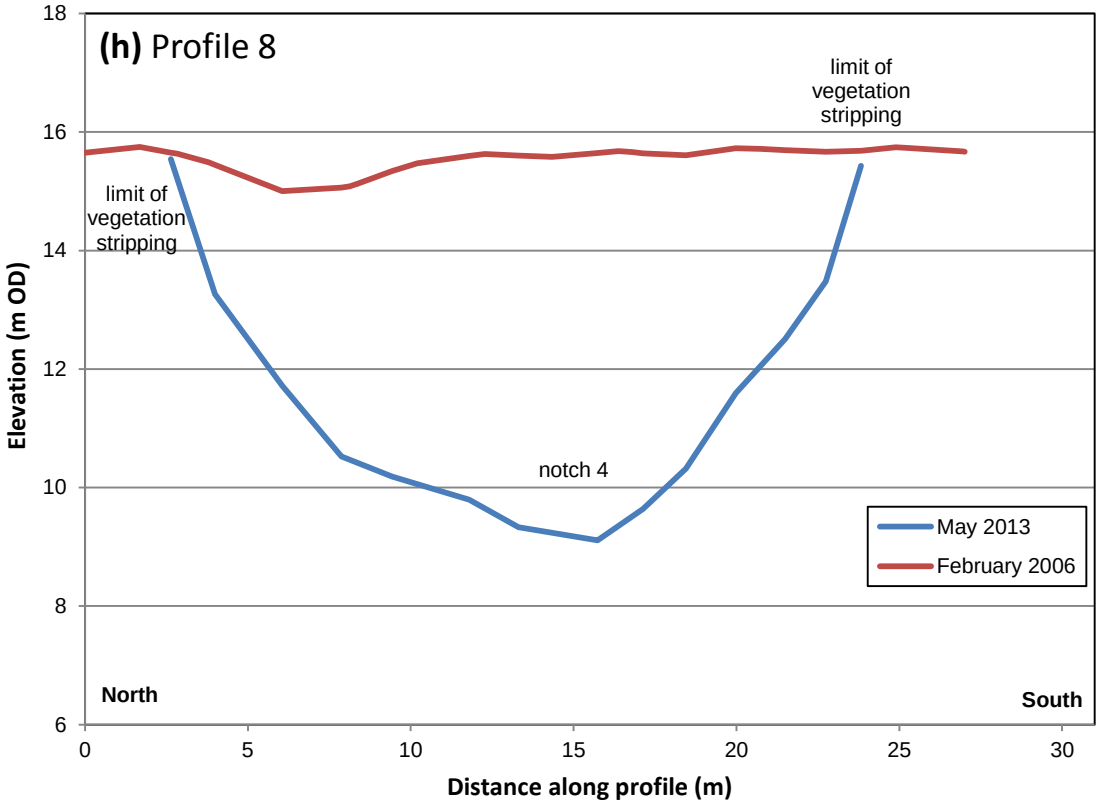

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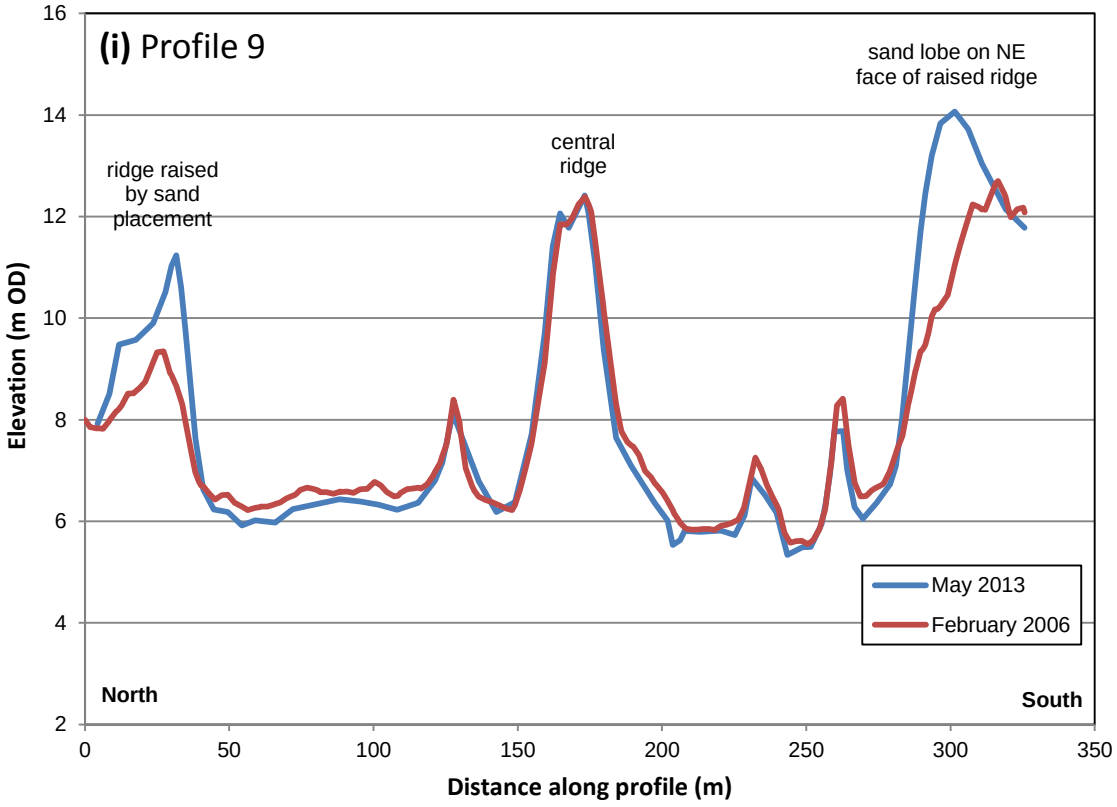

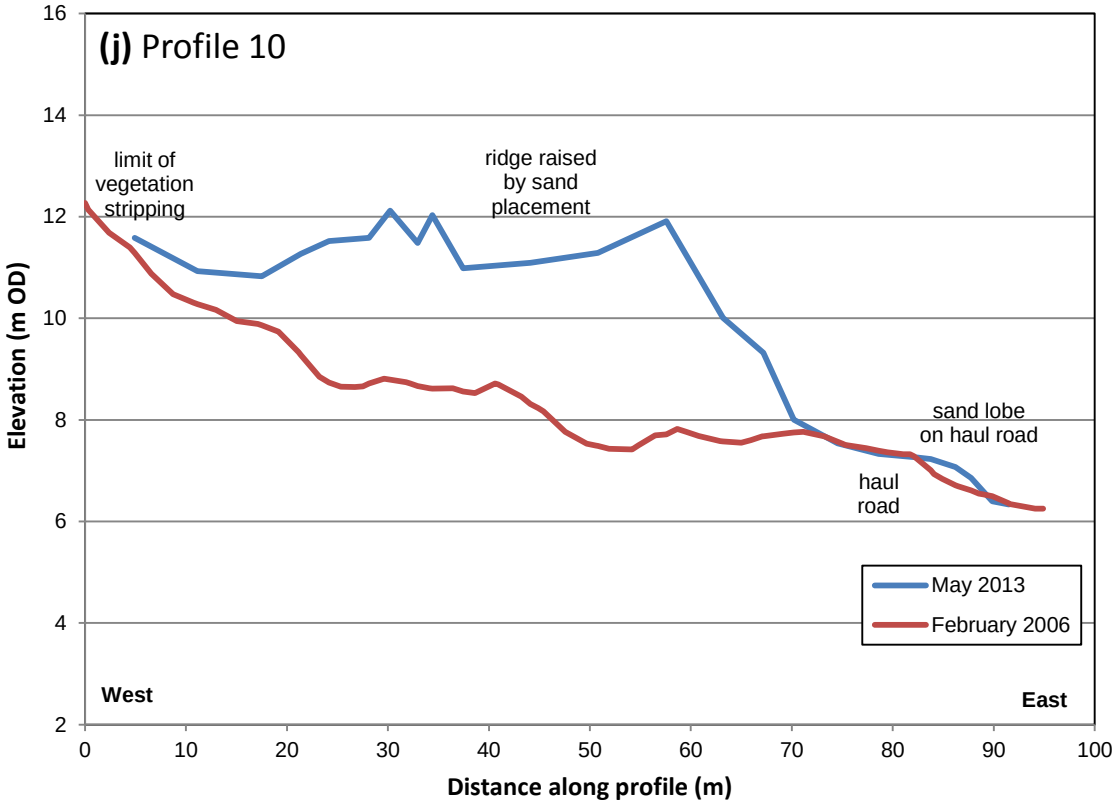

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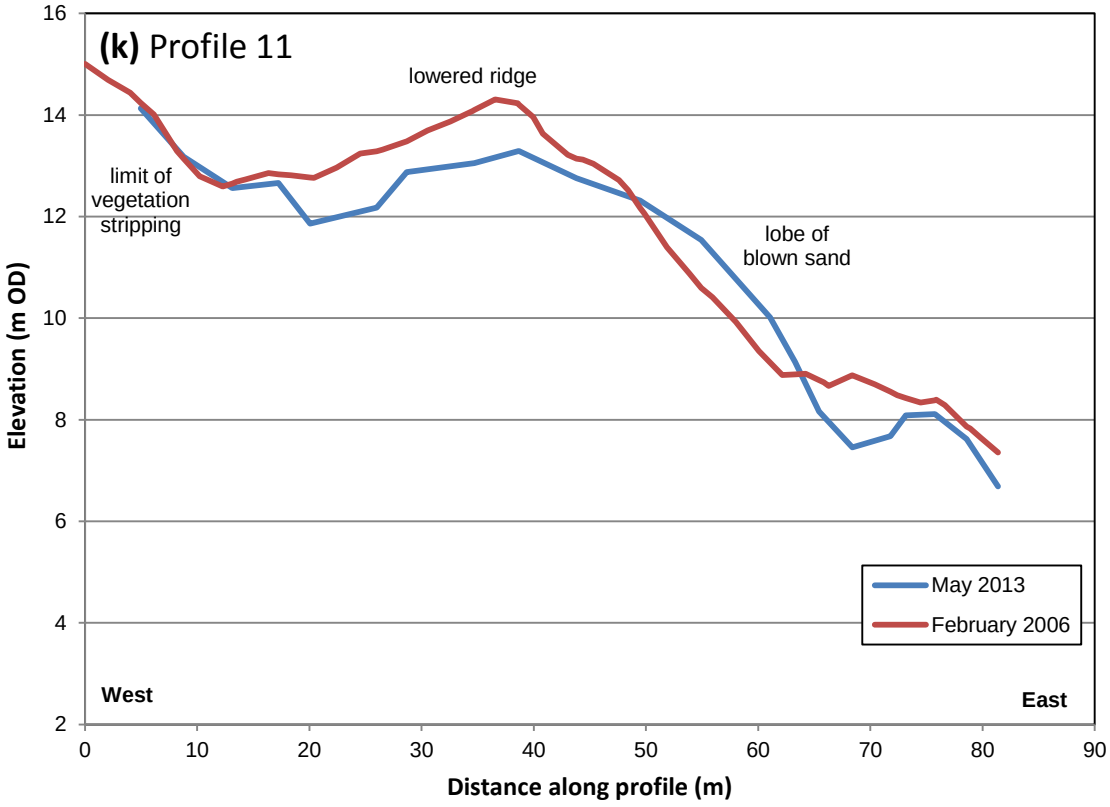

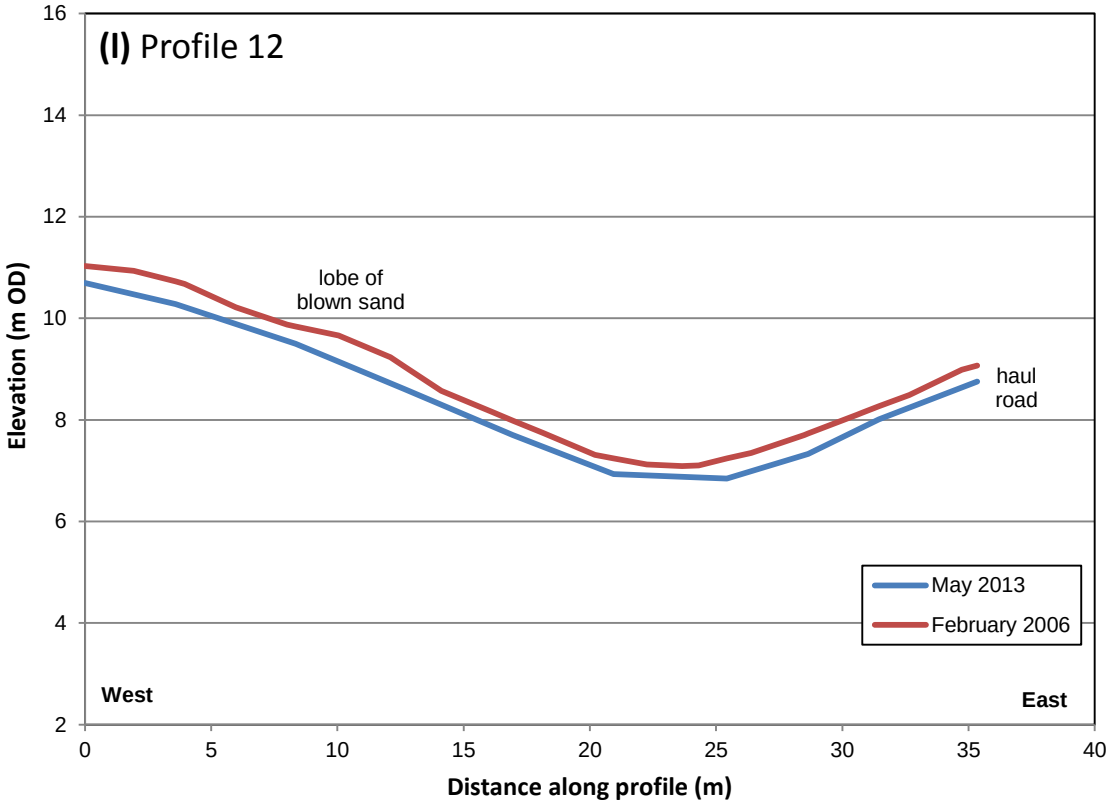

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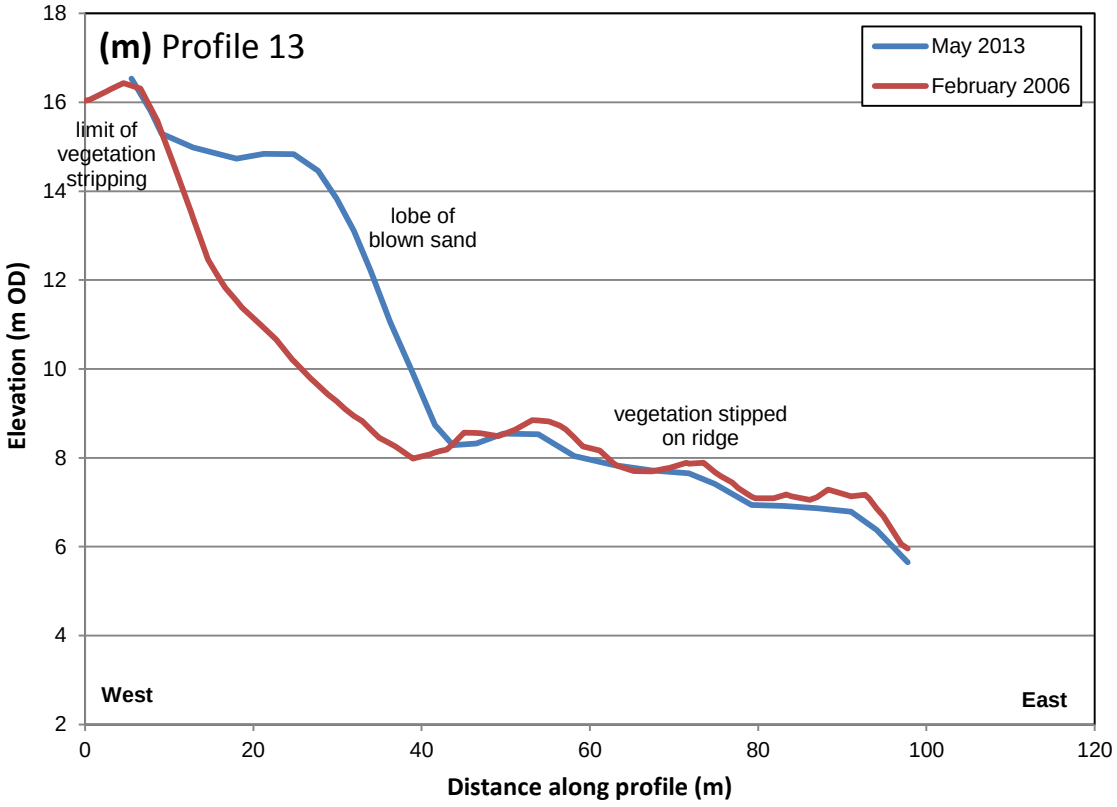

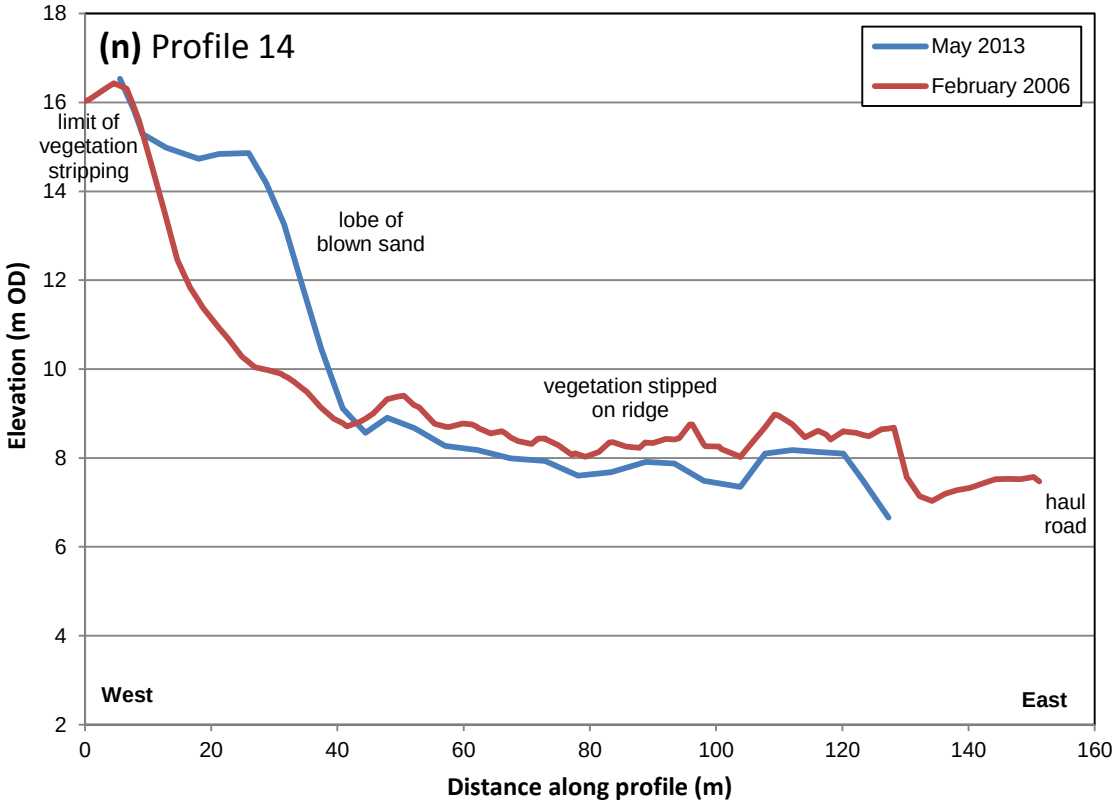

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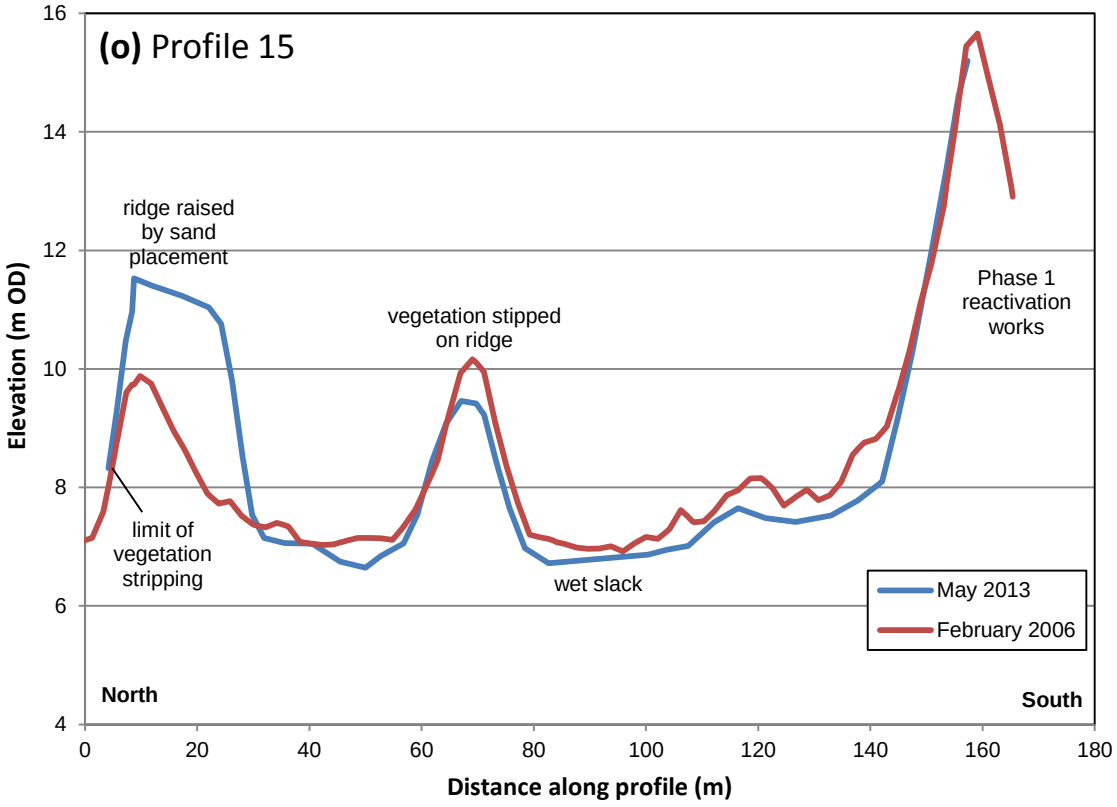

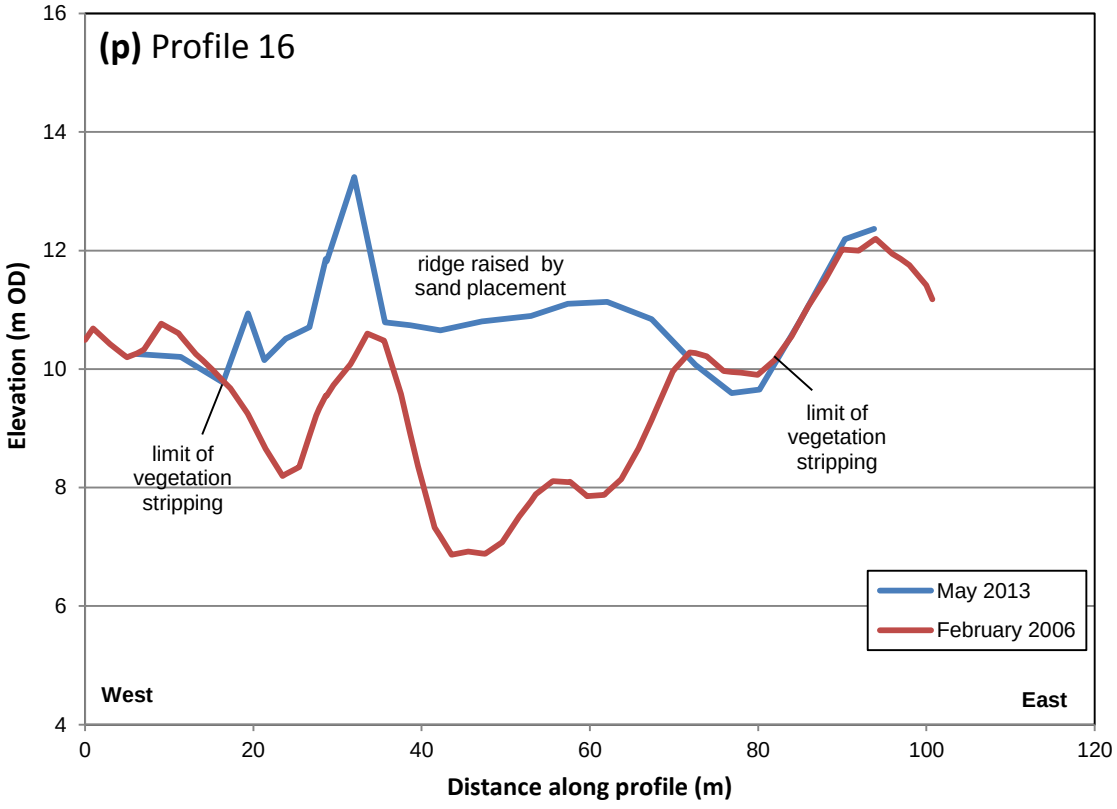

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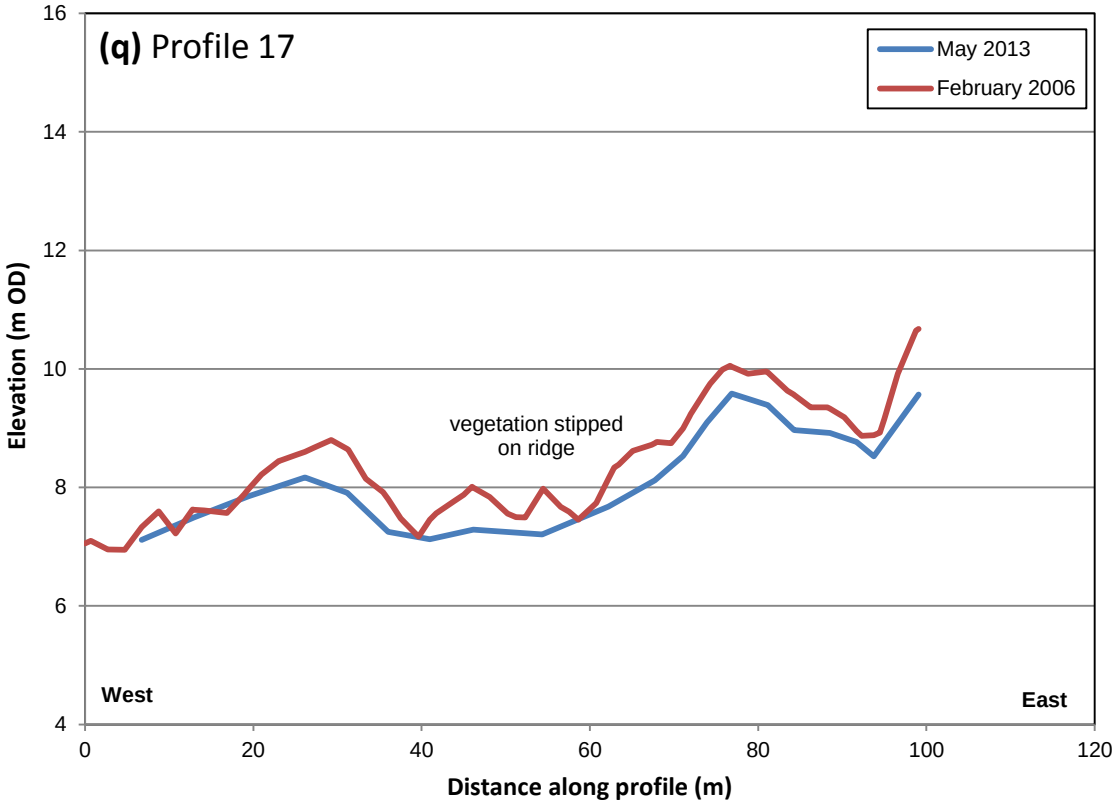

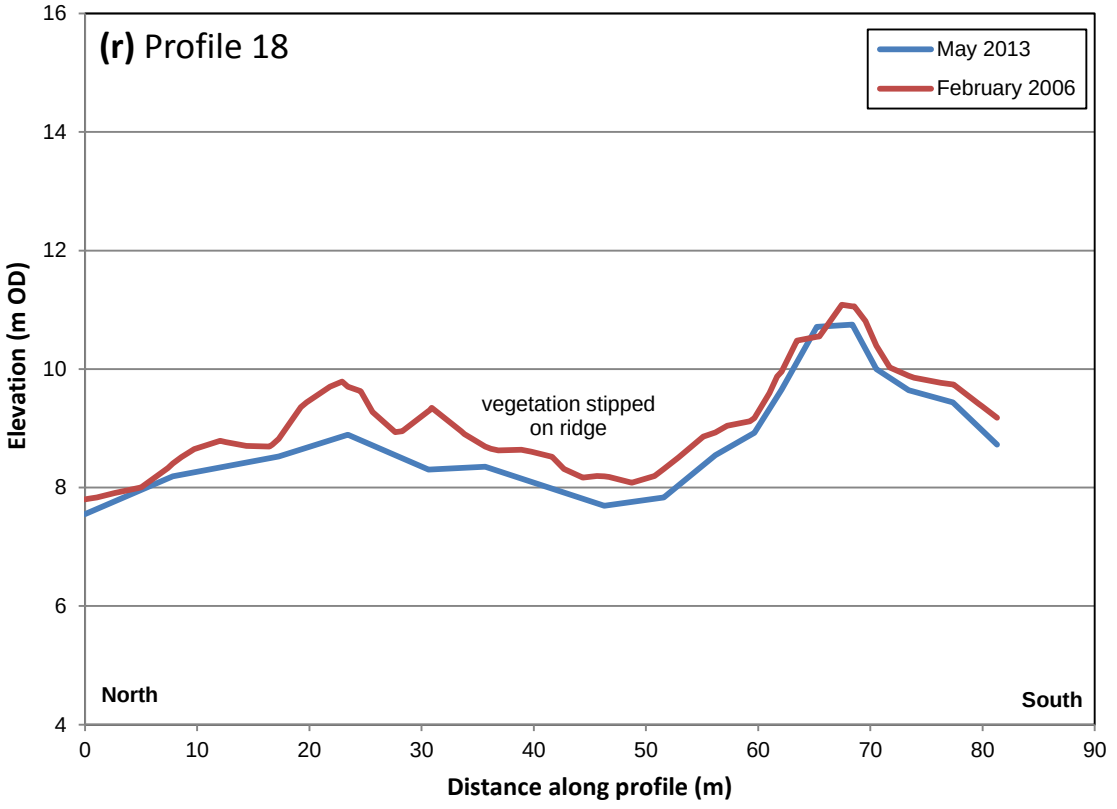

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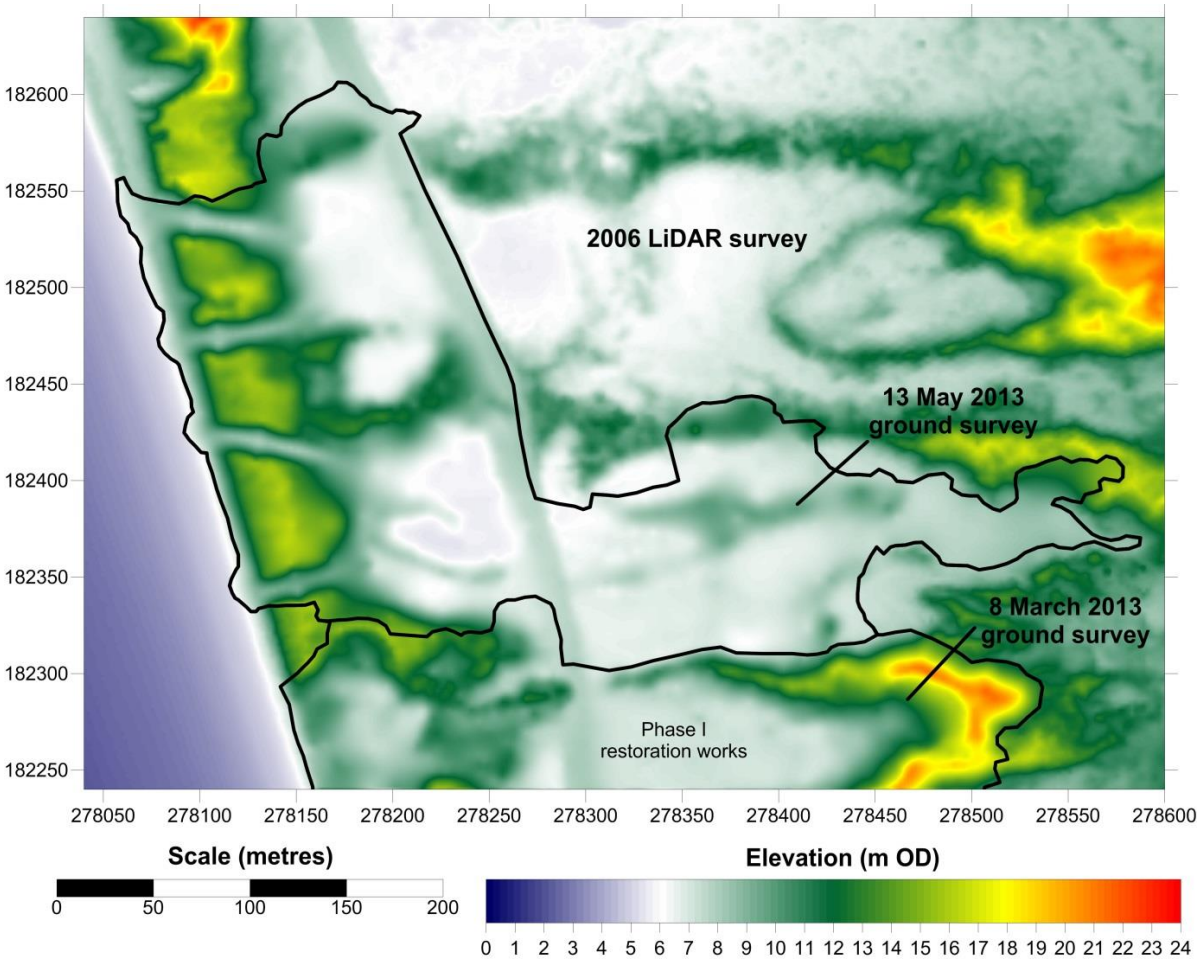

Figure 3. Digital elevation model of the restoration works site surveyed on 13 May 2013, with the black line indicating the limit of the survey. The Phase I restoration area to the south, surveyed on 8 March 2013, is also shown. The areas outside the black lines are taken from the LiDAR survey flown in February 2006.

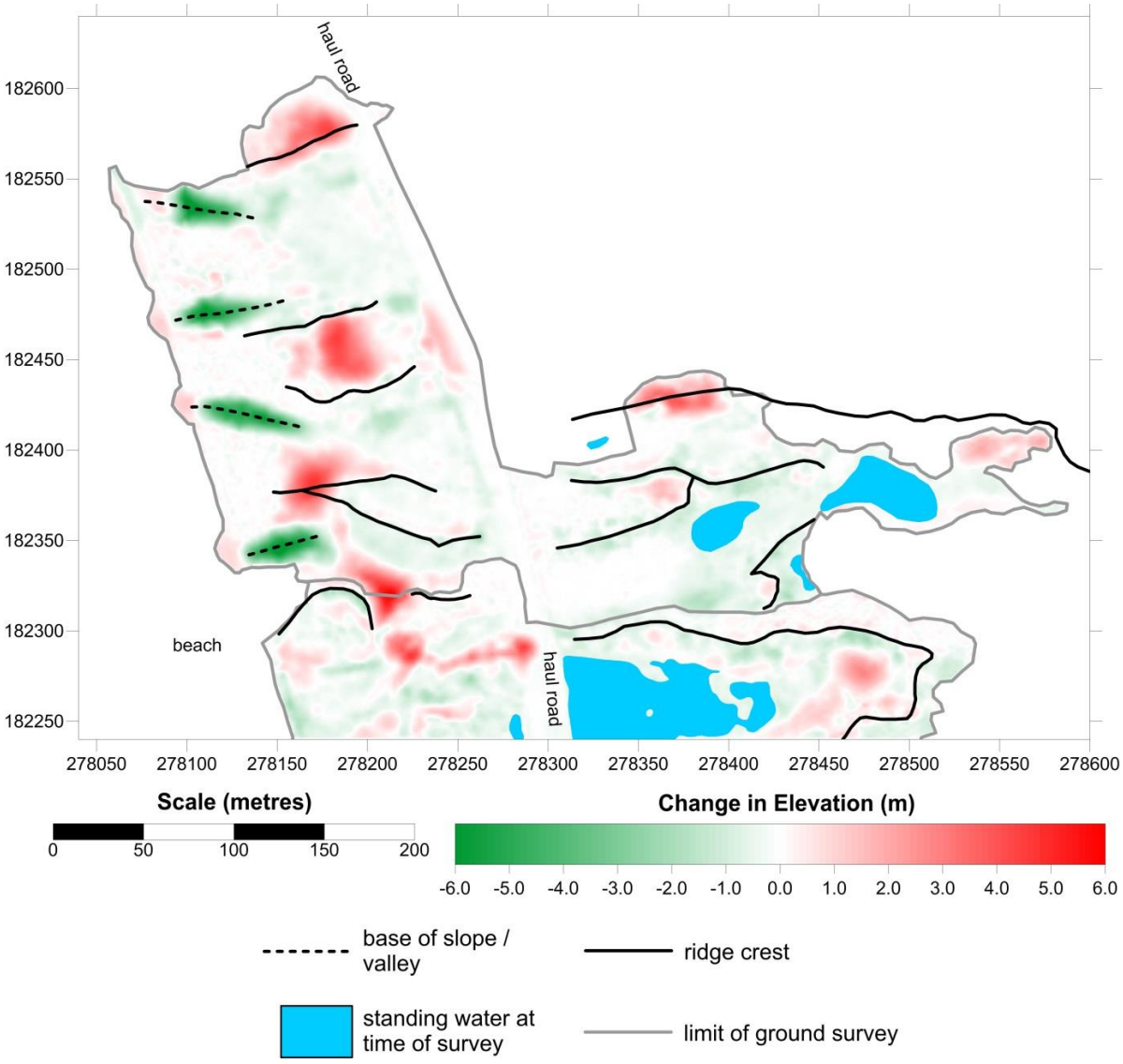

Figure 4. Change in elevation between the LiDAR survey flown in February 2006, and the ground surveys of the restoration works site on 13 May 2013 and 8 March 2013.

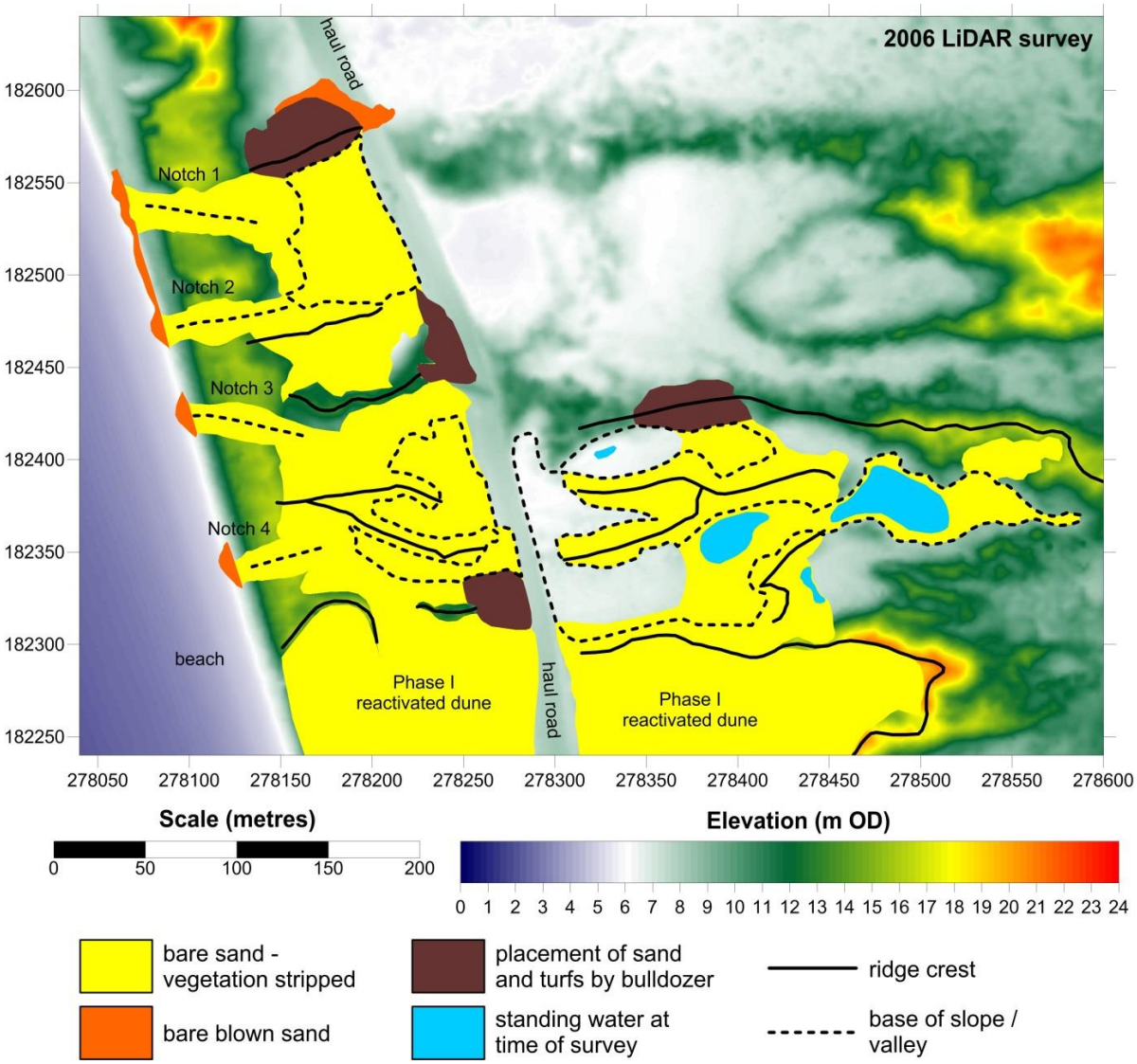

Figure 5. Features mapped in the field, overlaid on LiDAR DEM flown in February 2006, showing areas of bare sand (either through vegetation stripping or wind-blown), areas where significant quantities of sand and/or turf have been placed, and standing water at the time of the survey. Solid and dashed lines indicate the crest and base of the main slopes on the site.

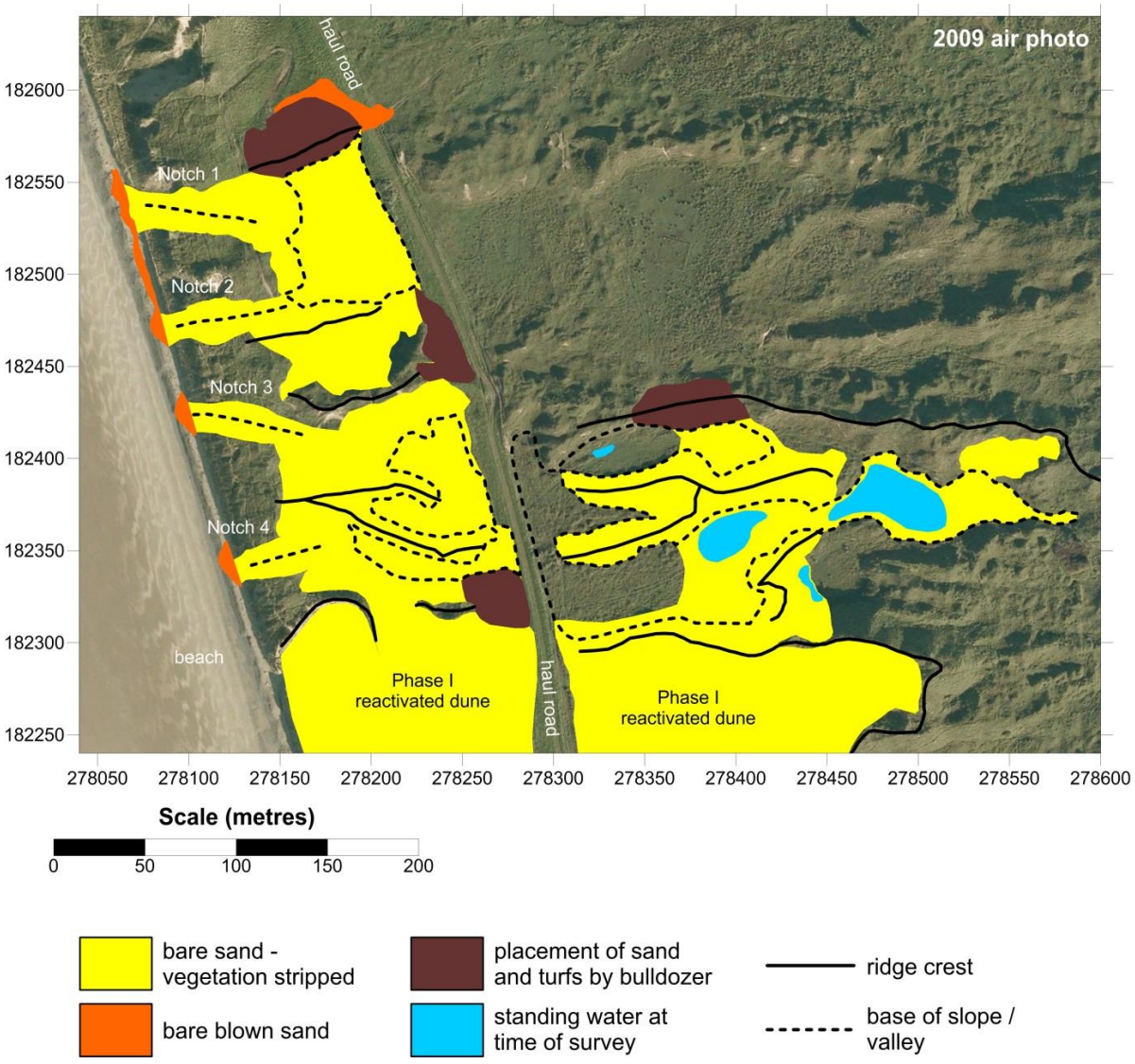

Figure 6. Features mapped in the field, overlaid on air photographs flown in October 2009, showing areas of bare sand (either through vegetation stripping or wind-blown), areas where significant quantities of sand and/or turf have been placed, and standing water at the time of the survey. Solid and dashed lines indicate the crest and base of the main slopes on the site.

Table 3. Particle size characteristics of dune samples collected at the Kenfig Burrows restoration works site on 13 May 2013. Statistics are calculated using GRADISTAT software (Blott & Pye, 2001), mean and sorting using the formulae of Folk & Ward (1957).

ID	Mean (µm & class)		D50 (µm)	Mode (µm)	Mean (phi)	Sorting (phi & description)		Gravel (%)	Sand (%)	Mud (%)
KF1	241	FS	239	196	2.05	0.37	WS	0.0	100.0	0.0
KF2	210	FS	204	196	2.25	0.33	VWS	0.0	100.0	0.0
KF3	221	FS	218	196	2.18	0.28	VWS	0.0	100.0	0.0
KF4	190	FS	187	165	2.39	0.38	WS	0.0	100.0	0.0
KF5	203	FS	206	231	2.30	0.36	WS	0.0	100.0	0.0
KF6	249	FS	251	275	2.01	0.37	WS	0.0	100.0	0.0
KF7	202	FS	204	231	2.30	0.35	WS	0.0	100.0	0.0
KF8	251	MS	243	196	2.00	0.40	WS	0.0	100.0	0.0
KF9	245	FS	241	196	2.03	0.38	WS	0.0	100.0	0.0
KF10	243	FS	255	275	2.04	0.25	VWS	0.0	100.0	0.0
KF11	262	MS	269	275	1.93	0.32	VWS	0.0	100.0	0.0
KF12	268	MS	270	275	1.90	0.41	WS	0.0	100.0	0.0
KF13	245	FS	246	275	2.03	0.36	WS	0.0	100.0	0.0
KF14	264	MS	264	275	1.92	0.41	WS	0.0	100.0	0.0
KF15	260	MS	260	275	1.95	0.37	WS	0.0	100.0	0.0
KF16	197	FS	197	165	2.34	0.36	WS	0.0	100.0	0.0
KF17	266	MS	271	275	1.91	0.34	VWS	0.0	100.0	0.0
KF18	241	FS	236	196	2.05	0.37	WS	0.0	100.0	0.0

Mean Size Classification:

VCS (very coarse sand)
CS (coarse sand)
MS (medium sand)
FS (fine sand)
VFS (very fine sand)

Sorting Descriptions:

VWS (very well sorted)
WS (well sorted)
MWS (moderately well sorted)
MS (moderately sorted)
PS (poorly sorted)
VPS (very poorly sorted)

Blott, S.J. and Pye, K. (2001) GRADISTAT: a grain size distribution and statistics package for the analysis of unconsolidated sediments. *Earth Surface Processes and Landforms*, 26, 1237-1248.

Folk, R.L. and Ward, W.C. (1957) Brazos river bar: a study in the significance of grain size parameters. *Journal of Sedimentary Petrology*, 27, 3-26.

Table 4. Sediment textural classifications, according to Folk (1954) and Blott and Pye (2012), from the samples collected on 13 May 2013.

ID	Folk (1954)	Blott and Pye (2012)
KF1	Sand	Sand
KF2	Sand	Sand
KF3	Sand	Sand
KF4	Sand	Sand
KF5	Sand	Sand
KF6	Sand	Sand
KF7	Sand	Sand
KF8	Sand	Sand
KF9	Sand	Sand
KF10	Sand	Sand
KF11	Sand	Sand
KF12	Sand	Sand
KF13	Sand	Sand
KF14	Sand	Sand
KF15	Sand	Sand
KF16	Sand	Sand
KF17	Sand	Sand
KF18	Sand	Sand

Folk, R.L. (1954) The distinction between grain size and mineral composition in sedimentary-rock nomenclature. *Journal of Geology*, 62, 344-359.

Blott, S.J. & Pye, K. (2012) Particle size scales and classification of sediment types based on particle size distributions: review and recommended procedures. *Sedimentology*, 59, 2071-2096.

Table 5. Particle size distribution of samples collected on 13 May 2013: percentage dry weight retained on sieves spaced at notional 'half phi' intervals.

Size	Sediment retained on sieve (%)								
(µm)	KF1	KF2	KF3	KF4	KF5	KF6	KF7	KF8	KF9
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
850	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
710	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
600	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3
500	0.3	0.0	0.2	0.0	0.2	0.4	0.0	0.7	0.6
425	1.6	0.0	0.2	0.8	0.4	1.1	0.5	4.2	1.6
355	5.2	0.7	0.9	1.7	1.3	4.5	0.7	12.4	4.6
300	10.2	1.7	4.5	1.8	3.1	11.2	3.0	14.5	9.9
250	24.1	11.8	21.4	5.0	6.9	26.1	9.8	30.7	20.0
212	19.4	12.3	38.8	16.4	20.4	19.8	21.7	26.5	18.1
180	24.8	26.1	39.7	15.0	15.8	15.3	16.6	36.7	21.2
150	6.1	7.0	6.4	23.2	16.2	3.2	20.1	6.0	4.4
125	1.5	4.1	4.0	6.4	4.3	2.4	4.6	1.6	1.4
106	0.3	1.0	1.3	3.3	1.2	0.8	1.7	0.2	0.1
90	0.1	0.2	0.3	1.0	0.3	0.2	0.2	0.1	0.0
75	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Size	Sediment retained on sieve (%)								
(µm)	KF10	KF11	KF12	KF13	KF14	KF15	KF16	KF17	KF18
1000	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
850	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
710	0.0	0.0	0.2	0.0	0.2	0.5	0.0	0.0	0.0
600	0.0	0.0	0.5	0.2	0.4	0.7	0.0	0.4	0.2
500	0.0	0.3	1.5	0.4	1.3	1.4	0.1	0.7	0.4
425	0.0	0.4	3.1	1.1	3.2	3.2	0.5	2.4	1.3
355	1.2	4.7	7.4	3.4	7.9	9.8	1.4	10.4	6.2
300	5.2	20.8	13.2	7.4	14.2	20.9	3.2	26.6	8.3
250	69.3	40.3	23.9	19.9	22.0	41.9	5.6	60.6	21.0
212	21.7	14.5	12.9	13.3	16.5	27.1	18.0	19.5	20.5
180	31.6	15.7	13.2	17.0	15.4	27.0	16.2	21.1	24.6
150	5.3	2.8	2.7	3.4	3.3	4.4	20.1	3.6	5.1
125	1.2	0.7	0.7	1.2	0.8	1.2	5.3	1.1	1.0
106	0.2	0.1	0.1	0.2	0.3	0.2	1.3	0.8	0.4
90	0.1	0.0	0.0	0.0	0.1	0.0	0.2	0.3	0.2
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

4. Field Photographs

Taken 13 May 2013

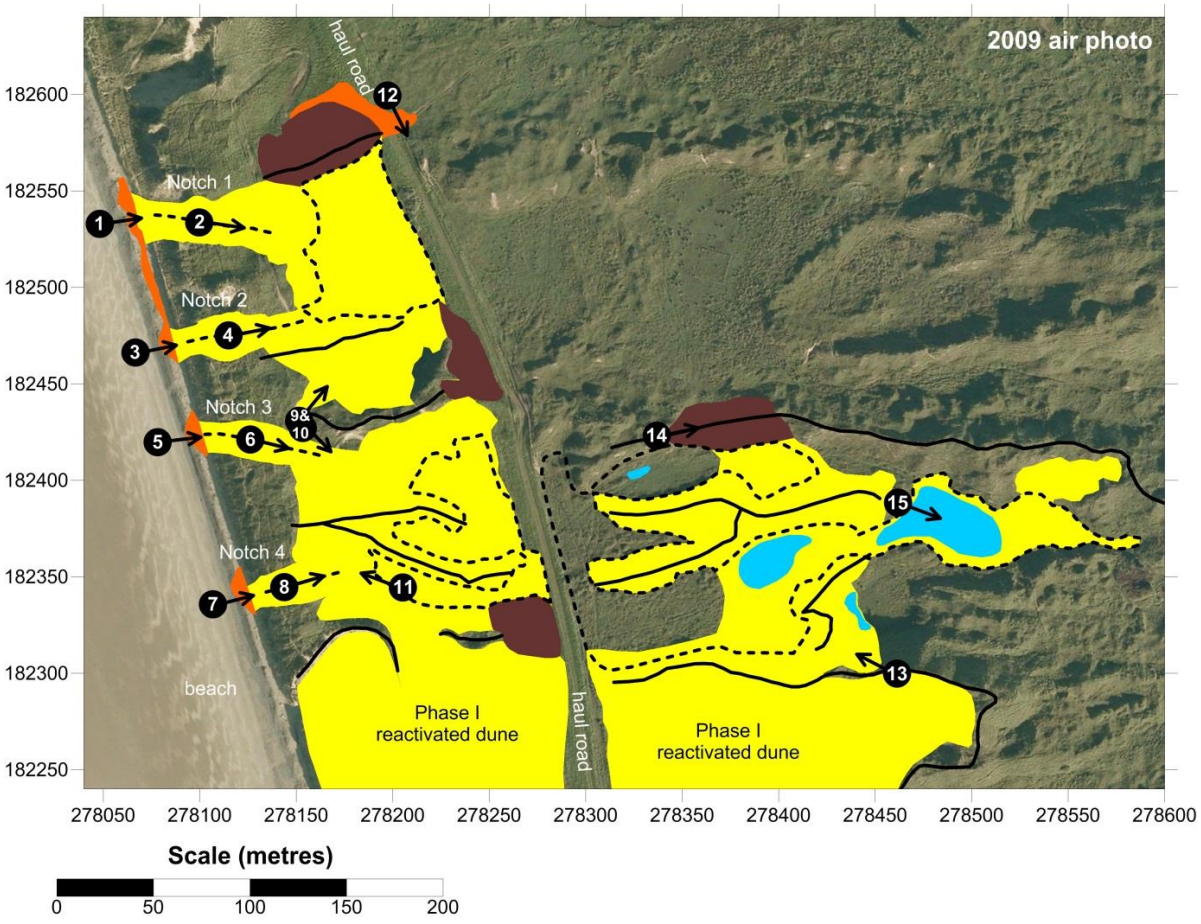

Figure 7. Locations of field photographs. Numbers indicate photograph numbers, while arrows indicate the direction of the photograph

Photo 1. Notch 1, looking inland from the beach

Photo 2. Notch 1, looking inland midway along the notch

Photo 3. Notch 2, looking inland from the beach

Photo 4. Notch 2, looking inland midway along the notch

Photo 5. Notch 3, looking inland from the beach

Photo 6. Notch 3, looking inland midway along the notch

Photo 7. Notch 4, looking inland from the beach

Photo 8. Notch 4, looking inland midway along the notch

Photo 9. Area of vegetation stripping inland of notches 1 and 2

Photo 10. Area of vegetation stripping inland of notches 3 and 4

Photo 11. Lobe of blown sand migrating inland behind notch 4

Photo 12. Blown sand crossing the haul road at the northern end of the site

Photo 13. Area of vegetation stripping inland of the haul road

Photo 14. Enlarged ridge created by placing stripped sand and turf, northern edge of the area inland of the haul road

Photo 15. Wet slack area at the eastern end of the site

Data Archive Appendix

Data outputs associated with this project are archived at 'Topographical Survey of Kenfig Dune Rejuvenation Work project 420, media 1438' on server–based storage at Natural Resources Wales.

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

[B] An Excel file named (Kenfig Dune Survey Data 13-05-2013.xls) of data points (x,y,z)

[C] A series of GIS layers on which the maps in the report are based.

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue http://libcat.naturalresources.wales/webview/ (English Version) and http://libcat.naturalresources.wales/cnc/ (Welsh Version) by searching 'Dataset Titles'. The metadata is held as record no [115776]

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