

An archaeological gradiometer survey

# A new electricity cable for Denbrook Wind Farm, North Tawton, Devon

Centred on NGR (E/N): 265936,100334 (point) to 266614,100417 (point)

Report: 1601NOR-R-1

Ross Dean BSc MSc MA MCIfA 22 April 2016

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## Project archive

Report	Adobe PDF format
Copies of report figures	Adobe PDF format
Raw and processed grid & composite files I	DW Consulting TerraSurveyor 3 formats
Minimal processing data plots and metadata I	DW Consulting TerraSurveyor 3 formats
Final data processing data plots and metadata I	DW Consulting TerraSurveyor 3 formats
GIS project, shape files and classification schema	
GIS project	Manifold 8 '.map' file
GIS shape files	ESRI standard
GIS classification schema	Adobe PDF format
AutoCAD version of the survey interpretation	AutoCAD DXF

## Website: substrata.co.uk

For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

- 1 Survey description and summary
- 1.1 Survey
  Type: twin-sensor fluxgate gradiometer
  Date: 22 and 23 March 2016
  Area: Plot 4: 0.48ha
  Plot 5: 0.36ha
  Plot 6 revised route: 0.48ha
  Plot 6 original route: 1.26ha
  Lead surveyor: Mark Edwards BA
  Author: Ross Dean BSc MSc MA MIFA

#### 1.2 Client

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch, Nr Exeter, Devon EX5 4QL

1.3	Location				
	Site:	Denbrook Wind Farm			
	Civil Parish:	North Tawton			
	District:	West Devon			
	County:	Devon			
	Nearest Postcode:	EX20 2DA to EX20 2BJ			
	NGR:	SS 653 101 (point) to SS 689 100 (point)			
	Ordnance Survey NGR (E/N):	265260,101240 (point) to 268920,100020 (point)			
	• ` ` ` ` `				

## 1.4 Archive

Alchive	
OASIS number:	substrat1-249368
Archive:	The full archive of this survey will be held by Substrata. A copy of
	the digital archive will be submitted to AC Archaeology Ltd for
	deposition with the ADS as specified in Valentin (2016).

#### 1.5 Introduction

This report was prepared for AC archaeology on behalf of Western Power Distribution. It presents the results of an archaeological magnetometer survey across a subsection of the route for a new buried cable between Week and Denbrook Wind Farm, North Tawton. The subsection is shown in Figure 1 and is hereafter referred to as the survey area.

The cable route was altered during the period of the survey. Two sets of data were collected for the 'previous route' and 'revised route' as shown in Figure 1. Both data sets are presented in this report at the request of AC archaeology on behalf of Western Power Distribution. The 'revised route' is the current planned cable route.

This survey has been prepared and completed in response to a Written Scheme of Investigation by AC Archaeology Ltd (Valentin 2016) and complies with Scheduled Monument and Section 42 consents issued by Historic England.

#### 1.6 Summary

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Forty-four magnetic anomaly groups were mapped as representing possible archaeological features. Of these, one is likely to represent an extension of an extant field boundary. Six anomaly groups coincide with cropmarks mapped within Scheduled Monument 1021151 (legacy identifier 10384) and are likely to represent archaeological deposits and structures. One group may represent a cluster of archaeological features such as pits and/or large postholes. The remaining anomaly groups are relatively densely distributed and typical of anomalies representing former field, enclosure and other boundaries of unknown origin and likely of more than one phase.

#### 2 Survey aims and objectives

#### 2.1 Aims

To establish the presence or absence, extent and character of any archaeological features and deposits within the survey area. The results of the survey and any subsequent trial trenching will be reviewed and used to inform any ensuing mitigation.

- 2.2 Survey objectives
  - 1. Complete a magnetometer survey across agreed parts of the survey area.
  - 2. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
  - 3. Within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies.
  - 4. Accurately record the location of the identified anomalies.
  - 5. Produce a report based on the survey that is sufficiently detailed to inform any subsequent development on the survey area about the location and possible archaeological character of the recorded anomalies.

#### 3 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2010). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service/Digital Antiquity Guides (undated).

#### 4 Site description

4.1 Landscape and land use

The survey area was divided into Plot 4, Plot 5 and Plot 6 shown in Figure 2. These designations are those used in an historic environment assessment produced by AC Archaeology Ltd as part of the same programme of work as this report (Chandler, Corney and Sims, 2010).

- Plot 4: A large field of grass pasture which slopes gently down to the south. Newland Mill is located to the west.
- Plot 5: A field of grass pasture with a level ridge along the course of the route that slopes moderately down to the south. It is bounded by a prominent hedgebank to the east.
- Plot 6: A field of grass pasture with a level ridge that slopes gently down to the south. The plot is bounded by a hedgebank and road to the east.

#### 4.2 Geology

The survey area has a solid geology of Permian Bow Breccia Formation. These rocks are reddish-brown, silty and sandy, with pebbles of sandstone, slate, shale, hornfels, acid lava, vein-quartz, quartz porphyry, lamprophyre and basalt. The superficial geology is not recorded across most of the survey area but is mapped as Quaternary Taw River Terrace Deposits on the western boundary of Plot 4 (British Geological Survey, undated).

- 5 Archaeological background
- 5.1 Historic landscape characterisation

Plot 4: Modern enclosures adapting medieval fields

These modern fields have been created out of probable medieval enclosures themselves based on strip fields. The sinuous medieval boundaries survive in places (Devon County Council, undated).

#### Plot 5: Barton fields

These relatively large, regular enclosures seem likely to have been laid out between the fifteenth and eighteenth centuries. Some curving boundaries may be following earlier divisions in the pre-existing medieval fields (ibid).

#### 5.2 Historical and archaeological background

A historic environment assessment for the cable route was produced by AC Archaeology Ltd as part of the same programme of work as this report (Chandler, Corney and Sims, 2010). The reader is directed to the AC Archaeology document for a comprehensive assessment of the historical and archaeological background for the programme of work as a whole and for the complex archaeology recorded across the survey area. A summary of this background is presented by Valentin (2016). The proposed cable route has been amended within the survey area since the assessment was produced. The current proposed route is shown in Figure 1.

As shown in Figure 10, Plot 4, Plot 5 and the western edge of Plot 6 are within Scheduled Monument 1021151 *Roman forts, marching camps and associated monuments* (legacy unique identity 10384). Historic assets close to the proposed cable route and thought relevant to this magnetometer survey are described in the Devon Historic Environment Records 55836, 29192 and 67181 (Chandler, Corney and Sims, 2010 and Historic England, undated) and are summarised in Figure 10.

#### 6 Results, discussion and conclusions

This survey was designed to record magnetic anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits, structures and features.

The terms archaeological deposits, structures and features refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity and not undertaken as recent land maintenance or farming.

The reader is referred to section 7.

6.1 Results

Figure 2 shows the interpretation of the data across the survey area. It includes the anomaly groups identified as relating to archaeological deposits along with their identifying numbers. Figures 3 to 5 are larger scale plots of the interpretation for Plots 4 to 6 respectively.

Table 1 is an extract of the detailed analysis of the survey data sourced from the attribute tables of the GIS project provided in the project archive:

Figures 6 to 9 are plots of processed data as specified in Table 3.

Figures 10 and 11 respectively show the interpretation and data plots along with an amended plot of mapped cropmarks (Chandler, Corney and Sims, 2010).

Figures 2 to 11 and Table 1 comprise the analysis of the survey data.

#### 6.2 Discussion

6.2.1 General points

#### Discussion scope

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held the survey archive.

#### Data collection

Data collection along the survey area edges was restricted as shown in Figures 2 to 11 due to the presence of magnetic materials within and adjacent to the field boundaries. Strong magnetic responses mapped close to the field boundaries are likely to relate to these materials except where otherwise indicated in Figures 2 to 5.

#### Anomaly characterisation and mapping

There are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

Recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic responses across the dataset that needed clarification. If mapped, they are listed in Table 1 but are not discussed below.

Anomalies thought to relate to natural features were not mapped.

Numerous dipole magnetic anomalies are scattered across the data set. These are likely to represent recent buried ferrous objects and such patterns are frequently found in close proximity to settlements.

6.2.2 Data relating to historic maps and other records

Magnetic anomaly groups **1 to 6** in Plot 4 (Figures 2, 3 and 7) coincide with cropmarks recorded within Scheduled Monument 1021151 (legacy unique identifier 10384) as listed in Table 1. Groups 1 and 3 are likely to relate to a prehistoric or Roman rectangular enclosure whilst group 2 and groups 4 and 5 probably reflect two former tracks or roads (Figures 10 and 11).

#### 6.2.3 Data with no previous archaeological provenance

Anomaly group 7 has characteristics typical of footings of a former Devon bank. A typical Devon bank is a field boundary comprising a stone-revetted earthen bank with a hedge on top and flanking ditches. Group 7 is most likely to represent a former north-westwards extension of an extant field boundary.

Group 9 are a spatially close group of anomalies representing a cluster of deposits. Their distribution demands that they be considered as potentially archaeologically significant; possibly pits and/or large postholes.

The remaining anomaly groups are relatively densely distributed indicating a good survival of potential archaeological deposits but are otherwise typical of anomalies representing former field, enclosure and other boundaries of unknown origin and likely of more than one phase of land enclosure.

#### 6.3 Conclusions

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Forty-four magnetic anomaly groups were mapped as representing possible archaeological features. Of these, one is likely to represent an extension of an extant field boundary. Six anomaly groups coincide with cropmarks mapped within Scheduled Monument 1021151 (legacy identifier 10384) and are likely to represent archaeological deposits and structures. One group may represent a cluster of archaeological features such as pits and/or large postholes. The remaining anomaly groups are relatively densely distributed and typical of anomalies representing former field, enclosure and other boundaries of unknown origin and likely of more than one phase.

#### 7 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

Ross Dean, trading as Substrata, will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79). This report contains material that is non-Substrata copyright or the intellectual property of third parties. Such material is labelled with the appropriate copyright and is non-transferrable by Substrata.

#### 8 Acknowledgements

Substrata would like to thank John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

#### 9 Bibliography

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### Appendix 1 Supporting plots

#### General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.



266000 m

British Grid centre X: 266323.71 m, centre Y: 100318.21 m Geophysical survey: Copyright Substrata 2016. Base map: Ordnance Survey (c) Crown Copyright 2016, Licence number 100022432. All rights reserved.

Scale: 1:5000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 1: location map



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#### Site: An archaeological gradiometer survey

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plot	anomaly	anomaly characterisation	anomaly form	additional archaeological	comments
number	group	certainty & class		characterisation	
4	1	likely, positive	return	rectilinear enclosure	anomaly group coincides with a prehistoric or Roman rectilinear enclosure recorded as cropmarks within Scheduled Monument 1021151
	2	likely, positive	linear	track or road	anomaly group coincides with recorded cropmarks within Scheduled Monument 1021151
	3	likely, positive	linear	rectilinear enclosure	anomaly group coincides with a prehistoric or Roman rectilinear enclosure recorded as cropmarks within Scheduled Monument 1021151
	4	likely, positive	disrupted linear	track or road	anomaly group coincides with recorded cropmarks within Scheduled Monument 1021151
	5	likely, positive	disrupted linear	track or road	anomaly group coincides with recorded cropmarks within Scheduled Monument 1021151
	6	likely, positive	disrupted linear		anomaly group coincides with recorded cropmarks within Scheduled Monument 1021151
	7	possible, positive/negative/positive	disrupted linear	field wall - possible Devon bank	anomaly group appears to represent a north-western extension of an extant field wall but removed before the Ordnance Survey first edition map of 1888
	101	possible, high contrast linear		ferrous cable, pipe or drain	
5	8	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	9	possible, positive	spread of ovals	a group of pits and, possibly, large postholes	anomaly group lies within Scheduled Monument 1021151
	10	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	11	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	12	possible, positive	disrupted linear		anomaly group lies within Scheduled Monument 1021151
	13	possible, positive	curvilinear		anomaly group lies within Scheduled Monument 1021151
	14	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	15	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	16	possible, positive	disrupted linear		anomaly group lies within Scheduled Monument 1021151
	17	possible, positive	curvilinear		anomaly group lies within Scheduled Monument 1021151
	18	possible, positive	disrupted linear		anomaly group lies within Scheduled Monument 1021151
	19	possible, positive	disrupted linear		anomaly group lies within Scheduled Monument 1021151
	20	possible, positive	disrupted linear		anomaly group lies within Scheduled Monument 1021151
	21	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	22	possible, positive	curvilinear		anomaly group lies within Scheduled Monument 1021151
	23	possible, positive	disrupted curvilinear		anomaly group lies within Scheduled Monument 1021151
	24	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	25	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	26	possible, positive	curvilinear		anomaly group lies within Scheduled Monument 1021151
	27	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
	28	possible, positive	curvilinear		anomaly group lies within Scheduled Monument 1021151
	29	possible, positive	linear		anomaly group lies within Scheduled Monument 1021151
6	30	possible, positive	disrupted linear		
	31	possible, positive	oval	pit	
	32	possible, positive	disrupted curvilinear		
	33	possible, positive	linear		
	34	possible, positive	disrupted linear		
	35	possible, positive	disrupted linear		anomaly group lies within Scheduled Monument 1021151
	36	possible, positive	linear		
	37	possible, positive	linear		
	38	possible, positive	linear		
	39	possible, positive			
	40	possible, positive	disrupted linear		
	41	possible, positive	linear		
	42	possible, positive	linear		
	43	possible, positive	disrupted linear		
	44	possible, positive	linear		
	102	possible, regular narrow linears		field drains	
	103	possible, high contrast linear		ferrous cable, pipe or drain	
	104	possible, high contrast linear		ferrous cable, pipe or drain	

#### supporting evidence

Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0 Devon HER MDV55836, Scheduled Monument 1021151, AC Archaeology Ltd unpublished document ACD13/1/0



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Figure 3: survey interpretation, plot 4

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British Grid centre X: 266296.15 m, centre Y: 100369.27 m

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:

- 1. All interpretations are provisional and represent potential archaeological deposits.
- 2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological chartarisation.
- 3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps, mapped cropmarks and/or visible earthworks.
- 4. Representative; not all instances are mapped.
- 5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 4: survey interpretation, plot 5

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Figure 5: survey interpretation, plot 6

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Figure 6: shade plot of processed data

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Figure 7: shade plot of processed data, plot 4

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Figure 8: shade plot of processed data, plot 5

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A37: HER 55836, a prehistoric or Roman rectilinear enclosure recorded as a cropmark.

A38: HER 29192, a prehistoric double ring ditch of c.38m diameter, apparently cut by Roman fort, recorded as a cropmark.

A41: HER 67181, a Roman track with a pronounced camber excavated with sherds of Roman pottery and a fragment of worked basalt.

A52: a rabbit warren named Coney Park of unknown period with documentary evidence.

A70: a curving feature, possibly part of ring ditch or associated with features north of A3072, of unknown period recorded as a cropmark.

A71: a double linear feature of unknown period recorded as a cropmark.

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> Figure 10: survey interpretation with an amended RCHME plot of cropmarks after Chandler, Corney and Sims (2010)

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A37: HER 55836, a prehistoric or Roman rectilinear enclosure recorded as a cropmark.

A38: HER 29192, a prehistoric double ring ditch of c.38m diameter, apparently cut by Roman fort, recorded as a cropmark.

A41: HER 67181, a Roman track with a pronounced camber excavated with sherds of Roman pottery and a fragment of worked basalt.

A52: a rabbit warren named Coney Park of unknown period with documentary evidence.

A70: a curving feature, possibly part of ring ditch or associated with features north of A3072, of unknown period recorded as a cropmark.

A71: a double linear feature of unknown period recorded as a cropmark.

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> Figure 11: shade plot of the processed data with an amended RCHME plot of cropmarks after Chandler, Corney and Sims (2010)

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### Appendix 2 Methodology Summary

Table 2: method	lology summary
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#### Documents

Project design for archaeological mitigation: Valentin (2016) Survey methodology statement: Dean (2016)

#### Methodology

- 1. The work was undertaken in accordance with the survey methodology statement. The geophysical (magnetometer) survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service/ Digital Antiquity Guides (undated).
- 2. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system.
- 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology.

#### Grid

*Method of Fixing:* DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. *Composition:* 30m by 30m grids

Recording: Geo-referenced and recorded using digital map tiles.

DGPS used: Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.

#### Equipment Data Capture Instrument: Bartington Instruments grad601-2 Sample Interval: 0.25m Firmware: version 6.1 Traverse Interval: 1 metre Traverse Method: zigzag *Traverse Orientation:* along the line of the cable route, west to east Data Processing, Analysis and Presentation Software IntelliCAD Technology Consortium IntelliCAD 8.0 DW Consulting TerraSurveyor3 Manifold System 8 GIS Microsoft Corp. Office Excel 2013 Microsoft Corp. Office Publisher 2013 Adobe Systems Inc Adobe Acrobat 9 Pro Extended

Table 3: magnetometer survey - processed data metadata			
SITE Instrument Type: Units: Direction of 1st Traverse: Collection Method: Sensors: Dummy Value: PROGRAM Name: Terra Version: 3.0.22	Bartington Grad-601 gradiometer nT along line of cable, west to east ZigZag 2 @ 1.00 m spacing. 32702 Surveyor 8 1		
PLOT 4 Stats Max: 28.76 Min: -31.04 Std Dev: 2.73 Mean: 0.11 Median: 0.00 Composite Area: 0.48 ha	Processes: 5 1 Base Layer 2 Clip at 1.00 SD 3 De Stagger: Grids: All Mode: Both By: -2 intervals 4 DeStripe Median Sensors: All 5 Interpolate: Match X & Y Doubled.		
PLOT 5         Stats         Max:       2.78         Min:       -2.83         Std Dev:       0.52         Mean:       0.04         Median:       0.01         Composite Area:       0.36 ha	<ul> <li>Processes: 5</li> <li>1 Base Layer</li> <li>2 Clip at 1.00 SD</li> <li>3 De Stagger: Grids: All Mode: Both By: -2 intervals</li> <li>4 DeStripe Median Sensors: All</li> <li>5 Interpolate: Match X &amp; Y Doubled.</li> </ul>		
PLOT 6 revised route Stats Max: 15.79 Min: -9.25 Std Dev: 1.37 Mean: 0.01 Median: -0.02 Composite Area: 0.48 ha	<ul> <li>Processes: 7</li> <li>1 Base Layer</li> <li>2 Clip at 1.00 SD</li> <li>3 De Stagger: Grids: All Mode: Both By: -1 intervals</li> <li>4 DeStripe Median Sensors: All</li> <li>5 Edge Match (Area: Top 0, Left 0, Bottom 19, Right 79) to Right edge</li> <li>6 De Stagger: Grids: a26.xgd Mode: Both By: 1 intervals</li> <li>7 Interpolate: Match X &amp; Y Doubled.</li> </ul>		
PLOT 6 original route Stats Max: 18.23 Min: -18.85 Std Dev: 5.89 Mean: -1.09 Median: -0.06 Composite Area:1.26 ha	<ul> <li>Processes: 6</li> <li>1 Base Layer</li> <li>2 Clip at 1.00 SD</li> <li>3 De Stagger: Grids: a_a8.xgd Mode: Both By: 2 intervals</li> <li>4 DeStripe Median Sensors: a_a8.xgd a_a9.xgd a_a10.xgd a_a11.xgd a_a12.xgd a_a13.xgd a_a14.xgd</li> <li>5 DeStripe Median Sensors: a_a4.xgd a_a3.xgd a_a2.xgd a_a1.xgd</li> <li>6 DeStripe Median Sensors: a_a7.xgd</li> </ul>		