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Tamar/Lidar; A Single Source Approach to Landscape Survey and Socially Distanced Community Archaeology

Richard Sims & Stephanie Knight

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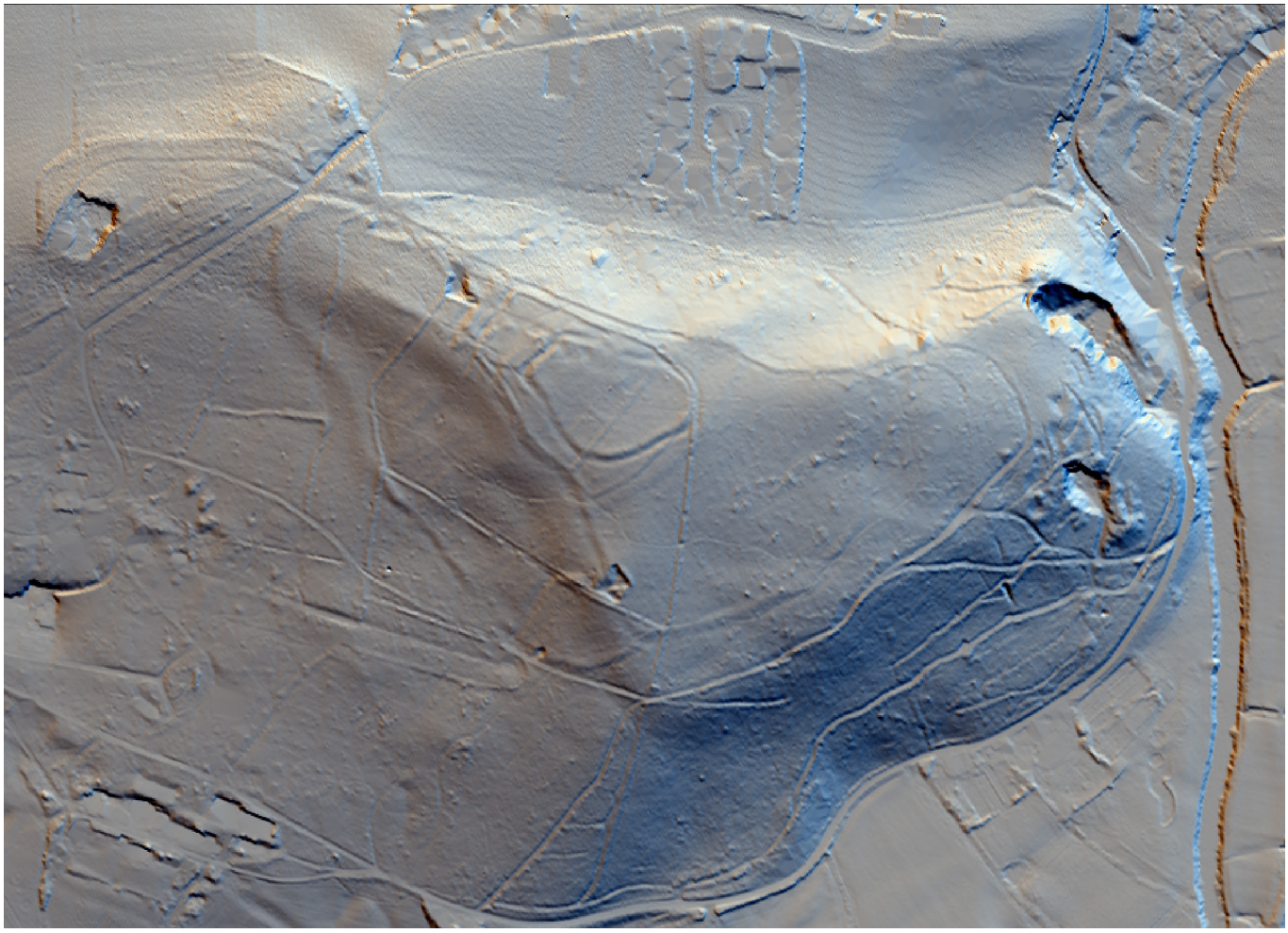

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TAMAR/LIDAR; A SINGLE SOURCE APPROACH TO LANDSCAPE SURVEY AND SOCIALLY DISTANCED COMMUNITY ARCHAEOLOGY

Richard Sims & Stephanie Knight

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SUMMARY

This document is the final report for the Aerial Investigation and Mapping (AI&M, previously National Mapping Programme or NMP) project of the Tamar/Lidar survey; a single source approach to landscape survey and socially distanced community archaeology.

It takes the form of an illustrated report that provides a review of the methodological outcomes as well as some of the archaeological highlights to emerge from the survey. Key outcomes and highlights include:

- Enhanced knowledge of Bronze Age mortuary monuments, their grouping and distribution.
- Identification of extensive medieval field systems and several deserted or shrunken settlements, perhaps a result of the later industrialisation of the landscape.
- Recording of medieval and later streamworks, mines and associated features that characterise the southern part of the survey area, including the Lumburn Leat, a 15th century feat of engineering.
- Addition of 791 new records to the Devon Historic Environment Record, particularly subtle earthworks and those that had been obscured by vegetation cover on the aerial photographs examined for the earlier National Mapping Programme project.
- Building capacity in the community through systematically assessing and enhancing community-derived data, and providing feedback which included under-represented but locally distinctive monument types such as orchard banks and catchmeadows, as well as industrial features.
- Analysis suggests that certain monument types such as barrows were over-represented in the community derived data. Recommendations for similar projects in the future include a greater element of interaction and ongoing quality assurance and use of standardised recording terminologies.

CONTRIBUTORS

The survey, research and report were undertaken by Cain Hegarty, Richard Sims, Stephanie Knight and Emily Houghton of AC archaeology, on behalf of Devon County Council Historic Environment Team.

ACKNOWLEDGEMENTS

This survey was funded by Historic England and the Culture Recovery Fund for Heritage. Historic England is the public body that looks after England's historic environment. This includes the statutory protection of historic buildings and archaeological sites, development and promotion of national frameworks, policies and best practice in heritage protection. The Culture Recovery Fund for Heritage is part of a rescue package announced by the Department for Digital, Culture,

Media and Sport (DCMS) to safeguard cultural and heritage organisations across the UK from the economic impact of COVID-19.

Helen Winton, Historic England Aerial Investigation and Mapping (AI&M) Manager and acting AI&M Manager Matthew Oakey served as Project Assurance Officers.

Devon County Council Historic Environment Record support and quality assurance was provided by Stephanie Knight.

The survey was carried out in partnership with the University of Exeter's National Lottery Heritage Fund Understanding Landscapes project. The AI&M team are grateful for the advice and help of Understanding Landscapes Project Manager Christopher Smart and to project member João Fonte.

The survey was overseen by Bill Horner, County Archaeologist for Devon County Council, who also provided advice on interpretation and invaluable local detail. AC archaeology are grateful to Devon County Council Historic Environment Team for continuing to host the survey team within the Historic Environment Record.

The survey was primarily carried out using freely available Tellus and Environment Agency (EA) lidar data. Other sources, including historic maps, 1940s RAF and GetMapping and Bluesky digital aerial photograph mosaics were made available by Devon Council Historic Environment Team. Most archaeological sites in Devon are on private land. Depiction of a site on an aerial photograph or lidar visualisation, or its inclusion in the Historic Environment Record, does not imply any right of public access.

DATE OF SURVEY

November 2020 to June 2021

CONTACT DETAILS

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CONTENTS

FIGURES

1. INTRODUCTION

Overview

This report presents the results of an Aerial Investigation and Mapping (AI&M, formerly National Mapping Programme) survey of two areas (Areas 1 and 2) along the Tamar Valley within the county of Devon, from the northern outskirts of Plymouth to the North Devon coast. Area 1 of the survey comprises 135sq km focused upon the Tamar Valley AONB and Area 2 comprises 134sq km between the Tamar Valley AONB and the south-western boundary of the North Devon Coast AONB (Figures 1 and 2).

The survey was carried out between November 2020 and June 2021 and was undertaken by AC archaeology in partnership with the University of Exeter's National Lottery Heritage Fund Understanding Landscapes project and hosted by Devon County Council Historic Environment Team (DCC HET). Area 1 of the survey was funded by Historic England and Area 2 by the Culture Recovery Fund for Heritage and both were administered by Historic England. For the purpose of this report, the use of 'survey area' refers to both Areas 1 and 2 of the Tamar/Lidar project. ULP is also used when referring to the Understanding Landscapes project.

The survey area contains a rich diversity of heritage, spanning the prehistoric period through to the 19th century. The significance of the industrial heritage is demonstrated by its inclusion within the Cornwall and West Devon Mining Landscape World Heritage Site which occupies 16.5 per cent of the Tamar Valley AONB, along the western fringe of Area 1. The Tamar Valley AONB remains a priority area for the Countryside Scheme which aims to look after and improve the environment by, amongst other things, maintaining the character of the countryside and preserving historical features in the landscape.

The historic environment of the survey area is vulnerable to diverse pressures facing the rural landscape. These include a range of climate crisis and Ash die back initiatives, potential undergrounding of electricity cables within the AONB, changing farming practices, recreational activities such as multi-use trails, and residential and commercial development in the greater Plymouth area.

The area had previously been investigated as part of the Tamar Valley National Mapping Programme (NMP) project from 2001 to 2002 (Taylor 2002; Young 2007). Within Area 1, the monuments identified in the NMP survey had already been accessioned into the Devon County Council Historic Environment Record (DCC HER) by the AC archaeology AI&M survey team. In Area 2, only those monuments within the North Devon Coast AONB had been accessioned.

The ongoing restrictions necessitated by the coronavirus pandemic have resulted in the delay, or cancellation, of many planned archaeological projects, including those of traditional AI&M surveys based largely on hard-copy aerial photographs. Freely available digital aerial photographic and remote sensing resources, such as Google Earth and Tellus and Environment Agency lidar data, are increasingly used sources in both systematic and *ad hoc* interpretation of the historic

landscape. This survey, therefore, provided the opportunity to assess the use of mainly digital sources and the impact of this for landscape survey.

Background to the survey

Understanding Landscapes is a University of Exeter National Lottery Heritage Fund community archaeology project, in which Devon County Council (DCC) is a project partner.

The 2020 field season, desk-based heritage activity days and community workshops had to be cancelled due to the COVID-19 pandemic. To maintain research momentum and volunteer interest, the Understanding Landscapes project redefined its methodology to focus on a desk-based programme compatible with social-distancing. This utilised freely available digital resources, specifically Environment Agency and Tellus South West (Ferraccioli *et al* 2014) lidar data.

This method has proved successful in the identification of many previously unrecorded monuments of prehistoric, Roman and medieval date and has received considerable media attention.

The Understanding Landscapes project area covers a total of nearly 4,000sq km, from Fowey in south-east Cornwall to Barnstaple in North Devon. Excluding Plymouth Unitary Authority, Dartmoor National Park and those areas previously surveyed as part of NMP/AI&M surveys including a lidar component, 1,495sq km in the DCC HER admin area has not seen any lidar data assessment (Figure 1).

The Tamar/Lidar survey was proposed to provide an opportunity for the AC archaeology AI&M team to apply their expertise in archaeological lidar interpretation to partnership working with the Understanding Landscapes project.

Its underlying aim was to support and enhance the community-generated data, ensuring it was appropriately interpreted, consistently recorded on the Devon HER and, by providing feedback to the volunteers via links to the DCC HER and Environment Viewer, build community capacity for future community-led work.

The survey has several important methodological outcomes. By reviewing the results of the Understanding Landscapes project, the survey has been able to go some way to assessing trends or biases in monument identification in a publicly or community-generated dataset, characterising what such work recognises and perceives to be of value.

Perhaps more significantly, by systematically assessing the available lidar data in areas that have previously had NMP/AI&M survey without a lidar component, the survey could also assess the impact of lidar data on archaeological landscape survey in an environment where it can be easily distinguished from NMP/AI&M data generated solely from aerial photographic sources.

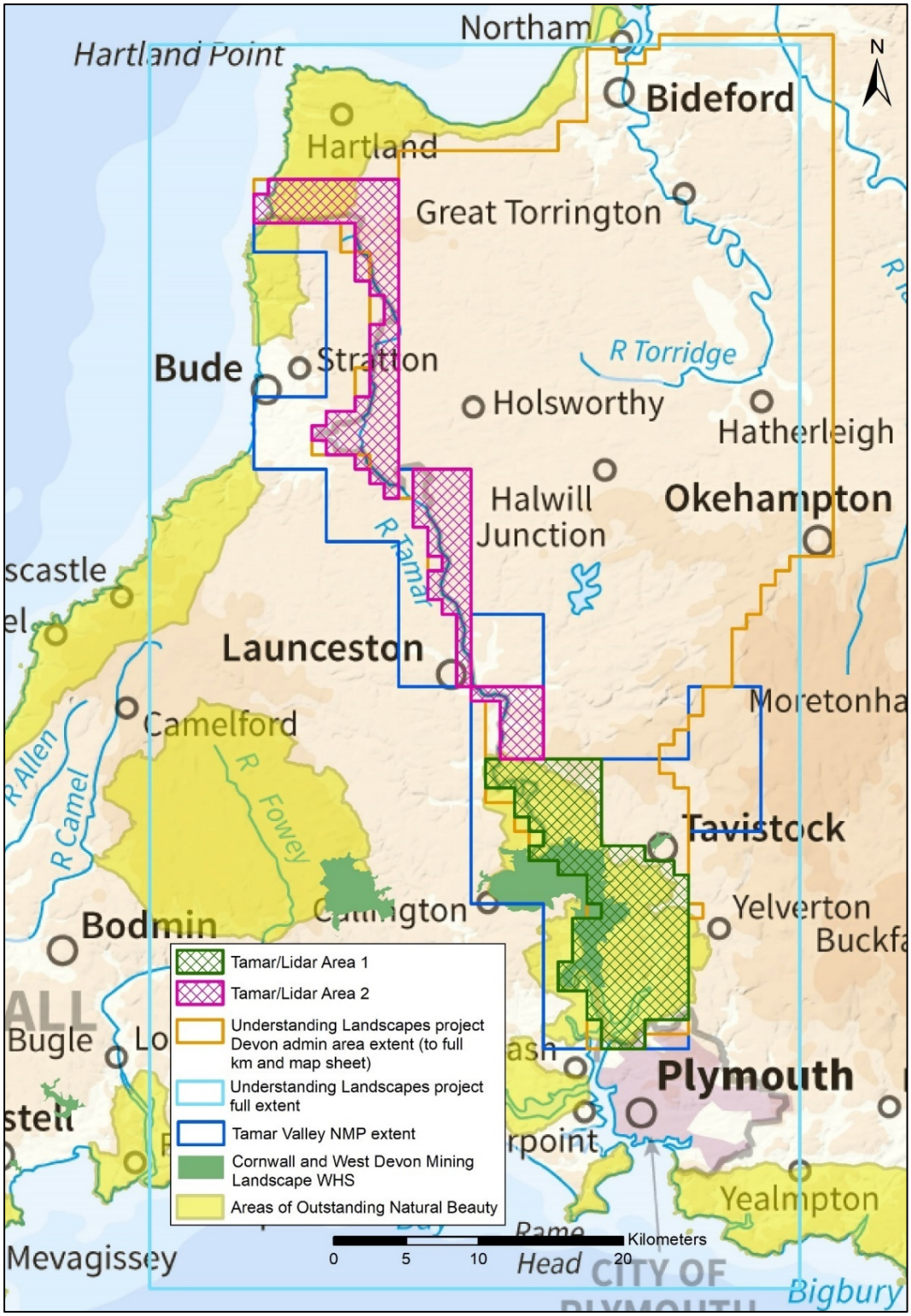

Figure 1: The Tamar/Lidar, Understanding Landscapes and NMP survey areas. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783.

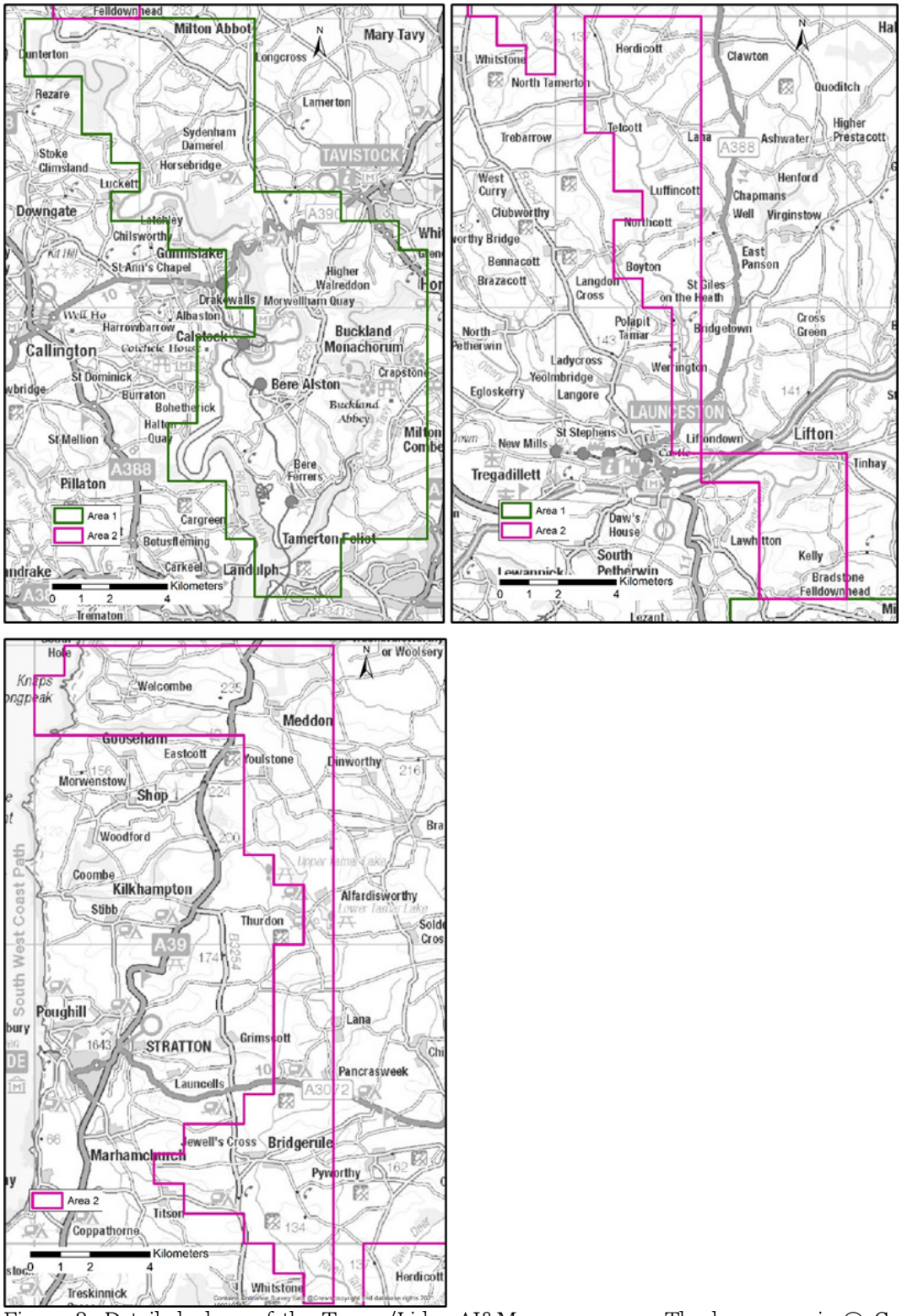

Figure 2: Detailed plans of the Tamar/Lidar AI&M survey areas. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783.

2. AIMS & OBJECTIVES

Aims

The specific aims of the survey can be summarised as:

- Identify Historic Environment assets within the Tamar Valley AONB and wider Tamar Valley, in particular those areas with potential for lidar-based survey, eg wooded areas, to facilitate positive management.
- Support and enhance community-led interpretation of archaeological monuments and landscape features from lidar-derived visualisations by volunteers involved with the University of Exeter's Understanding Landscapes project.
- Ensure that the community-generated data is recorded to a consistent standard on the Devon HER and provide feedback on recording standards to build community capacity.
- Use community-generated and AI&M standard lidar interpretation to quantify the contribution of lidar data as a component of integrated AI&M survey methodology, in an area previously assessed by traditional aerial survey methods.

Objectives

The survey achieved these aims through meeting the following objectives:

- Digital transcription of monuments and archaeological landscape features interpreted solely from visualisations derived from Tellus and Environment Agency lidar data, to AI&M standards, with reference to other readily available sources, such as Google Earth, historic maps and aerial photographs accessible via the DCC HER.
- Recording of new monument interpretations into the DCC HER, to AI&M standards, to inform future strategic, agri-environment and development management advice.
- Dissemination of AI&M/HER standard transcriptions and monument records to the University of Exeter's Understanding Landscapes project volunteers.
- The quantification and characterisation of monuments and archaeological landscape features identified solely from lidar-derived visualisations by;
    - Understanding Landscapes project volunteers, and
    - the AC archaeology AI&M survey team.
- Provide a valuable methodological assessment of lidar data's contribution to landscape survey in an area previously assessed by traditional aerial survey methods.

- Publication and dissemination of the survey results in a summary Project Report and the dissemination of survey results via the DCC Environment Viewer.
- Provision of the project archive to Historic England for integration into the Historic England Archive.

3. SCOPE OF THE SURVEY

Methodology

The survey followed Historic England AI&M standards and methodology for transcription in a GIS environment (Winton 2020; Hegarty 2020). The survey involved the identification, interpretation, transcription and recording of archaeological sites visible on visualisations derived from Environment Agency and Tellus lidar data, within the AI&M sphere of interest.

The Tellus data covers the whole of the project area, and was flown in July and August 2013. At the time of the survey, the Environment Agency lidar covered approximately 80 per cent of the project area and dated to between June 2000 and September 2019. Both survey areas had several pockets missing EA lidar, with the largest area in the north-west (adjacent parts of the parishes of Welcombe, Hartland and Bradworthy) and numerous irregularly shaped areas in other locations (especially Bridgerule, Luffincott, Milton Abbot and Lamerton).

The Environment Agency data is derived from a combination of Time Stamped archive and National LIDAR Programme lidar, which when merged results in a 25m overlap between survey areas within which a 'feathering' process replaces any 'steps' in the output composite. This makes for a smooth transition at the overlap area that is suited to flood risk mapping and modelling but has the potential to mask microtopography.

Both the Tellus and Environment Agency lidar used had a spatial resolution of 1m. Five DTM-based visualisations were produced for each, using the Relief Visualisation Toolbox (Kokalj and Somrak 2019). They comprised:

1. Hillshade
2. Hillshade with 16 direction lighting
3. Negative Openness
4. Positive Openness
5. Simple Local Relief

Additional web and digital HER sources were also consulted during this survey to aid interpretation and for cross-referencing. These included:

- Historic maps (1830-1840s Tithe maps and Ordnance Survey mapping from the late-19th century to the second half of the 20th century)
- 1940s RAF aerial photographs mosaic
- GetMapping/Bluesky photo mosaics
- Google Earth

The Understanding Landscapes project consulted National LIDAR Programme Environment Agency lidar data visualised using planlauf/TERRAIN and Tellus lidar data visualised using the Relief Visualisation Toolbox. Both were visualised as Simple Local Relief. The Tellus lidar data was additionally visualised as a Slopeshade using Global Mapper. Historic maps and Google Earth sources were also consulted by the community project team. The project initially consulted Tellus lidar data, which was followed by Environment Agency lidar data once it had been processed.

Community-generated data was produced in a Google Earth, rather than a GIS environment. Point data of individual records was received by the AI&M survey as KMZ files, with a unique identifier linking them to further information in an excel spreadsheet. The KMZ files were converted to shapefiles by the AI&M survey team in ArcMap GIS. The spreadsheet fields included the name of the volunteer recorder, monument type and period, data source and summary and interpretative text, though not all fields were always populated. The specific recording framework of the survey relating to the working procedures of the AI&M team in conjunction with the community-generated data is outlined in the Project Design (Hegarty 2020) and will not be repeated here.

The Tamar/Lidar survey area encroaches into the county of Cornwall and also incorporates the south-western and northern fringes of Dartmoor National Park and Plymouth Unitary Authority, respectively. These areas are not administered as part of the DCC HER and were excluded from the survey.

Survey data was recorded by the AI&M survey team directly into the DCC HER. Interpretations of date, function and summaries of survival and condition were recorded in text-based and numeric fields in the database. Transcriptions of all visible features and monument polygons defining the extent of the recorded features were created in a linked GIS using standard AI&M symbology. This ensured that monument data was available immediately to researchers, for consideration in planning and environmental management matters, and rapidly accessible online via Heritage Gateway and Devon County Council's Environment Viewer. All HER monument record details can be viewed, using HER monument unique identifiers referred to throughout this report, via the search function in Heritage Gateway and Environment Viewer.

The AI&M sphere of interest includes archaeological sites and landscapes visible as cropmarks, soilmarks, earthworks and structures, including sites that are extant on historic photographs, but which have since been levelled or destroyed. Buildings within certain contexts (most commonly military or industrial) may also be recorded. The date range spans the Neolithic up to and including the 20th century (Winton 2020). The most recent sites and landscapes recorded under the AI&M methodology are typically those associated with the major 20th century conflicts, including the Cold War.

This survey provides historic environment data upon which additional research or field investigations can be based. A list of monuments for which it is felt that further field-based investigations would be particularly beneficial, and suggestions for suitable types of further work, is included as Appendix 5.

Further background to the Aerial Investigation and Mapping methodology and best practice is available in the Management of Research in the Historic Environment (MoRPHE) Project Planning Note 7: interpretation and mapping from aerial photographs and other aerial remote sensed data (Historic England 2012), although this document has been archived by Historic England and is currently available by request only; to request a copy please email guidance@HistoricEngland.org.uk. A recent review document summarises the development of the AI&M methodology and standards, and has facilitated the

drafting of an updated AI&M standards and technical specification (Evans 2019; Historic England 2019).

Geology, topography and land-use

The bedrock of the survey area is varied.

Much of Area 1, from the northern outskirts of Plymouth to Horsebridge, is dominated by Devonian slate of the Tavy Formation. From Horsebridge to the southern extent of Area 2 at Launceston, the geology is more mixed. It includes Devonian slate and siltstone of the Liddaton Formation, Carboniferous slate, siltstone and sandstone of the Brendon Formation, Carboniferous basaltic lava and balsaltic tuff of the Milton Abbot Formation and Carboniferous chert of the Teign Chert Formation.

From Launceston to the south of Bridgerule, which incorporates the southern half of Area 2, the geology comprises Carboniferous mudstone and siltstone of the Crackington Formation. The remaining northern half of Area 2 consists of Carboniferous sandstone of the Bude Formation.

This varied geology has had important implications for the historical land-use and landscape character of the area, particularly within Area 1. The heat and pressure of the granitic intrusion of the Dartmoor massif to the east of this area altered the character of the surrounding Devonian and Carboniferous rocks, creating an aureole of metamorphic rock. Subsequent cooling concentrated minerals in the intrusive granite and surrounding 'country' rocks, resulting in veins of tin, copper, lead and arsenic ore. The historic and industrial exploitation of these rich mineral resources across much of Area 1 has resulted in a unique and complex archaeological landscape characterised by extensive earthwork remains of extractive pits and quarries, prospecting pits, mine shafts, spoil heaps, streamworks and openworks. This is discussed more fully below (see Section 5 The Survey Results: An industrial landscape).

The overlying soils across the survey area are dominated by low fertility freely draining slightly acid loamy soils, interspersed with freely draining acid loamy soils over rock. High fertility soils of slightly acid but base-rich soils are present from Horsebridge to Launceston, between the northern and southern part of Areas 1 and 2. The northern half of Area 2 from Bridgerule is also characterised by slowly permeable seasonally wet acid loamy and clayey soils of impeded drainage and low fertility. The upland moorland soils around Meddon in the very north of Area 2 are slowly permeable wet and very acid with peat. The floodplain soils along the River Tamar are freely draining and of moderate to high fertility. The soils across the survey area mostly support grasslands and arable, with some forestry and rough grazing. (http://www.landis.org.uk/soilscapes).

The Tamar Valley is in the far west of the County and for much of its length defines the border with Cornwall. Most of the southern extent of the survey area (Area 1) lies within the Tamar Valley AONB. The landscape shows a classic progression of river landscape types. To the south, the tidal estuaries of the River Tamar and its tributary the River Tavy are broad and lined with low hills, with the area in between these rivers forming a plateau. Further north, where the rivers

narrow the landscape is defined by steeper and more wooded valleys. At Gunnislake, the valley is crossed by a granite ridge that produces a thickly wooded gorge-like landscape of rocky outcrops. Beyond this ridge further to the north, the valley generally widens and shallows and is still quite wooded, but also steepens and narrows in places (Church 2002). Several steep-sided north-east to south-west orientated combes that feed into the River Tamar also dissect the area.

The survey results demonstrate that a significant proportion of woodland within the river valleys and combes of Area 1 was established on the earthwork remains of former extractive industries where survival of these remains is good (see Sections 4 and 5 The Survey Results). In such cases, woodland, whether coppice or plantation, was clearly an efficient and pragmatic use of land rendered otherwise agriculturally unproductive by industrial use.

Across Area 2, the Tamar Valley remains largely shallow and broad, but is less wooded than Area 1 to the south. Several tributaries, including the Rivers Lyd, Carey, Claw and Deer feed into the eastern side of the Tamar. The area is also crossed by numerous combes that feed into both sides of the valley. At its north-west extent, the survey area lies within the North Devon Coast AONB which is characterised by its rugged coastline and by narrow sheltered and wooded combes. The higher lying plateaux and ridges and moorland present across much of the northern half of Area 2 is a focus of prehistoric activity, in particular Bronze Age barrows, and this is discussed below (see Section 5 The Survey Results: Prehistoric funerary monuments; Figure 4).

Settlements throughout the survey area are mostly scattered and consist of dispersed individual farmsteads, hamlets and nucleated villages, with the larger of these including Bere Alston and Bridgerule. The stannary town of Tavistock falls partly within the survey area.

Historic Landscape Character

The Historic Landscape Characterisation (HLC) mapping for Devon has characterised the survey area as a heavily intermixed pattern of 29 landscape elements. Its character is derived largely from medieval enclosure that includes character types of medieval enclosures, medieval enclosures based on strip fields, medieval strip enclosures and post-medieval enclosures with medieval elements.

There is a broad difference in the historic character across the survey area. Area 1 is characterised as post-medieval enclosures with medieval elements and Area 2 as medieval enclosures based on strip fields. Large parts of Area 2 along the combes and moorland, such as Bursdon and Hendon Moor to the far north, are also characterised as rough grazing ground, heathland or moorland. This difference might be a reflection of the varying geologies and soil types, as well as the estates, such as the Duke of Bedford Estate, which controlled parts of Area 1. Seeking greater returns from their land, such estates were driven towards greater agricultural production and efficiency in the post-medieval period and 19th century, by enclosing moor and common land and re-ordering the layout of fields (B Horner *pers comm,* 9 July 2021). The importance of the industrial heritage along the lower portion of the Tamar Valley in Area 1 is reflected in numerous pockets of this area being characterised as mining.

4. THE SURVEY RESULTS: OVERVIEW

General quantification

The total number of monuments recorded during the survey was 992, of which 781 (79 per cent) were newly created. This is a higher proportion of new records than for other aerial survey projects undertaken recently within the Devon HER. To a large extent this can be explained by the type of source being used; lidar picks up subtle features that may not be visible as earthworks on aerial photographs (Hegarty *et al* 2018, 110).

The 781 monument records added to the HER by the project significantly increases the number of records in the survey area, from 3,639 to 4,420. This is an increase of just over 21 per cent and demonstrates the value of revisiting areas surveyed before lidar data was easily accessible.

Nineteen per cent of the records created or amended also had the Understanding Landscapes project source attached. These are records where community-generated data had recorded possible archaeological features in the same location, although interpretations did not necessarily always match. These are discussed in more detail below.

The types of monuments recorded are dominated by post-medieval or 19th century industrial features and medieval field boundaries and systems, and these are characterised and illustrated below (see Section 5 The Survey Results; Appendix 1 and Appendix 4).

A greater density of records were made in Area 1 (600) than Area 2 (392), at least partly due to the prevalence of mining remains in the southern part of the Tamar Valley. Many of these were obscured by tree cover on the aerial photographs and not therefore identified during the Tamar Valley NMP survey, which took place before lidar imagery was available.

It would be reasonable to expect that there would be a higher proportion of new records identified from lidar data in Area 1, where tree cover is greater. However, the opposite is true, and there are in fact a higher proportion of new records (86 per cent compared to 74 per cent) in Area 2. This cannot be explained by better lidar coverage, as the Environment Agency lidar coverage was actually a little less comprehensive for Area 2. The discrepancy is simply due to variability in accessioning, with Area 1 having been fully accessioned into the HER, but Area 2 remaining in the backlog, with a few exceptions (as described in Section 1 Introduction: Overview).

Comparison with the Tamar Valley NMP survey

Five hundred and ninety-three monuments are recorded in the HER as having been identified during the earlier NMP survey, 412 of which are located within Area 1. Since Area 2 had not been fully accessioned, only Area 1 records are considered in the analysis below. Ninety-two of these sites were amended by the Tamar/Lidar survey, meaning that the majority of records (over 500) recorded from lidar in Area 1 were of earthwork features that had not been visible on the aerial photographs. There are a few different factors that help to explain this.

Many of the field systems and field boundaries were visible as very subtle earthworks, which are unlikely to be clearly visible on the available aerial photographs. This is reflected by the figures, which show that almost a third of records made from lidar but not recorded from the aerial photographs were of field boundaries or field systems. Where field systems had previously been recorded, reference to the lidar data could enhance both detail and extent, and this was also true of other types of monument (see Section 5 The Survey Results).

Field boundaries and field systems were also very frequently recorded during the NMP survey (36 per cent of all features only visible on aerial photographs), but they comprise a much lower proportion of the features visible on both lidar and aerial photographs (17 per cent). Two-thirds of the field boundaries recorded from aerial photographs were not recorded from lidar imagery. While some had been destroyed in the intervening period, this would not entirely account for the discrepancy. Most obviously, any field boundaries that only survive as below ground remains would not have been recorded from lidar. Differing availability of the Tithe mapping also played a part. The Tamar/Lidar survey did not record boundaries depicted on the historic mapping, including the Tithe maps which are now digitally available. This was not the case for the earlier NMP project, where many of the transcribed boundaries correspond to boundaries on the Tithe maps, which was presumably not available to the aerial surveyors at that time. An exception are the parts of the Tamar/Lidar survey area that do not have digital Tithe maps available, where many of the boundaries identified and transcribed in the current project may well have been extant in the mid-19th century. In these areas they are probably over-represented. This combination of factors makes it difficult to draw any firm conclusions about survival.

Most of the 133 monuments recorded in areas defined by HLC as woodland or plantation would not generally have been visible on the aerial photographs, due to tree cover obscuring the ground surface. The vast majority of these monuments (124) were in Area 1, particularly on the valley slopes, meeting expectations that lidar would be especially useful in identifying earthworks in wooded areas. Over 50 of the 124 monuments were industrial sites of some kind, both within and beyond the Cornwall and West Devon Mining World Heritage Site boundary, and of particular significance are the possible segments of the medieval Lumburn Leat (see Section 5 The Survey Results: An industrial landscape; Figure 15).

Three hundred and twenty monuments in Area 1 were identified during the NMP survey but not amended by the Tamar/Lidar survey. Approximately a sixth of these were of types unlikely to have been recorded from lidar data. This included features outside the scope of the current aerial investigation and mapping methodology such as allotments, market gardens, tennis courts and quays depicted on the historic mapping.

An apparently greater incidence of orchards visible on the aerial photographs also results from differing methodology; the Tamar Valley NMP project recorded extant orchards (40 for Area 1), while the Tamar/Lidar survey only recorded earthwork remains of tree planting banks (20, and 8 possible). In no cases did these records correspond, and any banks within the orchards extant in the 1940s

were presumably too subtle or obscured by tree cover to have been identified from the aerial photographs.

Structures, military camps and bomb craters of Second World War date were not generally recorded from lidar. This is unsurprising given their small size and the common practice of demolishing or levelling such sites soon after the war ended. The exception is a pair of bomb craters that did survive as earthworks at Bickham (MDV114447).

Similarly predictable was the low incidence in the Tamar/Lidar survey of features normally recorded as cropmarks, the potential for surviving earthwork remains of these sites being relatively low. Consequently, enclosures comprised just 2 per cent of the total monuments visible only on lidar, compared to 9 per cent of the monuments recorded solely from aerial photographs. Five enclosures were recorded from both types of source. Four of these had substantial ramparts, but the curvilinear enclosure in Whitchurch recorded as MDV66940 was only visible as cropmarks and fossilised in a field boundary on the aerial photographs; the low earthworks visible on the lidar imagery allowed a more accurate and detailed transcription of some parts of the enclosure bank.

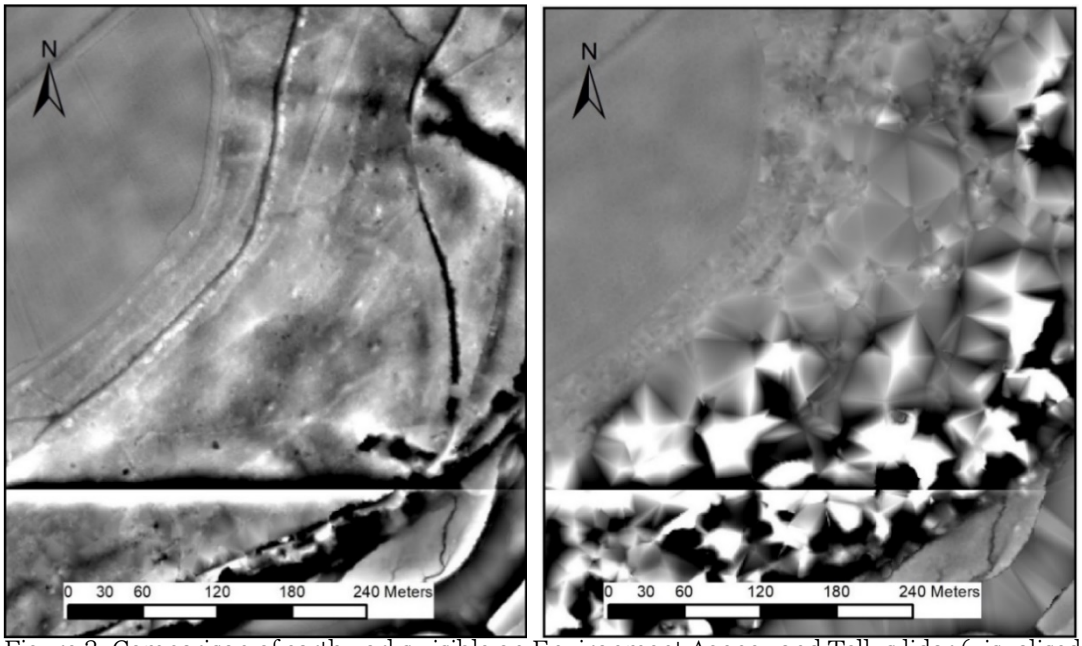

Figure 3: Comparison of earthworks visible on Environment Agency and Tellus lidar (visualised as Simple Local Relief); possible prospecting pits (MDV130658) in Bindwell and Whittacliffe Woods. *Left*: LIDAR Environment Agency LAST RETURN 19-APR-2019 LIDAR © Devon County Council. *Right*: Tellus LAST RETURN 01-JUL-2013 to 31-AUG-2013 © NERC (Centre for Ecology & Hydrology; British Antarctic Survey; British Geological Survey).

Of the 92 records of sites that had been recognised from both aerial photographs and lidar, the majority were substantial features, such as spoil heaps, extractive pits and mines. These would have been difficult to level without modern machinery, and presumably survived longer as a consequence. However, these features may well still be under-represented. The Tellus lidar had been processed in a way that makes it less useful for identification of archaeological earthworks than the Environment Agency lidar (Figure 3), and since the latter coverage does

not yet encompass the whole survey area it seems likely that further earthworks are yet to be discovered, especially in the wooded areas.

Where Environment Agency lidar was available, and in non-wooded areas, the extents of many previously recorded mine sites could be enhanced, as well as completely new discoveries made. Some of these are described below (see Section 5 The Survey Results).

While any patterns are complicated by evolving recording practices, variable accessioning rates and inconsistent availability of sources, the value of good quality lidar for identifying subtle earthwork features and those in woodland is clear. Certain types of feature are undoubtedly better represented on aerial photographs, and lidar cannot replace these. However, the benefit of revisiting areas where NMP projects were carried out prior to lidar availability is undeniable.

Comparison with the Understanding Landscapes community-generated data

ULP records were received as point data with an identifier linking to further information in a spreadsheet (see Section 3 Scope of the Survey: Methodology). These were incorporated into 186 (19 per cent) of the HER monument records made during the Tamar/Lidar survey. Two hundred and twenty-six individual ULP point records were included, as a number of these were interpreted as part of wider monuments (mostly field systems), and combined within the same HER record.

Approximately one-half of the total number of community-generated points in the survey area were incorporated into HER records by the AI&M survey team. Of these, the majority of interpretations matched, by which we mean that the monument type broadly matched the interpretation assigned by the ULP volunteers. A smaller proportion were assigned a different interpretation, and seven were recorded as very ambiguous features, or non-antiquities that have been recorded in the HER to avoid erroneous identification as a monument in future.

The ULP point records that were not accessioned into the HER fell into several broad categories (Appendix 2). These were dominated by features that the aerial survey team interpreted as natural in origin, with a smaller number outside the scope of the HER recording policy, for example field boundaries depicted on historic mapping. As described above, the processing of the Tellus lidar was less successful at stripping out dense surface vegetation than the Environment Agency lidar. Given that at least some of the grids were viewed by the ULP team when they only had access to Tellus lidar imagery, this may have contributed to the confusion between agricultural and archaeological features that resulted in more than 10 per cent of the ULP points being reinterpreted as modern agricultural features by the AI&M survey team.

A very small proportion of ULP point records were attributed by the survey team as lidar processing artefacts, indicating that this was not a major misleading factor for the volunteer community. More often, it was not possible to identify any anomaly on the available imagery that corresponded to the ULP point. In these

cases, it would have been useful to have had access to the same imagery datasets as the volunteer team. More detailed community-generated descriptions of the form and orientation of the features would also have provided guidance about exactly what to look for, though in none of these cases did the aerial survey team feel that a significant archaeological feature had been missed. A very small number of records did not have a corresponding spatial identifier or were accidental duplicate entries.

Field boundaries were the monument type most frequently assigned to records that incorporated community-generated information. This broadly matches the overall results for the whole survey, where field boundaries comprised 26 per cent of the monuments. Clearly the volunteers were able and keen to identify and record these characteristic features, as well as more rare and significant monuments. The field boundaries recorded by the ULP team numbered approximately one-fifth of the total recorded during the survey.

When it comes to field systems, a far higher proportion were associated with ULP points, at over two-fifths of the field system monuments recorded during the survey. These earthworks are easier to identify by dint of their greater extent, which probably accounts for the disparity.

A similarly high proportion of possible barrows were associated with ULP points. Without access to all the aerial imagery it was sometimes difficult to be certain of interpretation, and one-half of these were assigned a '?' for confidence in the HER. These would benefit from other forms of investigation such as ground survey to help inform their interpretation. Of 32 possible barrows noted as ULP points, approximately three-quarters were interpreted by the aerial survey team as non-archaeological, or a different monument type. Most of these were natural formations, but also modern features including structures and telegraph poles, and in four cases probable extractive pits. It seems then that barrows are likely to be over-represented in the community-generated records, probably attributable to a lack of experience identifying geological morphology, some difficulty recognising modern features on other available digital sources, and lack of familiarity with lidar data.

It may also be that this type of monument was more actively sought on the imagery, intentionally or otherwise, as a more significant or interesting monument. Enclosures and shrunken or deserted settlements were also better represented in the records that incorporated ULP data, and it is possible that these may also have been picked up more frequently by the volunteer team due to a perception of greater importance. Of the 47 mentions in the community-generated records, 11 were recorded as enclosures on the HER. Eight were recorded in the HER as different monument types - field boundaries, extractive pits and possible mining spoil - and the remainder were considered likely to have been natural, modern or agricultural features, or outside the scope of HER recording policy.

Conversely, some of the more monumental and significant features were not recorded by the volunteer team. Two hillforts and two possible mottes were re-transcribed by the aerial survey team to add detail or improve accuracy. Three were perhaps regarded as too obvious by the ULP volunteers, as they were

already recorded on the HER; the fourth (MDV129708) is unusual in form as a flat-topped mound that could be a levelled motte or a building platform.

In other cases, it seems likely that a lack of familiarity with certain agricultural features has led to an under-representation of these in the community-generated data (Appendix 2). Catchmeadows for instance were not associated with any ULP records, but 25 were mapped and recorded in the project overall. Of the 32 features interpreted as orchard banks, only five were associated with community-generated data. Both of these often-subtle types of earthwork can be easily confused with agricultural cultivation marks, and it is hoped that feedback to the ULP project will help build community understanding of these locally important features.

As noted above, many of the sites located in woodland were industrial in character and could be seen less clearly on the Tellus data than the Environment Agency lidar. This partially explains the much lower incidence of mining and extractive industry records associated with the ULP source (20 per cent, compared to 34 per cent overall; Appendix 3), since initially the volunteer team only had access to Tellus and not Environment Agency lidar. Only 5 per cent of spoil heaps for instance were recorded by volunteers despite their generally large scale and extent. In the non-wooded areas though, other factors must have played a part. Often, for example, spoil heaps are irregular in shape and could perhaps have been dismissed as natural ground disturbance. Indeed, it seems likely that some were shaped by water erosion subsequent to abandonment (eg MDV3818). Mining remains are explored in more detail below (see Section 5 The Survey Results: An industrial landscape).

The earthwork forms of some less common site types, such as streamworks (MDV130513 and MDV130546), charcoal burning platforms (MDV130660 and MDV130771), and peat cutting (MDV129721), may not have been familiar to the ULP volunteer team. These were found in small numbers across the survey area, but none were associated with ULP data.

The enthusiasm and knowledge demonstrated by the ULP volunteer team was considerable, and it is hoped that the points above can be used to further refine and build on community identification skills. Future projects of this type could benefit from a greater element of ongoing quality assurance, and training in particular themes and types of monument that are perhaps less frequently encountered outside of the discipline of landscape archaeology.

Time assessment

Because a single source approach of this kind had not been undertaken in Devon-based aerial survey projects before, the timescale for transcription and recording had to be estimated. The figure of 0.5 days per square kilometre was based on time recording figures from adjacent and other recent aerial survey and investigation projects in Devon (Hegarty 2020). Because these were full AI&M projects, the proportion of time spent viewing lidar had not been recorded separately to the other sources, and had to be inferred using the teams experience of consulting lidar sources as part of these standard projects. The estimate was rounded down from the projected 3.9 hours per square kilometre to 3.75 hours

for project planning purposes. Unfortunately, there was no opportunity to test or refine this timeframe by selecting a smaller pilot area to begin with, so it is hoped that results presented here will help to inform any similar projects in the future.

Overall for this project, and excluding all areas outside the Devon HER administrative area (that is, excluding Dartmoor, Plymouth and Cornwall) from the calculations, 4.5 monuments were recorded per square kilometre[1]. This relatively high number closely matches the average of 4.6 monuments per square kilometre for standard AI&M projects, which include all aerial sources readily available at the time of the survey (Evans 2019, 81). This average has increased over time and now stands at approximately 6 monuments per square kilometre for recent projects (Evans 2019: Figure 45). Even with this higher average, it is clear from this current survey just how important the addition of lidar as a source is to complement the results of NMP projects undertaken before widespread lidar availability. As discussed above, this is particularly the case for wooded areas, reflected in the higher number of records per square kilometre in Area 1 (5.1) compared to Area 2 (3.7).

The number of monuments is regarded as the key factor in determining the amount of time required to map a square kilometre (Evans 2019, 78). Perhaps unsurprisingly given the number of monuments, for this project the time taken was much higher than had been predicted. This averaged 1.0 days per square kilometre overall[2]. For reasons mentioned below it was not possible to accurately quantify by project area, though rough figures indicate that Area 1 took 1.1 days per square kilometre, while Area 2 took 0.9 days, and progress through Area 2 felt considerably quicker than for Area 1. For future or follow-on projects of this type, the time requirement would potentially be lower depending on how many of the issues outlined below were relevant or could be addressed.

Of the numerous factors that impacted on the timescale of the survey, assimilation of community-generated data was significant. The estimate did not take into account the time necessary for checking, recording and providing feedback, and it became clear that this element of the survey was considerably more time consuming than anticipated. Even discounting features thought to be geological took cumulatively a substantial amount of time, given the large number of ULP points submitted. Unfortunately, this time cannot be reliably quantified, as disruption and workarounds meant that tasks could not be neatly compartmentalised (see below). As an estimate though, up to 25 per cent of the time taken may have been spent on assessing and incorporating volunteer data.

Feedback to the volunteer team illustrates some of the issues that slowed progress (described in the MoRPHE report for this project). Many of these were to do with clarity of descriptions to allow the AI&M survey team to understand and assess the anomalies the volunteers were seeing. Particularly important was the need to be specific about which source the feature was seen on, and noting details of orientation, extent and evidence form. Consultation and use of the Forum on Information Standards in Heritage (FISH) monument and evidence thesauri could also have reduced potential for misunderstanding. Grouping of some features, for instance recording multiple adjacent field boundaries as a single field system, would have reduced the time needed for assessment. Access to multiple

visualisations from the start of the project may have helped the volunteer team to gain a deeper understanding of the form of the features, which it is anticipated would reduce the number of ULP records reinterpreted as geological by the AI&M survey team. It is expected that the impact of these sorts of issues would reduce as continued training and feedback builds capacity within the volunteer community. However, some time still needs to be allocated for the assessment, integration and feedback of community-generated information.

As well as the greater number of monuments, the higher time requirement for Area 1 is partly a result of unusual work circumstances during the COVID-19 pandemic and disruption caused by staff changes and the short-term nature of the projects. These will not all be discussed here and are described in the MoRPHE report for this project.

Without volunteer involvement, and with the issues above addressed, 0.5-0.6 days per square kilometre would probably be a fair assessment of the time required for this quantity of monuments, though eye fatigue needs to be taken into account given the less varied nature of the source material. Given that standard AI&M projects producing 4-5 monuments per square kilometre average 1.3 days per square kilometre (Evans 2019: Figure 43), the data produced by this single source project seems to represent good value.

[1] If the full kilometre squares are used in the calculations this figure is 3.7 monuments per square kilometre, but this is thought to be misleading as records were not created for areas outside the Devon HER administrative area.

[2] If the full kilometre squares are used in the calculations this figure is 0.8 days per square kilometre, but this is thought to be misleading as records were not created for areas outside the Devon HER administrative area.

5. THE SURVEY RESULTS: CASE STUDIES

Introduction to the results

This section provides a brief overview of some of the highlights to emerge from this survey. It aims to illustrate the diverse historic character of the Tamar Valley and demonstrate how the Understanding Landscapes project, in collaboration with the AI&M survey team, have made a positive contribution towards the understanding and interpretation or reinterpretation of this landscape. It will also demonstrate how this survey has complemented and enhanced transcriptions made by previous NMP/AI&M surveys. As has been highlighted above (see Section 4 The Survey Results), meaningful quantification with the Tamar Valley NMP survey has been slightly hampered, because only records within the AONB in Area 1 had been fully accessioned into the HER. The Tamar Valley NMP source was, however, added to both newly created and amended records in Area 2 when the NMP transcriptions corresponded with those made by this lidar survey. Any quantification in this section of the report refers to the whole dataset, not just Area 1.

This section illustrates sites that typify a theme, some unusual or previously unknown monuments, and sites considered by the AI&M survey team to be of potential national importance. The report is not a comprehensive synthesised interpretation of the survey results. The full monument records created or amended by the survey are available on the DCC HER via Heritage Gateway.

Prehistoric funerary monuments

Round barrows are commonly perceived to be the archetypal Bronze Age monument type, but their first appearance was in fact contemporary with the linear monuments of the Early to Middle Neolithic (Woodward 2000, 36). From the later Neolithic, the construction of larger round barrows has been suggested by some to represent a shift from a communal to a more individualistic way of life and death (such as Smith and Brickley 2009, 138), although this assertion has been much debated. Some monuments have been interpreted as memorials with no evidence for burials. Others seem to have been intended for the successive internment of multiple individuals, perhaps over several generations, perhaps expressing levels of individuality and personal wealth or status through grave goods, but within a wider framework of communal monumentality (Woodward 2000, 23-28, 36-7; Smith and Brickley 2009, 138).

Barrows of the Beaker period and Early Bronze Age tended to be smaller than the large Neolithic monuments, and it is to the Early Bronze Age period that most of the excavated examples in Devon belong (Griffith and Quinnell 1999). However, reuse of round barrows in the Middle Bronze Age is well known and smaller barrow construction also continued into this period; in Devon some examples are known to extend to the Middle to Late Bronze Age (Griffith and Quinnell 1999).

Complex barrows and highly visible cemeteries are rare in Devon, with relatively simple bowl barrows being the most common form recorded. However, simple forms can conceal complex developmental histories, and it is increasingly

apparent that South Western barrows are local expressions of widely held beliefs (Quinnell 1988; Griffith & Quinnell 1999).

Typically, South Western barrows range in size from 3m to 30m in diameter, with or without evidence for outer banks and ditches.

A total of 28 monument records for barrows or monuments of related type (including Round Barrow, Bowl Barrow and Disc Barrow) were created or amended by the survey, with over half of these being newly created. Of the amended records that relate to barrows, 58 per cent had been previously recorded by the Tamar Valley NMP project. Forty per cent of amended and newly created records were of sites identified by the Understanding Landscapes volunteer project team (Figure 4).

This increase in the number of newly recorded barrows is significant, and although the results have not drastically changed the perception of this monument type's distribution, they have strengthened the known pattern.

The distribution of amended and newly recorded barrows shows a clear differentiation based on landform, with three-quarters of monuments across the higher lying plateaux and ridges, between 120m to 225m AOD, that characterise the northern half of Area 2. Here, the geology is exclusively Carboniferous sandstone of the Bude Formation, with freely draining loamy soils and the peaty upland soils of Hendon Moor and Bursdon Moor.

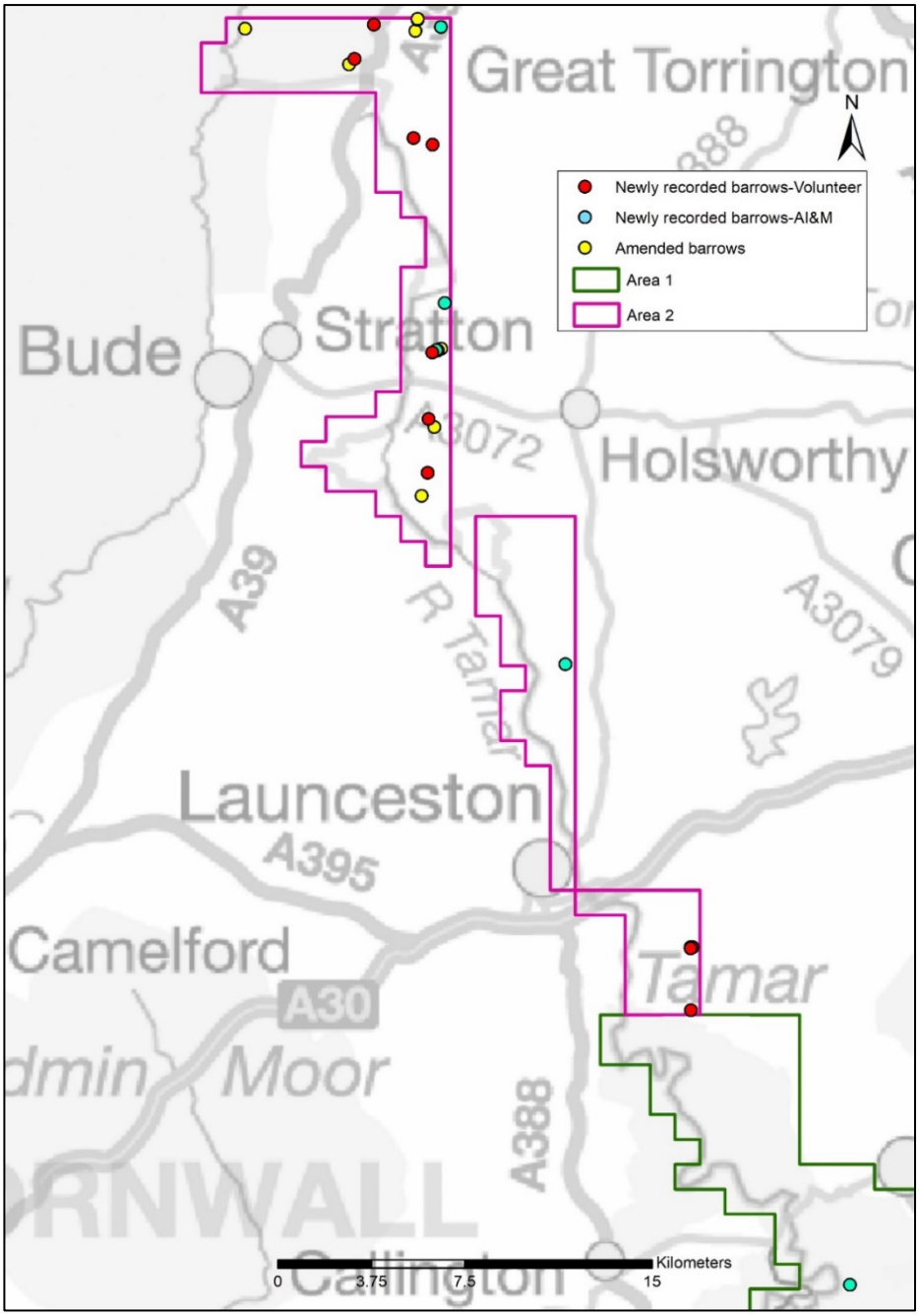

Figure 4: Distribution of barrows, showing amended and newly created records including those identified by the Understanding Landscapes project volunteer and the AI&M survey teams. This figure does not include previously recorded barrows that have not been amended by this survey. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783.

Both newly recorded and previously identified barrows were most often recorded within or on the periphery of other known barrow sites, hinting at ritual landscapes of previously unappreciated complexity. This survey was able to enhance the record of one such example of a previously recorded linear barrow cemetery (comprising MDV7116, MDV7117, MDV7118, MDV76198 and MDV60124) at Highermoor Cross, along the edge of and parallel to a north-east to south-west orientated ridge (Figures 5 and 6). Earthworks of three of these barrows (MDV7116, MDV7117 and MDV7118) had already been transcribed by

the Tamar Valley NMP survey, although this information had not been assimilated into the HER. The better spatial accuracy of lidar data, which was unavailable to the earlier NMP survey, warranted their re-transcription, whereby the known extent of each of these scheduled barrows has increased at least two-fold. This increase in extent can be explained by the visible earthworks not being clearly defined on the available aerial photographs when they were transcribed during the NMP survey, or alternatively could be due to soil spread from later 20th century ploughing.

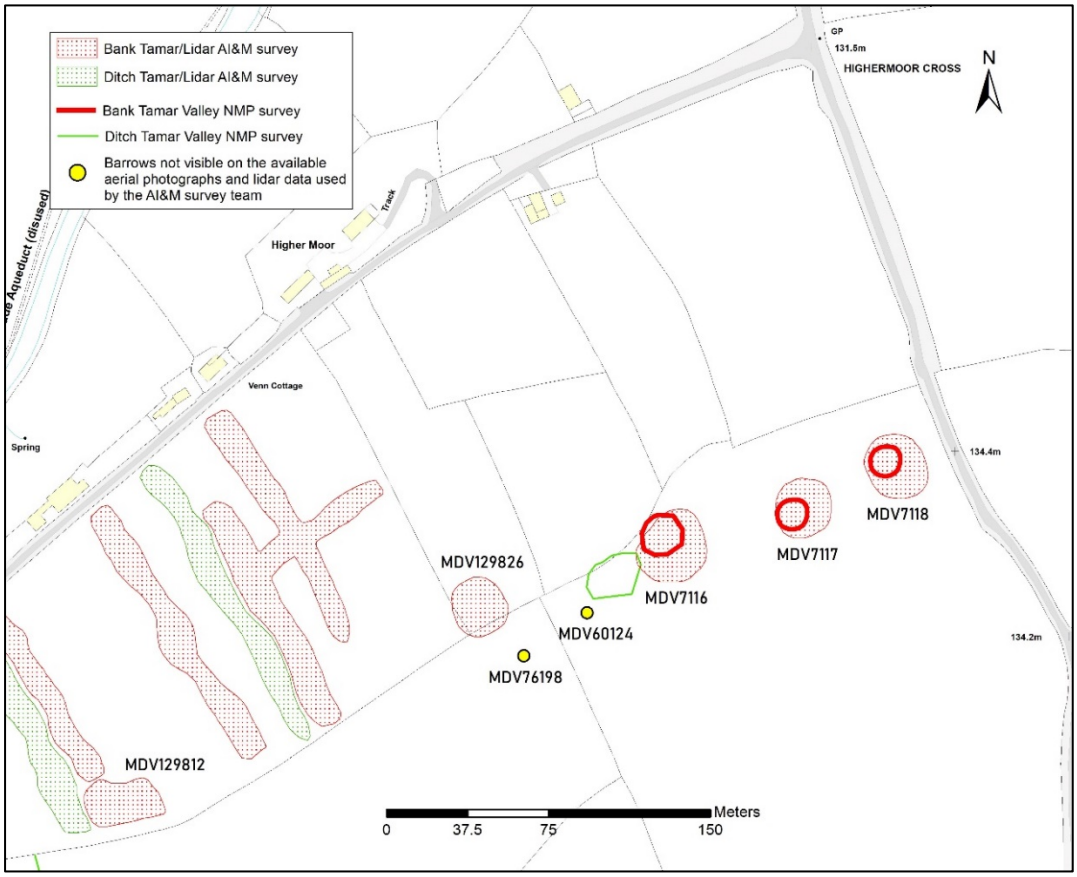

Figure 5: Barrow cemetery at Highermoor Cross, showing a comparison of transcriptions made from aerial photographs during the Tamar Valley NMP survey and from lidar data during the AI&M survey, as well as two previously unrecorded barrows (MDV129812 & MDV129826). Also see Figure 6. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England.

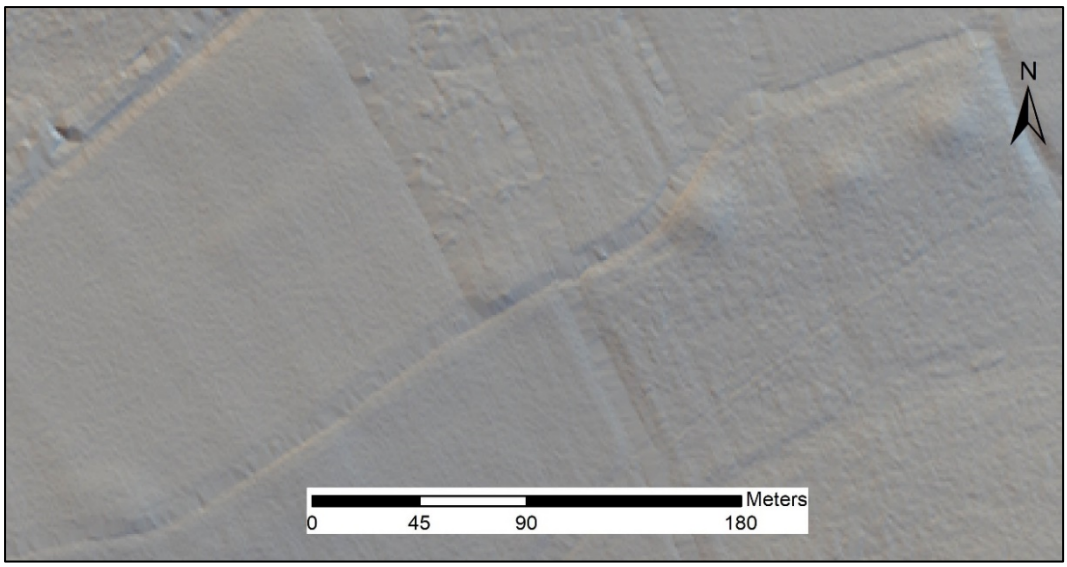

Figure 6: Barrow cemetery at Highermoor Cross showing from east to west: MDV7118, MDV7117, MDV7116, MDV129826 & MDV129812. Also see Figure 5. LIDAR Tellus LAST RETURN 01-JUL-2013 to 31-AUG-2013 © NERC (Centre for Ecology & Hydrology; British Antarctic Survey; British Geological Survey).

Earthworks of two possible newly identified barrows associated with this cemetery have also been recorded from lidar data by this survey (MDV129812 and MDV129826), with one of these (MDV129812) being identified by the volunteer team. This aptly demonstrates the value in a collaborative approach towards landscape survey. Atypically for this survey, both possible barrows were transcribed from the 2013 Tellus lidar data, where the extents of these earthworks are marginally better defined when compared with the earlier Environment Agency lidar data of 2004 (Figure 7). MDV129812 is sub-oval to irregularly shaped and measures *c* 40m long by 25m wide. Its southern edge has possibly been truncated by an extant field boundary and its western edge may have been disturbed by earthworks of a relict field boundary. MDV129826 is a slight sub-circular mound, *c* 26m in diameter, that is located within the south-western corner of a land parcel. It is also visible as a dark circular vegetation mark on Google Earth imagery of 2001. Further investigation of these possible barrows is recommended in light of their potential national significance.

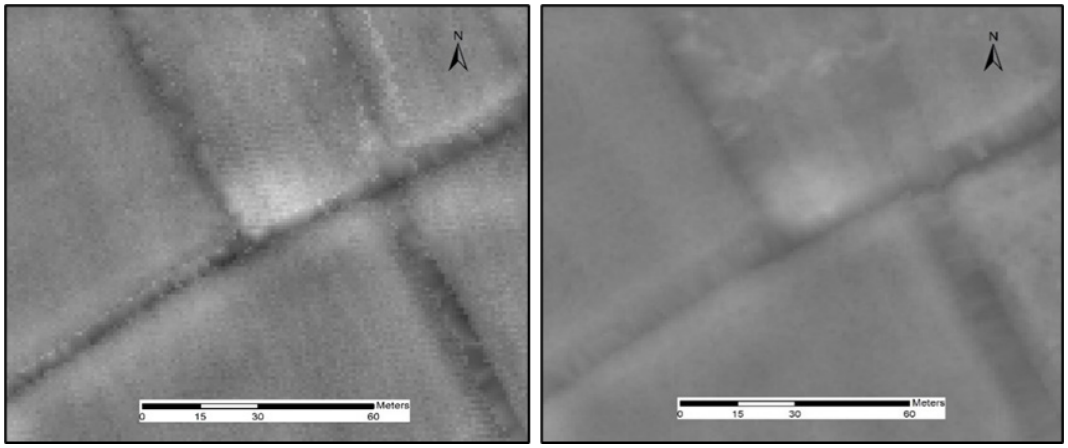

Figure 7: Possible newly recorded barrow (MDV129826); comparison of Simple Local Relief visualisations of 2004 Environment Agency lidar, *left*, and 2013 Tellus lidar, *right*. LIDAR Environment Agency LAST RETURN 19-DEC-2004 © Devon County Council. LIDAR Tellus LAST RETURN 01-JUL-2013 to 31-AUG-2013 © NERC (Centre for Ecology & Hydrology; British Antarctic Survey; British Geological Survey).

A similarly orientated group of possible barrows was newly identified by the survey on the north-east slopes of a ridge in East Gorvin Plantation (MDV129790). Here, earthworks of three roughly circular mounds, between 11m and 16m in diameter, were recorded from Tellus lidar data since Environment Agency lidar for this area was unavailable. The ground surface in this location is obscured by tree cover on many of the available aerial photographs, but the mounds are clearly visible on aerial photographs taken in 2010 when the woodland had recently been felled (Figure 8). The earthworks are located in an area of known prehistoric burial mounds on land surrounding Bursdon Moor and Hendon Moor, supporting the interpretation that they form part of this important funerary landscape.

Other examples of possible newly recorded barrows appear to be single, isolated examples in the landscape, for example at Higher Broomhill Farm (MDV129840), north-east of West Peekeand (MDV130023), south of Bounds Farm (MDV129680) and south-east of Maddacleave Wood (MDV129482).

Figure 8: Earthwork mounds of three possible barrows (MDV129790) in East Gorvin Plantation. Google Earth imagery of 2010, *left*, and AI&M transcriptions, *right*. EARTH.GOOGLE.COM 21-APR-2010 ACCESSED 19-JAN-2021. © 2021 Maxar Technologies. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England.

Medieval and post-medieval landscape: Field systems and settlement desertion

Many of the field systems and settlements that make up Devon's rural landscape probably date to the 16th century, some with early medieval or prehistoric antecedents.

In his study of the Tamar Valley, Turner (2007, 135-146) argues it is probable that the basic structure of the medieval settlement pattern was established between the 7th and 9th centuries, and the familiar pattern of hamlets and roads that characterise the area was in existence by the late Saxon period. By the time of the early 11th century, the Domesday Book records that much of the lands of the Tamar Valley, including the parishes of Tavistock, Gulworthy and Milton Abbot, were controlled by Tavistock Abbey, which had important implications in the shaping of the landscape here. As was common throughout Devon and Cornwall during the medieval period, most of the land was probably farmed as unenclosed strip fields. Enclosure of arable fields into large regular closes was, however, practiced from the early 14th century, as is evident in the fields to the north and west of Tavistock, for example around the Tavistock Abbey farm at Hurdwick Barton. These so- called 'Barton Fields' were created by larger landowners seeking greater returns from their land and they can be seen in other parts of Devon where similar agricultural developments were taking place. Elsewhere across the area, patterns of smaller medieval enclosures demonstrate that tenants were able to acquire and enclose strips of land, for example at Bere Alston.

Drives for greater agricultural production and efficiency continued into the modern period. This was a reflection of the expansion of the agrarian economy, particularly in the 19th century as fields were straightened, new farms were carved out of rough ground and small holdings created for the growing number of industrial workers in the area (B Horner *pers comm,* 9 July 2021).

Evidence for settlement desertion, loss or clearance, including house platforms, is well-represented in the survey area, with a total of 20 recorded examples. Field

systems and strip field systems, which were often recorded in association with these deserted or shrunken settlements, but which do not include records of individual field boundaries which were recorded across the survey area, total 102 records.

In both instances, three-quarters of these monuments were newly identified by the survey. This significant increase adds to our understanding of the Tamar Valley and its distinctive historic character. Of the amended records that relate to deserted and shrunken settlement, 20 per cent had been previously recorded by the Tamar Valley NMP project and 35 per cent of amended and newly created records were of sites identified by the Understanding Landscapes community team. Of the amended records that relate to field systems, 60 per cent had been previously recorded by the Tamar Valley NMP project and approximately 40 per cent of amended and newly created records were of sites identified by the Understanding Landscapes community team.

These monument types are distributed across the survey area (Figure 9). Previously unrecorded field systems were most frequently identified across the northern half of Area 1 in a landscape that was to be transformed by industrial activity from the 18th century, but also within the southern part of Area 2. These areas are largely characterised by the HLC as post-medieval enclosures with medieval elements. The bias towards the northern half of Area 1 can be partially explained by the absence of the Tavistock Parish Tithe Map which has probably resulted in an over-representation of field systems here, since any depicted on this map would not have been transcribed. A notable concentration of both newly recorded and amended field systems is also apparent towards the northern extent of Area 2, and this cannot be explained by the lack of the Tithe maps. Records of shrunken and deserted settlement are more evenly distributed across the survey area.

These broad trends are a possible indication of where changes in the patterns of land-use in the 19th century were most acutely felt. Improvements in agricultural practice reflected by an expansion of the agrarian economy and difficult economic conditions during this time may have made smaller holdings less viable, resulting in settlement contraction, farm engrossment and boundary loss. The impact of mining and its related industries, particularly across the northern half of Area 1, but also more widely, is also likely to have had an important impact on settlement and field patterns. Here, the demand for labour may have been drawn from the surrounding farmsteads, hamlets and villages and with workers relocating to larger towns such as Tavistock, or mining settlements such as Calstock or Gunnislake.

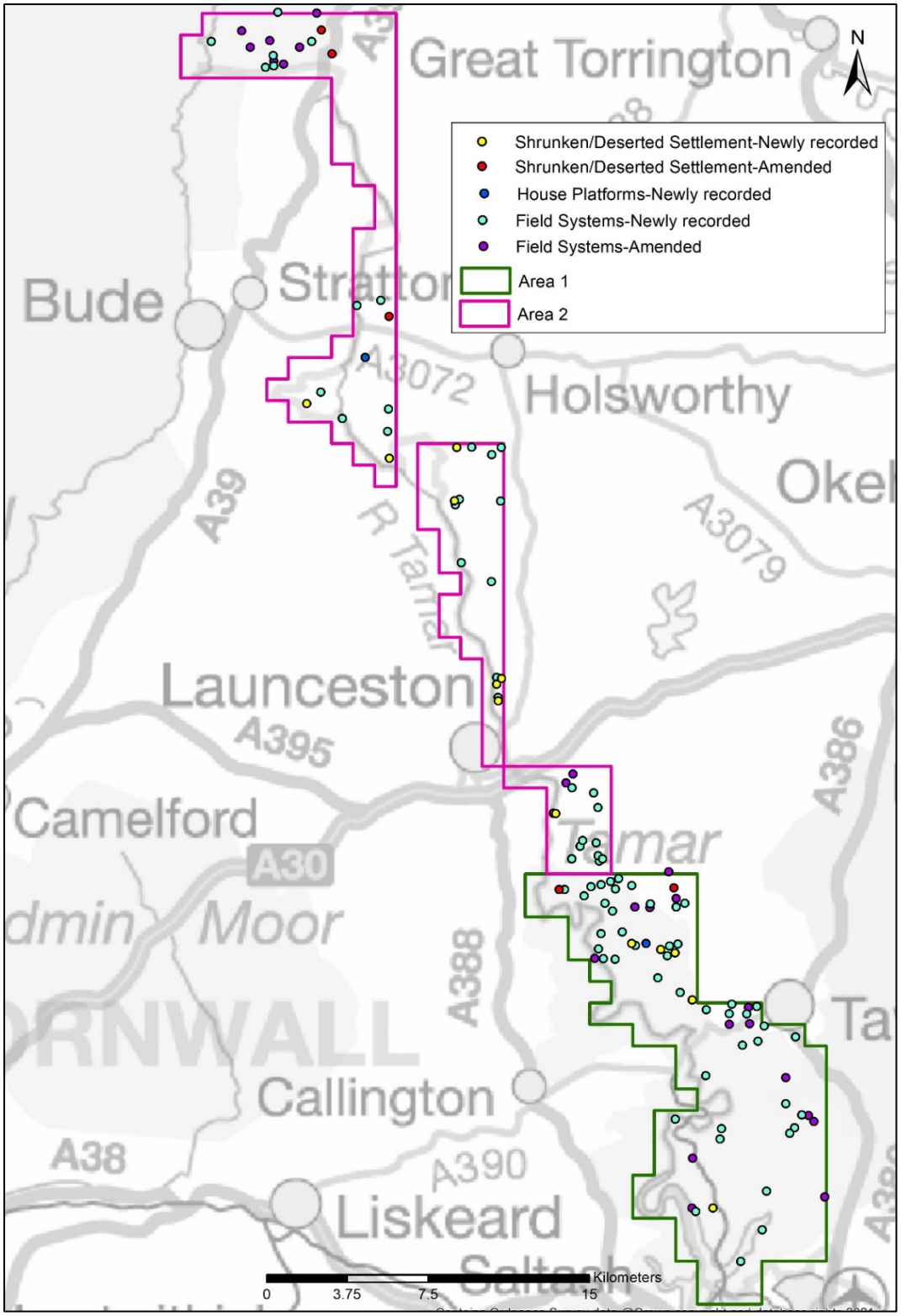

Figure 9: Distribution of newly recorded and amended records that relate to deserted/shrunken settlements and field systems. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783.

Nowhere was such wholescale change in the medieval character of this landscape more apparent than on the south and south-west facing slopes surrounding Milton Abbot, along the northern edge of Area 1 (Figures 10 and 11). Here, extensive earthwork remains of several relict medieval strip field systems were recorded. These field systems probably form part of the same broad cohesive field pattern that would have characterised much of the Tamar Valley in the medieval period, and elsewhere across Devon.

Only partial elements of the field systems at Milton Abbot were recorded by the Tamar Valley NMP survey, as individual field boundaries (Figure 10). This clearly demonstrates the added value of using lidar data in conjunction with more traditional methods of aerial investigation, particularly as in the example here, where the earthwork remains in the pasture fields are more subtle.

The field systems recorded at Milton Abbot, and elsewhere across the survey area, were frequently identified by the Understanding Landscapes community team. These tended to be as individual field boundaries, but the AI&M survey team felt it more appropriate to amalgamate these individual records together in instances where they clearly formed part of a single, cohesive field system (see Section 4 The Survey Results: Comparison with the Understanding Landscapes community-generated data; Time assessment).

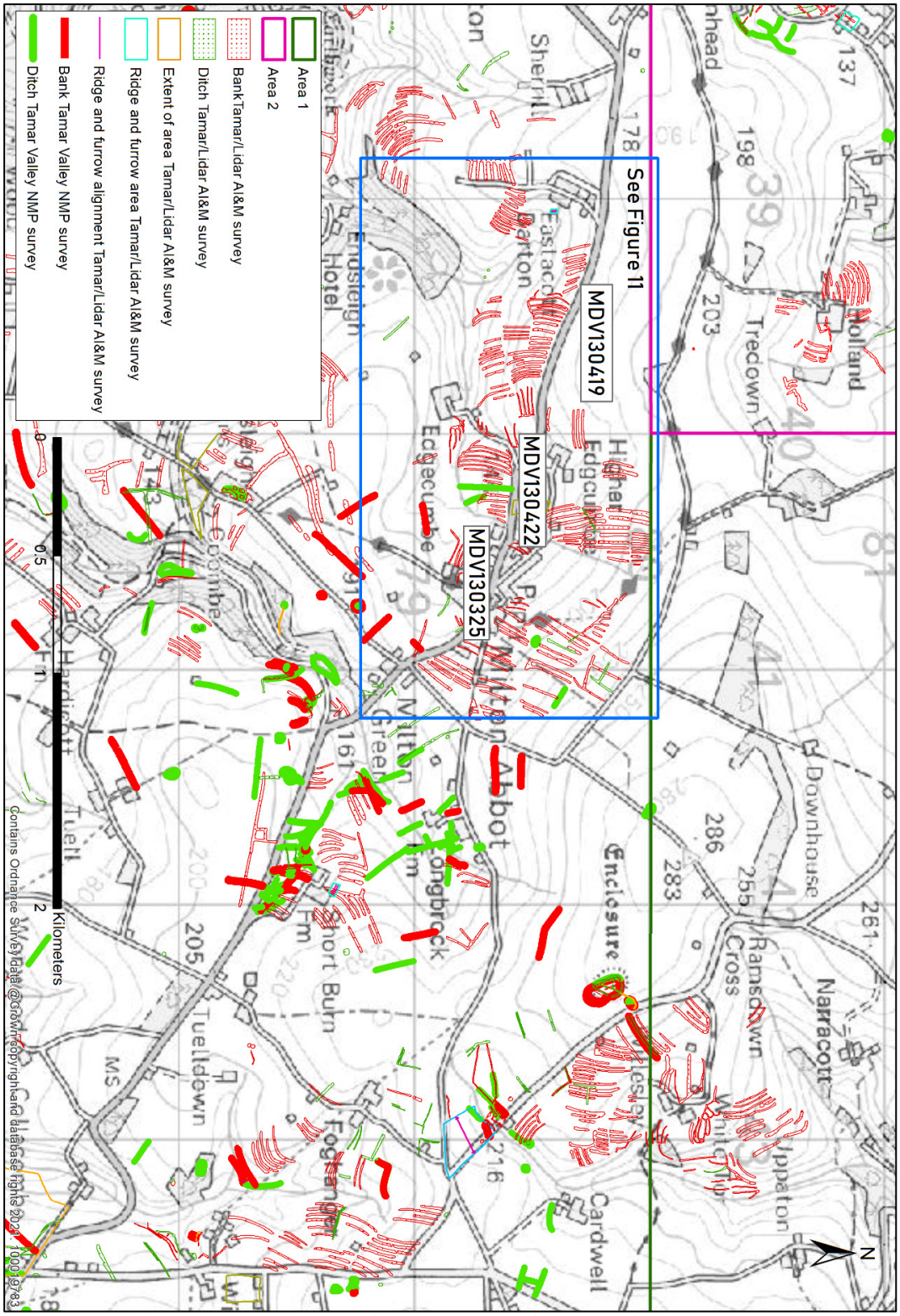

Figure 10: Field systems at Milton Abbot, comparing the Tamar/Lidar AI&M and Tamar Valley NMP transcriptions. The field systems within the blue outline (MDV130325, MDV130419 & MDV130422) are separately illustrated as Figure 11. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England.

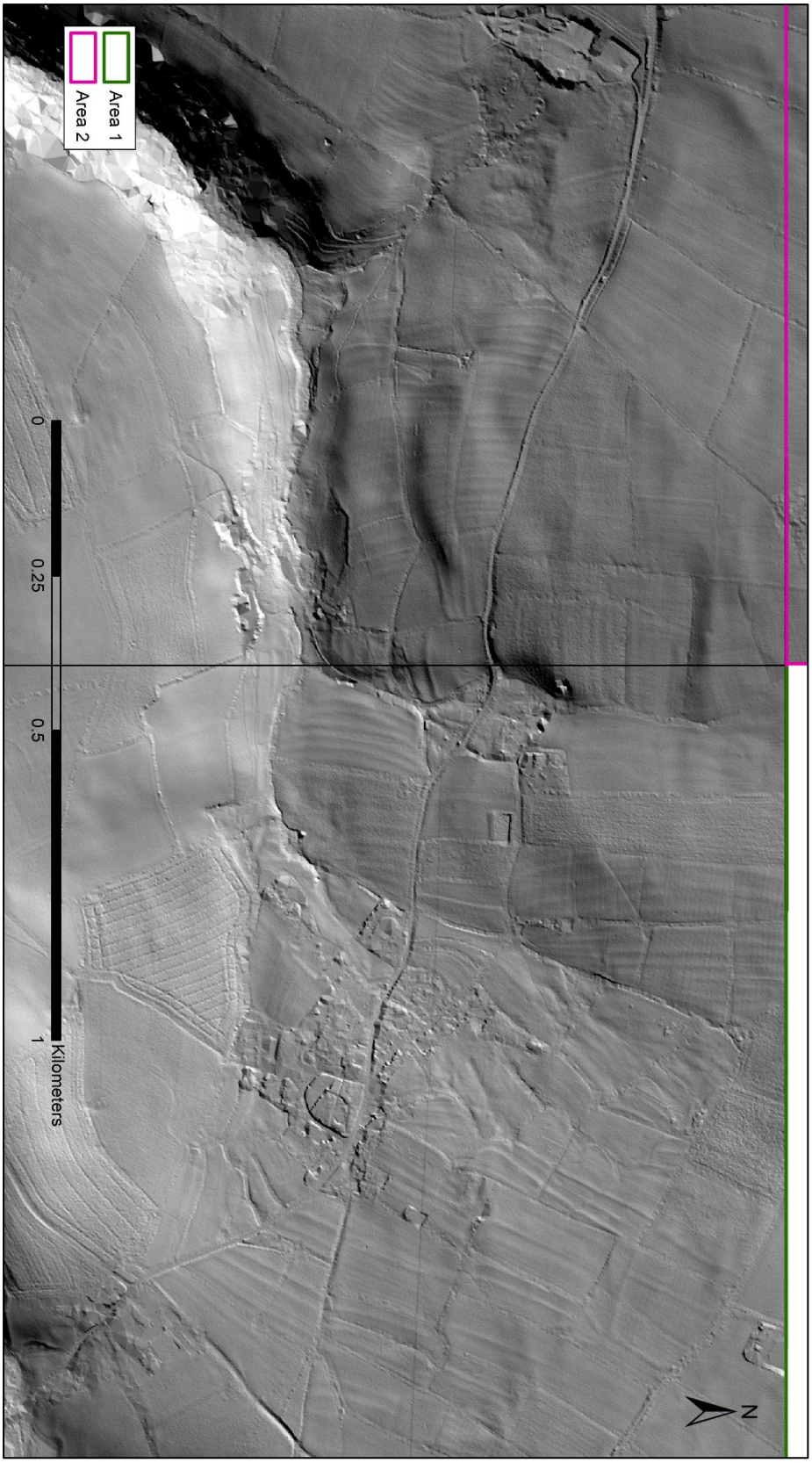

Figure 11: Field systems at Milton Abbot, including MDV130325, MDV130419 & MDV130422, visible as curvilinear earthwork banks on Tellus lidar. Also see Figure 10. LIDAR Tellus LAST RETURN 01-JUL-2013 to 31-AUG-2013 © NERC (Centre for Ecology & Hydrology; British Antarctic Survey; British Geological Survey).

The earthworks are visible as subtle curvilinear banks orientated across the slope, that typically measure between 4m to 8m wide and define a series of narrow strips between 7m to 30m wide. The cohesive pattern of field systems at Milton Abbot recorded by the Understanding Landscapes community team and enhanced by the AI&M survey team are an important surviving example of medieval strip field agriculture in the Tamar Valley. Such extensive and well-preserved examples are rare in Devon, and those recorded here are potentially of local, as well as national, significance.

Evidence of shrunken and deserted settlement was recorded across the survey area. Wholesale farm-scale desertion was rare, but a few examples were recorded, for instance at Forda to the east of Forda Mill (MDV129548; Figure 12). A farmstead of probable medieval origin is shown in this location on the mid-19th century Parish Tithe Map, although this had reduced in size by the late 19th century and had evidently been abandoned by the 1940s. Newly recorded earthworks of relict field boundaries possibly define former building plots and platforms, and a broad access track seems to link the complex to the road to the south, suggesting that this settlement may have been more extensive during the medieval period.

Figure 12: Deserted farmstead at Forda (MDV129548) depicted on the Parish Tithe Map, *left*, and AI&M transcriptions, *right*. The Tithe Map is © Devon County Council and Devon Heritage Centre. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England.

More often, the earthworks were recorded in association with extant farmsteads and hamlets. At Tinney (MDV130236) for example (Figure 13), numerous newly recorded rectilinear and curvilinear flat-topped mounds, between 25m and 40m long, were visible as slight earthworks to the north, east and west of the existing settlement. The form of the earthworks and their similarity with features recorded on the periphery of other extant settlements, such as at Youngcott (MDV130335), Portingtown (MDV129258) and Lower Horslett (MDV130073), support the interpretation that they are building platforms of a shrunken medieval hamlet. The footprint of the redundant building plots recorded at Tinney had evidently been retained following demolition of any structures, and by the mid-19th century they had been repurposed as garden and orchard. The re-use of former building

plots for orchard was also observed at Youngcott and Portingtown, suggesting that such redundant land was better suited for the growing of fruit trees than for other agricultural uses.

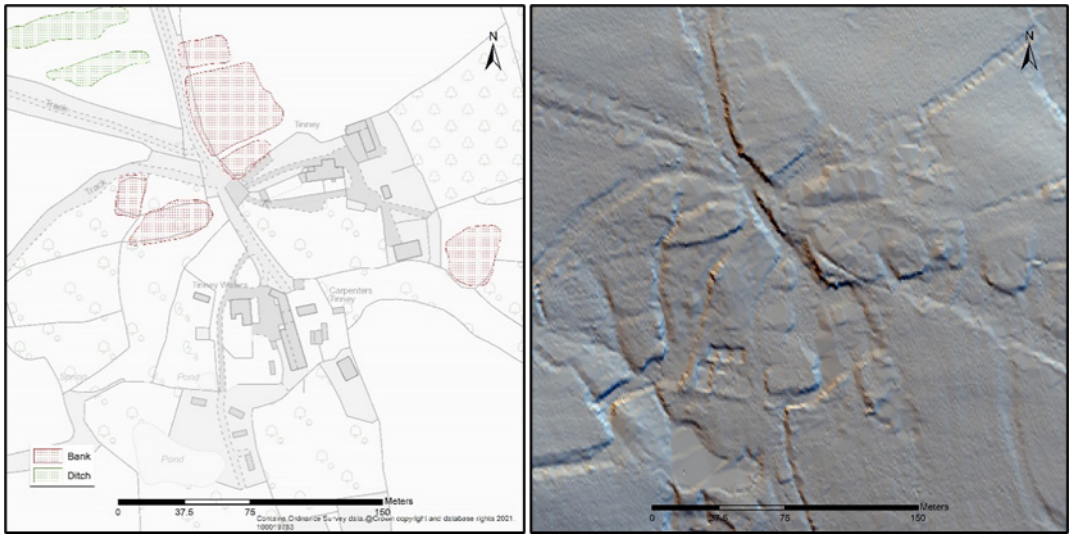

Figure 13: Shrunken settlement at Tinney (MDV130236). AI&M transcriptions, *left*, and lidar visualisation, *right*. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England. LIDAR Environment Agency LAST RETURN 19-DEC-2004 © Devon County Council.

An industrial landscape: Medieval and post-medieval mining

The history of the Tamar Valley has been more influenced by its geology and climate than most other areas of Devon. The area is rich in its reserves of copper, arsenic, silver, lead, tin, wolfram and manganese which were exploited from the medieval period onwards. The boom years of mining, however, were between the 18th to early 20th centuries, when at its height, over 100 mines were at work. It was this mineral wealth which led mining to dominate the industrial development of the Tamar Valley and become one of the most productive industrial centres in England (Booker 1967).

Fundamental to the success of mining in the area was the River Tamar, which not only provided the principal source of power for many of the mines in the area, via a series of leats, but was also a natural routeway for the industrial traffic. Other purpose-built infrastructure, such as the Tavistock Canal and a standard gauge mineral railway at Devon Great Consols Mine, completed in 1817 and 1859 respectively, served to connect up a number of the mines, as well as with other ancillary industries, to the industrial Tamar ports of Calstock and Morwellham (Cornwall and West Devon Mining Landscape nd, 63-66).

Monuments categorised as Industrial in character were well-represented in the survey records. Extractive pits and quarries, prospecting pits, mines and mine shafts, as well as spoil heaps, are a major component of this survey. Predictably, the vast majority of amended and newly created records that relate to mining were centred on the industrial heartland of the Tamar Valley, to the south-west of Tavistock, within Area 1 (Figure 14).

The more generic monument types such as extractive pits, quarries, spoil heaps and leats, which are not necessarily related to industrial mining, are excluded from the figures given below.

The majority of monuments recorded by this survey that relate to industrial-scale mining can probably be assigned to the period of the boom years of the 18th to early 20th centuries. Approximately three-quarters of these monuments were amended records. This high percentage is unsurprising given the importance of the Tamar Valley as an industrial landscape, the availability of documentary evidence and the amount of research and field investigation the area has consequently attracted. Despite this, the amended records, as well as those that have been newly created by this survey, have made an important contribution to our understanding of this World Heritage site. Of the amended records, only 60 per cent had been recorded by the Tamar Valley NMP survey. The remaining 40 per cent of sites not identified by the NMP survey again demonstrates the limitations of traditional aerial survey in areas such as the Tamar Valley where significant remains are likely to be covered in dense woodland. As mentioned above (see Section 4 The Survey Results: Comparison with the Understanding Landscapes community-generated data), mining features were less frequently identified by the Understanding Landscapes community team.

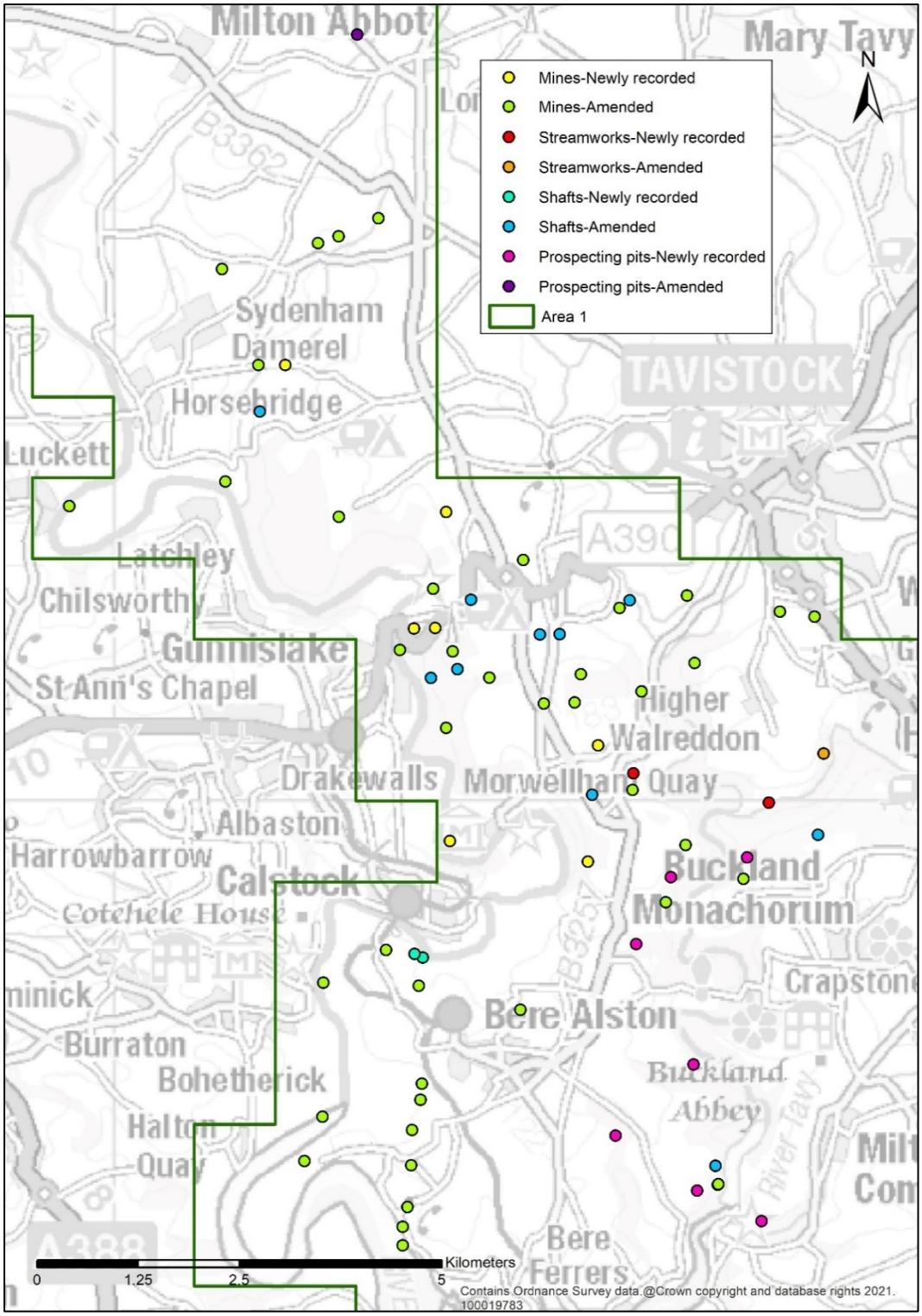

Figure 14: Distribution of the main monument types that relate to mining. Mines include copper, tin and lead mines. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783.

One particularly significant industrial feature recorded within the survey area is the Lumburn Leat (MDV63055). This is an early surviving example of a water management system associated with the silver mines at Bere Ferrers. Exploitation of silver bearing deposits in the Bere Ferrers peninsula is first recorded from the late 13th century when the Crown opened new mines here. These remained under royal control until at least 1349, after which time they were leased out. This area of the Tamar Valley was to become the centre of England's silver mining industry, until their closure in the mid-16th century (Rippon, Claughton & Smart 2009).

The Lumburn Leat was a purpose-built 16km long watercourse constructed in the late 15th century to divert water from the head of a tributary of the River Lumburn at Ogbear, west of Tavistock, down the Lumburn and Tamar valleys to the silver lead mines north of Lockridge Hill (Figure 15), bisecting the central region of Area 1. It was constructed to power suction lift pumps that drained the mines, combating the problems caused by working deeper deposits to respond to increasing demand for silver. In places, the leat had to be tunnelled through the bedrock, making it one of the most impressive engineering feats of medieval Devon, and its scale is possibly unique in England at this time (Rippon, Claughton & Smart 2009, 114-119).

Little in the way of previous research of the leat has been carried out. Several short sections of it were identified during the 1960s by Booker, but its function at this time was largely unclear (Booker 1967). More recent research in the 1990s followed by a survey of its surviving remains (Rippon, Claughton and Smart 2009) was able to confirm that it formed a single continuous feature, demonstrating its association with the water-powered pumps of the mines at Lockridge Hill. The leat was described as surviving in varying degrees of preservation, from subtle, barely perceptible earthworks to substantial cuttings. Better preserved earthworks were present along the slopes of the wooded combes.

This survey has helped to enhance our understanding of this leat by mapping several possible surviving sections along its length (MDV129483, MDV130557, MDV130558, MDV130737, MDV130741, MDV130750, MDV130846, MDV130847, MDV130848 and MDV130849). These were typically visible as subtle earthworks of ditch and/or banked features largely infilled or reduced through agricultural improvement.

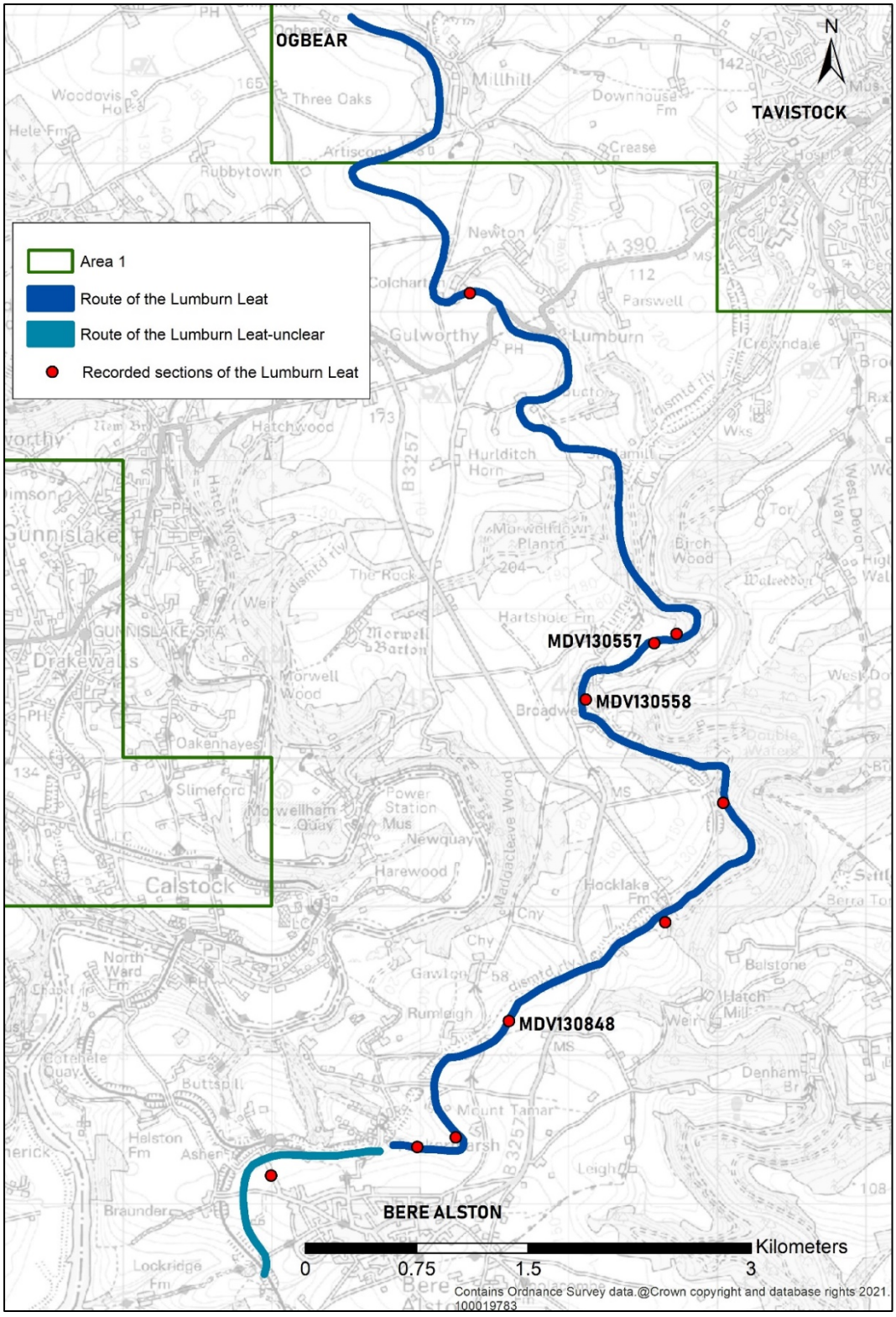

Figure 15: Route of the Lumburn Leat and possible recorded sections by the AI&M survey, showing monument numbers referred to in the text. Route of leat is reproduced with permission from Rippon, Claughton and Smart (2009, 112). The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783.

The most extensive remains of the leat were recorded at Broadwell (MDV130558; Figures 15 and 16). The earthworks, which were partly visible on aerial imagery taken from the 1940s onwards, survive as subtle curvilinear features comprising a ditch flanked on one or both sides by banks, between 2m and 5m wide, and extending to a length of *c* 520m along the contours of the east facing slope. A section of the disused leat had evidently been incorporated into a field boundary by the late 19th century. An additional short section of bank which defines a slight scarp (MDV130557; Figures 15 and 16) was also recorded just to the north-east.

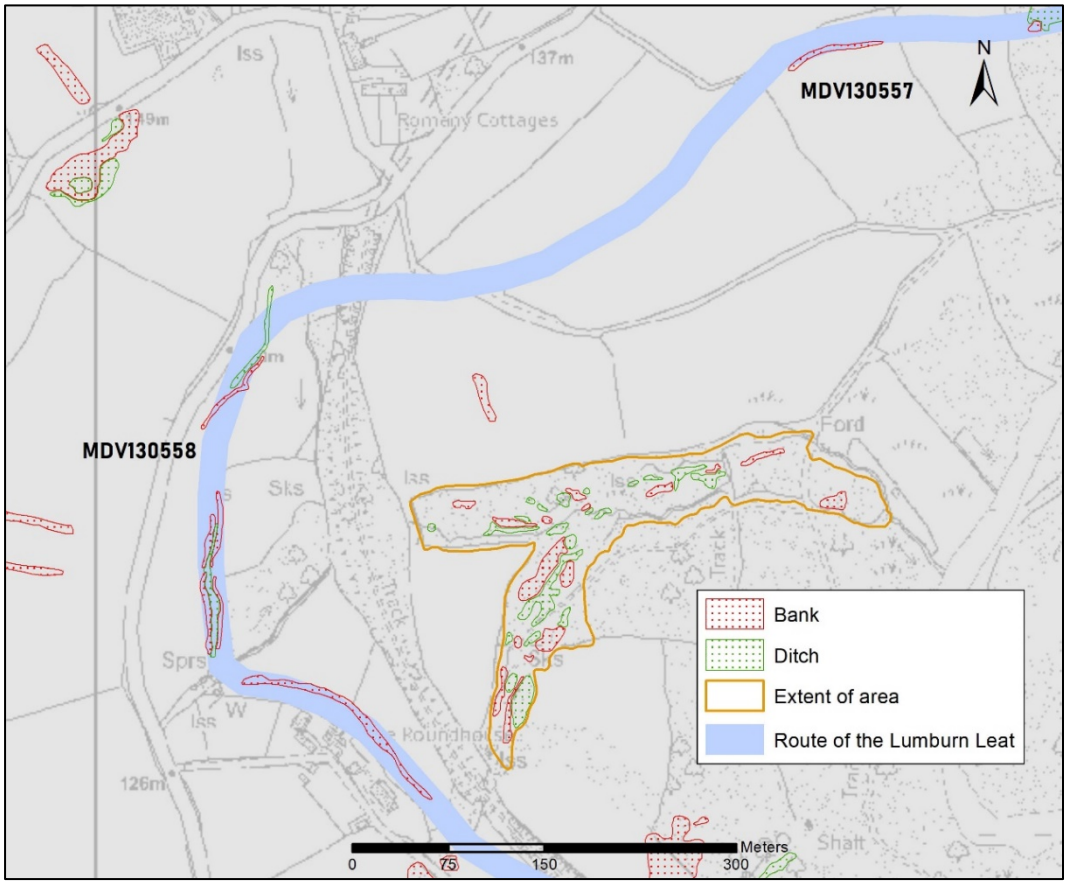

Figure 16: Recorded sections of the Lumburn Leat at Broadwell (MDV130557 & MDV130558). The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England.

Other recorded sections of the leat are only visible where they have been entirely incorporated and thus preserved within the later historic field pattern, where the redundant earthworks would have provided convenient boundaries. At Slymeford Farm (MDV130848; Figures 15 and 17), a 310m long section was recorded along the length of an extant field boundary. The earthworks here comprised a ditch, *c* 2m wide, flanked on each side by broad banks, *c* 5m wide.

The slightness of the surviving earthworks, their incorporation into later field patterns, and tree cover obscuring the ground surface probably account for the fact that no sections of the Lumburn Leat were identified during the Tamar Valley NMP survey.

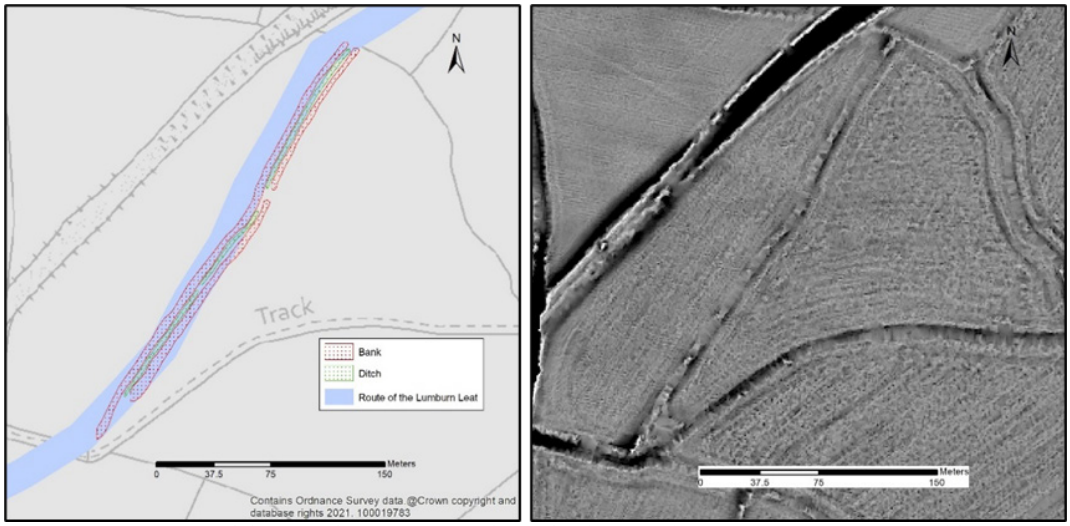

Figure 17: Section of the Lumburn Leat at Slymeford Farm (MDV130848) preserved by a later field boundary. AI&M transcriptions, *left*, and Environment Agency lidar visualisation, *right*. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England. LIDAR Environment Agency LAST RETURN 19-APR-2019 © Devon County Council.

The earliest references made to tin working in the survey area are at Bucktor in 1508 and at Crowndale in 1539. Tin was, however, probably exploited before this (Newman 2011, 3). Evidence of early tin working is recorded at several locations in the survey area and include evidence of openworks, for example at Morewelldown Plantation (MDV79980) and Wheal Crowndale (MDV3956), and streamworks, for example within the River Walkham Valley to the south of Lower Grenofen (MDV63696). Tin was also later mined in conjunction with other mineral resources, principally copper and arsenic, during the peak years of underground mining between the 18th to early 20th centuries, for example the mines of New Great Consols, Drakewells and East Russel.

The early tin industry is probably under-represented in the survey records due to surviving earthworks potentially being overshadowed by or confused with those from workings of later copper and arsenic mines, as seems to be the case of the openworks at Wheal Crowndale (MDV3956) for example. It is also possible that evidence of early tin workings has been completely subsumed by later industrial activity on the same site. Distinguishing between features from the different industries is not, therefore, straightforward.

Extensive earthworks of a previously recorded alluvial streamworks (MDV63696), with a possible newly recorded component to the south-west (MDV130513), were recorded along the Walkham Valley (Figure 18). Remains of these streamworks were partly surveyed in 1999 (Greaves & Passmore 1999, 3-4), but AI&M recording from lidar data has significantly enhanced the known extent of these earthworks and has much better defined their character.

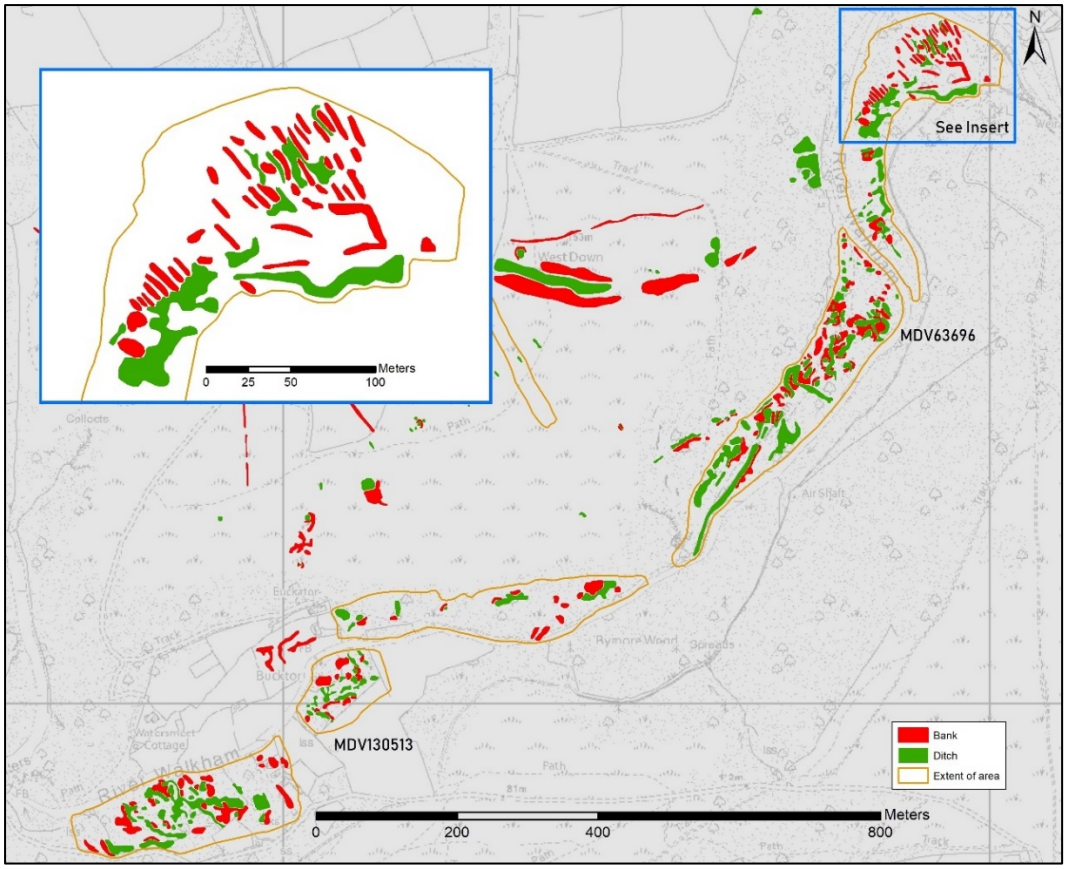

Figure 18: Streamworks (MDV63696 & MDV130513) recorded along the River Walkham Valley. The extent of the earthworks is defined by 'extent of area' polygons. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England.

The streamworks here occupy an area of some 14ha of floodplain either side of the River Walkham, close to where it feeds into the River Tavy. The earthworks are more random in form compared with many of their Dartmoor counterparts, which may be a direct result of the tin reserves here having been re-worked at a later date. An indication of how this streamworks originally operated is, however, clearly discernible to the north of the system at Grenofen Bridge (Figure 18 insert), where the earthworks are visible as a series of linear and curvilinear channels and banks perpendicular to the river. Here, the parallel trenches (tyes) would have been hand-dug through the tin ground, with the unwanted overburden dumped to form banks to one side of the tye. As work progressed, typically in an uphill direction, new tyes were dug, with the resulting spoil from each being dumped into the channel of its predecessor. Several surviving sections of leat, which would have diverted the flow of water from the River Walkham for the purpose of washing the tin, are also clearly visible along the length of MDV63696.

An additional, newly recorded, tin streamworks within Broadwell Wood (MDV130546; Figure 19) was also recorded *c* 1.5km to the north-west of those along the Walkham Valley, within a combe that also extends into the River Tavy valley. The earthworks here are less extensive at *c* 2.7ha and give little indication as to how the system operated.

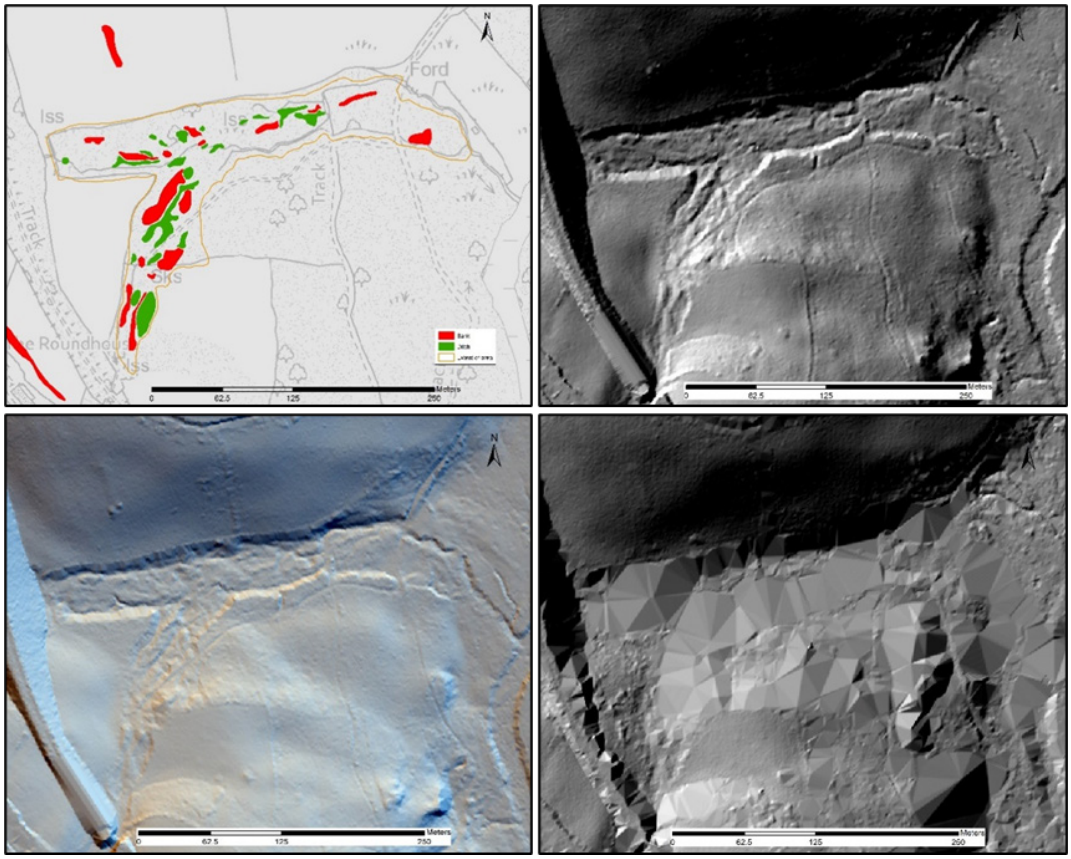

Figure 19: A possible streamworks recorded within Broadwell Wood (MDV130546). *Top left*, AI&M transcriptions, *top right*, Environment Agency Hillshade lidar visualisation, *bottom left*, Environment Agency Hillshade with 16 direction lighting and, *bottom right*, Tellus lidar Hillshade. The base map is © Crown Copyright and database right 2021. Ordnance Survey 100019783. AI&M transcriptions are © Devon County Council/Historic England. LIDAR Environment Agency LAST RETURN 17-JAN-2010 © Devon County Council. LIDAR Tellus LAST RETURN 01-JUL-2013 to 31-AUG-2013 © NERC (Centre for Ecology & Hydrology; British Antarctic Survey; British Geological Survey).

The subtle nature and amorphous form of these earthworks bear some similarity to landforms of geological origin. This, in addition to their topographic setting within the heavily wooded combes, makes identification of these important medieval mining landscape features difficult. The advantages of using multiple lidar visualisations to landscape survey is clearly demonstrated at Broadwell Wood, where the earthworks are better defined with the Hillshade visualisation than with Hillshade with 16 direction. The identification of such features is also clearly dependent on the availability of high quality lidar data, where Tellus lidar data within the survey area has been shown to be largely ineffective within woodland (Figure 19). For these reasons, it is possible that the remains of tin streaming, as well as other remnants of the tin industry, within the Tamar Valley are more extensive than has been recorded by this survey, especially where Environment Agency lidar data is not yet available.

Copper mining in the Tamar Valley, in comparison to the silver and tin industries, did not take hold in the area until the early 19th century, and was at its most prosperous between 1844 and 1870. Most mines operated intermittently into the 1880s, with a few continuing in use up until the early 20th century (Booker

1967). Their earthwork remains are characterised by numerous mine shafts and adits, spoil heaps, quarries and sites of mine buildings, as well as associated infrastructure such as leats and tramways.

The largest and most productive of these mines are those that make up Devon Great Consols (MDV3862). These extended over 60ha, employed over 1,200 workers and gave indirect employment to over 6,000 people in the area. The mines produced more copper in 1850 that any other site in western Europe. When its lodes began to fail by the late 19th century, which coincided with a fall in the price of copper, production was given over to arsenic, where output in 1869 was equal to half of the world's supply (Booker 1967, 143-161).

Many of the earthwork features and structures that make up these copper and arsenic mines are depicted on the late 19th and early 20th century First and Second Edition Ordnance Survey maps. Despite this, most visible earthwork elements of these mine workings were transcribed by this survey where their visible limits extended beyond those shown on these maps, or where additional detail and clarity could be provided. The transcriptions largely complement, but they also enhance, those derived from the Tamar Valley NMP survey, particularly since large areas of these former mine workings are located within extensive woodland.

In several instances, however, the Tamar/Lidar survey did not enhance the records of these mines, for example where no additional detail could be provided or where the earthworks appear to have since been levelled, as at East Wheal Crebor (MDV51353). Structures associated with these mines were, likewise, not identified during this survey, but they had often been transcribed from aerial photographs during the Tamar Valley NMP survey. This clearly demonstrates the continued value of using historic aerial photographs as a resource in future landscape surveys even in wooded areas, where there is not sufficient clarity on the available lidar, or where structures have since been demolished or sites completely levelled.

At Bedford United Mine (MDV3861), extensive earthworks of extractive workings and associated spoil heaps were visible as irregularly shaped pits and mounds. This mine was principally worked for copper, but also arsenic, tin, mundic and wolfram. Mundic and wolfram was mined and/or worked in the south-west part of this complex, which was possibly established, or re-activated, in the late 19th to early 20th centuries, after the copper working site to the north-east had been abandoned (Figure 20). This survey has been able to significantly increase the known extent of earthworks in this location, adding to what was visible during both previous survey, where much of the area was covered by woodland, and to what was depicted on historic maps.

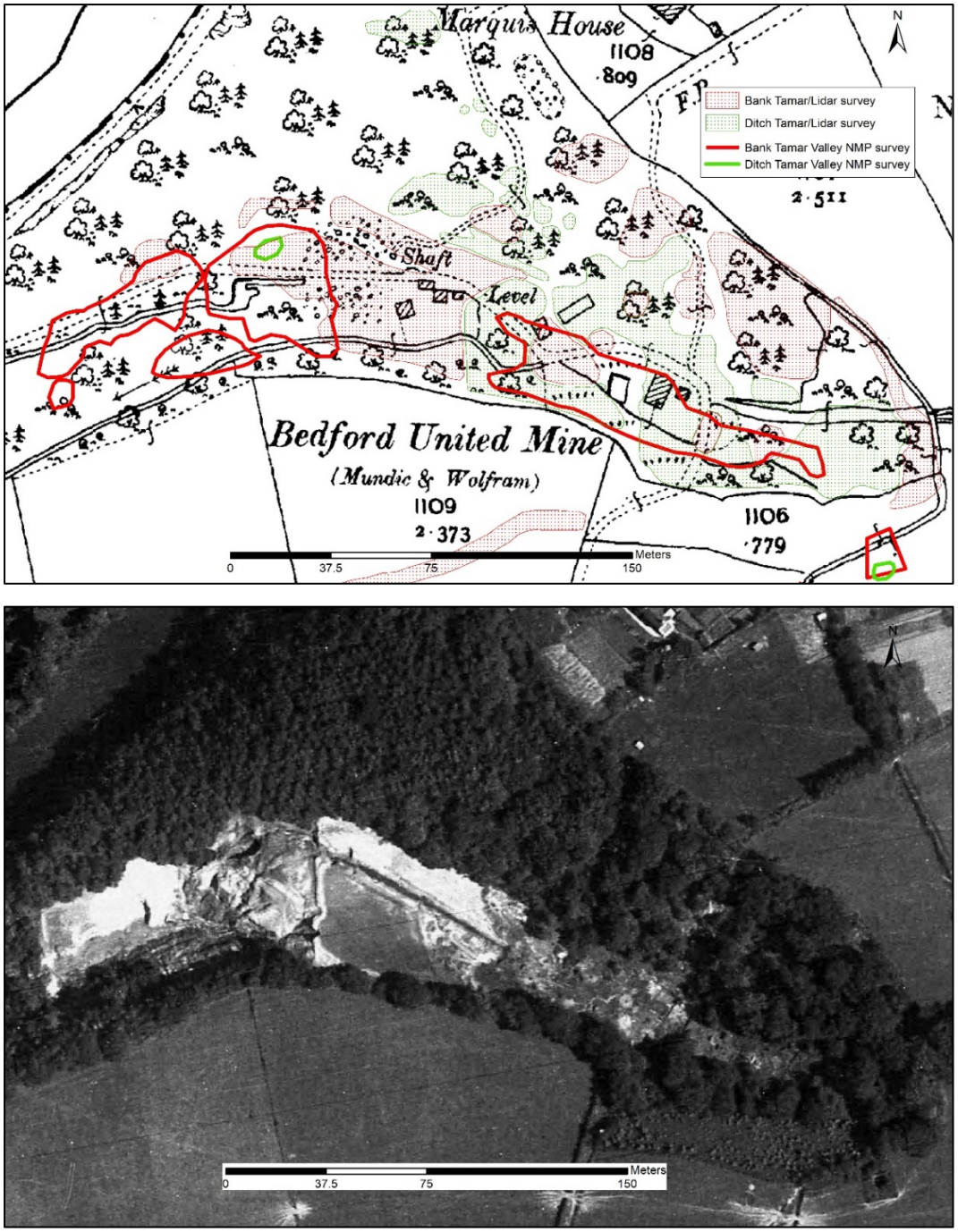

Figure 20: AI&M transcriptions and earthworks at Bedford United Mine (MDV3861). *Top*, AI&M transcriptions against the Second Edition Ordnance Survey map and, *bottom*, earthworks partly visible on RAF aerial photographs of the mid-1940s, where tree cover obscures many of the earthworks that are visible on lidar data. Second Edition Ordnance Survey 25-inch map © Crown copyright and Landmark Information Group Ltd. AI&M transcriptions are © Devon County Council/Historic England. Devon County Council 1946-1949 RAF Aerial Photograph mosaic.

6. RECOMMENDATIONS

A list of specific recommendations for future projects that have a similarly strong community component and those which revisit previous NMP/AI&M survey areas, as well as general recommendations for single source survey projects, are summarised below:

- General
    - Where possible, ensure survey data from either previous NMP/AI&M surveys or community-based projects is fully reviewed and assessed at the Project Design stage, and any implications of this data, for example where survey data is incomplete, or where different recording methodologies have been used, is considered and mitigated against accordingly.
    - If, for any reason, lines of communication between any of the parties involved (survey team, project funders, HER officers and community-based project team members) is impeded, consider pausing the survey until this can be remedied.
    - Build in time at the Project Design stage for site visits to potential features of geological origin, where an absence of aerial photographs makes appreciation of the landform difficult.
- Previous NMP/AI&M surveys;
    - The survey will be more streamlined if records and transcriptions of any previous NMP/AI&M projects are fully accessioned onto the relevant HER, complete with relevant reports and documentation. This will help facilitate the interpretation and re-assessment of archaeological monuments recorded by these earlier surveys, reduce unnecessary delays and also allow for more meaningful quantifications to be made, particularly for those surveys without a lidar component. If this information hasn't been fully accessioned, then an appropriate amount of time will be needed to deal with this.
- Community-based surveys;
    - At an early stage, highlight to community project teams the advantages of using HER and AI&M standards of monument recording and reporting, as outlined for example by Historic England (Winton 2020), and standardised recording terminologies, such as the FISH thesaurus (http://www.heritage-standards.org.uk/wp-content/uploads/2020/02/Mon_class.pdf), to ensure greater consistency of recording, avoid ambiguous or misleading monument descriptions and facilitate efficient accessioning onto the relevant HER.
    - Realistic time allowance to be built in at the Project Design stage to allow for the checking, assessment and recording of community project team data.
    - More generous time allowance to be built in at the Project Design stage to allow for greater interaction with the community project

team, for example to promote exchange and discussion of ideas and to provide regular feedback and comments on more unusual, uncertain or locally distinctive archaeological features. For projects undertaken remotely, a dedicated forum set up in advance of a survey would help to facilitate this and embed a pattern of co-operation between the different project teams. Other avenues to explore might be in-person or remote learning workshops.

- Ensure that community-generated data is produced to a consistent standard and subject to quality assurance to help minimise delays and ensure efficient working by the AI&M survey team.
- Ensure that any AI&M survey team are mindful of the recording methodologies of a community-based project and have access to the datasets used. This is important, for example, in cases where archaeological features are identified by a community team using more bespoke lidar visualisations, because features do not manifest in the same way on different visualisations. This will ensure a better understanding and allow for more efficient assessment of community-generated data.

7. FURTHER WORK

A list of sites where further work would be of particular benefit, and where consideration for heritage protection or adjustments to existing designation extents is recommended, is included as Appendix 5.

There are six sites where the scheduled area does not quite encompass all of the earthworks visible on lidar. For these barrows and hilltop enclosures a reassessment of the designated extent might be worthwhile, to better reflect the surviving remains.

A few newly recorded barrows are suggested for possible heritage protection, one of an unusual disc shape, and another that may form part of a wider barrow cemetery. Consideration of the two hilltop enclosures at Lifton of possible Iron Age and early medieval date is also recommended. An unusually large area of well-defined medieval strip field boundaries and lynchets around Milton Abbot may also be worthy of consideration. Of particular interest though are the possible sections of the Lumburn Leat, significant for their association with early silver mining (see Section 5 The Survey Results: An industrial landscape), which are potentially threatened by tree root growth and neglect.

Although very many of the sites identified during this survey would repay further work, only a selection have been listed here, due to space constraints. These are monuments where it is considered that further work would be particularly beneficial. Most of the work recommended starts with a site visit. In some cases, this is to establish whether features are genuine and undisturbed, especially when vegetation cover limits interpretation. Checking how well-established some earthworks are is recommended in some cases to confirm whether they are likely to be of modern origin. Viewing subtle earthworks on the ground can assist in understanding topographic setting and also inform future interpretations of features visible on lidar that manifest in a similar way. Ground assessment of several of the shrunken settlements could clarify whether the earthworks are consistent with an interpretation as building platforms, or just small enclosures.

Further remote sensing in the form of geophysical survey is recommended for several monuments to better define extents and identify internal features that would help to confirm interpretations. Earthwork survey and excavation is recommended in cases where this would clarify phases and relationships between monuments and produce evidence that would characterise the type, date and operation of some sites, particularly industrial ones. For a few mining sites, a greater degree of caution than usual would be needed for any further investigations. Fencing or walling of deep workings such as mine shafts might be appropriate for safety reasons, if undertaken in a manner sympathetic to their landscape setting and significance.

In addition to the list presented in this report, the feedback provided to the ULP volunteer community could usefully be interrogated to identify a set of monuments where a site visit would enhance interpretations and develop knowledge, either as a future phase of the Understanding Landscapes project, or as a separate volunteer project.

8. CONCLUSIONS

The Tamar/Lidar survey has added 781 previously unrecorded monuments to the Devon HER. A total of 211 further monuments have been substantially enhanced by the survey. This equates to *c* 4.5 newly created or amended monument records and associated transcription data for each square kilometre within the Devon HER admin area.

The data generated by this survey has been recorded directly into the Devon HER according to Historic England's AI&M standards, ensuring that the survey's findings are available immediately to researchers, for consideration in planning and environmental management matters, and accessible online by the public via Heritage Gateway and Devon County Council's Environment Viewer.

Fundamental to the approach of this survey has been its partnership with the University of Exeter's Understanding Landscapes project, as part of a collaborative approach towards landscape investigation. One of its principal aims was to support and enhance community-led interpretation of archaeological monuments and landscape features from lidar-derived visualisations. In working towards this aim, the data received from the community project team has been systematically assessed and interpreted against the AI&M lidar visualisations and other available datasets.

A combined spreadsheet of the original Understanding Landscapes project data was created by the AI&M survey team and updated with our interpretations, along with constructive comments and relevant HER monument numbers. This spreadsheet, together with a pdf of all monument records created and amended as part of this survey, has been submitted to the Understanding Landscapes Project Manager as feedback for the community team for use in conjunction with the transcriptions that have been made publicly available online on the Devon Environment Viewer. Its purpose is to further refine and develop the identification and interpretation skills already acquired by the community team and to help build such capacity for future projects. A list of recommended sites for ground survey also presents a valuable opportunity for further community-led work.

From the data provided by the Understanding Landscapes project, it has been possible to make a quantified assessment of a number of general trends or biases, where certain classes of monument for instance are possibly over-represented, such as barrows, at the detriment of other more locally distinctive features with which the community project team may be unfamiliar with, such as catchmeadows and orchard banks. Such trends or biases are an important consideration for future community-based projects.

This survey has also provided a quantified assessment of lidar data's contribution to landscape survey, in an area previously assessed by traditional aerial survey methods. It has demonstrated that lidar data has significantly enhanced our understanding of the historic landscape, for example, by improving upon the spatial accuracy and clarity of these earlier transcriptions, as well as providing additional detail. This was most apparent with the complexes of mining earthworks in the wooded valleys of Area 1. Perhaps most importantly, the use of lidar data has significantly increased the number of previously unrecorded sites

that are not easily identifiable using aerial photographs, such as the subtle earthworks of the medieval strip field systems surrounding Milton Abbot.

Further examples of how this survey has built on and enhanced the data provided by the Understanding Landscapes project team and the Tamar Valley NMP project are provided in several case studies in this report.

Several broad conclusions can be drawn with regards to the methodological outcomes of this survey. From the project team's perspective, consultation of only recent digital sources, excluding the aerial photographs that would be viewed in stereo in a conventional AI&M survey, had some drawbacks. As well as physical considerations (the project was felt to be more tiring to the eye), the dearth of imagery dating to between the 1940s and 2000s meant that understanding of the development of the landscape was more limited. This often made it more difficult to judge whether earthworks seen on the lidar data were the relicts of 20th century activity, such as pipelines, landscaping, poaching around cattle troughs and millennium beacons. An indistinct earthwork ring ditch (MDV129493) at Beckaton illustrates this impediment. The feature could have been recorded (or dismissed) with a much greater degree of confidence if a wide range of aerial sources had been available for consultation, in order to discount (or identify) modern activity that might have caused this anomaly.

Exclusion of aerial photographs was also considered to give the surveyor less of a sense of the landform, making initial interpretations slower, for example when deciding whether ridging was geological or potentially archaeological. Had circumstances allowed, an element of fieldwork in the form of site visits would have been valuable near the start of the project, to confirm initial interpretations of some of the more subtle features (for example MDV130800). The impact of this drawback reduced over time, as frequent discussions allowed the AI&M survey team to share experience and knowledge, but might be an area where increased formal quality assurance as well as site visits would help with the accuracy and speed of interpretation.

It is possible that some of the features mapped by this survey were not archaeological, but have been erroneously recorded. In a very few cases where a feature had been noted by the volunteers, but judged to be non-archaeological by the AI&M survey team, it was recorded as a non-antiquity to avoid similar instances of misinterpretation in the future. In some other instances, interpretation was very uncertain and it would have been useful in these examples to have had access to the same visualisations as those consulted by the community project team. As there was no time or opportunity, given the public health restraints, to refine interpretations by stereo-viewing hard copy aerial photographs or undertaking site visits, these uncertain features have been flagged as 'possible' in the HER, to prompt further investigation in the future.

However, the negatives of this type of survey can be easily mitigated in future projects by building in increased quality assurance procedures, an element of ongoing ground recording and checking, and greater volunteer interaction. The benefits are numerous and compelling. Existing records can be enhanced with greater precision, detail and extent. New sites can be identified as subtle earthworks and in places where they were previously hidden by vegetation,

especially as Environment Agency lidar coverage improves. There is excellent scope for volunteers to learn reflexively from more intensive and continued feedback, training in certain specific areas of landscape archaeology, and follow-on projects to assess the sites on the ground.

9. REFERENCES

Booker, F 1967 *Industrial Archaeology of the Tamar Valley*. Newton Abbot: David & Charles

Cornwall and West Devon Mining Landscape nd *World Heritage Site Management Plan 2005-2010*

Church, S 2002 *The Devon Landscape, An Appraisal of Devon's Landscape at the Beginning of the 21st Century*. Tiverton: Devon Books

Evans, S 2019 *Historic England Aerial Investigation & Mapping (formerly National Mapping Programme) Standards Technical Review*. Historic England Research Report Series no. 46-2019

Ferraccioli, F Gerard, F, Robinson, C, Jordan, T, Biszczuk, M, Ireland, L, Beasley, M, Vidamour, A, Barker, A, Arnold, R, Dinn, M, Fox, A and Howard, A 2014 *LiDAR based Digital Surface Model (DSM) data for South West England*. NERC Environmental Information Data Centre. https://doi.org/10.5285/b81071f2-85b3-4e31-8506-cabe899f989a

Greeves, T and Passmore, A 1999 'Report on recent work in the Walkham Valley' *DTRG Newsletter* **17**, 3-4

Griffith, F and Quinnell, H 1999 'Barrows and ceremonial sites in the Neolithic and Earlier Bronze Age' *in* Kain, R and Ravenhill, W (eds) *Historical Atlas of South-West England*. Exeter: University of Exeter Press

Hegarty, C, Knight, S and Sims, R 2018 *The Blackdown Hills Area of Outstanding Natural Beauty & East Devon River Catchments Aerial Investigation and Mapping Survey* Historic England Research Report Series no. 24-2018

Hegarty, C 2020 *Tamar/Lidar; A Single Source Approach to Landscape Survey and Socially Distanced Community Archaeology*. Unpublished Project Design. AC archaeology Document no. ACD2270/1/4

Historic England 2012 *Historic Environment (MoRPHE) Project Planning Note 7: Interpretation and mapping from aerial photographs and other aerial remote sensed data*. Historic England

Historic England 2019 *Aerial Investigation and Mapping Technical Specification*. Historic England

Kokalj, Ž, Somrak, M 2019 *Why Not a Single Image? Combining Visualizations to Facilitate Fieldwork and On-Screen Mapping*. *Remote Sensing* ***11***(**7**), 747

Newman, P 2011 *Mining in the Tavy Valley, West Devon: An Assessment of Archaeological Potential*. Unpublished report, South-West Landscape Investigations

Quinnell, H 1988 'The local character of the Devon Bronze Age and its interpretation in the 1980s'. *Proceedings of the Devon Archaeological Society* **46**, 1-14

Rippon, S, Claughton, P and Smart, C 2009 *Mining in a Medieval Landscape. The Royal Silver Mines of the Tamar Valley*. Exeter: University of Exeter Press

Smith, M and Brickley, M 2009 *People of the Long Barrows: Life, Death and Burial in the Earlier Neolithic*. The History Press: Stroud

Taylor, E 2002 *Cornish Mining World Heritage Site Bid, NMP Mapping in West Devon*. Cornwall Archaeological Unit report

Turner, S 2007 *Ancient Country: The Historic Character of Rural Devon*. Exeter: Devon Archaeological Society, Occasional Paper 20

Winton, H 2020 *Standards for Aerial Investigation and Mapping projects*. Historic England

Woodward, A 2000 *British Barrows: A Matter of Life and Death*. Stroud: Tempus

Young, A 2007 *Cornwall and Isles of Scilly Mapping Project: A Report for The National Mapping Programme*. Historic England Research Report 111/2007

APPENDIX 1: Comparison of monument types in Area 1, grouped by top term (in bold).

The two left columns list the monuments that were recorded from lidar data and not seen on the aerial photographs, and the two right columns list the monuments recorded from aerial photographs during the NMP project and not subsequently seen on the lidar. Arranged within broad categories (HER 'Top Terms') and by incidence (most numerous at the top). MONUMENT <BY FORM> is a wide-ranging category in which form rather than function is deemed useful for HER searches, and as such is often well-represented in AI&M surveys (including for example field boundaries and enclosures).

Recorded only from lidar	% Lidar	Recorded only from aerial photographs	% APs
INDUSTRIAL	**37.1**	**MONUMENT <BY FORM>**	**39.9**
EXTRACTIVE PIT	15.4	FIELD BOUNDARY	29.8
SPOIL HEAP	6.2	ENCLOSURE	4.2
QUARRY	4.6	MOUND	1.3
MINE	1.8	FIELD BOUNDARY (POSSIBLE)	0.9
MINE SHAFT	1.2	OVAL ENCLOSURE	0.7
LEAT	1.0	RECTILINEAR ENCLOSURE	0.7
EXTRACTIVE PIT (POSSIBLE)	1.0	CURVILINEAR ENCLOSURE	0.7
LEAT (POSSIBLE)	0.7	FEATURE	0.2
PROSPECTING PIT	0.7	ENCLOSURE (POSSIBLE)	0.2
TIN MINE	0.6	NATURAL FEATURE (POSSIBLE)	0.2
SPOIL HEAP (POSSIBLE)	0.4	EARTHWORK	0.2
COPPER MINE	0.4	PILLOW MOUND	0.2
STREAMWORKS	0.4	LINEAR FEATURE	0.2
PROSPECTING PIT (POSSIBLE)	0.4	DITCH	0.2
MINE (POSSIBLE)	0.4	DOUBLE DITCHED ENCLOSURE	0.2
LEAD MINE	0.3	**AGRICULTURE AND SUBSISTENCE**	**17.8**

WHEEL PIT	0.3	FIELD SYSTEM	5.7
ADIT	0.3	ORCHARD	4.4
CHARCOAL BURNING PLATFORM (POSSIBLE)	0.1	MARKET GARDEN	2.6
HORSE WHIM	0.1	RIDGE AND FURROW	2.2
QUARRY (POSSIBLE)	0.1	ALLOTMENT	1.1
CHARCOAL BURNING PLATFORM	0.1	CATCH MEADOW	0.7
ENGINE HOUSE	0.1	CATCH MEADOW (POSSIBLE)	0.4
MONUMENT <BY FORM>	29.6	FIELD SYSTEM (POSSIBLE)	0.4
FIELD BOUNDARY	23.7	PILLOW MOUND	0.2
FIELD BOUNDARY (POSSIBLE)	1.8	INDUSTRIAL	14.9
MOUND	0.6	QUARRY	6.6
NATURAL FEATURE (POSSIBLE)	0.4	MINE SHAFT	2.2
CURVILINEAR ENCLOSURE	0.3	SPOIL HEAP	1.5
HOUSE PLATFORM (POSSIBLE)	0.3	MINE	0.9
ENCLOSURE (POSSIBLE)	0.3	LEAT	0.9
ENCLOSURE	0.3	EXTRACTIVE PIT	0.7
HA HA	0.3	PROSPECTING PIT	0.7
OVAL ENCLOSURE	0.1	COPPER MINE	0.4
BOUNDARY	0.1	TIN MINE	0.4
RECTANGULAR ENCLOSURE (POSSIBLE)	0.1	BRICKWORKS	0.2
BUILDING PLATFORM (POSSIBLE)	0.1	WATER WHEEL	0.2
BUILDING PLATFORM	0.1	TIN WORKS	0.2
CURVILINEAR ENCLOSURE (POSSIBLE)	0.1	TRANSPORT	7.7
PALAEOCHANNEL (POSSIBLE)	0.1	TRACKWAY	3.7
MOTTE AND BAILEY	0.1	QUAY	3.1

RING DITCH	0.1	HOLLOW WAY	0.4
FARMSTEAD	0.1	TRAMWAY	0.2
NATURAL FEATURE	0.1	HARD	0.2
AGRICULTURE AND SUBSISTENCE	**14.3**	**GARDENS PARKS AND URBAN SPACES**	**6.1**
FIELD SYSTEM	6.8	ORCHARD	4.4
CATCH MEADOW	2.9	ALLOTMENT	1.1
ORCHARD	1.5	ORNAMENTAL GARDEN	0.2
ORCHARD (POSSIBLE)	0.6	GARDEN	0.2
LYNCHET	0.4	GARDEN FEATURE	0.2
RIDGE AND FURROW (POSSIBLE)	0.3	**UNASSIGNED**	**3.7**
NARROW RIDGE AND FURROW	0.3	SHAFT	1.3
STRIP FIELD	0.1	BOMB CRATER	0.9
RIDGE AND FURROW	0.1	PIT	0.9
STRIP LYNCHET (POSSIBLE)	0.1	BUILDING	0.4
FARMYARD (POSSIBLE)	0.1	HOLLOW	0.2
FARMSTEAD	0.1	**WATER SUPPLY AND DRAINAGE**	**3.5**
NARROW RIDGE AND FURROW (POSSIBLE)	0.1	LEAT	0.9
STRIP FIELD (POSSIBLE)	0.1	WATER CHANNEL (POSSIBLE)	0.7
CATCH MEADOW (POSSIBLE)	0.1	WATER CHANNEL	0.7
LYNCHET (POSSIBLE)	0.1	DRAINAGE DITCH	0.4
FIELD SYSTEM (POSSIBLE)	0.1	RESERVOIR	0.2
TRANSPORT	**7.6**	DRAINAGE DITCH (POSSIBLE)	0.2
TRACKWAY	4.6	DRAIN	0.2
TRACKWAY (POSSIBLE)	1.9	DRAINAGE SYSTEM	0.2
HOLLOW WAY	0.4	**MARITIME**	**3.5**
CAUSEWAY	0.3	QUAY	3.1
HARD	0.1	DRAINAGE SYSTEM	0.2

ROAD (POSSIBLE)	0.1	HARD	0.2
ROAD	0.1	**DEFENCE**	**1.5**
UNASSIGNED	**3.2**	MILITARY CAMP	1.3
SHAFT	2.5	ANTI AIRCRAFT BATTERY	0.2
VENTILATION SHAFT	0.1	**RECREATIONAL**	**0.7**
TERRACED GROUND	0.1	TENNIS COURT	0.7
PIPELINE	0.1	**MILITARY DEFENCE AND FORTIFICATION**	**0.4**
NON ANTIQUITY	0.1	MILITARY SITE (POSSIBLE)	0.2
PIT	0.1	BOMB CRATER	0.2
WATER SUPPLY AND DRAINAGE	**3.2**	**DOMESTIC**	**0.2**
LEAT	1.0	BARRACKS	0.2
LEAT (POSSIBLE)	0.7		
DRAINAGE DITCH (POSSIBLE)	0.4		
WATER CHANNEL	0.3		
FLOOD DEFENCES	0.3		
WATER CHANNEL (POSSIBLE)	0.1		
DRAIN	0.1		
POND	0.1		
GARDENS PARKS AND URBAN SPACES	**2.9**		
ORCHARD	1.5		
ORCHARD (POSSIBLE)	0.6		
HA HA	0.3		
GARDEN FEATURE	0.3		
GARDEN FEATURE (POSSIBLE)	0.1		
GARDEN TERRACE	0.1		
DOMESTIC	**1.2**		
SHRUNKEN VILLAGE	0.4		

SETTLEMENT (POSSIBLE)	0.3	
DESERTED SETTLEMENT	0.3	
DESERTED SETTLEMENT (POSSIBLE)	0.1	
MARITIME	**0.4**	
FLOOD DEFENCES	0.3	
HARD	0.1	
MILITARY DEFENCE AND FORTIFICATION	**0.1**	
RIFLE RANGE	0.1	
RELIGIOUS RITUAL AND FUNERARY	**0.1**	
BARROW	0.1	
DEFENCE	**0.1**	
MOTTE AND BAILEY	0.1	

APPENDIX 2: Community-generated data within the project area, categorised by the aerial survey team.

Interpretation	Recorded in HER?	% of volunteer points	
		Area 1	Area 2
Matching interpretations	Yes	45	37
Mismatching interpretations	Yes	6	8
Possible archaeological feature	Yes	<1	3
Natural feature	No	15	19
Modern agricultural feature	No	14	11
Outside scope of HER recording policy	No	15	10
Not seen on available lidar imagery	No	3	8
Lidar processing artefact	No	1	2
Point not found	No	<1	1
Duplicate comment	No	1	1

APPENDIX 3: Comparison of types of monument recorded in the Tamar/Lidar survey, compared with just those records that incorporated volunteer data.

Monument Types	% of all records	% of ULP records
INDUSTRIAL	34	20
MONUMENT <BY FORM>	32	38
AGRICULTURE AND SUBSISTENCE	14	22
TRANSPORT	5	6
GARDENS PARKS AND URBAN SPACES	4	4
WATER SUPPLY AND DRAINAGE	3	2
UNASSIGNED	2	1
RELIGIOUS RITUAL AND FUNERARY	2	4
DOMESTIC	2	3
MARITIME	<1	<1
DEFENCE	<1	0
RECREATIONAL	<1	0
MILITARY DEFENCE AND FORTIFICATION	<1	0

APPENDIX 4: Monuments categorised by 'period from'.

	% of monuments
Prehistoric	4
Medieval	45
Post Medieval	39
Modern	12

APPENDIX 5: Sites recommended for further work or heritage protection.

Sites recommended for heritage protection consideration or amendment listed first. Inclusion on this list does not imply public access.

Site name	Period	Monument UID	Recommended work	Comments
Disc barrow south-west of Strawberry Bank, Pyworthy	Bronze Age	MDV7124	Consider Heritage Protection	The barrow is visible as a ringed bank surrounded by an outer ditch. The central area within the ringed bank is possibly raised. This is an unusual type of barrow similar in style to a disc barrow. Consider for scheduling, given its unusual form.
Various field systems around Milton Abbot	Medieval	MDV130325 MDV130418 MDV130419 MDV130420 MDV130422	Consider Heritage Protection	Extensive remains of medieval strip field systems are visible around Milton Abbot, incorporating lynchets in places as well as boundary banks. It is rare to see earthwork survival covering such a wide area.
Hillfort in Lifton Wood	Iron Age	MDV108533	Consider Heritage Protection; Excavation	Earthworks of banks and ditches of a recently discovered Iron Age hillfort within Lifton Wood. Earthworks transcribed from this survey suggests two possible phases. The hillfort has been subject to an earthwork survey, but further investigations, such as targeted trenching, would help to clarify its phasing and date. Recommended for heritage protection in conjunction with the possible outer Saxon enclosure (MDV130053).

Curvilinear enclosure within Lifton Wood, Lifton	Early Medieval	MDV130053	Consider Heritage Protection; Excavation	Earthworks of curvilinear banks and a ditch that define a large curvilinear enclosure around the contours of a prominent hilltop and hillfort (MDV108533). Given the strategic importance of Lifton in the late Anglo-Saxon period, it may be that the hillfort saw a period of reuse at this time, and that this enclosure was part of this reworking. The site has been visited but would benefit from further investigation, such as targeted trenching, to help ascertain its date and relationship to the hillfort (MDV108533). Recommended for heritage protection in conjunction with the hillfort.
Surviving sections of the Lumburn Leat MDV63055	Medieval	MDV130557 MDV130558 MDV130737 MDV130750 MDV130741 MDV129483 MDV130846 MDV130847 MDV130848 MDV130849	Consider Heritage Protection; Site visit	Possible surviving sections of the Lumburn Leat visible as earthworks of banks and ditches. The leat is of national importance and is an early surviving example of a water management system associated with lead and silver smelting. A site visit is recommended for these possible surviving sections to help establish the origin and extent of these earthworks. Well-preserved representative lengths should be considered for heritage protection.
Barrow at Highermoor Cross, Pancrasweek	Bronze Age	MDV129826	Consider Heritage Protection; Site visit	A sub-circular earthwork mound visible on lidar and interpreted as a Bronze Age barrow. It forms part of a barrow cemetery made up of a linear group of 6 barrows. A site visit is recommended initially in view of heritage protection to assess the condition of the earthworks. Three barrows to the east are scheduled.

Bowl Barrows north-west of Gorvin Farm, Hartland	Bronze Age	MDV11609	Review Heritage Protection	The earthwork appears to extend beyond the scheduled area. Recommend re-examining the area and extending if necessary.
Bowl Barrows north-west of Gorvin Farm, Hartland	Bronze Age	MDV11610	Review Heritage Protection	The earthwork does not exactly correlate to the OS mapped or scheduled area. Recommend re-examining the area and amending if necessary.
Enclosure on Bera Tor, Buckland Monachorum	Iron Age	MDV5484	Review Heritage Protection	The earthworks visible on lidar appear to extend beyond the scheduled area. Revision may be worthwhile.
Bowl barrow north-east of Bridgemoor Cross, Bridgerule	Bronze Age	MDV7123	Review Heritage Protection	Recommend a slight extension of the scheduled area to incorporate the possible outer barrow ditch by up to 3m.
Northcott Wood Camp	Iron Age	MDV2760	Review Heritage Protection	Recommend the scheduled area is expanded to include the adjacent enclosure (MDV2763).
Hilltop Enclosure north-west of Lucy Cleave Wood	Iron Age	MDV2689	Review Heritage Protection	Scheduled area does not encompass full extent of ditch. Revision may be worthwhile.
Shrunken settlement at Youngcott, Sydenham Damerel	Medieval	MDV130335	Site visit	This is one of numerous probable shrunken or deserted medieval settlements recorded during the project. Further survey work could help to ascertain the extent of archaeological remains west of the road, starting with a site visit.

Shrunken settlement at Portingtown, Sydenham Damerel	Medieval	MDV129258	Site visit	This possible shrunken settlement was identified by volunteers and a site visit might help to establish whether the platforms are likely to be archaeological or whether they have a possible modern origin.
Shrunken settlement at Collacombe Barton, Lamerton	Medieval	MDV130780	Site visit	This is one of numerous probable shrunken or deserted medieval settlements recorded during the project. Further survey work could help to clarify whether building platforms were present or whether the enclosures are just infields.
Possible curvilinear enclosure south-east of Warleigh Barton, Bickleigh	Iron Age	MDV130794	Site visit; Aerial survey	A curvilinear bank possibly defines the northern edge of a newly recorded late prehistoric or Roman date curvilinear enclosure. It is sited 120m to the north of a complex of cropmark enclosures. A site visit and further targeted aerial reconnaissance is recommended to help establish more fully the extent and character of this possible enclosure.
Possible building platform or motte at Dux Farm, Bridgerule	Medieval	MDV129708	Site visit; Geophysical survey	A sub-ovoid, flat-topped enclosure is interpreted as a possible medieval building platform or landscaped motte. A site inspection, possibly followed by geophysical survey, may help to clarify the origin of this earthwork and the nature and layout of below-ground remains.
Settlement on the south-west side of Druxton, St Giles on the Heath	Medieval	MDV130068	Site visit; Geophysical survey	Possible deserted settlement features; a site visit to assess whether there is any modern ground disturbance, and subsequent remote sensing survey to identify below-ground remains, could help confirm this interpretation.

Settlement on the north side of Druxton, St Giles on the Heath	Medieval	MDV130179	Site visit; Geophysical survey	Possible deserted settlement earthworks; a site visit to assess whether there is any modern ground disturbance, and subsequent survey if warranted, could help confirm this interpretation.
Settlement south-east of Pool, St Giles on the Heath	Medieval	MDV130196	Site visit; Geophysical survey	Possible deserted settlement features; a site visit to assess whether there is any modern ground disturbance, and subsequent survey if warranted, could help confirm this interpretation.
Devon Mine, Lamerton	Modern	MDV3823	Site visit; Mitigation works	The shafts appear to survive as clearly defined circular cut features, and safety fencing may be appropriate.
Tin streamworks south of Lower Grenofen, Whitchurch and Buckland Monachorum	Medieval	MDV63696	Earthwork survey; Excavation	Extensive earthworks of a possible medieval or post-medieval tin streamworks. An earthwork survey and/or targeted trenching is recommended to help establish more fully the extent, character and methods of tin working operations and for environmental analysis.
Possible tin streamworks at Bucktor, Whitchurch and Buckland Monachorum	Medieval	MDV130513	Earthwork survey; Excavation	Earthworks along the River Walkham floodplain interpreted as possible medieval or post-medieval streamworks, probably associated with MDV63696 to the north-east. An earthwork survey and or possible targeted trenching is recommended to help establish more fully the extent, character and methods of tin working operations and for environmental analysis.

Prospecting pits or shafts under Hatherleigh Wood and Great Hatch Wood, Bere Ferrers	Modern	MDV129484	Site visit	Possible 18/19th century prospecting pits or air shafts associated with Tavy Consols Mine. A site visit is recommended to confirm the form of the earthworks.
Charcoal burning platforms or prospecting pits in Webber's Wood, Bere Ferrers	Post-medieval	MDV130771	Site visit	Possible charcoal burning platforms within woodland - a site visit is recommended to confirm this interpretation.
Charcoal burning platforms in South Wood, Buckland Monachorum	Post-medieval	MDV130660	Site visit	Possible charcoal burning platforms within woodland - a site visit is recommended to confirm this interpretation.
Mine workings within Birch Wood, Whitchurch	Post-medieval	MDV130411	Site visit	Earthworks of newly recorded pits and banks within Birch Wood. The earthworks are interpreted variously as extractive pits, openworks, shafts and spoil heaps of post-medieval or 19th century mine workings, possibly associated with Devon and Courtenay Mine. A site inspection is recommended to confirm the extent and potentially clarify the origin and relationship of the earthworks.
Possible tin streamworks within Broadwell Wood, Gulworthy	Medieval	MDV130546	Site visit; Earthwork survey; Excavation	Earthworks interpreted as a possible newly recorded tin streamworks within Broadwell Wood. An initial site visit, possibly followed by an earthwork survey and/or targeted trenching, is recommended to help establish more fully the extent, date and character of these possible tin workings.

Mound, possibly a barrow, west of Dunsdon Cross, Pancrasweek	Bronze Age	MDV129840	Site visit; Geophysical survey	Newly identified mounds; a site visit is recommended in the first instance to assess whether they are likely to be modern features. If not, then remote sensing survey could help to ascertain whether buried features survive.
Mounds, possibly barrows, in East Gorvin Plantation, Hartland	Bronze Age	MDV129790	Site visit; Geophysical survey	Newly identified mounds; a site visit is recommended in the first instance to assess whether they are likely to be modern features. If not, then remote sensing survey could help to ascertain whether buried features survive.
Mounds, possibly barrows, on the east of Burson Moor, Hartland	Bronze Age	MDV129727	Site visit; Geophysical survey	Newly identified mounds; a site visit is recommended in the first instance to assess whether they are likely to be modern features. If not, then remote sensing survey could help to ascertain whether buried features survive.
Field boundary or routeway north of Higher Woodley, Lamerton	Post-medieval	MDV130800	Site visit	Though not of high significance or rarity, site visits to this and similar subtle features would help determine whether they are likely to be genuine archaeological earthworks. Ideally and in normal circumstances this would have happened near the start of the project, to inform interpretation. However, site visits to monuments in accessible locations would still be valuable when it is safe to do so.
Trackways across Collacombe Down, Lamerton	Medieval	MDV130779	Site visit	Numerous tracks or hollow ways possibly predating the formalisation of the current road across Collacombe Down. Assessment of digital RAF 1940s and Google Earth aerial photography does not indicate a very recent origin. A site visit would help to confirm this and assess their condition.

Various extractive pits and shafts in woodland south of Wheal Grace	Modern	MDV130579 MDV114162 MDV130578 MDV130577	Site visit	A site visit would provide more certainty about their function, though care would need to be taken with possible shafts and steep drops.
Peat cutting earthworks on the east of Bursdon Moor, Hartland	Modern	MDV129721	Site visit	Additional possible peat cutting earthworks should be assessed on the ground to help confirm that they are not modern cut features.
Relict field system on Bursdon Moor	Medieval	MDV102320	Site visit; Earthwork survey	Additional probable field boundaries have been identified and should be assessed on the ground to ensure they are not modern features; earthwork survey could help establish their relationship to other boundaries.

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