software, colour, grey shading, annotation and lettering can all be incorporated and reproduced through suitable printing equipment to high standards.

The finished product

The final report resulting from a piece of fieldwork should contain a balanced selection of *relevant* illustrations, drawn to a consistent standard. By using a variety of drawings of differing scales, it is possible to convey not only highly detailed plans of the archaeological features, using data from a variety of sources, but also the geographical context and relationships with the landscape and with other monuments. The inclusion of interpretative plans can, in addition, convey many of the thoughts and conclusions regarding the chronology and nature of the site that come about as a result of the survey.

Reports

The principal written product resulting from a survey will be the *archive* report. This is distinct from the *publication* report (Bowden 1999, 186–8).

Producing a coherent written description that integrates the available evidence is a particular skill. This description, with the drawings, provides the communication of understanding by those involved in the fieldwork, who have had privileged access to the field remains, to their readers, now or in the future, who may not have that access.

Objectivity cannot be a valid aim in the light of the necessary choices about inclusion, order and weighting, and the imperative to allow the understanding resulting from fieldwork to be developed and conveyed must be the culmination of the process. Yet at the heart of the activity lies the observation and recording of field remains, and similarly at the heart of the resulting report must be a description of those remains, sometimes even a catalogue of features, including observations of relationships, out of which grows the interpretation and understanding.

Dissemination

Archaeology depends upon a fragile and finite resource. It is the archaeologist's duty to conserve this resource and to make the results of a fieldwork project, including the original archive, available to the public. Archiving issues are covered by guidance notes, codes of conduct and standards (eg MGC 1992; SMA 1993; Handley 1999).

Archiving principles

The archive should be deposited in an appropriate and accessible public record within a reasonable period of the end of the project, even if the project has been fully published (ACAO 1993, 10.1; IFA 1993, 4.2). For non-destructive fieldwork, public access to the archive may not appear critical, but there are strong reasons for its public deposition:

- The archive created by a survey is a point-in-time record of condition. If the site is subsequently destroyed or eroded, or even restored for display, the archive remains an invaluable source of evidence for what has been lost.
- Publication media usually impose limitations of scale. A survey plan will often have to be reduced, with loss of detail. The full-size plan will only be available as archive.
- Public access to the archive will help disseminate any insight gained by the fieldwork – especially if the project remains unpublished, but true even after formal publication.
- Publication should be at a level appropriate to the importance of the results (EH 1991, A7.2.1.i). Much detail will therefore remain unpublished and available only in the archive.

Materials

From the outset of a project, due consideration must be given to permanence (using the correct materials). Published guidance on the preparation of archaeological archives is available (Ferguson and Murray 1997; Walker 1990; *see also* IFA 1994, 3.6.3, 3.6.5).

Storage

Long-term storage in the correct environment is the responsibility of the repository but the surveyor is responsible for ensuring that the correct materials are used and that the archive is maintained in good condition prior to its deposition (IFA 1993, 3.5). This requires attention to some house-keeping issues:

- Masking tape must be peeled off drawing film as soon as possible.
- Do not store or use the archive in areas prone to damp, dust or dirt, or of fluctuating temperature or humidity.
- Do not leave the archive in strong light.
- Do not expose the archive to risk from food, drink or tobacco.
- Do not use steel paper-clips, staples, pressure-sensitive adhesive tape or rubber bands.
- Do not fold or roll the archive unnecessarily – where possible, store it flat.
- Always handle documents with care: wash your hands.

Case Study 7

Jervaulx Abbey, North Yorkshire: a Level 3 survey of a rural monastic landscape

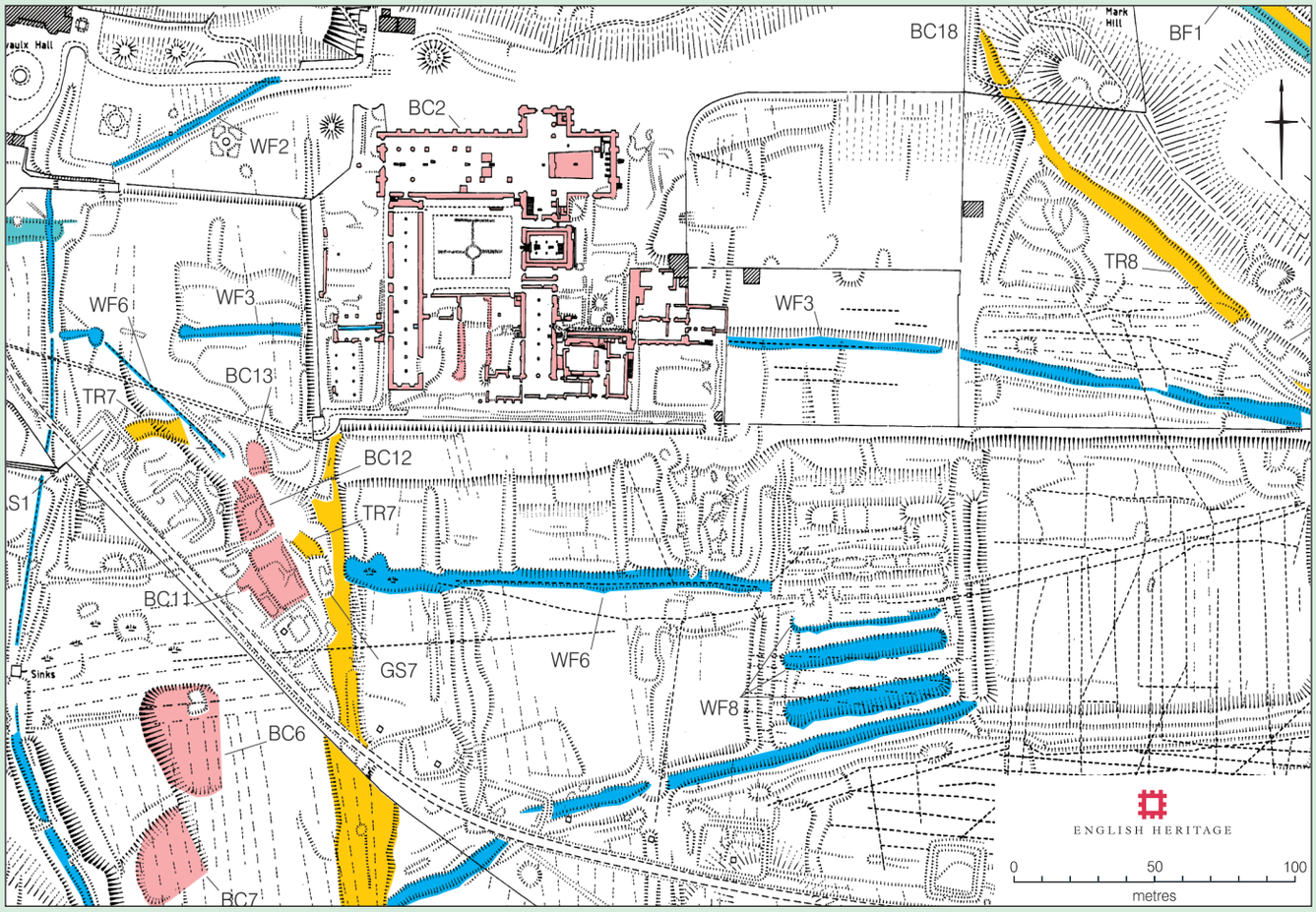
In 1998–9, the former RCHME surveyed a large area of complex multi-period earthworks surrounding the ruins of the Cistercian Abbey of Jervaulx. The survey was undertaken on behalf of EH, who wished to know if and how the earthwork landscape related to the ruined abbey church and claustral buildings, which at the time was the only part of the site enjoying legal protection. EH also needed an accurate map depiction of both ruins and earthworks (the latter had never previously been recorded) to assist in the conservation and management of the site as a whole.

The scale selected for the survey was 1:1 000, enabling the accurate plotting of slight scarps as small as *c* 0.4m wide. The survey pre-dated the widespread availability of survey-grade GPS equipment, and was therefore carried out as a divorced survey capable of later graphical fix to OS National Grid by overlay of detail common to both the survey and OS maps. A total-station EDM was employed to observe a ring traverse of control stations around the edge of the site from which points of hard detail and a network of subsidiary ground-control points were recorded; a number of additional internal link traverses was also observed in order to control parts of the site not directly visible from stations on the outer ring traverse. No attempt was made at this stage to record earthwork detail directly via the total station, as it was felt that the complexity of the features demanded more considered observation than this would allow.

Once the data from the control survey had been computed, a series of scaled overlapping polyester-film plots showing all the

ground-control points and hard detail recorded was taken into the field, and the earthworks added by hand, using traditional graphical methods of taped baseline and offset. One person laid tapes between selected ground-control points and took offsets to nearby archaeological detail, while the other plotted the measurements onto the emerging plan. This meant that decisions over the extents of features, their relationships to others and ultimately their interpretation, benefited from the observations of two people involved in considered and at times lengthy discussion on the ground, rather than being the decision of just one person with a prism-pole making up their mind instantly and on the fly (which would have been the case if archaeological detail had been recorded at the control stage).

The findings of the survey were presented in an interpretative report integrating both graphical and textual information (Jecock 1999). The final survey plan was inked up by hand in traditional hachured form. Hachures have the distinct advantage over other forms of earthwork depiction that they permit the portrayal of stratigraphic relationships between features. However, at a scale of 1:1 000 a plan of the size of Jervaulx is a large document incapable of easy reproduction and dissemination; it was therefore photographically reduced to a scale of 1:2 500 which could be included in the report as an A3 foldout. Also, on a plan of multi-period earthworks as complex as this, it is impossible for the reader to take in and make immediate sense of all the information presented. A series of interpretative diagrams was produced at this smaller scale to fit into the report, therefore, highlighting features that could be assigned to each of seven broad phases, into which the earthworks were divided on the basis of form, stratigraphy and context. These diagrams were generated electronically by scanning the reduced copy of the inked plan into AutoCAD®. The use of different colours on each phase diagram then enabled features to be distinguished graphically by function. Each feature-type was also allocated a unique alphanumeric code to tie in with the written description and interpretation in the main report, which is ordered chronologically. The project archive has been deposited in the NMR in Swindon.



the original). Interpretation of earthworks clarified by colours: tracks in orange, water features abels allow specific references in the text to be linked to the drawings (eg WF8 – Water

Publication

Publication should be considered wherever a survey has produced significant new information or insights. Advice on the publication of survey projects can be found in Bowden 1999, 186–8.

- to inform academic research across a range of disciplines;
- to establish proper curatorial concern for what are often fragile remains;
- through improved analysis and understanding to generate appropriate processes of conservation and management;

- to assess rates of attrition and threats to the historic environment;
- to assess significance and provide a basis for strategic heritage management;
- to provide a firm foundation for thematic, topographic or period-specific works of synthesis; and
- to deposit a permanent record in an established archive.

By providing guidance and defining levels of recording and analysis for archaeological survey a number of benefits are achieved. These levels are summarised as follows:

- They provide published, easily accessible and clearly defined terms of reference, giving those compiling records guidance about how they are expected to work.
- They define a common standard, making it possible to categorise, group and compare in broad terms records that may vary considerably in detail.
- They provide guidance to those commissioning, procuring or specifying work by others with a checklist of what should be included in the record of a site or landscape.
- They enable an estimate of the resources required to be made before the beginning of a project or survey.
- They enable the users of the completed record to appreciate the intensity of recording and to understand the basis upon which conclusions have been reached.

All archaeological records generated as a result of field investigation must attain the following criteria:

- A record should chart the historical development of an archaeological site or landscape and provide a clear statement of its significance.
- A record should aim to be accurate, clear and concise.
- The scope or level of the record and its limitations should be stated.
- A record should make a clear distinction between observation and interpretation, thereby allowing data to be reinterpreted at a later date.
- Wherever practicable, a record should have regard to the context of the site, including its wider archaeology, known and potential, whether in terms of below-ground deposits or landscape archaeology.
- A record should include an indication of any sources consulted.
- A record should identify the compilers and give the date of creation. Any subsequent amendments to the record should be similarly endorsed.
- The report and supporting material should be produced on a medium that can be copied easily and which ensures archival stability.
- A record should be made accessible through deposit in a permanent archive.
- Those creating a record should be mindful at all times of the rights and sensitivities of owners and occupants, and of the health-and-safety implications of working in historic landscapes.
- Note that no fieldwork can be regarded as complete until all the necessary documentation has been entered in the appropriate database and archive.

In addition, all records generated by survey should be indexed to a core data standard compatible with national and international standards for records, such as RCHME (1998 – currently being updated by EH) and CIDOC (1995). NMR Thesauri should be used where appropriate to ensure standardisation of terminology: **http://thesaurus.englishheritage.org.uk/**

Within EH the results of all survey work have been summarised in a Monument record entry (or multiple entries as appropriate) compiled to core data standards on the AMIE database. An Event record (or records) also has to be entered on AMIE in order to provide a digital link between the survey and any connected project work. This is linked to all Monuments records created or enhanced as a result of the survey.

In addition to the core data, most records of an archaeological monument will combine a written description and analysis, with a visual record made by a metrically accurate survey drawing.

Three levels of recording have been identified and are described below; they range from the least detailed (Level 1), comprising a basic map/plan depiction and brief annotation, to the most comprehensive (Level 3), which consists of the fullest combination of archaeological source material, surveys, descriptions, interpretations and contextual analyses.

Archaeological survey and recording will normally correspond to one of these levels. It is, however, not possible to be prescriptive about the levels of record for all circumstances – objectives, time and resources will vary from case to case. Furthermore, initial aims must be flexible in practice; procedures adopted at the outset of a survey may require subsequent modification. The paramount considerations are accuracy and clarity. For example, more complex investigations will result in a number of other outputs including:

- large-scale survey of a particular monument;
- a plan at 1:2 500 of its setting and context within the wider historic environment;
- a landscape survey fitted on to the OS digital map base and with possible long-term further research through GIS;
- establishment of permanent survey control to aid excavation, water flow monitoring, land use change, environmental impacts and similar studies;
- creation of a digital three-dimensional model of the monument.

Each of the descriptions of the three levels of recording is followed by a specification of the recommended components (Items) that can be combined to make up an archaeological record to the standards set by EH. These Items are set out under three headings:

- the written account
- survey drawings
- ground photography (Ground photography of field monuments must be regarded as complementary to a survey and not as a substitute.)

The descriptions of the three levels are followed by reference lists, which define each of the numbered Items.

In any record where it is not appropriate to conform exactly to one of the three prescribed levels, components may be included or omitted but any substantial departure should be noted.

Multiple-level recording of an archaeological field monument, using the appropriate level criteria, is permissible: Level 1 verification of previously recorded Level 2 and Level 3 field investigations; Level 3 investigation of previously recorded Level 1 field inspections, etc. Fieldworkers are strongly urged to tailor the format of their records to the NMR model or to that adopted by the relevant County SMR or HER.

Case Study 8

The Earthworks of South Wiltshire: RCHME research-led Level 3 surveys

The area covered by the fieldwork comprised the southern third of the county of Wiltshire, an area of approximately 1,100 square kilometres. It is bounded on the north by Salisbury Plain (McOmish *et al* 2002); to the west, south and east by the county boundaries with Somerset, Dorset and Hampshire, respectively.

The work built upon the results of the survey of the Stonehenge area (RCHME 1979), and the aerial photographic transcription of the Danebury hillfort environs (Palmer 1984) but additionally drew inspiration from a much longer history of investigation in the area that incorporated the pioneering work of Stukeley, Colt Hoare and Pitt Rivers.

Four main recording techniques were employed – analytical earthwork survey, air photography, geophysical survey, and surface collection of artefacts (field-walking). Relying largely on archaeological field survey conferred two major benefits. Firstly, in a period of unprecedented destruction of the rural landscape, those remains that do survive become rare and valuable, and so survey, which can elicit information without excavation, is particularly valuable. Secondly, archaeological survey is much more cost-effective than excavation, and makes possible the investigation of entire landscapes.

The project was undertaken at a time when the use of electronic survey equipment in the archaeological sector was in

Earthwork survey of a deserted medieval village at Norrington in Wiltshire. This has been drawn using traditional pen and ink techniques and is reduced from the original 1:1 000 scale survey.

its infancy. Nonetheless, all of the surveys employed either an electronic theodolite and EDM or a total-station to position accurately and plan a network of control points and record OS map detail. Archaeological detail was recorded using taped offsets from base lines extended between these control points. Most sites were surveyed at a scale of 1:1 250, 1:1 000 or 1:500.

Air photography was utilised to enhance the information derived from field survey and this project also marked a watershed in investigation, witnessing the first large-scale use of geophysical prospection to complement traditional methods. In one example, geophysical survey on the Late Neolithic henge at Sutton Common showed that the monument had undergone significant alterations, including a blocking of one entrance and a re-alignment of another, which were completely undetectable from the surface. At Yarnbury hillfort and the Late Iron Age – Romano-British complex at Hanging Langford Camp, field-walking was carried out across areas of the earthworks that were either being actively eroded or destroyed by cattle and burrowing animals, or were under cultivation. In all cases this technique proved invaluable in terms of better understanding of site chronology, for example, but was also of great use in aiding improved site management.

Meticulous survey of archaeological remains recorded sites of all dates from the Early Neolithic through to the end of the Middle Ages and demonstrated the crucial importance of studying small, superficially insignificant remains. For example, the slight fragments of medieval settlement that survive in the Vale of Wardour often comprise little more than a low platform or a few irregular banks, and provide the only evidence for the dispersed medieval settlement pattern of this region. These types of unprepossessing earthwork remains are easily ignored as insignificant, but must be recognised for the valuable resource they are, particularly within the planning process when they are vulnerable to destruction during small-scale development or infilling.

Perhaps the most startling point about the archaeological heritage of south Wiltshire is the abundance and ubiquity of surviving earthwork remains. Today it appears to be an unexceptional modern rural region of villages, roads, farming, trade and light industry, yet the physical remains of the past of all periods are everywhere. It is very unusual, and accordingly very advantageous, to find in southern England a region that contains such a varied archaeological landscape. Rightly the subject of intensive study in the past, the potential such a region holds for further revelations in the future remains immense.

Level 1

Level 1 is mainly a visual record, supplemented by the minimum of information needed to identify the archaeological site's location, possible date and type (Case Studies 1 and 2). This is the least complex record, and will typically be undertaken when the aim is to provide essential core information to agreed standards, including structured indexes of the location, period, condition and type of the monument that, typically, would result from rapid field investigation (*see* The written account, *below*: Items 1–5), such as assessments of change to the historic environment, historic landscape characterisation, for an initial assessment determining the scope of a project, or whenever resources are limited and much ground has to be covered in a short time. This would be accompanied by a simplified cartographic record, often at 1:10 000, of the location and extent of the site.

There should be basic consultation of easily available related information sets: these may include field surveys, records of buildings, archives, aerial and ground photography, geophysical survey, field-walking, excavation records and other local sources.

A Level 1 record will typically consist of:

- The core monument record
- The written account: Items 1–5, and 12
- Survey drawings: an annotated 1:10 000 map (either digital or hardcopy), indicating location and extent (Item 13) and a cartographic record (Item 14)

Level 2

This is a descriptive record that provides qualitative information beyond the scope of Level 1 inspection (Case Studies 3–5). It may be made of an archaeological site that is judged not to require any fuller record, or it may serve to gather data for a wider project.

A Level 2 record provides a basic descriptive and interpretive record of an archaeological monument or landscape, as a result of field investigation. It is both metrically accurate and analytical, depicting the real landscape context of the archaeological features. The examination of the site will have produced an analysis of its development and use, and the record will include the conclusions reached, but it will not discuss in detail the evidence on which this analysis is based.

This record must include the core monument data. Beyond that, the information provided at Level 2 should be able to satisfy broad academic and management requirements. It will normally include a divorced (ie non-map based) measured survey or an accurately located map-based survey at a scale that will represent the form of the monument. In addition, the location and extent will be indicated on a 1:10 000 index map to ensure consistency with other levels of recording. Some statement of method, accuracy, and of the quality of investigation and survey will normally be included. Related information sets consulted at this Level may include field surveys, records of buildings, archives, aerial and ground photography, geophysical survey, field-walking, excavation records and other local sources.

A Level 2 record will typically consist of:

- the core monument record
- the written account: Items 1–5, 8–12
- survey drawings: accurate cartographic location and extent of the monument(s) at scales of 1:10 000 and 1:2 500; site plan at a scale of up to 1:2 500. Items 13–14 and 18 (and in exceptional cases Item 15)
- ground photography: as appropriate

Level 3

A Level 3 record provides an enhanced and integrated, multi-disciplinary record of an archaeological field monument or landscape, resulting from the process of field investigation (Case Studies 6–12). This is often enhanced in one or more ways by additional specialist research or fieldwork such as geophysical survey; aerial survey; field-walking programmes; specialist assessment of artefacts; the analytical recording of standing structures; and excavation. In many cases such enhancements would result from contracted-out arrangements of negotiated partnerships. A distinguishing characteristic of this Level is that the

enhancement will be included in the design of the project or task and will form an integrated part of the resulting record and analysis (rather than being simply an information set that has been consulted, or a separate event). Taken to its logical conclusion, this Level extends to an all-inclusive ideal of interdisciplinary investigation.

This record will provide a quality of description, interpretation, graphical depiction and analysis beyond the scope of a Level 2 entry. It must include the core monument data. Level 3 investigation will normally be used only for selected monuments, reflecting their importance, or where a specific management/client need has been identified that makes this level of detail appropriate (eg threat, Scheduling requirement, research, etc). An accurately located, measured survey (map-based or divorced) at an appropriate scale (at 1:1 250 or larger), designed to represent adequately the form and complexity of the monument, will always be part of the record; additional documentary and cartographic material may also be generated as part of the detailed recording and analysis.

To some extent, Level 3 field investigation may be seen as being open ended, with specifications tailored individually to suit a variety of requirements, but it always demands a detailed descriptive and analytical approach, complemented by an accurate measured survey or surveys. A statement of method, of accuracy and of the quality of investigation and survey will always be included. All related and readily accessible information sets should be consulted at this Level. These may include field surveys, records of buildings, unpublished documents, aerial and ground photography, geophysical survey, field-walking, excavation records and other local sources.

A Level 3 record will typically consist of:

- the core monument record
- the written account: Items 1–12
- survey drawings: accurate location of the monument(s) at scales of 1:10 000 and 1:2 500
- site plan at a scale of 1:2 500 or larger. Items 13–21
- ground photography: as appropriate

A guide to potential uses of the Levels is outlined below:

circumstance	*principal need*	*level of record*	*form of record*
Strategic heritage planning at national, regional or local level; studies of landscapes, pilot projects	Information on the distribution, survival, variation and significance of archaeological sites, defined geographically, typologically or chronologically, and understanding of their evolution, to inform a range of national and local policy initiatives, to underpin heritage management decisions and as a contribution to academic knowledge	Generally low-level record – typically Level 1 or 2, but in selected cases 3. Map accuracy required is *c* 10m.	May make extensive use of external photography, supplemented by written accounts of individual sites and/or synthetic text. Drawn element may be omitted, simplified, limited to maps or restricted to key examples. Locations to be identified by a grid reference and plotted on a 1:10 000 base map
Management planning for individual sites or components within the landscape	Baseline information on the nature and significance of archaeological sites, providing a foundation for long-term decision-making, and identifying where further knowledge is required	Level 2 (or, on occasion 3), is required. Map accuracy required is *c* 1m.	Measured drawings may form an important and cost-effective component, meeting a range of non-historical as well as historical needs. Where sites form a tight geographical group, or belong to an historic estate, more extensive documentary research may be practical. Objects and monuments to be plotted against an OS 1:2 500 map, or production of a plan of similar scale.
Full contextual assessment of an archaeological site and its landscape setting for research/academic and curatorial reasons	Understanding of the significance of the archaeological site and providing detailed analytical appraisal of its context, date and function	At all times Level 3. Map accuracy required is *c* 0.10m	An account of the site and its landscape setting accompanied by a full range of measured and annotated drawings as well as photographs and reconstruction/phased diagrams. An accurate, measured survey plan is essential, at a scale of 1:1 000 or larger, alongside three-dimensional data.
Rescue or remedial survey when rapid response is required	Proper contextual appraisal of damage or threat to monument or landscape	Dependent on scale of site/landscape and the nature of response to the threat. This may well include all Levels of survey.	Could require the use of all available methods of analysis. Thoroughness of the resulting record is dependent upon the nature and extent of the threat but will include, as a minimum, a measured drawing and annotated text.

Case Study 9

The Cumbrian Gunpowder project: Level 3 surveys of industrial remains

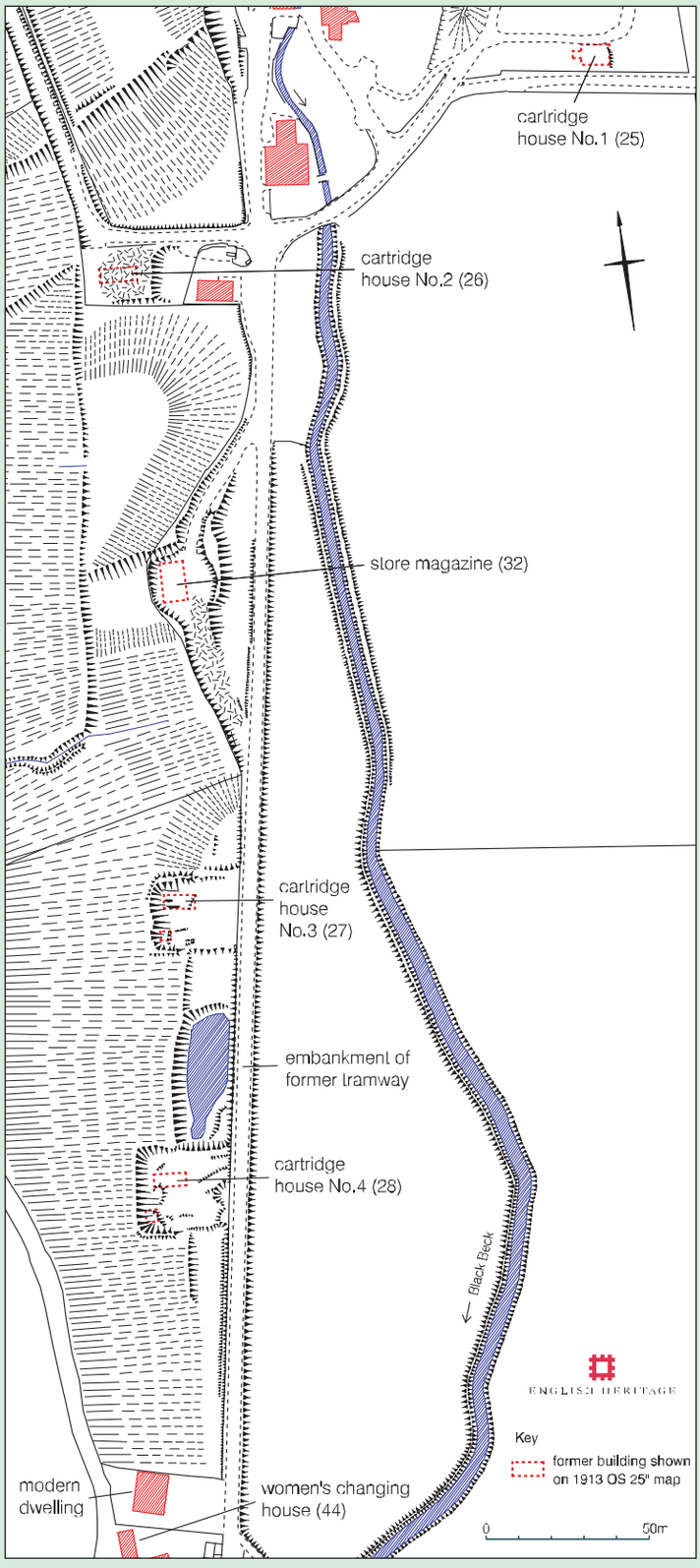
The Cumbrian Gunpowder Industry Project has been undertaken by EH as a follow up to the Monuments Protection Programme, which studied the gunpowder industry nationally. Several of the Cumbrian works were recommended for scheduling but required survey in order to understand the remains so that essential information for site management and conservation could be provided. Previous researchers have

concentrated on the documentary evidence relating to these sites and there has been little formal recording and analysis of the surviving physical remains. In order to rectify this situation, the EH project considered all seven of the Cumbrian sites, irrespective of their current designation, in order to enhance overall understanding of this once important regional industry and also to contribute to knowledge about the gunpowder industry at a national level.

The remains of this industry survive as a combination of extant buildings and earthworks. The former tend to be the buildings connected with the storage and processing of raw materials, and houses for the site managers, together with ancillary buildings such as stables, saw mills and cooperages. The actual buildings connected with gunpowder manufacture had by law to be demolished or burnt down when a works closed, so that there was no danger of any residual gunpowder adhering to their fabric accidentally igniting and causing explosions. Low platforms and ruined walls sometimes mark the sites of these deliberately destroyed buildings. Other archaeological remains include weirs, leats, waterwheel pits, blast walls/banks together with the track beds of the former tramways that served the works.

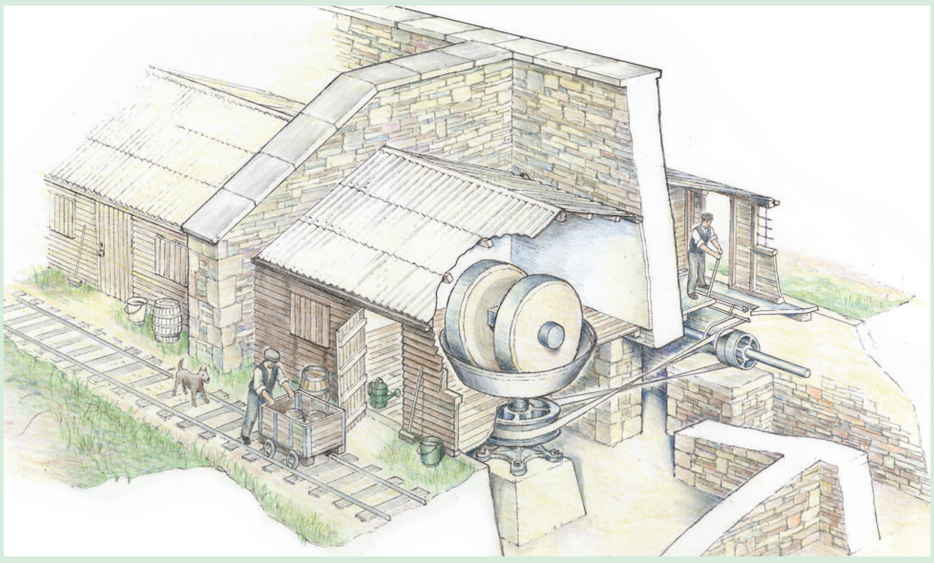
The sites are often complex and occupy a considerable area because individual process buildings were widely separated, to reduce the likelihood of an accidental explosion at one building spreading to others. The majority of the sites are in woodland; survey has to be undertaken chiefly in the winter months and it is impossible to use GPS, so survey was carried out using a total-station EDM to create a series of interlinked traverses. Much of the archaeological detail, together with buildings and walls, was recorded electronically at this stage but temporary points were also established for the recording of those parts that are either difficult to reach or where the remains require more time to understand. Once the electronically captured data was processed and a plan generated, these temporary points were used as the framework for tape and offset survey plotted directly on to the plan by hand. The hand-drawn material was later digitised to produce a digital plan of the whole site at a scale of 1:1 000. Where insufficient survives to warrant large scale survey, the OS 1: 2 500 map was used as a base on which any surviving remains were either annotated or added. The buildings were measured with hand tapes, but where parts are either inaccessible or dangerous, an electronic theodolite with a reflectorless EDM was used.

Documentary research also formed a vital component of the methodology. Gunpowder processing buildings were subject to government legislation, changes of function, and also to explosions that resulted in rebuilding, sometimes at a new location. The only way to understand how a site evolved and what the surviving remains actually represent is through the study of a variety of sources including early OS maps, historic site plans, the reports of the Explosives Inspectorate, local newspaper accounts of gunpowder explosions and inquests, and the manufacturing method books. The latter were produced for each site by the Imperial Chemical Industries (ICI) who owned the Cumbrian gunpowder works in their final years. Early photographs, often in private collections, of the sites when still in operation and verbal testimonies from some of the last surviving gunpowder workers also contribute an important element to the story.



Reduced extract from the EH 1:1 000 scale survey plan of the Blackbeck Gunpowder Works showing the earthwork remains of the store magazine and blasting cartridge house sites. The outlines of the former buildings that were depicted on the 1913 OS 1:2 500 map have been superimposed. The entire drawing (including hachures) was produced using AutoCAD® *software.*

A detailed report for each site has been produced containing, where appropriate, a copy of the survey plan at a scale of 1:1 000 (eg Dunn *et al* 2004). Copies of the electronic survey plans and the analytical reports are deposited in the NMR on completion.



Hand-drawn reconstruction of the incorporating mills at the Blackbeck Gunpowder Works. Reconstruction diagrams such as this can help clarify how the surviving ground remains, which are often incomplete, relate to the original industrial process.

This drawing was produced by Tony Berry using coloured pencils.

The written account

Taking account of:

- existing practices and formats
- the circumstances that led to the generation of the record and the uses to which the information will be put
- the need to adopt common data standards and models
- whether information is presented as text or in tabular format

The introductory material should always include Items 1 to 3 (below).

Item 4 may prove adequate for the description at Level 1, and Item 5 for Level 2. However, in Level 3, Item 6 is the mandatory minimum in order to give the much fuller description and analysis demanded. Exactly how this information is given may vary, depending on the type of field monument being investigated: accuracy and clarity are more important than rigid structure. Unnecessary descriptions, and measurements that can be obtained readily from the survey drawings, should be avoided. Where complex relationships exist, the use of interpretive drawings is to be encouraged. A clear and explicit distinction must always be made between the descriptive part of a report and the interpretation.

A written account may contain the following Items:

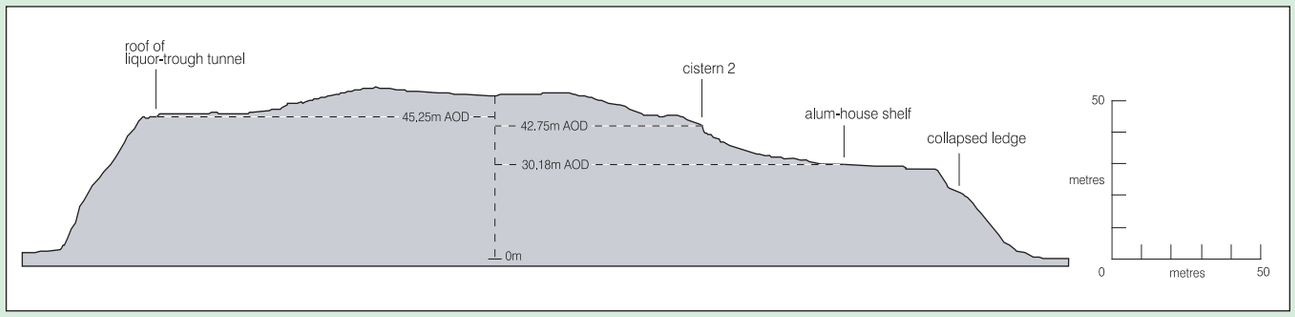
1 The type (classification) of the archaeological field monument being investigated, and its period; normally the Thesaurus of Monument Types (EH 1998; **http://thesaurus.english-heritage.org.uk/**) should also be used.
2 The exact location of the site; the NGR (up to 8 figures, as appropriate) and the Civil Parish, District, and County or Unitary Authority; along with identification numbers (NMR, SMR, HER, SAM) for the site. **1**
3 The name of the compiler, the date of the investigation and reason(s) for the survey, with details of site ownership and present land use.
4 The key source (eg an aerial photograph or principal publication).
5 A summary of the salient features – this is particularly important for monuments that have lengthy and complex descriptive reports.
6 A concise description of the site, including information on plan, form, dimensions and area, function, age, developmental sequence and past land use.
7 A detailed description of the site, including the same information as Item 6 plus full analysis and interpretation with supporting evidence presented.
8 Consideration of the topographical setting of the monument and its relationship to other sites and landscapes, and to historic buildings in the immediate vicinity.
9 The potential for further investigation and for other forms of survey should be assessed and recommendations made. Any finds made during the investigation should be noted.
10 Relevant information from other sources, including published or unpublished accounts and oral information; the location of unpublished records must always be given. Relevant bibliographical references must be included, but an inclusive bibliography need not be assembled.
11 A brief assessment of the local, regional and national significance of the site or landscape with regard to its origin, purpose, form and status (ie its academic context).
12 A brief Event Record: this is a succinct description of the activities that were necessary for the compilation of the monument record, which may be coupled with the information provided in Item 3.

Case Study 10

Kettleness Alum Works, North Yorkshire: a Level 3 study of a threatened coastal industrial landscape

Kettleness Alum Works occupies a small coastal promontory a few kilometres north of Whitby. It comprises a massive shale quarry, an alum house and associated processing facilities. The site is a scheduled monument, but sits above cliffs that are collapsing into the North Sea. In 1999, EH selected the site for analytical survey at Level 3. The aims of the survey were to improve our understanding of the history and development of the site, at the same time as creating a permanent record of it in advance of further attrition and loss.

The site presented a very peculiar set of hazards and difficulties. The cliffs along this stretch of coast are retreating at an average rate of perhaps a metre or two each century; most of the erosion is small-scale and gradual, but periodically larger sections fail catastrophically without warning. Because of the friable nature of the shale, much of the floor of the quarry is also



Profile taken from the DTM to illustrate the height relationship between features on the site and the topography.

covered by a blanket of scree, which shifts with wind and rain, masking and re-exposing features. Furthermore, the archaeological interest is not confined to the headland but extends onto the foreshore at the base of the cliffs.

Because of the obvious dangers in working near crumbling shale cliffs over 50m high, which also provide few safe points of access to the beach, a methodology was formulated that entailed surveying the more hazardous parts of the site (the foreshore, cliff and quarry faces, and a zone close to the top and bottom of the latter) remotely via photogrammetry and aerial transcription. The results would then be checked visually and amended by survey-grade GPS fieldwork if practicable and safe, at the same time as the remaining parts of the site were recorded by the same technique. The advantage of such a methodology was not just that it minimised risk, but also that it would result in an accurate, three-dimensional, interpretative record of the visible surface archaeology of the entire headland and foreshore. Because of the threat to the site's long-term survival and the fact that structures periodically disappear from view beneath scree (and the tide), it was decided that a detailed ground photographic record would also be made of all visible features.

The first step in surveying the site was the creation of a high-quality photogrammetric DTM as far out as the low spring-tide mark, for which new vertical aerial stereo-photography was commissioned at a flown scale of 1:3 000. Recent advances in aerial photogrammetric photography mean that images can now be geo-referenced in flight, but in 2000 when fieldwork at Kettleness began, this had to be carried out as a separate task using differential survey-grade GPS ground survey to acquire OS National Grid coordinates for a number of selected control points (for example, small boulders) common to adjacent images in each run. The images were then scanned at a 25-micron pixel resolution using a high definition photogrammetric scanner. This resulted in each pixel representing approximately 0.095m on the ground, and enabled the DTM to be created automatically using the terrain extraction module of the photogrammetric workstation sampling points on a 1m grid. Archaeological and topographical features visible on the images were then plotted from the stereoscopic view, and a 2D plot of the data was taken into the field at 1:1 000 scale for checking and enhancement, again using differential GPS survey. The various datasets were subsequently edited and merged within a computer environment using AutoCAD® software, and new combined plots generated were field checked by eye.

The report (Jecock *et al* 2003) detailed and described the findings of the survey and as far as possible sought to phase the archaeology with the aid of hachured survey plans, interpretative diagrams, reconstruction drawings and photographic evidence. Because most survey data were collected electronically and in 3D, all drawings were produced on the computer; the production of a DTM also enabled profiles to be generated at will to illustrate changes in level almost anywhere across the site. However, the use of photogrammetry also enabled the production of a number of other products not normally available, principally an orthophotograph (a single true-to-scale aerial image of the site stitched together from all the stereo-photographs, in which scale errors caused by camera tilts and ground-height displacements are rectified), which could be draped over the DTM. The project archive has been deposited in the NMR, Swindon.

Conventional methods of depiction such as natural hachures and contours often do not adequately show very steep and complex slopes. This still image of the orthophotograph draped over the 3D model illustrates well how the understanding of the site topography can be enhanced by a visual representation of the data. For very unstable and dangerous sites photogrammetry is also the ideal technique for providing a baseline record and field plot for further analysis. The computer model can also be viewed from any angle and rotated in 3D space. This type of visualisation can be very effective for display and presentation purposes.