Historic England

# Preserving Archaeological Remains

## Appendix 5 – The Reburial of Archaeological Sites

# Summary

This appendix covers the processes and materials required for the successful reburial of an archaeological site. The document defines what reburial means and emphasises the importance of having clear reburial objectives. In line with the processes described in the main text, reburial schemes require:

- an assessment of significance (of the material being buried).
- a condition assessment (of the state of preservation of the materials being buried).
- an assessment of impacts (identifying threats and assessing risks to the reburied material).

Usually, the most appropriate material for reburial is that which has been excavated from the site. If additional material is required (for example, if the previous soil is contaminated or has been taken off site), it must meet certain criteria. These include capillarity (promoting the free movement of water), chemical compatibility with the buried material (inert or similar pH), and the need to be compactable and to maintain intimate physical contact with the buried feature. Reburial materials should cause no mechanical damage to archaeological remains, release no new material into the site and have no significant effect on soil water chemistry.

If sand is to be used for reburial, specific calculations are needed to correctly identify the most appropriate material. These are summarised for readers in this document. Different types and uses for geosynthetics are also reviewed, and advice given about the situations in which they might be used. Generally, though, geosynthetics are not needed.

The text identifies the range of specialist expertise that may be required to design a reburial scheme. Architectural features may need to be stabilised before reburial, and advice is provided on good practice. Requirements for monitoring and maintaining reburied sites are discussed, and recommendations are made about appropriate record keeping ensuring archaeologists can access details of past reburial schemes if sites are revisited in the future.

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**Front cover:** Aerial view of Curzon Street Roundhouse. [Image courtesy of HS2 Ltd.]

This document was prepared by Jim Williams, John Stewart and Matt Canti. It is part of a suite of documents about the preservation of archaeological sites. It is a technical appendix to the main guidance Preserving Archaeological Remains: Decision-taking for Sites Under Development (Historic England 2016) and should be read in conjunction with that document and, where appropriate, the range of planning policy guidance detailed therein. Additional methodological detail and technical advice is provided in the following appendices:

Appendix 1 – Case Studies

Appendix 2 – Preservation Assessment Techniques

Appendix 3 – Water Environment Assessment Techniques

Appendix 4 – Water Monitoring for Archaeological Sites

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# Contents

# 1. Introduction

Archaeological sites sometimes need to be reburied as part of a development plan or after an intervention that leaves unexcavated stratigraphy exposed. The reburial may be a temporary measure to protect the intact portions of the site for the short or medium term, before further excavation. However, the aim of most reburial programmes is the long-term preservation of the structures, artefacts, ecofacts and other forms of archaeological evidence that the site contains.

The materials used for reburial need to meet particular specifications. On some sites, there may also be aesthetic and economic considerations.

The principal objective for any reburial is to create an environment as close as possible to (or better than) that which existed prior to excavation. This document outlines the steps to follow when considering a reburial scheme:

- Identify the objectives of reburial.
- Complete an assessment of significance (of the material being buried), condition assessment (of the state of preservation of the materials being buried) and an assessment of threats and risks (to the reburied material).
- Design the scheme in consultation with relevant specialists and stakeholders, as needed.

These steps are described in more detail throughout this document. It is important to remember that reburial is not the end of the process. Sites will require some degree of maintenance and monitoring over time, even if that is just visual inspection.

**Why does this matter to me?**

It may seem that some of the recommendations within this document are only relevant to sites that contain structural or decorative remains. As in the main guidance *Preserving Archaeological Remains: Decision-taking for Sites Under Development* (Historic England 2016) and its appendices, the recommendations outlined are scalable, and the most significant and complex sites will require the most detailed investigations and assessments. At many English archaeological sites, features consist of ditches and pits only, and most common finds are robust and able to withstand further burial or backfilling with minimal protection. Nonetheless, there may be unexpected discoveries, during the work, that require designs to be changed to protect significant remains. Following the guidance in this document will help ensure the long-term preservation of surviving archaeological features.

## 1.1 Reburial and backfilling definitions

It is worth emphasising that reburial is not the same as backfilling. Reburial is a design process, guided by specific objectives. In contrast, backfilling is the process of putting soil back into an excavated trench once evaluation or excavation has been completed.

The following definitions are used in this document. They are relevant to English archaeological sites, for which this guidance was written. As a result, they may differ from definitions used in other countries.

**Reburial:** The purposeful placement of excavated soil or other appropriate materials into an archaeological excavation area to protect remaining archaeological deposits/finds/structures and to ensure their future survival.

**Backfilling:** The replacement of excavated soil into an evaluation trench or excavation area, by hand or more often by machine. Backfilling takes place after the site has been excavated in line with a Written Scheme of Investigation (WSI)/project design and after the site has been signed off by the relevant authority (for example, local authority planning archaeologist, Inspector of Ancient Monuments). This definition of backfilling covers the process used for most archaeological excavations. Where sensitive and complex archaeological remains are present and, depending on the future use of the area being backfilled, it may be beneficial to follow the guidance set out in this document, and rebury rather than backfill in that area.

### 1.1.1 Backfilling process

In commercial archaeology in England, it is standard practice for evaluation excavations to be carried out. In rural environments, these usually involve the machine removal of topsoil (including turf where it is present) and the machine excavation of the underlying subsoil until archaeological features are exposed. At this point, features are excavated (usually a half-section through a pit or posthole, or a slot through a ditch) to characterise them and the finds they contain. Once the trench has been sufficiently characterised and signed off by the relevant authority, it is backfilled (usually by machine) with subsoil then topsoil. Unless it was removed and stored separately, turf is generally mixed with the topsoil at this point. In an urban environment, a similar process is followed, but the top surface is more likely to be tarmac, concrete or another construction material, and the upper deposits often contain a mix of building materials and soils from previous construction works (usually called 'made ground'). Even within constrained sites, it is usual for the excavated soil to be stored adjacent to the trench and used as backfill once the evaluation is complete. Resurfacing works may be needed if the land is still in active use.

**Figure 1:** Backfilling of archaeological evaluation trenches. [© Wessex Archaeology]

Unless significant or fragile remains are found during the evaluation, no specific methods are needed for backfilling. Generally, a machine driver places the soil back into the trench under archaeological supervision. It is not usual practice for excavated features to be filled in prior to machine backfilling. Where significant remains (graves, waterlogged wood, treasure, fragile structural remains and so on) are identified in evaluation trenches, discussions should take place with the relevant authority about whether it is appropriate to excavate or leave these remains in the ground. If they are left in place, a reburial strategy may be needed for that part of the site.

Evaluation trenches are samples of the archaeology present in the wider area. Even where archaeological remains have been sampled and removed, they survive in the adjacent unexcavated parts of the site. If the proposed development (that led to the evaluation) is refused, the majority of the archaeology on the site, including undisturbed parts within the evaluation trenches, will remain for the future.

If a development proposal is approved, the archaeology on site is either preserved within/under the development (as set out in Preserving Archaeological Remains) or it is excavated. Following an excavation, and once the work has been signed off by the relevant authority, the site is handed back to the developer. They may choose to backfill the site and build over it, or to remove further soil to reach final formation levels. Even if the site area is built up and the remaining unexcavated archaeology is protected, it is not usually described as ‘preserved’ because most of the site has been excavated. For that reason, no specific methods are required for the backfilling and it is generally undertaken by machine.

Most archaeological sites excavated in England are backfilled rather than reburied.

### 1.1.2 Reburial strategies

Reburial may be required in the following situations (following the methodology set out in *Preserving Archaeological Remains*).

**Opportunistic preservation:** This occurs when unexpected remains are encountered during a planned excavation (for example, strip, map and record as part of the proposed mitigation strategy) and a decision is taken to incorporate them into the development design, rather than excavate them. This may happen if the remains are of high significance, or complex and it would be especially time-consuming and costly to deal with them. It would, however, only happen if design amendments can be made to protect the archaeological site beneath the development or within an area of open space. Many sites where reburial has taken place in the past are opportunistic preservation sites, as described in case studies for Curzon Street, Harvil Road and Hunt’s Green Farm.

**Planned mitigation preservation:** This occurs when features and areas of high significance are identified during an evaluation and decisions are made to preserve them within the development. In many cases, there is no further excavation of the area being preserved, and no reburial strategy is, therefore, needed. However, there may be situations where essential ground reduction works expose as area of archaeological significance. In such cases, specific materials may be needed for reburial. There may also be instances when significant remains are identified during evaluation. A temporary reburial may be carried out, and then reviewed and updated as part of the final reburial strategy (*see* Figure 2). In either situation, the advice set out in this document will aid planning and decision-making.

Occasionally in England, an archaeological site that has been excavated in the past has been reburied in response to ongoing deterioration caused by exposure (case study 3 Culverwell Mesolithic site). This process has occurred in England to protect some mosaics since the late 18th century (Stewart 2005).

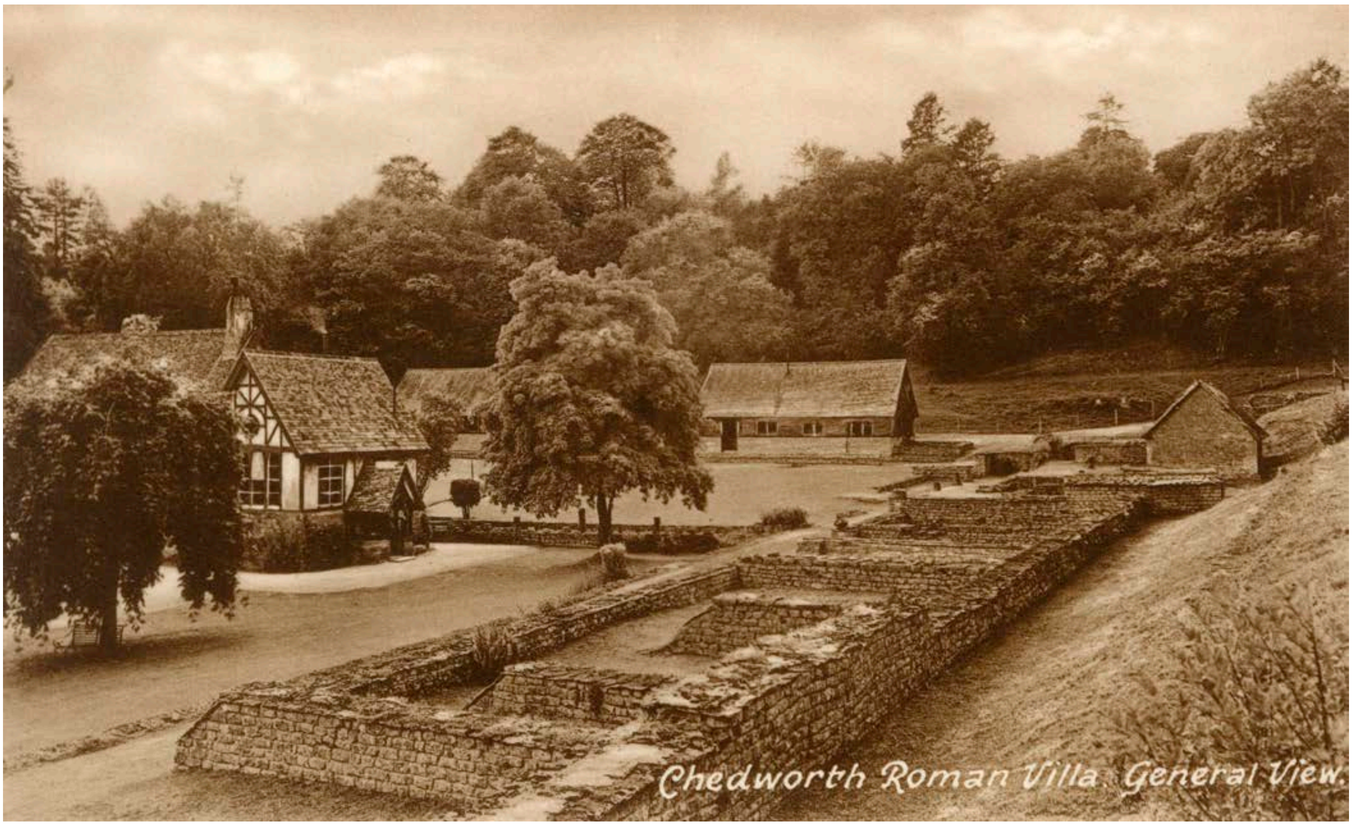


**Figure 2:** Chedworth Roman Villa (Gloucestershire).
The site was excavated in the 1860's. The most important mosaics were protected and exhibited under simple vernacular shelters (centre background). Plainer mosaics were reburied for their preservation, until re-excavated and incorporated into a new conservation shelter in 2010. This is part of a long tradition of reburying some archaeological features in England. [Alamy Ltd]

**Research excavations:** These come in many forms. They may be carried out by local communities, local archaeological societies, other grassroots archaeological organisations, universities or other research organisations. They may be undertaken or commissioned by local or national heritage organisations. Excavations are carried out to investigate sites, address new research questions, help with site management or its presentation to the public. Excavation areas are usually small, and investigations are targeted at a specific part of the site. They do not generally involve the total removal of all archaeological remains in that area.

There is a tendency for research excavations to focus on known sites, sometimes designated sites, which may contain a range of complex or significant features, such as structural remains. These sites may also have some form of surface expression (banks, ditches and so on) that needs to be reinstated as part of the reburial design. It is unusual for soil to be taken away from a site during excavation. It is, therefore, common and standard practice for it to be available to backfill trenches. Where excavated trenches do not contain complex remains and can be backfilled immediately, it is best practice to replace the soil in the trenches in reverse order (subsoil, topsoil, turf). Where trenches contain complex remains, or where excavation is undertaken over several seasons/years, the advice within this document will be particularly useful to ensure the protection and preservation of the remaining archaeological features, structures and deposits.

## 1.2 Reburial objectives

A key starting point for any reburial scheme is to define its objectives. These help to determine the reburial materials and design (what to use and how to rebury the area). The principal objective for any reburial is to create an environment as close as possible to (or better than) that which existed prior to excavation – to ensure long-term preservation.

The purpose of a reburial is to mitigate and manage the rate of deterioration of archaeological features. Choosing suitable materials and an appropriate reburial design is vital, and decisions are often influenced by the duration of the burial. Protecting exposed features from plant growth or weathering for a few months will require a different reburial solution to burying a site under a new embankment or protecting it within a development site. The duration of the reburial scheme needs to be clear from the start. It may be seasonal, short to medium term, or long term.

Although most reburial objectives will relate to duration and purpose, others are likely to be identified during initial discussions. Where the conditions of the burial environment have been deteriorating (for example, due to erosion of the site through flooding), improving the environment to increase the chances of long-term preservation would be a relevant objective.

# 2. Fundamentals of reburial

There are three types of criteria that need to be considered when planning a reburial scheme: environmental, functional and programmatic.

## 2.1 Environmental criteria

It is important to consider the following environmental issues when designing a reburial scheme.

**Good water movement:** Water moves through most English archaeological sites in response to rainfall or rising or falling groundwater levels. The chosen reburial material should not significantly change the way water moves through the archaeological layers and features (*see* Capillarity).

**Intimate contact between the fill material and buried feature:** To promote water movement and to ensure there are no voids in the reburial stratigraphy, the fill material and buried features/deposits should be in intimate contact. Geosynthetics (*see* 5.5 Material requirements), if used, should not be placed in direct contact with structural remains, as they have, in the past, caused problems for reburied feature(s).

**Chemical and physical compatibility between the fill material and buried feature:** The material that is most likely to be chemically and physically compatible with the buried feature is that which was excavated in the first place. Where this is not available, the properties of alternative materials will need to be investigated (using commercial material data sheets or through testing).

**Thermal protection:** The reburial material should be thick enough and of a suitable composition to protect against environmental impacts, ranging from freezing to excess thermal gain.

**Burrowing animals:** If not carefully selected, reburial materials could become a focus for burrowing animal activity. This issue can be controlled by securely fencing the area around the site until the reburial material has stabilised (for example, grass has grown) and ensuring the habitat is maintained in a way that discourages animal activity (consult an ecological specialist for more information; some general information is given in Historic Scotland 1999). Risks are probably greatest when nearby setts or burrows are disturbed.

Generally, rabbits and badgers are creatures of habit and faithful to existing burrows/setts, which tend to be located at the edge of fields, in hedgerows, and within banks and other slopes or mounds.

**Vegetation growth:** After reburial, vegetation needs to be managed to avoid damage to the site from tree and scrub roots that may find preferential pathways through loose backfill material.

**Site erosion:** Soil may need to be stabilised on slopes adjacent to reburied sites (for example by using temporary measures such as netting/matting that promote vegetation growth), to reduce the erosion of reburial materials.

**Capillarity**: The placement of reburial materials should aim to recreate the natural capillarity of water in the soil above the reburied deposits and avoid creating capillary breaks. Water should be able to move up and down the sediment profile (as it did before the excavation took place). If reburial materials prevent the movement of water, it may pool on top of the buried surfaces. This may cause leaching and weakening of any constituent mortars in architectural features. Equally, if material is placed onto a surface that prevents upward water movement above that surface (for example, if you place a thick bed of pea gravel above a mosaic), then any aggressive salts within the underlying soil may crystallise on the surface of architectural features, leading to mechanical degradation.

## 2.2 Functional criteria

The following functional considerations may need to be factored into the design of a reburial scheme.

**Re-excavation:** Materials used to rebury a site temporarily (for example, between seasonal excavations to make it quicker and easier to start again the next season) still need to satisfy the criteria set out in Sections 2 and 4. They should only be used where there is a specific plan (and appropriate funding) in place for subsequent phases of excavation.

**Theft, vandalism or accidental damage:** Theft and vandalism are not common occurrences at archaeological sites in England. However, where it is not possible to secure the site perimeter and the risks are deemed to be high, ground-level or buried deterrents may be necessary, such as reinforced concrete pads or thick stainless-steel mesh. These may degrade and break down over time, so the impact of any deterioration on the buried remains needs to be assessed. Accidental damage should be controlled through mitigation measures identified in the risk assessment, *see* Section 3.3.

**Minimal maintenance:** Reburial schemes are unlikely to be successful if they require complex maintenance. Some upkeep (for example, grazing or cutting grassed areas) may be necessary, but most schemes for medium- to long-term reburial should be designed to be as passive as possible, requiring only the initial reburial/construction phase and subsequent monitoring visits.

**Activity over the reburied feature:** After reburial, many sites may continue to be used for farming, as open spaces or integrated into development sites. The reburial design needs to take these and other future uses into consideration. Sometimes, the activities may need to be controlled, using protective fencing, site visits or monitoring. Trials carried out in the 1990s and 2000s to understand the impact of ploughing on archaeological sites used coloured glass chippings which were buried at different depths in a field that was being ploughed. If the glass was brought to the surface, it provided a clear visual warning that the ploughing was too deep, *see* Figure 3.

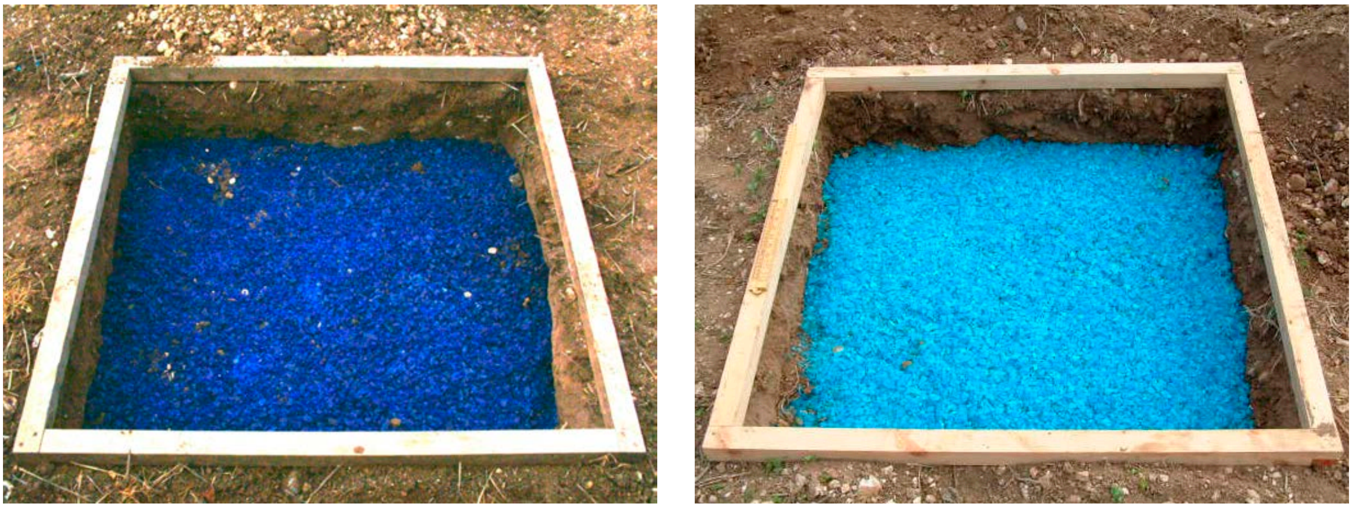

Figure 3: Different coloured glass chippings buried at different depths.
Left image: dark blue chippings buried at 30cm. Right image: light blue chippings buried at 20cm. They can provide a visual indication of cultivation depth above sensitive archaeological remains.

## 2.3 Programmatic criteria

The duration of the reburial will have a big influence on the decisions made. However, given the potential for short-term reburial solutions to become long-term conservation problems, it is good practice for any reburial to fully consider all relevant reburial criteria. Where a seasonal reburial has taken place but has become, by default, a permanent reburial, the site may need to be revisited and the reburial materials upgraded.

**Seasonal:** When archaeological sites are excavated intermittently, over several seasons for example, a temporary reburial between excavation periods may be required. Any materials used, such as a geosynthetic to separate the backfill from the unexcavated areas, should be selected in accordance with the environmental criteria in Section 2.1. For example, it would still be necessary to cover a sensitive area with an appropriate fill prior to laying down a geosynthetic. Putting down a cheap impermeable tarpaulin or geotextile of unknown properties and covering it with a few heavy objects is not an adequate strategy.

**Figure 4:** 'Temporary' reburial of a seasonal research excavation, photo from 2015. The image illustrates the problem of poorly chosen materials, inadequate subsequent monitoring and management.

**Short to medium term:** Sometimes, a temporary reburial is required to protect a site while a longer term plan is devised or funding acquired. This may include further excavation or incorporation within a construction design for long-term reburial. The likelihood that plans may change or funding may not be forthcoming should be identified by the risk assessment process. Adequate mitigation measures should be considered, for example designing the reburial scheme with a longer lifespan.

**Long term:** A reburial programme with a long duration may be 'forever'. However, there may be other long-term timescales that influence the reburial objectives (for example, reburial until the next time the site is developed). These decisions are informed by other discussions about the management of the site that are outside the scope of this document and should follow the processes set out in *Preserving Archaeological Remains*.

## 2.4 When should you start thinking about reburial?

Reburial can sometimes be a complex, expensive and time-consuming process. It requires time and possible input from specialists, as well as a range of assessments. It needs to be properly planned, so damage and deterioration do not occur while assessments and decisions are being made. In other cases it may be quite simple.

It is good practice for reburial to be considered from the outset of any archaeological investigation – during the project planning/design stage or when applying for funding. This will ensure adequate consideration is given to soil retention and management (for example, the separation of soils based on area of excavation), and to the time and budget requirements of any interim solutions (such as temporary reburial or managing vegetation growth). These considerations will be particularly important if significant archaeological features are encountered.

As previously mentioned, the most suitable material for reburial is usually that excavated from the site being reburied. Not only does this material meet many of the criteria outlined in Section 2: Fundamentals of reburials, but it also reduces the cost of bringing new materials to site (and the time spent selecting them). However, using soil from the site requires careful planning from the start – to separate the materials that can be used for reburial. For example, if you have soil that has been excavated from directly above a mosaic, this will most certainly be the best material to put back on top of the mosaic. It is, therefore, essential that it is kept separate. It is good practice for stored soil to be covered, for example with tarpaulins, to prevent contamination by seeds and vegetation growth.

If soil is being removed from a site during the excavation, as may happen at an urban site, it is worth considering whether some soil could be retained on site for reburial purposes. This may avoid the need to bring in new materials at a later date.

Where the potential for reburial is only identified during excavation, this should trigger the process of designing a reburial strategy (*see* Curzon Street case study). The framework of objectives, assessment and design set out in this document is equally applicable for a planned or unplanned reburial. When significant remains are discovered, getting the appropriate advice, for example from an architectural conservator, conservation architect or engineer as soon as possible will be essential to ensure any condition assessment is conducted in a timely manner. It is not good practice for remains such as mosaics or wall plaster to be reburied without specialist input. For excavations with a short duration, contingency plans to ensure sufficient time for assessment and reburial design may need to be put in place if material requiring reburial is identified towards the end of the excavation period. Reburial shouldn't be rushed through without appropriate assessments just because of a planned excavation end-date.


Figure 5: Reburied area of Curzon Street Round house fenced off with signage to prevent accidental damage during construction activities.

# 3. Assessments for reburial

It is good practice for all reburial schemes to undertake assessments of significance, condition, threats and risks, as set out below.

## 3.1 Assessment of significance

It is important to understand what is being reburied and why it is important. This is established by carrying out an assessment of significance. As indicated in *Preserving Archaeological Remains*, the approach should follow that set out in *Managing Significance in Decision-Taking in the Historic Environment* (Historic England 2015). This identifies three aspects of an assessment of significance that are particularly pertinent to reburial discussions.

**Understanding the nature of significance:** What aspects of the site's archaeological remains are important and why? Are they all of the same significance, and, by extension, do they all require the same approach to reburial and preservation for the future? Do they retain archaeological interest (the ability for future expert archaeological investigation to reveal more about our past)? Or are they largely of historic or architectural interest (in that most archaeological deposits have been removed and only solid masonry remains)?

**Understanding the extent of significance:** What is the geographical extent of the important archaeological remains? Can areas of different significance be defined across the site?

**Understanding the level of significance:** Is the site or areas of the site of high or low significance? Within a development/planning context, the level of significance is used to guide to how relevant planning policies are applied. It is intrinsic to decision-taking where there is unavoidable conflict with other planning objectives.

The assessment of significance should highlight where further investigation of the site and/or archaeological materials is needed to adequately define significance. It will also provide an opportunity to understand whether the reburial of the site will harm the significance of any archaeological remains. A useful approach on a complex site is to map out areas of relative significance, to help guide the design of reburial stratigraphy.

## 3.2 Condition assessment

An assessment of the condition (state of preservation) of relevant archaeological and environmental materials, from deposits within the site, is needed to understand the impact of any reburial proposal. In addition, chemical characterisation of the site should take place. Where new materials (imported fill) are to be used for reburial, are they chemically compatible with the existing geology (similar pH, for example)?

Appendix 2 of *Preserving Archaeological Remains* (Historic England 2016a) provides advice on preservation assessment techniques. However, many archaeological sites where reburial is recommended contain substantial structural remains (for example walls, floors, culverts, hypocaust pilae stacks) and these are not covered in Appendix 2. Prior to reburial, the stability of these structural remains, including any decorative surfaces, need to be assessed (*see* Curzon Street Case Study). It is good practice for this assessment to be carried out by a suitably experienced architectural conservator, conservation architect/surveyor or engineer, as required.

**Finding a conservation professional**

Depending on the nature and condition of the architectural features to be reburied, different conservation professionals may be required to assess significance, condition, threats and risks, and also to assist in designing the reburial stratigraphy. They may include an architectural conservator, conservation architect/surveyor, civil engineer or hydrogeologist, for example. For more information, *see* Section 8: Where to get advice and How to Find the Right Professional Help.

Few conservation professionals in England have direct experience of conserving archaeological features, and fewer still of reburial design. They can be engaged on the basis of their general conservation credentials, but should be required to follow the guidance in this document.

A condition assessment should identify if any architectural features have materials that need to be stabilised prior to reburial, or if additional protection may be needed during reburial to protect the most fragile remains. On rare occasions, it may be necessary to undertake research to establish which materials were used originally, to ensure the reburial materials will not cause any negative impacts.

## 3.3 Assessment of threats and risks

This assessment should identify existing threats and potential risks to the success of the reburial scheme (specifically, the preservation of the site). It should assess not only their impact on the significance of the remains but also any proposed mitigation measures. Once completed, the assessment should provide much of the detail needed for reburial design.

General threat categories are described below, but it is important that these are tailored to the specific site.

**Environmental threats:** Water, vegetation, livestock and burrowing animals, erosion (Stewart 2016).

**External human threats:** Theft, vandalism, accidental damage from subsequent use (for example, agricultural activity, construction (*see* Figures 5 and 6) or post-construction maintenance activities (as set out in Davis et al. 2004).

**Project development (management) threats:** Construction design changes during reburial design/programme, accidental damage from construction activity, timescale challenges (important discoveries made at the end of the excavation), permission for further seasonal excavation withdrawn.

**Financial threats:** Lack of funding for reburial or for extending excavation timescale to allow for adequate assessment prior to reburial, further funding for seasonal excavations unavailable (where only short-term reburial scheme is in place), funding for monitoring unavailable.

**Legal threats:** Legal consequences of the reburial scheme.

**Materials threats:** Chosen materials unavailable, use of substandard or inappropriate materials.

**Monitoring threats:** People responsible for monitoring leave the scheme or site, monitoring equipment is damaged or stolen.

An outline threat and risk assessment table is shown below (*see* page 16) and is available for download. The details are not included because these will be site specific, provided by those proposing/designing/undertaking the reburial scheme. Not all threat and risk categories will be relevant for each site (and some could, therefore, be removed from the table).

The details of any potential risk should be entered in the first column. It is advisable to be as specific as possible, describing and quantifying the activities or events that might create risk, and their potential frequency, duration, location or intensity (Ashley-Smith 1999).

| Threat category | Detail of any potential risk | Impact on significance | Likelihood of impact | Severity of impact | Risk level (*see* risk matrix) | Proposed mitigation measures |
|---|---|---|---|---|---|---|
| **Environmental** | | | | | | |
| Water | | | | | | |
| Vegetation | | | | | | |
| Livestock/ burrowing animals | | | | | | |
| Erosion | | | | | | |
| **External human** | | | | | | |
| Theft | | | | | | |
| Vandalism | | | | | | |
| Accidental damage | | | | | | |
| **Project management** | | | | | | |
| Construction design changes | | | | | | |
| Accidental damage | | | | | | |
| Timescale challenges | | | | | | |
| Permission withdrawn | | | | | | |
| **Financial** | | | | | | |
| Lack of funding | | | | | | |
| Further seasons unfunded | | | | | | |
| No monitoring funds | | | | | | |
| **Legal** | | | | | | |
| Legal consequences | | | | | | |
| **Materials** | | | | | | |
| Materials unavailable | | | | | | |
| Substandard / inappropriate materials | | | | | | |
| **Monitoring** | | | | | | |
| Monitoring personnel leave | | | | | | |
| Damaged equipment | | | | | | |


Figure 6: Protecting fencing around a reburied well.
The well was not fully excavated and will be preserved as part of the HS2 High Speed Rail scheme. The sign explains that no machinery can enter and no breaking ground can take place without the relevant paperwork. [Image courtesy of HS2 Ltd.]

The potential impact on the significance of the site being reburied, or on specific elements of that site, should be identified in the next column. Subsequent columns can be used to capture the likelihood of that impact occurring, the severity of the impact and the overall risk level. Figure 7 is a template of severity and likelihood that uses a five-point scale to estimate risk.

The final column should be used to propose mitigation measures that will or could be put in place to manage the potential risk. Where the estimation of risk (risk level) for any category is greater than medium, mitigation measures should be proposed to reduce the level to low/ low to medium.

| Columns: Severity<br>Rows: Likelihood | Negligable | Minor | Moderate | Significant | Severe |
|---|---|---|---|---|---|
| **Very likely** | Low med | Medium | Med high | High | High |
| **Likely** | Low | Low med | Medium | Med high | High |
| **Possible** | Low | Low med | Medium | Med high | Med high |
| **Unlikely** | Low | Low med | Low med | Medium | Med high |
| **Very unlikely** | Low | Low | Low med | Medium | Medium |

**Figure 7:** Example of a five-point risk matrix, showing likelihood, severity and risk level.

# 4. Reburial materials and their properties

Fill materials for any reburial scheme need to be:

- inert or chemically compatible (similar pH) with the buried feature(s)
- compactable and provide good continuous physical contact with the buried feature(s)

For most sites, fill materials will also need to provide good capillarity (free movement of ascending and descending moisture). Soil from the excavation is usually the ideal fill material.

## 4.1 Existing soil from the site

In most circumstances, the existing soil from an excavated site is the optimum choice for the reburial of that site. Nothing else can be specified that will so effectively minimise the risks of damaging surviving archaeological remains.

Some soil management may be needed to ensure that the existing soil from the current excavation is usable: for example, sieving to remove large or sharp stones from soil that is placed in direct contact with the reburied feature. The extent of sieving and mesh size requirements will be determined by the nature of the remains being reburied. Soil should be placed and compacted by hand over sensitive remains. Further material can be back-tipped or applied carefully by machine once a sufficient depth of protective soil has been deposited by hand.

The placement of soil within the reburial scheme should be seen as part of the archaeological process, overseen by appropriately qualified individuals. It should be described in the relevant WSI/project design and allocated sufficient time within the project timetable. When placing upper reburial materials, without using sediment compactors (rollers), it may be prudent to deposit the soil and then leave it for a short period of time to compact and consolidate under its own weight before returning and topping up any areas to the final levels. Alternatively, a higher level of fill can be placed over the reburied site, to allow for eventual settlement to an acceptable level. Either way, it is advisable to work with the landowner/site manager to determine the appropriate level of reinstatement and ensure it has been reached. This may require additional works once the initial reburial materials have settled.

It is good practice to separate out topsoil and subsoil/archaeological deposits. On many larger projects, soil handling recommendations will be covered by a site soil management plan. Soil for reburial needs to be free from upper organic humus-rich topsoil material and roots. Where possible, and as soon as reburial is proposed, soil from features being excavated should be separated and stored for later reuse. Covering the soil (for example with a tarpaulin) will help retain moisture and reduce plant growth and deposition of wind-borne seeds. For more detail on reburying waterlogged sites, *see* Section 5.4 Reburying waterlogged archaeological sites.

At some sites, space constraints have commonly led to soil being removed from site and deposited elsewhere. It is recognised that storing soil for subsequent reburial represents an additional challenge and cost. However, these need to be balanced against the cost and effort required to source an appropriate replacement fill material that can satisfy the reburial criteria as described in this document. Retaining even a small amount of existing soil to use immediately above or adjacent to a significant feature would likely improve a reburial design.

Exceptions to using existing soil would include contaminated soil: for example, that contaminated by hydrocarbons, industrial waste or asbestos. Soil with a very high clay or silt content might also not be appropriate in all situations. Such soil is more difficult to compact by hand or using the sort of non-vibratory plant that would normally be specified for a reburial scheme (to reduce vibration impacts on buried features). If the soil cannot be sufficiently compacted, it may not provide a good continuous physical contact with the buried feature. Furthermore, clays absorb and retain moisture, rather than transmit it through capillary action.

Using sandbags, for example to support features, should be avoided. It is hard to place sandbags without creating voids, and difficult, therefore, to ensure the backfill is properly compacted. Also, plastic sandbags impede the free transmission of moisture through the reburial profile. Similarly, turves (such as those removed by hand at the start of the excavation), should not be used to provide structural support during reburial, as they cannot be placed in direct contact with the material being reburied (risking the creation of voids or slumping) and introduce humus-rich topsoil material into lower levels, potentially altering the burial environment.

## 4.2 Other reburial materials

Other reburial materials will be needed if there is insufficient existing excavated material to complete the reburial, the existing soil is contaminated or fill materials must meet specific geotechnical requirements. The properties of any such materials will need to be assessed. Most material suppliers have data sheets for their products, and these can be consulted to gather precise information. If no such information exists for a specific product, it should not be used.

It is essential to consider whereabouts within the reburial scheme the fill materials are to be used. Will the material be used for the primary fill, in direct contact with the archaeological remains, or is it providing secondary fill further up the sediment sequence?

**Sand:** The mechanical properties of some sands make them suitable for reburial. Sand is often the cheapest readily available material, but it should be sourced as locally as possible because transport costs are a large part of the bill. For a reburial project, sand needs to have high silica and low iron content, be free of soluble salts and organic material, low in clay, and chemically inert (at least over human timescales). Ideally, it should be well-graded to promote capillary transmission of moisture. Poorly graded sand, or sand used in too great a depth, can impede water capillarity and so may not be suitable in some circumstances. For example, it may cause water ponding on reburied structural surfaces.

A detailed methodology for characterising and selecting sands for reburial can be found in Annex 1: Finding a suitable sand for reburial. Sometimes, an onsite or locally available sand may not meet these criteria, but it may match the site geology and geochemistry. A condition assessment to determine the state of preservation of the remains to be reburied will indicate whether it would be suitable as a fill material. [*See* Case Study 1 – Curzon Street]

From a chemical perspective, an inert sand will not change the chemical composition (the solute properties) of the pore water in the deposits. While this is usually key when selecting a fill material, it does mean that (unlike a soil, for example) an inert sand cannot provide any buffer against chemical changes, such as agricultural chemicals in surface run-off.

**Gravel and other forms of ballast:** Siliceous gravel can be a useful substitute for mass volume filling. It may be appropriate where the existing site material is not present, where capillary issues are not a concern, or where protection of archaeological remains is not needed or has already been provided by another fill material. An advantage of rounded flint gravels (such as pea shingle) is that they are free-running and, therefore, do not need compression. Gravel or shingle should not be used in direct contact with a buried feature, as this can create water ponding on top. It may also cause long-term degradation or may lead to excessive point loading due to the larger particle size.

Gravels composed of silica are unlikely to lead to chemical changes in the deposits. There may be circumstances in which gravels or crushed rock from other geologies are proposed as a reburial material for engineering or economic reasons. If used, they need to be chemically compatible (similar pH) with the local soils and geology of the reburial site. Any gravels used should be washed and should not contain adhering particles.

### 4.3 Geosynthetics

There is a wide range of geosynthetic materials used in the construction industry, such as geotextiles, geomembranes and geogrids. They are largely made from polymer materials such as polypropylene or polyester, derived from hydrocarbons, and can last for centuries in the ground.

Geotextiles are permeable meshes or fabrics that are designed to separate, protect and reinforce layers, filter materials or assist drainage in many geotechnical and construction situations (Kavazanjian 2004). The numerous types available have a range of strengths and permeabilities. Non-woven geotextiles offer greater permeability over woven ones. Geomembranes are usually impermeable, used as a barrier or liner to control liquid or gas movement. Geogrids are used to reinforce and stabilise soils and have a grid or net-like structure.

There has been an increasing and almost default use of geotextiles in the reburial of archaeological remains in England, either as a horizon marker or to facilitate re-excavation. Although geotextiles have been applied with the best intentions, they are not usually required and can at times cause damage to the assets they are installed to protect. Furthermore, they derive from fossil fuels and have an environmental (and financial) cost – so are not environmentally sustainable.

Installing geotextiles needs to be justified and based on a full understanding of their material properties. It is particularly important that geotextiles provide good liquid and water vapour permeability (measured in litres per metre). To perform effectively, there also needs to be sufficient hydrostatic pressure in the ground to ensure moisture movement through the geotextile. Manufacturers' technical data sheets should be consulted in advance of specification and purchase. Materials without good technical data should not be used.

Geotextiles vary hugely and using the wrong one could be harmful to the reburial environment. They should not be placed in direct contact with archaeological or architectural features (or shoved into holes), because this can create voids between the archaeological remains and the fill material. A geotextile may also promote root growth below it or cause mineral precipitation that adheres the geotextile to the archaeological feature (Neguer 2004).

**Figure 8:** Geotextile used at Grim's Ditch, Buckinghamshire, for temporary protection. [Image courtesy of HS2 Ltd.]

With appropriate archaeological recording (a site survey that includes levels, plans/sections and photographs), it should not be necessary to leave a marker layer for future archaeologists. After all, there are many thousands of archaeological sites recorded on Historic Environment Records, and their locations are not usually marked on the ground in any way. Equally, when previously explored sites are re-excavated, archaeologists are usually able to identify the trenches of past investigations. Marker layers are also not particularly effective where protection is required from accidental damage. Fencing or an enhanced system of working (such as permit to dig/permit to work) will be a more effective way to manage that risk – rather than hoping that someone digging a hole will notice a marker layer and stop their work.

If geotextiles must be used for short- or medium-term reburial, the reburial design should consider the reuse, resale or recycling of these materials. However, as noted above, short-term options have the habit of becoming long-term solutions through inertia and funding difficulties.

There are some circumstances in which it would be considered good practice to use a geotextile or geogrid as part of a reburial design. These include:

**To separate different reburial/construction fills:** Geotechnical engineers will sometimes use geotextiles as a separation layer to prevent intermixing of dissimilar soil layers. For example, in the Harvil Road case study, a geotextile was used in the construction of an embankment to stop finer-grained materials from filtering down into larger, coarser-grained material below, which could have resulted in the destabilisation of the embankment. Figure 8 shows a geotextile laid under a temporary working platform, which was installed on top of a scheduled Iron Age boundary ditch, to provide access for a geotechnical borehole rig. After the work was completed, the stones and geotextile were removed.

**As a load-spreading layer:** Geotextiles will have a slight load-spreading effect. Laying a geotextile on a subsoil or topsoil surface prior to adding further fill (for example, as part of the construction of an embankment) would help to spread the load of the initial weight. Using it for this purpose needs to be fully justified on geotechnical grounds, and not just a default option of 'lay geotextile, then sand, then gravel'. There needs to be an understanding of what each of these materials will contribute individually and collectively to the protection of the buried archaeological remains.

Geogrids (*see* Figure 9) can spread a load without the need to add a lot of extra reburial material and can be particularly useful in areas where ground levels cannot be raised significantly (where this may have a visual impact, for example).

**To inhibit root damage/burrowing:** Geotextiles can play a part in managing post-reburial impacts from tree roots or animal activity on site. However, many do not prevent root penetration. Those that supposedly do should be selected carefully because not all root control barrier geotextiles are permeable. If used, geotextiles should not be placed close to the archaeological remains. Their use should be discussed with an ecologist or similar specialist to consider whether other options are available. Geotextiles don't need to be used automatically whenever there is planting above archaeological remains, nor are they a substitute for designing and implementing an effective monitoring and maintenance programme for landscape works.

**Soil stabilisation:** A range of organic materials and geosynthetics are available for soil stabilisation and erosion control (such as erosion mats). These may be required to help ensure that reburied materials stay in place on sloping sites or where erosion from wind, surface water or waves is a concern (Stewart 2016). They would usually be applied at or just below the ground surface (rather than close to the archaeological remains), but it is still important that their permeability is assessed so they do not negatively impact the burial environment.

Figure 9: Example of a geogrid, used to spread a load.
[© Tensar International]

## 4.4 Human resources

In many cases, the placement of the reburial material will involve some element of manual handling, particularly when protecting fragile remains during the initial stages. This work is time-consuming and labour-intensive. As with other site activities, it needs to be appropriately planned within the schedule. Health and safety risks need to be properly and regularly reviewed. At the end of a long excavation, for example, tired staff may be more susceptible to slips, trips, falls and other manual handling accidents.

# 5. Producing a reburial design and specification

This section outlines a range of issues that need to be factored into a reburial design. It is important to allow enough time to produce the reburial design and specification documents. These may take as long to complete as the excavation process itself. This is because time is needed to carry out all the assessments, including those from relevant specialists (such as architectural conservators, engineers or hydrogeologists), and for stakeholders to review and approve the documentation.

In some circumstances, it will be known before the excavation begins that archaeological remains are likely to require reburial: for example, as part of a research excavation or one designed to investigate the preservation of an existing, known and managed site. At such sites, it is good practice for an initial reburial design to be included in the WSI/project design, as much of the information needed to produce one will already be known prior to the excavation taking place. Producing an initial reburial design will ensure that decisions about reburial do not have to be made rapidly at the end of the excavation and that any costs associated with reburial have been allocated from the start.

## 5.1 Assessment review

Before undertaking any reburial, it is essential that the three assessments outlined in Section 3: Assessments for reburial are completed. These are an assessment of significance, a condition assessment, and an assessment of threats and risks. They will provide much of the core information needed to plan and design the reburial strategy.

## 5.2 Stabilisation

**Structural remains:** The condition assessment may identify the need for structures and surfaces to be stabilised prior to reburial. If mortars are to be used, they need to be compatible with the feature. Cement mortars are not suitable for ancient or historic remains, because they are too strong and impermeable. Lime mortars are appropriate, but they vary in their setting times so their use may impact the timing of the reburial. All repair mortars need to be specified and applied by an accredited conservation specialist.

Figure 10: The base of a Roman tile kiln.
This particular site was not reburied but illustrates the type of remains that may need to be stabilised after a condition assessment.

Depending on the time between excavation and reburial, plant growth may need to be removed prior to backfilling. Where plants have rooted into a structure, careful removal and stabilisation may be required.

**Stabilising the periphery:** In addition to stabilising the structural remains, some sites may require the surrounding area to be stabilised, either temporarily or for the duration of the reburial. In some instances, part of the stabilisation process may include new drainage, such as geo-drains (Stewart 2016). Materials such as geotextiles, netting and so on may also be required for temporary or permanent slope stabilisation, assisting the growth of vegetation that will eventually retain the soil.

**Landscape cover:** Planting of shallow-rooted vegetation can help stabilise the reburial fill. It is important that habitats created to stabilise and cover reburial areas are managed and maintained to keep plant growth to an appropriate height and to ensure that scrub and trees do not become established. This is because you want to avoid deep root growth over reburial areas, as they are likely to favour the less well-consolidated fill. It is also important to manage the landscape to reduce burrowing animal activity. Advice from an ecologist will help to identify the most appropriate planting and maintenance regimes.

On urban sites, landscape cover may be a combination of planting and paving, with due attention paid to the management of surface and subsurface drainage.

## 5.3 Material requirements

It is important to select suitable fill materials, because poor choices and bad reburial design can ultimately be detrimental to the site. Fill materials need to provide good capillarity (free movement of ascending and descending moisture, with an appropriate grain size distribution). They also need to be inert or chemically compatible with the buried features (similar or neutral pH) and compactable, and they must provide good continuous physical contact with the buried feature. Soil from the excavation is usually the ideal fill material. Simple 'kitchen sink' tests can be conducted on some reburial materials to choose those that are appropriate (Roby *et al.* 2024).

The use of separation layers (for example geotextiles or plastic netting) should be carefully considered. They can be used to facilitate re-excavation (for seasonal excavations) or stabilisation, or as a physical separation layer between two fills for engineering purposes (for example, to stop the mixing of two different layers of material). Aside from these limited uses, they are not normally necessary and are not, therefore, recommended for a reburial scheme.

When choosing fill materials, consideration should be given to whether there are any restrictions on what can be used on a specific site, for example as a result of environmental considerations and designations (such as Site of Special Scientific Interest).

Further detail on fill materials is given in Section 4: Reburial materials and their properties.

## 5.4 Reburying waterlogged archaeological sites

These are some of the most complex sites and they will require more information to be gathered to inform the reburial design. A hydrogeological assessment may be required to understand the water environment. It should consider how any development or land use change with which the excavation and reburial are associated may impact water levels in the future. It is not the purpose of this appendix to explain the processes needed to understand waterlogged sites or methods for their long-term preservation. These are explained fully in *Preserving Archaeological Remains* (2016) and its *Appendix 3: Water Environment Assessment Techniques* (2016b).

When excavating a waterlogged archaeological site, it is common practice to keep the parts of the site being excavated wet, so that archaeological materials do not degrade. It is also advisable, particularly if reburial is a possibility, that waterlogged organic deposits removed during the excavation are stored separately and protected from drying out. Having this material available (and still damp) will make it easier to place reburial fill back over any fragile and sensitive materials (such as waterlogged wood). This should ensure that the site is able to return to a waterlogged anoxic state more quickly once any pumping or dewatering processes (used to facilitate the excavation) cease.

There is a balance between having a sufficiently large excavation area open for long enough to record and understand waterlogged archaeological remains, and the potential short and long-term impacts of exposing these remains to oxygen, which can lead to their degradation. For that reason, reburial decisions will need to be made rapidly, drawing on all available evidence to limit the time between excavation and reburial.

It should be noted that backfilling waterlogged archaeological deposits with a granular fill could reduce capillarity and impact the long-term preservation of these deposits.

## 5.5 Loading and settlement

If archaeological remains are to be retained within or below a development site, there are several ways they can be protected and integrated into the final scheme. One option is to create an area of open space or other benign landscaping over the archaeology. Alternatively, the development can be redesigned to bridge over the remains. It may be possible to protect the remains from the additional load of the building using ground beams, piling and tensioned concrete slabs, which transfer the load away from the archaeology to adjacent areas. If it is not possible to transfer the load, the developer's engineers will need to provide an assessment of the settlement that the additional load will cause to the deposits below (that is, from a building or embankment). This assessment should identify the amount of settlement and the depths at which it will occur. The image below (Figure 11) which was supported by a more detailed assessment, shows this for the site of Harvil Road.

Whether or not the level of settlement will harm the significance of the buried/reburied archaeological remains will be governed by the nature of the remains and the surrounding deposits. Where the archaeological remains are robust (for example, some walls or most pottery) and the predicted settlement is limited, the future understanding of the site is unlikely to be compromised (such as those shown in Figure 10). Where the site contains fragile remains and the predicted settlement is large, reburial may not be possible and other options (excavation/redesign of the development) may be required. The case studies from Hunts Green Farm and Harvil Road provide examples of embankments constructed over archaeological remains. It may also be possible to reduce the load of an embankment, for example by using a lightweight fill or by transferring the load to piles.

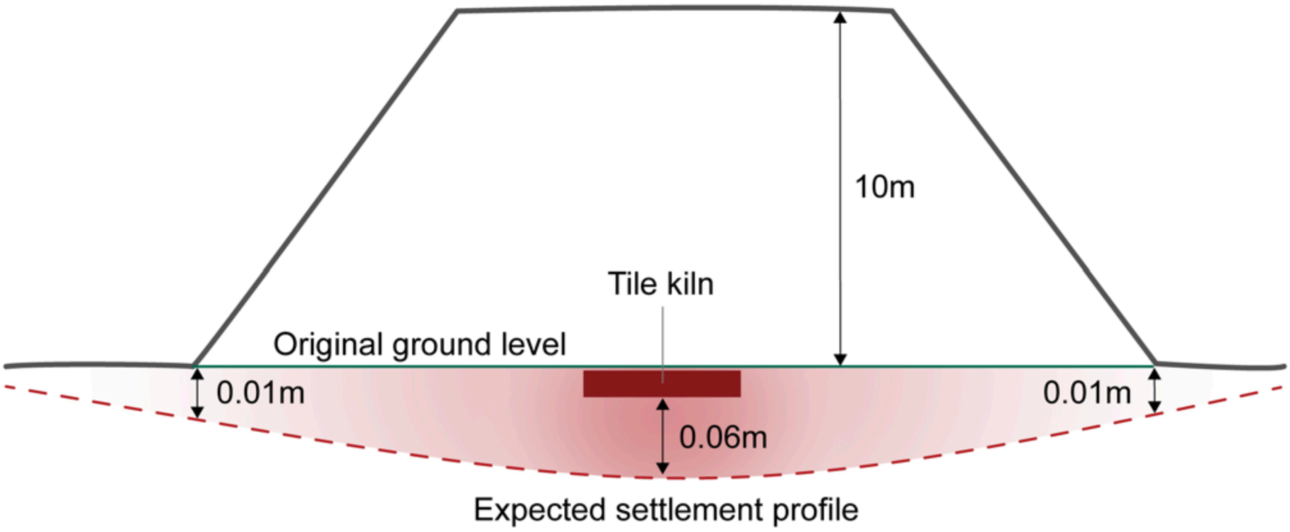


Figure 11: Simplified section showing expected settlement under an embankment.
[Image after HS2 Ltd; not to scale]

## 5.6 Post-reburial land use and landscaping

As noted in Section 2.2 Functional criteria, one aspect of reburial is about accommodating activity above the reburial. Section 5.5 Loading and settlement discusses some of the issues associated with post-reburial land-use for large-scale developments. For excavations on open (grass) or agricultural land where no subsequent development will take place, it is essential that discussions are held with the landowner/site manager on the level of reinstatement they will require. Ensuring the land is left in good workable condition may require additional works once the initial reburial material has settled.

The profile of the reburial may also need attention, for example where previous earthworks or areas of ridge and furrow have been excavated and need to be reinstated. These earthwork profiles should be recorded prior to excavation. Where archaeological features on slopes have been excavated, consolidation to avoid slumping may be required when turf is re-laid (*see* Section 4.3 Soil stabilisation). For any site where excavation and reburial involve removing and replacing turf, it is essential that the turf is properly managed and maintained to ensure it does not dry out in storage or die once re-laid.

Reconstructing cairns and other rubble structures will require specific consideration.

## 5.7 Mosaics

Mosaics are relatively uncommon on archaeological sites in England. However, where they are discovered, they may be highly significant. In the past, the rarity of mosaics has led people to protect them during reburial using large amounts of imported materials and geotextiles. Generally, unless there is a clear conservation requirement for additional materials to be used, reburying mosaics using clean soil from the excavation is the best option. If the soil contains a lot of stones or large rocks, it may be necessary to sieve it, providing a small amount of finer grade material to place in immediate contact with the mosaic. Another key aspect to consider when reburying mosaics (and other sensitive remains) is whether there is enough fill to provide 'insulation from extremes of and changes in both temperate and moisture at the surface of the mosaic' (Roby 2004). Few English mosaics are found on raised floors (with heating hypocaust systems below them), but where there are voids within the mosaic, they will need to be stabilised by an architectural conservator.

Wherever mosaics or other remains of high significance are exposed, or their discovery anticipated in new excavations (for example, at a suspected or known Roman site), a conservator with experience in mosaics should be identified in advance and be on call as part of the planning and excavation team – to advise on the best approach to reburial (Stewart 2004). It is essential that they are involved in the condition assessment which should be produced prior to reburial of any mosaics or similar features, such as in situ wall plaster.

**Why mosaics do not usually need a different reburial strategy**

Covering a mosaic with a geotextile of unknown properties and an inappropriate fill can be detrimental. For example, the geotextile could act as a barrier to water movement. In extreme cases, mineral precipitates can develop and adhere the geotextile to the surface of the mosaic. Similarly, sand (particularly any sand cover of more than 20–30mm) is likely to reduce capillarity if it is not well-graded. This can cause water to pool on the surface of the mosaic, which can lead to a range of negative impacts. Where soluble salts are present in deposits below or in a mosaic, the movement of water to the surface of the mosaic can cause salts to crystallise. Reburying a mosaic with material from the excavation (sieved to remove any large stones) avoids these problems. Water can move freely up and down the soil profile, and any salt precipitation is likely to take place in the deposits above, rather than on, the surface of the mosaic (Podany *et al*. 1994).

## 5.8 Maintenance and monitoring

Most sites will require some form of maintenance and monitoring after reburial, even if that is just grazing of grass and an occasional visual inspection. The aim of the monitoring is to ensure that fill materials are continuing to provide adequate protection to the reburied remains and that the site is not subject to harmful erosion, vegetation growth or unacceptable human activity.

Maintenance and monitoring require staffing and funding. The duration needs to be discussed and agreed with relevant stakeholders. Maintenance and monitoring proposals should be included within the project documentation (*see* 5.10 Documentation and archiving) and, where necessary, secured through management agreements.

Undoubtedly, the simpler the maintenance and monitoring regime, the greater the chance of success. Where a reburial strategy requires an ongoing commitment to significant levels of intervention, there is a greater risk the scheme will fail (Demas 2004). The risk assessment process (as described in Section 3.3 Assessment of threats and risk) and stakeholder engagement should hopefully provide mechanisms to develop manageable reburial strategies.

## 5.9 Stakeholders

It is essential that relevant stakeholders are involved in the development of the reburial design. Various forms of consent may be needed prior to reburial taking place, including Scheduled Monument Consent for designated archaeological sites or natural environment consent (for example, if the reburial scheme involves a Site of Special Scientific Interest). Stakeholders are likely to be project funders, site owners, archaeologists who have excavated the site, relevant authorities required to approve the reburial proposals (local authority planning archaeologist, Inspector of Ancient Monuments), specialists (such as conservation engineers/conservators), consultants, and project managers and their engineers (where the reburial is being delivered as part of a development). The landowner/site manager is a critical stakeholder, because the long-term management of the site is ultimately going to be their responsibility.

## 5.10 Documentation and archiving

Regardless of the scale and type of archaeological site, or how it is funded (commercial development or community research excavation, for example), a reburial design and detailed specification documents should be produced. The precise details and layout of these documents are not described in this guidance because they will vary depending on the significance and scale of the archaeological site/project/development.

These documents (reburial design/specification) should, however, include:

- location (National Grid Reference coordinates)
- extent ($m^2$) of area of buried remains
- any buffer zone and its extent ($m^2$)
- depth of buried remains (Above Ordnance Datum – AOD)
- type of buried remains (human, structural, palaeochannels and so on)
- reburial objectives
- assessment of significance
- condition assessment
- threat and risk assessment
- whether any stabilisation or repair is needed, or has been carried out
- reburial design and process, including the environmental, functional and programmatic criteria
- materials used for reburial (including data sheets and test reports) and stratigraphy design (rationale)
- what activities will be taking place above the remains once the reburial is complete, and whether the buried remains are sensitive to activities such as compaction or dewatering
- evidence of stakeholder engagement and agreement
- maintenance and monitoring programme
- locations where reburial design documentation will be stored

A reburial checklist is included in Section 6. It contains a set of questions and tasks relating to and cross-referencing the main components of this guidance, plus a check box to tick when each element has been completed. Prompts summarise the information that should be entered in each box. A template is available to download.

The process of designing and implementing a reburial strategy for a large development scheme may be complex. There may be quite a long time between archaeological excavation and reburial, and when any subsequent construction activity takes place in and around the area. It is also possible that different contractors will be responsible for the area during different phases of work. It is vital that the site is not accidentally damaged between the phases of work. Protective fencing and signage can reduce the risks, as can including the reburial site in all relevant project documentation.

Reburied/remaining archaeological features (or human remains) on a construction site come under the category of 'residual risk' for the person(s) inheriting the site, and there is a duty of care to inform the client and any subsequent contractors or site owner/occupiers of any residual risks that may be relevant to future site use, maintenance or modification. The list above covers the type of information that is likely to be needed for handover.

It may be recorded within:

- the health and safety file
- Inspection and Test Plans and relevant quality documentation relating to the site
- any documentation that is relevant to temporary works that are being handed over if the preservation of the archaeological site (or remains) has required a temporary structure to protect it. (This might be a slab or gabion wall, for example, which may be classed as 'temporary works' where it has a temporary lifespan and requires inspection)
- any other handover and completion documentation (including GIS schema, photographic archive and so on)

The final reburial design and specification should be given to the landowner/site manager and also included in the site archive (paper or digital). It is beneficial for these documents to be shared with the local Historic Environment Record so that they are available if further development, land use change or excavation takes place in the future. They also provide an important record of the decisions made about the reburial should any aspect of the scheme fail and need remedial action.

## 5.11 Approval

Where a site requires the approval of a relevant authority (local authority planning archaeologist, Inspector of Ancient Monuments), a WSI may be needed to set out the reburial processes, or the reburial design/method statement may be appended to an agreed WSI. In such cases, reburial should not start until that methodology has been approved. Including a completed reburial checklist as part of the documentation will help those approving the reburial design to see that all the relevant requirements (as set out in section 5.10) have been fulfilled.

On large development sites, reburial proposals may also need to pass internal governance checkpoints to be agreed by the engineering project director/design manager/commercial director.

# 6. Reburial checklist

| Checklist | Tick |
|---|---|
| Have you identified the objectives of reburial? (Section 1) | |
| What are they? Summarise the objectives (for example, why are you reburying and what is the purpose of the reburial process?): | |
| Have you carried out an assessment of significance? (Section 3.1) | |
| Is the significance uniform across the site or are there areas that contribute to a greater or lesser degree? Summarise the key aspects of the archaeology that contribute to the significance of the site: | |
| Have you carried out a condition assessment? (Section 3.2) | |
| What are the main characteristics and vulnerabilities of the site and its proposed reburial materials (archaeological materials, pH and so on)? List any areas/features that require stabilisation prior to reburial: | |
| Have you carried out a threat and risk assessment? (Section 3.3) | |
| What are the main risks and how can they be mitigated? | |
| Have you produced a reburial design? (Sections 2 and 5) | |
| What are the main environmental criteria the scheme is designed to control? (Section 2.1) | |
| What are the key functional criteria that the design reflects? (Section 2.2) | |
| What programmatic criteria have influenced the design? (Section 2.3) | |
| Summarise and justify the reburial design (stratigraphy, depth) and materials: | |
| Have you consulted relevant stakeholders (including the landowner/site manager) during the design phase? (Section 5.9) | |
| Who are they? Set out the steps you have taken to ensure that all stakeholders (including the landowner) are aware of the reburial scheme and have approved the design: | |
| Do you have a maintenance and monitoring programme? (Section 5.8) | |
| Summarise the main components of the programme here and the measures in place to ensure it will remain successful. Include the responsibilities of specific stakeholders: | |
| Will the design documentation be stored so that it is accessible in the future? Section 5.10) | |
| Where will it be stored? How have the responsibilities been passed on from the project manager to the landowner, or from one construction team to another? | |

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In addition to the references above, this guidance is based on the authors' experience of discussing and designing reburial schemes. It is informed by international research on reburial, the work of staff at the Getty Conservation Institute and subject-specific meetings, such as Reburial of archaeological sites: A colloquium organized by The Getty Conservation Institute, The National Park Service (Intermountain Region) and ICCROM at Santa Fe, New Mexico, 17–21 March 2003. Papers from this colloquium were published in 2004 in *Conservation and Management of Archaeological Sites* 6 (3–4). Those by Demas, Neguer, Roby and Stewart can be seen as the starting point for many of the overarching themes in this document.

The Getty Conservation Institute has also trained conservation technicians in the treatment and maintenance of mosaics on archaeological sites in North Africa and the Middle East, in association with national authorities in those regions. A lecture on the reburial of mosaics is available at: getty.edu/conservation/publications_resources/teaching/pdf/mosaics_conservation/mosaics_reburial_july2021.pdf

# 8. Where to get advice

## 8.1 Historic England

The first point of contact within Historic England for general archaeological science enquiries, including those relating to the reburial of archaeological remains, should be the Historic England science advisors, who can provide independent, non-commercial advice. They are based in the Historic England local offices.

For contact details, *see* HistoricEngland.org.uk/scienceadvice

## 8.2 Local authority planning archaeologists

Local authority planning archaeologists can be contacted via the ALGAO website algao.org.uk/

## 8.3 Finding a conservation professional

Building Conservation Directory: www.buildingconservation.com

ICON Conservation Register: www.conservationregister.com

IHBC Database of Accredited Practitioners: https://ihbc.org.uk/accredited

Register of Architects Accredited in Building Conservation (AABC): www.aabc-register.co.uk

The Royal Institute of British Architects (RIBA) Conservation Register www.architecture.com/working-with-an-architect/conservation-register

Royal Institution of Chartered Surveyors (RICS) www.rics.org/surveyor-careers/career-development/accreditations/building-conservation-accreditation

## 8.4 Finding an accredited material testing laboratory

United Kingdom Accreditation Service
www.ukas.com/

# 9. Annex 1: Finding a suitable sand for reburial

A full discussion of sand characteristics and sourcing can be found in 'Tests and guidelines for the suitability of sands to be used in archaeological site reburial' (Canti and Davis 1999). A summary selection procedure adapted from that paper is given here:

- Source as locally as possible; transport costs are a large part of the final bill.
- Sands need to be pale (ideally yellow to white) and non-calcareous. The best range of Munsell Hues is 7·5 YR, 10 YR and 2·5 Y to ensure low iron content (which reduces the risk of staining), and the values should be 6, 7 or 8 to help ensure low organic matter. These are partly characteristics of the geological deposits from which the sands are derived, details of which the quarry should be able to supply.
- Sands need to be relatively low in clay, because higher clay content impedes capillary movement of moisture. The clay content can be a function of geology, but can also be artificially reduced by quarries through washing.

Once potential sands have passed these general suitability tests, more detailed examination of their characteristics needs to be carried out. Most quarries will provide accredited chemical data from X-ray fluorescence (XRF) tests, loss-on-ignition (which determines the amount of organic content) and particle size (often called 'mechanical') analyses. Alternatively, samples can be requested and the three tests commissioned from commercial laboratories (*see* Section 8 Where to get advice).

Once the data are available, the following selection procedures should be followed:

- Particle size data should show 98% (or more) finer than 2mm, and 5% (or less) finer than 63μm.
- Loss-on-ignition should be 2 per cent (or less), as organic matter increases chemical and biological activity.
- The loss-on-ignition percentage and any other tiny values (labelled 'trace' or 'less than 1 per cent') can now be ignored and the other percentages recalculated.

- These modified oxide percentage values should be put into three groups:
  - inert oxides: $SiO_2$, $Al_2O_3$, $TiO_2$, $ZrO_2$, $V_2O_5$
  - reactive oxides: $CaO$, $Na_2O$, $MgO$, $K_2O$, $P_2O_5$, $BaO$, $SrO$, $ZnO$
  - staining oxides: $Fe_2O_3$, $Mn_3O_4$, $Cr_2O_3$

The totals of these groups should be: staining oxides 1 per cent or less and reactive oxides 1.5 per cent or less, leading to an inert oxides total of 97.5 per cent or more. This can be visualised as a ternary diagram, on which the suggested oxide group limits are represented as an area of acceptability (Figure 12).

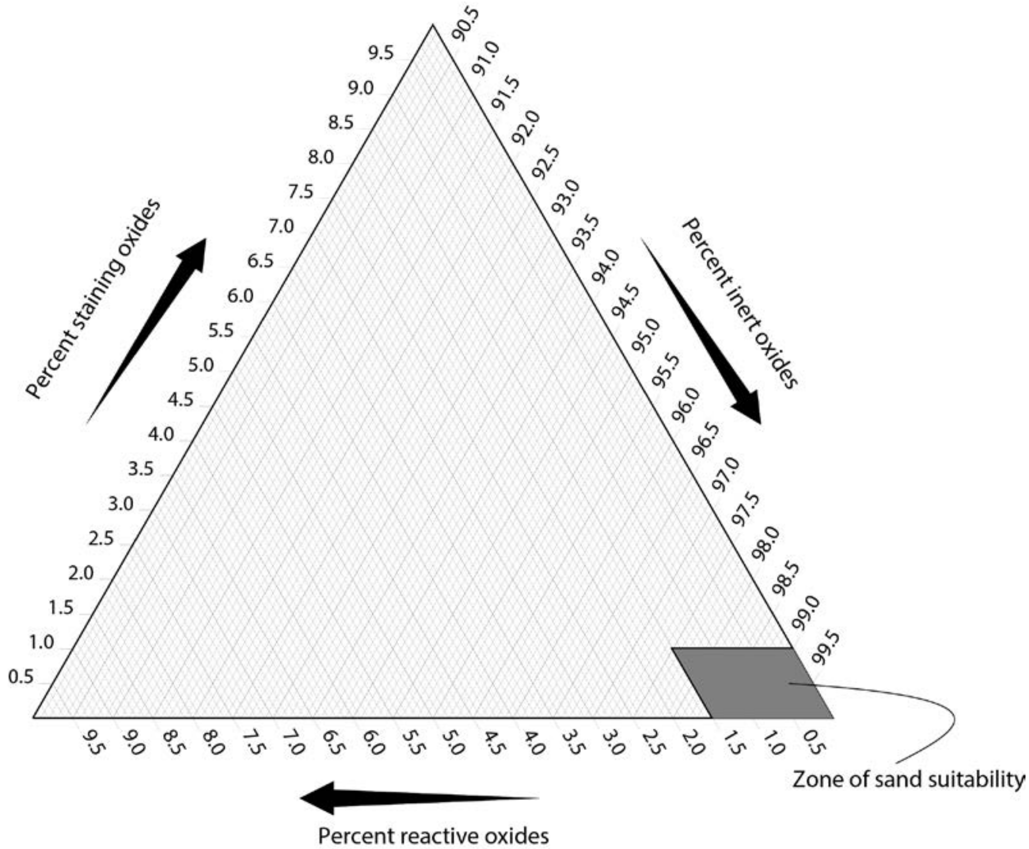


**Figure 12:** Ternary diagram for sand selection.

Four sand samples from the original study are shown in the table below. Samples A and B would pass the tests described above, as they contain more than 97.5 per cent inert oxides, and very low percentages of reactive or staining oxides. Sample C contains higher levels of calcium oxide (CaO) and potassium oxide ($K_2O$) than is appropriate in a sand used for reburial (and also a higher loss-on-ignition result than is acceptable). Sample D has a high level of iron oxide ($Fe_2O_3$), which is also higher than the levels for staining oxides suggested above.

| **Sample** | **A** | **B** | **C** | **D** |
|---|---|---|---|---|
| Munsell | 2.5Y | 10YR | 2.5Y | 10YR |
| Colour (value) | 7/4 | 6/2 | 7/4 | 6/4 |
| XRF—$SiO_2$ | 98.42 | 98.82 | 86.62 | 93.47 |
| XRF—$Al_2O_3$ | 0.45 | 0.28 | 3.42 | 1.15 |
| XRF—$TiO_2$ | 0.1 | <0.05 | 0.19 | 0.08 |
| XRF—$ZrO_2$ | <0.05 | <0.05 | 0.05 | <0.05 |
| XRF—$V_2O_3$ | <0.05 | <0.05 | <0.05 | <0.05 |
| Total inert oxides | **98.97** | **99.10** | 90.28 | 94.7 |
| XRF—CaO | <0.05 | <0.05 | 2.49 | 0.11 |
| XRF—$Na_2O$ | <0.05 | <0.05 | 0.14 | <0.05 |
| XRF—MgO | <0.05 | <0.05 | 0.49 | 0.14 |
| XRF—$K_2O$ | <0.05 | 0.05 | 2.22 | 0.61 |
| XRF—$P_2O_5$ | <0.05 | <0.05 | 0.05 | 0.1 |
| XRF—BaO | <0.05 | <0.05 | 0.55 | <0.05 |
| XRF—SrO | <0.05 | <0.05 | <0.05 | <0.05 |
| XRF—ZnO | <0.05 | <0.05 | <0.05 | <0.05 |
| Total reactive oxides | <0.5 | <0.5 | **5.9** | 0.96 |
| XRF—$Fe_2O_3$ | 0.18 | 0.23 | 0.75 | 3.1 |
| XRF—$Mn_3O_4$ | <0.05 | <0.05 | <0.05 | <0.05 |
| XRF—$Cr_2O_3$ | <0.05 | <0.05 | <0.05 | <0.05 |
| Total staining oxides | 0.20 | 0.25 | 0.80 | **3.15** |
| LOI (loss on ignition) | 0.03 | 0.14 | 2.84 | 1.13 |

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