

# Tregargus, St. Stephen in Brannel, Cornwall

## Conservation Management Statement



**Historic Environment**



## **Tregargus Valley, St. Stephen in Brannel, Cornwall**

### **Conservation Management Statement**

<b>Client</b>	<b>Tregargus Trust</b>
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We are grateful to David Hazlehurst, Natural England, for clarification of the extent of the area managed by the Tregargus Trust.

The views and recommendations expressed in this report are those of the Historic Environment projects team and those of the other authors and organisations whose reports are summarised here. They are presented in good faith on the basis of professional judgement and on information currently available.

## Freedom of Information Act

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.



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## Cover illustration

An archive view of Big Wheel Mill, with Blacksmith's Shop Mill and Big Wheel Mill in the background. British Geological Survey © NERC. All rights reserved. IPR/121-15CT

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## **Abbreviations**

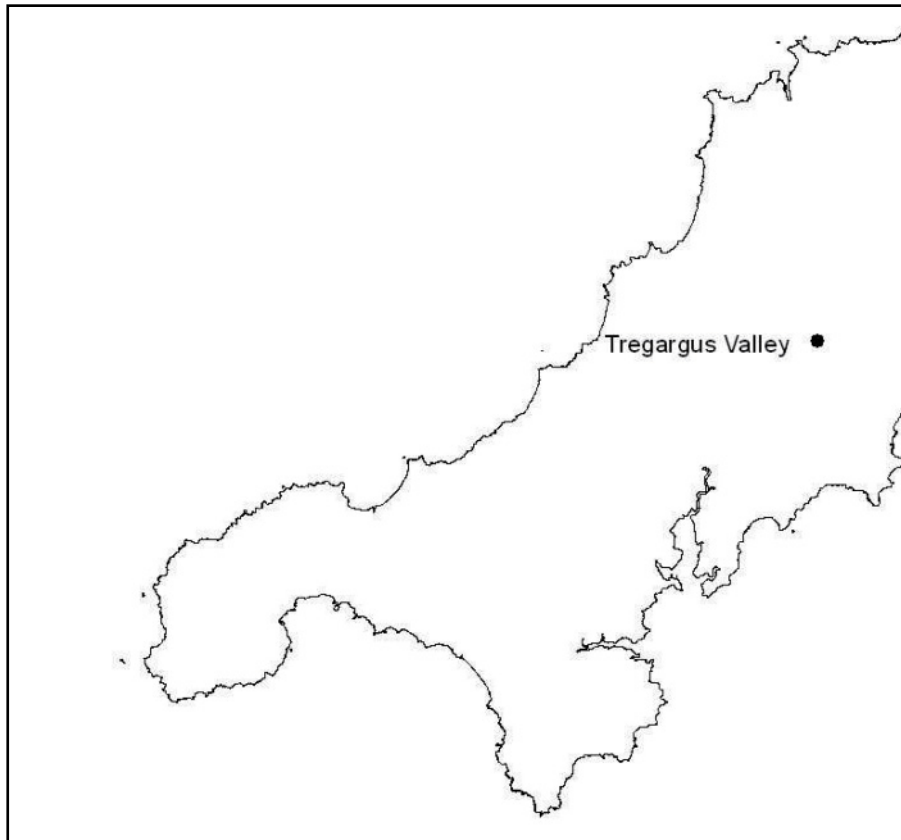
CRO	Cornwall County Record Office
EH	English Heritage
HER	Cornwall and the Isles of Scilly Historic Environment Record
NGR	National Grid Reference
OS	Ordnance Survey

## Summary

Following the agreement of a lease from IMERYS and Goonvean Ltd with the Tregargus Trust, an archaeological assessment of the Tregargus Valley was undertaken in 2002 by Cornwall Archaeological Unit (now Historic Environment, Cornwall Council). This report recommended the drawing up of a conservation plan for the valley, a report to include recommendations for the conservation of historic structures in the valley associated with the china stone industry, the creation of enhanced public access to the valley and the sites it contains and the provision of interpretation. To this end an assessment of the structures and their conservation management needs was commissioned from Knevitt Consulting of Wadebridge in March 2009, whilst an updated ecological assessment was commissioned from Spalding Associates, Truro in 2010.

In the context of the potential availability of grant aid for the works needed to achieve many of the aims of the Tregargus Trust, this conservation management statement draws together the results of the 2002 archaeological assessment with structural and ecological assessments to set out an integrated and prioritised approach to the conservation needs of the valley as a whole and its structures in particular. The plan is intended to allow the non-specialist reader to understand Tregargus and its significance as well as the natural and historic processes that have created it. The plan also sets out the issues which currently affect the valley and the philosophy which should underpin any proposals for the conservation of its mills and associated features.

This Conservation Management Statement will also be used in support of applications for Scheduled Monument and Listed Building Consent to undertake required conservation works to Big Wheel Mill.



*Fig 1. The location of the Tregargus Valley project area.*

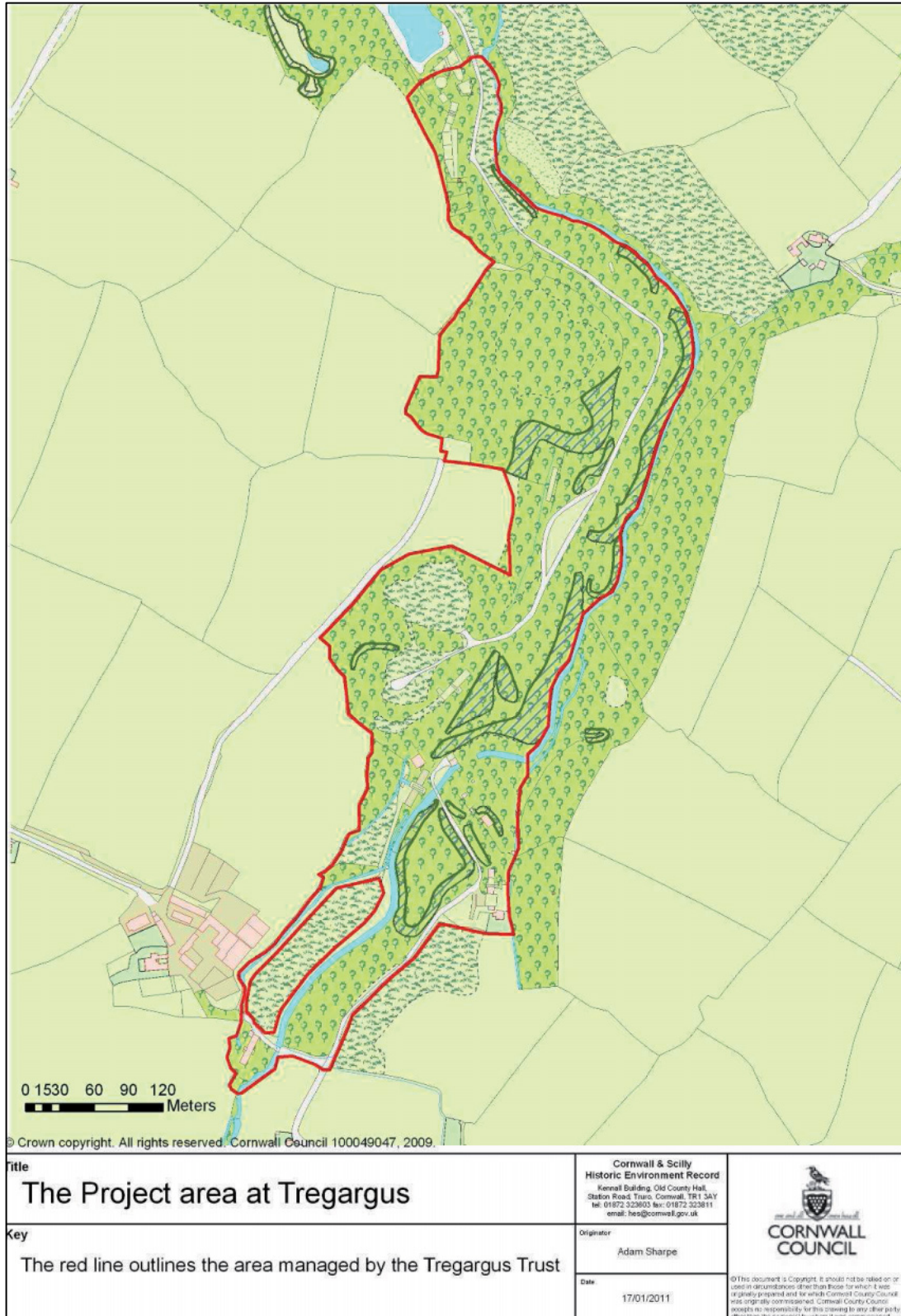


Fig 2. The extent of the Project Area at Tregargus.

# 1 Introduction

## 1.1 Scope and rationale for this Conservation Management Statement

This Conservation Management Statement is intended to provide a brief and readily comprehensible introduction to the sites in the Tregargus Valley; it is intended to allow the non-specialist reader to understand the site and its significance as well as the natural and historic processes that have created it. It also sets out the issues which currently affect it and the philosophy underlying proposals for its management, in particular the conservation of its structures.

One element of the site (Big Wheel Mill) is a Scheduled Monument (SM) and a Grade II Listed Building; works within the designated area will require specific written permission (Scheduled Monument Consent) from the Department of Culture Media and Sport (DCMS) and Listed Building Consent from Cornwall Council. A Conservation Management Statement (CMS) or Conservation Management Plan (CMP) is required by DCMS for such permission to be granted.

## 1.2 Requirement for works

The Tregargus Valley is of exceptional importance for the history of china stone extraction and processing in Cornwall, being the principal and best-preserved example of the small number of sites at which this industry was pursued in Britain.

China stone was quarried and milled in the Valley from *circa* 1870 until 1965, when the market for lower grades of china stone collapsed and the mills were abandoned. The site includes the remains of five china stone mills, which together with their associated stone quarries, are the finest assemblage of stone mills in Western Britain. They include **Wheal Arthur** at the northern end of the Valley, with its quarry, stone mill and pan-kiln; the partial remains of **Blacksmith's Shop Mill** and **Big Wheel Mill** in the middle part of the valley with their associated infilled quarries, mills, tramways and leats; **Trevar Mill** to the south with its attached pan-kiln and miller's cottage; and **Lower Tregargus/Mica Mill** with its associated tramway and leat at the southern entrance to the Valley.

These rare structures have remained un-managed since their abandonment four decades ago and have suffered significant deterioration through both natural processes and human interventions. A recent structural assessment (Knevitt 2009) has confirmed the general impression that conservation measures will be required if these buildings are not to suffer significant collapse and loss of integrity within the near future.

The range of works will include the clearance of vegetation which is currently masking structures, restricting access to them and, in many cases, accelerating damage to them. Following this preliminary work it is likely that wall capping and pointing in lime mortar and the limited rebuilding of lost masonry where this compromises structural stability will be required, together with the replacement of rotten timber lintels, the arresting of corrosion processes on ironwork components and a range of public safety works. In line with the aims of the Tregargus Trust, who have taken on responsibility for the management of the site, enhancement of public access and the provision of interpretation for the valley are also considered desirable.

## 1.3 Aims of this Conservation Management Statement

This CMS is intended to guide and underpin proposed conservation, stabilisation and safety works to structures at Tregargus, as well as the management of the site within which they sit, including provision for public access and for interpretation. A principal aim of this CMS is to ensure that these works are carried out following best conservation practice, and that they will enhance the site without resulting in

unwanted and avoidable negative effects on other aspects of the site; this guidance will also ensure that the works will be carried out in a sustainable and appropriate fashion.

## **1.4 Consultation**

This draft report was circulated for comments to Natural England, English Heritage, The Tregargus Trust, Historic Environment Advice Cornwall Council, Goonvean Ltd and IMERYS prior to finalisation.

## **1.5 Structure of Conservation Project Team**

In order to progress the conservation of the structures on the site, it is proposed that a conservation project team will be established to achieve these aims. Individuals representing organisations and interests in the site will be brought together for an initial project meeting to explore the scope and nature of the proposed works, to identify any constraints on the works and to agree the mitigation which would be needed to minimise loss of information or damage to sites or habitats occurring during or as a result of the Project. Grant aid will be sought from Natural England to fund the works.

The suggested Project Team (below) will consist of the Client (The Tregargus Trust), a range of specialists charged with drawing up specifications for the works, the chosen principal contractor, representatives of relevant statutory agencies, and specialist advisors, as below.

### **The Client**

The Tregargus Trust

### **Architect/engineer**

To be appointed

### **CDM coordinator/health and safety advisor**

To be appointed

### **Principal Contractor**

To be appointed

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### **Ecological advisor (assessment and conservation plan)**

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## **2 Understanding the Asset**

For site location see Fig 1, for extent Fig 2, locations of principal archaeological sites and features Figs 3-11, relevant designations Fig 3, suggested contractor's access routes and compound sites Fig 13 and locations of sites of ecological interest Fig 94.

In the spring of 1999, the China Clay Area LEADER project headed by Len Smith initiated a proposal for public access and conservation in the Tregargus Valley just to the north-east of St. Stephen in Brannel. This proposal has since been adopted and developed by the Tregargus Trust, a registered charity whose aim is to manage and conserve the Tregargus Valley for public access and recreation. A lease of most of the Tregargus Valley was acquired jointly from IMERYS and Goonvean Ltd by the Tregargus Trust circa 2000 (for the extent of the leased area see Fig 2). The Trust's aims are to preserve the important industrial sites within the Valley and to present them to the general public within the context of the wider landscape. A five year management agreement between English Heritage and The Tregargus Trust relating to the scheduled Big Wheel Mill has now lapsed.

The project area (see Fig 2) is approximately 200 Ha in extent, and occupies a section of this north-south trending steep-sided, wooded valley which was created by the Barn River; the river provided water for a series of china stone mills which processed the output of the nearby stone quarries. China stone was quarried and milled in the Valley from *circa* 1870 until 1965, when the market for lower grades of china stone collapsed and the mills were abandoned. Since then, the Tregargus china stone quarries have been infilled with mica waste and two of the central mills have been almost completely demolished or buried.

## 2.1 Geology, Mineralogy and soils

The northern section of the project area is underlain by Hensbarrow granite, though in the northern part of the valley this has been blanketed by a build up of Quaternary alluvium. To the south, the granite is covered by hornfelsed slates of the Early Devonian Meadfoot Group, the southern section again being blanketed in alluvium (information derived from BGS datasets). The soils that have developed on these bedrocks are, to the north, soils of the Upper Moorgate series – typically well-drained loams over granite, and to the south the well-drained fine loams or silty loams of the Manod group – derived from Lower Palaeozoic slates, mudstones and siltstones. Altered granite (in the form of china stone) outcrops in the northern part of the valley on its western side, where it has been quarried at a number of locations. The lower quarries, now substantially infilled, have been designated SSSIs for their geological importance, their western working faces remaining exposed.

## 2.2 Aspect and setting

The Barn River, which flows through the Tregargus Valley, rises just to the north of Nanpean near the Great Wheal Prosper works, and flows southwards and then south-westwards for 2.5Km to Higher Tregargus where its course again turns to the south, flowing for just over 1 Km through the Tregargus Valley project area. The river continues 1.5 Km to the south-east to Gwindra, where it turns to the south, eventually meeting the River Fal at Coombe.

The Tregargus Valley is narrow (averaging 170m wide) and is steep-sided, cutting through the southern side of the Hensbarrow granite massif, and falling 50m (between 130m and 80m) in the one Km section which forms the project area, the stream being, in places, incised into the valley floor. The stream no longer follows its original course within substantial sections of the valley, having been diverted to allow spoil dumping operations adjacent to the Wheal Arthur works, and in two locations in the southern part of the valley where tin streaming operations took place. Within the project area the valley follows a sinuous course, its 250m long upper section being orientated north-south, the 200m long section to the south of this being orientated north-west to south-east, the remaining 600m being orientated north-north-east to south-south-west, the valley opening out at its southern end, where it forms the eastern boundary of the settlement of St. Stephen in Brannel. Within most of the project area the river has been used as a source of water for leats serving industrial structures.

## 2.3 Historic Landscape Zones

During 1994, Cornwall Archaeological Unit (CAU) carried out a map-based historic landscape assessment across the whole of Cornwall, using existing field patterns and early map and place-name evidence to characterise the landscape (Countryside Commission 1996). This characterisation reflects the historic processes that have shaped the Cornish landscape and involved dividing Cornwall into a series of zones, each of which reflects a particular set of historic processes and tends to contain a predictable range of archaeological sites and historic features.

The Landscape Assessment classed the core area of the Tregargus Valley as *Plantation and Scrub, Upland Woods*, Rescrowsa Pit and Wheal Arthur Quarry being classified as *Industrial, Disused*, whilst the remainder of the area, comprising Higher and Lower Tregargus Quarries, Big Wheel Mill and the Wheal Arthur complex being classified as *Anciently Enclosed Land* (land enclosed for agriculture between prehistory and the Medieval period), with some possible later enclosures to the north and east. The 2002 survey makes it clear, however, that much of the study area should be re-characterised as a *Steep-sided Valley* which also contains considerable evidence of china stone and other extractive industries (*Industrial, Disused*).

## 2.4 Designations affecting the area

Big Wheel china stone mill is a scheduled monument (Cornwall 668) and a Grade II listed building (SW 95 SW 3/123, LBS No 71464, the structure having been listed on the 20<sup>th</sup> December 1988). The listing description reads:

*"Mill: formerly used for stone-grinding. Early-mid C19, with few later alterations. The mill was in operation until circa 1965. Granite rubble with granite dressings and quoins. The roof was formerly of slate and shingles, with gable ends.*

*Plan: There are two rectangular mill houses with the wheelpit between the two; overshot wheel formerly powered by a leat at the rear, with the tailrace running along the front of the mill houses.*

*Exterior: Each mill house is 2-storey at the front, built into the bank and single storey at the rear. Each has a symmetrical front, each the same, with two round-arched doorways at ground floor with keystones and window openings above. The front is much overgrown. The wheel is set centrally, cast iron wheel with cast iron launder at the rear. The right gable end of the mill house has a central loading door at upper ground level with granite lintel and small gabled hoist housing above the pulley wheel. At the rear the mill house to left has 2 door openings and 2 small window openings, with an unexplained projection in stone rubble to left. The mill house to right has similar door and window openings.*

*Interior: No internal machinery remaining; the roof trusses only survive, halved and bolted at the apex of the principal rafters."*

The Tregargus Higher and Lower Quarries two thirds down on the west side of the site have been designated as a Site of Special Scientific Interest for geological reasons. The boundaries and details of the SSSI are included in the Appendices to this report (see Fig 3 for the extent of the SSSI). The condition of the SSSI was last assessed by Natural England in 2008 when the condition was described as "unfavourable" due to the encroachment of vegetation which was obscuring the features of interest. This is a result of a deliberate decision by the Tregargus Trust to allow such growth in this area, as the dense scrub and tree growth discourages members of the public accessing what they consider an unsafe site.



## 2.5 Access and rights of way

There are no public rights of way within the Tregargus Valley, nor has the Valley been designated as Access Land under the CROW Act 2000. Nevertheless, the Valley contains a series of informal paths which are used by local people, access to the valley being gained from the lane linking Tregargus and Trevear at the southern end of the Valley and from the road linking Stepside and Goonamarris to the north. The part of the route running between the public road to the north and the Wheal Arthur works is, however, not owned or managed by the Tregargus Trust. Some surfacing works have already been undertaken along a former haul road through the northern part of the valley by the Tregargus Trust, whilst safety works have been carried out at a number of bridges incorporated into the footpath network.

## 2.6 The historic environment

Within Britain, the china stone quarrying and milling industry was geographically almost entirely sited within a small area of the south-western part of Hensbarrow Moor (see Section 2.4), a reflection of the very limited area within which the geological resource on which it depended was available. The massive expansion and modernisation of the Cornish china clay industry during the 20<sup>th</sup> century inevitably resulted in the destruction or over-dumping of some of the sites related to this industry; the final cessation of china stone milling at its traditional water-powered sites during the 1960s brought about the abandonment of the remaining sites and the stripping of their machinery, together with any useful construction materials. Many of these sites remained in the ownership of the china clay producing companies, however, and in the case of the complex at Tregargus, this helped to ensure the survival of many of its elements, with the result that the group of mills, pan kilns and associated structures and earthworks in the valley now represents by far the best-preserved evidence for this uniquely Cornish industry. Big Wheel Mill has been designated as a scheduled monument and a Listed Building as a result (see Section 2.4), whilst Chapel Mill at St. Stephen in Brannell (a short distance to the south) has been Listed Grade II\*, given its intact machinery.

The Tregargus Valley also witnessed other formative activities in the evolution of its landscape character and complexity, including tin streaming, corn milling, woodland management, quarrying and china-clay extraction, as is evidenced in some of the sites to be found flanking the Barn River, whilst in recent decades it has also been used for the disposal of waste from china clay operations – a major factor in the development of the landscape character of Hensbarrow Moor. Taken together all of these factors make the Valley a rich and valuable resource in the understanding of the development of this part of the Cornish landscape.

## 2.7 Landscape history

Summarised from the HES 2002 assessment (Cole and Smith 2002)

The Tregargus Valley takes its name from the settlement of Tregargus to its south. First recorded in 1356, the farm's name is derived from the Cornish place-name element *Tre* 'farmstead' which suggests an origin in the pre-Norman period (Padel 1985, 223-232). It also incorporates an unknown second element. Other farms incorporating the same initial place-name element which lie around the Valley include Trevear, Trethosa and Tregascoe. Each was recorded for the first time in 1327, though they are considerably older than that.

The Churchtown of St Stephen was recorded in 1200, though it was often known by the alternative name of Egloshellings at this time. Of the other nearby farms, Carloggas was first recorded in 1284, its name derived from *cruc* 'barrow' and *logaz* 'mice,' (Padel 1985, 73-74, 152) while Rescrowsa Farm was first documented in 1695. Rescrowsa is derived from *rid* 'ford' and *crous* 'cross' (Padel 1985, 72-3, 197-9). Goonabarn to the south includes the element *goon* 'downland, unenclosed pasture'

(Padel 1985, 108-109) demonstrating an early enclosure of open heathland. It was first recorded in 1312.

Later (19<sup>th</sup> century) settlements which grew up to the north of the study area were Hill Head (recorded on 1813 OS 1 inch map), Stepside and Higher Tregargus. Higher Tregargus immediately to the west of the study area was first recorded on the 1840 OS map as Trethewy's Tenement.

The St Stephen Tithe map (Fig 14) shows that the majority of the study area was associated with Tregargus Farm in 1840, while the accompanying apportionment documents a range of different land-uses prior to the development of china stone milling in the valley. The better land included that on the north-west side of the actual valley associated with Trethewy's Tenement and in Quarry Close, all of which was recorded as 'arable.' There was also pasture land to the west of the Valley in areas simply named 'Moor' (the word here having the meaning of poor, uncultivable land, including, in the south of the area, low-lying boggy land adjacent to the river). Along the Barn River itself, the apportionment records Outer Hill and Plantation as 'pasture and trees' while Hills was less wooded, recorded as '*furzy, stones and pasture.*' The fringes of two fields associated with Trevear and named Higher and Middle Rick Park were recorded as arable, though the part of the enclosures within the study area are very steep and almost certainly would have been wooded in 1840.

Of paramount importance to the development of the Valley was the Barn River which is likely to have long been used as a source of water power for corn mills, while possibly also being used in early tin extraction in this area, there being evidence for tin streaming activity in two areas of the valley base towards the southern part of the project area.

Post-medieval activities in the Tregargus Valley were probably not that dissimilar to other valleys in Cornwall at this time. Its woodland would have been exploited by farmers and craftsmen of the Tregargus, Trevear and possibly Rescrowsa holdings as pasture grounds (underwood), sources of fuel, coppice wood and timber. Local mines and miners may also have had a close relationship with the Valley, which could have provided both timber and charcoal (for smelting). Field banks (possibly boundary features) are clearly visible within the woodland and these areas may also include many other related unsurveyed redundant features such as tracks, charcoal burners' platforms etc. Analysis of the 1880 and 1907 OS maps show that the entire valley bottom included both deciduous and coniferous trees, suggesting a policy of deliberate planting which could have been undertaken after the end of early mineral exploration in this area as a means of partially reclaiming an 'industrial' landscape.

Charles Henderson records early evidence of mining in the parish of St Stephen-in-Brannel with a list of tin bounds in Brannel Manor dating to 1685 (Henderson 1935, 133-134). Some of the bounds can be identified from surviving place-names such as Drinnick, Goonabarn and Goverseth, though the majority may be more difficult to identify spatially with names like 'Good Speed,' 'Little Good Luck' and 'Vincent's Well.' Dr. Sandy Gerrard (1986) compiled a list of early tin works from various historic documents as part of his PhD research into early mining activity, his lists including a considerable number within the St Stephen Parish from as early as 1508. Given the possible tin streaming remains identified through the HES 2002 archaeological assessment, it may be that some of the tin bounds recorded by Henderson or Gerrard relate to the Valley.

By 1807, R. M. Barton noted that there were seven china clay pits in the St Stephen area, each with its own china stone quarry. "These comprised two at Treviscoe, two at Hendra and one each at Trethosa, Goonvean and Goonamarris. One, and perhaps both, of the Treviscoe works was on lease to Wedgewood; the Goonvean and Trethosa pits were those being worked by Warrick and Dickins and the Hendra Works (Hendra and Treleavour) were being worked by the Hendra Company. To these must be added the pit on Carloggas Moor occupied by Spode and Wolfe, and the works of Warrick and

Dickins on Hallow Moor to the north and also 'at St Stephens' (Barton 1966, 40). Barton also attests that the land noted 'at St Stephens' refers to the Tregargus Stone Quarry, which was recorded for sale in 1807 (Sherbourne Mercury, 16<sup>th</sup> November 1807) as "*adjoining the great china clay works of Wedgewood, Spode, Woolf, Close and others.*" This is borne out by the St Stephen Tithe map of 1840 which records the Lower Quarry within an enclosure known as 'Quarry Close.' This map also describes the area around and to the north of Rescrowsa Clay Pit as 'Moor and Clay Pits' at this time.

In 1849, the china stone producers came together with a scheme which attempted to regulate the price of their raw material. A scheme was agreed in which they agreed to control output in order to maintain a good price in November of that year. By 1858, Wheal Arthur was recorded as producing 800 tons of potting clay each year. At this time it was owned by Coode and worked by R. Martin and Lovering.

The arrangement of china stone quarries and mills within the valley and their supporting infrastructure continued to grow during the early 20<sup>th</sup> century, revisions of the Ordnance Survey 25" to the mile maps dating to 1907 and 1930 demonstrating this process well (Figs 15 - 20). In the post-war years, however, quarrying and milling within the Valley seems to have gone into a rapid decline as the demand for second grade china stone fell away, the last mill closing down in the mid-1960s. At present, the only china stone quarry still at work is at Restowrack, not far away to the north. Most redundant mills were stripped of their roofing slates, doors and windows and most of their iron components. Abandoned to the elements, they soon began to deteriorate, whilst parts of the site were used by local people for rubbish disposal.

Subsequent to the abandonment of the Tregargus mills, mica waste was disposed of into Higher and Lower Tregargus Quarries by pipeline (this process being virtually complete by the mid 1980s), a haul road was laid down through the upper section of the Valley and the mica lagoons were blanketed with sand and stent to allow them to revegetate, this process burying (or almost completely burying) two mills (Long Incline and Short Incline), partly burying a third (Blacksmith Mill), destroying parts of the settling tanks to the south of Wheal Arthur and obscuring sections of original roadways and leats.

The agreement of a lease between the china clay companies and the Tregargus Trust a decade ago laid the foundations for tackling some of the issues affecting the valley and its sites, whilst this management plan aims to continue that process, arresting structural decay and dilapidation and enhancing access to and enjoyment of the Valley as a whole.

## **2.8 History of the china stone industry**

The extraction of china clay dominates the upland landscape of the Hensbarrow Moors north of St Austell. For the past two hundred years it has been a powerful economic force in Cornwall, and in the 20<sup>th</sup> century has outstripped and eclipsed Cornwall's traditional industries of hard-rock mining for tin and copper. China clay is a soft white mineral, formed by the decomposition of feldspar in granite at a time when the igneous mass was in the post-intrusive stage. This process of decomposition is known as kaolinisation, and the altered product as kaolin, after the Chinese mountain Kao-Lin where this mineral had been located in antiquity.

The Chinese were pre-eminent in the manufacture of porcelain or hard-paste ware, and for centuries only they knew the secret of its manufacture. The European potters used re-deposited china clay (ball-clay) for their white earthenware, but had no knowledge of the second essential ingredient of fine porcelain – china stone. China stone is a local form of partially kaolinised altered granite with a low iron content and is found in close proximity to fully kaolinised granite. In china stone there is sufficient feldspar to act as a flux when ground, mixed with china clay and fired to form the body of hard paste wares, William Cookworthy remarking that the '*the clay is the*

*bones of the body and the stone is the flesh'*. On firing at high temperatures, this mix vitrifies to produce the translucent, delicate ware highly prized as fine porcelain.

William Cookworthy, born in Kingsbridge, Devon, in 1705, was the first to recognise these minerals in Cornwall and their relevance to the potter's search for the materials required for the production of true porcelain. Working from details of the Chinese process contained in two obscure essays by a French Jesuit priest, Cookworthy became engaged in a search for kaolin and china stone in Britain. As a wholesale chemist based in Plymouth, he took frequent business trips on horseback through Cornwall; eventually, in the 1740s, he identified the minerals he sought at Tregonning Hill in the parish of Germoe, and in the parish of St Stephen-in-Brannel. The Cornish had in fact been using these materials for centuries, though not for pottery. Quarried on a small, local scale, china stone had been used in building as an easily-worked freestone, whilst china clay itself had found some use as a lining for smelting-house furnaces. Indeed, if the quarries had not already existed, Cookworthy would have found his prospecting far more difficult.

Cookworthy went on to establish his own porcelain manufactory, first in Plymouth, then Bristol, and the future of the extractive industry in Cornwall (and Devon) was assured. While china clay went on to have a multitude of uses in the modern paper, chemical and pharmaceutical industries, china stone has only ever found a market in the potteries. As a result, its production has always been small-scale and very specialised.

China stone was and is quarried from the ground in the same manner as any other granite, unlike china clay, which in its soft form lends itself to hydraulic means of extraction. The stone quarries are always found close by the clay pits and were often worked in association with them, the high value of the stone offering a useful buffer to the clay companies in times of recession. Traditional methods of working the often loosely jointed stone included drilling the rock with hand held 'jumpers', and splitting it by the use of wedges (the 'tare and feathers'). Gunpowder (later replaced by dynamite) was used in more recent times to 'heave' the large blocks of stone from the working face. The quarries producing the very best grades of stone are on the Rostowrack Downs near St Dennis; the quality of the stone is of prime importance for porcelain manufacture, as there must be no iron or other impurities in the rock that might mar the finished ware.

Four different grades of stone were originally supplied: the Hard Purple, Mild Purple, White and Buff varieties, which contained different proportions of the altered feldspar and purple fluorspar. More recently other grades such as Hard White, Soft White and Ponto Mill were also produced, as well as de-fluorinated varieties. Each variety has its own use in the ceramics industry, and the grades were separately marketed and priced, the higher the feldspar content, the higher the price. From the mid-nineteenth century onwards, all the major clay producers on Hensbarrow had their own china stone quarries. The main areas of extractive activity were Rostowrack Downs, Slip Quarries near Goonvean, the West of England works at Quarry Close, Nanpean, and in the Barn River valley at Wheal Arthur and Tregargus. In addition, there were many smaller quarries throughout the region.

Initially, all china stone was shipped direct to the potteries in lump form, or dressed to size for mill pavers and runners. The very best stone continued to be sent direct in this way until the 1980s, as the pottery millers insisted on having it in lump form so that they could check its quality. They, often controlled by syndicates of potters, crushed and ground it in their own Staffordshire mills, and sold it as a liquid slip ready for use. In the latter half of the nineteenth century lesser grades of stone were ground in Cornwall in mills specially constructed for the purpose. Stone of this lower grade was used in the body of cheaper varieties of ware and not as a glaze; the product was sold dried and bagged from the Cornish mills.

Typical production figures were 1850, 11,600 tons; 1868, 29,000 tons; 1907, 68,174 tons. By 1932 the world slump had cut production back to the level of 1850. The market for china stone became severely depleted after 1945, when export markets shrank and other materials were adopted by the potters. Stone ceased to be ground in Cornwall in the 1960s. The entire output of Cornish stone in 1983 was 8,000 tons, supplied entirely from one quarry, and in 2001 was only about 4,000 tons per annum.

## 2.9 Cornish china stone mills

Cornish china stone mills were first established during the second half of the nineteenth century. Pontois Mill was in operation after 1876, and earlier schemes had been proposed in 1854. Trenowth was in operation by 1880. The location of the mills is highly concentrated, most being in the parish of St Stephen-in-Brannel. The first mill, at South Goonvean, was on the lower edge of the main quarrying area; Wheal Arthur, the Tregargus mills, Trevear, Lower Tregargus and Chapel Mill followed the Barn River south as their source of power. Terras Mill, Combe Vale and Trenowth are in the same general area, but dispersed to the south and west. The last of the mills to work was at Par Harbour, where the stone was ground dry. Outside the Hensbarrow district were the mills at Pontois Mill and Carmears in the Luxulyan Valley, and a complex of three mills at Kergilliack near Penryn.

Site	NGR	Surviving components (1985)	Status 2010
South Goonvean	SW 9470 5470	Pan kiln	Destroyed
Wheal Arthur	SW 9495 5453	Mill, pan kiln, quarry, tramway route	Deterioration
Big Wheel Mill, Tregargus	SW 9495 5400	Four mills, infilled quarries	Deterioration
Trevear	SW 9498 5385	Mill, pan kiln, cottage	Deterioration
Lower Tregargus	SW 9477 5370	Mill	Deterioration
Chapel Mill	SW 9485 5310	Mill, pan kiln	Deterioration
Gwindra	SW 9510 5295	Two kilns	Some remains
Combe Vale	SW 9485 5149	Mill	Some remains
Trenowth	SW 9355 5053	Mill, two pan kilns	No change
Kergilliack	SW 7820 3402	Three mills, pan kiln	One mill destroyed
Wheelpit Mill, Carmears	SW 0656 5669	Mill	No change
Pontois Mill	SW 0723 5630	Mills, pan kiln	Mills destroyed

The basic construction of all the mills followed a similar pattern, although there were detail variations. An overshot waterwheel in its pit was commonly flanked by a mill building on either side, often all under a single roof. Horizontal shafting was driven from the hub of the wheel, running in tunnels beneath the floors of the mill buildings (see Fig 26). Vertical shafts were driven by bevel gears from this mainshaft, and these rotated in the centre of the grinding pans on the upper floor (see Fig 25). The circular grinding-pans, normally one or two on each side of the wheelpit, were usually constructed with granite sides and floored with china stone 'pavers' (though some examples (as at Tregargus) were constructed of brick. Attached to the central rotating shaft was a four-armed cast-iron 'gate' – the arms of the gate supported vertical

wooden uprights shod with iron feet, which pushed large blocks of china stone (the 'runners') around the base of the pan. Each pan had a piped supply of water and a drain hole in the base which could be unplugged to empty the pan (see Figs 23 and 24).

Lump stone from the quarries was piled in a yard at the front or rear of the mill and knapped by hand to a suitable size for grinding (in later years a jaw crusher was used for preliminary size reduction, whilst Pons Mill employed pneumatic stamps in addition). The stone was barrowed into the mill, and loaded into the pans which were then filled with water; the water-wheel was set in motion, and as the gate and runners rotated, the stone was gradually wet-ground to a creamy slurry. The miller would test the contents of the pan at intervals by taking a sample on his tongue and pressing it against the roof of his mouth. When he judged it to be sufficiently fine, the ground stone was run off through launders to dumb buddles, after which it was classified, the coarse material being reground. It was then sent to settling tanks. This process was lengthy one, and it would take a day or more to grind a load of stone. The contents of the settling tanks were dried on the floor of a pan-kiln, in the same fashion as china clay. Sometimes this kiln would be attached to the mill itself, as at Trevear; in other cases the kiln would be entirely separate (Wheal Arthur) or located some distance away (Tregargus) with the slurry despatched to the kiln via a pipe-line. The dried china stone, converted to a fine talc-like powder, was then bagged for shipment. The mills commonly ground not only china stone, but also other materials according to demand – quartz sand for use in abrasive cleaning powder (at Cornwall Mills, Par Harbour), shell stone (iron-rich granite), feldspar for high-grade insulators, and flint for the potteries (for example at Trevear Mill).

As demand for second-grade china stone fell after 1945, Cornish stone mills ceased to work one by one. In most cases the water-wheels and machinery were stripped for scrap, either legitimately or surreptitiously by local 'metal sharks'. Some mill buildings were subsequently demolished, and most of those which remain are now roofless and ruinous.

### **3 Previous studies**

In 2002, Cornwall Archaeological Unit (now Historic Environment, Cornwall Council) were commissioned to produce an archaeological assessment of the Tregargus Valley by English Heritage. The resulting report (Cole and Smith 2002) combined all readily available documentary information in the public domain with the results of a detailed walk-over survey which extended beyond the area managed by the Tregargus Trust, including in particular a section of the valley to the north of the Wheal Arthur complex which takes in the site entrance and Wheal Arthur Quarry, and also a strip of land on the eastern side of the Barn River. The report also included some preliminary management recommendations. The principal sources consulted were:

- The HE Sites and Monuments record.
- Extracts from Herring and Smith's 1991 archaeology survey of the Hensbarrow china-clay district
- Sharpe and Smith's 1985 survey of Chapel Mill china stone mill complex at St. Stephen in Brannel
- Aerial photographs within the CC photographic archive
- Copies of historic maps held by HE including Gascoyne's maps of 1699, Martyn's map of 1748, the OS 1<sup>st</sup> Edition 1" to the mile map and survey sheets (circa 1810), the 1842 Tithe Map for the parish of St. Stephen in Brannel and the OS 1:2500 mapping dating to 1880, 1907 and 1930.
- Information resulting from the 1994 Cornwall Landscape Assessment

- Primary sources in the Courtney Library (Cornwall Museum) and Cornwall Record Office.
- Published sources.
- Scheduling and Listing descriptions for Big Wheel Mill

An ecological assessment of the valley was undertaken by Cornwall Environmental Consultants Ltd. (CEC) in 2002. In addition, an (undated) assessment of the Barn River had been undertaken by the Westcountry Rivers Trust, whilst a bat survey was undertaken by English Nature in 2003. JNC Safety Services of Truro have undertaken an H&S audit of the valley, whilst the Tregargus Trust has also undertaken some oral history research into the valley with the support of the Scarman Trust, this work involving children from local schools.

Some small-scale management works had been undertaken by the Tregargus Trust through the CAU Scheduled Monument Management Programme, including repairs to a bridge at the rear of Big Wheel Mill and a tramway bridge to its east (these being reported on by Cole in 2004). Other minor works have also been undertaken to some of the structures by the Trust.

In 2009, Knevitt Consulting of Wadebridge were commissioned by HE Projects to carry out a structural survey of the remaining buildings within the Valley, the survey report being completed in November 2009; the results of the survey have been incorporated into this report. Mica Mill, at the southern end of the Valley was not included within this assessment due to uncertainties about its ownership status at the time of commissioning.

In 2010, Spalding Associates of Truro were commissioned by HE Projects, Cornwall Council to undertake a habitat survey and impact assessment of the areas and structures proposed for works as part of this Conservation Management Plan. The survey was undertaken in May 2010 and the results of the study have been incorporated into this report. Due to a misunderstanding concerning the extent of the area leased by the Tregargus Trust at the time of commissioning, this survey covers the area of the 2002 archaeological assessment.

A full list of surveys and other information relating to the property are to be found in the bibliography to this report (Section 11).

### **3.1 Summary results from the 2002 archaeological assessment**

See Figs 4 – 5 for site locations

A total of seven china stone mills has been documented within the Tregargus Valley, of which five survive (with limited fragments of a sixth). The earliest two mills are likely to be the complexes of Wheal Arthur and Trevear, both of which had their own attached pan-kilns. Wheal Arthur had its own quarry at the northern end of the Valley, whilst the remaining mills were supplied from two quarries (Higher and Lower Tregargus) in the central part of the Valley.

#### Wheal Arthur China Stone Mill

This mill and associated structures at the northern end of the valley were first recorded on 1880 OS map, with their own attached processing arrangements. This is clearly one of the earliest two mills in the Valley, as it has its own pan kiln attached to the mill structure and was not dependent on the later arrangement of pumping the slurry away for final processing off-site. This complex includes the mill and waterwheel, pan-kiln and settling tanks, quarry, tramways connecting the mill to the quarry and the pan kiln, a number of leats, and a further detached waterwheel to the north which probably worked the pump in a nearby shaft.

The site has suffered to a degree from fly tipping and the effects of the construction of the ECLP haul road nearby, together with scrub growth, but is generally intact.

### Trevear Mill

First recorded on 1880 OS map along with its attached processing works, this china stone mill had previously been recorded as a 'flint mill' in Kelly's Directory of 1873. In subsequent directories, the mill was recorded as working china stone, while all that time remaining in the ownership of the Olver family. On the 1930s OS map, the mill was recorded as 'disused.' The Trevear Mill complex includes the mill, pan kiln, building and a remote chimney, plus the Miller's Cottage, as well as the tramway leading to it from the quarries near Big Wheel Mill.

This complex is in fair condition, though its structures are deteriorating and becoming overgrown.

The 1880 OS 25" map records three more mills in the centre of the Valley (below, Top Wheel, Blacksmith's Shop and Short Incline Mills) which, it might be argued, were later in date than the above. These mills did not have their own dries and pumped their clay slurry to Gwindra.

### Top Wheel or Long Incline Mill

According to Mr Roy Carkeek who worked in the Valley in the late 1940s (letter to John Yeo), this mill got its alternative name from having the "*longest incline from the crushing plant.*" He remembers it standing silent for many years before being brought back into operation "*in his time.*" He also states it had only a single grinding pan. This mill was first recorded on the 1880 OS map with a wheel attached to the southern end of the structure; it had been extended to the south by 1907 but was largely destroyed in the recent years through over-dumping during the infilling of Tregargus Higher Quarry, though parts of its eastern elevation appear to have survived, and protrude from the eastern side of the quarry infill.

### Blacksmith's Shop Mill

Mr Carkeek also states that this mill was so named because "*the older men said the Blacksmith shop was located there.*" Originally containing four grinding pans, the eastern half of the structure survives, as does its southern end, though these remains lie within an area of dense undergrowth and are currently difficult to access; the western and northern parts of the structure were over-dumped during the infilling of the adjacent china stone quarries. No surviving associated features were recorded during the 2002 fieldwork.

### Short Incline Mill

This mill was named because it had the "*shortest incline from the crushing plant.*" John Yeo states that a young boy was killed in the vicinity of this site in about 1947. A structure was recorded on the site of the mill in 1880 (covering the eastern part of the site later occupied by the mill) and by 1907 the OS map evidence clearly shows a stone mill. This structure does not survive, its remains having been completely buried when the southern china-stone quarry at Tregargus was infilled.

### Big Wheel Mill

This stone mill was constructed in 1898, and photographs of the structures here survive within the Cornwall Record Office and in the collection of the British Geological Survey (BGS), two of which (Figs 21-22) have been used in this report. An additional photograph is included in Barton 1966. It had six grinding pans and was one of the largest such mills in Cornwall. The waterwheel also survives in situ and this mill is protected as both a Scheduled Monument and a Listed Building. This complex includes the mill, the later winder house, tanks, leat and a tramway. In the general area to the south and east of the mill, there are a series of buildings including a blacksmith's shop and an associated chimney.



### Lower Tregargus / Mica Mill

This mill is known by two names; Lower Tregargus and as the 'Mica Mill.' This mill had four grinding pans and a double wheel, which no longer survives *in situ*. The Mica Mill complex includes the mill building plus evidence for a tramway, leat and aqueduct. In the Cornwall Record Office, a detailed pre-construction sectional elevation of the Lower Tregargus Mill survives from 1896 (CRO X223/20). The plan shows a number of features including mica runs, timber lintels, window openings, shafts and cranks, as well as the grinding pans (see Cole and Smith 2002, Fig 7).

### Other sites

As well as the evidence for china stone extraction, the Valley contains more limited evidence for china clay extraction and processing. The 1840 Tithe Map records a large area of pasture as 'Moor and Clay Pits,' an area which includes the site of three disused quarries marked on 1880 and 1907 OS maps as well as the site of the Rescrowsa China Clay Works.

The Rescrowsa China Clay Works is first recorded on the 1930s OS 25" map along with mica drags. It is likely that settling tanks to the south of the mica drags were also associated with the pit, although the tanks were recorded at an earlier date on the OS 1907 25" OS map. The clay pit itself is large but shallow and is now occupied by open woodland; the only surviving structure at the pit is a single storey blacksmith's shop.

Other sites in the Valley include four infilled quarries in the north-western part of the Valley, these probably being small-scale china clay pits or china-stone quarries. Linear hollows adjacent to the western side of the track entering the Valley from the north were probably small scale, possibly early, china stone quarries associated with Wheal Arthur, some of these connecting to the main Wheal Arthur china stone quarry. Two large, now infilled, china stone quarries (Higher and Lower Quarries) lie to the north-west of Big Wheel Mill whilst three small quarries in the valley base and on the eastern valley side nearby probably provided building stone.

There are also two possible sites of corn mills; one surviving as low ruins lies immediately to the east of the Barn River near the centre of the project area, being identified in the field by John Yeo of the Tregargus Trust; the other, nearby, was documented on the 1907 OS mapping but its site has since been buried under a mica lagoon.

Evidence for other activities in the Valley takes the form of at least one area to the north of Trevear Mill where the original course of the Barn River has been diverted to the west to allow the streaming of the alluvium in the valley base, leaving a very substantial linear hollow and an adjacent area of disturbed ground to the west. Further, well-preserved evidence for tin streaming is found in the form of a series of low parallel banks of water-washed stone set diagonally to the river in an area to the north of Mica Mill. This area also sites a small number of what appear to be prospecting tunnels into the alluvium blanketing the valley floor.

There are also a number of weirs and stretches of leat, these supplying waterwheels used to drive a pump, the grinding wheels in the china stone mills, and at least one corn mill. Subsequent large scale dumping of waste from china clay pits and china stone quarries in the valley has disrupted the earlier arrangement of many of these water channels, whose layout is best understood from the 1880 OS 25" mapping.

Waste dumping associated with clay and china stone working has also substantially altered the topography of the valley in a number of areas. To the east of the Rescrowsa clayworks the creation of a series of substantial mica lagoons between 1907 and 1930 has resulted in the course of the Barn River being diverted some distance to the east, covering the site of the documented corn mill, whilst to the east of Higher and Lower Tregargus Quarries, dumps containing large volumes of waste rock occupy the centre of the valley; the Barn River kinks around these features, again suggesting a diversion of its original course. At the northern end of the valley,

mica flows from the clayworks to the north have buried the original valley floor, whilst in the central and southern parts of the valley Higher and Lower Tregargus Quarries have been deliberately infilled with mica waste, whilst the haul roads created to carry stent (waste rock produced by china clay working) to top off the infilled quarries are far broader than they originally were, in places this widening resulting in the partial removal of features and the burial of others. Other smaller-scale works to install sub-surface pipework carrying waste water from clayworks, or decant water from settling ponds have resulted in further localised damage to the areas they transect.

### **3.2 Summary results from the ecological survey**

See Fig 93. Note that this survey covers a slightly larger area than that managed by the Tregargus Trust. Any recommendations made in the following sections relating to land not managed by the Tregargus Trust should be considered as advisory only.

#### **3.2.1 Background**

The Tregargus Valley supports habitats of nature conservation importance, falling within the St. Austell China Clay Area which has been targeted as an area for biodiversity conservation by the Cornwall Biodiversity Initiative. Key habitats include lowland heath, ancient, species-rich hedgerows, wet woodland and lowland acid grassland.

Tregargus Valley is a wooded river valley that has been intensively disturbed by industrial activities primarily associated with the working of china stone. There are numerous derelict structures including quarries, leats, adits, tunnels, chimneys, mills, areas of re-vegetated disturbed ground and a lagoon. The Tregargus Trust manages the site and is seeking to preserve the historical mining features and to promote safe public access around the site. It is planned that the valley will also be managed to retain and enhance the wildlife interest of the site.

The ecological interest of Tregargus Valley was first assessed in February and April 2002 by Cornwall Environmental Consultants. There have been bat surveys carried out by Natural England concentrating on some of the adits and a Resource Management Plan written by the Westcountry Rivers Trust (undated). There are also occasional wildlife records from the Tregargus Trust.

Historic Environment Service Cornwall Council requested an updated ecological survey to inform this Conservation Management Statement. An up-to-date records search for species recorded in the area was also commissioned from the Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS). A walkover survey was carried out on 12<sup>th</sup> May 2010 by J. Pilkington of Spalding Associates (Environmental) Ltd. Habitats were recorded and mapped according to Phase 1 Habitat Survey methodology and species lists compiled. Habitats and species were evaluated for their conservation importance. Parts of the site were inaccessible due to dense vegetation and limited time on site meant that a detailed survey of all areas was not possible.

From the updated ecological survey and previous survey reports information on protected, Biodiversity Action Plan (BAP) and Red Listed species have been extracted. Noteworthy and Biodiversity Action Plan Habitats have also been listed in order to identify which species and which habitats might be most threatened from the proposed activities and which might benefit; this is intended to inform working methods and protocols.

#### **3.2.2 Results from the desktop survey**

A list of vascular plant species found in Tregargus Valley on the May 2010 survey is included in the Appendices to this report. Species that were found only in 2002 are indicated. Habitats and species located during the field survey have been assessed for their significance according to the following sources:

#### International significance

- European Habitats and Species Directive (CEC, 1992)
- European Red Data lists (IUCN, 2000)
- European Council Birds Directive (CEC, 1979)

#### National significance

- The Conservation (Natural Habitats, &c.) Regulations 1994 and amendments
- Wildlife and Countryside Act 1981 and amendments
- Countryside and Rights of Way Act 2000
- Natural Environment and Rural Communities Act 2006
- Protection of Badgers Act 1992
- The Hedgerow Regulations 1997
- UK Biodiversity Steering Group reports (UKBSG, 1995 and updates)
- UK Biodiversity Action Plan: Species and Habitat Review, 2007
- British Red Data Books and Lists (various authorities)
- Birds of Conservation Concern 3; the population status of birds in the United Kingdom, Channel Islands and Isle of Man (fourth, 2009, review) (Eaton *et al*, 2009)
- Guidelines for Selection of Biological SSSIs (NCC, 1989 and updates)

#### Regional, county and local significance

- Southwest Regional Biodiversity reports (Cordrey, 1997 and additions/updates)
- Cornwall Biodiversity Initiative Volume 3 (CBI, 2004)
- Flora of Cornwall (French, Murphy and Atkinson, 1999)

Red listing based on 2001 IUCN guidelines:

The following abbreviations have been used in the following sections:

EN = Endangered - A taxon is Endangered when not Critically endangered but facing a very high risk of extinction in the wild in the near future.

VU = Vulnerable - A taxon is Vulnerable when not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium term future.

NT = Near Threatened - this category includes species which occur in 15 or fewer hectads but do not qualify as Critically Endangered, Endangered or Vulnerable.

BAP = Biodiversity Action Plan Lists: Species or habitats for which Action Plans have been/are being written.

#### Notable species

- **Skylark**- Skylark *Alauda arvensis* was listed in the 2002 report as having been recorded in the grid square SW 9554. The valley was not thought a suitable site for this species and it remains very unlikely. The quarries with developing heathland now provide potential nesting habitat but the area is small and too close to well used tracks. The grassland high up on the west side of the valley could potentially provide nesting sites for this species if the leasehold is acquired. Skylark is a UK BAP species and is red listed as a species of conservation concern (Eaton *et al*, 2009). Skylark and other birds are protected from disturbance whilst nesting.
- **Reptiles** – Track edges and the area of open vegetation and developing heathland in the quarries and Wheal Arthur potentially provide suitable habitat for BAP reptiles such as Adder *Vipera aspera*, Viviparous Lizard *Zootoca vivipara* as do walls and piles of stones. Grass snake *Natrix natrix* was recorded in July 2004 at SW 9453 and could use areas of tall or rank vegetation alongside tracks and occasionally around the built structures.
- **Badgers** – Evidence for the presence of Badger *Meles meles* was noted at the south end of the valley in a hedgebank bordering a field in 2002. Two sett

entrances were noted here and were in use at that time. No setts were noted here in the May 2010 survey and the hedgebank had suffered recent disturbance with some trees and scrub cleared and soil scraped from the side and placed on top. No other evidence for Badger was noted in the 2010 survey. There were many small paths and tracks in the areas of woodland and scrub but no definite signs were found to indicate the presence of this species. However, Badger is known to be active on the site and an active sett is known in the woodland east of the main track at SW 951 543 (John Yeo, pers. comm). The location of this sett is shown on Fig 93. There is also a report of Badger activity near the chimney (Cole and Smith 2002, structure 88) on the east of the Barn River at SW 951538. Badgers and their setts are legally protected from disturbance and destruction.

- **Bats** – The valley provides ample opportunities for roosting bats and offers very good foraging habitat. Greater Horseshoe *Rhinolophus ferruquinum* and Lesser Horseshoe *Rhinolophus hipposideros* are known to use the adits for hibernation and records for both of these species exist from winter 2003 and 2004. Natural England carried out a bat survey in Tregargus Valley and as a result of their findings bat-friendly grilles were fitted over almost all adits. The two Horseshoe species are UK BAP priority species and are on the Global Red List; The Greater Horseshoe is classed as Conservation Dependant and Lesser Horseshoe is classed as Vulnerable. Other species of bat are likely to roost or feed in Tregargus Valley. There are many features in the derelict built structures that provide potential bat roosting habitat. Bats will also roost in trees with holes, crevices, flaking bark or dense Ivy. Bats and their roosts (whether they are present in the roosts or not) are protected by legislation from disturbance and destruction.
- **Dormouse** – The woodland, scrub and hedgebanks provide suitable habitat for Dormouse, a UK BAP priority species, which is legally protected from interference with places used for shelter and disturbance when in these places. No signs of Dormouse were found on the current survey and there are no previous records for this species in the valley. However, no detailed survey has been undertaken.
- **Chamomile** – Chamomile has been recorded just outside the site boundary to the northeast at SW 949 546. This BAP species is classified as Vulnerable according to IUCN guidelines and could be present in short open grassland e.g. in the disused quarries at Tregargus Mill although none was noted in 2002 or during the recent survey.

**Ivy-leaved Bellflower** – This Near Threatened species was present at the edge of developing heathland in the quarries.

- **Japanese Knotweed** – This species was originally known from two sites in Tregargus Valley. The site near the north entrance appears to have been successfully controlled. The site at the quarries (see Fig 93) still exists (John Yeo, pers. comm..) but is obscured by taller vegetation and was not seen during the 2010 survey. Japanese Knotweed *Fallopia japonica* is a vigorous perennial plant which excludes other plant species which cannot compete with its tall summer growth or the thick mulch of decaying canes and leaves in winter. It forms stands of dense canes and spreads mainly vegetatively, from the stems, the crown and the rhizomes. The rhizomes can form an extensive underground network extending up to several metres from the plant and going down deep into the soil. The rhizomes have been shown to be viable 3 metres below ground in disturbed conditions. Japanese Knotweed can regenerate from very small amounts of tissue; less than 0.2 grams of rhizome can produce roots and shoots. Rhizomes can also remain dormant for several years, particularly when treated with sub-lethal doses of herbicide. Transportation of material downstream within river systems and movement of soil contaminated

by plant fragments are major ways in which new sites are established. It is an offence to cause the spread of this species in the wild.

### Notable habitats

The following types of vegetation are of ecological significance at this site:

- **Deciduous Woodland** – Most of the site is covered by mixed deciduous woodland, a BAP habitat with Oak *Quercus* sp., Beech *Fagus sylvatica* and Sycamore *Acer pseudoplatanus* with frequent Downy Birch *Betula pubescens*, Honeysuckle *Lonicera periclymenum*, Holly *Ilex aquifolium*, Hazel *Corylus avellana* and Hawthorn *Crataegus monogyna*. Ash *Fraxinus excelsior*, Elder *Sambucus nigra*, Common Gorse *Ulex europaeus*, Broom *Cytisus scoparia* and Blackthorn *Prunus spinosa* are occasional. Horse Chestnut *Castanea sativa* was noted in 2002. Although there are areas of secondary woodland and areas dominated by Sycamore to the southeast there must have been woodland in the valley for a long time as there are several Ancient Woodland Vascular Plant species present. These include Wood Anemone *Anemone nemoralis*, Wood Sorrel *Oxalis acetosella*, Climbing Corydalis *Ceratocladia claviculata* and Bluebell *Hyacinthoides non-scripta* (Rackham, 2006). Introduced scrub such as Rhododendron *Rhododendron ponticum* and Wilson's Honeysuckle *Lonicera nitida* are occasional. South of the quarries at Tregargus Mill on the west side of the valley is an area dominated by coppiced Hazel providing an attractive habitat for Dormouse. Bluebells dominate the ground flora here.
- **Wet woodland** – There are small areas of wet woodland, a BAP habitat, dominated by Grey Willow *Salix cinerea* ssp. *oleifolia* with occasional Goat Willow *Salix caprea*, Oak and Ash. Wetland herbs are present here including Opposite-leaved Golden-saxifrage *Chrysosplenium oppositifolium*, Hemlock Water-dropwort *Oenanthe crocata* and Lady Fern *Athyrium filix-femina*.
- **Developing heathland and open vegetation** – the heathland in the quarries along the west side of the valley has developed since the 2002 survey and ericaceous shrubs now cover more than 25% of the ground in some areas which can now be mapped as dry dwarf shrub heath according to the Phase 1 Habitat survey methodology. Lowland heathland is a European BAP Priority habitat but as this is such a small area it is only of local importance and increases biodiversity in the valley. There are further areas of open vegetation around Wheal Arthur where much of the scrub has been cut back. These habitats are potentially valuable for reptiles and invertebrates. Heather *Calluna vulgaris* is the predominant shrub and Bell Heather *Erica cinerea* was present rarely. There has been some management in these areas with evidence of burning and clearance of scrub. Common Gorse, Bramble *Rubus fruticosus* agg., young Willow and Downy Birch are still present but are low-growing. Herbaceous species associated with heathland are also present including Red Fescue *Festuca rubra*, Sheep's-sorrel *Rumex acetosella*, Bird's-foot-trefoil *Lotus corniculatus*, Common Bent *Agrostis capillaris* and Bristle Bent *Agrostis curtisii*. Other parts of the disused quarries support open vegetation with grasses such as Yorkshire Fog *Holcus lanatus*, Sweet Vernal-grass *Anthoxanthum odoratum* and Field Wood-rush *Luzula campestris* with Soft Rush *Juncus effusus*, Ivy-leaved Bellflower *Wahlenbergia hederacea* and Greater Bird's-foot-trefoil *Lotus pedunculatus* indicating poor drainage There are abundant mosses over much of this area.
- **Lowland acidic and neutral grassland** – There are small areas of these BAP habitats in the Tregargus Lower and Higher Quarries with locally occasional species characteristic of acidic grassland such as Sheep's-sorrel. These areas are of local conservation interest only due to their size.
- **Marshy grassland** – There are small areas of BAP marshy grassland, of local interest only, where there is poor drainage with frequent-abundant rushes,

mostly Soft Rush but also occasional Slender Rush *Juncus tenuis*, and Yorkshire Fog with Greater Bird's-foot-trefoil, Wild Angelica, Water Figwort *Scrophularia auriculata*, Hemlock Water-dropwort and Marsh Thistle *Cirsium palustre*. Ivy – leaved Bellflower was noted in the quarries and in one damp area around the buildings at Wheal Arthur where there are also small areas of standing water with Duckweed *Lemna* sp. and Sweet-grass *Glyceria* sp.

- **River and streams** – The water courses are BAP habitats and are protected by the Water Resources Act. They are generally shaded and the banks of the river support a woodland flora but there are occasional wetland species such as Hemlock Water-dropwort, Opposite-leaved Golden-saxifrage and Yellow Flag *Iris pseudocorus*. There are no records for Otter at this site but the habitat is suitable. The small shallow stream alongside the track at the north end of the site is of poor water quality (rusty in colour) but supports a greater range of common species along the generally more open banks. Brooklime *Veronica beccabunga* is present in the small stream at the south end of the site.
- **Hedges** – the hedges along the boundaries of the site qualify as BAP habitat and support a good diversity of species.

**Additional habitats**

The fields to the north west of the site support agriculturally improved grassland with some slightly more species-rich semi-improved grassland on the steeper slopes at the edge of the woodland where there is Field Wood-rush, Sweet Vernal-grass and Common Bent with occasional Common Dog-violet *Viola riviniana*, Creeping Buttercup *Ranunculus repens* and Common Mouse-ear *Cerastium fontanum*.

The edges of the two-year old unvegetated track down the centre of the valley where the scrub is cut back support a wide variety of herbaceous species with grassland, woodland and hedgerow species. There are occasional wetland species and rushes, including Slender Rush.

Patches of dense Bracken with occasional scrub and Bluebells dominate small areas of the site particularly on the west side on the higher part of the slope. Mixed scrub dominates areas around the quarries on the west side and elsewhere. Species include Common Gorse, Bramble, Hawthorn, Blackthorn, Elder and Broom. Non-native Butterfly-bush *Buddleja davidii* is occasional.

The lagoon supports very little aquatic vegetation but where the banks are not dominated by overhanging Grey Willow (and occasional Common Gorse) there are a few wetland species at the edges including Soft Rush, Hemlock Water-dropwort and Yellow Flag.

The derelict buildings are a special feature of the site and have some importance ecologically as well as historically. Nesting birds and roosting bats could use these features and it is possible that reptiles such as Adder and Common Lizard frequent these areas where they are not too shady. Some scrub and woodland have been cleared on and around these structures but much of this is now re-growing. Ivy has been cut at the base in many places. Greater Horseshoe and Lesser Horseshoe bats were seen in an adit at SW 948 545 in January 2003 (Carol Williams – Roost Report Form supplied by the Tregargus Trust) and apparently hibernate there. Only one individual of each species was seen but more are likely to use deeper areas and other adits/tunnels etc. There are other records for these two species at Tregargus during November 2004 (ERRCIS, 2010). Crevice dwelling bats are also very likely to roost in some of the buildings.

**Table 1: Species of particular national significance recorded in the project area**

Greater Horseshoe <i>Rhinolophus ferrumequinum</i>	UK BAP Priority Species, also protected by European and UK legislation. Greater Horseshoe Bats are known to use adits in the valley.
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Lesser Horseshoe <i>Rhinolophus hipposideros</i>	UK BAP Priority Species, also protected by European and UK legislation. Lesser Horseshoe bats have been shown to use adits in the valley.
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**Table 2: Legislation relevant to the site**

<b>Species</b>	<b>Main legislation or policy</b>	<b>Significant habitat and recommended timing</b>
Bats	Conservation (Natural Habitats etc) Regulations 1994 Wildlife and Countryside Act 1981 and amendments (Schedules 5 & 6) Countryside & Rights of Way Act 2000	Greater and Lesser Horseshoe bats are known to use adits/tunnels for hibernation. Shafts, adits, tunnels, chimneys as well as crevices in derelict mining structures and trees could be used by roosting bats. Dense Ivy over buildings and mature trees with holes and crevices at all times. Work should ideally be carried out in May or September. Work during the hibernation period should be avoided. Work should be preceded by bat surveys.
Badger	Protection of Badgers Act 1992	Active sett known in woodland east of the main track and there are reports of a sett near the chimney east of Trevear Mill (structure 88). An active sett was also recorded at the south end of the site in 2002 along a hedgebank. Although no evidence of badger occupation was noted in 2010 they could return. Badger setts could also exist areas of dense scrub. Legislation protects badgers from disturbance and lists restrictions on works within 30 metres of an occupied sett at all times. However, recent changes in legislation reflect the tolerance of this species to vegetation clearance.
Reptiles	Wildlife and Countryside Act 1981 (and amendments) Countryside & Rights of Way Act 2000	Scrub/grass/ open dry vegetation mosaic, walls and piles of stones. Grass Snake could occur in tall herbaceous vegetation. Clearance of scrub and tall herbaceous vegetation should take place in the active season.
Breeding birds	Wildlife and Countryside Act 1981 (and amendments) Countryside and Rights of Way Act 2000	Work on scrub, trees and built structures during the nesting season March to August should be avoided.
Dormouse	Wildlife and Countryside Act Schedules 1,5 and 8 (protected birds, animals and plants)	There has been no detailed survey for Dormouse in the valley which offers suitable habitat for this species. Major woodland management, coppicing/clearance etc should be preceded by a survey for this species.
Japanese Knotweed	Wildlife and Countryside Act 1981 Schedule 9	It is an offence to plant or otherwise encourage the growth of Japanese Knotweed in the wild. Japanese Knotweed is present in the quarries in the central part of the site. Cutting the plant or roots and/or disturbing the surrounding soil may encourage its spread if not correctly managed.
Rhododendron	Wildlife and Countryside Act 1981 Schedule 9	It is an offence to plant or otherwise encourage the growth of Rhododendron in the wild. This species is present occasionally in the wooded areas of the valley.
<b>Habitats</b>		<b>Location</b>
The river and stream	Water Resources Act 1993; the river and streams constitutes controlled waters; it is an offence to deliberately or accidentally pollute any controlled waters in England	The river and streams at all times.

## 4 Interim Statement of Significance

The Tregargus Valley contains the finest assemblage of china stone mills in Cornwall. They are set within a wider landscape which also includes the surviving industrial infrastructure of associated quarries, leats, pan kilns and tramways. China stone mills as a monument class are confined to Cornwall and the Staffordshire potteries, but the Staffordshire stone mills were not used solely for china stone and were principally used for flint grinding. Only in Cornwall are these stone mills found in direct association with their raw materials, and their complex supporting infrastructure is thus regionally distinctive. The Tregargus Valley mills, comprising Wheal Arthur to the north, the Tregargus group in the centre of the Valley, Trevear Mill and Lower Tregargus to the south, have a combination of Group Value, Survival and Completeness found nowhere else in Cornwall or Britain.

There are a small number of china stone mills elsewhere in Cornwall, some very close to the Tregargus Valley (see Section 2.5). Just to the south is Chapel Mill, which is the only stone mill still to have its machinery intact and is a Grade II\* listed building. This is an isolated example, however, and does not have the group value of the Tregargus Mills, though given its remarkable completeness, the opportunity should be sought to manage and interpret this site in combination with those at Tregargus. At Coombe there is the Coombe Vale Mill, which has been demolished to its foundations. Trenowth Mill survives in a reasonably complete condition, but is again an isolated example. The only other stone mills in Cornwall are the group of (originally) three at Kergilliack, near Penryn. Only the lowest mill of this group now survives intact. This excellent example is now deteriorating badly, and the Kergilliack group cannot rival Tregargus in terms of Setting or Group Value.

The study area is also uniquely placed in terms of its potential for public access and amenity. The Valley already possesses the rudiments of a footpath network, and the scenery, despite years of industrial activity, is beguiling and attractive. As is the case elsewhere in Cornwall, at sites such as the Kennall Vale Gunpowder Works or the Luxulyan Valley, the remains of industry now lend an additional dimension of mystery and romance to wooded valley landscapes. Such opportunities for multi-faceted conservation initiatives which can involve the local community and a wide range of environmental partners are few and far between. The Tregargus Valley is thus of prime importance and sits within the very top rank of such sites in Cornwall.

The woodland which covers most of the project area is a valuable habitat, but is also interspersed with developing heathland and open vegetation, also very valuable features of the site for wildlife. The valley also includes a number of gated adits which afford important bat roosting sites, in particular for Greater and Lesser Horseshoe bats.

## 5 Principal issues

Whilst the conservation works proposed as part of this project will necessarily focus on the china stone mills and associated structures in the valley, necessary associated works such as vegetation clearance, the enhancement of long term public access and the creation of temporary contractor's access to the structures will inevitably impinge on the wider site, including areas of actual or potential archaeological and ecological significance. These will also impose temporary restrictions on public access. Issues relating to the provision of interpretation and information during and subsequent to the works programme also need to be addressed. The entrance used by the public to access the northern end of the Valley (which is not on land managed by the Tregargus Trust) is adjacent to a lay-by and suffers from persistent and problematic fly tipping; it has also become infested with Japanese knotweed.

It is felt particularly important that a plan for the future management of the Valley, including the timing and nature of cyclical management works and for periodic review of the plan, should also be drawn up.



## 5.1 Vegetation management

The control of scrub vegetation will be essential for the future management of the site and will need to be undertaken in a series of locations prior to any building conservation works taking place. In some areas, scrub growth obscures buildings and impedes access to them, sometimes preventing the level of detailed survey and inspection required when drawing up specifications for conservation work; in some cases vegetation clearance will need to be undertaken before a full assessment of the condition of a building and its conservation needs can be determined. In other areas vegetation growth on structures is actively damaging them through root infiltration and the imposition of un-designed structural loadings (particularly where ivy is present or trees are growing from walls). The negative impacts of scrub growth on and adjacent to buildings are progressive and should be arrested wherever possible.

In places (in particular at Trevear Mill and Lower Tregargus Mill), trees have rooted into or immediately adjacent to structures. As these trees have become mature their roots have disrupted masonry, in some cases significantly (see Figs 76, 91-92). Elsewhere, mature trees were found to be leaning on or over structures (as for example at Trevear Mill), or had already collapsed onto them, causing significant levels of damage. Preferentially, any tree growing within five metres of any of these historic and important buildings, or any tree which has the potential to fall onto a building and cause significant damage should be felled. It is recognised, however, that given other interests in the site it will probably be necessary to negotiate the removal of any tree on a case by case basis.

It should also be noted that it was abundantly clear from the 2009/10 site inspections that simple felling of problem trees is not the answer. In many places where trees had been cut down by the Tregargus Trust vigorous coppicing had taken place, and regrowth was already several metres high. As a result all stumps should be treated with specialised non-persistent poisons to kill off roots and prevent such regrowth. It is now illegal to use ammonium sulphamate based chemicals for this purpose, but other options such as SBK or glyphosate-based products can still be used.

Alien species have also begun to spread out from the former garden adjacent to Trevear Mill, covering features within the surrounding area, including the pan kiln and linhay. This scrub will also need to be cut back and controlled.

The cutting down of scrub vegetation, including trees, will inevitably have visual impacts on the Valley, whilst the clearance of vegetation from on around buildings will change their appearance. Both operations must be carefully handled to avoid negative impacts on important habitats, whilst the rationale for the work and the necessity of undertaking it must be communicated to local people. Advice should be taken from the ecological consultant as to whether it is best to stack cleared scrub and trees and allow them to rot down on site, to chip them, burn them, remove them from site for disposal or to employ combinations of these approaches.

It should be noted that vegetation clearance could impact upon nesting birds, reptiles and possibly Dormouse and Badger. Communities with a diversity of vascular plants and habitats of nature conservation value such as the developing heathland and open vegetation in the quarries could also be affected.

## 5.2 Repair/consolidation of built structures

The structures proposed for conservation consist of a series of 19<sup>th</sup> and early 20<sup>th</sup> century china stone mills and associated structures, including a miller's cottage. Following the progressive abandonment of milling within the Tregargus Valley, all work ending in 1965, and the removal of water wheels and other equipment, the recovery of roofing and other materials for re-use from some buildings, structures in the valley were left unmanaged. Some were subsequently over-dumped or demolished during the after-use of the valley by IMERYS and Goonvean Ltd, or were affected by the

creation of access roads. Parts of the site have also been used by local people for fly-tipping.

Exposure to the elements and, in particular, the decay of the remaining incorporated timber elements and the surviving iron components, together with a degree of vandalism and theft, and the effects of encroaching vegetation has led to progressive dilapidation and destabilisation. Whilst the buildings were originally robustly constructed, over four decades of abandonment have taken their toll on their integrity and stability.

The rarity of these structures and their group value in particular establish a requirement that conservation approaches adopted respect their authenticity whilst meeting the requirements of the project to stabilise and consolidate them, so that they are assured a sustainable long term future. The range of interventions adopted must be appropriate to their building type, age and importance and the works undertaken should be limited to those required to achieve these ends. This work will involve the relaying of wall heads to prevent water ingress, repointing in lime mortar, some rebuilding where structural stability has been compromised, the replacement of rotten or missing timber lintels in hardwood and the stabilisation of corroded iron components. Some temporary propping of unstable masonry will probably be required and some of these props may need to be made permanent. It is also very likely that permanent props, struts or other repairs to waterwheels will be required to prevent their collapse.

Given the rarity and importance of these structures, it is particularly important that they are recorded in detail before any works take place, and that all interventions arising from the conservation works programme are also recorded.

### **5.3 Safety works**

There are several currently unsecured drops in a number of areas of the site which present potential hazards to the visiting public including deep wheel pits, a flooded shaft and upper floor windows and doorways which give onto drops; there are also a number of open adits, though most of these have recently been gated. Many of these features will become more accessible following proposed vegetation clearance and site works, and this will inevitably necessitate the provision of some discrete safety barriers. Where the current path network crosses bridges with low or no parapets, the Tregargus Trust has installed galvanised braided wire fences, but for new works of this type within the Valley chestnut post and rail barriers are recommended. These utilise sustainable materials, will blend in well, can be easily maintained, and have a good life span, even in damp environments.

In some areas, discreet signage may also be needed to alert walkers to the presence of hazards, and safety information should also be included on the interpretation panel which is proposed for siting at the northern entrance to the Valley (subject to the agreement of the owners of this land), with a second possibly sited at the southern end of the site, as well as on any self-guided leaflets relating to the Valley.

### **5.4 Impacts on the wider site**

As well as the china stone and clay works structures, the Tregargus site includes landscape evidence (principally in the form of earthworks) for other activities associated with tin streaming. Facilitating the conservation works to the buildings will inevitably have impacts on other areas and aspects of the site, and there is the potential for damage or other negative impacts to such landscape features, particularly where currently masked by scrub or trees. Good baseline information and the ability to work flexibly will be essential to avoid any collateral damage to other site features.

A range of works are required to provide safe and sustainable access to the buildings. These will include the clearance of vegetation and the creation of temporary roadways, storage and work areas, the safe scaffolding of the mills and some temporary safety works (as for instance temporary propping of unstable structures).

It is most important that the works to the structures in the Tregargus Valley, the works required to facilitate them, and any enhancement of public access do not negatively impact upon the nature conservation importance of the site. In particular, bats may occupy recesses in the masonry of the buildings or roost within the adits. Specialist pre-works surveys must be undertaken to ensure that significant habitats are not damaged or destroyed during the works and that protected species are not harmed or unduly disturbed. The project should also be designed to enhance the nature conservation value of the site and to broaden its biodiversity. Input from appropriate specialists will be essential during the project design and its implementation.

### **5.5 Plant and machinery movements**

There are no public rights of way through the Tregargus Valley, though there is a permissive public access into the valley from the road from Stepside to Goonamarris at its northern end, entering the land managed by the Tregargus Trust at the northern end of the Wheal Arthur complex. The path follows a haul road through the northern part of the valley down to the Tregargus china stone quarries. From this point southwards smaller paths provide access to Big Wheel, Trevear and Lower Tregargus mills, and to connections with public footpaths at the southern end of the valley. The northern part of this path between the main road and the Wheal Arthur works is owned and managed by Goonvean Ltd, and the Tregargus Trust will need to negotiate permission to use this route if, as seems likely, it is proposed as the contractors' access during the works programme.

Contractors will need to bring a certain amount of equipment (such as scaffolding, welfare facilities, temporary store buildings) onto site at the beginning of the contract, will need to bring materials such as lime, aggregate, sand and water to the site and to structures being worked on during the contract, and will need to remove waste, equipment and surplus materials from site at the end of the contract. Most of these movements will entail the use of vehicles. It will be particularly important that the routes to be used for any vehicle movements are agreed in advance and do not unduly compromise archaeological or ecological features. It may be necessary to lay down temporary roadways or sections of roadway using removable barrier membranes and hardcore where the ground is soft or otherwise prone to damage. Particular care will be required in the selection of contractors' access routes and thought given to the range of works required to make them usable on a temporary basis and the works which will be needed to rehabilitate these routes on the completion of activities.

Site working procedures should give walkers precedence over contractors where works vehicles need to negotiate any regularly-used path.

### **5.6 Impacts on the public at large**

Despite the lack of public rights of way to and through the Valley, the site is currently treated as *de facto* public access land. The works programme will inevitably require some temporary restrictions on those areas to which the public currently have access. Whilst this is inevitable (though will be temporary), the Project provides a good opportunity to disseminate information about the works programme, to provide updates on progress, to provide controlled access to groups with specific interests in the site, to promote the philosophy underlying projects of this type, and to raise the profile of the Tregargus Trust. Care will need to be taken to make sure that the working areas of the site remain closed to all but authorised visitors. It was also noted that a large number of pan kiln tiles had been removed from the Wheal Arthur dry

during the autumn of 2009, presumably for the construction of a patio; whilst these have now been recovered and placed in safe storage, vehicle access to the site must be controlled during the works and restricted following them to prevent any further similar vandalism.

## **6 Conservation philosophy relating to conservation proposals**

It shall be agreed by the Project Team that the philosophy underpinning the works should be that repairs undertaken to the buildings shall be a close match in terms of detail and materials, pointing styles should be consistent with those currently existing, and repairs should be intended to blend in and be consistent with the overall existing finish of the structures. Appropriate and traditional materials and methods of workmanship will be used throughout the works. Non original materials will not be used except in those limited areas where repairs are to be undertaken on structural grounds alone. These will be small scale and, where possible, rendered invisible (for example pinning of masonry, fleeting of wall pockets, repairs to waterwheel ironwork). Where new work is unavoidable to confer required structural stability, this must be agreed in advance and must not, if at all possible, impinge on the integrity of the building to which it is to be applied. In limited areas of the site, however, substantial interventions will be required to avert catastrophic collapse and to achieve required levels of public safety.

Works required to achieve the provision of materials access routes, storage compounds, pedestrian access routes, safety fencing, securing of elements of the scaffolding and other associated works will, wherever possible, be temporary and reversible, and take into account the archaeological and ecological sensitivities of the site.

Where adequate pre-works surveys are not presently available, these will be undertaken to guide the proposals and to ensure that they do not damage significant features or habitats.

All efforts will be taken not to damage any significant site feature or habitat during the works programme. Archaeological and ecological consultants will be involved in the finalisation of any decisions relating to groundworks, vegetation clearance or other works which would impinge on habitats, the siting of facilities &c, whilst allowance will be made for appropriate watching briefs for the duration of the works programme.

Reasonable provision will be made for continued public access to those parts of the site on which works are not taking place, including viewpoints of the work in progress, whilst information about the project will be made available to the public in safe locations on the site and via other means such as websites, information disseminated through the media, &c.

The setting up of the management agreement between IMERYS and Goonvean Ltd on the one hand and the Tregargus Trust on the other was intended to help to safeguard the spectacular archaeology found within this valley. The conservation of the china stone mills, pan kiln, miller's cottage and other associated structures is a particular priority towards this end, but will have impacts which must be controlled to prevent damage to the overall significance of the Valley. The work proposed will necessarily involve the creation of access routes, materials storage areas, work areas for a range of specialist contractors, and the preparation of areas on which temporary buildings can be sited. Specialist scaffolding contractors will need to transport their materials to relatively inaccessible sites within the Valley. The works required to consolidate the buildings may be undertaken as a single project, or one phased over several years, but will not be achieved quickly, and will require an extended site presence, which must not conflict or interfere with other interests (such as habitats occupied by rare species, nesting birds or roosting bats). It must equally not result in the creation of public access to dangerous parts of the site, or to currently unstable structures. It is

particularly important that the conservation of the buildings is not achieved at the expense of damage to other areas of the site.

Quantities of materials will need to be brought to the site (the only vehicle access to the various structures being unsurfaced tracks), stored on it and transported to the structures to be conserved. Contractors will need to be given as safe a working environment as can reasonably be achieved, will need safe access routes to and from their place of work, and will require on-site welfare facilities, whilst the public must legally be excluded from all working areas.

As Big Wheel Mill is a Scheduled Monument, an application for Scheduled Monument Consent will need to be made to the Department of Culture Media and Sport at the earliest possible date in advance of the anticipated start of works. DCMS will need to be satisfied that the works are appropriate to the site, and that any residual unavoidable impacts can be adequately mitigated through detailed recording prior to and during the works by properly qualified specialists. It is likely that DCMS will require archaeological consultancy/watching briefs to be undertaken throughout the course of the works and an ecological watching brief may also be deemed appropriate. Big Wheel Mill is also a Grade II Listed Building and an application for Listed Building Consent will need to be made to Cornwall Council before works can proceed.

In the case of Scheduled Monuments it is an English Heritage requirement that a Conservation Management Plan (or if appropriate, a Conservation Management Statement) should be prepared for all designated sites on which work is proposed. This report is designed to satisfy that requirement.

## **7 Summary of current proposals for works to structures**

A detailed specification for the scope of works to the structures in the Tregargus Valley should be commissioned from a suitably qualified architect or engineer, building on the structural assessment carried out by the Knevitt Consultancy (2009). It should be noted that in view of the scheduled status of Big Wheel Mill, English Heritage may require that the architectural/engineering consultancy is certified as suitably qualified to specify and oversee conservation work to scheduled monuments. Specialised consultancy will also be required to determine the nature of the works which will be required to conserve and safeguard water wheels at Wheal Arthur and Big Wheel china stone mills.

The final detail of the works specification will need to be agreed between the Tregargus Trust, English Heritage, Cornwall Council planners, the Historic Environment Consultant and the Environmental Consultant, and is likely to require the incorporation of specialist input from a structural engineer, from scaffolding sub-contractors and from a crane hire company, taking on board feedback from other interested parties.

The building works listed below have been drawn from the Knevitt Consultancy's 2009 report, supplemented by site inspection undertaken by the historic environment consultant during November 2009. The works have been assigned one of three priorities – 1) Urgent or high priority, 2) Medium priority, 3) Longer term priority. All works should be completed within a ten year period and should be designed to last for at least 30 years. Some building works will almost certainly be reprioritised as a result of conditions revealed following vegetation clearance, especially where cloaking ivy is currently present on buildings. Other works as part of this project (below) will include those relating to improvements to public access and the provision of interpretation. The preliminary works to the mills and allied structures will generally comprise the removal of any cloaking ivy, the cutting back and stump treatment of invasive or damaging trees on or in close proximity to buildings, and the removal of rubbish and debris within buildings. Following these initial works most buildings will require the relaying of all wall top courses in a lime mortar, the removal of defective pointing and its replacement in lime mortar, the replacement of lost or failing lintels or timber bearers and the reinstatement of structural stonework where necessary. In some

instances temporary or permanent props will need to be installed to confer needed structural stability.

The conditions of the remaining waterwheels are of particular concern. In the case of the wheel at Wheal Arthur, the rims are currently held in place by two rotting timber spokes. Should either one of these fail the wheel will collapse into the pit and the cast iron rim will break up. The wheel at Big Wheel Mill has iron spokes which have, in many cases, corroded away to breaking point. There can be no doubt that unless the wheel is stabilised by propping and the failing spokes replaced in the near future, this wheel will also collapse into the wheel pit and break up. The third surviving waterwheel (that formerly working pumps at Wheal Arthur) is less threatened at present, though should also be the subject of minor repairs.

A trail (following the line of the former haul road) already exists down through the Valley, and passes close to the Wheal Arthur complex, mica drags and tanks, Blacksmith Shop Mill and Big Wheel Mill. From this point smaller-scale paths give access to Trevear Mill and cottage, and to Lower Tregargus or Mica Mill. Access to most of the buildings is currently unformalised and incorporates potential slip and trip hazards, as well as exposure to unstable areas of buildings and to unfenced drops (as into wheelpits). The provision of contractors' access to the buildings to be conserved will inevitably make some of the potentially hazardous areas of these buildings markedly more accessible and measures will have to be taken to limit risks to the public following the completion of the project, as well as to lay out some new paths to improve access to sites within the Valley.

As noted above, some vegetation management will be required to gain access to buildings, to draw up detailed specifications for their conservation and to remove structurally-damaging trees. A broader plan for the management of vegetation within the valley should also be considered to achieve the control of areas of invasive scrub, tackle alien invasive species and open up further areas of the site for public access.

During site visits during both November 2009 and May 2010 it was noted that the water quality of the Barn River appeared to be poor, with strong evidence for uncontrolled nutrient inputs from at least one local farm. The ecological impacts of these inputs has not been assessed, but the resultant unpleasant smell issuing from the watercourse certainly detracts considerably from the enjoyment of the Valley when close to the stream, particularly during warm weather. It is recommended that the water quality of the Barn River is tested at a series of locations through the Valley, the sources of the inputs are identified and appropriate measures taken to control them.

For the locations of the principal groups of structures/features within the project area see Figs 4-5. For the locations of structures proposed for conservation works, see Figs 7 to 12. The sites/features shown are as follows:

**Wheal Arthur Quarry (Figs 7, 27-28) (land not managed by the Tregargus Trust)**

1. Wheal Arthur Quarry
2. Adit in Wheal Arthur Quarry
3. Adit in Wheal Arthur Quarry

**Wheal Arthur china stone mill and dry (Figs 8, 32-41)**

4. Settling tank
5. Pumping water wheel
6. Settling tank
7. Settling tank
8. Pumping shaft
9. Settling tank

10. Wheal Arthur china stone mill
11. Wheal Arthur dry
12. Wheal Arthur linhay
13. Wheal Arthur chimney
14. Tramway
15. Settling tank

**Rescrowsa china clay pit (Figs 9, 42-43, 46, 55)**

16. Blacksmith's shop
17. Adit
18. Adit
19. Mica drags
20. Settling tanks

**Structures to the north of Big Wheel Mill (Figs 10, 44-45, 49)**

21. Structure
22. Top Wheel Mill
23. Blacksmith's Shop Mill
24. Chimney
25. Big Wheel Mill winder house
26. Blacksmith's Shop
27. Powder house

**Big Wheel Mill and Trevear Mill (Figs 11, 21-22, 47-48, 50, 56-81)**

28. Blockwork building
29. Big Wheel Mill
30. Adit
31. Crib Hut
32. Trevear china stone mill
33. Water tank
34. Trevear dry
35. Trevear Cottage

**Mica Mill (Figs 12, 82-92)**

36. Leat
37. Streamwork and adits
38. Aqueduct/bridge
39. Lower Tregargus/Mica Mill

## **7.1 General and preliminary**

Some works which will relate to the works across the site will be required. These will include:

- Obtaining permission from Goonvean Ltd. to use the unsurfaced track from the public highway to the Wheal Arthur works as the principal contractors' access.

- Further specialist surveys, in particular for bats, but also for evidence for badger activity and for birds' nests.
- Pre-works building recording.
- Preparation of a pre-works H&S Plan consistent with the requirements of the CDM 2007 regulations.
- Preparation of a construction phase H&S plan.
- Securing of Scheduled Monument and Listed Building consent for all proposed works to Big Wheel Mill. In practice, given that Scheduled Monument status is treated as the senior protection, Listed Building consent should be a formality, though should still be applied for.
- Agreement of specifications for the repointing of masonry joints and for rebuilding where required using mortars based on hydraulic lime to approved mixes, textures and finishes. A range of pointing test panels will be required and agreement reached on suitable mixes, aggregates and finishes prior to any conservation taking place. Test panels will need to be allowed to cure properly before any final selection is made; the selected panel should be retained for reference during the works.
- Agreement of specifications for the removal and replacement of failed or missing timber lintols and other timberwork in approved hardwoods.
- Agreement of specifications and methodology for the stabilisation of surviving wall plasterwork.
- Agreement of specifications and methodology for the stabilisation of corrosion on ironwork using Amerlock 400 or a similar product following scale removal by light hammering or light grit blasting.
- Agreement for the methods to be used to repair or otherwise stabilise badly corroded and/potentially structurally unstable iron features. A report by Peter Badcock, formerly Senior Conservation Engineer, English Heritage, highlighted the need for sympathetic restoration work to the Big Wheel Mill water wheel. The water wheel at Wheal Arthur Mill also urgently requires similar treatment.
- Selection, acquisition and approval of all required materials. All masonry used in the conservation works should be sourced from rubble piles on site (with the agreement of the historic environment consultant) or from approved local stockpiles where this is not possible.
- Creation of a dedicated contractor's access route from the public highway to the north to a site compound and from there to working areas adjacent to the buildings to be conserved (Fig 13).
- Creation of one or more centralised unloading and storage area (an area at Wheal Arthur is the most likely candidate, though an additional site may be required adjacent to Big Wheel Mill, possibly in one of the infilled quarries nearby); additionally preparation of one or more sites for welfare facilities.
- Provision of all required temporary fencing, notices and interpretation.
- Preliminary scrub vegetation management works, including the cutting and removal of ivy, scrub and other shrouding vegetation as well as trees growing from or near buildings. Cut material may be disposed of by composting, shredding, burning or removal from the site as advised by the ecological consultant. All cut tree stumps should be treated with a non-polluting poison to prevent regrowth. Ivy should be removed from the buildings and not simply cut



off at ground level, as this will encourage the infiltration of the structure by aerial roots.

- Preliminary site meeting by the project team and other invitees, as appropriate.
- Regular site meetings of the project team during the works programme to review progress, undertake valuations, agree variations, &c.
- Removal, on completion of works, of all materials which may be required for the creation of any temporary paths, roadways and compounds.
- Removal, on completion of works, of all building materials, waste, scaffolding &c.
- Production of reports on the works and the completion of the Health and Safety Plan, which should be passed to the Tregargus Trust.

## 7.2 Wheal Arthur complex

Sites 1 to 15, see Figs 7-8.

The Wheal Arthur complex includes the northernmost surviving structures in the Valley and includes a group of settling tanks, a pumping shaft and waterwheel, the china stone mill, with attached pan kiln, dry, linhay and chimney. To the north-west is Wheal Arthur quarry, which is connected to the mill by a tramway route (but which is not included in the area leased by the Tregargus Trust); there are also the remains of a number of sections of leats in the vicinity, as well as some small, overgrown early china stone quarries which are currently rather overgrown.

The quarry, which is a secluded, attractive and interesting feature of the Valley, and which retains its original form, is not currently readily accessible from the haul road, though it would not be difficult to clear a small amount of scrub vegetation to create a path to make this possible, subject to the permission of its owners. The adits within the quarry have been fitted with bat-friendly grilles; though some form of fence or similar barrier would be required around the northern side of the flooded section of the quarry if the public continue to explore this area, whilst the owners might wish to check that there are no dangerously loose sections of rock face overhanging the access route. The quarry access track, quarry and quarry pond have also been subjected to some fly tipping, which is unsightly.

The Wheal Arthur site has already received some attention in the form of preliminary vegetation clearance, though as the stumps of the trees which were cut down were not treated these have coppiced and will need re-cutting and stump-treating. Further vegetation needs to be cleared from the settling tanks, from around the western side of the mill and from around the pan kiln and chimney and nearby tanks. The removal of fly-tipped rubbish from the north-western settling tank unfortunately resulted in the substantial infilling of this feature, which is now difficult to see; some of the infill material should be removed to expose the walling of the settling tank. The pumping water wheel to the north is in fair condition, though its wheelpit is almost wholly obscured by scrub vegetation, as is the pumping shaft, which may require enclosure within a fence or similar barrier on safety grounds; the nearby tanks also require vegetation clearance.

The mill is in fair condition structurally, requiring only relatively small scale works, though access into and through the mill is difficult at present. Its water wheel is in imminent danger of collapse, its cast iron rims being retained in position only by two rotting timber spokes, and should be either propped or carefully dismantled as a matter of urgency.

Some clearance of vegetation and built up material has taken place within the pan kiln, but unfortunately the increased public access to this area has allowed someone to

steal a large number of tiles from the pan kiln floor (these have now been retrieved and placed in storage off-site). Vegetation, debris, rubbish and tipped material obscure the southern section of the base of the linhay, and should be removed. The chimney is in fair condition, though its upper brick courses will need to be taken down and re-set. The adjacent structures also need some work, and the tanks to its south are presently difficult to access because of the vegetation which covers them.

The Wheal Arthur mill complex is the most complete and potentially accessible of all of the sites in the Valley, and also incorporates the widest range of elements. Works required to enhance its structural stability and provide safe access to its components will include the following:

- Creation of a temporary storage and working area adjacent to the mill.
- Preliminary vegetation clearance and stump treatment works (priority 1).
- Provision of a safe pedestrian access route for contractor's staff and site visitors.
- Provision of appropriate temporary safety fencing and notices.
- Agreement of final works specifications (priority 1).

#### **7.2.1 Pumping shaft (Fig 8, site 8)**

In view of the potential hazard presented by this flooded pumping shaft of unknown depth, a permanent barrier fence should be erected around its periphery (priority 1).

#### **7.2.2 Chimney (Fig 8, site 13)**

- Vegetation removal and structural inspection (priority 1/2).
- Install access scaffold (priority 2).
- Stabilise top courses of brickwork by resetting loose courses (priority 2).
- Corrosion treatment to the iron strapping bands (priority 2)
- Stabilise/repoint flue entry (priority 2).
- Stabilise/repoint adjacent supporting structures (priority 1)
- Monitor lateral lean of top section of brickwork if rebuilding works are not undertaken (priority 3 and ongoing).

#### **7.2.3 Settling tanks (site Fig 8, site 15)**

- Vegetation removal (priority 1/2).
- Re-bed wall top masonry (priority 3).
- Re-point external masonry (priority 3).
- Re-point internal masonry (priority 3).

#### **7.2.4 Pan kilns (Fig 8, sites 11/12)**

- Vegetation removal (priority 1).
- Clear rubble and rubbish from linhay area (priority 2).
- Install access scaffold (priority 2).
- Stabilise hypocaust walls (priorities 1 and 2)
- Stabilise, partially reconstruct and repoint supporting wall (priority 1).
- Stabilise and repoint brick structure between sites 14 and 15 (priority 3).

- Reinstate missing pan kiln tiles (priority 2).

#### **7.2.5 China stone mill (Fig 8, site 10)**

- Clear vegetation from mill (priority 1).
- Install temporary props/support to prevent the collapse of the waterwheel (priority 1).
- Either dismantle and store or reconstruct waterwheel (priority 2).
- Install access scaffold (priority 2).
- Stabilise walling affected by root infiltration (priority 1).
- Relay wall capping and repoint external and internal wall elevations (priority 2).
- Assess condition of grinding pan floor in southern section of the mill (priority 1).
- Stabilise southern grinding pan floor (priority dependent on results of assessment).
- Assess and if necessary replace timbers supporting waterwheel bearings (priority 1).

#### **7.2.6 Settling tanks (Fig 8, sites 4, 6, 7, 9)**

- Clear vegetation (priority 1).
- Remove recent infill and rubbish (priority 2).
- Re-set wall capping, repoint exposed masonry where required (priority 3).

#### **7.2.7 Pumping waterwheel (Fig 8, site 5)**

- Clear vegetation (priority 1).
- Stabilise and repoint masonry and concrete mountings (priority 2).
- Undertake anti-corrosion treatment to waterwheel (priority 2).
- Install safety fencing to wheelpit (priority 2).

### **7.3 Rescrowsa Pit**

#### **Sites 16 - 20, Fig 9**

This china clay pit and its associated dumps abut the western side of the haul road to the south of the Wheal Arthur complex. The pit itself is completely ingrown and difficult to access, as are the associated dumps to its east, though a track into the works could be cleared if wished, and would give access to a pleasant area of woodland. A mass concrete constructed blacksmith's shop is sited on the edge of the pit. No works to the pit, dumps or blacksmith's shop are proposed as part of the current works programme, though the creation of further paths within this attractive but rather inaccessible area might be considered in the future, together with some conservation works to the Blacksmith's Shop (Site 16).

#### **7.3.1 Mica drags (Fig 9, site 19)**

A free-standing set of concrete-constructed mica drags associated with Rescrowsa Pit lie immediately to the west of the haul road and are readily accessible. A considerable amount of clearance work has already been undertaken here by the Tregargus Trust, though trees within this site which were cut down were not stump treated to prevent regrowth and have coppiced. The roots of a tree at the southern end of the structure

have heaved and disrupted the end of the mica drag. Some further clearance work is required to fully expose this structure and tree stumps within the drags should be treated and removed. An area immediately to the east of the mica drags has been partially cleared of vegetation and organic build up; further work is required to expose this structure.

- Complete clearance of mica drags and associated concrete area to their east (priority 1)
- Clear vegetation on and immediately adjacent to mica drags (priority 1).
- Treat tree stumps on and adjacent to mica drags (priority 1).

### **7.3.2 Adits (Fig 9, sites 16-17)**

At the northern end of the drags are a pair of adits. The mouth of the example to the north of the drags has substantially collapsed; as this is no longer readily accessible no works are proposed beyond the installation of a bat-friendly grille. The mouth of the adit to the north-west of the drags still retains its timber setts and lagging boards, installed under an unstable section of the roof near the adit entrance. The adit beyond this timbered section is still open and potentially accessible, though partly infilled with clay. In view of the likelihood of enhanced public access to the nearby mica drags it would be prudent to undertake safety works to the adit entrance. The existing timbering will need to be removed, together with the rubble which part covers it and a bat-friendly lockable grille incorporating structural support to the loose rock at the adit portal should be installed to prevent access by the public.

- Remove timberwork and rubble from the entrance to adit 47 and install bat-friendly lockable grille (priority 2).
- Install grille to adit 46 (priority 3).

### **7.3.3 Settling tanks (Fig 9, site 20)**

A group of stone-built settling tanks to the south of the mica drags were partly destroyed during the creation of the haul road through the upper part of the Valley. These could be rendered more visible to walkers through a small amount of scrub clearance (priority 2). No other works are required to stabilise them.

## **7.4 Top Wheel china stone mill**

### **Site 22, Fig 10**

This mill was almost completely over-dumped during the infilling of Higher Quarry, though some sections of the mill walling protrude from the dumped material. There are also the overgrown remains of a small, apparently un-mapped masonry-constructed building immediately to the north of the mill (Site 20) which was probably associated with the quarry, sited as it is near its entrance. Small scale works would allow the exposure of the remaining fabric of both of these buildings and add interest to this part of the trail.

- Clear vegetation from eastern facings of the remains of the mill (priority 2).
- Rake back rubble and masking debris to expose surviving eastern sections of mill masonry (priority 3).
- Clear vegetation from the structure to the north of the mill (priority 2).

## **7.5 Higher and Lower Tregargus Quarries**

These two quarries, the principal source of china stone for the lower mills in the Valley, were infilled with mica waste and graded off in sand and stent during the late 1970s and early 1980s. They are now levelled grassy areas which are beginning to scrub in. The western quarry faces are designated as a SSSI for their geological

interest. No works are proposed to either site, though scrub development across these sites should be undertaken to allow continued access to them and to points from which views of the quarry faces can be obtained.

## **7.6 Blacksmith's Shop Mill**

### **Site 23, Fig 10**

Blacksmith's Shop Mill lies immediately to the east of Tregargus Lower Quarry and just to the west of the access track running through the Valley, which here runs downslope towards Big Wheel Mill. The northern end of the mill was partly overdumped during the infilling of Lower Quarry, though the southern section of the mill and most of its eastern elevation survives. Ivy covers most of the stonework, making it difficult to see. The access road to this mill has become overgrown with saplings and brambles (together with a small amount of rubble), though this could be readily cleared to provide access to this site, and there is the potential to extend a path beyond the mill to access the area to the rear of Big Wheel Mill. It is suggested that, given the amount of overdumping which has taken place at Blacksmith's Shop Mill, works should be confined to the opening up of the access track, the removal of ivy from the surviving elevations and any minor works needed to stabilise the structure. The provision of access into what remains of the mill is not required, as its interior appears to have become completely infilled. Some thought could also be given to cutting back scrub between the mill and the access track through the Valley to make this site visible from the main path route.

- Clear vegetation from roadway passing to the east of the mill to provide site access (priority 2).
- Clear ivy from eastern elevation of mill (priority 2).
- Assess structure to finalise schedule of works (priority 2).
- Re-lay wall heads and undertake other minor repairs to confer structural stability to remains of mill (priority 3).
- Thin/clear scrub vegetation between the mill and the main access route through the Valley (priority 3).

## **7.7 Big Wheel Mill**

### **Site 29, Fig 11**

The largest china stone mill in the Valley, this is a scheduled monument and grade II listed building. Although some of the grinding pans have been removed and others have been partly demolished, the majority of the structure is intact, and the mill retains its central water wheel and iron feed launder, supported by a rare brick flying arch. The roof structure, which remained intact until the mid 1980s, has now collapsed.

Some works have already been undertaken to elements of this complex, including emergency repairs to the leat bridge to its west and some vegetation clearance in and around the mill, in particular to its east between the mill and the river. Although a number of small trees were cut down, these were not stump treated and have now regenerated, obscuring much of the eastern elevation of the structure, which is also partly covered in ivy.

Works required to this structure will include the removal of ivy, the cutting back of scrub and trees, accompanied by stump treatment where required and the clearance of rubbish and debris. This should be followed by stabilisation works including some repointing and the rebedding of the top wall masonry. Discreet safety barriers will be required to the openings on the upper floor on its eastern side to safeguard the existing dangerous drops.

The most urgent and substantial works required on this structure relate to the water wheel, however. The cast iron rim sections are connected to the cast iron hub by means of fifteen pairs of T-section iron spokes and circular section tie rods. Almost all of the spokes have corroded very extensively, some having failed completely and the structural integrity of the wheel must now be severely compromised, with the total collapse of the rim and the breakage of its components being a very real possibility in the near future. The stabilisation of this important element of the structure is an urgent priority, which will require either the installation of supporting scaffolding or the careful dismantling of the water wheel pending its repair. Given the extent of deterioration of the spokes it is likely that most of these will need to be replaced with modern equivalents. Although this will be an expensive, complex and intrusive operation, it is considered that the loss of integrity to this scheduled site which would result from allowing the collapse of the wheel would be significant and ought to be averted. Discussions will be required with English Heritage to approve this course of action and specialist advice will be needed to establish how best to achieve the stabilisation of the water wheel. Given the size and weight of the wheel it might be necessary to bring a crane to site to move its components. If this is the case, some upgrading works to the access track to site will inevitably be required. It is also recommended that some conservation is undertaken to the iron launder to confer structural stability, much of the base of the launder having corroded away, making it prone to distortion or collapse. Should the launder become unstable this might result in the unusual brick flying arch which supports it being severely damaged or destroyed.

The conservation of the other peripheral elements of the site will entail only minor works and is considered to be a low priority. Following the conservation of the mill, thought will need to be given to some access and safety works, in particular the provision of fencing or a barrier to prevent falls into the deep wheelpit and from the openings on the upper floor of the eastern elevation of the building.

- Create temporary storage and working area adjacent to the mill (priority 1).
- Provide a safe pedestrian access route for contractor's staff and site visitors (priority 1).
- Provide appropriate temporary safety fencing and notices (priority 1).
- Clear vegetation from building and from the area to its east between the mill and the river. Treat all stumps to prevent regrowth (priority 1).
- Provide temporary props or scaffolding to support waterwheel (priority 1)
- Agreement of final works specifications (priority 1).
- Install access scaffold (priority 2).
- Clear debris and install temporary props under southern grinding pan floor (priority 1).
- Repoint external and internal masonry (priority 2)
- Re-set wall capping masonry (priority 2).
- Clear vegetation, debris and water from wheelpit (priority 2).
- Repoint wheelpit wall facings (priority 2).
- Undertake anti-corrosion treatment and any necessary repairs to waterwheel (priority 2).
- Clear debris from, undertake anti-corrosion treatment to and undertake repairs to launder (priority 2).

- Clear vegetation from tanks at rear of building (priority 2).
- Reset steps leading from mill to tanks (priority 3).
- Reinstate timber lintels in gable and other walls where required (priority 1).
- Clear vegetation and debris from access area to grinding pans and install temporary props if required (priority 1).
- Clear vegetation from circular tank adjacent to southern wall (priority 2).
- Clear vegetation from circular structure adjacent to northern gable wall (priority 1).
- Stabilise and repoint circular structure adjacent to northern gable wall (priority subject to assessment following vegetation clearance).
- Clear vegetation from grinding floors following installation of temporary props (priority 1).
- Apply timber treatment to bell frame on northern elevation (priority 3).

## **7.8 Adit**

### **Site 30, Fig 11**

A small open adit debouches onto the Barn River immediately to the south of Big Wheel Mill, and presumably originally drained the Tregargus china stone quarries to the north. The adit has been fitted with a bat-friendly galvanised steel gate and requires no further work.

## **7.9 Chimney**

### **Site 24, Fig 10**

A small detached chimney just to the north-east of Big Wheel Mill, this seems originally to have been part of a complex of buildings (shown on the 1880 and 1908 OS maps) which have now been demolished to their foundations. The chimney is in fair condition and requires only small-scale works to stabilise it.

- Provide appropriate temporary safety fencing and notices (priority 2).
- Install access scaffold (priority 2).
- Clear vegetation from chimney (priority 2).
- Stabilise chimney masonry, repoint external elevations and re-set top masonry courses (priority 3).

## **7.10 Blacksmith's and carpenter's shop**

### **Site 26, Fig 10**

A small structure adjacent to the modern bridge over the Barn River, this requires only minor stabilisation works.

- Clear encroaching vegetation and remove debris (priority 2).
- Create temporary storage and working area adjacent to the structure (priority 2).
- Provide appropriate temporary safety fencing and notices (priority 2).
- Clear vegetation (priority 2).
- Install access scaffold (priority 3).

- Stabilise and repoint masonry, re-set wall capping (priority 3).

### **7.11 Bridge**

This fine, masonry-constructed arch bridge to the east of Big Wheel Mill originally carried a tramway from the Tregargus Higher and Lower Quarries to Trevear Mill over a roadway cutting. The bridge has been incorporated into the Valley path network, and a strained galvanised steel cable safety fence prevents falls from it. Stabilisation works to repair partial collapse of the structure noted in 2002 have been undertaken to a high standard and no further works are required to this structure at present.

### **7.12 Three small buildings**

#### **Sites 27, 28 and 31, Figs 10 - 11**

These three small buildings lie in the valley bottom to the east of Big Wheel Mill and comprise the remains of a masonry-constructed powder magazine (site 27), a small modern blockwork structure (site 28) and a blockwork-constructed crib hut (site 31). All are currently unroofed. Parts of the asbestos reinforced cement sheet roofing lie in and around this last building and should be removed for disposal at a licensed tip by a specialist company (priority 1). There is some potential for stabilisation works to the powder magazine, but these are a low priority (priority 2). No other works are required for the two modern buildings.

- Remove asbestos roof section (priority 2)

### **7.13 Chimney**

This small chimney which served Trevear pan kiln lies just outside the leased area. The chimney is in fair condition, though may be in danger of being undermined by badger activity. No works are proposed to this structure at present, though the effects of the badger activity should be monitored. Vegetation growth on the chimney should be controlled.

### **7.14 Trevear china stone mill and pan kiln**

#### **Sites 32-34, Fig 11**

This china stone mill is sited in the south-eastern part of the Valley, stone originally being trammed to it from the Tregargus Higher and Lower Quarries. The mill (32) is asymmetric, originally having had two grinding pans to the north of the wheelpit and one to the south. A substantially demolished pan kiln (34) is attached to the south of the mill, its linhay having become completely overgrown with privet. Some vegetation clearance has taken place around the mill, though most of the cut area has now revegetated.

The condition of the mill is the poorest of any of those which survive to any substantial degree in the Valley, there having been substantial collapses of parts of its floor structure. This appears to be substantially due to the rotting out of some of the timbers which supported the vaulting under the grinding pan floor. The replacement of the remaining failing timbers and the reinstatement of those which are now missing are required to prevent further collapse. Temporary propping of the floor should be undertaken in advance of any other works. Rubble, rubbish and ivy will also need to be removed from the building and from the wheelpit in advance of consolidation works, which will include re-setting the top courses of the walls, the replacement of failed pointing and the installation of some safety barriers where dangerous drops exist. The condition of the flying arch which originally supported the launder over the wheelpit should also be examined, given the particular rarity of these features (only two examples survive in the Valley).

The pan kiln and its linhay are covered in rubble and dense scrub, including privet which has spread from the nearby miller's garden. This will require clearance before



the scope of the works required to this part of the complex can be assessed. To the east of the mill, trees roots growing into the water tank (33) have already destabilised a section of its masonry; this tree is likely to fall soon and will cause severe damage to walls of the adjacent mill. The tree should be carefully felled as a matter of urgency, as should a second leaning tree immediately to its south.

- Vegetation clearance works, including removal and stump treatment of trees growing from masonry, especially those growing on the masonry water tank immediately to the east of the mill (priority 1).
- Agreement of final works specifications (priority 1).
- Create temporary storage and working area adjacent to the mill (priority 2).
- Provide appropriate temporary safety fencing and notices (priority 2).
- Repoint internal and external elevations where required (priority 2).
- Re-lay wall topping courses (priority 2).
- Install temporary props under grinding pan floor (priority 1).
- Replace timber bearers under grinding pan floor arches (priority 2).
- Install stainless steel ties to stabilise cracks in grinding pans (priority 2).
- Remove vegetation and debris from waterwheel pit (priority 1).
- Fell trees immediately to the east of the mill growing out of or adjacent to the water tank (priority 1).
- Repoint wheelpit masonry (priority 2).
- Install safety barriers (priority 2).

## **7.15 Miller's cottage**

### **Site 35, Fig 11**

Trevar china stone mill is unusual amongst the mills of the Tregargus Valley in that it is accompanied by an adjacent miller's cottage. Constructed on two storeys, this building has apparently been modified during its life, the northernmost of the paired fireplaces in the eastern ground floor wall having been blocked in, the southernmost having been substantially reduced in size. Although Cole and Smith (2002) suggest that the building had a two up two down arrangement, this evidence suggests that the building originally had three small rooms on the lower floor. There are two extensions – a substantial two storey lean-to attached to the south whose external wall has substantially collapsed and a smaller wash house to the west. The building is roofless, and has been heavily overgrown with ivy externally. Internally, much of the wall plaster survives. The removal or failure of internal lintels has caused localised wall collapse, whilst some structural movement in the northern wall has led to cracks extending the full width of the surviving granite lintels.

Despite immediate appearances, this building is in fair condition and could be rescued from collapse with some fairly simple remedial works. The ivy growing on the walls has been cut off above ground level, and should be removed before its roots infiltrate too deeply into the walls in search of moisture and minerals. The wall heads will need to be capped, the lost lintels and masonry reinstated and the cracked lintels should be secretly pinned using stainless steel rods and epoxy resin. It might be possible to retain much of the internal plaster by filleting its broken edges to prevent water ingress, though in the long term exposure to the elements will probably result in its gradual loss. Broken ends where walls have collapsed will need to be pointed, as will

areas of failed pointing on the external elevations. Some minor rebuilding may also be required to reinstate necessary levels of stability in some areas of the walling.

Two mature sycamores immediately to the east of the cottage should be felled, given the high potential that they will eventually fall onto the structure and cause significant damage. Clearance of scrub from the garden adjoining the miller's cottage would help to reinstate an appropriate setting from the building, would expose the dry and linhay, and would also facilitate the creation of a path leading down to Trevear Lane nearby.

- Remove vegetation, including residual ivy, two mature sycamores to the immediate east of the cottage which threaten to collapse onto it, and selected vegetation from around adjacent pan kiln (priority 1).
- Agreement of final works specifications (priority 1).
- Create temporary storage and working area adjacent to the cottage (priority 1).
- Provide appropriate temporary safety fencing and notices (priority 1).
- Install access scaffolding (priority 1).
- Stabilise rear wall of extension through re-laying wall heads, repointing of masonry, including broken wall ends (priority 1).
- Re-lay wall heads to main building and repoint internal and external elevations with the exception of areas where sound plaster has survived (priority 1).
- Undertake limited reconstruction of chimney masonry (priority 1).
- Install stainless steel bedjoint reinforcement across cracking in gable wall (priority 1).
- Install stainless steel bedjoint reinforcement across junction between original building and extension (priority 1).
- Install stainless steel bar reinforcement to pin cracks in both granite lintels on the front elevation (priority 1).
- Reinstate lost internal lintels in front elevation, pin to existing lintels and make good lost masonry above lintels (priority 1).
- Stabilise rear wall of original cottage through limited reconstruction using recovered materials and reinstatement of missing lintels (priority 1).
- Reinstate lost internal timber lintel over doorway in left hand elevation and provide additional bearing for external granite lintel if practicable (priority 1).
- Re-lay wall heads and repoint internal and external elevations of single storey extension to the right of the cottage (priority 1).
- Reinstate supporting masonry and lintels to outbuilding chimney (priority 1).
- Replace steel plates over pan kiln furnace opening and stabilise masonry over opening (priority 1).
- Remove and stump treat trees growing from steps leading to furnace room (priority 1).
- Re-lay wall heads and repoint walls of furnace room (priority 1).

## **7.16 Tin streaming and prospecting adits**

### **Site 37, Fig 12**

A roughly triangular area within which overgrown parallel banks of rounded stone provide evidence for tin streaming activity lies to the east of the Barn River to the south of Trevear Mill. Two or more prospecting adits have been driven into the unworked eastern part of the alluvium which blankets the valley bottom. These have been fitted with galvanised bat-friendly grilles. No further works are required in this area, though it should be periodically monitored in case other tunnels open up through subsidence collapse.

## **7.17 Leat**

### **Sites 36 and 38, Fig 12**

A leat leading southwards from the path to the south of Big Wheel Mill runs to the rear of Lower Tregargus or Mica china stone mill. This provides an excellent path linking these sites and appears to have been cleared to make this possible. No other works are required to this feature, though the condition of the iron supports to the former tramway bridge adjacent to the mill to the south and the structure of the infilled iron aqueduct should be inspected to determine whether they have corroded to the point where they need to be replaced or strengthened. A modern strained galvanised steel cable fence has removed the risk of falls over the aqueduct sides, this now forming the path over the bridge.

## **7.18 Lower Tregargus or Mica china stone mill**

### **Site 39, Fig 12**

This finely-constructed china stone mill, the southernmost in the Valley, lies at the southern end of the area leased to the Tregargus Trust. A detailed pre-construction plan of the mill dating to 1896 exists in the Cornwall Record Office (CRO X223/20, reproduced as Fig. 7 in Cole and Smith 2002).

The gables and eastern elevation of the mill survive intact but the western wall has substantially collapsed, allowing ready access into the upper floor of the building, where there are four well-preserved brick-constructed grinding pans. Dense ivy covers most of the eastern elevation of the building, and will need to be removed and stump treated, whilst a pair of mature trees growing out of the masonry flanking the wheelpit at its western end should be cut down and stump treated before they inevitably cause severe damage to the structure, some dislodging of and damage to the masonry having already taken place.

The surviving masonry elements of the structure are in generally good condition and would require only small levels of conservation works, including the re-bedding of the top wall stones and some replacement of failed wall pointing. The paired massive timber beams spanning the wheelpit are in fair condition, though should be monitored for rot at their ends. The surviving window frames would benefit from timber treatment to prevent rot and worm taking hold. Rubbish should be removed from the lower floor of the building, whilst rubbish and the remains of the roof trusses should be cleared from the wheelpit. Some minor drainage works might be needed to dry out the area immediately adjacent to the mill to its north to improve access to it.

- Remove vegetation on and immediately surrounding building, in particular two mature trees growing from the masonry forming the western end of the wheelpit. Treat stumps to prevent regrowth (priority 1, subject to owner's permission).
- Undertake structural assessment of mill and associated buildings (priority 1).
- Create temporary storage and dispatching area adjacent to the mill (priority 2).

- Remove rubbish and rubble from within mill and wheelpit (priority 2).
- Undertake consolidation works to wall faces and wall heads as required (priority 2).
- Undertake minor repairs to grinding pans (priority 3).
- Undertake minor drainage works to the north and west of the mill (priority 2).
- Provide a safe pedestrian access route for contractor's staff and site visitors (priority 2).
- Provide appropriate temporary safety fencing and notices (priority 2).
- Provide permanent safety barrier adjacent to wheel pit (priority 2).

### **7.19 Creation of enhanced public access**

A route for a trail through and around the Valley should be agreed. Most of this route already exists, making use of the haul road from the northern site entrance down to the Tregargus quarries (the northern part of which lies outside the area managed by the Tregargus Trust), together with a series of smaller paths from this point southwards. A circular route back along the eastern side of the Valley could be established if wanted. A rather overgrown and badly-drained lane from the south-eastern boundary of the leased area provides a route back to Trevear Mill, whilst existing bridges are already in use to link the northern extension of this path back to Big Wheel Mill.

- Agree the route for the elements of any formalised trail through and around the Valley which will be shown on interpretation panels, leaflets and maps.
- Agree future maintenance schedule.
- Undertake access works.

### **7.20 Provision of interpretation**

- Agree an interpretation strategy for the Valley. This may incorporate fixed interpretation panels, waypoints, self-guiding leaflets, web-based materials and educational material.
- Agree locations for and nature of any fixed interpretation material. Note: it is unlikely that English Heritage would sanction the installation of such material at or on the scheduled Big Wheel Mill. The erection of an interpretation panel at the northern entrance to the Tregargus Valley (adjacent to the lay-by) is recommended, though the use of this site would have to be with the agreement of its owners, Goonvean Ltd.; a further interpretation panel at the southern end of the Valley adjacent to the site entrance near Mica Mill should also be considered.
- Commission interpretative material from design consultants. Input will be required from archaeological and ecological consultants as well as local experts and English Heritage before the designs are finalised.
- Install fixed interpretative material.
- Trial educational materials with local schools; establish links with local schools and other educational establishments to promote the development of the use of the Tregargus Valley as an educational resource.

### **7.21 Maintenance programme**

A maintenance schedule for the Valley should be agreed and drawn up. This should set out those tasks which should be undertaken annually (or more frequently if

required) which will be required to maintain public safety, access and enjoyment of the Valley, and to prevent deterioration of the structures. The schedule should include:

- Cyclical vegetation management on and around structures.
- Cyclical vegetation management adjacent to paths and access routes.
- Inspection and maintenance of any safety fences, barriers and notices.
- Inspection and maintenance of paths.
- Ongoing treatment of Japanese knotweed.
- Minor works required to enhance the path network to extend public access to other areas of the Valley.
- Promote and enhance volunteer involvement in the management and maintenance of the Valley.
- Five yearly review of maintenance programme.

## 8 Range of impacts and proposed mitigation

### 8.1 The effects of undertaking conservation works to the structures

#### Potential impacts

- Potential loss of historical and visual authenticity to the site and its structures.
- Introduction of non-original materials.
- Introduction of props, struts or other elements required to provide structural stability.
- Lack of information as to the extent and nature of repair works undertaken as part of the conservation project.
- Impacts on significant habitats and species, including roosting bats, nesting birds and lichens. Communities of interesting vascular plants could be affected if close to sites to be worked on.

#### Suggested mitigation

- A *de minimis* approach to the works will be taken, consistent with making the buildings maintenance-free in the mid term (30 years as a minimum).
- A detailed pre-works measured and archive quality photographic survey should be undertaken to record the extent of original fabric and detailing.
- Further building recording will be required once scaffolding is in place in order that a suitably detailed pre-works survey is created, including detailing which cannot be recorded in advance of scaffold erection.
- A historic environment consultancy should be established prior to the works to ensure that the specifications for the works are sympathetic to the buildings.
- A watching brief should be commissioned during the works; this must be undertaken by an appropriately qualified historic environment consultant.
- Replacement of areas of lost stonework will be kept to the minimum consistent with restoring structural stability.
- The use of locally-sourced stone from rubble piles will be used for essential repairs where original material has been lost.
- The use of hardwood replacements will be specified where lintels have been lost.

- Specialist advice will be sought on works which would be required to ensure the survival of the water wheels.
- A conservation mortar based on hydraulic lime and appropriate aggregates will be used to provide a finish similar to the original pointing.
- Original pointing and plaster will be retained where it has not failed or become detached.
- Non-original temporary or permanent props, buttresses or other similar artificial aids to stability will not be used unless essential.
- Birds sometimes nest in dense Ivy and bats have been known to roost behind mature dense Ivy. Ivy on structures could also conceal crevices or holes where bats may roost. Any areas of ivy on structures should be inspected by a competent profession prior to their removal to assess the impact of such work on habitats and species. Emergence bat surveys should be carried out on structures with crevices and holes suitable for bats where these features are to be re-pointed. Because bats are so mobile it will also be necessary to examine these features just before building consolidation work starts. Ideally a visual inspection with an endoscope should be undertaken when scaffolding is in place. Any crevices that cannot be fully examined and declared free of bats should be left open or have an exclusion device fitted so that bats can emerge but cannot re-enter. Where possible potential bat roosts should be preserved.
- Although there is no evidence to suggest that this site is of importance for lichens or bryophytes if these taxa are present on the areas where repointing etc is to be carried out then a survey for these species should be undertaken prior to work.
- A full record of works undertaken will be maintained by the contractor and supervising engineer/architect and will be lodged with the Tregargus Trust as site managers on completion of the project.

## **8.2 Provision of contractors' access to the buildings**

### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.

### Suggested mitigation

- Archaeological and ecological surveys will be undertaken prior to the planning of the works to provide information about sensitive areas of the site, and those which could withstand limited impacts during the works programme.
- New access tracks should avoid areas of nature conservation interest such as heathland, species-rich grassland and wetland areas including flushes and wet woodland.
- All approaches and opportunities should be explored to limit the impacts associated with the creation of safe access routes. Consideration may need to be given to temporary protective surfacings on tracks which are likely to be used on a regular basis. Where possible, materials should be transported by hand, by vehicles fitted with low pressure tyres or by tracked hand barrows. Vehicle use must be kept to a minimum, and should be restricted during wet weather or where soft ground conditions develop and there is an enhanced risk of surface damage. Temporary ground protection (in the form of geotextile membranes) may be required in some areas. All temporary surfacings should be removed on the completion of works and reinstatement measures carried out where required. Where geotextile is used to protect surfaces, this should be removed at the earliest possible opportunity to allow underlying vegetation to

recover. The routes shown on Fig. 13 are likely to form the basis of the access network used during the conservation programme. Whilst access to the Wheal Arthur complex is straightforward, it will not be easy to provide contractor's access to Trevear Mill except from the south.

- Should a crane be required during works to the waterwheels at Wheal Arthur and Big Wheel Mill, temporary access routes will almost certainly be required. The creation of such an access to Big Wheel Mill from the north will require the felling of overhanging trees adjacent to the access route, as well as the re-grading of the route surface. If an approach using cranes to effect the conservation of the water wheels is decided upon, a specialist crane contractor should undertake a site visit with the project engineer, historic environment consultant and ecologist at an early stage in the specification of the project in order to assess the nature, costs and impacts of any preparatory works which will be required.
- Temporary works may be necessary to make safe unsecured drops where these present potential dangers to contractors or the public. These should be removed on completion of the works. Where permanent solutions are deemed to be required, these should be visually non-intrusive and low maintenance.
- Any necessary fencing should be temporary and sited so as to result in minimal impacts on the site whilst being consistent with achieving required levels of safety.
- Ecological impacts will need to be taken into account following the survey recommendations. Nesting birds in trees, scrub or on the ground could be affected; reptiles could also exist in these areas. Communities with interesting vascular plants such as the developing heathland and open vegetation in the quarries could be affected. Trees with holes, crevices or heavy Ivy could be used by roosting bats. Care must be taken not to disturb nesting birds, potentially restricting any works taking place during the nesting season. Potential bat roosts must be checked by a specialist in advance of works which would impact on them.
- Where proposed access routes are created by tree felling or scrub cutting through areas which are presently inaccessible, the historic environment and ecological consultants should inspect the cleared routes to determine whether their use will have any unforeseen significant impacts on previously unknown features or habitats. If this is found to be the case, re-routing will probably be necessary.
- Prior to erection of scaffolding to the buildings to be conserved and in other areas where scaffolding or other temporary works are deemed to be required to facilitate the works, a detailed ground inspection shall be carried out by the historic environment consultant. The final design of any works required to allow the erection of scaffolding or other similar works shall be subject to discussion with and agreement by the historic environment consultant and ecologist, who may require further appropriate mitigation before works take place. Unless absolutely necessary, all scaffolding and other temporary support should be erected off existing ground surfaces and any founding excavation work kept to a minimum.

### **8.3 Delivery and erection of scaffolding and delivery of contractors' materials to site.**

#### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.

#### Suggested mitigation

- A method needs to be found to enable large quantities of scaffolding and other building materials to be delivered to the buildings to be conserved without causing collateral damage to other parts of the site. All materials required for the works (scaffolding, masonry, timbers and, if batching is to be done on site, mortars, aggregates and water bowsers) may be put in place as part of a single operation. In order to minimise deliveries, sufficient scaffolding should be brought to site in a single operation to allow work to subsequently progress sequentially across the site (scaffolding from a completed building being transferred to another structure which is to be conserved). An area close to the site may need to be identified where loads can be batched and transported by a vehicle appropriate for use within the Valley. Considerable and careful pre-preparation will be required to achieve this, whilst contractors may need to have their materials purchase costs paid for at this stage, rather than throughout the life of the Project. Low-impact access routes will need to be identified, as well as appropriate, safe methods of transporting materials in ways which will result in the least damage being caused to the site.
- Scaffolding structures should generally be free-standing, and not rely on attachment to buildings for structural stability.

### **8.4 Achieving site safety during and subsequent to the works**

#### Potential impacts

- Temporary or permanent loss of visual integrity.
- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.

#### Suggested mitigation

- Works will be needed to protect contractors from hazards presented by unsecured drops. These works should be reversible and have minimum impact. Where a requirement for long-term hazard protection is identified, these works should be undertaken at an early stage of the project and, where possible, undertaken as priority works.
- Contractors' routes to and within the buildings will need to be made safely accessible during a range of weather conditions, probably including periods of poor visibility, cold and wet weather. Any works or surfacings required to achieve this should be of an agreed and temporary nature, and should not involve any excavation of archaeologically or ecologically sensitive material or the undue use of temporary fixings.
- Scrub management followed by marking (both on the ground and on maps supplied to the contractors) will probably be required to provide clear, safe routes from site compounds to specific buildings. Deviations from the agreed routes should not be allowed without prior agreement following careful examination of the proposed route variations.
- Legislation requires that the public will need to be excluded from all work areas during the Project. This will involve the erection of fencing and notices, whose locations should be agreed with English Heritage and the historic environment consultant. All fences, exclusion barriers and notices shall be inspected and maintained on a daily basis to ensure they are fit for purpose and shall be removed from site on the conclusion of the works.
- Consideration will need to be given to how the safety of visitors to the site can be achieved on the completion of the works. Where possible, visually intrusive fences or other barriers should be avoided. Clear safety signage will be



required at the entrances to the site, together with some specific signage or protective measures near specific and particular hazards.

## **8.5 Provision of contractors' compounds and facilities**

### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity, in particular those with communities of the interesting vascular plants.
- Damage to undocumented sub-surface archaeology.
- Significant visual impacts during the works programme

### Suggested mitigation

- Areas for compounds and storage areas must be agreed in advance so that these can be sited in locations which are not inconvenient to the contractors, but where site impacts will be minimised. Where preparatory excavation, levelling up or other works are required, their scope must be agreed in advance and any necessary variations to the mitigation procedures undertaken. Any materials brought onto site to create these compounds should be placed on a layer of geotextile membrane, which must be removed from site on completion of the works. It should be recognised that compounds and storage areas distant from the work areas will necessitate additional vehicle movements, and a compromise between siting these in wholly insensitive areas and the impacts of higher levels of vehicle movement will need to be sought.
- The sparsely vegetated areas are a valuable ecological feature on this site and are potentially of value for reptiles and invertebrates. Although no rare plant species grow in these areas, (particularly in the quarries) special care must be taken not to disturb the vegetation including mosses and lichens. The siting of storage compounds should avoid these areas.
- The siting of storage compounds should be considered carefully to avoid habitats of ecological interest such as species-rich heathland/grassland and open vegetation. Materials should be storage on a non-permeable membrane and protected from rain to avoid the leaching of potentially damaging substances. Ideally storage compounds should be sited on unvegetated tracks.
- Security fencing around these compounds must be in agreed locations and so erected as to limit impacts on the site.

## **8.6 Ivy clearance from structures**

### Potential impacts

- Disturbance to active bat roosts or to nesting birds

### Suggested mitigation

- Ivy on structures such as the Millers Cottage should be cut at the base by hand at the earliest opportunity once funding for the works has been agreed. The foliage will die and the leaves will fall off discouraging nesting birds and roosting bats. This will also expose crevices and holes in the structure which may need examining for occupation by bats.
- When the Ivy is to be removed it should be carefully pulled off by hand in late summer or autumn (mid-August – late October) to avoid disturbance to breeding/hibernating bats and nesting birds. It is unlikely that bats breed in the walls and structures at this site but non-breeding bats could be present at any time of the year. Bats could hibernate in the built structures between November-April and are particularly vulnerable to disturbance at this time of year.

## 8.7 Tree and scrub clearance

### Potential impacts

- Disturbance to bird nesting sites.
- Injury to ground-dwelling reptiles.
- Disturbance to badgers and their setts.
- Potential impacts on dormice.

### Suggested mitigation

- Scrub should be cut outside the bird nesting season which starts in mid-March and finishes in mid-August. If scrub must be cleared in the bird-nesting season then a breeding bird survey of the areas concerned should be undertaken before work starts.
- To avoid injury and killing of reptiles, clearance of scrub and tall herbaceous vegetation should be done in the active season when these species can move to escape injury. During the active season individual animals should retreat from areas that are being disturbed; care should be taken when working through heathland/grassland/scrub/bracken/open vegetation to ensure any individual animals can hear the approach of machinery. This limits the opportunities for scrub clearance to late summer and early autumn i.e. mid-August to late September if disturbance to nesting birds is also to be avoided.
- Badgers are active on the site and although the main sett is not located close to any of the proposed works dense scrub could conceal other setts and there are reports of badgers close to the chimney east of Trevear Mill (88). If signs of badgers are found during the works then further survey work may be necessary. Badger is legally protected under the Protection of Badgers act 1992 which makes it a criminal offence to intentionally or recklessly interfere with a sett including damaging or destroying a sett, obstructing the entrances to a sett or disturbing a badger within its sett. A badger's sett is defined as 'Any structure or place which displays signs indicating current use by a badger'. Natural England has released new advice on what actions will require a licence as they have concluded that Badgers are relatively tolerant of moderate levels of noise and activity at or near their setts.
- As a result acts which only cause levels of disturbance described in this way will no longer require a licence. Examples of activities which Natural England suggests would not need a licence include:
  - Development or other activities occurring close to Badger setts which will not cause disturbance greater than that commonly tolerated by badgers, using hand tools and/or machinery.
  - Removal of vegetation over and adjacent to setts, using hand tools and/or machinery.
  - Clearing of ditches/watercourses using hand tools and/or machinery where Badger setts are present.
  - However, any activities which will/or is likely to cause damage to a sett tunnel or chamber or obstruct the entrance to a sett will continue to require a licence. Consideration should be given to the fact that the tunnels within setts can extend tens of metres underground.
- If major clearance work is proposed in the woodland then a detailed survey should be undertaken for Dormouse.

## 8.8 Works to adits

### Potential impacts

- Disturbance of active bat roosts.

### Suggested mitigation

- The timing of this work should avoid the bat hibernation period as these features are very important for rare species of hibernating bats. Work should be carried out in May or between late August and the end of September. This allows a safe margin avoiding the breeding season (Horseshoe bats occasionally breed underground) and an extended period on either side of hibernation to avoid disturbance to torpid bats before and after the core hibernation period. Bat friendly grilles should be fitted in all openings allowing uninterrupted access for all species of bat, particularly Greater and Lesser Horseshoe.

## 8.9 Impacts on the broader site

### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.
- Impacts on water courses.

### Suggested mitigation

- Contractors will be provided with maps indicating access routes, sensitive areas and any no-go areas. A site walk-over with all contractors and sub-contractors will be required to ensure that these restrictions are fully understood and followed. All contractors will be made aware of national and other designations applying to the site, and the constraints on work practices which these impose.
- The potential for mortar batching in relatively insensitive areas of the site should be explored. Care must be taken to ensure that lime-based products are not transported by wind or water into sensitive areas (those where the survival of habitats is dependant on acid substrate conditions).
- Slops, rakings, unused batched mortar, mixer wash water, timber offcuts and other unused materials should not be disposed of on site. Bunds or other temporary works or controls may be required by the Environment Agency to prevent spillages of potential pollutants into the Barn River.
- No fires are to be lit on site without prior agreement, and only in agreed areas.

## 8.10 Disturbance to habitat

### Potential impacts

- Potential release of pollutants: fuel/chemical spillage, dust associated with vehicle movements or strongly alkaline dust associated with mixing of mortar.
- Damage to habitats through vehicle movements on existing tracks, creation of compounds and storage areas, works required to create access to and between buildings, or other contractors' activities.

### Suggested mitigation

- Commission an ecologist to carry out a walkover survey following identification of the preferred access routes and compound areas in order to identify any particularly features of ecological importance and further inform mitigation.

- Following walkover survey above, develop a sensitive methodology, in consultation with an ecologist, for the creation of the access routes. Recommendations to minimise impact are likely to include:
- Use of geo-textiles and trackway/matting along access route where/if appropriate to minimise compaction and potential for contamination of soils.
- Minimise number of vehicle movements (but potentially also limit maximum loaded weight of vehicles – optimum 'trade-off' to be decided).
- Clearly delimit operational routes with high-vis tape or similar to prevent works encroaching upon surrounding areas of habitat.
- Follow Environment Agency guidelines to minimise release of pollutants, dedicated areas will be required for the mixing of mortar. Temporary bunds may also be required to prevent the release of pollutants into the adjacent water course.
- Care should be taken to ensure that traffic is restricted to the access track during operations such that works do not encroach upon surrounding areas of habitat. Any additional areas cleared should not be used for storage, mixing of mortar etc. unless this is agreed in advance.

It is anticipated that providing these precautions are taken that the likely impacts upon habitats will be temporary and affected areas are likely to re-vegetate naturally within a relatively short time, (this assessment however will be further informed by the results of the walkover survey following initial clearance recommended above).

## **8.11 Disturbance to species**

### Potential impacts

The creation of the access track has the potential to cause disturbance to species which could be present along the proposed route:

- Breeding birds: species nesting in trees, ivy or scrub.
- Amphibians are likely to make use of adjacent more densely vegetated damp or wetland areas.
- Badger setts could be present within close proximity to proposed access routes or to buildings.
- Reptiles such as grass snakes may be present in tall herbaceous vegetation.

Consolidation works have the potential to impact upon the following species which may be present within the buildings or immediate surroundings:

- Bats may make use of cracks/crevices within the structure and be impacted by erection of scaffolding and re-pointing (to be determined by further survey work).
- Breeding birds may be disturbed throughout works.
- Bryophytes and lichens: notable species could be present on the buildings or on neighbouring trees and could be impacted directly by re-pointing or indirectly by cement dust. Blown strongly-alkaline dust may be of particular concern if specialist lichens (which are particularly sensitive to changes in pH) are found to be present.

### Suggested mitigation

- Commission an ecologist to carry out a walkover survey following initial clearance of the access route in order to inform mitigation for potential impacts upon habitats and species.
- If vegetation clearance work is to be carried out during the breeding bird season (peak season in generally considered to be April-July) proposed access

routes should be surveyed for nesting birds immediately prior to being cut. If any nesting birds are found to be present, work within 5m of the active nest must stop until the chicks have fledged.

- Carry out consolidation works outside of the nesting bird season. It should be noted that any bird listed on Schedule 1 of the Wildlife and Countryside Act is afforded additional protection against intentional or reckless disturbance whilst building a nest or in or near a nest containing eggs or dependant young.

## 8.12 Other

### Suggested mitigation

- A detailed illustrated report covering the works shall be produced by the historic environment consultant and ecological consultant on the conclusion of the project.
- Any potentially significant variation from the agreed mitigation must be discussed in full and agreed in advance, and may require a variation from the agreed Scheduled Monument Consent. Where site conditions require less significant variations from the agreed specification to be made quickly, efforts should be made to discuss and agree these with key project team members.

## 9 Public access during works; interpretation and engagement activities

The works proposed at Tregargus will take place in an area to which local people customarily have access. Some limitation of public access to parts of the site on which work is being undertaken will be required by law during the works programme.

Some areas of the site which have customarily been open to public access will need to be closed off for safety reasons for the duration of the works. All efforts will be made to limit the disruption of public access during the works programme, and to ensure the safety, wellbeing and enjoyment of those legally accessing the site.

Access around the site is currently fairly easy, there being a good track from the north entrance passing the buildings at Wheal Arthur China stone works, the mica dries and down to the quarries branching off to Tregargus Mill. Other footpaths around the southern section permit easy access to Trevear Mill although temporary vehicular access will probably be created as a result of the proposed works. Wider tracks through the Sycamore-dominated woodland here would encourage a more diverse flora. Access to the areas of the quarry where Greater and Lesser Horseshoe bats are known to roost in the adits should be discouraged.

It is recognised that there may well be local public interest in this project, and all efforts will be made to meet this requirement, both on site, through the provision of safe viewing areas and information panels, and by other means including notices on the safety fences surrounding excluded areas.

Local and national media will be fully informed of progress at key stages in the project, most particularly on the instigation of the works and on their completion. The Tregargus Trust and partners will coordinate this element of the Project and will also provide material to local journals and media.

The project partners will devise a programme of opportunities for engagement by local people and interested groups during the works programme within the constraints of health and safety legislation. Site visits by local groups and local schools will be arranged if practicable. Following the completion of works, efforts should be made to raise levels of local engagement with the work of the Tregargus Trust in managing and enhancing the site as a whole.

Subject to the granting of permission from relevant landowners, interpretation boards could be erected at the north and south entrances of the site. Apart from locating and describing features of archaeological interest, the inclusion of information about the wildlife on the site would enhance the interest of the valley for the public.

## 10 Further recommendations

### 10.1 Habitat enhancement

The proposed works provide an opportunity to enhance affected areas of habitat in the course of carrying out works. In particular there may be an opportunity to open up some additional areas of existing scrub in the course of creating access tracks by extending the width of the corridor/ creating scalloped edges and/or cutting some sections of willow scrub, clearing over-dense areas of saplings, or felling and piling dangerous trees. Other vegetation clearance and some opening up of habitats/scrub clearance is likely to be of benefit to a number of species in creating greater physiognomic diversity and habitat diversity. Consideration should also be given to the provision of additional bat roosts during the works. Natural England may also suggest additional works to enhance the SSSI.

Japanese Knotweed growing near the site entrance and at a small number of locations on site should be treated before it spreads to the detriment of the native flora. A minimum of 3 years treatment is required to have any effective control of the above ground material, but the rhizomes may still remain viable. The most effective active ingredient for use on Japanese Knotweed is glyphosate, best used when there are large numbers of leaves present allowing a large quantity of herbicide to be absorbed into the plant. Glyphosate is approved for use in or near water and is best used in autumn when it can penetrate to the rhizomes.

Some Rhododendron still exists in the woodland and should be cut and the stumps treated to prevent re-growth otherwise it will spread and the dense shade this species casts along with the toxic leaf litter eliminates the native ground flora.

Sycamore and possibly Beech should be thinned. These species out-compete Oak and the resulting woodland has a poorer flora and is consequently of less interest for invertebrates. Beech does not usually re-grow from the base when felled but Sycamore readily grows more stems so the cut stump should be treated to prevent re-growth. This would create glades within the woodland and would encourage a more diverse flora and fauna.

Dead wood should be piled and left for wildlife and if possible should not be cut into smaller pieces but left to decay as a whole piece slowly over the years. Standing dead wood is a valuable habitat for birds such as Woodpeckers and should be left where it poses no risk to the public. Smaller branches, twigs and brash could be burnt on unvegetated areas such as the track. Some brash can be left as "habitat piles" for species such as Hedgehog. Large amounts of herbaceous material should be removed from the site.

The re-introduction of small areas of coppicing would encourage a more diverse woodland flora and fauna.

Clearance of occasional trees and scrub along the river (see report from the Westcountry Rivers Trust) will permit more light to reach the ground flora. The banks will become better vegetated and lighter conditions will encourage an aquatic flora and wetland species on the banks. In turn this will result in an increase in the invertebrate population which will enhance the habitat for fish and for bats and perhaps Otter. Increased ground cover will also help to stabilise the earth banks. Trees should be assessed for bat interest and any trees with potential bat roosting habitat should undergo survey work for bats before felling or heavily pruning. Older trees including Willow should be left standing. The track edges support a diverse flora and the cutting

back of scrub creates lighter conditions and encourages many species. The track is in effect a woodland "ride" and the flora will encourage an increased diversity of invertebrates and other wildlife on the site.

## **10.2 Further survey work**

### **10.2.1 Birds**

Scrub clearance and removal of Ivy from buildings anywhere on the site should be carried out when birds are not breeding. If this is not possible then a breeding bird survey should be carried out in the areas concerned before work starts. It may be possible to continue without disturbing nesting birds, otherwise work will have to be postponed until outside the breeding season.

The consolidation work on the buildings should also only be carried out if birds are not nesting in or on the structures. If work has to be timed during the breeding season then breeding bird surveys need to be undertaken first. It should be noted that Natural England issue a general licence permitting disturbance of nesting pest species such as Herring Gull, Feral Pigeon, Crow and Jackdaw for public health and safety reasons.

### **10.2.2 Bats**

A walkover survey is recommended to identify features of potential interest to bats. Ideally this should be undertaken after scrub and trees on and adjacent to the structure has been cleared (including Ivy).

Bats are already known to roost in the adits and it should be assumed that every adit or tunnel is used. It is also possible that bats roost in flues, chimneys and in crevices or holes in the masonry of the derelict buildings and in lintels. Bats could also roost in larger trees with holes, crevices, flaking bark or dense Ivy. Bat roosts are protected whether bats are present or not so bat emergence surveys should be carried out on any structures with these features if they will be affected by the proposed works. Ideally two or three emergence surveys should be carried out during the active season (May to late September).

Because bats are so mobile and move between a network of roosts depending on the time of year, food availability *etc.* it will also be necessary to carry out a visual survey of all potential bat roosting sites immediately prior to the commencement of work using scaffolding and an endoscope if necessary. Work on potential bat roosts should avoid the hibernation period between November and April inclusive.

### **10.2.3 Badgers**

The badger sett known east of the track is not likely to be affected by the proposed works. If any vegetation clearance or excavations are to be undertaken in this area a Badger survey should be carried out to identify the location of all sett entrances. Elsewhere on the site dense scrub may conceal setts and if signs of badgers are found during the works then further survey work or a watching brief may be necessary.

### **10.2.4 Bryophytes and lichens**

No rare bryophytes or lichens have been recorded at this site so far; none were listed in the records supplied recently by ERCCIS (2010). However, a survey has probably not yet been undertaken. If bryophytes and lichens on buildings will be affected by the proposed works then a survey should be undertaken before work starts. Rare species of calcicolous lichens and Bryophytes could exist on the lime mortar of the old buildings.

### 10.2.5 Dormice

If there is to be major clearance of woodland or scrub a detailed Dormouse survey should be undertaken prior to work. The survey should include a nut hunt in the area of woodland dominated by Hazel west of Big Wheel Mill.

### 10.3 Monitoring

The spread of Japanese Knotweed should be monitored and if it is treated with a herbicide then the area should be regularly checked for re-growth and this should be treated again as soon as possible.

The spread of scrub and the re-growth of scrub such as Bramble, Common Gorse and Willow on the open areas in the Tregargus Mill quarries should be monitored and controlled before it threatens the developing heathland.

The growth of Rhododendron should also be monitored and re-growth cut and treated as soon as possible.

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### 11.1 Primary sources

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### 11.2 Secondary sources

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### 11.3 Websites

<http://www.imagesofengland.org.uk/> English Heritage's online database of Listed Buildings

## 12 Appendices

### 12.1 List of vascular plant species found at Tregargus valley, May 2010.

Blue coded species were only seen in 2002 (Cornwall Environmental Consultants)

<b>Scientific name</b>	<b>Common Name</b>
<i>Acer pseudoplatanus</i>	Sycamore
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostis curtisii</i>	Bristle Bent
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Ajuga reptans</i>	Bugle
<i>Anemone nemoralis</i>	Wood Anemone
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Anthriscus sylvestris</i>	Cow Parsley
<i>Arum maculatum</i>	Lords-and-Ladies
<i>Asplenium adiantum-nigrum</i>	Black Spleenwort
<i>Athrium filix-femina</i>	Lady Fern
<i>Athyrium sylvestris</i>	Cow Parsley
<i>Bellis perennis</i>	Daisy
<i>Betula pubescens</i>	Downy Birch
<i>Blechnum spicant</i>	Hard Fern
<i>Brachypodium sylvaticum</i>	False Wood-brome
<i>Buddleja davidii</i>	Butterfly-bush
<i>Callitriche</i> sp.	Water-starwort
<i>Calluna vulgaris</i>	Heather
<i>Cardamine flexuosa</i>	Wavy Bittercress
<i>Cardamine pratensis</i>	Cuckooflower (double form)
<i>Carex pendula</i>	Pendulous Sedge
<i>Carex remota</i>	Remote Sedge
<i>Castanea sativa</i>	Horse Chestnut
<i>Centaurea</i> sp.	Knapweed
<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Ceratocapnos claviculata</i>	Climbing Corydalis
<i>Chamerion angustifolium</i>	Rosebay Willowherb
<i>Chrysosplenium oppositifolium</i>	Opposite-leaved Golden-saxifrage
<i>Circaea lutetiana</i>	Enchanters-nightshade
<i>Cirsium arvense</i>	Creeping Thistle

<i>Cirsium palustre</i>	Marsh Thistle
<i>Cirsium vulgare</i>	Spear Thistle
<i>Cochlearia officinalis</i>	Common Scurvy-grass
<i>Corylus avellana</i>	Hazel
<i>Cotoneaster</i> sp.	Cotoneaster
<i>Crataegus monogyna</i>	Hawthorn
<i>Crococsmia x crocosmiiflora</i>	Montbretia
<i>Cytisus scoparius</i>	Broom
<i>Dactylis glomerata</i>	Cock's-foot
<i>Deschampsia cespitosa</i>	Tufted Hair-grass
<i>Digitalis purpurea</i>	Foxglove
<i>Dryopteris affinis</i>	Scaly Male-fern
<i>Dryopteris dilatata</i>	Broad Buckler-fern
<i>Dryopteris filix-mas</i>	Male Fern
<i>Epilobium montanum</i>	Broad-leaved Willowherb
<i>Epilobium</i> sp.	Willowherb
<i>Equisetum arvense</i>	Field Horsetail
<i>Erica cinerea</i>	Bell Heather
<i>Erica tetralix</i>	Cross-leaved Heath
<i>Eupatorium cannabinum</i>	Hemp-agrimony
<i>Fagus sylvatica</i>	Beech
<i>Fallopia japonica</i>	Japanese Knotweed
<i>Festuca rubra</i>	Red Fescue
<i>Fragaria vesca</i>	Wild Strawberry
<i>Fraxinus excelsior</i>	Ash
<i>Galium aparine</i>	Cleavers
<i>Galium mollugo</i>	Hedge Bedstraw
<i>Galium mollugo</i>	Hedge Bedstraw
<i>Geranium robertianum</i>	Herb Robert
<i>Geum urbanum</i>	Wood Avens
<i>Glechoma hederacea</i>	Ground-ivy
<i>Glyceria declinata</i>	Small Sweet-grass
<i>Glyceria</i> sp.	Sweet-grass
<i>Hedera helix</i> ssp. <i>hibernica</i>	Atlantic Ivy
<i>Heracleum sphondylium</i>	Hogweed
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Holcus mollis</i>	Creeping Soft-grass
<i>Hyacinthoides non-scripta</i>	Bluebell
<i>Hypericum androsaemum</i>	Tutsan
<i>Hypochoeris radicata</i>	Common Cat's-ear
<i>Ilex aquifolium</i>	Holly
<i>Iris pseudocorus</i>	Yellow Flag
<i>Juncus effusus</i>	Soft Rush
<i>Juncus tenuis</i>	Slender Rush

<i>Lemna minor</i>	Common Duckweed
<i>Lemna sp.</i>	Duckweed
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Lonicera nitida</i>	Wilson's Honeysuckle
<i>Lonicera periclymenum</i>	Honeysuckle
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Luzula campestris</i>	Field Wood-rush
<i>Luzula sylvatica</i>	Great Wood-rush
<i>Lysimachia nemoralis</i>	Yellow-pimpernel
<i>Oenanthe crocata</i>	Hemlock Water-dropwort
<i>Oxalis acetosella</i>	Wood Sorrel
<i>Pentaglottis sempervirens</i>	Green Alkanet
<i>Phalaris arundinacea</i>	Reed canary-grass
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Poa annua</i>	Annual Meadow-grass
<i>Poa sp.</i>	Meadow-grass
<i>Polypodium sp.</i>	Polypody Fern
<i>Polystichum setiferum</i>	Soft Shield-fern
<i>Potentilla anserina</i>	Silverweed
<i>Potentilla reptans</i>	Creeping Cinquefoil
<i>Potentilla sterilis</i>	Barren Strawberry
<i>Primula vulgaris</i>	Primrose
<i>Prunella vulgaris</i>	Selfheal
<i>Prunus spinosa</i>	Blackthorn
<i>Pteridium aquilinum</i>	Bracken
<i>Quercus petraea</i>	Sessile Oak
<i>Quercus sp.</i>	Oak
<i>Ranunculus ficaria</i>	Lesser Celandine
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Rhododendron ponticum</i>	Rhododendron
<i>Ribes nigrum</i>	Black Currant
<i>Rosa sp.</i>	Wild Rose
<i>Rubus fruticosus agg.</i>	Bramble
<i>Rumex acetosa</i>	Common Sorrel
<i>Rumex acetosella</i>	Sheep's-sorrel
<i>Rumex obtusifolius</i>	Broad-leaved Dock
<i>Rumex sanguineus</i>	Wood Dock
<i>Rumex sp.</i>	Dock
<i>Sagina procumbens</i>	Procumbent Pearlwort
<i>Salix caprea</i>	Goat Willow
<i>Salix cinerea ssp. oleifolia</i>	Grey Willow
<i>Sambucus nigra</i>	Elder

<i>Scrophularia auriculata</i>	Water Figwort
<i>Scropularia nodosa</i>	Common Figwort
<i>Sedum anglicum</i>	English Stonecrop
<i>Senecio aquaticus</i>	Marsh Ragwort
<i>Senecio jacobaea</i>	Ragwort
<i>Silene dioica</i>	Red Campion
<i>Sonchus oleraceus</i>	Smooth Sow-thistle
<i>Stachys officinalis</i>	Betony
<i>Stellaria alsine</i>	Bog Stitchwort
<i>Stellaria holostoides</i>	Greater Stitchwort
<i>Stellaria media</i>	Chickweed
<i>Taraxacum officinale</i> agg.	Dandelion
<i>Teucrium scorodonia</i>	Wood-sage
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover
<i>Trifolium</i> sp.	Trefoil
<i>Ulex europaeus</i>	Common Gorse
<i>Umbilicus rupestris</i>	Navelwort
<i>Urtica dioica</i>	Nettle
<i>Vaccinium myrtilis</i>	Bilberry
<i>Veronica chamaedrys</i>	Germander Speedwell
<i>Veronica hederifolia</i>	Ivy-leaved Speedwell
<i>Veronica montana</i>	Wood Speedwell
<i>Veronica serpyllifolia</i>	Thyme-leaved Speedwell
<i>Vicia sativa</i>	Common Vetch
<i>Vicia sepium</i>	Bush Vetch
<i>Viola riviniana</i>	Common Dog-violet
<i>Wahlenbergia hederacea</i>	Ivy-leaved Bellflower

## 12.2 SSSI citation, damaging operations and recent condition assessment

**County:** Cornwall

**Site Name:** Tregargus Quarries

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981, as amended.

**Local Planning Authority:** Cornwall Council

**National Grid Reference:** SW 949541 **Area:** 1.8 (ha) 4.4 (ac)

**Ordnance Survey Sheet 1:50,000:** 200 **1:10,000:** SW 95 SW, SE

**Date Notified (under 1949 Act):** 1951

**Date of Last Revision:** 1973

**Date Notified (under 1981 Act):** 1986

**Date of Last Revision:** None

**Other Information:** GCR site. Boundary amended by deletion.

**Description and Reasons for Notification:** These quarries provide excellent exposures of two late-magmatic varieties of the varied St. Austell granite mass (of Permo-Carboniferous age). Fluorite granite predominates, but this is accompanied by irregular patches of non-megacrystic lithium-mica granite. The site is significant in illustrating that the contacts between the two rock-types are transitional and non-intrusive in nature and they may be accounted for by metasomatic over-printing of an original biotite granite by a lithium rich fluid. The biotite was replaced by a lithium mica while elsewhere high fluorine contents resulted in the crystallisation of fluorite.

**Operations likely to damage the special interest**

**Site name: Tregargus Quarries, Cornwall, OLD1000625**

**Ref. No. Type of Operation**

- 7 Dumping, spreading or discharge of any materials.
- 12 The introduction of tree and/or woodland management and changes in tree and/or woodland management, including afforestation and planting.
- 14 The changing of water levels and tables and water utilisation (including irrigation, storage and abstraction from existing water bodies and through boreholes).
- 20 Extraction of minerals.
- 21 Construction, removal or destruction of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, or the laying, maintenance or removal of pipelines and cables, above or below ground.
- 22 Storage of materials on or against rock faces or outcrops.
- 23 Erection of permanent or temporary structures, or the undertaking of engineering works, including drilling.
- 24 Modification of natural or man-made features, clearance of boulders, large stones, loose rock or scree and battering, buttressing or grading rock-faces and cuttings, infilling of pits and quarries.

**Most recent condition assessment by Natural England Team - Cornwall, Devon And The Isles Of Scilly - SSSI name - Tregargus Quarries**

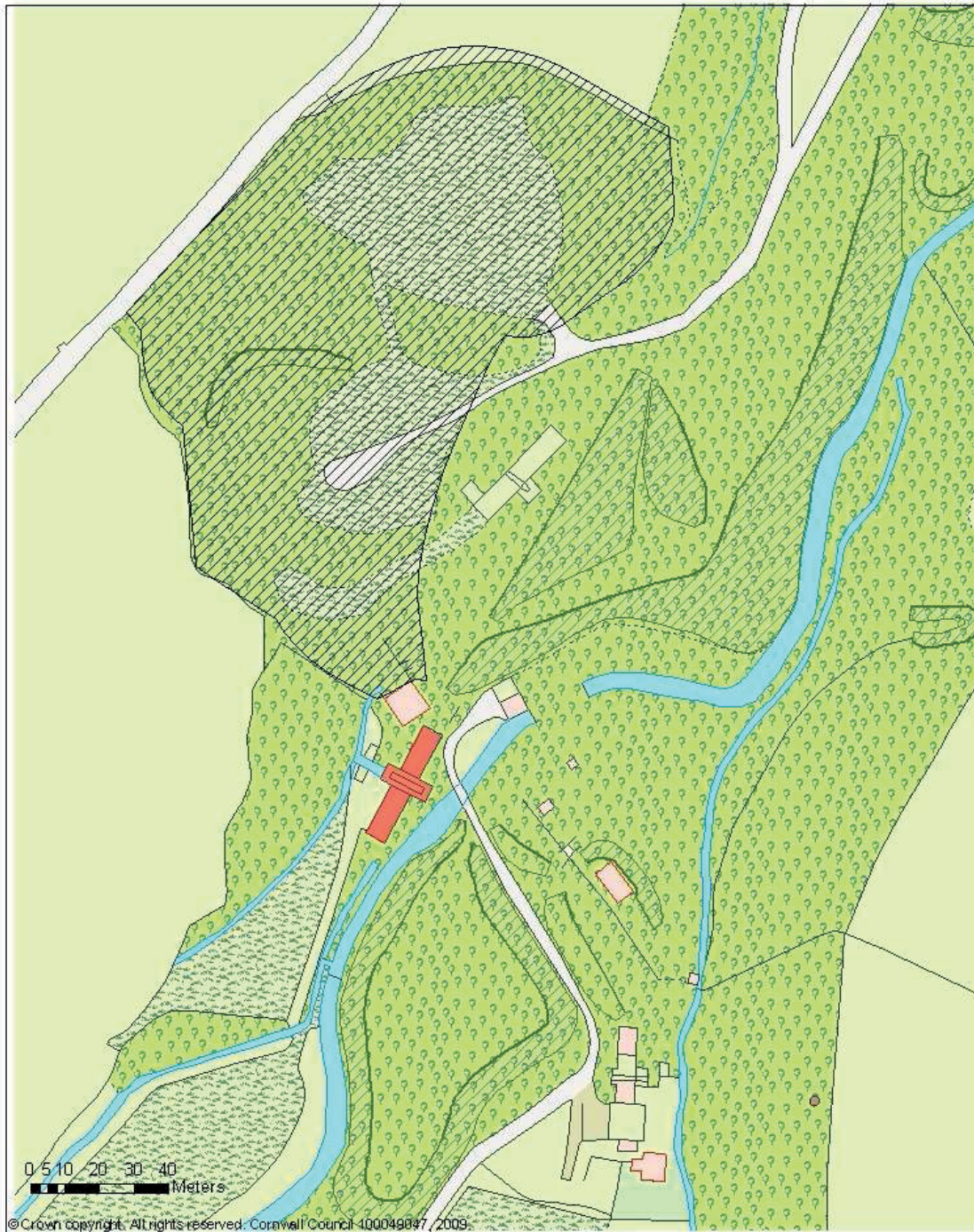
Main habitat	Staff member responsible for unit	Unit ID	Unit area (ha)	Latest assessment date	Assessment description	Condition assessment comment	Reason for adverse condition
Earth heritage	David Hazlehurst	1003818	1.65	22 Oct 2008	Unfavourable no change	Site visit with Hannah Townley. Extensive vegetation encroachment is obscuring the features of interest.	Earth science feature obstructed

## **13 Project archive**

The HES project number is 20082180

The project's documentary, photographic and drawn archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file containing site records and notes, project correspondence and administration.
2. Digital photographs stored in the R:\Historic Environment (Images)\SITES.Q-T\Tregargus\Tregargus CMP images
3. This report text is held in digital form as: G:\Historic Environment (Documents)\HE Projects\Sites\Sites T\Tregargus Management Plan\CMS Report\Tregargus CMS Final.doc
4. The ecological report is held in digital form as: G:\Historic Environment (Documents)\HE Projects\Sites\Sites T\Tregargus Management Plan\Reports\Tregargus Valley Ecology.doc



<p><b>Title</b></p> <p><b>Designations</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old County Hall, Sticker Road, Truro, Cornwall, TR1 3AG tel: 01872 323903 fax: 01872 323883 email: hrr@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p><b>Scheduled Monuments and SSSIs</b></p>	<p>Originator <b>Adam Clarke</b></p>	<p><small>In this document, the Copyright is attributed to the relevant person or organisation responsible for which it was originally prepared and for which Cornwall County Council was engaged to compile. Cornwall County Council accept no responsibility for the drawing or any other party who does the printing of which it was compiled.</small></p>
<p>Date <b>17/05/2010</b></p>		

Fig 3. Designations affecting the Tregargus Valley project area. Black hatch – Site of Special Scientific Interest; Red – Scheduled Monument and Listed Building.



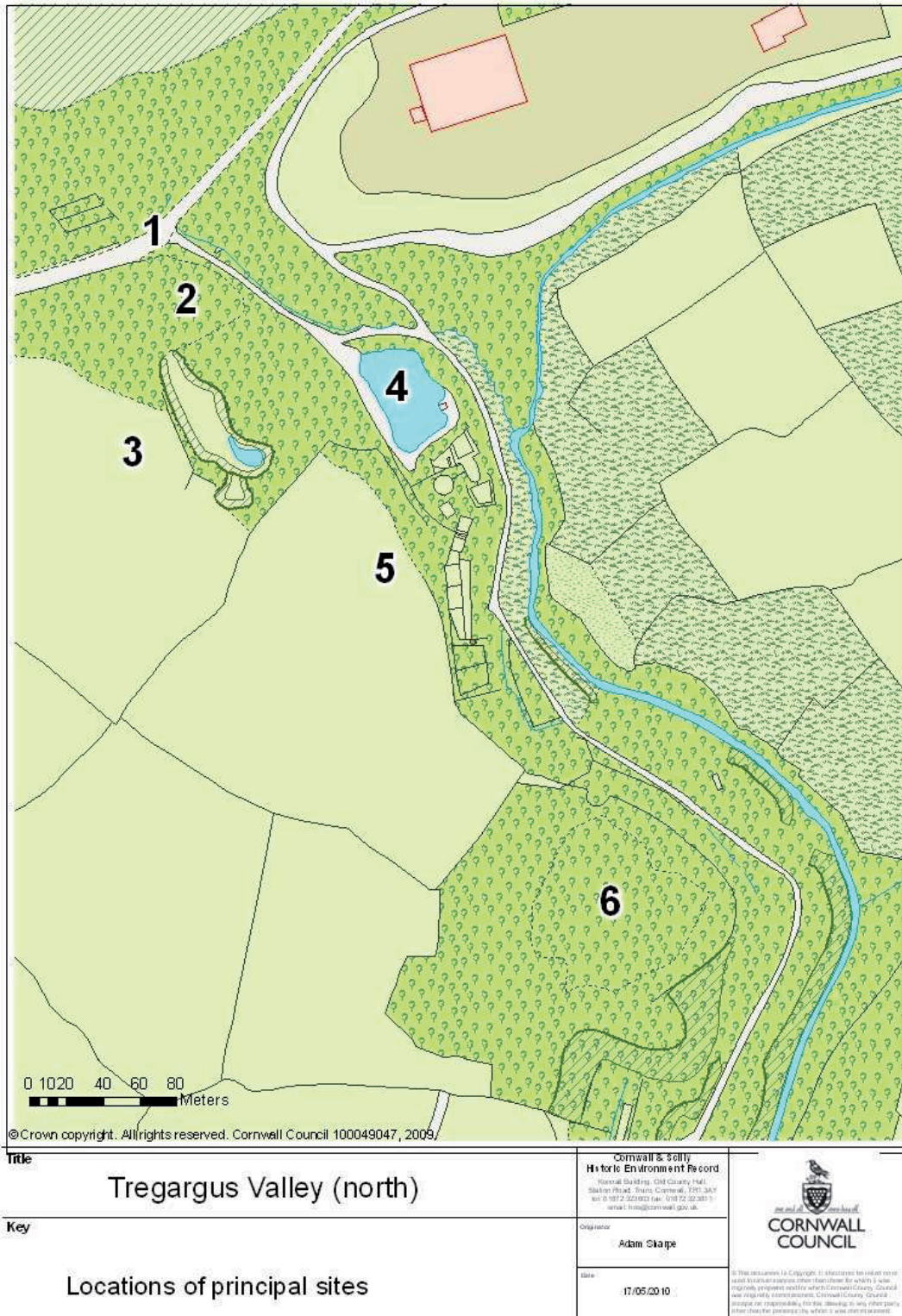


Fig 4. Locations of principal sites in the northern part of the Tregargus Valley. 1. Site entrance, 2. Small china stone quarries, 3. Wheal Arthur china stone quarry, 4. Top pond, 5. Wheal Arthur complex, 6. Rescrowsa china clay pit. Sites 1 to 4 lie outside the area managed by the Tregargus Trust.

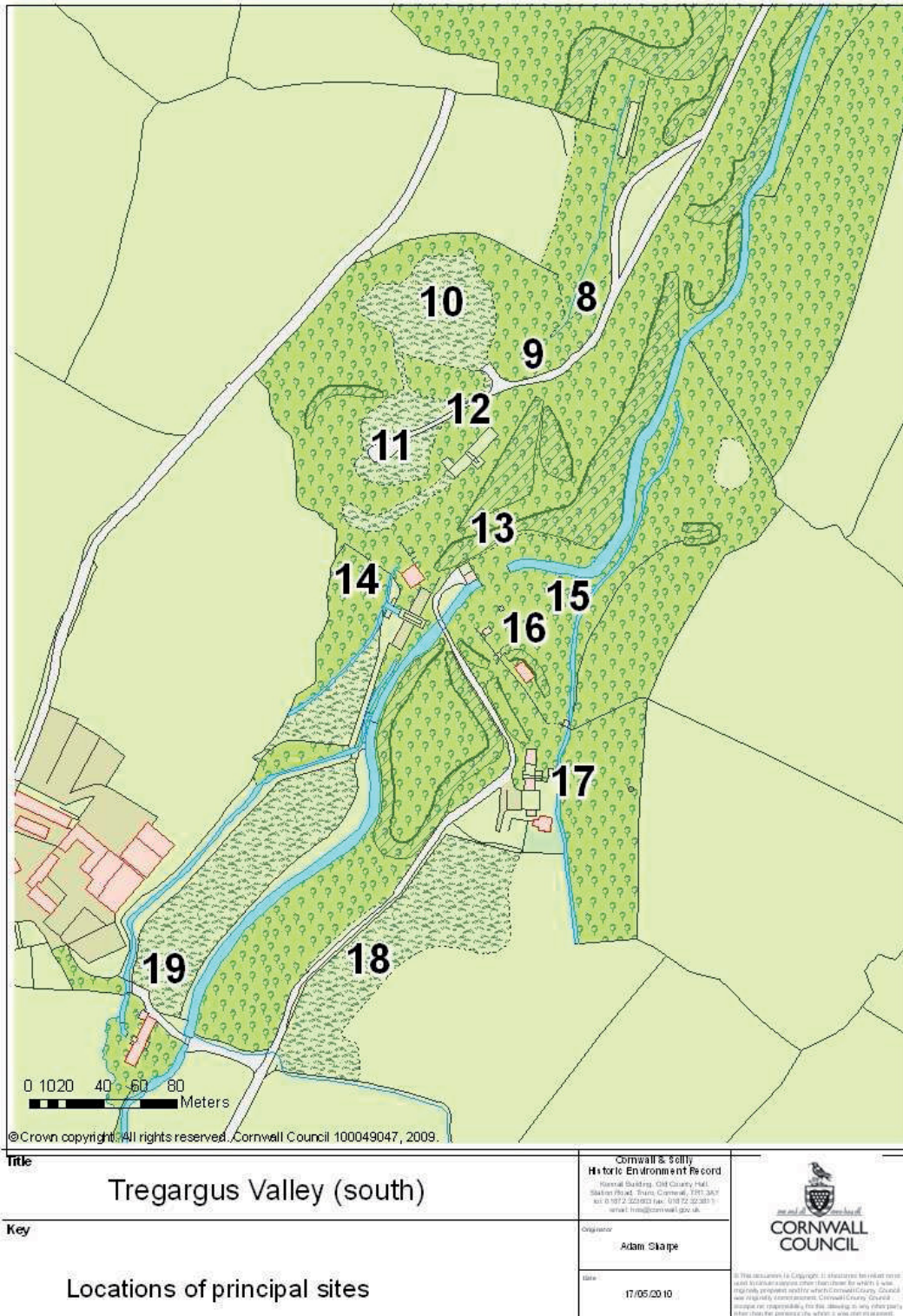
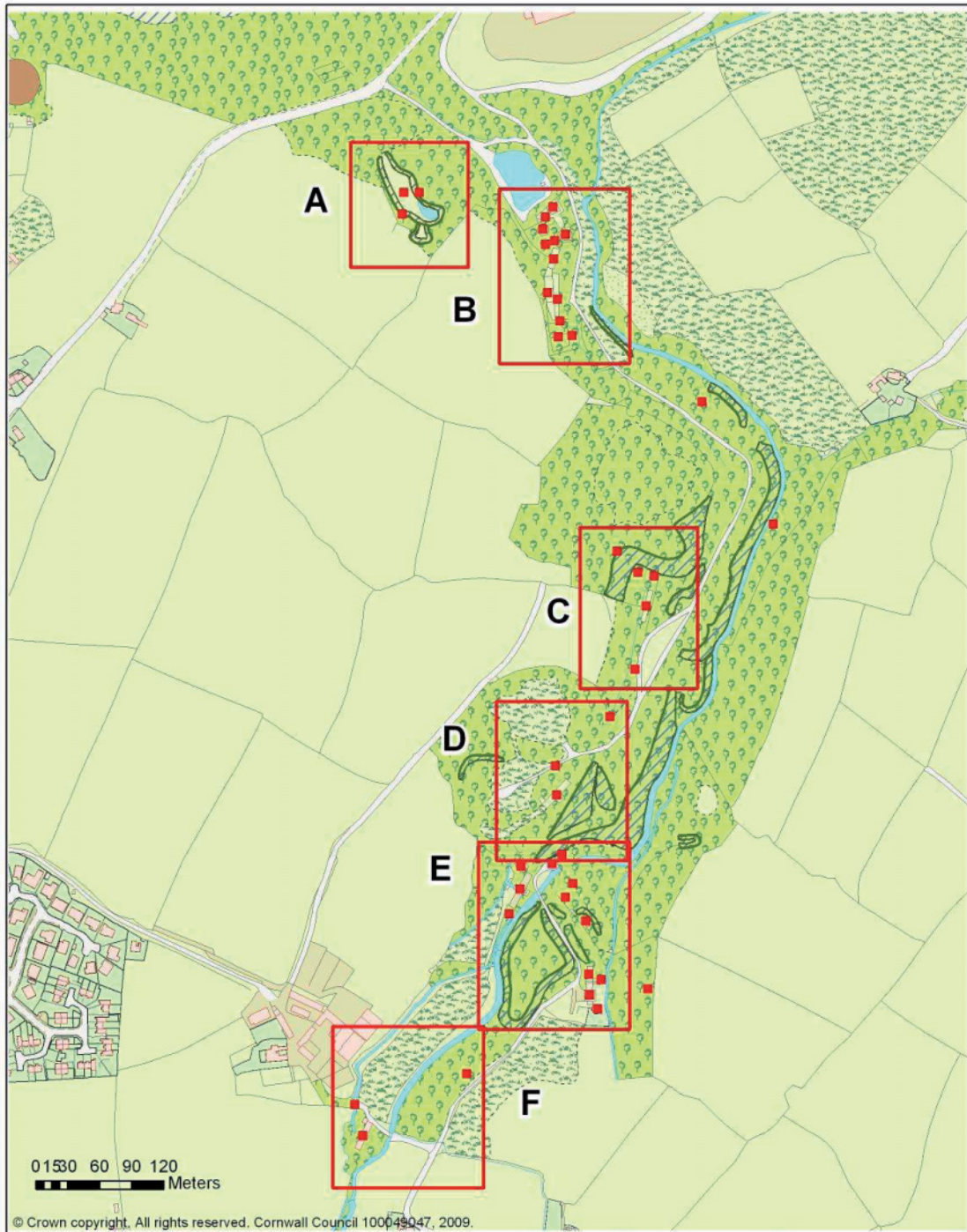


Fig 5. Locations of principal sites in the southern part of the Tregargus Valley. 7. Mica drags and adits, 8. Settling tanks, 9. Top Wheel Mill, 10. Tregargus Higher Quarry, 11. Tregargus Lower Quarry, 12. Blacksmith's Mill, 13. Smithy, 14. Big Wheel Mill, 15. Tin streamworking, 16. Concrete structures and powder house, 17. Trevear Mill complex, 18. Tin streamworking, 19. Mica or Lower Tregargus Mill.




<p><b>Title</b></p> <p><b>Inventory key maps</b></p>	<p><b>Cornwall &amp; Scilly Historic Environment Record</b>                  Kennall Building, Old County Hall,                  Station Road, Truro, Cornwall, TR1 3AY                  tel: 01872 323603 fax: 01872 323611                  email: her@cornwall.gov.uk</p>	
<p><b>Key</b></p> <p><b>Red rectangles indicate extents of inventory maps</b></p>	<p><b>Originator:</b> Adam Sharpe</p>	<p><b>Date:</b> 17/05/2010</p> <p><small>© This document is Copyright. It should not be relied on or used in circumstances other than those for which it was originally prepared and for which Cornwall County Council was originally commissioned. Cornwall County Council accepts no responsibility for this drawing to any other party other than the person(s) by whom it was commissioned.</small></p>

Fig 6. Inventory key map – see Figs 6 to 11 for Maps A to F.

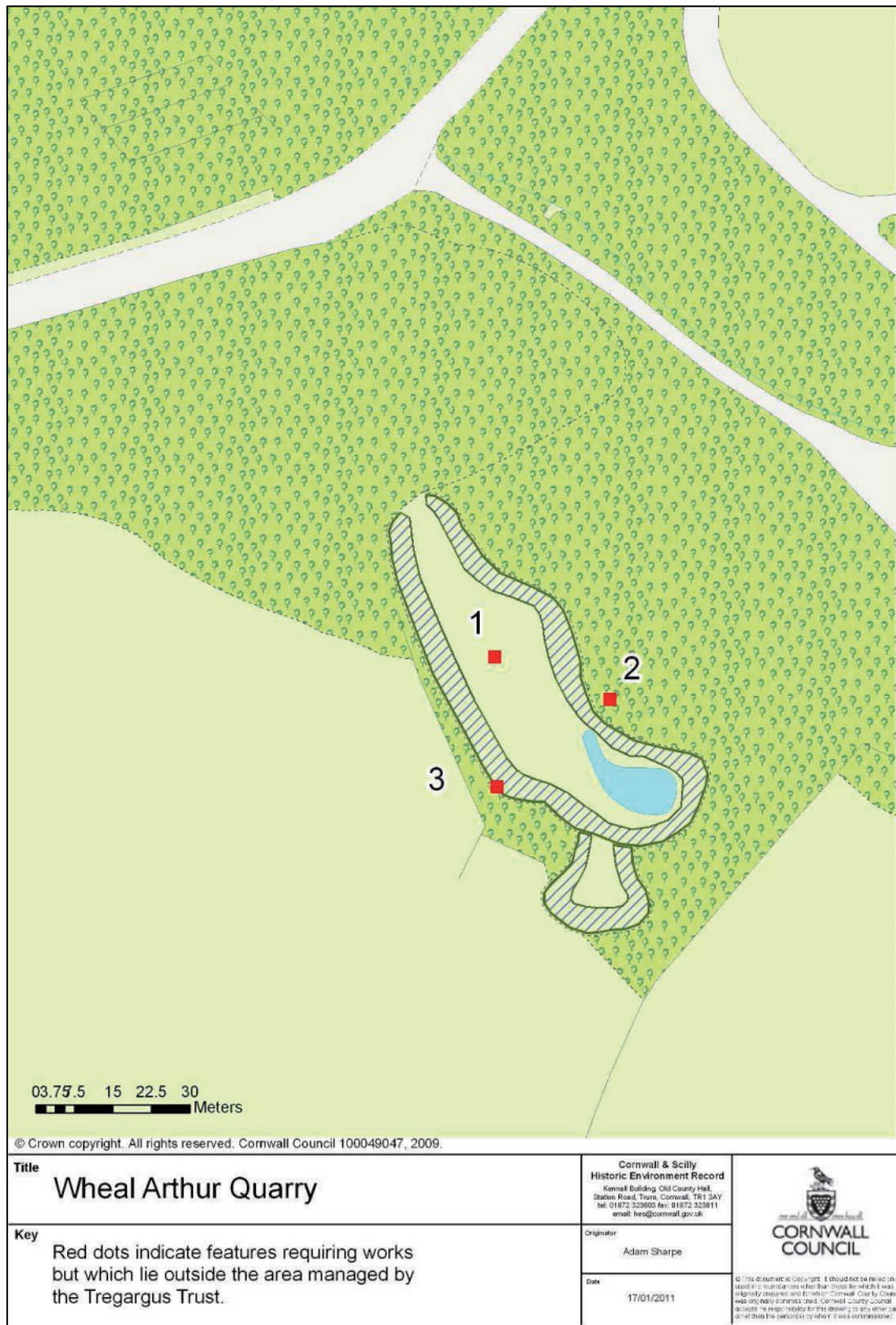
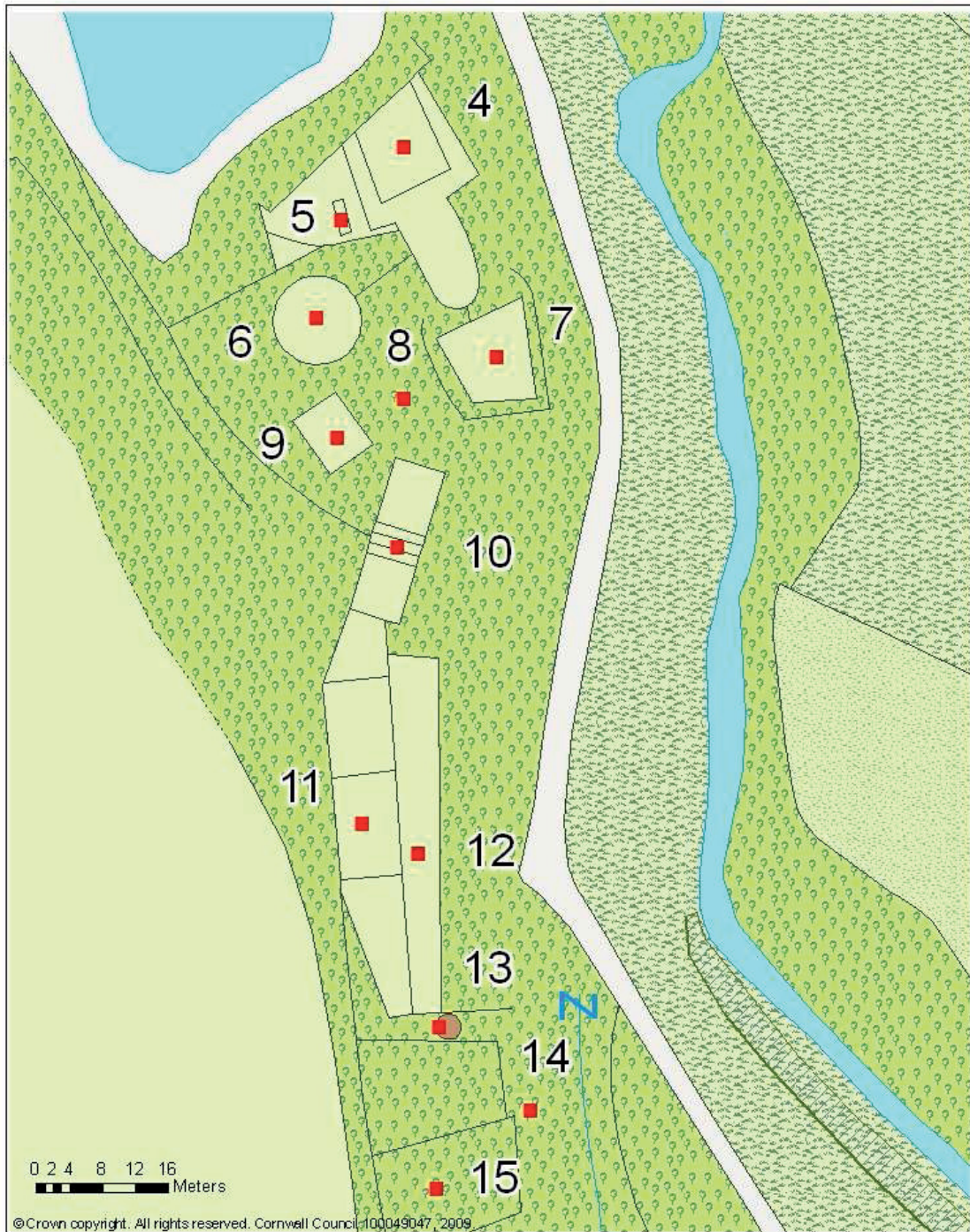


Fig 7. Map A. 1. Quarry, 2. Adit, 3. Adit.




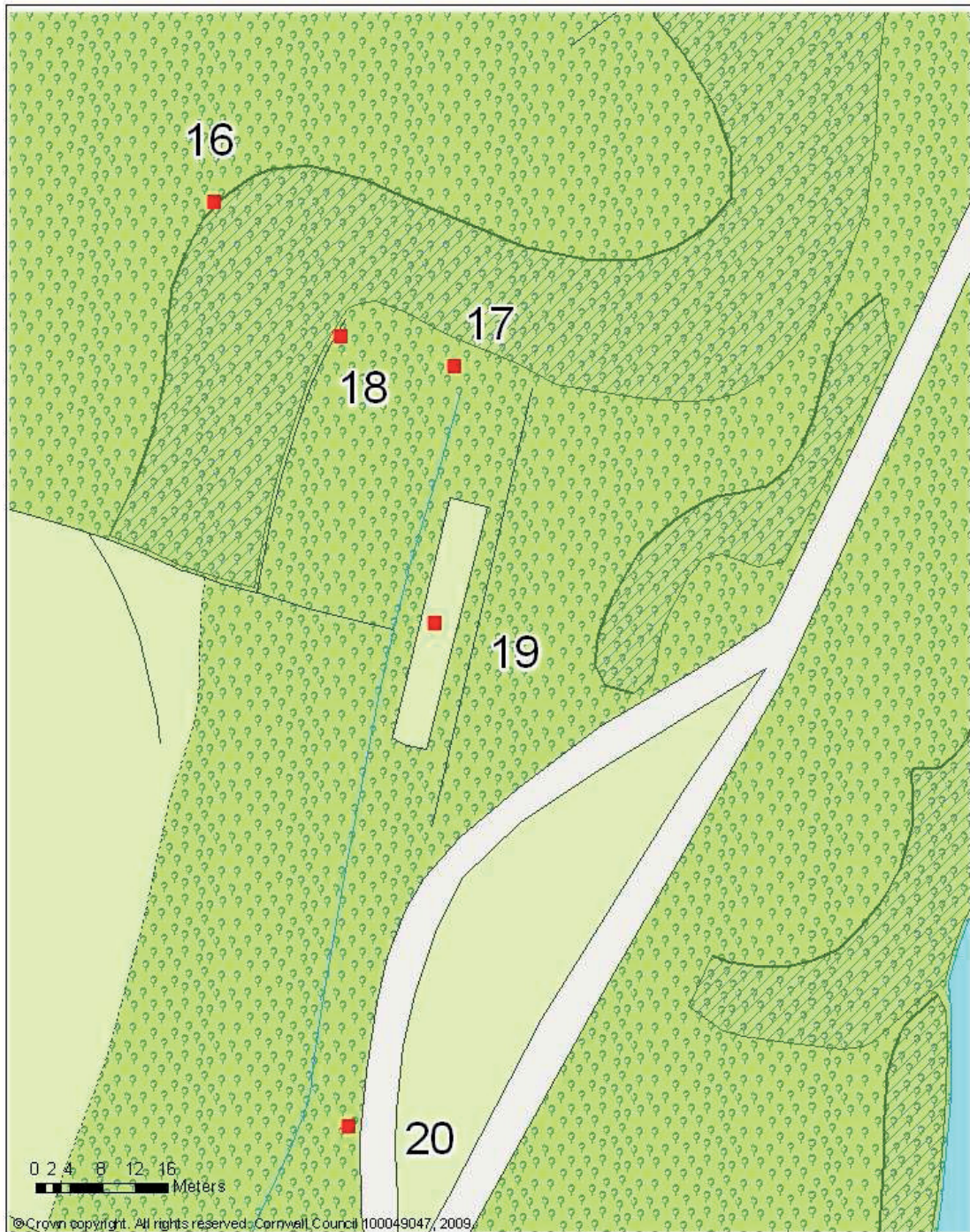
<p><b>Title</b></p> <p>Structures at Wheal Arthur</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old Quay, Mill, Sticker Road, St Austrey, Cornwall, TR1 3AF Tel: 01872 522903 Fax: 01872 522881 www.here@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator</p> <p>Adam Skape</p> <p>Date</p> <p>17/05/2010</p>	<p><small>In this document, the Copyright in illustrations is retained solely in order to facilitate copying, other than for those for which it was originally intended and for which Cornwall County Council are directly responsible. Cornwall County Council accepts no responsibility for the copying of any other parts other than the graphics for which it was responsible.</small></p>

Fig 8. Map B. 4. Settling tank, 5. Water wheel, 6. Tank, 7. Tank, 8. Shaft, 9. Tank, 10. China stone mill, 11. Dry, 12. Linbay, 13. Chimney, 14. Tramway, 15. Tanks. Features 4 and 5 lie just to the north of the boundary of the area managed by the Tregargus Trust.




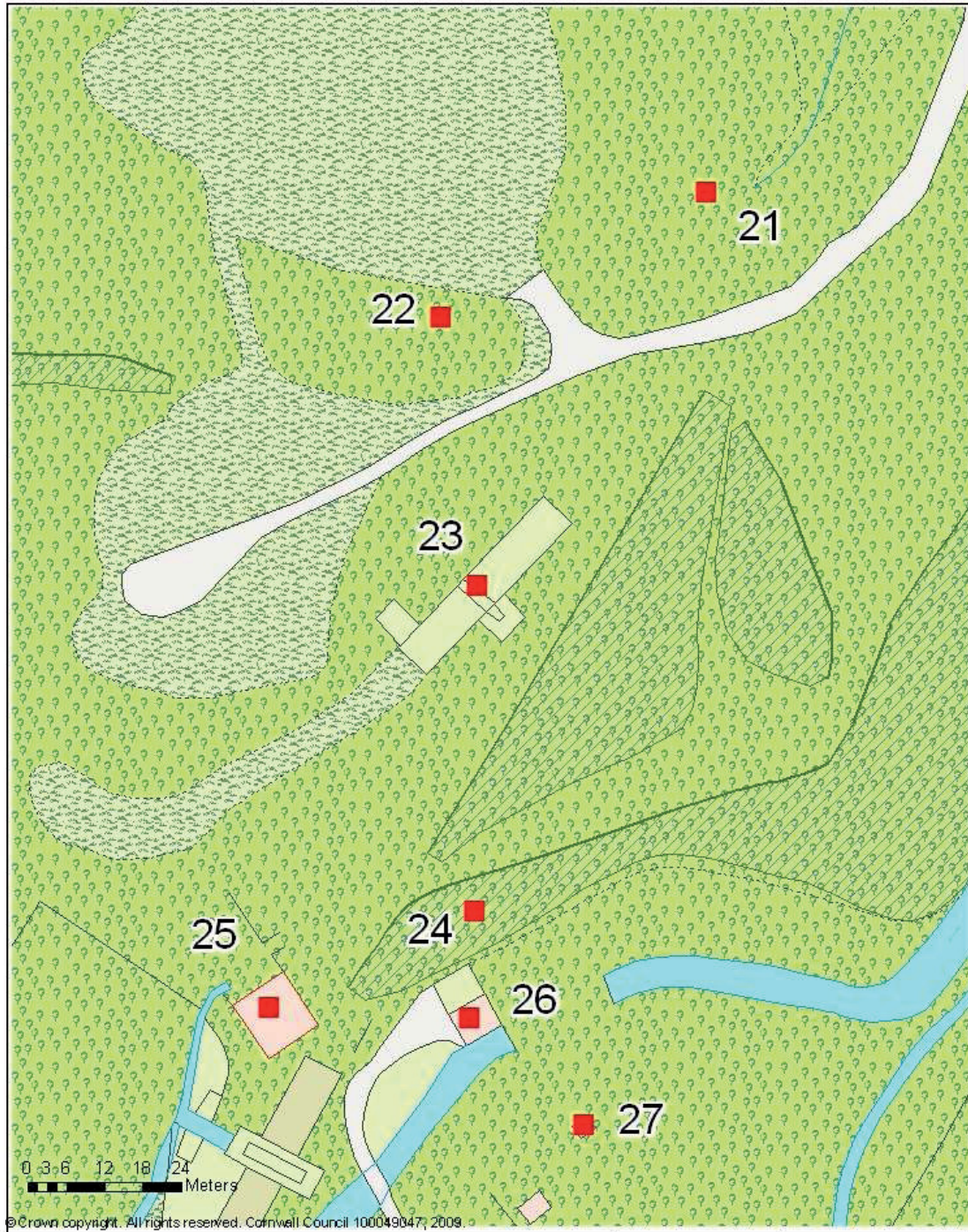
<p><b>Title</b></p> <p>Structures to the south of Wheal Arthur</p>	<p><b>Cornwall &amp; Scilly Historic Environment Record</b>                  Historic Buildings, Old Cornish, Hall,                  St Austine Road, St Austine, Cornwall, TR15 3AG                  Tel: 01872 522923 Fax: 01872 522927                  email: htr@cornwall.gov.uk</p>	
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Original record Adam Skarpe</p>	<p><small>© This document is Copyright © Cornwall Council and is subject to the terms and conditions of the Cornwall Council Open Access Licence. All rights reserved. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without the prior written permission of Cornwall Council.</small></p>
<p>Date: 17/05/2010</p>		

Fig 9. Map C.16. 16. Blacksmith's Shop, 17. Adit, 18. Adit, 19. Mica drags, 20. Settling tanks.




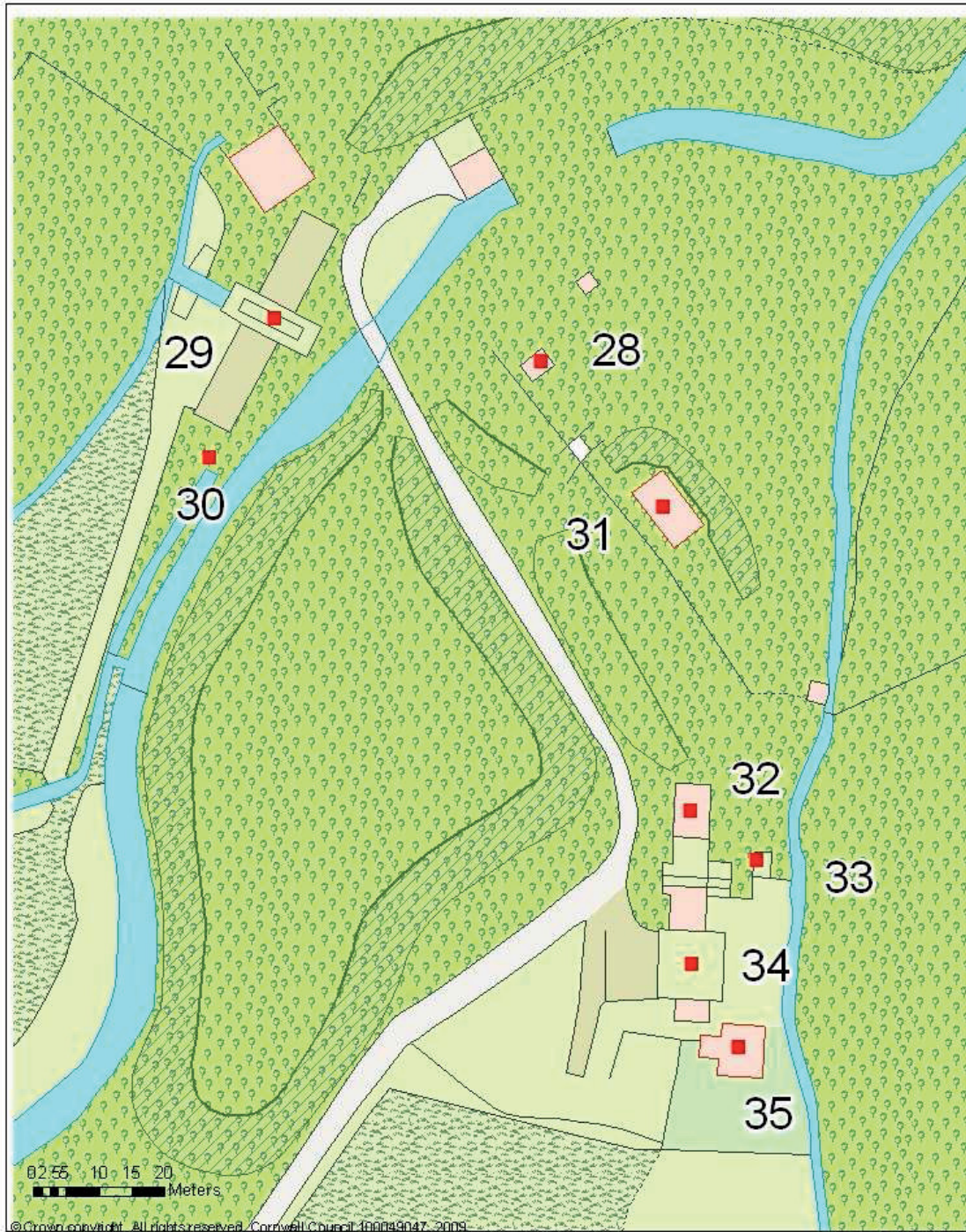
<p><b>Title</b> Structures to the north of Big Wheel Mill</p>	<p>Cornwall &amp; Scilly Historic Environment Record National Building, Old County Hall, St Austine Place, Truro, Cornwall, TR1 3AY Tel: 01872 522803 Fax: 01872 522803 email: hrr@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b> Red dots indicate structures requiring conservation works</p>	<p><b>Originator</b> Adam Skape</p>	<p><small>In this document, the Copyright in the content has been licensed for reuse under the Creative Commons Attribution-NonCommercial-ShareAlike license. For more information on this license, please visit <a href="http://creativecommons.org/licenses/by-nc-sa/4.0/">http://creativecommons.org/licenses/by-nc-sa/4.0/</a>. Cornwall Council is not responsible for any other party's use of the information, which is used in this document.</small></p>
<p><b>Date</b> 17/05/2010</p>		

Fig 10. Map D. 21. Structure, 22. Top Incline Mill, 23. Blacksmith's Shop Mill, 24. Chimney, 25. Winder house, 26. Blacksmith's Shop, 27. Powder house.




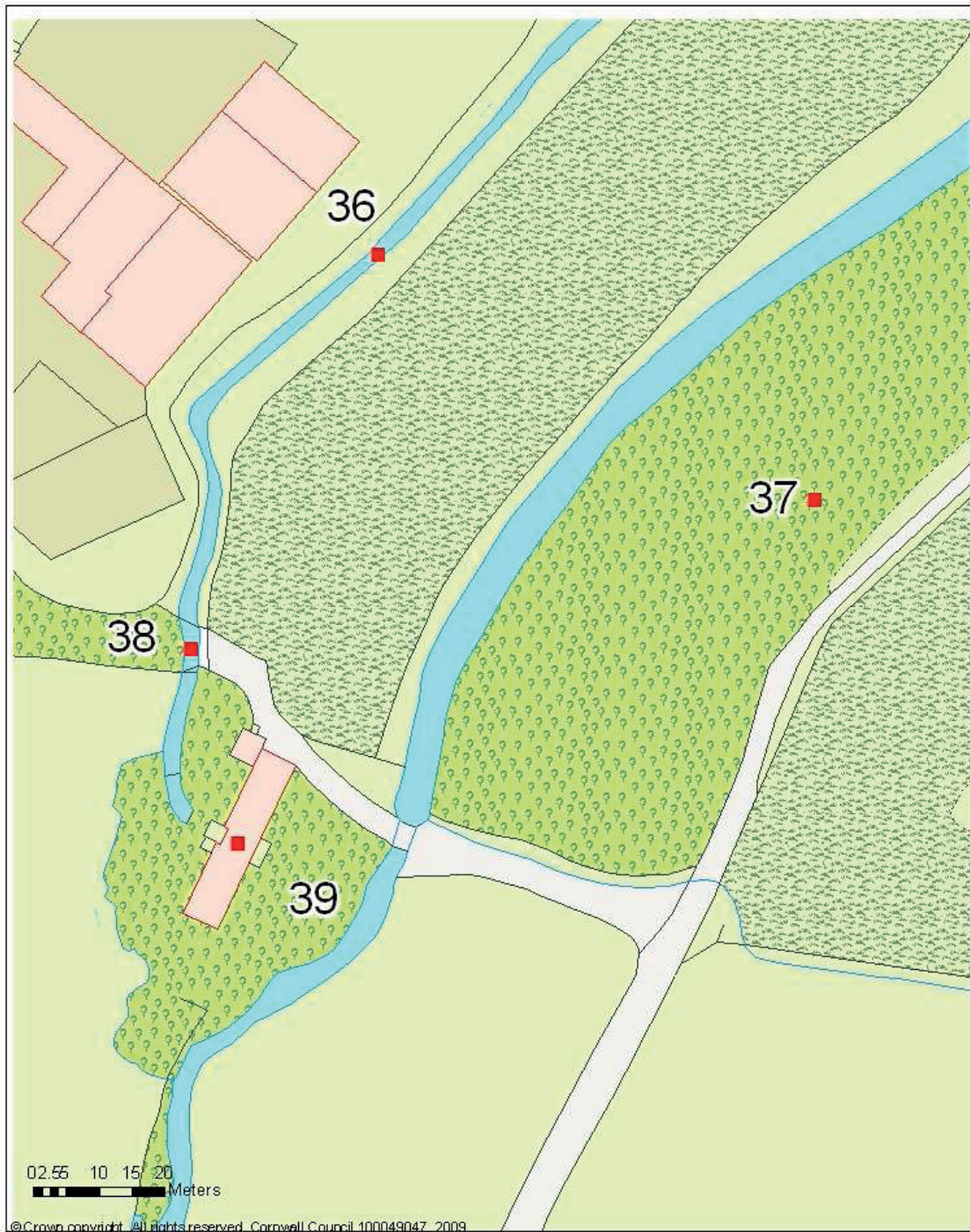
<p><b>Title</b></p> <p>Big Wheel and Trevear Mills</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old County Hall, Sticker Road, Truro, Cornwall, TR1 3AY Tel: 01872 522883 Fax: 01872 522881 mailto:hr@cornwall.gov.uk</p>	 <p>CORNWALL COUNCIL</p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator</p> <p>Adam Skarpe</p>	<p><small>© This document is Copyright © Cornwall Council and is subject to the terms and conditions of the Cornwall Council Open Access Licence. All rights reserved. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without the prior written permission of Cornwall Council.</small></p>
	<p>Date</p> <p>17/05/2010</p>	

Fig 11. Map E. 28. Blockwork structure, 29 Big Wheel Mill, 30. Adit, 31. Crib but, 32. Trevear china stone mill, 33. Tank, 34. Trevear pan kiln, 35. Trevear Cottage.






<p><b>Title</b></p> <p>Mica Mill</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings Unit Sticker Road, Truro, Cornwall, TR1 3AY Tel: 01872 522900 Fax: 01872 522881 www.htr@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator</p> <p>Adam Skape</p> <p>Date</p> <p>17/05/2010</p>	<p><small>In this document, the Copyright in illustrations is retained solely in order to allow copies to be made for use in other documents. It is not intended to be used for other purposes. Cornwall Council is not responsible for the design or any other parts of this document which are the property of, or under the control of, any other party.</small></p>

Fig 12. Map F. 36. Leat, 37. Streamworks and adits, 38. Bridge/aqueduct, 39. Lower Tregargus/Mica Mill.

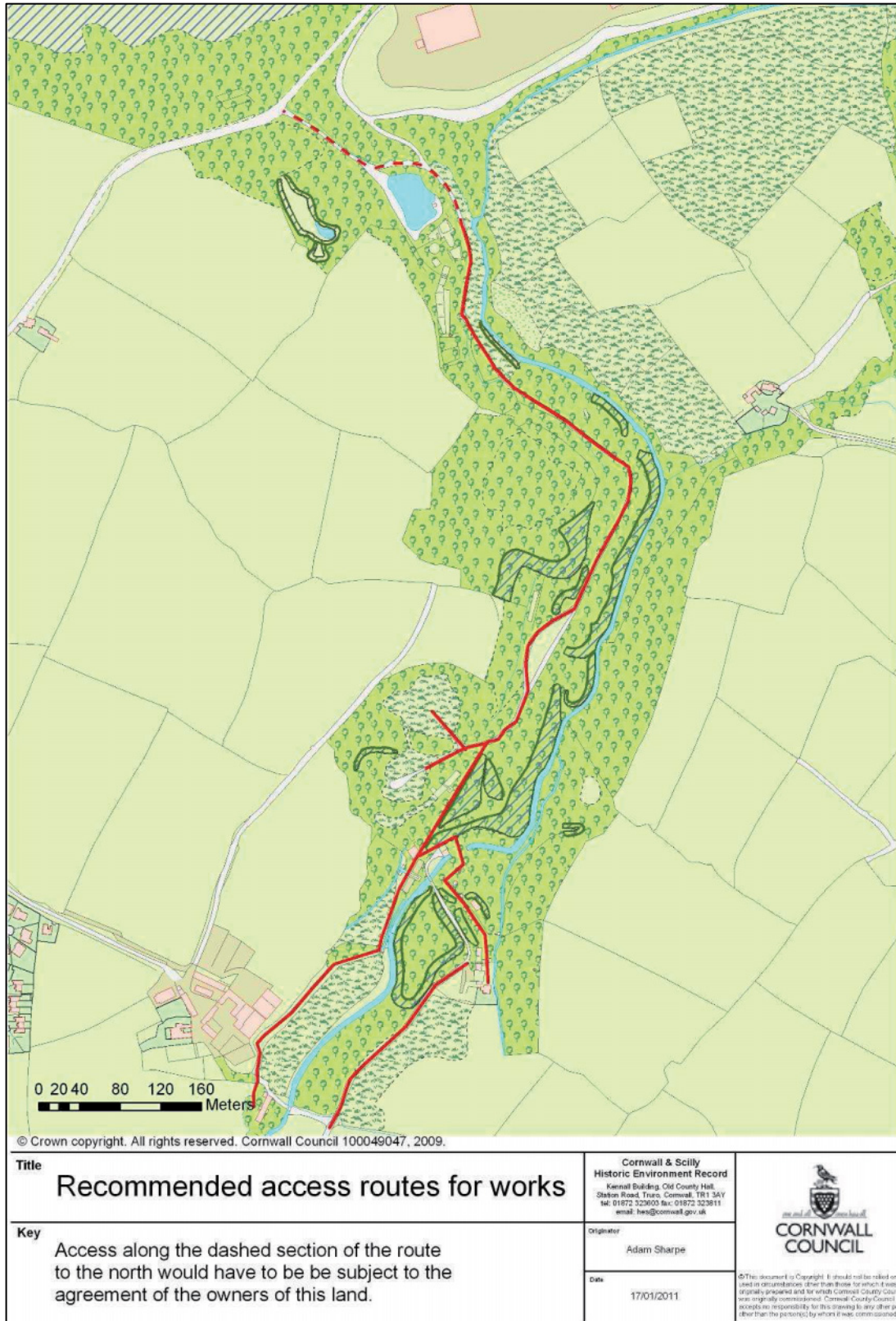
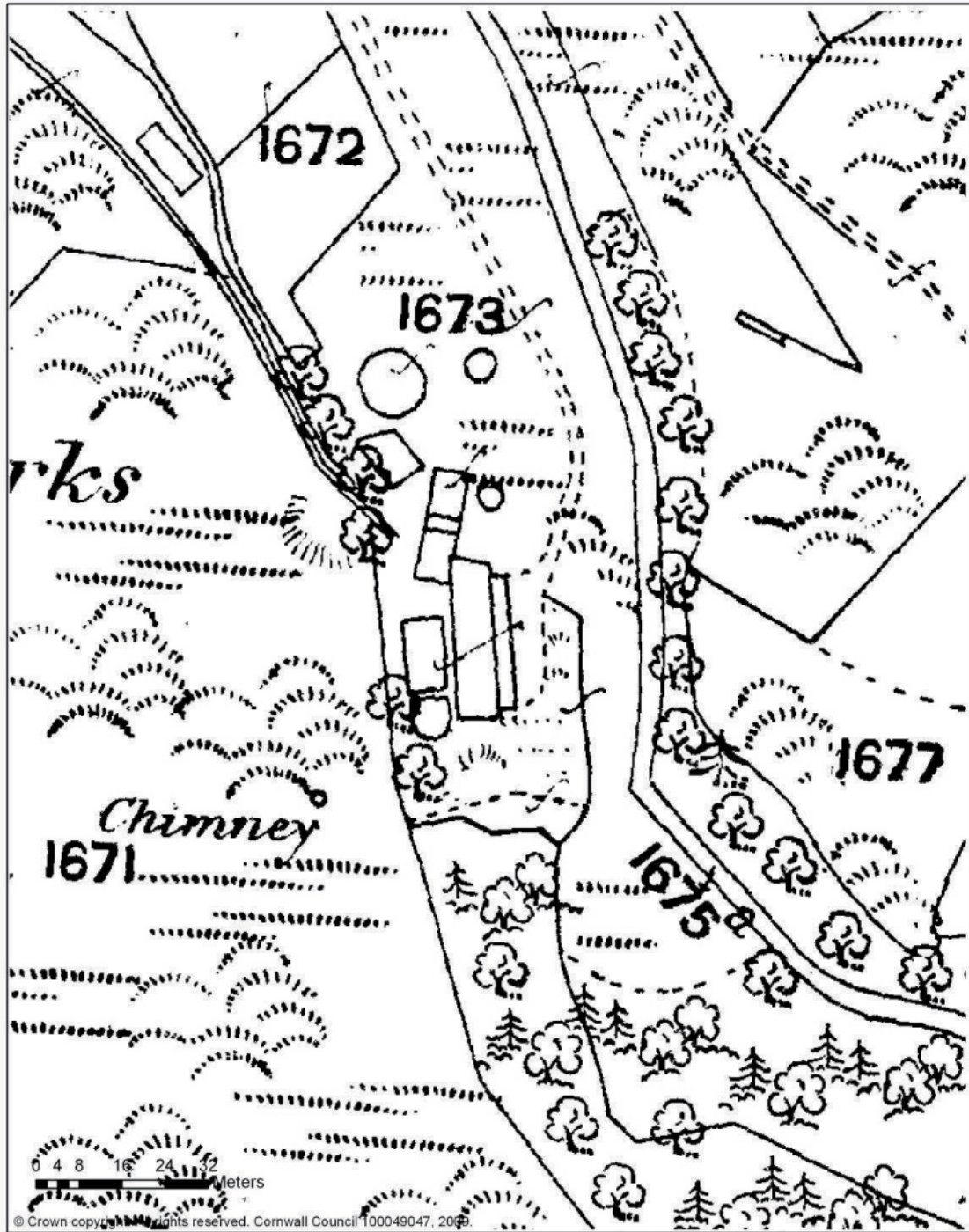


Fig 13. Suggested access routes to be used by contractors during conservation works to sites in the Tregargus Valley.



*Fig 14. An extract from the circa 1840 Tithe Map for St. Stephen in Brannel showing the section of the Barn River valley occupied by the Tregargus sites (centre). None of the structures described in this report are shown on this mapping. Block 1459 (upper centre) including the site of the Rescrowns china clay works was recorded as 'Moor and Clay Pits', whilst Block 1415 (lower centre), the site of the Higher and Lower Tregargus Quarries was recorded as 'Quarry Close'. Digitised image © Copyright Cornwall Council.*



Title  
The Wheal Arthur Mill complex in 1880

Cornwall & Scilly  
Historic Environment Record  
Kennel Building, Old County Hall,  
Station Road, Truro, Cornwall, TR1 3AY  
tel: 01872 325603 fax: 01872 323811  
email: hes@cornwall.gov.uk



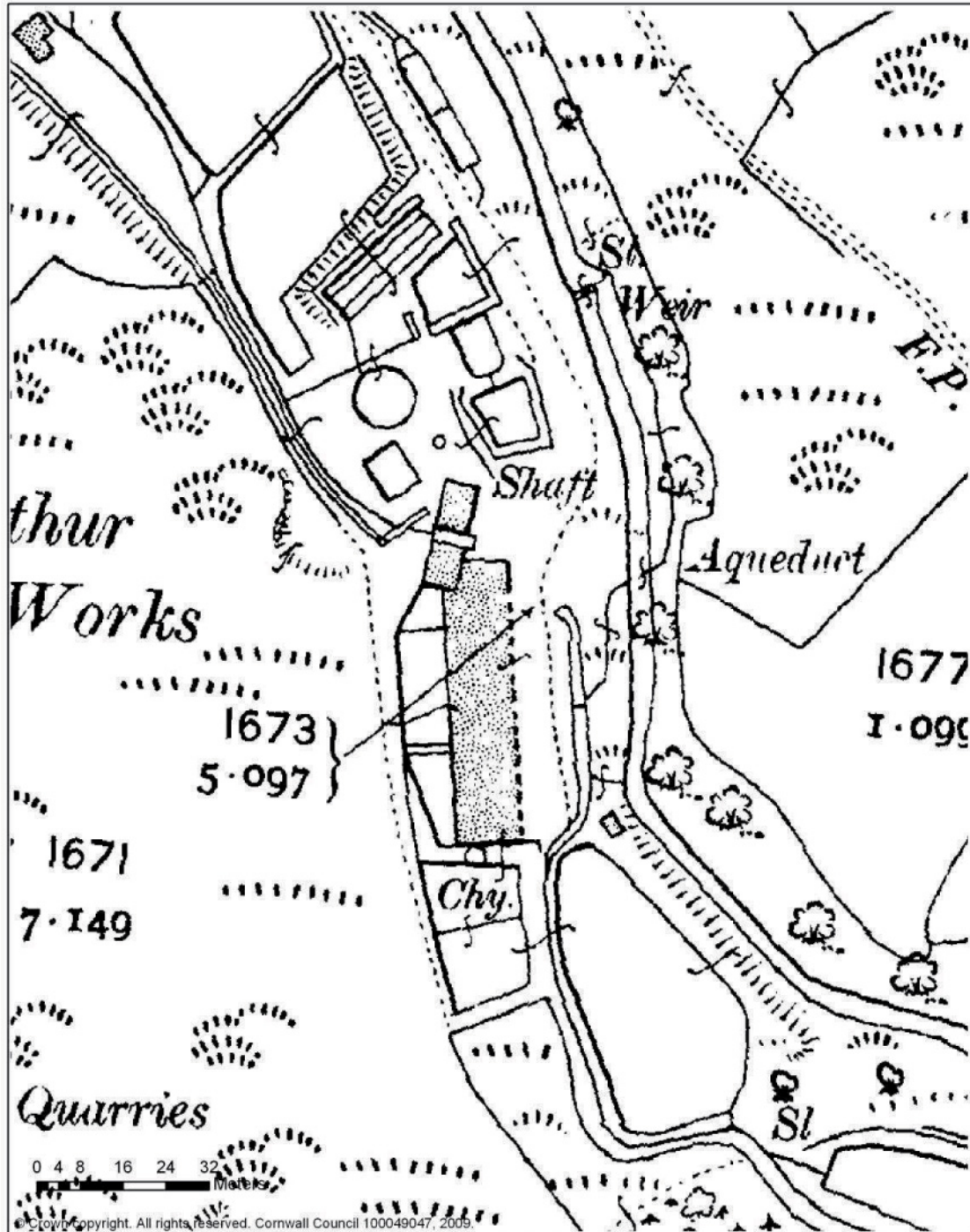
Key

Originator  
Adam Sharpe

Date  
17/05/2010

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Fig 15. The Wheal Arthur complex in 1880.




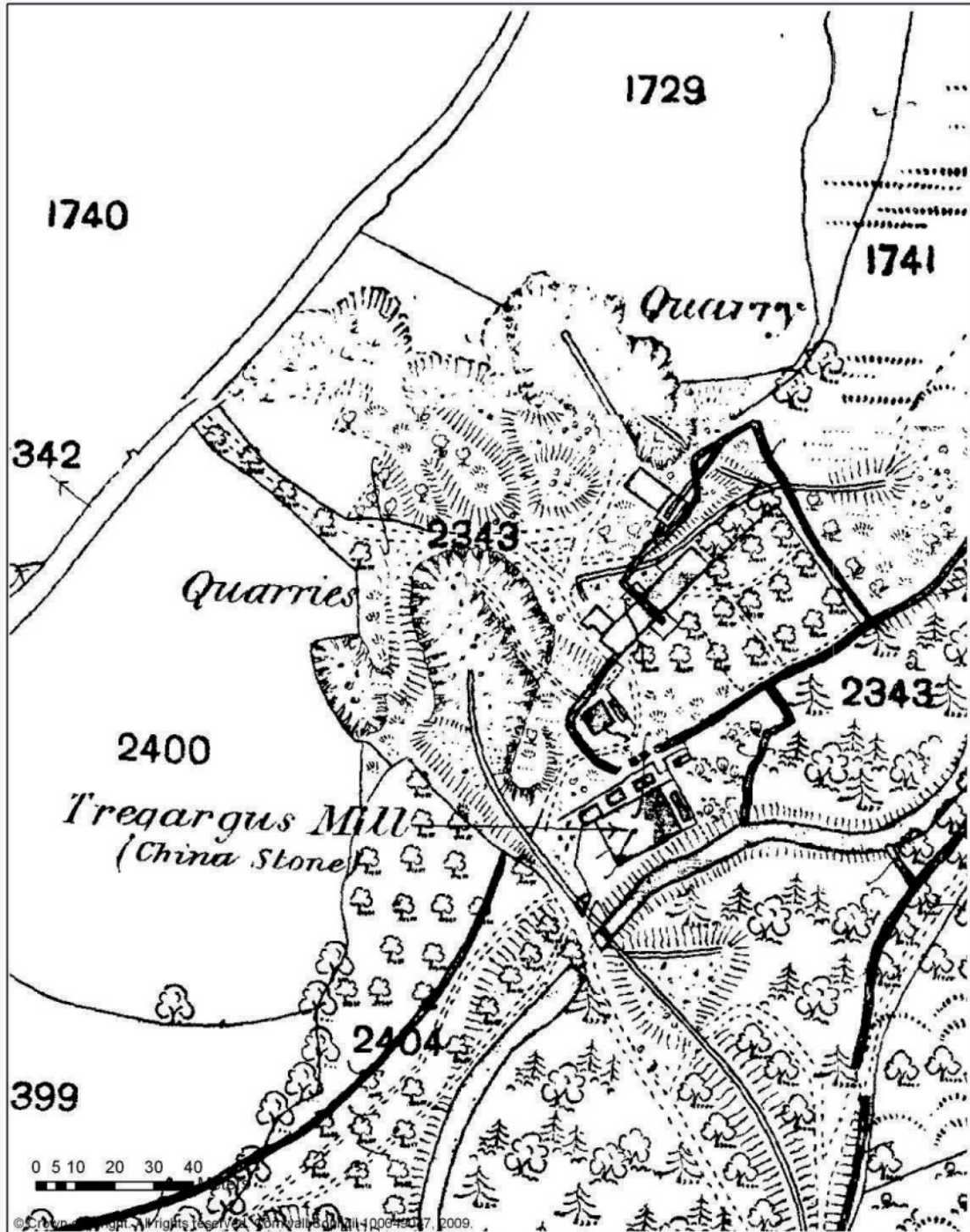
<p><b>Title</b> The Wheal Arthur Mill complex in 1908</p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennel Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY Tel: 01872 323603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p>	<p><b>Originator</b> Adam Sharpe</p>	<p><small>© This document is Copyright. It should not be relied on or used in circumstances other than those for which it was originally prepared and for which Cornwall County Council was originally commissioned. Cornwall County Council accepts no responsibility for this drawing to any other party other than the person(s) by whom it was commissioned.</small></p>
	<p><b>Date</b> 17/05/2010</p>	

Fig 16. The Wheal Arthur complex in 1908. The expansion and development of the site is clearly seen in comparison to the mapping drawn up less than three decades before (Fig 15).




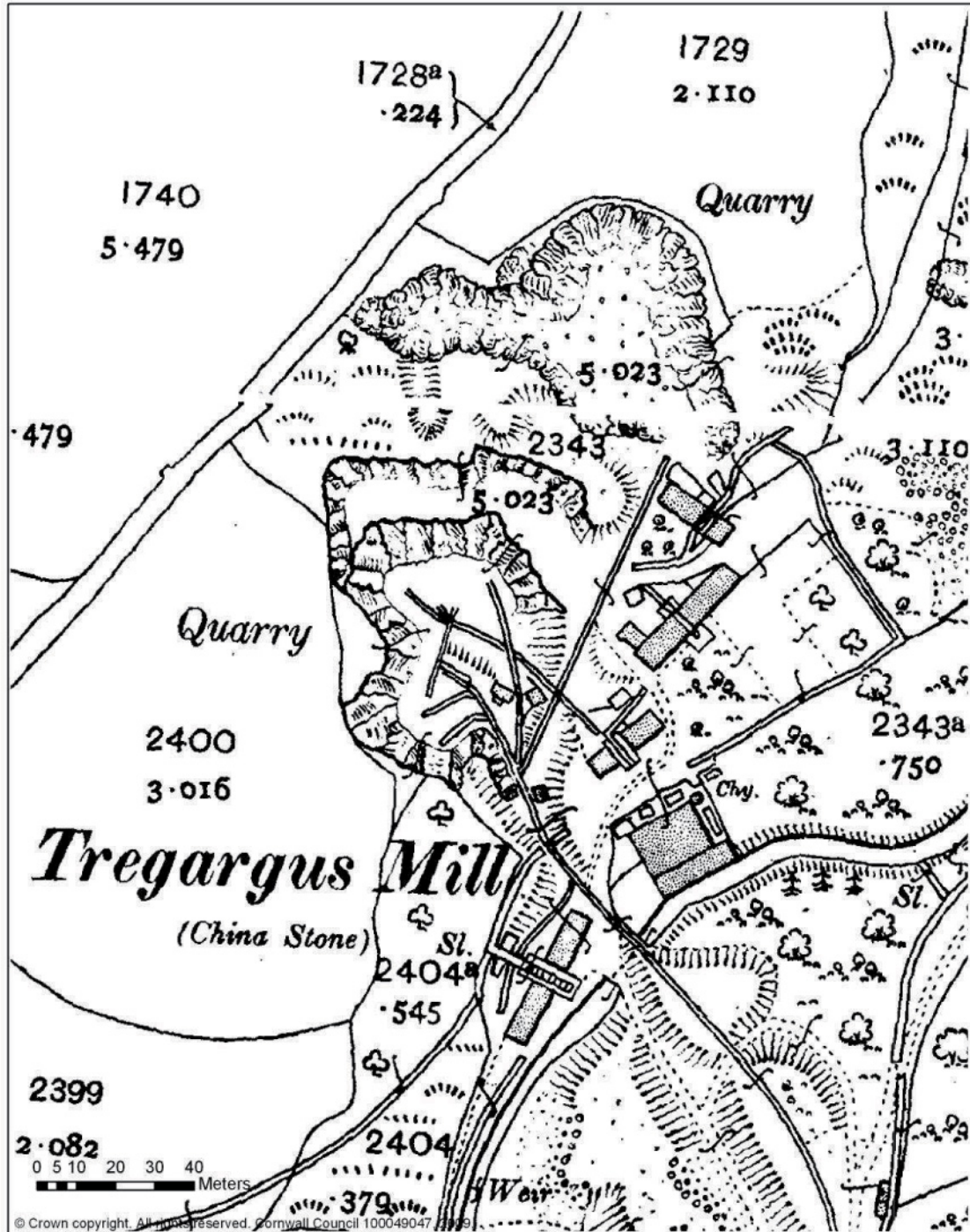
<p>Title <b>Big Wheel Mill and surrounding structures in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennel Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY tel: 01872 325603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p>Key</p>	<p>Originator Adam Sharpe</p>	<p>Date 17/05/2010</p>
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Fig 17. Higher and Lower Tregargus quarries with their associated structures in 1880. The stone quarried here was processed in Short Incline and Long Incline Mills. A further mill (labelled on the map) was sited near the stream, at the site now occupied by chimney 24. A tramway led south-east to Trevear Mill.




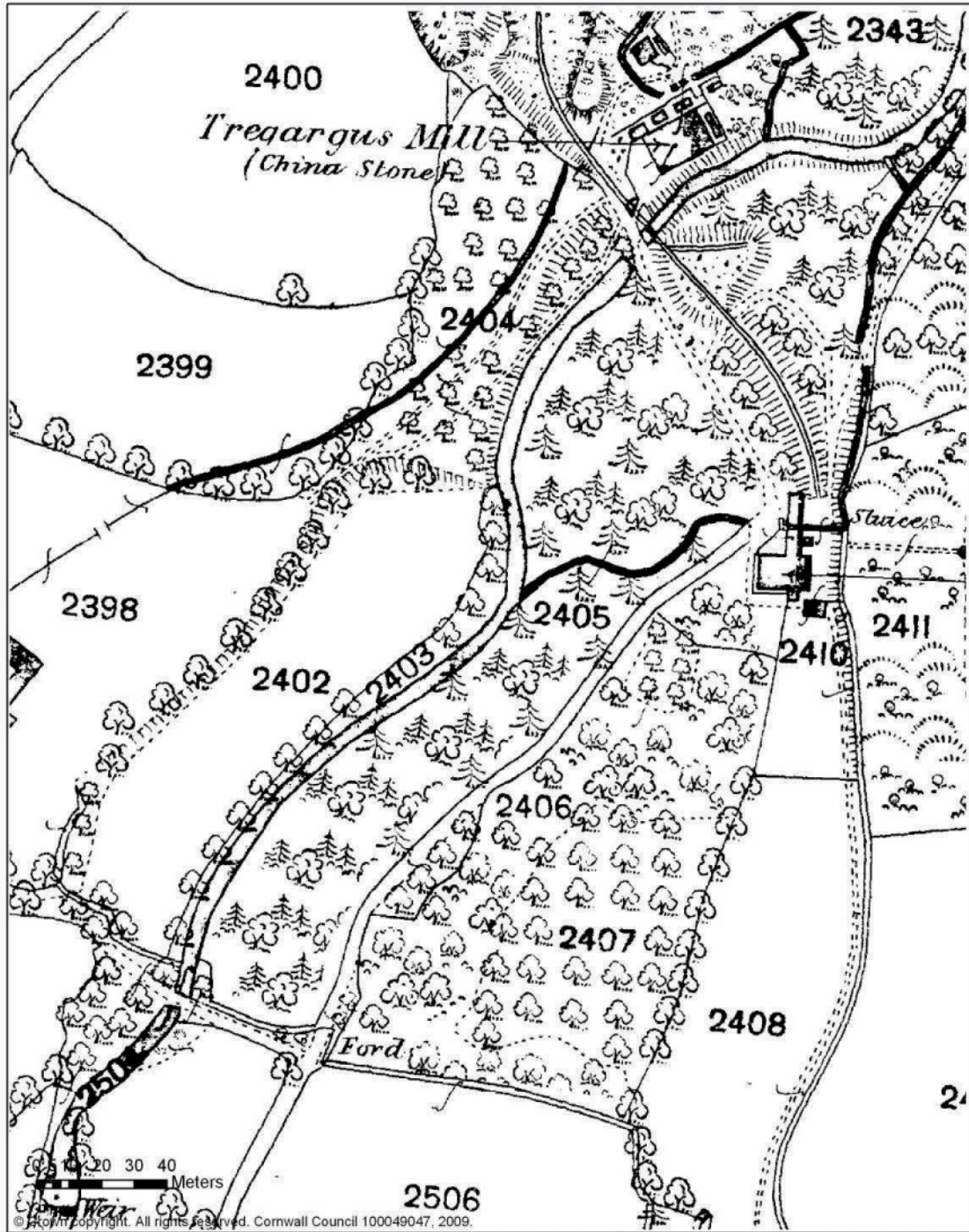
<p>Title <b>Big Wheel Mill and surrounding structures in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennell Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY Tel: 01872 323603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	
<p>Key</p>	<p>Originator Adam Sharpe</p>	<p>Date 17/05/2010</p>
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Fig 18. Higher and Lower Tregargus Quarries and associated structures in 1908. Two new mills had been added by this date: Blacksmith's Shop Mill and Big Wheel Mill, the leat and tramway networks had become far more complex.




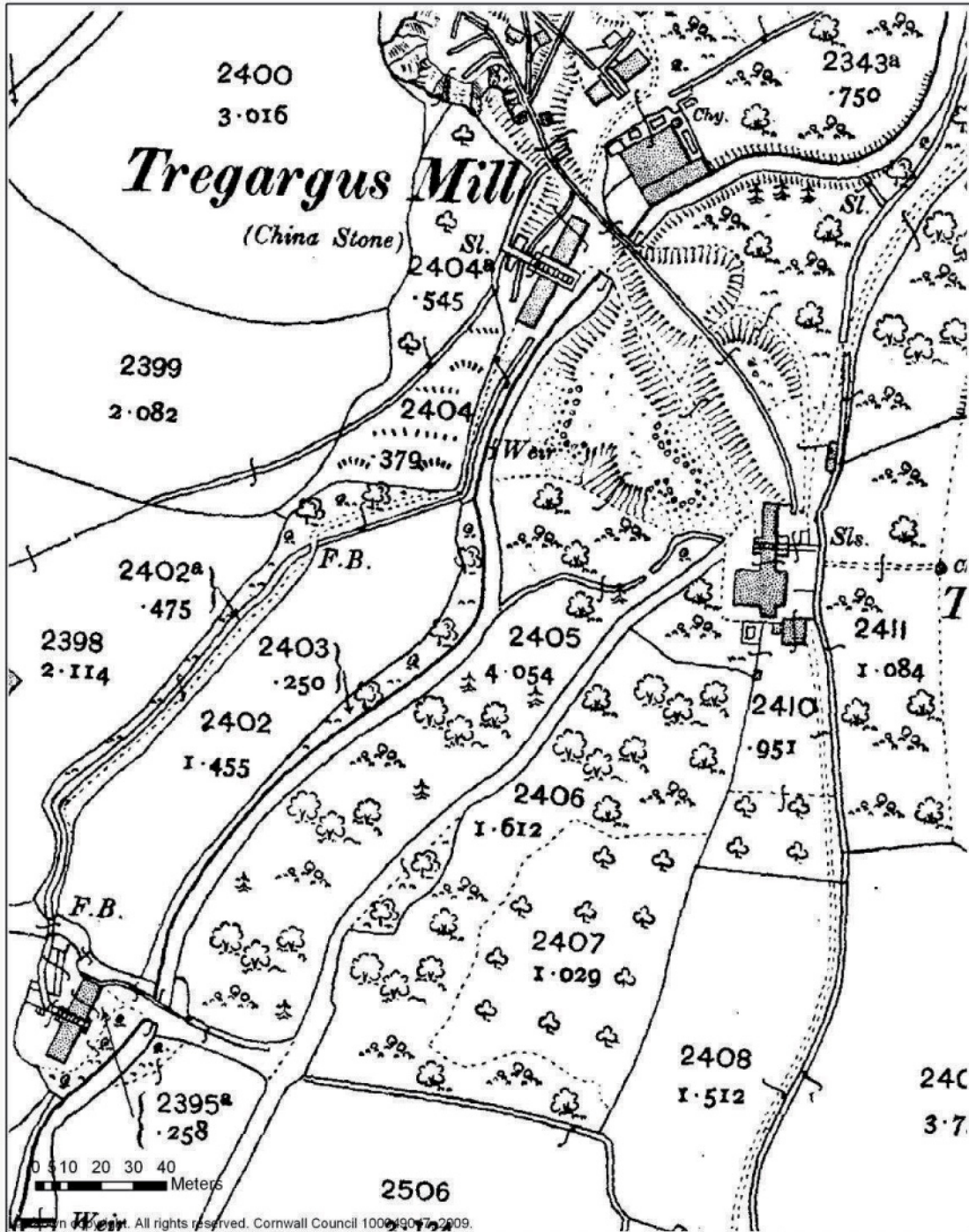
<p>Title</p> <p><b>Trevear and Mica Mills in 1880</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennel Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY tel: 01872 325603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p>Key</p>	<p>Originator</p> <p>Adam Sharpe</p>	
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Fig 19. Structures at the lower end of the project area in 1880. Lower Tregargus or Mica Mill had not been built at this date; Trevear Mill was supplied with stone from Lower Tregargus Quarry.






<p>Title</p> <p><b>Trevar and Mica Mills in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennell Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY Tel: 01872 323603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p>Key</p>	<p>Originator</p> <p>Adam Sharpe</p>	<p>Date</p> <p>17/05/2010</p>
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Fig 20. The lower end of the project area in 1908. The Trevear Mill complex remained unchanged, but the Lower Tregargus/Mica Mill complex had been constructed to its south-west.



*Fig 21. An archive view of Big Wheel Mill, with Short Incline Mill, Top Wheel Mill and Blacksmith's Shop Mill in the background. British Geological Survey © NERC. All rights reserved. IPR/121-15CT*



*Fig 22. An archive view of the interior of Big Wheel Mill, showing two of its grinding pans. British Geological Survey © NERC. All rights reserved. IPR/121-15CT*

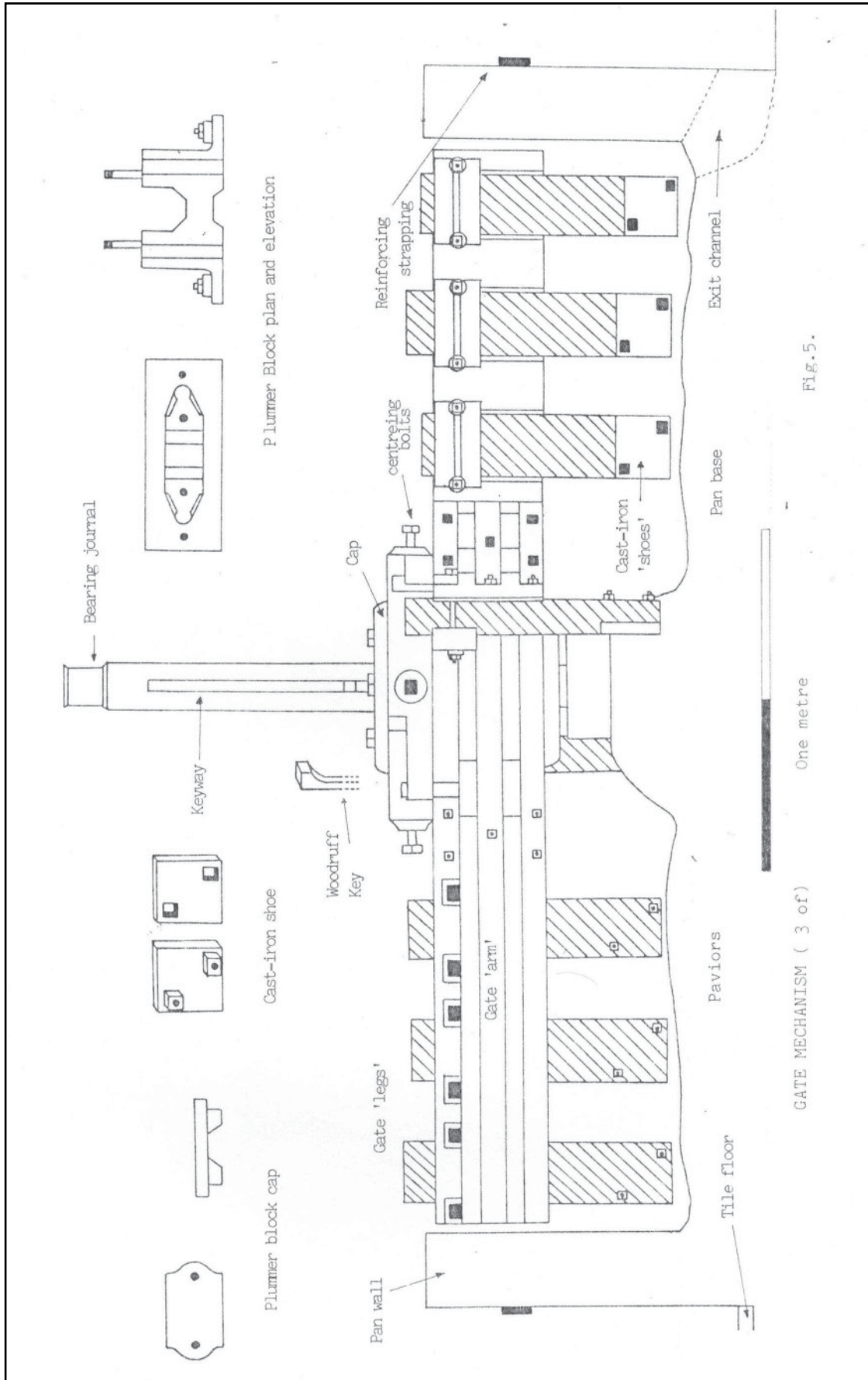


Fig.5.

Fig 23. The arrangement of the components of a china stone grinding pan, in this case one of the surviving examples at Chapel Mill, St. Stephen in Brannel. The gate legs are vertically adjustable so that they can be lowered as the paviors in the pan base wear down. Source Sharpe and Smith 1985.

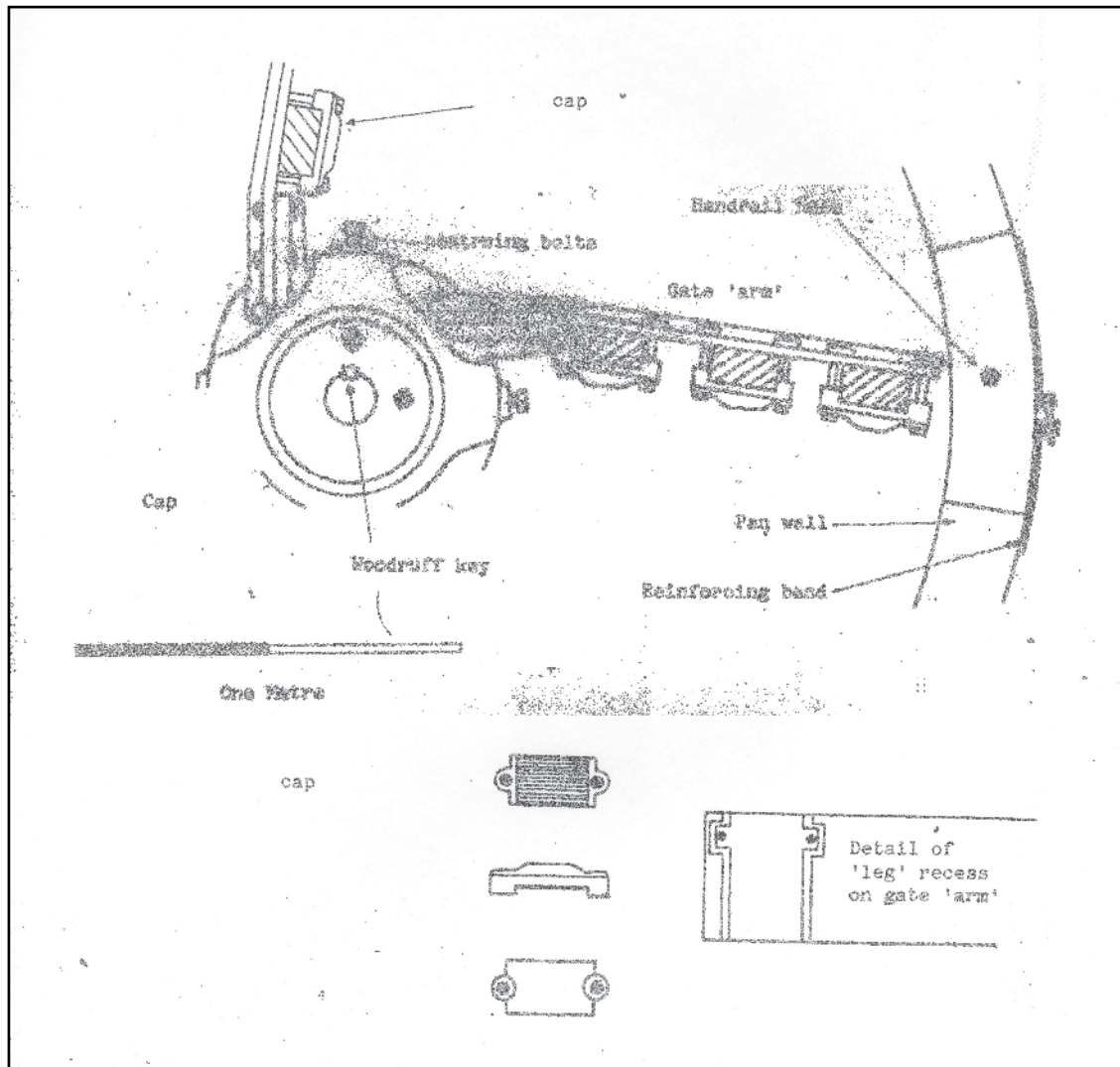


Fig 24. A plan of a typical grinding pan showing details of the gates and hub. Source: Sharpe and Smith 1985

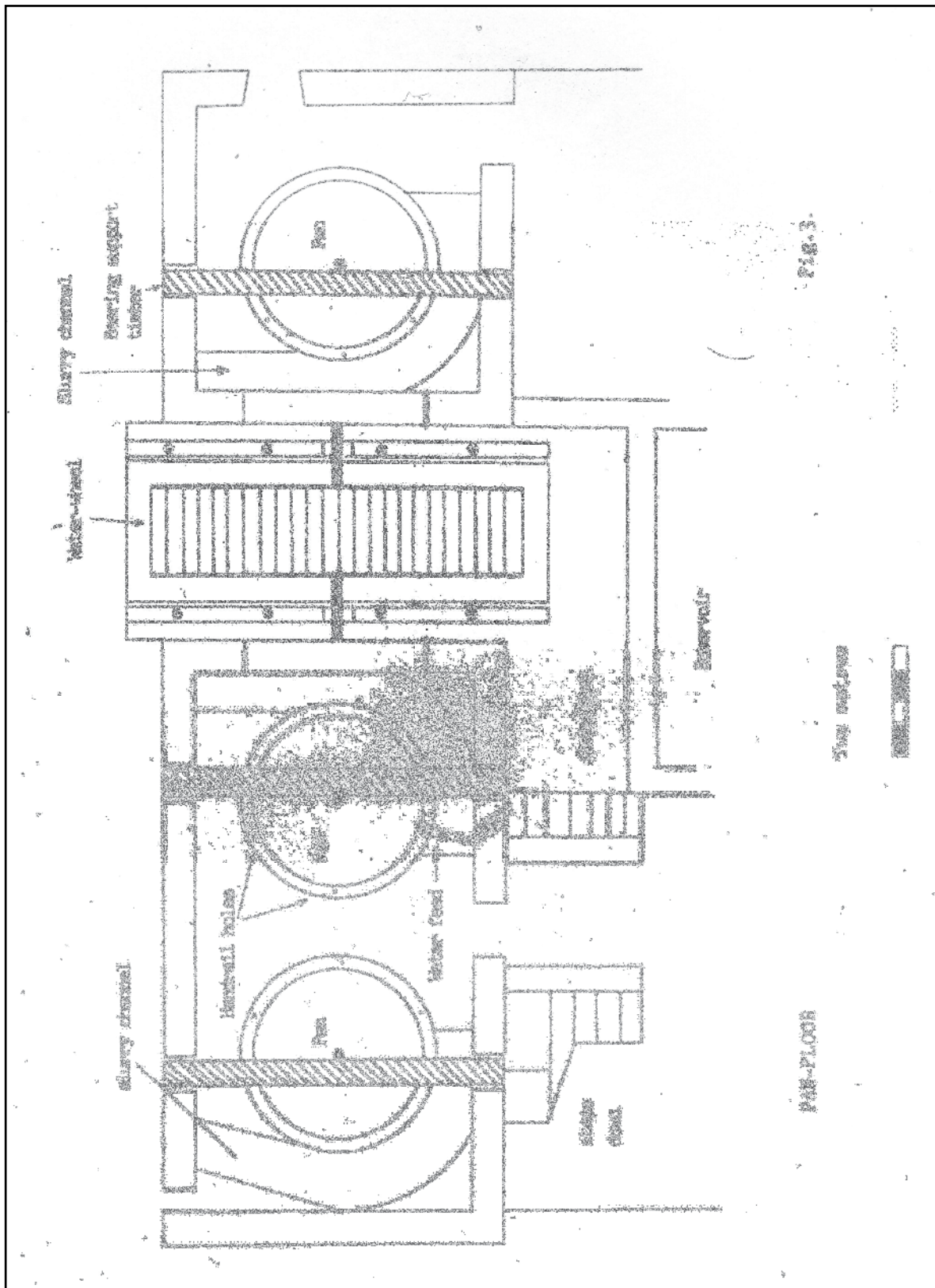


Fig 25. A typical arrangement of the ground floor of a china stone mill (Chapel Mill), showing the water wheel in its wheel-pit, the grinding pans flanking it and the bressmers over them which supported the upper ends of the vertical axles. Source: Sharpe and Smith 1985.

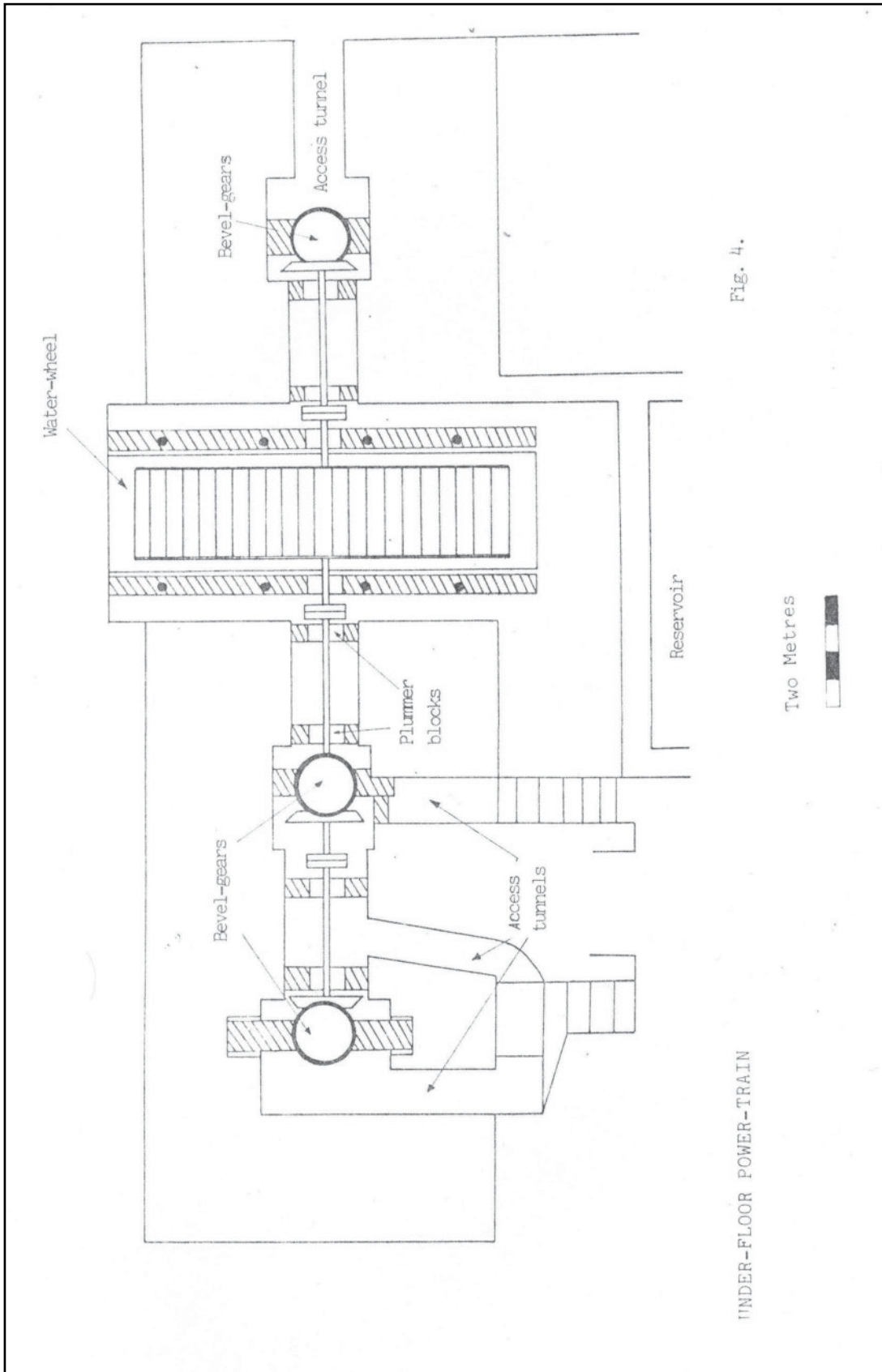


Fig 26. A typical under-floor arrangement in a china stone mill (Chapel Mill), showing the horizontal drive axles from the water wheel, the bevel gears which powered the axles running up to the grinding pans and the access tunnels from the exterior of the building. Source: Sharpe and Smith 1985.



*Fig 28. One of the bat-friendly galvanised steel grilles [3] fitted in the adits in Wheal Arthur Quarry [1]. The quarry is outside the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 27 A typical view in the secluded interior of Wheal Arthur Quarry [1]. The quarry lies outside the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 29. The pond and pump house just to the north of the Wheal Arthur complex. This site is just to the north of the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 30. The overflow water discharge from the pond above the Wheal Arthur complex, just to the north of the area managed by the Tregargus Trust. HE Digital Image Archive.*





*Fig 31. The cascade formed by the Barn River near the Wheal Arthur complex just to the east of the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 32. The Wheal Arthur complex from the south, with the dry [11] to the left and china stone mill [10] to the right. HE Digital Image Archive.*



*Fig 33. The china stone mill [10] at Wheal Arthur from the south-east, showing the vegetation which has grown up in the central wheelpit. HE Digital Image Archive.*



*Fig 34. The brick-built grinding pans in the northern section of Wheal Arthur china stone mill [10]. The crown of the central waterwheel can be seen in the background. HE Digital Image Archive.*



*Fig 35. The under-floor axle from the water wheel and one of the vertical axles driving the grinding pans in the southern section of Wheal Arthur china stone mill [10]. HE Digital Image Archive.*



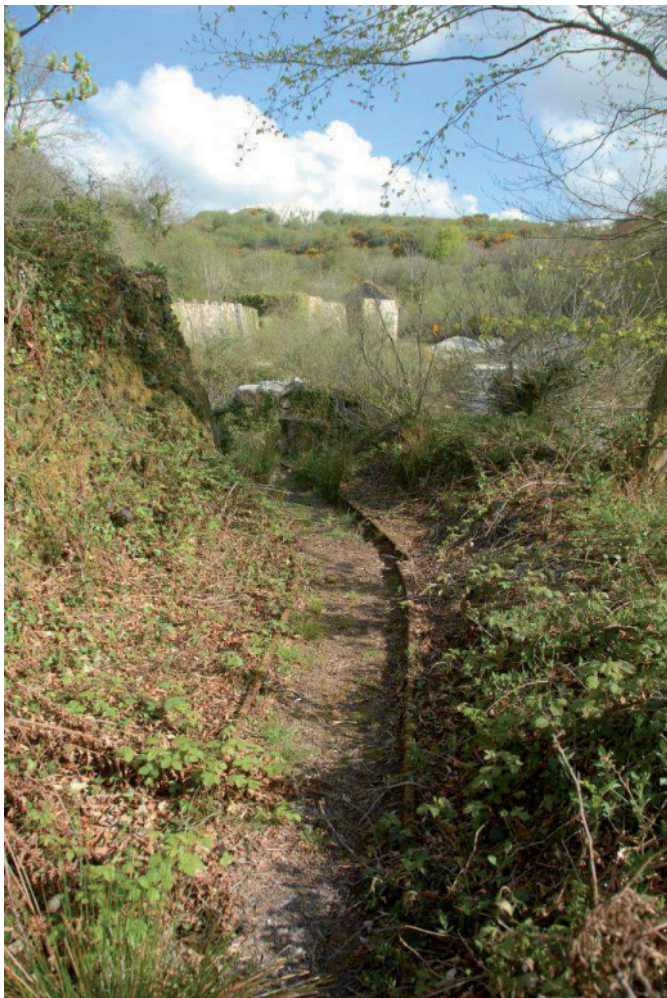
*Fig 36. The interior of the Wheal Arthur pan kiln [11], showing the area from which the hypocaust tiles were recently removed. HE Digital Image Archive.*



*Fig 37. The linbay [12] to the east of the Wheal Arthur dry [11], showing one of the bays which has been cleared out by the Tregargus Trust. HE Digital Image Archive.*



*Fig 38. The top of the cast iron rising main adjacent to the pumping shaft [8] at Wheal Arthur mill. HE Digital Image Archive.*



*Fig 39. The in situ tramway [14] to the east of the southern settling tanks at the Wheal Arthur complex. HE Digital Image Archive.*



*Fig 40. The pumping water wheel [5] at the northern end of the Wheal Arthur complex. HE Digital Image Archive.*



*Fig 41. The chimney [13] attached to the dry at the southern end of the Wheal Arthur complex. HE Digital Image Archive.*



*Fig 42. The mica drags [19] from the north, showing the regenerating stumps of some of the trees which formerly covered them. HE Digital Image Archive.*



*Fig 43. The northern end of the mica drags [19]. The entrance to its Adit [17] lies just beyond the clump of ferns. HE Digital Image Archive.*



*Fig 44. The overgrown and fragmentary remains of Top Mill [22] at the entrance to the infilled Tregargus upper quarry. HE Digital Image Archive.*



*Fig 45. The stump of the chimney [24] just to the north of the Barn River to the north-east of Big Wheel Mill. HE Digital Image Archive.*





*Fig 46. The overgrown remains of the blacksmith's shop [16] at the southern entrance to Rescrowsa china clay pit. HE Digital Image Archive.*



*Fig 47. The remains of the blockwork-built crib hut [31] to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 48. The ruinous rendered blockwork building [28] to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 49. The overgrown remains of the masonry-constructed powder house [27] to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 50. The guard fencing on the tramway bridge to the east of Big Wheel Mill, with the crib but [31] in the background. HE Digital Image Archive.*



*Fig 51. The recently-consolidated tramway bridge over the roadway to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 52. A typical scene next to the Barn River in the central part of the valley during the winter of 2009-2010. HE Digital Image Archive.*



*Fig 53. The infilled Lower Tregargus Quarry. The protected section of quarry face is below the trees at centre left. HE Digital Image Archive.*



*Fig 54. A sylvan scene on the revegetated spoil dumps just to the north of Rescrowsa china clay pit. HE Digital Image Archive.*



*Fig 55. The partially-collapsed entrance to the adit [18] leading into Rescrowsa china clay pit. HE Digital Image Archive.*



*Fig 56. Big Wheel Mill [29] from the north. The site of the winder house [24] is to its right under the trees. HE Digital Image Archive.*



*Fig 57. Big Wheel Mill [29] from the north-east, showing the overgrown water wheel and the eastern face of the building, partly cleared of ivy growth. HE Digital Image Archive.*



*Fig 58. Big Wheel Mill [29] from the east showing the vegetation growing over and adjacent to it. HE Digital Image Archive.*



*Fig 59. The remains of the brick-built grinding pans in the southern section of Big Wheel Mill [29]. HE Digital Image Archive.*



*Fig 60. The recently-conserved laundry bridge and the launder to the west of Big Wheel Mill [29]. HE Digital Image Archive.*



*Fig 61. The northern section of the grinding floor of Big Wheel Mill [29] seen from the south-east. HE Digital Image Archive.*





*Fig 62. The southern end of Big Wheel Mill [29], showing the pipeline running just to the east of the mill. HE Digital Image Archive.*



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*Fig 86. The northern section of Mica Mill [39] seen from the north-east. The massive central wheelpit can be seen to the left. HE Digital Image Archive.*



*Fig 87. The central wheelpit at Mica Mill [39] seen from the east. The surviving spanning timbers can be seen in this view. HE Digital Image Archive.*



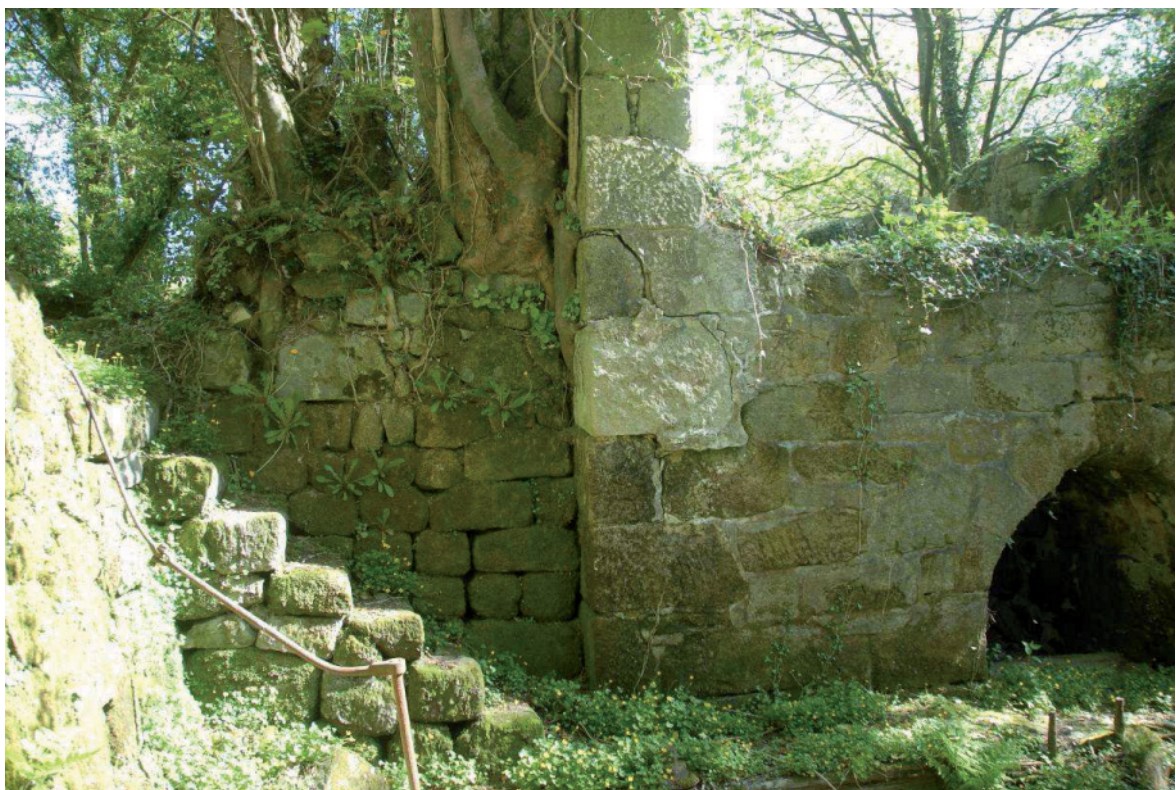
*Fig 88. Looking north along the grinding floor in Mica Mill [39], showing the well-preserved brick-built grinding pans. HE Digital Image Archive.*



*Fig 89. The large central wheelpit at Mica Mill [39] seen from the south-west. HE Digital Image Archive.*



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*Fig 92. Tree roots infiltrating the masonry on the northern side of the wheelpit at Mica Mill exemplify the types of problems affecting sites at Tregargus which require urgent attention if this rare group of structures are not to suffer severe deterioration. HE Digital Image Archive.*



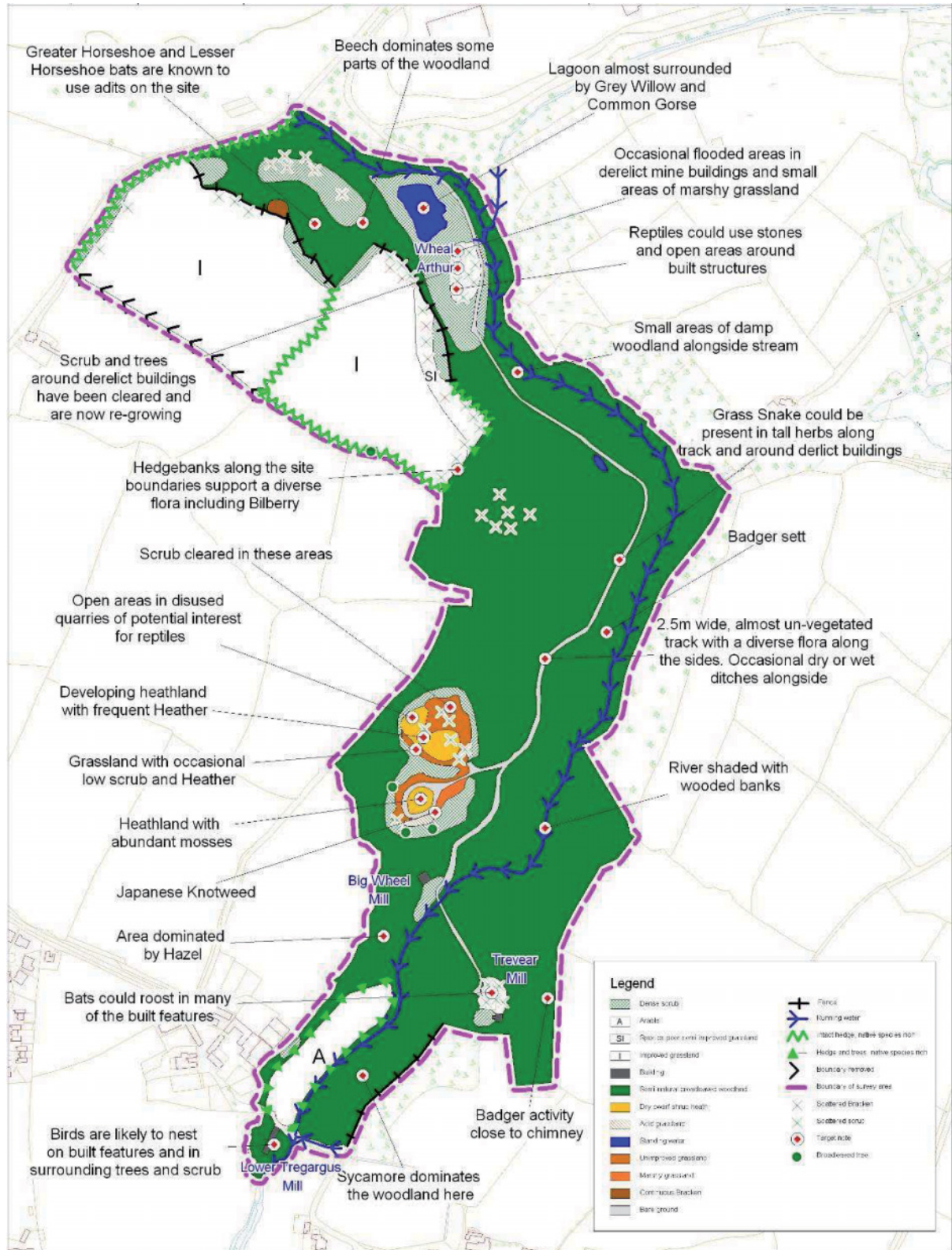


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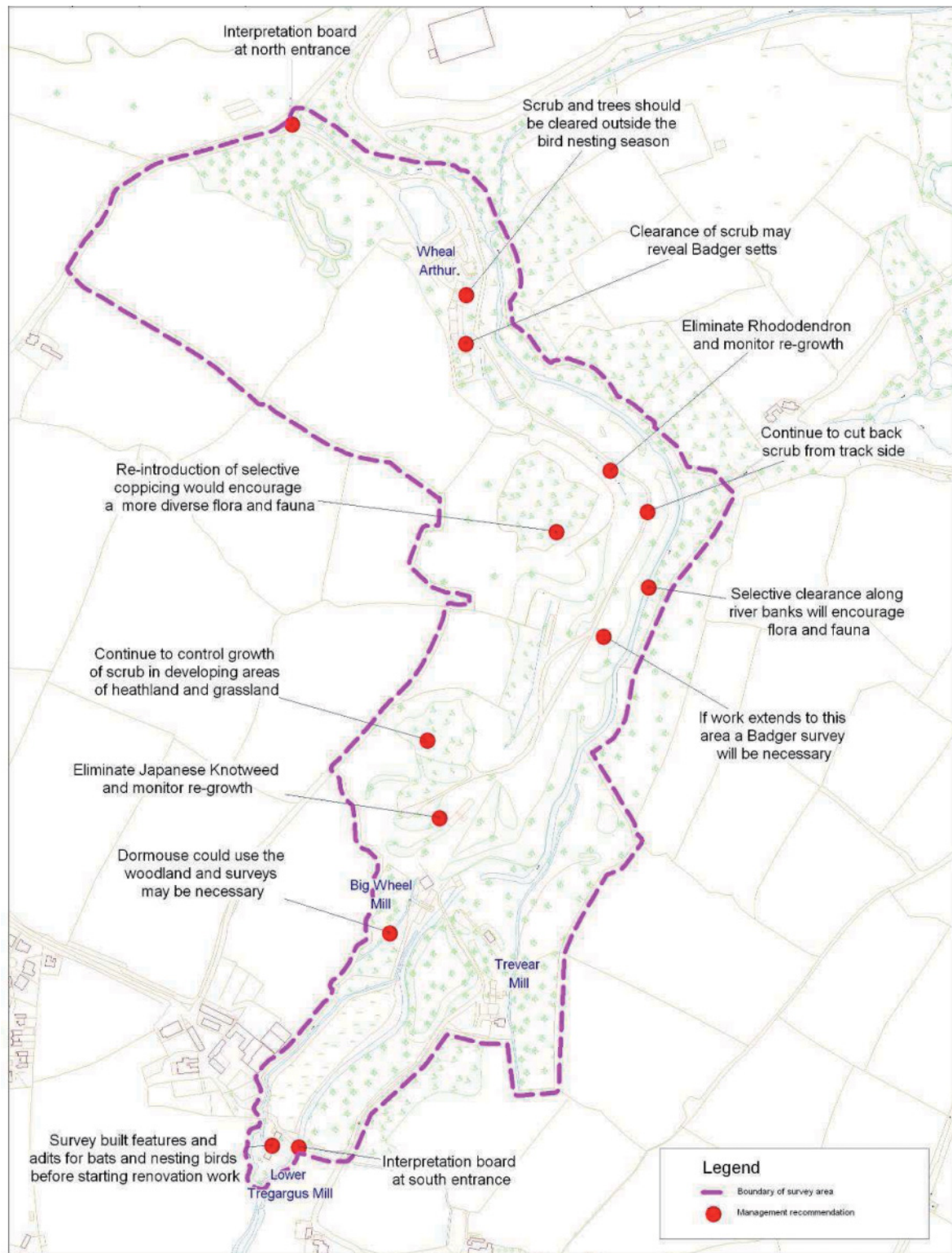


Fig 94. Summary of principal management recommendations from the 2010 ecological survey undertaken by Spalding Associates

# Tregargus, St. Stephen in Brannel, Cornwall

## Conservation Management Statement



**Historic Environment**



## **Tregargus Valley, St. Stephen in Brannel, Cornwall**

### **Conservation Management Statement**

<b>Client</b>	<b>Tregargus Trust</b>
<b>Report Number</b>	<b>2010R052</b>
<b>Date</b>	<b>16 February 2011</b>
<b>Status</b>	<b>Final</b>
<b>Report author(s)</b>	<b>Adam Sharpe BA MIFA, Jane Pilkington BSc, PhD</b>
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We are grateful to David Hazlehurst, Natural England, for clarification of the extent of the area managed by the Tregargus Trust.

The views and recommendations expressed in this report are those of the Historic Environment projects team and those of the other authors and organisations whose reports are summarised here. They are presented in good faith on the basis of professional judgement and on information currently available.

## Freedom of Information Act

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.



Historic Environment is registered as an archaeological organisation with the  
Institute for Archaeology

## Cover illustration

An archive view of Big Wheel Mill, with Blacksmith's Shop Mill and Big Wheel Mill in the background. British Geological Survey © NERC. All rights reserved. IPR/121-15CT

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*Fig 92. Tree roots infiltrating the masonry on the northern side of the wheelpit at Mica Mill exemplify the types of problems affecting sites at Tregargus which require urgent attention if this rare group of structures are not to suffer severe deterioration.*

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*Fig 94. Summary of principal management recommendations from the 2010 ecological survey.*

## **Abbreviations**

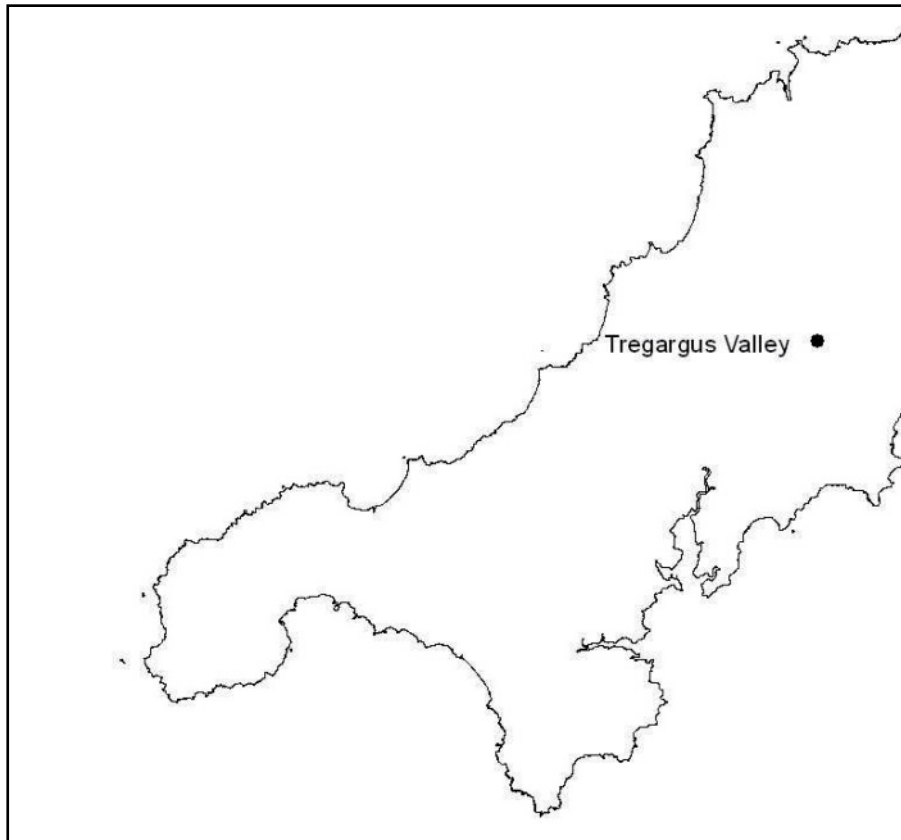
CRO	Cornwall County Record Office
EH	English Heritage
HER	Cornwall and the Isles of Scilly Historic Environment Record
NGR	National Grid Reference
OS	Ordnance Survey

## Summary

Following the agreement of a lease from IMERYS and Goonvean Ltd with the Tregargus Trust, an archaeological assessment of the Tregargus Valley was undertaken in 2002 by Cornwall Archaeological Unit (now Historic Environment, Cornwall Council). This report recommended the drawing up of a conservation plan for the valley, a report to include recommendations for the conservation of historic structures in the valley associated with the china stone industry, the creation of enhanced public access to the valley and the sites it contains and the provision of interpretation. To this end an assessment of the structures and their conservation management needs was commissioned from Knevitt Consulting of Wadebridge in March 2009, whilst an updated ecological assessment was commissioned from Spalding Associates, Truro in 2010.

In the context of the potential availability of grant aid for the works needed to achieve many of the aims of the Tregargus Trust, this conservation management statement draws together the results of the 2002 archaeological assessment with structural and ecological assessments to set out an integrated and prioritised approach to the conservation needs of the valley as a whole and its structures in particular. The plan is intended to allow the non-specialist reader to understand Tregargus and its significance as well as the natural and historic processes that have created it. The plan also sets out the issues which currently affect the valley and the philosophy which should underpin any proposals for the conservation of its mills and associated features.

This Conservation Management Statement will also be used in support of applications for Scheduled Monument and Listed Building Consent to undertake required conservation works to Big Wheel Mill.



*Fig 1. The location of the Tregargus Valley project area.*

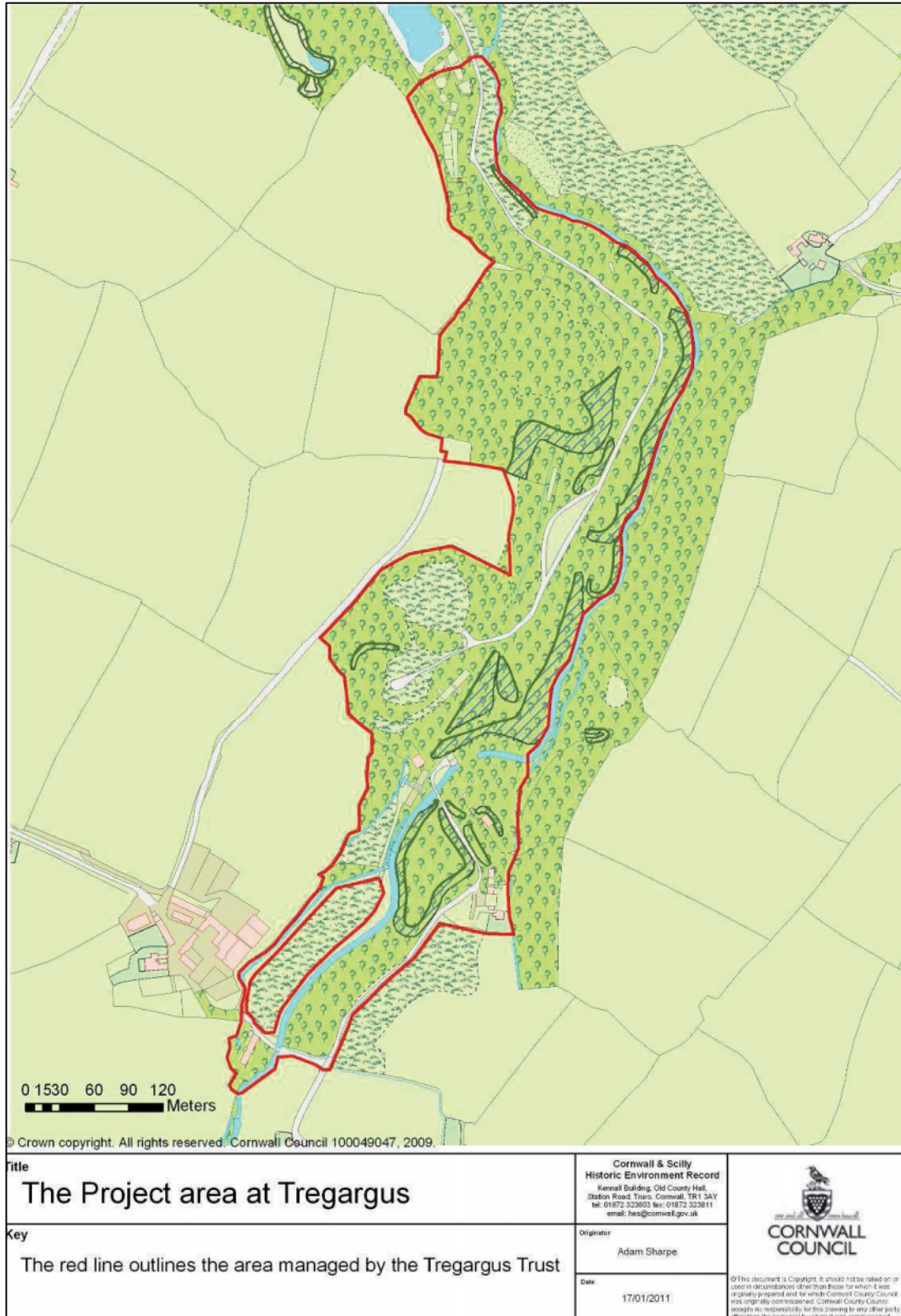


Fig 2. The extent of the Project Area at Tregargus.

# 1 Introduction

## 1.1 Scope and rationale for this Conservation Management Statement

This Conservation Management Statement is intended to provide a brief and readily comprehensible introduction to the sites in the Tregargus Valley; it is intended to allow the non-specialist reader to understand the site and its significance as well as the natural and historic processes that have created it. It also sets out the issues which currently affect it and the philosophy underlying proposals for its management, in particular the conservation of its structures.

One element of the site (Big Wheel Mill) is a Scheduled Monument (SM) and a Grade II Listed Building; works within the designated area will require specific written permission (Scheduled Monument Consent) from the Department of Culture Media and Sport (DCMS) and Listed Building Consent from Cornwall Council. A Conservation Management Statement (CMS) or Conservation Management Plan (CMP) is required by DCMS for such permission to be granted.

## 1.2 Requirement for works

The Tregargus Valley is of exceptional importance for the history of china stone extraction and processing in Cornwall, being the principal and best-preserved example of the small number of sites at which this industry was pursued in Britain.

China stone was quarried and milled in the Valley from *circa* 1870 until 1965, when the market for lower grades of china stone collapsed and the mills were abandoned. The site includes the remains of five china stone mills, which together with their associated stone quarries, are the finest assemblage of stone mills in Western Britain. They include **Wheal Arthur** at the northern end of the Valley, with its quarry, stone mill and pan-kiln; the partial remains of **Blacksmith's Shop Mill** and **Big Wheel Mill** in the middle part of the valley with their associated infilled quarries, mills, tramways and leats; **Trevar Mill** to the south with its attached pan-kiln and miller's cottage; and **Lower Tregargus/Mica Mill** with its associated tramway and leat at the southern entrance to the Valley.

These rare structures have remained un-managed since their abandonment four decades ago and have suffered significant deterioration through both natural processes and human interventions. A recent structural assessment (Knevitt 2009) has confirmed the general impression that conservation measures will be required if these buildings are not to suffer significant collapse and loss of integrity within the near future.

The range of works will include the clearance of vegetation which is currently masking structures, restricting access to them and, in many cases, accelerating damage to them. Following this preliminary work it is likely that wall capping and pointing in lime mortar and the limited rebuilding of lost masonry where this compromises structural stability will be required, together with the replacement of rotten timber lintels, the arresting of corrosion processes on ironwork components and a range of public safety works. In line with the aims of the Tregargus Trust, who have taken on responsibility for the management of the site, enhancement of public access and the provision of interpretation for the valley are also considered desirable.

## 1.3 Aims of this Conservation Management Statement

This CMS is intended to guide and underpin proposed conservation, stabilisation and safety works to structures at Tregargus, as well as the management of the site within which they sit, including provision for public access and for interpretation. A principal aim of this CMS is to ensure that these works are carried out following best conservation practice, and that they will enhance the site without resulting in

unwanted and avoidable negative effects on other aspects of the site; this guidance will also ensure that the works will be carried out in a sustainable and appropriate fashion.

## **1.4 Consultation**

This draft report was circulated for comments to Natural England, English Heritage, The Tregargus Trust, Historic Environment Advice Cornwall Council, Goonvean Ltd and IMERYS prior to finalisation.

## **1.5 Structure of Conservation Project Team**

In order to progress the conservation of the structures on the site, it is proposed that a conservation project team will be established to achieve these aims. Individuals representing organisations and interests in the site will be brought together for an initial project meeting to explore the scope and nature of the proposed works, to identify any constraints on the works and to agree the mitigation which would be needed to minimise loss of information or damage to sites or habitats occurring during or as a result of the Project. Grant aid will be sought from Natural England to fund the works.

The suggested Project Team (below) will consist of the Client (The Tregargus Trust), a range of specialists charged with drawing up specifications for the works, the chosen principal contractor, representatives of relevant statutory agencies, and specialist advisors, as below.

### **The Client**

The Tregargus Trust

### **Architect/engineer**

To be appointed

### **CDM coordinator/health and safety advisor**

To be appointed

### **Principal Contractor**

To be appointed

### **Historic Environment Consultants (assessment and conservation plan)**

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### **Conservation Officer**

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### **English Heritage**

Nick Russell, Inspector of Monuments, English Heritage (South West Regional Team), 29 Queens Square, Bristol, BS1 4ND, (01179) 750799

### **Ecological advisor (assessment and conservation plan)**

Spalding Associates (Environmental) Ltd., Norfolk House, 16-17 Lemon Street, Truro, Cornwall TR1 2LS

## **2 Understanding the Asset**

For site location see Fig 1, for extent Fig 2, locations of principal archaeological sites and features Figs 3-11, relevant designations Fig 3, suggested contractor's access routes and compound sites Fig 13 and locations of sites of ecological interest Fig 94.



In the spring of 1999, the China Clay Area LEADER project headed by Len Smith initiated a proposal for public access and conservation in the Tregargus Valley just to the north-east of St. Stephen in Brannel. This proposal has since been adopted and developed by the Tregargus Trust, a registered charity whose aim is to manage and conserve the Tregargus Valley for public access and recreation. A lease of most of the Tregargus Valley was acquired jointly from IMERYS and Goonvean Ltd by the Tregargus Trust circa 2000 (for the extent of the leased area see Fig 2). The Trust's aims are to preserve the important industrial sites within the Valley and to present them to the general public within the context of the wider landscape. A five year management agreement between English Heritage and The Tregargus Trust relating to the scheduled Big Wheel Mill has now lapsed.

The project area (see Fig 2) is approximately 200 Ha in extent, and occupies a section of this north-south trending steep-sided, wooded valley which was created by the Barn River; the river provided water for a series of china stone mills which processed the output of the nearby stone quarries. China stone was quarried and milled in the Valley from *circa* 1870 until 1965, when the market for lower grades of china stone collapsed and the mills were abandoned. Since then, the Tregargus china stone quarries have been infilled with mica waste and two of the central mills have been almost completely demolished or buried.

## **2.1 Geology, Mineralogy and soils**

The northern section of the project area is underlain by Hensbarrow granite, though in the northern part of the valley this has been blanketed by a build up of Quaternary alluvium. To the south, the granite is covered by hornfelsed slates of the Early Devonian Meadfoot Group, the southern section again being blanketed in alluvium (information derived from BGS datasets). The soils that have developed on these bedrocks are, to the north, soils of the Upper Moorgate series – typically well-drained loams over granite, and to the south the well-drained fine loams or silty loams of the Manod group – derived from Lower Palaeozoic slates, mudstones and siltstones. Altered granite (in the form of china stone) outcrops in the northern part of the valley on its western side, where it has been quarried at a number of locations. The lower quarries, now substantially infilled, have been designated SSSIs for their geological importance, their western working faces remaining exposed.

## **2.2 Aspect and setting**

The Barn River, which flows through the Tregargus Valley, rises just to the north of Nanpean near the Great Wheal Prosper works, and flows southwards and then south-westwards for 2.5Km to Higher Tregargus where its course again turns to the south, flowing for just over 1 Km through the Tregargus Valley project area. The river continues 1.5 Km to the south-east to Gwindra, where it turns to the south, eventually meeting the River Fal at Coombe.

The Tregargus Valley is narrow (averaging 170m wide) and is steep-sided, cutting through the southern side of the Hensbarrow granite massif, and falling 50m (between 130m and 80m) in the one Km section which forms the project area, the stream being, in places, incised into the valley floor. The stream no longer follows its original course within substantial sections of the valley, having been diverted to allow spoil dumping operations adjacent to the Wheal Arthur works, and in two locations in the southern part of the valley where tin streaming operations took place. Within the project area the valley follows a sinuous course, its 250m long upper section being orientated north-south, the 200m long section to the south of this being orientated north-west to south-east, the remaining 600m being orientated north-north-east to south-south-west, the valley opening out at its southern end, where it forms the eastern boundary of the settlement of St. Stephen in Brannel. Within most of the project area the river has been used as a source of water for leats serving industrial structures.

## 2.3 Historic Landscape Zones

During 1994, Cornwall Archaeological Unit (CAU) carried out a map-based historic landscape assessment across the whole of Cornwall, using existing field patterns and early map and place-name evidence to characterise the landscape (Countryside Commission 1996). This characterisation reflects the historic processes that have shaped the Cornish landscape and involved dividing Cornwall into a series of zones, each of which reflects a particular set of historic processes and tends to contain a predictable range of archaeological sites and historic features.

The Landscape Assessment classed the core area of the Tregargus Valley as *Plantation and Scrub, Upland Woods*, Rescrowsa Pit and Wheal Arthur Quarry being classified as *Industrial, Disused*, whilst the remainder of the area, comprising Higher and Lower Tregargus Quarries, Big Wheel Mill and the Wheal Arthur complex being classified as *Anciently Enclosed Land* (land enclosed for agriculture between prehistory and the Medieval period), with some possible later enclosures to the north and east. The 2002 survey makes it clear, however, that much of the study area should be re-characterised as a *Steep-sided Valley* which also contains considerable evidence of china stone and other extractive industries (*Industrial, Disused*).

## 2.4 Designations affecting the area

Big Wheel china stone mill is a scheduled monument (Cornwall 668) and a Grade II listed building (SW 95 SW 3/123, LBS No 71464, the structure having been listed on the 20<sup>th</sup> December 1988). The listing description reads:

*"Mill: formerly used for stone-grinding. Early-mid C19, with few later alterations. The mill was in operation until circa 1965. Granite rubble with granite dressings and quoins. The roof was formerly of slate and shingles, with gable ends.*

*Plan: There are two rectangular mill houses with the wheelpit between the two; overshot wheel formerly powered by a leat at the rear, with the tailrace running along the front of the mill houses.*

*Exterior: Each mill house is 2-storey at the front, built into the bank and single storey at the rear. Each has a symmetrical front, each the same, with two round-arched doorways at ground floor with keystones and window openings above. The front is much overgrown. The wheel is set centrally, cast iron wheel with cast iron launder at the rear. The right gable end of the mill house has a central loading door at upper ground level with granite lintel and small gabled hoist housing above the pulley wheel. At the rear the mill house to left has 2 door openings and 2 small window openings, with an unexplained projection in stone rubble to left. The mill house to right has similar door and window openings.*

*Interior: No internal machinery remaining; the roof trusses only survive, halved and bolted at the apex of the principal rafters."*

The Tregargus Higher and Lower Quarries two thirds down on the west side of the site have been designated as a Site of Special Scientific Interest for geological reasons. The boundaries and details of the SSSI are included in the Appendices to this report (see Fig 3 for the extent of the SSSI). The condition of the SSSI was last assessed by Natural England in 2008 when the condition was described as "unfavourable" due to the encroachment of vegetation which was obscuring the features of interest. This is a result of a deliberate decision by the Tregargus Trust to allow such growth in this area, as the dense scrub and tree growth discourages members of the public accessing what they consider an unsafe site.

## 2.5 Access and rights of way

There are no public rights of way within the Tregargus Valley, nor has the Valley been designated as Access Land under the CROW Act 2000. Nevertheless, the Valley contains a series of informal paths which are used by local people, access to the valley being gained from the lane linking Tregargus and Trevear at the southern end of the Valley and from the road linking Stepside and Goonamarris to the north. The part of the route running between the public road to the north and the Wheal Arthur works is, however, not owned or managed by the Tregargus Trust. Some surfacing works have already been undertaken along a former haul road through the northern part of the valley by the Tregargus Trust, whilst safety works have been carried out at a number of bridges incorporated into the footpath network.

## 2.6 The historic environment

Within Britain, the china stone quarrying and milling industry was geographically almost entirely sited within a small area of the south-western part of Hensbarrow Moor (see Section 2.4), a reflection of the very limited area within which the geological resource on which it depended was available. The massive expansion and modernisation of the Cornish china clay industry during the 20<sup>th</sup> century inevitably resulted in the destruction or over-dumping of some of the sites related to this industry; the final cessation of china stone milling at its traditional water-powered sites during the 1960s brought about the abandonment of the remaining sites and the stripping of their machinery, together with any useful construction materials. Many of these sites remained in the ownership of the china clay producing companies, however, and in the case of the complex at Tregargus, this helped to ensure the survival of many of its elements, with the result that the group of mills, pan kilns and associated structures and earthworks in the valley now represents by far the best-preserved evidence for this uniquely Cornish industry. Big Wheel Mill has been designated as a scheduled monument and a Listed Building as a result (see Section 2.4), whilst Chapel Mill at St. Stephen in Brannell (a short distance to the south) has been Listed Grade II\*, given its intact machinery.

The Tregargus Valley also witnessed other formative activities in the evolution of its landscape character and complexity, including tin streaming, corn milling, woodland management, quarrying and china-clay extraction, as is evidenced in some of the sites to be found flanking the Barn River, whilst in recent decades it has also been used for the disposal of waste from china clay operations – a major factor in the development of the landscape character of Hensbarrow Moor. Taken together all of these factors make the Valley a rich and valuable resource in the understanding of the development of this part of the Cornish landscape.

## 2.7 Landscape history

Summarised from the HES 2002 assessment (Cole and Smith 2002)

The Tregargus Valley takes its name from the settlement of Tregargus to its south. First recorded in 1356, the farm's name is derived from the Cornish place-name element *Tre* 'farmstead' which suggests an origin in the pre-Norman period (Padel 1985, 223-232). It also incorporates an unknown second element. Other farms incorporating the same initial place-name element which lie around the Valley include Trevear, Trethosa and Tregascoe. Each was recorded for the first time in 1327, though they are considerably older than that.

The Churchtown of St Stephen was recorded in 1200, though it was often known by the alternative name of Egloshellings at this time. Of the other nearby farms, Carloggas was first recorded in 1284, its name derived from *cruc* 'barrow' and *logaz* 'mice,' (Padel 1985, 73-74, 152) while Rescrowsa Farm was first documented in 1695. Rescrowsa is derived from *rid* 'ford' and *crous* 'cross' (Padel 1985, 72-3, 197-9). Goonabarn to the south includes the element *goon* 'downland, unenclosed pasture'

(Padel 1985, 108-109) demonstrating an early enclosure of open heathland. It was first recorded in 1312.

Later (19<sup>th</sup> century) settlements which grew up to the north of the study area were Hill Head (recorded on 1813 OS 1 inch map), Stepside and Higher Tregargus. Higher Tregargus immediately to the west of the study area was first recorded on the 1840 OS map as Trethewy's Tenement.

The St Stephen Tithe map (Fig 14) shows that the majority of the study area was associated with Tregargus Farm in 1840, while the accompanying apportionment documents a range of different land-uses prior to the development of china stone milling in the valley. The better land included that on the north-west side of the actual valley associated with Trethewy's Tenement and in Quarry Close, all of which was recorded as 'arable.' There was also pasture land to the west of the Valley in areas simply named 'Moor' (the word here having the meaning of poor, uncultivable land, including, in the south of the area, low-lying boggy land adjacent to the river). Along the Barn River itself, the apportionment records Outer Hill and Plantation as 'pasture and trees' while Hills was less wooded, recorded as '*furzy, stones and pasture.*' The fringes of two fields associated with Trevear and named Higher and Middle Rick Park were recorded as arable, though the part of the enclosures within the study area are very steep and almost certainly would have been wooded in 1840.

Of paramount importance to the development of the Valley was the Barn River which is likely to have long been used as a source of water power for corn mills, while possibly also being used in early tin extraction in this area, there being evidence for tin streaming activity in two areas of the valley base towards the southern part of the project area.

Post-medieval activities in the Tregargus Valley were probably not that dissimilar to other valleys in Cornwall at this time. Its woodland would have been exploited by farmers and craftsmen of the Tregargus, Trevear and possibly Rescrowsa holdings as pasture grounds (underwood), sources of fuel, coppice wood and timber. Local mines and miners may also have had a close relationship with the Valley, which could have provided both timber and charcoal (for smelting). Field banks (possibly boundary features) are clearly visible within the woodland and these areas may also include many other related unsurveyed redundant features such as tracks, charcoal burners' platforms etc. Analysis of the 1880 and 1907 OS maps show that the entire valley bottom included both deciduous and coniferous trees, suggesting a policy of deliberate planting which could have been undertaken after the end of early mineral exploration in this area as a means of partially reclaiming an 'industrial' landscape.

Charles Henderson records early evidence of mining in the parish of St Stephen-in-Brannel with a list of tin bounds in Brannel Manor dating to 1685 (Henderson 1935, 133-134). Some of the bounds can be identified from surviving place-names such as Drinnick, Goonabarn and Goverseth, though the majority may be more difficult to identify spatially with names like 'Good Speed,' 'Little Good Luck' and 'Vincent's Well.' Dr. Sandy Gerrard (1986) compiled a list of early tin works from various historic documents as part of his PhD research into early mining activity, his lists including a considerable number within the St Stephen Parish from as early as 1508. Given the possible tin streaming remains identified through the HES 2002 archaeological assessment, it may be that some of the tin bounds recorded by Henderson or Gerrard relate to the Valley.

By 1807, R. M. Barton noted that there were seven china clay pits in the St Stephen area, each with its own china stone quarry. "These comprised two at Treviscoe, two at Hendra and one each at Trethosa, Goonvean and Goonamarris. One, and perhaps both, of the Treviscoe works was on lease to Wedgewood; the Goonvean and Trethosa pits were those being worked by Warrick and Dickins and the Hendra Works (Hendra and Treleavour) were being worked by the Hendra Company. To these must be added the pit on Carloggas Moor occupied by Spode and Wolfe, and the works of Warrick and

Dickins on Hallow Moor to the north and also 'at St Stephens' (Barton 1966, 40). Barton also attests that the land noted 'at St Stephens' refers to the Tregargus Stone Quarry, which was recorded for sale in 1807 (Sherbourne Mercury, 16<sup>th</sup> November 1807) as "adjoining the great china clay works of Wedgewood, Spode, Woolf, Close and others." This is borne out by the St Stephen Tithe map of 1840 which records the Lower Quarry within an enclosure known as 'Quarry Close.' This map also describes the area around and to the north of Rescrowsa Clay Pit as 'Moor and Clay Pits' at this time.

In 1849, the china stone producers came together with a scheme which attempted to regulate the price of their raw material. A scheme was agreed in which they agreed to control output in order to maintain a good price in November of that year. By 1858, Wheal Arthur was recorded as producing 800 tons of potting clay each year. At this time it was owned by Coode and worked by R. Martin and Lovering.

The arrangement of china stone quarries and mills within the valley and their supporting infrastructure continued to grow during the early 20<sup>th</sup> century, revisions of the Ordnance Survey 25" to the mile maps dating to 1907 and 1930 demonstrating this process well (Figs 15 - 20). In the post-war years, however, quarrying and milling within the Valley seems to have gone into a rapid decline as the demand for second grade china stone fell away, the last mill closing down in the mid-1960s. At present, the only china stone quarry still at work is at Restowrack, not far away to the north. Most redundant mills were stripped of their roofing slates, doors and windows and most of their iron components. Abandoned to the elements, they soon began to deteriorate, whilst parts of the site were used by local people for rubbish disposal.

Subsequent to the abandonment of the Tregargus mills, mica waste was disposed of into Higher and Lower Tregargus Quarries by pipeline (this process being virtually complete by the mid 1980s), a haul road was laid down through the upper section of the Valley and the mica lagoons were blanketed with sand and stent to allow them to revegetate, this process burying (or almost completely burying) two mills (Long Incline and Short Incline), partly burying a third (Blacksmith Mill), destroying parts of the settling tanks to the south of Wheal Arthur and obscuring sections of original roadways and leats.

The agreement of a lease between the china clay companies and the Tregargus Trust a decade ago laid the foundations for tackling some of the issues affecting the valley and its sites, whilst this management plan aims to continue that process, arresting structural decay and dilapidation and enhancing access to and enjoyment of the Valley as a whole.

## **2.8 History of the china stone industry**

The extraction of china clay dominates the upland landscape of the Hensbarrow Moors north of St Austell. For the past two hundred years it has been a powerful economic force in Cornwall, and in the 20<sup>th</sup> century has outstripped and eclipsed Cornwall's traditional industries of hard-rock mining for tin and copper. China clay is a soft white mineral, formed by the decomposition of feldspar in granite at a time when the igneous mass was in the post-intrusive stage. This process of decomposition is known as kaolinisation, and the altered product as kaolin, after the Chinese mountain Kao-Lin where this mineral had been located in antiquity.

The Chinese were pre-eminent in the manufacture of porcelain or hard-paste ware, and for centuries only they knew the secret of its manufacture. The European potters used re-deposited china clay (ball-clay) for their white earthenware, but had no knowledge of the second essential ingredient of fine porcelain – china stone. China stone is a local form of partially kaolinised altered granite with a low iron content and is found in close proximity to fully kaolinised granite. In china stone there is sufficient feldspar to act as a flux when ground, mixed with china clay and fired to form the body of hard paste wares, William Cookworthy remarking that the '*the clay is the*

*bones of the body and the stone is the flesh'*. On firing at high temperatures, this mix vitrifies to produce the translucent, delicate ware highly prized as fine porcelain.

William Cookworthy, born in Kingsbridge, Devon, in 1705, was the first to recognise these minerals in Cornwall and their relevance to the potter's search for the materials required for the production of true porcelain. Working from details of the Chinese process contained in two obscure essays by a French Jesuit priest, Cookworthy became engaged in a search for kaolin and china stone in Britain. As a wholesale chemist based in Plymouth, he took frequent business trips on horseback through Cornwall; eventually, in the 1740s, he identified the minerals he sought at Tregonning Hill in the parish of Germoe, and in the parish of St Stephen-in-Brannel. The Cornish had in fact been using these materials for centuries, though not for pottery. Quarried on a small, local scale, china stone had been used in building as an easily-worked freestone, whilst china clay itself had found some use as a lining for smelting-house furnaces. Indeed, if the quarries had not already existed, Cookworthy would have found his prospecting far more difficult.

Cookworthy went on to establish his own porcelain manufactory, first in Plymouth, then Bristol, and the future of the extractive industry in Cornwall (and Devon) was assured. While china clay went on to have a multitude of uses in the modern paper, chemical and pharmaceutical industries, china stone has only ever found a market in the potteries. As a result, its production has always been small-scale and very specialised.

China stone was and is quarried from the ground in the same manner as any other granite, unlike china clay, which in its soft form lends itself to hydraulic means of extraction. The stone quarries are always found close by the clay pits and were often worked in association with them, the high value of the stone offering a useful buffer to the clay companies in times of recession. Traditional methods of working the often loosely jointed stone included drilling the rock with hand held 'jumpers', and splitting it by the use of wedges (the 'tare and feathers'). Gunpowder (later replaced by dynamite) was used in more recent times to 'heave' the large blocks of stone from the working face. The quarries producing the very best grades of stone are on the Rostowrack Downs near St Dennis; the quality of the stone is of prime importance for porcelain manufacture, as there must be no iron or other impurities in the rock that might mar the finished ware.

Four different grades of stone were originally supplied: the Hard Purple, Mild Purple, White and Buff varieties, which contained different proportions of the altered feldspar and purple fluorspar. More recently other grades such as Hard White, Soft White and Pons Mill were also produced, as well as de-fluorinated varieties. Each variety has its own use in the ceramics industry, and the grades were separately marketed and priced, the higher the feldspar content, the higher the price. From the mid-nineteenth century onwards, all the major clay producers on Hensbarrow had their own china stone quarries. The main areas of extractive activity were Rostowrack Downs, Slip Quarries near Goonvean, the West of England works at Quarry Close, Nanpean, and in the Barn River valley at Wheal Arthur and Tregargus. In addition, there were many smaller quarries throughout the region.

Initially, all china stone was shipped direct to the potteries in lump form, or dressed to size for mill pavers and runners. The very best stone continued to be sent direct in this way until the 1980s, as the pottery millers insisted on having it in lump form so that they could check its quality. They, often controlled by syndicates of potters, crushed and ground it in their own Staffordshire mills, and sold it as a liquid slip ready for use. In the latter half of the nineteenth century lesser grades of stone were ground in Cornwall in mills specially constructed for the purpose. Stone of this lower grade was used in the body of cheaper varieties of ware and not as a glaze; the product was sold dried and bagged from the Cornish mills.

Typical production figures were 1850, 11,600 tons; 1868, 29,000 tons; 1907, 68,174 tons. By 1932 the world slump had cut production back to the level of 1850. The market for china stone became severely depleted after 1945, when export markets shrank and other materials were adopted by the potters. Stone ceased to be ground in Cornwall in the 1960s. The entire output of Cornish stone in 1983 was 8,000 tons, supplied entirely from one quarry, and in 2001 was only about 4,000 tons per annum.

## 2.9 Cornish china stone mills

Cornish china stone mills were first established during the second half of the nineteenth century. Pontois Mill was in operation after 1876, and earlier schemes had been proposed in 1854. Trenowth was in operation by 1880. The location of the mills is highly concentrated, most being in the parish of St Stephen-in-Brannel. The first mill, at South Goonvean, was on the lower edge of the main quarrying area; Wheal Arthur, the Tregargus mills, Trevear, Lower Tregargus and Chapel Mill followed the Barn River south as their source of power. Terras Mill, Combe Vale and Trenowth are in the same general area, but dispersed to the south and west. The last of the mills to work was at Par Harbour, where the stone was ground dry. Outside the Hensbarrow district were the mills at Pontois Mill and Carmears in the Luxulyan Valley, and a complex of three mills at Kergilliack near Penryn.

Site	NGR	Surviving components (1985)	Status 2010
South Goonvean	SW 9470 5470	Pan kiln	Destroyed
Wheal Arthur	SW 9495 5453	Mill, pan kiln, quarry, tramway route	Deterioration
Big Wheel Mill, Tregargus	SW 9495 5400	Four mills, infilled quarries	Deterioration
Trevear	SW 9498 5385	Mill, pan kiln, cottage	Deterioration
Lower Tregargus	SW 9477 5370	Mill	Deterioration
Chapel Mill	SW 9485 5310	Mill, pan kiln	Deterioration
Gwindra	SW 9510 5295	Two kilns	Some remains
Combe Vale	SW 9485 5149	Mill	Some remains
Trenowth	SW 9355 5053	Mill, two pan kilns	No change
Kergilliack	SW 7820 3402	Three mills, pan kiln	One mill destroyed
Wheelpit Mill, Carmears	SW 0656 5669	Mill	No change
Pontois Mill	SW 0723 5630	Mills, pan kiln	Mills destroyed

The basic construction of all the mills followed a similar pattern, although there were detail variations. An overshot waterwheel in its pit was commonly flanked by a mill building on either side, often all under a single roof. Horizontal shafting was driven from the hub of the wheel, running in tunnels beneath the floors of the mill buildings (see Fig 26). Vertical shafts were driven by bevel gears from this mainshaft, and these rotated in the centre of the grinding pans on the upper floor (see Fig 25). The circular grinding-pans, normally one or two on each side of the wheelpit, were usually constructed with granite sides and floored with china stone 'pavers' (though some examples (as at Tregargus) were constructed of brick. Attached to the central rotating shaft was a four-armed cast-iron 'gate' – the arms of the gate supported vertical

wooden uprights shod with iron feet, which pushed large blocks of china stone (the 'runners') around the base of the pan. Each pan had a piped supply of water and a drain hole in the base which could be unplugged to empty the pan (see Figs 23 and 24).

Lump stone from the quarries was piled in a yard at the front or rear of the mill and knapped by hand to a suitable size for grinding (in later years a jaw crusher was used for preliminary size reduction, whilst Pons Mill employed pneumatic stamps in addition). The stone was barrowed into the mill, and loaded into the pans which were then filled with water; the water-wheel was set in motion, and as the gate and runners rotated, the stone was gradually wet-ground to a creamy slurry. The miller would test the contents of the pan at intervals by taking a sample on his tongue and pressing it against the roof of his mouth. When he judged it to be sufficiently fine, the ground stone was run off through launders to dumb buddles, after which it was classified, the coarse material being reground. It was then sent to settling tanks. This process was lengthy one, and it would take a day or more to grind a load of stone. The contents of the settling tanks were dried on the floor of a pan-kiln, in the same fashion as china clay. Sometimes this kiln would be attached to the mill itself, as at Trevear; in other cases the kiln would be entirely separate (Wheal Arthur) or located some distance away (Tregargus) with the slurry despatched to the kiln via a pipe-line. The dried china stone, converted to a fine talc-like powder, was then bagged for shipment. The mills commonly ground not only china stone, but also other materials according to demand – quartz sand for use in abrasive cleaning powder (at Cornwall Mills, Par Harbour), shell stone (iron-rich granite), feldspar for high-grade insulators, and flint for the potteries (for example at Trevear Mill).

As demand for second-grade china stone fell after 1945, Cornish stone mills ceased to work one by one. In most cases the water-wheels and machinery were stripped for scrap, either legitimately or surreptitiously by local 'metal sharks'. Some mill buildings were subsequently demolished, and most of those which remain are now roofless and ruinous.

### **3 Previous studies**

In 2002, Cornwall Archaeological Unit (now Historic Environment, Cornwall Council) were commissioned to produce an archaeological assessment of the Tregargus Valley by English Heritage. The resulting report (Cole and Smith 2002) combined all readily available documentary information in the public domain with the results of a detailed walk-over survey which extended beyond the area managed by the Tregargus Trust, including in particular a section of the valley to the north of the Wheal Arthur complex which takes in the site entrance and Wheal Arthur Quarry, and also a strip of land on the eastern side of the Barn River. The report also included some preliminary management recommendations. The principal sources consulted were:

- The HE Sites and Monuments record.
- Extracts from Herring and Smith's 1991 archaeology survey of the Hensbarrow china-clay district
- Sharpe and Smith's 1985 survey of Chapel Mill china stone mill complex at St. Stephen in Brannel
- Aerial photographs within the CC photographic archive
- Copies of historic maps held by HE including Gascoyne's maps of 1699, Martyn's map of 1748, the OS 1<sup>st</sup> Edition 1" to the mile map and survey sheets (circa 1810), the 1842 Tithe Map for the parish of St. Stephen in Brannel and the OS 1:2500 mapping dating to 1880, 1907 and 1930.
- Information resulting from the 1994 Cornwall Landscape Assessment



- Primary sources in the Courtney Library (Cornwall Museum) and Cornwall Record Office.
- Published sources.
- Scheduling and Listing descriptions for Big Wheel Mill

An ecological assessment of the valley was undertaken by Cornwall Environmental Consultants Ltd. (CEC) in 2002. In addition, an (undated) assessment of the Barn River had been undertaken by the Westcountry Rivers Trust, whilst a bat survey was undertaken by English Nature in 2003. JNC Safety Services of Truro have undertaken an H&S audit of the valley, whilst the Tregargus Trust has also undertaken some oral history research into the valley with the support of the Scarman Trust, this work involving children from local schools.

Some small-scale management works had been undertaken by the Tregargus Trust through the CAU Scheduled Monument Management Programme, including repairs to a bridge at the rear of Big Wheel Mill and a tramway bridge to its east (these being reported on by Cole in 2004). Other minor works have also been undertaken to some of the structures by the Trust.

In 2009, Knevitt Consulting of Wadebridge were commissioned by HE Projects to carry out a structural survey of the remaining buildings within the Valley, the survey report being completed in November 2009; the results of the survey have been incorporated into this report. Mica Mill, at the southern end of the Valley was not included within this assessment due to uncertainties about its ownership status at the time of commissioning.

In 2010, Spalding Associates of Truro were commissioned by HE Projects, Cornwall Council to undertake a habitat survey and impact assessment of the areas and structures proposed for works as part of this Conservation Management Plan. The survey was undertaken in May 2010 and the results of the study have been incorporated into this report. Due to a misunderstanding concerning the extent of the area leased by the Tregargus Trust at the time of commissioning, this survey covers the area of the 2002 archaeological assessment.

A full list of surveys and other information relating to the property are to be found in the bibliography to this report (Section 11).

### **3.1 Summary results from the 2002 archaeological assessment**

See Figs 4 – 5 for site locations

A total of seven china stone mills has been documented within the Tregargus Valley, of which five survive (with limited fragments of a sixth). The earliest two mills are likely to be the complexes of Wheal Arthur and Trevear, both of which had their own attached pan-kilns. Wheal Arthur had its own quarry at the northern end of the Valley, whilst the remaining mills were supplied from two quarries (Higher and Lower Tregargus) in the central part of the Valley.

#### Wheal Arthur China Stone Mill

This mill and associated structures at the northern end of the valley were first recorded on 1880 OS map, with their own attached processing arrangements. This is clearly one of the earliest two mills in the Valley, as it has its own pan kiln attached to the mill structure and was not dependent on the later arrangement of pumping the slurry away for final processing off-site. This complex includes the mill and waterwheel, pan-kiln and settling tanks, quarry, tramways connecting the mill to the quarry and the pan kiln, a number of leats, and a further detached waterwheel to the north which probably worked the pump in a nearby shaft.

The site has suffered to a degree from fly tipping and the effects of the construction of the ECLP haul road nearby, together with scrub growth, but is generally intact.

### Trevear Mill

First recorded on 1880 OS map along with its attached processing works, this china stone mill had previously been recorded as a 'flint mill' in Kelly's Directory of 1873. In subsequent directories, the mill was recorded as working china stone, while all that time remaining in the ownership of the Olver family. On the 1930s OS map, the mill was recorded as 'disused.' The Trevear Mill complex includes the mill, pan kiln, building and a remote chimney, plus the Miller's Cottage, as well as the tramway leading to it from the quarries near Big Wheel Mill.

This complex is in fair condition, though its structures are deteriorating and becoming overgrown.

The 1880 OS 25" map records three more mills in the centre of the Valley (below, Top Wheel, Blacksmith's Shop and Short Incline Mills) which, it might be argued, were later in date than the above. These mills did not have their own dries and pumped their clay slurry to Gwindra.

### Top Wheel or Long Incline Mill

According to Mr Roy Carkeek who worked in the Valley in the late 1940s (letter to John Yeo), this mill got its alternative name from having the "*longest incline from the crushing plant.*" He remembers it standing silent for many years before being brought back into operation "*in his time.*" He also states it had only a single grinding pan. This mill was first recorded on the 1880 OS map with a wheel attached to the southern end of the structure; it had been extended to the south by 1907 but was largely destroyed in the recent years through over-dumping during the infilling of Tregargus Higher Quarry, though parts of its eastern elevation appear to have survived, and protrude from the eastern side of the quarry infill.

### Blacksmith's Shop Mill

Mr Carkeek also states that this mill was so named because "*the older men said the Blacksmith shop was located there.*" Originally containing four grinding pans, the eastern half of the structure survives, as does its southern end, though these remains lie within an area of dense undergrowth and are currently difficult to access; the western and northern parts of the structure were over-dumped during the infilling of the adjacent china stone quarries. No surviving associated features were recorded during the 2002 fieldwork.

### Short Incline Mill

This mill was named because it had the "*shortest incline from the crushing plant.*" John Yeo states that a young boy was killed in the vicinity of this site in about 1947. A structure was recorded on the site of the mill in 1880 (covering the eastern part of the site later occupied by the mill) and by 1907 the OS map evidence clearly shows a stone mill. This structure does not survive, its remains having been completely buried when the southern china-stone quarry at Tregargus was infilled.

### Big Wheel Mill

This stone mill was constructed in 1898, and photographs of the structures here survive within the Cornwall Record Office and in the collection of the British Geological Survey (BGS), two of which (Figs 21-22) have been used in this report. An additional photograph is included in Barton 1966. It had six grinding pans and was one of the largest such mills in Cornwall. The waterwheel also survives in situ and this mill is protected as both a Scheduled Monument and a Listed Building. This complex includes the mill, the later winder house, tanks, leat and a tramway. In the general area to the south and east of the mill, there are a series of buildings including a blacksmith's shop and an associated chimney.

### Lower Tregargus / Mica Mill

This mill is known by two names; Lower Tregargus and as the 'Mica Mill.' This mill had four grinding pans and a double wheel, which no longer survives *in situ*. The Mica Mill complex includes the mill building plus evidence for a tramway, leat and aqueduct. In the Cornwall Record Office, a detailed pre-construction sectional elevation of the Lower Tregargus Mill survives from 1896 (CRO X223/20). The plan shows a number of features including mica runs, timber lintels, window openings, shafts and cranks, as well as the grinding pans (see Cole and Smith 2002, Fig 7).

### Other sites

As well as the evidence for china stone extraction, the Valley contains more limited evidence for china clay extraction and processing. The 1840 Tithe Map records a large area of pasture as 'Moor and Clay Pits,' an area which includes the site of three disused quarries marked on 1880 and 1907 OS maps as well as the site of the Rescrowsa China Clay Works.

The Rescrowsa China Clay Works is first recorded on the 1930s OS 25" map along with mica drags. It is likely that settling tanks to the south of the mica drags were also associated with the pit, although the tanks were recorded at an earlier date on the OS 1907 25" OS map. The clay pit itself is large but shallow and is now occupied by open woodland; the only surviving structure at the pit is a single storey blacksmith's shop.

Other sites in the Valley include four infilled quarries in the north-western part of the Valley, these probably being small-scale china clay pits or china-stone quarries. Linear hollows adjacent to the western side of the track entering the Valley from the north were probably small scale, possibly early, china stone quarries associated with Wheal Arthur, some of these connecting to the main Wheal Arthur china stone quarry. Two large, now infilled, china stone quarries (Higher and Lower Quarries) lie to the north-west of Big Wheel Mill whilst three small quarries in the valley base and on the eastern valley side nearby probably provided building stone.

There are also two possible sites of corn mills; one surviving as low ruins lies immediately to the east of the Barn River near the centre of the project area, being identified in the field by John Yeo of the Tregargus Trust; the other, nearby, was documented on the 1907 OS mapping but its site has since been buried under a mica lagoon.

Evidence for other activities in the Valley takes the form of at least one area to the north of Trevear Mill where the original course of the Barn River has been diverted to the west to allow the streaming of the alluvium in the valley base, leaving a very substantial linear hollow and an adjacent area of disturbed ground to the west. Further, well-preserved evidence for tin streaming is found in the form of a series of low parallel banks of water-washed stone set diagonally to the river in an area to the north of Mica Mill. This area also sites a small number of what appear to be prospecting tunnels into the alluvium blanketing the valley floor.

There are also a number of weirs and stretches of leat, these supplying waterwheels used to drive a pump, the grinding wheels in the china stone mills, and at least one corn mill. Subsequent large scale dumping of waste from china clay pits and china stone quarries in the valley has disrupted the earlier arrangement of many of these water channels, whose layout is best understood from the 1880 OS 25" mapping.

Waste dumping associated with clay and china stone working has also substantially altered the topography of the valley in a number of areas. To the east of the Rescrowsa clayworks the creation of a series of substantial mica lagoons between 1907 and 1930 has resulted in the course of the Barn River being diverted some distance to the east, covering the site of the documented corn mill, whilst to the east of Higher and Lower Tregargus Quarries, dumps containing large volumes of waste rock occupy the centre of the valley; the Barn River kinks around these features, again suggesting a diversion of its original course. At the northern end of the valley,

mica flows from the clayworks to the north have buried the original valley floor, whilst in the central and southern parts of the valley Higher and Lower Tregargus Quarries have been deliberately infilled with mica waste, whilst the haul roads created to carry stent (waste rock produced by china clay working) to top off the infilled quarries are far broader than they originally were, in places this widening resulting in the partial removal of features and the burial of others. Other smaller-scale works to install sub-surface pipework carrying waste water from clayworks, or decant water from settling ponds have resulted in further localised damage to the areas they transect.

### **3.2 Summary results from the ecological survey**

See Fig 93. Note that this survey covers a slightly larger area than that managed by the Tregargus Trust. Any recommendations made in the following sections relating to land not managed by the Tregargus Trust should be considered as advisory only.

#### **3.2.1 Background**

The Tregargus Valley supports habitats of nature conservation importance, falling within the St. Austell China Clay Area which has been targeted as an area for biodiversity conservation by the Cornwall Biodiversity Initiative. Key habitats include lowland heath, ancient, species-rich hedgerows, wet woodland and lowland acid grassland.

Tregargus Valley is a wooded river valley that has been intensively disturbed by industrial activities primarily associated with the working of china stone. There are numerous derelict structures including quarries, leats, adits, tunnels, chimneys, mills, areas of re-vegetated disturbed ground and a lagoon. The Tregargus Trust manages the site and is seeking to preserve the historical mining features and to promote safe public access around the site. It is planned that the valley will also be managed to retain and enhance the wildlife interest of the site.

The ecological interest of Tregargus Valley was first assessed in February and April 2002 by Cornwall Environmental Consultants. There have been bat surveys carried out by Natural England concentrating on some of the adits and a Resource Management Plan written by the Westcountry Rivers Trust (undated). There are also occasional wildlife records from the Tregargus Trust.

Historic Environment Service Cornwall Council requested an updated ecological survey to inform this Conservation Management Statement. An up-to-date records search for species recorded in the area was also commissioned from the Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS). A walkover survey was carried out on 12<sup>th</sup> May 2010 by J. Pilkington of Spalding Associates (Environmental) Ltd. Habitats were recorded and mapped according to Phase 1 Habitat Survey methodology and species lists compiled. Habitats and species were evaluated for their conservation importance. Parts of the site were inaccessible due to dense vegetation and limited time on site meant that a detailed survey of all areas was not possible.

From the updated ecological survey and previous survey reports information on protected, Biodiversity Action Plan (BAP) and Red Listed species have been extracted. Noteworthy and Biodiversity Action Plan Habitats have also been listed in order to identify which species and which habitats might be most threatened from the proposed activities and which might benefit; this is intended to inform working methods and protocols.

#### **3.2.2 Results from the desktop survey**

A list of vascular plant species found in Tregargus Valley on the May 2010 survey is included in the Appendices to this report. Species that were found only in 2002 are indicated. Habitats and species located during the field survey have been assessed for their significance according to the following sources:

#### International significance

- European Habitats and Species Directive (CEC, 1992)
- European Red Data lists (IUCN, 2000)
- European Council Birds Directive (CEC, 1979)

#### National significance

- The Conservation (Natural Habitats, &c.) Regulations 1994 and amendments
- Wildlife and Countryside Act 1981 and amendments
- Countryside and Rights of Way Act 2000
- Natural Environment and Rural Communities Act 2006
- Protection of Badgers Act 1992
- The Hedgerow Regulations 1997
- UK Biodiversity Steering Group reports (UKBSG, 1995 and updates)
- UK Biodiversity Action Plan: Species and Habitat Review, 2007
- British Red Data Books and Lists (various authorities)
- Birds of Conservation Concern 3; the population status of birds in the United Kingdom, Channel Islands and Isle of Man (fourth, 2009, review) (Eaton *et al*, 2009)
- Guidelines for Selection of Biological SSSIs (NCC, 1989 and updates)

#### Regional, county and local significance

- Southwest Regional Biodiversity reports (Cordrey, 1997 and additions/updates)
- Cornwall Biodiversity Initiative Volume 3 (CBI, 2004)
- Flora of Cornwall (French, Murphy and Atkinson, 1999)

Red listing based on 2001 IUCN guidelines:

The following abbreviations have been used in the following sections:

EN = Endangered - A taxon is Endangered when not Critically endangered but facing a very high risk of extinction in the wild in the near future.

VU = Vulnerable - A taxon is Vulnerable when not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium term future.

NT = Near Threatened - this category includes species which occur in 15 or fewer hectads but do not qualify as Critically Endangered, Endangered or Vulnerable.

BAP = Biodiversity Action Plan Lists: Species or habitats for which Action Plans have been/are being written.

#### Notable species

- **Skylark**- Skylark *Alauda arvensis* was listed in the 2002 report as having been recorded in the grid square SW 9554. The valley was not thought a suitable site for this species and it remains very unlikely. The quarries with developing heathland now provide potential nesting habitat but the area is small and too close to well used tracks. The grassland high up on the west side of the valley could potentially provide nesting sites for this species if the leasehold is acquired. Skylark is a UK BAP species and is red listed as a species of conservation concern (Eaton *et al*, 2009). Skylark and other birds are protected from disturbance whilst nesting.
- **Reptiles** – Track edges and the area of open vegetation and developing heathland in the quarries and Wheal Arthur potentially provide suitable habitat for BAP reptiles such as Adder *Vipera aspera*, Viviparous Lizard *Zootoca vivipara* as do walls and piles of stones. Grass snake *Natrix natrix* was recorded in July 2004 at SW 9453 and could use areas of tall or rank vegetation alongside tracks and occasionally around the built structures.
- **Badgers** – Evidence for the presence of Badger *Meles meles* was noted at the south end of the valley in a hedgebank bordering a field in 2002. Two sett

entrances were noted here and were in use at that time. No setts were noted here in the May 2010 survey and the hedgebank had suffered recent disturbance with some trees and scrub cleared and soil scraped from the side and placed on top. No other evidence for Badger was noted in the 2010 survey. There were many small paths and tracks in the areas of woodland and scrub but no definite signs were found to indicate the presence of this species. However, Badger is known to be active on the site and an active sett is known in the woodland east of the main track at SW 951 543 (John Yeo, pers. comm). The location of this sett is shown on Fig 93. There is also a report of Badger activity near the chimney (Cole and Smith 2002, structure 88) on the east of the Barn River at SW 951538. Badgers and their setts are legally protected from disturbance and destruction.

- **Bats** – The valley provides ample opportunities for roosting bats and offers very good foraging habitat. Greater Horseshoe *Rhinolophus ferruquinum* and Lesser Horseshoe *Rhinolophus hipposideros* are known to use the adits for hibernation and records for both of these species exist from winter 2003 and 2004. Natural England carried out a bat survey in Tregargus Valley and as a result of their findings bat-friendly grilles were fitted over almost all adits. The two Horseshoe species are UK BAP priority species and are on the Global Red List; The Greater Horseshoe is classed as Conservation Dependant and Lesser Horseshoe is classed as Vulnerable. Other species of bat are likely to roost or feed in Tregargus Valley. There are many features in the derelict built structures that provide potential bat roosting habitat. Bats will also roost in trees with holes, crevices, flaking bark or dense Ivy. Bats and their roosts (whether they are present in the roosts or not) are protected by legislation from disturbance and destruction.
- **Dormouse** – The woodland, scrub and hedgebanks provide suitable habitat for Dormouse, a UK BAP priority species, which is legally protected from interference with places used for shelter and disturbance when in these places. No signs of Dormouse were found on the current survey and there are no previous records for this species in the valley. However, no detailed survey has been undertaken.
- **Chamomile** – Chamomile has been recorded just outside the site boundary to the northeast at SW 949 546. This BAP species is classified as Vulnerable according to IUCN guidelines and could be present in short open grassland e.g. in the disused quarries at Tregargus Mill although none was noted in 2002 or during the recent survey.

**Ivy-leaved Bellflower** – This Near Threatened species was present at the edge of developing heathland in the quarries.

- **Japanese Knotweed** – This species was originally known from two sites in Tregargus Valley. The site near the north entrance appears to have been successfully controlled. The site at the quarries (see Fig 93) still exists (John Yeo, pers. comm..) but is obscured by taller vegetation and was not seen during the 2010 survey. Japanese Knotweed *Fallopia japonica* is a vigorous perennial plant which excludes other plant species which cannot compete with its tall summer growth or the thick mulch of decaying canes and leaves in winter. It forms stands of dense canes and spreads mainly vegetatively, from the stems, the crown and the rhizomes. The rhizomes can form an extensive underground network extending up to several metres from the plant and going down deep into the soil. The rhizomes have been shown to be viable 3 metres below ground in disturbed conditions. Japanese Knotweed can regenerate from very small amounts of tissue; less than 0.2 grams of rhizome can produce roots and shoots. Rhizomes can also remain dormant for several years, particularly when treated with sub-lethal doses of herbicide. Transportation of material downstream within river systems and movement of soil contaminated

by plant fragments are major ways in which new sites are established. It is an offence to cause the spread of this species in the wild.

### Notable habitats

The following types of vegetation are of ecological significance at this site:

- **Deciduous Woodland** – Most of the site is covered by mixed deciduous woodland, a BAP habitat with Oak *Quercus* sp., Beech *Fagus sylvatica* and Sycamore *Acer pseudoplatanus* with frequent Downy Birch *Betula pubescens*, Honeysuckle *Lonicera periclymenum*, Holly *Ilex aquifolium*, Hazel *Corylus avellana* and Hawthorn *Crataegus monogyna*. Ash *Fraxinus excelsior*, Elder *Sambucus nigra*, Common Gorse *Ulex europaeus*, Broom *Cytisus scoparia* and Blackthorn *Prunus spinosa* are occasional. Horse Chestnut *Castanea sativa* was noted in 2002. Although there are areas of secondary woodland and areas dominated by Sycamore to the southeast there must have been woodland in the valley for a long time as there are several Ancient Woodland Vascular Plant species present. These include Wood Anemone *Anemone nemoralis*, Wood Sorrel *Oxalis acetosella*, Climbing Corydalis *Ceratocladia claviculata* and Bluebell *Hyacinthoides non-scripta* (Rackham, 2006). Introduced scrub such as Rhododendron *Rhododendron ponticum* and Wilson's Honeysuckle *Lonicera nitida* are occasional. South of the quarries at Tregargus Mill on the west side of the valley is an area dominated by coppiced Hazel providing an attractive habitat for Dormouse. Bluebells dominate the ground flora here.
- **Wet woodland** – There are small areas of wet woodland, a BAP habitat, dominated by Grey Willow *Salix cinerea* ssp. *oleifolia* with occasional Goat Willow *Salix caprea*, Oak and Ash. Wetland herbs are present here including Opposite-leaved Golden-saxifrage *Chrysosplenium oppositifolium*, Hemlock Water-dropwort *Oenanthe crocata* and Lady Fern *Athyrium filix-femina*.
- **Developing heathland and open vegetation** – the heathland in the quarries along the west side of the valley has developed since the 2002 survey and ericaceous shrubs now cover more than 25% of the ground in some areas which can now be mapped as dry dwarf shrub heath according to the Phase 1 Habitat survey methodology. Lowland heathland is a European BAP Priority habitat but as this is such a small area it is only of local importance and increases biodiversity in the valley. There are further areas of open vegetation around Wheal Arthur where much of the scrub has been cut back. These habitats are potentially valuable for reptiles and invertebrates. Heather *Calluna vulgaris* is the predominant shrub and Bell Heather *Erica cinerea* was present rarely. There has been some management in these areas with evidence of burning and clearance of scrub. Common Gorse, Bramble *Rubus fruticosus* agg., young Willow and Downy Birch are still present but are low-growing. Herbaceous species associated with heathland are also present including Red Fescue *Festuca rubra*, Sheep's-sorrel *Rumex acetosella*, Bird's-foot-trefoil *Lotus corniculatus*, Common Bent *Agrostis capillaris* and Bristle Bent *Agrostis curtisii*. Other parts of the disused quarries support open vegetation with grasses such as Yorkshire Fog *Holcus lanatus*, Sweet Vernal-grass *Anthoxanthum odoratum* and Field Wood-rush *Luzula campestris* with Soft Rush *Juncus effusus*, Ivy-leaved Bellflower *Wahlenbergia hederacea* and Greater Bird's-foot-trefoil *Lotus pedunculatus* indicating poor drainage. There are abundant mosses over much of this area.
- **Lowland acidic and neutral grassland** – There are small areas of these BAP habitats in the Tregargus Lower and Higher Quarries with locally occasional species characteristic of acidic grassland such as Sheep's-sorrel. These areas are of local conservation interest only due to their size.
- **Marshy grassland** – There are small areas of BAP marshy grassland, of local interest only, where there is poor drainage with frequent-abundant rushes,

mostly Soft Rush but also occasional Slender Rush *Juncus tenuis*, and Yorkshire Fog with Greater Bird's-foot-trefoil, Wild Angelica, Water Figwort *Scrophularia auriculata*, Hemlock Water-dropwort and Marsh Thistle *Cirsium palustre*. Ivy – leaved Bellflower was noted in the quarries and in one damp area around the buildings at Wheal Arthur where there are also small areas of standing water with Duckweed *Lemna* sp. and Sweet-grass *Glyceria* sp.

- **River and streams** – The water courses are BAP habitats and are protected by the Water Resources Act. They are generally shaded and the banks of the river support a woodland flora but there are occasional wetland species such as Hemlock Water-dropwort, Opposite-leaved Golden-saxifrage and Yellow Flag *Iris pseudocorus*. There are no records for Otter at this site but the habitat is suitable. The small shallow stream alongside the track at the north end of the site is of poor water quality (rusty in colour) but supports a greater range of common species along the generally more open banks. Brooklime *Veronica beccabunga* is present in the small stream at the south end of the site.
- **Hedges** – the hedges along the boundaries of the site qualify as BAP habitat and support a good diversity of species.

**Additional habitats**

The fields to the north west of the site support agriculturally improved grassland with some slightly more species-rich semi-improved grassland on the steeper slopes at the edge of the woodland where there is Field Wood-rush, Sweet Vernal-grass and Common Bent with occasional Common Dog-violet *Viola riviniana*, Creeping Buttercup *Ranunculus repens* and Common Mouse-ear *Cerastium fontanum*.

The edges of the two-year old unvegetated track down the centre of the valley where the scrub is cut back support a wide variety of herbaceous species with grassland, woodland and hedgerow species. There are occasional wetland species and rushes, including Slender Rush.

Patches of dense Bracken with occasional scrub and Bluebells dominate small areas of the site particularly on the west side on the higher part of the slope. Mixed scrub dominates areas around the quarries on the west side and elsewhere. Species include Common Gorse, Bramble, Hawthorn, Blackthorn, Elder and Broom. Non-native Butterfly-bush *Buddleja davidii* is occasional.

The lagoon supports very little aquatic vegetation but where the banks are not dominated by overhanging Grey Willow (and occasional Common Gorse) there are a few wetland species at the edges including Soft Rush, Hemlock Water-dropwort and Yellow Flag.

The derelict buildings are a special feature of the site and have some importance ecologically as well as historically. Nesting birds and roosting bats could use these features and it is possible that reptiles such as Adder and Common Lizard frequent these areas where they are not too shady. Some scrub and woodland have been cleared on and around these structures but much of this is now re-growing. Ivy has been cut at the base in many places. Greater Horseshoe and Lesser Horseshoe bats were seen in an adit at SW 948 545 in January 2003 (Carol Williams – Roost Report Form supplied by the Tregargus Trust) and apparently hibernate there. Only one individual of each species was seen but more are likely to use deeper areas and other adits/tunnels etc. There are other records for these two species at Tregargus during November 2004 (ERRCIS, 2010). Crevice dwelling bats are also very likely to roost in some of the buildings.

**Table 1: Species of particular national significance recorded in the project area**

Greater Horseshoe <i>Rhinolophus ferrumequinum</i>	UK BAP Priority Species, also protected by European and UK legislation. Greater Horseshoe Bats are known to use adits in the valley.
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Lesser Horseshoe <i>Rhinolophus hipposideros</i>	UK BAP Priority Species, also protected by European and UK legislation. Lesser Horseshoe bats have been shown to use adits in the valley.
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**Table 2: Legislation relevant to the site**

<b>Species</b>	<b>Main legislation or policy</b>	<b>Significant habitat and recommended timing</b>
Bats	Conservation (Natural Habitats etc) Regulations 1994 Wildlife and Countryside Act 1981 and amendments (Schedules 5 & 6) Countryside & Rights of Way Act 2000	Greater and Lesser Horseshoe bats are known to use adits/tunnels for hibernation. Shafts, adits, tunnels, chimneys as well as crevices in derelict mining structures and trees could be used by roosting bats. Dense Ivy over buildings and mature trees with holes and crevices at all times. Work should ideally be carried out in May or September. Work during the hibernation period should be avoided. Work should be preceded by bat surveys.
Badger	Protection of Badgers Act 1992	Active sett known in woodland east of the main track and there are reports of a sett near the chimney east of Trevear Mill (structure 88). An active sett was also recorded at the south end of the site in 2002 along a hedgebank. Although no evidence of badger occupation was noted in 2010 they could return. Badger setts could also exist areas of dense scrub. Legislation protects badgers from disturbance and lists restrictions on works within 30 metres of an occupied sett at all times. However, recent changes in legislation reflect the tolerance of this species to vegetation clearance.
Reptiles	Wildlife and Countryside Act 1981 (and amendments) Countryside & Rights of Way Act 2000	Scrub/grass/ open dry vegetation mosaic, walls and piles of stones. Grass Snake could occur in tall herbaceous vegetation. Clearance of scrub and tall herbaceous vegetation should take place in the active season.
Breeding birds	Wildlife and Countryside Act 1981 (and amendments) Countryside and Rights of Way Act 2000	Work on scrub, trees and built structures during the nesting season March to August should be avoided.
Dormouse	Wildlife and Countryside Act Schedules 1,5 and 8 (protected birds, animals and plants)	There has been no detailed survey for Dormouse in the valley which offers suitable habitat for this species. Major woodland management, coppicing/clearance etc should be preceded by a survey for this species.
Japanese Knotweed	Wildlife and Countryside Act 1981 Schedule 9	It is an offence to plant or otherwise encourage the growth of Japanese Knotweed in the wild. Japanese Knotweed is present in the quarries in the central part of the site. Cutting the plant or roots and/or disturbing the surrounding soil may encourage its spread if not correctly managed.
Rhododendron	Wildlife and Countryside Act 1981 Schedule 9	It is an offence to plant or otherwise encourage the growth of Rhododendron in the wild. This species is present occasionally in the wooded areas of the valley.
<b>Habitats</b>		<b>Location</b>
The river and stream	Water Resources Act 1993; the river and streams constitutes controlled waters; it is an offence to deliberately or accidentally pollute any controlled waters in England	The river and streams at all times.

## 4 Interim Statement of Significance

The Tregargus Valley contains the finest assemblage of china stone mills in Cornwall. They are set within a wider landscape which also includes the surviving industrial infrastructure of associated quarries, leats, pan kilns and tramways. China stone mills as a monument class are confined to Cornwall and the Staffordshire potteries, but the Staffordshire stone mills were not used solely for china stone and were principally used for flint grinding. Only in Cornwall are these stone mills found in direct association with their raw materials, and their complex supporting infrastructure is thus regionally distinctive. The Tregargus Valley mills, comprising Wheal Arthur to the north, the Tregargus group in the centre of the Valley, Trevear Mill and Lower Tregargus to the south, have a combination of Group Value, Survival and Completeness found nowhere else in Cornwall or Britain.

There are a small number of china stone mills elsewhere in Cornwall, some very close to the Tregargus Valley (see Section 2.5). Just to the south is Chapel Mill, which is the only stone mill still to have its machinery intact and is a Grade II\* listed building. This is an isolated example, however, and does not have the group value of the Tregargus Mills, though given its remarkable completeness, the opportunity should be sought to manage and interpret this site in combination with those at Tregargus. At Coombe there is the Coombe Vale Mill, which has been demolished to its foundations. Trenowth Mill survives in a reasonably complete condition, but is again an isolated example. The only other stone mills in Cornwall are the group of (originally) three at Kergilliack, near Penryn. Only the lowest mill of this group now survives intact. This excellent example is now deteriorating badly, and the Kergilliack group cannot rival Tregargus in terms of Setting or Group Value.

The study area is also uniquely placed in terms of its potential for public access and amenity. The Valley already possesses the rudiments of a footpath network, and the scenery, despite years of industrial activity, is beguiling and attractive. As is the case elsewhere in Cornwall, at sites such as the Kennall Vale Gunpowder Works or the Luxulyan Valley, the remains of industry now lend an additional dimension of mystery and romance to wooded valley landscapes. Such opportunities for multi-faceted conservation initiatives which can involve the local community and a wide range of environmental partners are few and far between. The Tregargus Valley is thus of prime importance and sits within the very top rank of such sites in Cornwall.

The woodland which covers most of the project area is a valuable habitat, but is also interspersed with developing heathland and open vegetation, also very valuable features of the site for wildlife. The valley also includes a number of gated adits which afford important bat roosting sites, in particular for Greater and Lesser Horseshoe bats.

## 5 Principal issues

Whilst the conservation works proposed as part of this project will necessarily focus on the china stone mills and associated structures in the valley, necessary associated works such as vegetation clearance, the enhancement of long term public access and the creation of temporary contractor's access to the structures will inevitably impinge on the wider site, including areas of actual or potential archaeological and ecological significance. These will also impose temporary restrictions on public access. Issues relating to the provision of interpretation and information during and subsequent to the works programme also need to be addressed. The entrance used by the public to access the northern end of the Valley (which is not on land managed by the Tregargus Trust) is adjacent to a lay-by and suffers from persistent and problematic fly tipping; it has also become infested with Japanese knotweed.

It is felt particularly important that a plan for the future management of the Valley, including the timing and nature of cyclical management works and for periodic review of the plan, should also be drawn up.

## 5.1 Vegetation management

The control of scrub vegetation will be essential for the future management of the site and will need to be undertaken in a series of locations prior to any building conservation works taking place. In some areas, scrub growth obscures buildings and impedes access to them, sometimes preventing the level of detailed survey and inspection required when drawing up specifications for conservation work; in some cases vegetation clearance will need to be undertaken before a full assessment of the condition of a building and its conservation needs can be determined. In other areas vegetation growth on structures is actively damaging them through root infiltration and the imposition of un-designed structural loadings (particularly where ivy is present or trees are growing from walls). The negative impacts of scrub growth on and adjacent to buildings are progressive and should be arrested wherever possible.

In places (in particular at Trevear Mill and Lower Tregargus Mill), trees have rooted into or immediately adjacent to structures. As these trees have become mature their roots have disrupted masonry, in some cases significantly (see Figs 76, 91-92). Elsewhere, mature trees were found to be leaning on or over structures (as for example at Trevear Mill), or had already collapsed onto them, causing significant levels of damage. Preferentially, any tree growing within five metres of any of these historic and important buildings, or any tree which has the potential to fall onto a building and cause significant damage should be felled. It is recognised, however, that given other interests in the site it will probably be necessary to negotiate the removal of any tree on a case by case basis.

It should also be noted that it was abundantly clear from the 2009/10 site inspections that simple felling of problem trees is not the answer. In many places where trees had been cut down by the Tregargus Trust vigorous coppicing had taken place, and regrowth was already several metres high. As a result all stumps should be treated with specialised non-persistent poisons to kill off roots and prevent such regrowth. It is now illegal to use ammonium sulphamate based chemicals for this purpose, but other options such as SBK or glyphosate-based products can still be used.

Alien species have also begun to spread out from the former garden adjacent to Trevear Mill, covering features within the surrounding area, including the pan kiln and linhay. This scrub will also need to be cut back and controlled.

The cutting down of scrub vegetation, including trees, will inevitably have visual impacts on the Valley, whilst the clearance of vegetation from on around buildings will change their appearance. Both operations must be carefully handled to avoid negative impacts on important habitats, whilst the rationale for the work and the necessity of undertaking it must be communicated to local people. Advice should be taken from the ecological consultant as to whether it is best to stack cleared scrub and trees and allow them to rot down on site, to chip them, burn them, remove them from site for disposal or to employ combinations of these approaches.

It should be noted that vegetation clearance could impact upon nesting birds, reptiles and possibly Dormouse and Badger. Communities with a diversity of vascular plants and habitats of nature conservation value such as the developing heathland and open vegetation in the quarries could also be affected.

## 5.2 Repair/consolidation of built structures

The structures proposed for conservation consist of a series of 19<sup>th</sup> and early 20<sup>th</sup> century china stone mills and associated structures, including a miller's cottage. Following the progressive abandonment of milling within the Tregargus Valley, all work ending in 1965, and the removal of water wheels and other equipment, the recovery of roofing and other materials for re-use from some buildings, structures in the valley were left unmanaged. Some were subsequently over-dumped or demolished during the after-use of the valley by IMERYS and Goonvean Ltd, or were affected by the

creation of access roads. Parts of the site have also been used by local people for fly-tipping.

Exposure to the elements and, in particular, the decay of the remaining incorporated timber elements and the surviving iron components, together with a degree of vandalism and theft, and the effects of encroaching vegetation has led to progressive dilapidation and destabilisation. Whilst the buildings were originally robustly constructed, over four decades of abandonment have taken their toll on their integrity and stability.

The rarity of these structures and their group value in particular establish a requirement that conservation approaches adopted respect their authenticity whilst meeting the requirements of the project to stabilise and consolidate them, so that they are assured a sustainable long term future. The range of interventions adopted must be appropriate to their building type, age and importance and the works undertaken should be limited to those required to achieve these ends. This work will involve the relaying of wall heads to prevent water ingress, repointing in lime mortar, some rebuilding where structural stability has been compromised, the replacement of rotten or missing timber lintels in hardwood and the stabilisation of corroded iron components. Some temporary propping of unstable masonry will probably be required and some of these props may need to be made permanent. It is also very likely that permanent props, struts or other repairs to waterwheels will be required to prevent their collapse.

Given the rarity and importance of these structures, it is particularly important that they are recorded in detail before any works take place, and that all interventions arising from the conservation works programme are also recorded.

### **5.3 Safety works**

There are several currently unsecured drops in a number of areas of the site which present potential hazards to the visiting public including deep wheel pits, a flooded shaft and upper floor windows and doorways which give onto drops; there are also a number of open adits, though most of these have recently been gated. Many of these features will become more accessible following proposed vegetation clearance and site works, and this will inevitably necessitate the provision of some discrete safety barriers. Where the current path network crosses bridges with low or no parapets, the Tregargus Trust has installed galvanised braided wire fences, but for new works of this type within the Valley chestnut post and rail barriers are recommended. These utilise sustainable materials, will blend in well, can be easily maintained, and have a good life span, even in damp environments.

In some areas, discreet signage may also be needed to alert walkers to the presence of hazards, and safety information should also be included on the interpretation panel which is proposed for siting at the northern entrance to the Valley (subject to the agreement of the owners of this land), with a second possibly sited at the southern end of the site, as well as on any self-guided leaflets relating to the Valley.

### **5.4 Impacts on the wider site**

As well as the china stone and clay works structures, the Tregargus site includes landscape evidence (principally in the form of earthworks) for other activities associated with tin streaming. Facilitating the conservation works to the buildings will inevitably have impacts on other areas and aspects of the site, and there is the potential for damage or other negative impacts to such landscape features, particularly where currently masked by scrub or trees. Good baseline information and the ability to work flexibly will be essential to avoid any collateral damage to other site features.

A range of works are required to provide safe and sustainable access to the buildings. These will include the clearance of vegetation and the creation of temporary roadways, storage and work areas, the safe scaffolding of the mills and some temporary safety works (as for instance temporary propping of unstable structures).

It is most important that the works to the structures in the Tregargus Valley, the works required to facilitate them, and any enhancement of public access do not negatively impact upon the nature conservation importance of the site. In particular, bats may occupy recesses in the masonry of the buildings or roost within the adits. Specialist pre-works surveys must be undertaken to ensure that significant habitats are not damaged or destroyed during the works and that protected species are not harmed or unduly disturbed. The project should also be designed to enhance the nature conservation value of the site and to broaden its biodiversity. Input from appropriate specialists will be essential during the project design and its implementation.

### **5.5 Plant and machinery movements**

There are no public rights of way through the Tregargus Valley, though there is a permissive public access into the valley from the road from Stepside to Goonamarris at its northern end, entering the land managed by the Tregargus Trust at the northern end of the Wheal Arthur complex. The path follows a haul road through the northern part of the valley down to the Tregargus china stone quarries. From this point southwards smaller paths provide access to Big Wheel, Trevear and Lower Tregargus mills, and to connections with public footpaths at the southern end of the valley. The northern part of this path between the main road and the Wheal Arthur works is owned and managed by Goonvean Ltd, and the Tregargus Trust will need to negotiate permission to use this route if, as seems likely, it is proposed as the contractors' access during the works programme.

Contractors will need to bring a certain amount of equipment (such as scaffolding, welfare facilities, temporary store buildings) onto site at the beginning of the contract, will need to bring materials such as lime, aggregate, sand and water to the site and to structures being worked on during the contract, and will need to remove waste, equipment and surplus materials from site at the end of the contract. Most of these movements will entail the use of vehicles. It will be particularly important that the routes to be used for any vehicle movements are agreed in advance and do not unduly compromise archaeological or ecological features. It may be necessary to lay down temporary roadways or sections of roadway using removable barrier membranes and hardcore where the ground is soft or otherwise prone to damage. Particular care will be required in the selection of contractors' access routes and thought given to the range of works required to make them usable on a temporary basis and the works which will be needed to rehabilitate these routes on the completion of activities.

Site working procedures should give walkers precedence over contractors where works vehicles need to negotiate any regularly-used path.

### **5.6 Impacts on the public at large**

Despite the lack of public rights of way to and through the Valley, the site is currently treated as *de facto* public access land. The works programme will inevitably require some temporary restrictions on those areas to which the public currently have access. Whilst this is inevitable (though will be temporary), the Project provides a good opportunity to disseminate information about the works programme, to provide updates on progress, to provide controlled access to groups with specific interests in the site, to promote the philosophy underlying projects of this type, and to raise the profile of the Tregargus Trust. Care will need to be taken to make sure that the working areas of the site remain closed to all but authorised visitors. It was also noted that a large number of pan kiln tiles had been removed from the Wheal Arthur dry

during the autumn of 2009, presumably for the construction of a patio; whilst these have now been recovered and placed in safe storage, vehicle access to the site must be controlled during the works and restricted following them to prevent any further similar vandalism.

## **6 Conservation philosophy relating to conservation proposals**

It shall be agreed by the Project Team that the philosophy underpinning the works should be that repairs undertaken to the buildings shall be a close match in terms of detail and materials, pointing styles should be consistent with those currently existing, and repairs should be intended to blend in and be consistent with the overall existing finish of the structures. Appropriate and traditional materials and methods of workmanship will be used throughout the works. Non original materials will not be used except in those limited areas where repairs are to be undertaken on structural grounds alone. These will be small scale and, where possible, rendered invisible (for example pinning of masonry, fleeting of wall pockets, repairs to waterwheel ironwork). Where new work is unavoidable to confer required structural stability, this must be agreed in advance and must not, if at all possible, impinge on the integrity of the building to which it is to be applied. In limited areas of the site, however, substantial interventions will be required to avert catastrophic collapse and to achieve required levels of public safety.

Works required to achieve the provision of materials access routes, storage compounds, pedestrian access routes, safety fencing, securing of elements of the scaffolding and other associated works will, wherever possible, be temporary and reversible, and take into account the archaeological and ecological sensitivities of the site.

Where adequate pre-works surveys are not presently available, these will be undertaken to guide the proposals and to ensure that they do not damage significant features or habitats.

All efforts will be taken not to damage any significant site feature or habitat during the works programme. Archaeological and ecological consultants will be involved in the finalisation of any decisions relating to groundworks, vegetation clearance or other works which would impinge on habitats, the siting of facilities &c, whilst allowance will be made for appropriate watching briefs for the duration of the works programme.

Reasonable provision will be made for continued public access to those parts of the site on which works are not taking place, including viewpoints of the work in progress, whilst information about the project will be made available to the public in safe locations on the site and via other means such as websites, information disseminated through the media, &c.

The setting up of the management agreement between IMERYYS and Goonvean Ltd on the one hand and the Tregargus Trust on the other was intended to help to safeguard the spectacular archaeology found within this valley. The conservation of the china stone mills, pan kiln, miller's cottage and other associated structures is a particular priority towards this end, but will have impacts which must be controlled to prevent damage to the overall significance of the Valley. The work proposed will necessarily involve the creation of access routes, materials storage areas, work areas for a range of specialist contractors, and the preparation of areas on which temporary buildings can be sited. Specialist scaffolding contractors will need to transport their materials to relatively inaccessible sites within the Valley. The works required to consolidate the buildings may be undertaken as a single project, or one phased over several years, but will not be achieved quickly, and will require an extended site presence, which must not conflict or interfere with other interests (such as habitats occupied by rare species, nesting birds or roosting bats). It must equally not result in the creation of public access to dangerous parts of the site, or to currently unstable structures. It is

particularly important that the conservation of the buildings is not achieved at the expense of damage to other areas of the site.

Quantities of materials will need to be brought to the site (the only vehicle access to the various structures being unsurfaced tracks), stored on it and transported to the structures to be conserved. Contractors will need to be given as safe a working environment as can reasonably be achieved, will need safe access routes to and from their place of work, and will require on-site welfare facilities, whilst the public must legally be excluded from all working areas.

As Big Wheel Mill is a Scheduled Monument, an application for Scheduled Monument Consent will need to be made to the Department of Culture Media and Sport at the earliest possible date in advance of the anticipated start of works. DCMS will need to be satisfied that the works are appropriate to the site, and that any residual unavoidable impacts can be adequately mitigated through detailed recording prior to and during the works by properly qualified specialists. It is likely that DCMS will require archaeological consultancy/watching briefs to be undertaken throughout the course of the works and an ecological watching brief may also be deemed appropriate. Big Wheel Mill is also a Grade II Listed Building and an application for Listed Building Consent will need to be made to Cornwall Council before works can proceed.

In the case of Scheduled Monuments it is an English Heritage requirement that a Conservation Management Plan (or if appropriate, a Conservation Management Statement) should be prepared for all designated sites on which work is proposed. This report is designed to satisfy that requirement.

## **7 Summary of current proposals for works to structures**

A detailed specification for the scope of works to the structures in the Tregargus Valley should be commissioned from a suitably qualified architect or engineer, building on the structural assessment carried out by the Knevitt Consultancy (2009). It should be noted that in view of the scheduled status of Big Wheel Mill, English Heritage may require that the architectural/engineering consultancy is certified as suitably qualified to specify and oversee conservation work to scheduled monuments. Specialised consultancy will also be required to determine the nature of the works which will be required to conserve and safeguard water wheels at Wheal Arthur and Big Wheel china stone mills.

The final detail of the works specification will need to be agreed between the Tregargus Trust, English Heritage, Cornwall Council planners, the Historic Environment Consultant and the Environmental Consultant, and is likely to require the incorporation of specialist input from a structural engineer, from scaffolding sub-contractors and from a crane hire company, taking on board feedback from other interested parties.

The building works listed below have been drawn from the Knevitt Consultancy's 2009 report, supplemented by site inspection undertaken by the historic environment consultant during November 2009. The works have been assigned one of three priorities – 1) Urgent or high priority, 2) Medium priority, 3) Longer term priority. All works should be completed within a ten year period and should be designed to last for at least 30 years. Some building works will almost certainly be reprioritised as a result of conditions revealed following vegetation clearance, especially where cloaking ivy is currently present on buildings. Other works as part of this project (below) will include those relating to improvements to public access and the provision of interpretation. The preliminary works to the mills and allied structures will generally comprise the removal of any cloaking ivy, the cutting back and stump treatment of invasive or damaging trees on or in close proximity to buildings, and the removal of rubbish and debris within buildings. Following these initial works most buildings will require the relaying of all wall top courses in a lime mortar, the removal of defective pointing and its replacement in lime mortar, the replacement of lost or failing lintels or timber bearers and the reinstatement of structural stonework where necessary. In some

instances temporary or permanent props will need to be installed to confer needed structural stability.

The conditions of the remaining waterwheels are of particular concern. In the case of the wheel at Wheal Arthur, the rims are currently held in place by two rotting timber spokes. Should either one of these fail the wheel will collapse into the pit and the cast iron rim will break up. The wheel at Big Wheel Mill has iron spokes which have, in many cases, corroded away to breaking point. There can be no doubt that unless the wheel is stabilised by propping and the failing spokes replaced in the near future, this wheel will also collapse into the wheel pit and break up. The third surviving waterwheel (that formerly working pumps at Wheal Arthur) is less threatened at present, though should also be the subject of minor repairs.

A trail (following the line of the former haul road) already exists down through the Valley, and passes close to the Wheal Arthur complex, mica drags and tanks, Blacksmith Shop Mill and Big Wheel Mill. From this point smaller-scale paths give access to Trevear Mill and cottage, and to Lower Tregargus or Mica Mill. Access to most of the buildings is currently unformalised and incorporates potential slip and trip hazards, as well as exposure to unstable areas of buildings and to unfenced drops (as into wheelpits). The provision of contractors' access to the buildings to be conserved will inevitably make some of the potentially hazardous areas of these buildings markedly more accessible and measures will have to be taken to limit risks to the public following the completion of the project, as well as to lay out some new paths to improve access to sites within the Valley.

As noted above, some vegetation management will be required to gain access to buildings, to draw up detailed specifications for their conservation and to remove structurally-damaging trees. A broader plan for the management of vegetation within the valley should also be considered to achieve the control of areas of invasive scrub, tackle alien invasive species and open up further areas of the site for public access.

During site visits during both November 2009 and May 2010 it was noted that the water quality of the Barn River appeared to be poor, with strong evidence for uncontrolled nutrient inputs from at least one local farm. The ecological impacts of these inputs has not been assessed, but the resultant unpleasant smell issuing from the watercourse certainly detracts considerably from the enjoyment of the Valley when close to the stream, particularly during warm weather. It is recommended that the water quality of the Barn River is tested at a series of locations through the Valley, the sources of the inputs are identified and appropriate measures taken to control them.

For the locations of the principal groups of structures/features within the project area see Figs 4-5. For the locations of structures proposed for conservation works, see Figs 7 to 12. The sites/features shown are as follows:

**Wheal Arthur Quarry (Figs 7, 27-28) (land not managed by the Tregargus Trust)**

1. Wheal Arthur Quarry
2. Adit in Wheal Arthur Quarry
3. Adit in Wheal Arthur Quarry

**Wheal Arthur china stone mill and dry (Figs 8, 32-41)**

4. Settling tank
5. Pumping water wheel
6. Settling tank
7. Settling tank
8. Pumping shaft
9. Settling tank



10. Wheal Arthur china stone mill
11. Wheal Arthur dry
12. Wheal Arthur linhay
13. Wheal Arthur chimney
14. Tramway
15. Settling tank

**Rescrowsa china clay pit (Figs 9, 42-43, 46, 55)**

16. Blacksmith's shop
17. Adit
18. Adit
19. Mica drags
20. Settling tanks

**Structures to the north of Big Wheel Mill (Figs 10, 44-45, 49)**

21. Structure
22. Top Wheel Mill
23. Blacksmith's Shop Mill
24. Chimney
25. Big Wheel Mill winder house
26. Blacksmith's Shop
27. Powder house

**Big Wheel Mill and Trevear Mill (Figs 11, 21-22, 47-48, 50, 56-81)**

28. Blockwork building
29. Big Wheel Mill
30. Adit
31. Crib Hut
32. Trevear china stone mill
33. Water tank
34. Trevear dry
35. Trevear Cottage

**Mica Mill (Figs 12, 82-92)**

36. Leat
37. Streamwork and adits
38. Aqueduct/bridge
39. Lower Tregargus/Mica Mill

## **7.1 General and preliminary**

Some works which will relate to the works across the site will be required. These will include:

- Obtaining permission from Goonvean Ltd. to use the unsurfaced track from the public highway to the Wheal Arthur works as the principal contractors' access.

- Further specialist surveys, in particular for bats, but also for evidence for badger activity and for birds' nests.
- Pre-works building recording.
- Preparation of a pre-works H&S Plan consistent with the requirements of the CDM 2007 regulations.
- Preparation of a construction phase H&S plan.
- Securing of Scheduled Monument and Listed Building consent for all proposed works to Big Wheel Mill. In practice, given that Scheduled Monument status is treated as the senior protection, Listed Building consent should be a formality, though should still be applied for.
- Agreement of specifications for the repointing of masonry joints and for rebuilding where required using mortars based on hydraulic lime to approved mixes, textures and finishes. A range of pointing test panels will be required and agreement reached on suitable mixes, aggregates and finishes prior to any conservation taking place. Test panels will need to be allowed to cure properly before any final selection is made; the selected panel should be retained for reference during the works.
- Agreement of specifications for the removal and replacement of failed or missing timber lintols and other timberwork in approved hardwoods.
- Agreement of specifications and methodology for the stabilisation of surviving wall plasterwork.
- Agreement of specifications and methodology for the stabilisation of corrosion on ironwork using Amerlock 400 or a similar product following scale removal by light hammering or light grit blasting.
- Agreement for the methods to be used to repair or otherwise stabilise badly corroded and/potentially structurally unstable iron features. A report by Peter Badcock, formerly Senior Conservation Engineer, English Heritage, highlighted the need for sympathetic restoration work to the Big Wheel Mill water wheel. The water wheel at Wheal Arthur Mill also urgently requires similar treatment.
- Selection, acquisition and approval of all required materials. All masonry used in the conservation works should be sourced from rubble piles on site (with the agreement of the historic environment consultant) or from approved local stockpiles where this is not possible.
- Creation of a dedicated contractor's access route from the public highway to the north to a site compound and from there to working areas adjacent to the buildings to be conserved (Fig 13).
- Creation of one or more centralised unloading and storage area (an area at Wheal Arthur is the most likely candidate, though an additional site may be required adjacent to Big Wheel Mill, possibly in one of the infilled quarries nearby); additionally preparation of one or more sites for welfare facilities.
- Provision of all required temporary fencing, notices and interpretation.
- Preliminary scrub vegetation management works, including the cutting and removal of ivy, scrub and other shrouding vegetation as well as trees growing from or near buildings. Cut material may be disposed of by composting, shredding, burning or removal from the site as advised by the ecological consultant. All cut tree stumps should be treated with a non-polluting poison to prevent regrowth. Ivy should be removed from the buildings and not simply cut

off at ground level, as this will encourage the infiltration of the structure by aerial roots.

- Preliminary site meeting by the project team and other invitees, as appropriate.
- Regular site meetings of the project team during the works programme to review progress, undertake valuations, agree variations, &c.
- Removal, on completion of works, of all materials which may be required for the creation of any temporary paths, roadways and compounds.
- Removal, on completion of works, of all building materials, waste, scaffolding &c.
- Production of reports on the works and the completion of the Health and Safety Plan, which should be passed to the Tregargus Trust.

## 7.2 Wheal Arthur complex

Sites 1 to 15, see Figs 7-8.

The Wheal Arthur complex includes the northernmost surviving structures in the Valley and includes a group of settling tanks, a pumping shaft and waterwheel, the china stone mill, with attached pan kiln, dry, linhay and chimney. To the north-west is Wheal Arthur quarry, which is connected to the mill by a tramway route (but which is not included in the area leased by the Tregargus Trust); there are also the remains of a number of sections of leats in the vicinity, as well as some small, overgrown early china stone quarries which are currently rather overgrown.

The quarry, which is a secluded, attractive and interesting feature of the Valley, and which retains its original form, is not currently readily accessible from the haul road, though it would not be difficult to clear a small amount of scrub vegetation to create a path to make this possible, subject to the permission of its owners. The adits within the quarry have been fitted with bat-friendly grilles; though some form of fence or similar barrier would be required around the northern side of the flooded section of the quarry if the public continue to explore this area, whilst the owners might wish to check that there are no dangerously loose sections of rock face overhanging the access route. The quarry access track, quarry and quarry pond have also been subjected to some fly tipping, which is unsightly.

The Wheal Arthur site has already received some attention in the form of preliminary vegetation clearance, though as the stumps of the trees which were cut down were not treated these have coppiced and will need re-cutting and stump-treating. Further vegetation needs to be cleared from the settling tanks, from around the western side of the mill and from around the pan kiln and chimney and nearby tanks. The removal of fly-tipped rubbish from the north-western settling tank unfortunately resulted in the substantial infilling of this feature, which is now difficult to see; some of the infill material should be removed to expose the walling of the settling tank. The pumping water wheel to the north is in fair condition, though its wheelpit is almost wholly obscured by scrub vegetation, as is the pumping shaft, which may require enclosure within a fence or similar barrier on safety grounds; the nearby tanks also require vegetation clearance.

The mill is in fair condition structurally, requiring only relatively small scale works, though access into and through the mill is difficult at present. Its water wheel is in imminent danger of collapse, its cast iron rims being retained in position only by two rotting timber spokes, and should be either propped or carefully dismantled as a matter of urgency.

Some clearance of vegetation and built up material has taken place within the pan kiln, but unfortunately the increased public access to this area has allowed someone to

steal a large number of tiles from the pan kiln floor (these have now been retrieved and placed in storage off-site). Vegetation, debris, rubbish and tipped material obscure the southern section of the base of the linhay, and should be removed. The chimney is in fair condition, though its upper brick courses will need to be taken down and re-set. The adjacent structures also need some work, and the tanks to its south are presently difficult to access because of the vegetation which covers them.

The Wheal Arthur mill complex is the most complete and potentially accessible of all of the sites in the Valley, and also incorporates the widest range of elements. Works required to enhance its structural stability and provide safe access to its components will include the following:

- Creation of a temporary storage and working area adjacent to the mill.
- Preliminary vegetation clearance and stump treatment works (priority 1).
- Provision of a safe pedestrian access route for contractor's staff and site visitors.
- Provision of appropriate temporary safety fencing and notices.
- Agreement of final works specifications (priority 1).

#### **7.2.1 Pumping shaft (Fig 8, site 8)**

In view of the potential hazard presented by this flooded pumping shaft of unknown depth, a permanent barrier fence should be erected around its periphery (priority 1).

#### **7.2.2 Chimney (Fig 8, site 13)**

- Vegetation removal and structural inspection (priority 1/2).
- Install access scaffold (priority 2).
- Stabilise top courses of brickwork by resetting loose courses (priority 2).
- Corrosion treatment to the iron strapping bands (priority 2)
- Stabilise/repoint flue entry (priority 2).
- Stabilise/repoint adjacent supporting structures (priority 1)
- Monitor lateral lean of top section of brickwork if rebuilding works are not undertaken (priority 3 and ongoing).

#### **7.2.3 Settling tanks (site Fig 8, site 15)**

- Vegetation removal (priority 1/2).
- Re-bed wall top masonry (priority 3).
- Re-point external masonry (priority 3).
- Re-point internal masonry (priority 3).

#### **7.2.4 Pan kilns (Fig 8, sites 11/12)**

- Vegetation removal (priority 1).
- Clear rubble and rubbish from linhay area (priority 2).
- Install access scaffold (priority 2).
- Stabilise hypocaust walls (priorities 1 and 2)
- Stabilise, partially reconstruct and repoint supporting wall (priority 1).
- Stabilise and repoint brick structure between sites 14 and 15 (priority 3).

- Reinstate missing pan kiln tiles (priority 2).

#### **7.2.5 China stone mill (Fig 8, site 10)**

- Clear vegetation from mill (priority 1).
- Install temporary props/support to prevent the collapse of the waterwheel (priority 1).
- Either dismantle and store or reconstruct waterwheel (priority 2).
- Install access scaffold (priority 2).
- Stabilise walling affected by root infiltration (priority 1).
- Relay wall capping and repoint external and internal wall elevations (priority 2).
- Assess condition of grinding pan floor in southern section of the mill (priority 1).
- Stabilise southern grinding pan floor (priority dependent on results of assessment).
- Assess and if necessary replace timbers supporting waterwheel bearings (priority 1).

#### **7.2.6 Settling tanks (Fig 8, sites 4, 6, 7, 9)**

- Clear vegetation (priority 1).
- Remove recent infill and rubbish (priority 2).
- Re-set wall capping, repoint exposed masonry where required (priority 3).

#### **7.2.7 Pumping waterwheel (Fig 8, site 5)**

- Clear vegetation (priority 1).
- Stabilise and repoint masonry and concrete mountings (priority 2).
- Undertake anti-corrosion treatment to waterwheel (priority 2).
- Install safety fencing to wheelpit (priority 2).

### **7.3 Rescrowsa Pit**

#### **Sites 16 - 20, Fig 9**

This china clay pit and its associated dumps abut the western side of the haul road to the south of the Wheal Arthur complex. The pit itself is completely ingrown and difficult to access, as are the associated dumps to its east, though a track into the works could be cleared if wished, and would give access to a pleasant area of woodland. A mass concrete constructed blacksmith's shop is sited on the edge of the pit. No works to the pit, dumps or blacksmith's shop are proposed as part of the current works programme, though the creation of further paths within this attractive but rather inaccessible area might be considered in the future, together with some conservation works to the Blacksmith's Shop (Site 16).

#### **7.3.1 Mica drags (Fig 9, site 19)**

A free-standing set of concrete-constructed mica drags associated with Rescrowsa Pit lie immediately to the west of the haul road and are readily accessible. A considerable amount of clearance work has already been undertaken here by the Tregargus Trust, though trees within this site which were cut down were not stump treated to prevent regrowth and have coppiced. The roots of a tree at the southern end of the structure

have heaved and disrupted the end of the mica drag. Some further clearance work is required to fully expose this structure and tree stumps within the drags should be treated and removed. An area immediately to the east of the mica drags has been partially cleared of vegetation and organic build up; further work is required to expose this structure.

- Complete clearance of mica drags and associated concrete area to their east (priority 1)
- Clear vegetation on and immediately adjacent to mica drags (priority 1).
- Treat tree stumps on and adjacent to mica drags (priority 1).

### **7.3.2 Adits (Fig 9, sites 16-17)**

At the northern end of the drags are a pair of adits. The mouth of the example to the north of the drags has substantially collapsed; as this is no longer readily accessible no works are proposed beyond the installation of a bat-friendly grille. The mouth of the adit to the north-west of the drags still retains its timber setts and lagging boards, installed under an unstable section of the roof near the adit entrance. The adit beyond this timbered section is still open and potentially accessible, though partly infilled with clay. In view of the likelihood of enhanced public access to the nearby mica drags it would be prudent to undertake safety works to the adit entrance. The existing timbering will need to be removed, together with the rubble which part covers it and a bat-friendly lockable grille incorporating structural support to the loose rock at the adit portal should be installed to prevent access by the public.

- Remove timberwork and rubble from the entrance to adit 47 and install bat-friendly lockable grille (priority 2).
- Install grille to adit 46 (priority 3).

### **7.3.3 Settling tanks (Fig 9, site 20)**

A group of stone-built settling tanks to the south of the mica drags were partly destroyed during the creation of the haul road through the upper part of the Valley. These could be rendered more visible to walkers through a small amount of scrub clearance (priority 2). No other works are required to stabilise them.

## **7.4 Top Wheel china stone mill**

### **Site 22, Fig 10**

This mill was almost completely over-dumped during the infilling of Higher Quarry, though some sections of the mill walling protrude from the dumped material. There are also the overgrown remains of a small, apparently un-mapped masonry-constructed building immediately to the north of the mill (Site 20) which was probably associated with the quarry, sited as it is near its entrance. Small scale works would allow the exposure of the remaining fabric of both of these buildings and add interest to this part of the trail.

- Clear vegetation from eastern facings of the remains of the mill (priority 2).
- Rake back rubble and masking debris to expose surviving eastern sections of mill masonry (priority 3).
- Clear vegetation from the structure to the north of the mill (priority 2).

## **7.5 Higher and Lower Tregargus Quarries**

These two quarries, the principal source of china stone for the lower mills in the Valley, were infilled with mica waste and graded off in sand and stent during the late 1970s and early 1980s. They are now levelled grassy areas which are beginning to scrub in. The western quarry faces are designated as a SSSI for their geological

interest. No works are proposed to either site, though scrub development across these sites should be undertaken to allow continued access to them and to points from which views of the quarry faces can be obtained.

## **7.6 Blacksmith's Shop Mill**

### **Site 23, Fig 10**

Blacksmith's Shop Mill lies immediately to the east of Tregargus Lower Quarry and just to the west of the access track running through the Valley, which here runs downslope towards Big Wheel Mill. The northern end of the mill was partly overdumped during the infilling of Lower Quarry, though the southern section of the mill and most of its eastern elevation survives. Ivy covers most of the stonework, making it difficult to see. The access road to this mill has become overgrown with saplings and brambles (together with a small amount of rubble), though this could be readily cleared to provide access to this site, and there is the potential to extend a path beyond the mill to access the area to the rear of Big Wheel Mill. It is suggested that, given the amount of overdumping which has taken place at Blacksmith's Shop Mill, works should be confined to the opening up of the access track, the removal of ivy from the surviving elevations and any minor works needed to stabilise the structure. The provision of access into what remains of the mill is not required, as its interior appears to have become completely infilled. Some thought could also be given to cutting back scrub between the mill and the access track through the Valley to make this site visible from the main path route.

- Clear vegetation from roadway passing to the east of the mill to provide site access (priority 2).
- Clear ivy from eastern elevation of mill (priority 2).
- Assess structure to finalise schedule of works (priority 2).
- Re-lay wall heads and undertake other minor repairs to confer structural stability to remains of mill (priority 3).
- Thin/clear scrub vegetation between the mill and the main access route through the Valley (priority 3).

## **7.7 Big Wheel Mill**

### **Site 29, Fig 11**

The largest china stone mill in the Valley, this is a scheduled monument and grade II listed building. Although some of the grinding pans have been removed and others have been partly demolished, the majority of the structure is intact, and the mill retains its central water wheel and iron feed launder, supported by a rare brick flying arch. The roof structure, which remained intact until the mid 1980s, has now collapsed.

Some works have already been undertaken to elements of this complex, including emergency repairs to the leat bridge to its west and some vegetation clearance in and around the mill, in particular to its east between the mill and the river. Although a number of small trees were cut down, these were not stump treated and have now regenerated, obscuring much of the eastern elevation of the structure, which is also partly covered in ivy.

Works required to this structure will include the removal of ivy, the cutting back of scrub and trees, accompanied by stump treatment where required and the clearance of rubbish and debris. This should be followed by stabilisation works including some repointing and the rebedding of the top wall masonry. Discreet safety barriers will be required to the openings on the upper floor on its eastern side to safeguard the existing dangerous drops.

The most urgent and substantial works required on this structure relate to the water wheel, however. The cast iron rim sections are connected to the cast iron hub by means of fifteen pairs of T-section iron spokes and circular section tie rods. Almost all of the spokes have corroded very extensively, some having failed completely and the structural integrity of the wheel must now be severely compromised, with the total collapse of the rim and the breakage of its components being a very real possibility in the near future. The stabilisation of this important element of the structure is an urgent priority, which will require either the installation of supporting scaffolding or the careful dismantling of the water wheel pending its repair. Given the extent of deterioration of the spokes it is likely that most of these will need to be replaced with modern equivalents. Although this will be an expensive, complex and intrusive operation, it is considered that the loss of integrity to this scheduled site which would result from allowing the collapse of the wheel would be significant and ought to be averted. Discussions will be required with English Heritage to approve this course of action and specialist advice will be needed to establish how best to achieve the stabilisation of the water wheel. Given the size and weight of the wheel it might be necessary to bring a crane to site to move its components. If this is the case, some upgrading works to the access track to site will inevitably be required. It is also recommended that some conservation is undertaken to the iron launder to confer structural stability, much of the base of the launder having corroded away, making it prone to distortion or collapse. Should the launder become unstable this might result in the unusual brick flying arch which supports it being severely damaged or destroyed.

The conservation of the other peripheral elements of the site will entail only minor works and is considered to be a low priority. Following the conservation of the mill, thought will need to be given to some access and safety works, in particular the provision of fencing or a barrier to prevent falls into the deep wheelpit and from the openings on the upper floor of the eastern elevation of the building.

- Create temporary storage and working area adjacent to the mill (priority 1).
- Provide a safe pedestrian access route for contractor's staff and site visitors (priority 1).
- Provide appropriate temporary safety fencing and notices (priority 1).
- Clear vegetation from building and from the area to its east between the mill and the river. Treat all stumps to prevent regrowth (priority 1).
- Provide temporary props or scaffolding to support waterwheel (priority 1)
- Agreement of final works specifications (priority 1).
- Install access scaffold (priority 2).
- Clear debris and install temporary props under southern grinding pan floor (priority 1).
- Repoint external and internal masonry (priority 2)
- Re-set wall capping masonry (priority 2).
- Clear vegetation, debris and water from wheelpit (priority 2).
- Repoint wheelpit wall facings (priority 2).
- Undertake anti-corrosion treatment and any necessary repairs to waterwheel (priority 2).
- Clear debris from, undertake anti-corrosion treatment to and undertake repairs to launder (priority 2).



- Clear vegetation from tanks at rear of building (priority 2).
- Reset steps leading from mill to tanks (priority 3).
- Reinstate timber lintels in gable and other walls where required (priority 1).
- Clear vegetation and debris from access area to grinding pans and install temporary props if required (priority 1).
- Clear vegetation from circular tank adjacent to southern wall (priority 2).
- Clear vegetation from circular structure adjacent to northern gable wall (priority 1).
- Stabilise and repoint circular structure adjacent to northern gable wall (priority subject to assessment following vegetation clearance).
- Clear vegetation from grinding floors following installation of temporary props (priority 1).
- Apply timber treatment to bell frame on northern elevation (priority 3).

## 7.8 Adit

### Site 30, Fig 11

A small open adit debouches onto the Barn River immediately to the south of Big Wheel Mill, and presumably originally drained the Tregargus china stone quarries to the north. The adit has been fitted with a bat-friendly galvanised steel gate and requires no further work.

## 7.9 Chimney

### Site 24, Fig 10

A small detached chimney just to the north-east of Big Wheel Mill, this seems originally to have been part of a complex of buildings (shown on the 1880 and 1908 OS maps) which have now been demolished to their foundations. The chimney is in fair condition and requires only small-scale works to stabilise it.

- Provide appropriate temporary safety fencing and notices (priority 2).
- Install access scaffold (priority 2).
- Clear vegetation from chimney (priority 2).
- Stabilise chimney masonry, repoint external elevations and re-set top masonry courses (priority 3).

## 7.10 Blacksmith's and carpenter's shop

### Site 26, Fig 10

A small structure adjacent to the modern bridge over the Barn River, this requires only minor stabilisation works.

- Clear encroaching vegetation and remove debris (priority 2).
- Create temporary storage and working area adjacent to the structure (priority 2).
- Provide appropriate temporary safety fencing and notices (priority 2).
- Clear vegetation (priority 2).
- Install access scaffold (priority 3).

- Stabilise and repoint masonry, re-set wall capping (priority 3).

### **7.11 Bridge**

This fine, masonry-constructed arch bridge to the east of Big Wheel Mill originally carried a tramway from the Tregargus Higher and Lower Quarries to Trevear Mill over a roadway cutting. The bridge has been incorporated into the Valley path network, and a strained galvanised steel cable safety fence prevents falls from it. Stabilisation works to repair partial collapse of the structure noted in 2002 have been undertaken to a high standard and no further works are required to this structure at present.

### **7.12 Three small buildings**

#### **Sites 27, 28 and 31, Figs 10 - 11**

These three small buildings lie in the valley bottom to the east of Big Wheel Mill and comprise the remains of a masonry-constructed powder magazine (site 27), a small modern blockwork structure (site 28) and a blockwork-constructed crib hut (site 31). All are currently unroofed. Parts of the asbestos reinforced cement sheet roofing lie in and around this last building and should be removed for disposal at a licensed tip by a specialist company (priority 1). There is some potential for stabilisation works to the powder magazine, but these are a low priority (priority 2). No other works are required for the two modern buildings.

- Remove asbestos roof section (priority 2)

### **7.13 Chimney**

This small chimney which served Trevear pan kiln lies just outside the leased area. The chimney is in fair condition, though may be in danger of being undermined by badger activity. No works are proposed to this structure at present, though the effects of the badger activity should be monitored. Vegetation growth on the chimney should be controlled.

### **7.14 Trevear china stone mill and pan kiln**

#### **Sites 32-34, Fig 11**

This china stone mill is sited in the south-eastern part of the Valley, stone originally being trammed to it from the Tregargus Higher and Lower Quarries. The mill (32) is asymmetric, originally having had two grinding pans to the north of the wheelpit and one to the south. A substantially demolished pan kiln (34) is attached to the south of the mill, its linhay having become completely overgrown with privet. Some vegetation clearance has taken place around the mill, though most of the cut area has now revegetated.

The condition of the mill is the poorest of any of those which survive to any substantial degree in the Valley, there having been substantial collapses of parts of its floor structure. This appears to be substantially due to the rotting out of some of the timbers which supported the vaulting under the grinding pan floor. The replacement of the remaining failing timbers and the reinstatement of those which are now missing are required to prevent further collapse. Temporary propping of the floor should be undertaken in advance of any other works. Rubble, rubbish and ivy will also need to be removed from the building and from the wheelpit in advance of consolidation works, which will include re-setting the top courses of the walls, the replacement of failed pointing and the installation of some safety barriers where dangerous drops exist. The condition of the flying arch which originally supported the launder over the wheelpit should also be examined, given the particular rarity of these features (only two examples survive in the Valley).

The pan kiln and its linhay are covered in rubble and dense scrub, including privet which has spread from the nearby miller's garden. This will require clearance before

the scope of the works required to this part of the complex can be assessed. To the east of the mill, trees roots growing into the water tank (33) have already destabilised a section of its masonry; this tree is likely to fall soon and will cause severe damage to walls of the adjacent mill. The tree should be carefully felled as a matter of urgency, as should a second leaning tree immediately to its south.

- Vegetation clearance works, including removal and stump treatment of trees growing from masonry, especially those growing on the masonry water tank immediately to the east of the mill (priority 1).
- Agreement of final works specifications (priority 1).
- Create temporary storage and working area adjacent to the mill (priority 2).
- Provide appropriate temporary safety fencing and notices (priority 2).
- Repoint internal and external elevations where required (priority 2).
- Re-lay wall topping courses (priority 2).
- Install temporary props under grinding pan floor (priority 1).
- Replace timber bearers under grinding pan floor arches (priority 2).
- Install stainless steel ties to stabilise cracks in grinding pans (priority 2).
- Remove vegetation and debris from waterwheel pit (priority 1).
- Fell trees immediately to the east of the mill growing out of or adjacent to the water tank (priority 1).
- Repoint wheelpit masonry (priority 2).
- Install safety barriers (priority 2).

### **7.15 Miller's cottage**

#### **Site 35, Fig 11**

Trevar china stone mill is unusual amongst the mills of the Tregargus Valley in that it is accompanied by an adjacent miller's cottage. Constructed on two storeys, this building has apparently been modified during its life, the northernmost of the paired fireplaces in the eastern ground floor wall having been blocked in, the southernmost having been substantially reduced in size. Although Cole and Smith (2002) suggest that the building had a two up two down arrangement, this evidence suggests that the building originally had three small rooms on the lower floor. There are two extensions – a substantial two storey lean-to attached to the south whose external wall has substantially collapsed and a smaller wash house to the west. The building is roofless, and has been heavily overgrown with ivy externally. Internally, much of the wall plaster survives. The removal or failure of internal lintels has caused localised wall collapse, whilst some structural movement in the northern wall has led to cracks extending the full width of the surviving granite lintels.

Despite immediate appearances, this building is in fair condition and could be rescued from collapse with some fairly simple remedial works. The ivy growing on the walls has been cut off above ground level, and should be removed before its roots infiltrate too deeply into the walls in search of moisture and minerals. The wall heads will need to be capped, the lost lintels and masonry reinstated and the cracked lintels should be secretly pinned using stainless steel rods and epoxy resin. It might be possible to retain much of the internal plaster by filleting its broken edges to prevent water ingress, though in the long term exposure to the elements will probably result in its gradual loss. Broken ends where walls have collapsed will need to be pointed, as will

areas of failed pointing on the external elevations. Some minor rebuilding may also be required to reinstate necessary levels of stability in some areas of the walling.

Two mature sycamores immediately to the east of the cottage should be felled, given the high potential that they will eventually fall onto the structure and cause significant damage. Clearance of scrub from the garden adjoining the miller's cottage would help to reinstate an appropriate setting from the building, would expose the dry and linhay, and would also facilitate the creation of a path leading down to Trevear Lane nearby.

- Remove vegetation, including residual ivy, two mature sycamores to the immediate east of the cottage which threaten to collapse onto it, and selected vegetation from around adjacent pan kiln (priority 1).
- Agreement of final works specifications (priority 1).
- Create temporary storage and working area adjacent to the cottage (priority 1).
- Provide appropriate temporary safety fencing and notices (priority 1).
- Install access scaffolding (priority 1).
- Stabilise rear wall of extension through re-laying wall heads, repointing of masonry, including broken wall ends (priority 1).
- Re-lay wall heads to main building and repoint internal and external elevations with the exception of areas where sound plaster has survived (priority 1).
- Undertake limited reconstruction of chimney masonry (priority 1).
- Install stainless steel bedjoint reinforcement across cracking in gable wall (priority 1).
- Install stainless steel bedjoint reinforcement across junction between original building and extension (priority 1).
- Install stainless steel bar reinforcement to pin cracks in both granite lintels on the front elevation (priority 1).
- Reinstate lost internal lintels in front elevation, pin to existing lintels and make good lost masonry above lintels (priority 1).
- Stabilise rear wall of original cottage through limited reconstruction using recovered materials and reinstatement of missing lintels (priority 1).
- Reinstate lost internal timber lintel over doorway in left hand elevation and provide additional bearing for external granite lintel if practicable (priority 1).
- Re-lay wall heads and repoint internal and external elevations of single storey extension to the right of the cottage (priority 1).
- Reinstate supporting masonry and lintels to outbuilding chimney (priority 1).
- Replace steel plates over pan kiln furnace opening and stabilise masonry over opening (priority 1).
- Remove and stump treat trees growing from steps leading to furnace room (priority 1).
- Re-lay wall heads and repoint walls of furnace room (priority 1).

## **7.16 Tin streaming and prospecting adits**

### **Site 37, Fig 12**

A roughly triangular area within which overgrown parallel banks of rounded stone provide evidence for tin streaming activity lies to the east of the Barn River to the south of Trevear Mill. Two or more prospecting adits have been driven into the unworked eastern part of the alluvium which blankets the valley bottom. These have been fitted with galvanised bat-friendly grilles. No further works are required in this area, though it should be periodically monitored in case other tunnels open up through subsidence collapse.

## **7.17 Leat**

### **Sites 36 and 38, Fig 12**

A leat leading southwards from the path to the south of Big Wheel Mill runs to the rear of Lower Tregargus or Mica china stone mill. This provides an excellent path linking these sites and appears to have been cleared to make this possible. No other works are required to this feature, though the condition of the iron supports to the former tramway bridge adjacent to the mill to the south and the structure of the infilled iron aqueduct should be inspected to determine whether they have corroded to the point where they need to be replaced or strengthened. A modern strained galvanised steel cable fence has removed the risk of falls over the aqueduct sides, this now forming the path over the bridge.

## **7.18 Lower Tregargus or Mica china stone mill**

### **Site 39, Fig 12**

This finely-constructed china stone mill, the southernmost in the Valley, lies at the southern end of the area leased to the Tregargus Trust. A detailed pre-construction plan of the mill dating to 1896 exists in the Cornwall Record Office (CRO X223/20, reproduced as Fig. 7 in Cole and Smith 2002).

The gables and eastern elevation of the mill survive intact but the western wall has substantially collapsed, allowing ready access into the upper floor of the building, where there are four well-preserved brick-constructed grinding pans. Dense ivy covers most of the eastern elevation of the building, and will need to be removed and stump treated, whilst a pair of mature trees growing out of the masonry flanking the wheelpit at its western end should be cut down and stump treated before they inevitably cause severe damage to the structure, some dislodging of and damage to the masonry having already taken place.

The surviving masonry elements of the structure are in generally good condition and would require only small levels of conservation works, including the re-bedding of the top wall stones and some replacement of failed wall pointing. The paired massive timber beams spanning the wheelpit are in fair condition, though should be monitored for rot at their ends. The surviving window frames would benefit from timber treatment to prevent rot and worm taking hold. Rubbish should be removed from the lower floor of the building, whilst rubbish and the remains of the roof trusses should be cleared from the wheelpit. Some minor drainage works might be needed to dry out the area immediately adjacent to the mill to its north to improve access to it.

- Remove vegetation on and immediately surrounding building, in particular two mature trees growing from the masonry forming the western end of the wheelpit. Treat stumps to prevent regrowth (priority 1, subject to owner's permission).
- Undertake structural assessment of mill and associated buildings (priority 1).
- Create temporary storage and dispatching area adjacent to the mill (priority 2).

- Remove rubbish and rubble from within mill and wheelpit (priority 2).
- Undertake consolidation works to wall faces and wall heads as required (priority 2).
- Undertake minor repairs to grinding pans (priority 3).
- Undertake minor drainage works to the north and west of the mill (priority 2).
- Provide a safe pedestrian access route for contractor's staff and site visitors (priority 2).
- Provide appropriate temporary safety fencing and notices (priority 2).
- Provide permanent safety barrier adjacent to wheel pit (priority 2).

### **7.19 Creation of enhanced public access**

A route for a trail through and around the Valley should be agreed. Most of this route already exists, making use of the haul road from the northern site entrance down to the Tregargus quarries (the northern part of which lies outside the area managed by the Tregargus Trust), together with a series of smaller paths from this point southwards. A circular route back along the eastern side of the Valley could be established if wanted. A rather overgrown and badly-drained lane from the south-eastern boundary of the leased area provides a route back to Trevear Mill, whilst existing bridges are already in use to link the northern extension of this path back to Big Wheel Mill.

- Agree the route for the elements of any formalised trail through and around the Valley which will be shown on interpretation panels, leaflets and maps.
- Agree future maintenance schedule.
- Undertake access works.

### **7.20 Provision of interpretation**

- Agree an interpretation strategy for the Valley. This may incorporate fixed interpretation panels, waypoints, self-guiding leaflets, web-based materials and educational material.
- Agree locations for and nature of any fixed interpretation material. Note: it is unlikely that English Heritage would sanction the installation of such material at or on the scheduled Big Wheel Mill. The erection of an interpretation panel at the northern entrance to the Tregargus Valley (adjacent to the lay-by) is recommended, though the use of this site would have to be with the agreement of its owners, Goonvean Ltd.; a further interpretation panel at the southern end of the Valley adjacent to the site entrance near Mica Mill should also be considered.
- Commission interpretative material from design consultants. Input will be required from archaeological and ecological consultants as well as local experts and English Heritage before the designs are finalised.
- Install fixed interpretative material.
- Trial educational materials with local schools; establish links with local schools and other educational establishments to promote the development of the use of the Tregargus Valley as an educational resource.

### **7.21 Maintenance programme**

A maintenance schedule for the Valley should be agreed and drawn up. This should set out those tasks which should be undertaken annually (or more frequently if

required) which will be required to maintain public safety, access and enjoyment of the Valley, and to prevent deterioration of the structures. The schedule should include:

- Cyclical vegetation management on and around structures.
- Cyclical vegetation management adjacent to paths and access routes.
- Inspection and maintenance of any safety fences, barriers and notices.
- Inspection and maintenance of paths.
- Ongoing treatment of Japanese knotweed.
- Minor works required to enhance the path network to extend public access to other areas of the Valley.
- Promote and enhance volunteer involvement in the management and maintenance of the Valley.
- Five yearly review of maintenance programme.

## 8 Range of impacts and proposed mitigation

### 8.1 The effects of undertaking conservation works to the structures

#### Potential impacts

- Potential loss of historical and visual authenticity to the site and its structures.
- Introduction of non-original materials.
- Introduction of props, struts or other elements required to provide structural stability.
- Lack of information as to the extent and nature of repair works undertaken as part of the conservation project.
- Impacts on significant habitats and species, including roosting bats, nesting birds and lichens. Communities of interesting vascular plants could be affected if close to sites to be worked on.

#### Suggested mitigation

- A *de minimis* approach to the works will be taken, consistent with making the buildings maintenance-free in the mid term (30 years as a minimum).
- A detailed pre-works measured and archive quality photographic survey should be undertaken to record the extent of original fabric and detailing.
- Further building recording will be required once scaffolding is in place in order that a suitably detailed pre-works survey is created, including detailing which cannot be recorded in advance of scaffold erection.
- A historic environment consultancy should be established prior to the works to ensure that the specifications for the works are sympathetic to the buildings.
- A watching brief should be commissioned during the works; this must be undertaken by an appropriately qualified historic environment consultant.
- Replacement of areas of lost stonework will be kept to the minimum consistent with restoring structural stability.
- The use of locally-sourced stone from rubble piles will be used for essential repairs where original material has been lost.
- The use of hardwood replacements will be specified where lintels have been lost.

- Specialist advice will be sought on works which would be required to ensure the survival of the water wheels.
- A conservation mortar based on hydraulic lime and appropriate aggregates will be used to provide a finish similar to the original pointing.
- Original pointing and plaster will be retained where it has not failed or become detached.
- Non-original temporary or permanent props, buttresses or other similar artificial aids to stability will not be used unless essential.
- Birds sometimes nest in dense Ivy and bats have been known to roost behind mature dense Ivy. Ivy on structures could also conceal crevices or holes where bats may roost. Any areas of ivy on structures should be inspected by a competent profession prior to their removal to assess the impact of such work on habitats and species. Emergence bat surveys should be carried out on structures with crevices and holes suitable for bats where these features are to be re-pointed. Because bats are so mobile it will also be necessary to examine these features just before building consolidation work starts. Ideally a visual inspection with an endoscope should be undertaken when scaffolding is in place. Any crevices that cannot be fully examined and declared free of bats should be left open or have an exclusion device fitted so that bats can emerge but cannot re-enter. Where possible potential bat roosts should be preserved.
- Although there is no evidence to suggest that this site is of importance for lichens or bryophytes if these taxa are present on the areas where repointing etc is to be carried out then a survey for these species should be undertaken prior to work.
- A full record of works undertaken will be maintained by the contractor and supervising engineer/architect and will be lodged with the Tregargus Trust as site managers on completion of the project.

## **8.2 Provision of contractors' access to the buildings**

### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.

### Suggested mitigation

- Archaeological and ecological surveys will be undertaken prior to the planning of the works to provide information about sensitive areas of the site, and those which could withstand limited impacts during the works programme.
- New access tracks should avoid areas of nature conservation interest such as heathland, species-rich grassland and wetland areas including flushes and wet woodland.
- All approaches and opportunities should be explored to limit the impacts associated with the creation of safe access routes. Consideration may need to be given to temporary protective surfacings on tracks which are likely to be used on a regular basis. Where possible, materials should be transported by hand, by vehicles fitted with low pressure tyres or by tracked hand barrows. Vehicle use must be kept to a minimum, and should be restricted during wet weather or where soft ground conditions develop and there is an enhanced risk of surface damage. Temporary ground protection (in the form of geotextile membranes) may be required in some areas. All temporary surfacings should be removed on the completion of works and reinstatement measures carried out where required. Where geotextile is used to protect surfaces, this should be removed at the earliest possible opportunity to allow underlying vegetation to



recover. The routes shown on Fig. 13 are likely to form the basis of the access network used during the conservation programme. Whilst access to the Wheal Arthur complex is straightforward, it will not be easy to provide contractor's access to Trevear Mill except from the south.

- Should a crane be required during works to the waterwheels at Wheal Arthur and Big Wheel Mill, temporary access routes will almost certainly be required. The creation of such an access to Big Wheel Mill from the north will require the felling of overhanging trees adjacent to the access route, as well as the re-grading of the route surface. If an approach using cranes to effect the conservation of the water wheels is decided upon, a specialist crane contractor should undertake a site visit with the project engineer, historic environment consultant and ecologist at an early stage in the specification of the project in order to assess the nature, costs and impacts of any preparatory works which will be required.
- Temporary works may be necessary to make safe unsecured drops where these present potential dangers to contractors or the public. These should be removed on completion of the works. Where permanent solutions are deemed to be required, these should be visually non-intrusive and low maintenance.
- Any necessary fencing should be temporary and sited so as to result in minimal impacts on the site whilst being consistent with achieving required levels of safety.
- Ecological impacts will need to be taken into account following the survey recommendations. Nesting birds in trees, scrub or on the ground could be affected; reptiles could also exist in these areas. Communities with interesting vascular plants such as the developing heathland and open vegetation in the quarries could be affected. Trees with holes, crevices or heavy Ivy could be used by roosting bats. Care must be taken not to disturb nesting birds, potentially restricting any works taking place during the nesting season. Potential bat roosts must be checked by a specialist in advance of works which would impact on them.
- Where proposed access routes are created by tree felling or scrub cutting through areas which are presently inaccessible, the historic environment and ecological consultants should inspect the cleared routes to determine whether their use will have any unforeseen significant impacts on previously unknown features or habitats. If this is found to be the case, re-routing will probably be necessary.
- Prior to erection of scaffolding to the buildings to be conserved and in other areas where scaffolding or other temporary works are deemed to be required to facilitate the works, a detailed ground inspection shall be carried out by the historic environment consultant. The final design of any works required to allow the erection of scaffolding or other similar works shall be subject to discussion with and agreement by the historic environment consultant and ecologist, who may require further appropriate mitigation before works take place. Unless absolutely necessary, all scaffolding and other temporary support should be erected off existing ground surfaces and any founding excavation work kept to a minimum.

### **8.3 Delivery and erection of scaffolding and delivery of contractors' materials to site.**

#### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.

#### Suggested mitigation

- A method needs to be found to enable large quantities of scaffolding and other building materials to be delivered to the buildings to be conserved without causing collateral damage to other parts of the site. All materials required for the works (scaffolding, masonry, timbers and, if batching is to be done on site, mortars, aggregates and water bowsers) may be put in place as part of a single operation. In order to minimise deliveries, sufficient scaffolding should be brought to site in a single operation to allow work to subsequently progress sequentially across the site (scaffolding from a completed building being transferred to another structure which is to be conserved). An area close to the site may need to be identified where loads can be batched and transported by a vehicle appropriate for use within the Valley. Considerable and careful pre-preparation will be required to achieve this, whilst contractors may need to have their materials purchase costs paid for at this stage, rather than throughout the life of the Project. Low-impact access routes will need to be identified, as well as appropriate, safe methods of transporting materials in ways which will result in the least damage being caused to the site.
- Scaffolding structures should generally be free-standing, and not rely on attachment to buildings for structural stability.

### **8.4 Achieving site safety during and subsequent to the works**

#### Potential impacts

- Temporary or permanent loss of visual integrity.
- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.

#### Suggested mitigation

- Works will be needed to protect contractors from hazards presented by unsecured drops. These works should be reversible and have minimum impact. Where a requirement for long-term hazard protection is identified, these works should be undertaken at an early stage of the project and, where possible, undertaken as priority works.
- Contractors' routes to and within the buildings will need to be made safely accessible during a range of weather conditions, probably including periods of poor visibility, cold and wet weather. Any works or surfacings required to achieve this should be of an agreed and temporary nature, and should not involve any excavation of archaeologically or ecologically sensitive material or the undue use of temporary fixings.
- Scrub management followed by marking (both on the ground and on maps supplied to the contractors) will probably be required to provide clear, safe routes from site compounds to specific buildings. Deviations from the agreed routes should not be allowed without prior agreement following careful examination of the proposed route variations.
- Legislation requires that the public will need to be excluded from all work areas during the Project. This will involve the erection of fencing and notices, whose locations should be agreed with English Heritage and the historic environment consultant. All fences, exclusion barriers and notices shall be inspected and maintained on a daily basis to ensure they are fit for purpose and shall be removed from site on the conclusion of the works.
- Consideration will need to be given to how the safety of visitors to the site can be achieved on the completion of the works. Where possible, visually intrusive fences or other barriers should be avoided. Clear safety signage will be

required at the entrances to the site, together with some specific signage or protective measures near specific and particular hazards.

## **8.5 Provision of contractors' compounds and facilities**

### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity, in particular those with communities of the interesting vascular plants.
- Damage to undocumented sub-surface archaeology.
- Significant visual impacts during the works programme

### Suggested mitigation

- Areas for compounds and storage areas must be agreed in advance so that these can be sited in locations which are not inconvenient to the contractors, but where site impacts will be minimised. Where preparatory excavation, levelling up or other works are required, their scope must be agreed in advance and any necessary variations to the mitigation procedures undertaken. Any materials brought onto site to create these compounds should be placed on a layer of geotextile membrane, which must be removed from site on completion of the works. It should be recognised that compounds and storage areas distant from the work areas will necessitate additional vehicle movements, and a compromise between siting these in wholly insensitive areas and the impacts of higher levels of vehicle movement will need to be sought.
- The sparsely vegetated areas are a valuable ecological feature on this site and are potentially of value for reptiles and invertebrates. Although no rare plant species grow in these areas, (particularly in the quarries) special care must be taken not to disturb the vegetation including mosses and lichens. The siting of storage compounds should avoid these areas.
- The siting of storage compounds should be considered carefully to avoid habitats of ecological interest such as species-rich heathland/grassland and open vegetation. Materials should be storage on a non-permeable membrane and protected from rain to avoid the leaching of potentially damaging substances. Ideally storage compounds should be sited on unvegetated tracks.
- Security fencing around these compounds must be in agreed locations and so erected as to limit impacts on the site.

## **8.6 Ivy clearance from structures**

### Potential impacts

- Disturbance to active bat roosts or to nesting birds

### Suggested mitigation

- Ivy on structures such as the Millers Cottage should be cut at the base by hand at the earliest opportunity once funding for the works has been agreed. The foliage will die and the leaves will fall off discouraging nesting birds and roosting bats. This will also expose crevices and holes in the structure which may need examining for occupation by bats.
- When the Ivy is to be removed it should be carefully pulled off by hand in late summer or autumn (mid-August – late October) to avoid disturbance to breeding/hibernating bats and nesting birds. It is unlikely that bats breed in the walls and structures at this site but non-breeding bats could be present at any time of the year. Bats could hibernate in the built structures between November-April and are particularly vulnerable to disturbance at this time of year.

## 8.7 Tree and scrub clearance

### Potential impacts

- Disturbance to bird nesting sites.
- Injury to ground-dwelling reptiles.
- Disturbance to badgers and their setts.
- Potential impacts on dormice.

### Suggested mitigation

- Scrub should be cut outside the bird nesting season which starts in mid-March and finishes in mid-August. If scrub must be cleared in the bird-nesting season then a breeding bird survey of the areas concerned should be undertaken before work starts.
- To avoid injury and killing of reptiles, clearance of scrub and tall herbaceous vegetation should be done in the active season when these species can move to escape injury. During the active season individual animals should retreat from areas that are being disturbed; care should be taken when working through heathland/grassland/scrub/bracken/open vegetation to ensure any individual animals can hear the approach of machinery. This limits the opportunities for scrub clearance to late summer and early autumn i.e. mid-August to late September if disturbance to nesting birds is also to be avoided.
- Badgers are active on the site and although the main sett is not located close to any of the proposed works dense scrub could conceal other setts and there are reports of badgers close to the chimney east of Trevear Mill (88). If signs of badgers are found during the works then further survey work may be necessary. Badger is legally protected under the Protection of Badgers act 1992 which makes it a criminal offence to intentionally or recklessly interfere with a sett including damaging or destroying a sett, obstructing the entrances to a sett or disturbing a badger within its sett. A badger's sett is defined as 'Any structure or place which displays signs indicating current use by a badger'. Natural England has released new advice on what actions will require a licence as they have concluded that Badgers are relatively tolerant of moderate levels of noise and activity at or near their setts.
- As a result acts which only cause levels of disturbance described in this way will no longer require a licence. Examples of activities which Natural England suggests would not need a licence include:
  - Development or other activities occurring close to Badger setts which will not cause disturbance greater than that commonly tolerated by badgers, using hand tools and/or machinery.
  - Removal of vegetation over and adjacent to setts, using hand tools and/or machinery.
  - Clearing of ditches/watercourses using hand tools and/or machinery where Badger setts are present.
  - However, any activities which will/or is likely to cause damage to a sett tunnel or chamber or obstruct the entrance to a sett will continue to require a licence. Consideration should be given to the fact that the tunnels within setts can extend tens of metres underground.
- If major clearance work is proposed in the woodland then a detailed survey should be undertaken for Dormouse.

## 8.8 Works to adits

### Potential impacts

- Disturbance of active bat roosts.

### Suggested mitigation

- The timing of this work should avoid the bat hibernation period as these features are very important for rare species of hibernating bats. Work should be carried out in May or between late August and the end of September. This allows a safe margin avoiding the breeding season (Horseshoe bats occasionally breed underground) and an extended period on either side of hibernation to avoid disturbance to torpid bats before and after the core hibernation period. Bat friendly grilles should be fitted in all openings allowing uninterrupted access for all species of bat, particularly Greater and Lesser Horseshoe.

## 8.9 Impacts on the broader site

### Potential impacts

- Damage to known areas of archaeological or ecological sensitivity.
- Damage to undocumented sub-surface archaeology.
- Impacts on water courses.

### Suggested mitigation

- Contractors will be provided with maps indicating access routes, sensitive areas and any no-go areas. A site walk-over with all contractors and sub-contractors will be required to ensure that these restrictions are fully understood and followed. All contractors will be made aware of national and other designations applying to the site, and the constraints on work practices which these impose.
- The potential for mortar batching in relatively insensitive areas of the site should be explored. Care must be taken to ensure that lime-based products are not transported by wind or water into sensitive areas (those where the survival of habitats is dependant on acid substrate conditions).
- Slops, rakings, unused batched mortar, mixer wash water, timber offcuts and other unused materials should not be disposed of on site. Bunds or other temporary works or controls may be required by the Environment Agency to prevent spillages of potential pollutants into the Barn River.
- No fires are to be lit on site without prior agreement, and only in agreed areas.

## 8.10 Disturbance to habitat

### Potential impacts

- Potential release of pollutants: fuel/chemical spillage, dust associated with vehicle movements or strongly alkaline dust associated with mixing of mortar.
- Damage to habitats through vehicle movements on existing tracks, creation of compounds and storage areas, works required to create access to and between buildings, or other contractors' activities.

### Suggested mitigation

- Commission an ecologist to carry out a walkover survey following identification of the preferred access routes and compound areas in order to identify any particularly features of ecological importance and further inform mitigation.

- Following walkover survey above, develop a sensitive methodology, in consultation with an ecologist, for the creation of the access routes. Recommendations to minimise impact are likely to include:
- Use of geo-textiles and trackway/matting along access route where/if appropriate to minimise compaction and potential for contamination of soils.
- Minimise number of vehicle movements (but potentially also limit maximum loaded weight of vehicles – optimum 'trade-off' to be decided).
- Clearly delimit operational routes with high-vis tape or similar to prevent works encroaching upon surrounding areas of habitat.
- Follow Environment Agency guidelines to minimise release of pollutants, dedicated areas will be required for the mixing of mortar. Temporary bunds may also be required to prevent the release of pollutants into the adjacent water course.
- Care should be taken to ensure that traffic is restricted to the access track during operations such that works do not encroach upon surrounding areas of habitat. Any additional areas cleared should not be used for storage, mixing of mortar etc. unless this is agreed in advance.

It is anticipated that providing these precautions are taken that the likely impacts upon habitats will be temporary and affected areas are likely to re-vegetate naturally within a relatively short time, (this assessment however will be further informed by the results of the walkover survey following initial clearance recommended above).

## **8.11 Disturbance to species**

### Potential impacts

The creation of the access track has the potential to cause disturbance to species which could be present along the proposed route:

- Breeding birds: species nesting in trees, ivy or scrub.
- Amphibians are likely to make use of adjacent more densely vegetated damp or wetland areas.
- Badger setts could be present within close proximity to proposed access routes or to buildings.
- Reptiles such as grass snakes may be present in tall herbaceous vegetation.

Consolidation works have the potential to impact upon the following species which may be present within the buildings or immediate surroundings:

- Bats may make use of cracks/crevices within the structure and be impacted by erection of scaffolding and re-pointing (to be determined by further survey work).
- Breeding birds may be disturbed throughout works.
- Bryophytes and lichens: notable species could be present on the buildings or on neighbouring trees and could be impacted directly by re-pointing or indirectly by cement dust. Blown strongly-alkaline dust may be of particular concern if specialist lichens (which are particularly sensitive to changes in pH) are found to be present.

### Suggested mitigation

- Commission an ecologist to carry out a walkover survey following initial clearance of the access route in order to inform mitigation for potential impacts upon habitats and species.
- If vegetation clearance work is to be carried out during the breeding bird season (peak season in generally considered to be April-July) proposed access

routes should be surveyed for nesting birds immediately prior to being cut. If any nesting birds are found to be present, work within 5m of the active nest must stop until the chicks have fledged.

- Carry out consolidation works outside of the nesting bird season. It should be noted that any bird listed on Schedule 1 of the Wildlife and Countryside Act is afforded additional protection against intentional or reckless disturbance whilst building a nest or in or near a nest containing eggs or dependant young.

## 8.12 Other

### Suggested mitigation

- A detailed illustrated report covering the works shall be produced by the historic environment consultant and ecological consultant on the conclusion of the project.
- Any potentially significant variation from the agreed mitigation must be discussed in full and agreed in advance, and may require a variation from the agreed Scheduled Monument Consent. Where site conditions require less significant variations from the agreed specification to be made quickly, efforts should be made to discuss and agree these with key project team members.

## 9 Public access during works; interpretation and engagement activities

The works proposed at Tregargus will take place in an area to which local people customarily have access. Some limitation of public access to parts of the site on which work is being undertaken will be required by law during the works programme.

Some areas of the site which have customarily been open to public access will need to be closed off for safety reasons for the duration of the works. All efforts will be made to limit the disruption of public access during the works programme, and to ensure the safety, wellbeing and enjoyment of those legally accessing the site.

Access around the site is currently fairly easy, there being a good track from the north entrance passing the buildings at Wheal Arthur China stone works, the mica dries and down to the quarries branching off to Tregargus Mill. Other footpaths around the southern section permit easy access to Trevear Mill although temporary vehicular access will probably be created as a result of the proposed works. Wider tracks through the Sycamore-dominated woodland here would encourage a more diverse flora. Access to the areas of the quarry where Greater and Lesser Horseshoe bats are known to roost in the adits should be discouraged.

It is recognised that there may well be local public interest in this project, and all efforts will be made to meet this requirement, both on site, through the provision of safe viewing areas and information panels, and by other means including notices on the safety fences surrounding excluded areas.

Local and national media will be fully informed of progress at key stages in the project, most particularly on the instigation of the works and on their completion. The Tregargus Trust and partners will coordinate this element of the Project and will also provide material to local journals and media.

The project partners will devise a programme of opportunities for engagement by local people and interested groups during the works programme within the constraints of health and safety legislation. Site visits by local groups and local schools will be arranged if practicable. Following the completion of works, efforts should be made to raise levels of local engagement with the work of the Tregargus Trust in managing and enhancing the site as a whole.

Subject to the granting of permission from relevant landowners, interpretation boards could be erected at the north and south entrances of the site. Apart from locating and describing features of archaeological interest, the inclusion of information about the wildlife on the site would enhance the interest of the valley for the public.

## 10 Further recommendations

### 10.1 Habitat enhancement

The proposed works provide an opportunity to enhance affected areas of habitat in the course of carrying out works. In particular there may be an opportunity to open up some additional areas of existing scrub in the course of creating access tracks by extending the width of the corridor/ creating scalloped edges and/or cutting some sections of willow scrub, clearing over-dense areas of saplings, or felling and piling dangerous trees. Other vegetation clearance and some opening up of habitats/scrub clearance is likely to be of benefit to a number of species in creating greater physiognomic diversity and habitat diversity. Consideration should also be given to the provision of additional bat roosts during the works. Natural England may also suggest additional works to enhance the SSSI.

Japanese Knotweed growing near the site entrance and at a small number of locations on site should be treated before it spreads to the detriment of the native flora. A minimum of 3 years treatment is required to have any effective control of the above ground material, but the rhizomes may still remain viable. The most effective active ingredient for use on Japanese Knotweed is glyphosate, best used when there are large numbers of leaves present allowing a large quantity of herbicide to be absorbed into the plant. Glyphosate is approved for use in or near water and is best used in autumn when it can penetrate to the rhizomes.

Some Rhododendron still exists in the woodland and should be cut and the stumps treated to prevent re-growth otherwise it will spread and the dense shade this species casts along with the toxic leaf litter eliminates the native ground flora.

Sycamore and possibly Beech should be thinned. These species out-compete Oak and the resulting woodland has a poorer flora and is consequently of less interest for invertebrates. Beech does not usually re-grow from the base when felled but Sycamore readily grows more stems so the cut stump should be treated to prevent re-growth. This would create glades within the woodland and would encourage a more diverse flora and fauna.

Dead wood should be piled and left for wildlife and if possible should not be cut into smaller pieces but left to decay as a whole piece slowly over the years. Standing dead wood is a valuable habitat for birds such as Woodpeckers and should be left where it poses no risk to the public. Smaller branches, twigs and brash could be burnt on unvegetated areas such as the track. Some brash can be left as "habitat piles" for species such as Hedgehog. Large amounts of herbaceous material should be removed from the site.

The re-introduction of small areas of coppicing would encourage a more diverse woodland flora and fauna.

Clearance of occasional trees and scrub along the river (see report from the Westcountry Rivers Trust) will permit more light to reach the ground flora. The banks will become better vegetated and lighter conditions will encourage an aquatic flora and wetland species on the banks. In turn this will result in an increase in the invertebrate population which will enhance the habitat for fish and for bats and perhaps Otter. Increased ground cover will also help to stabilise the earth banks. Trees should be assessed for bat interest and any trees with potential bat roosting habitat should undergo survey work for bats before felling or heavily pruning. Older trees including Willow should be left standing. The track edges support a diverse flora and the cutting



back of scrub creates lighter conditions and encourages many species. The track is in effect a woodland "ride" and the flora will encourage an increased diversity of invertebrates and other wildlife on the site.

## **10.2 Further survey work**

### **10.2.1 Birds**

Scrub clearance and removal of Ivy from buildings anywhere on the site should be carried out when birds are not breeding. If this is not possible then a breeding bird survey should be carried out in the areas concerned before work starts. It may be possible to continue without disturbing nesting birds, otherwise work will have to be postponed until outside the breeding season.

The consolidation work on the buildings should also only be carried out if birds are not nesting in or on the structures. If work has to be timed during the breeding season then breeding bird surveys need to be undertaken first. It should be noted that Natural England issue a general licence permitting disturbance of nesting pest species such as Herring Gull, Feral Pigeon, Crow and Jackdaw for public health and safety reasons.

### **10.2.2 Bats**

A walkover survey is recommended to identify features of potential interest to bats. Ideally this should be undertaken after scrub and trees on and adjacent to the structure has been cleared (including Ivy).

Bats are already known to roost in the adits and it should be assumed that every adit or tunnel is used. It is also possible that bats roost in flues, chimneys and in crevices or holes in the masonry of the derelict buildings and in lintels. Bats could also roost in larger trees with holes, crevices, flaking bark or dense Ivy. Bat roosts are protected whether bats are present or not so bat emergence surveys should be carried out on any structures with these features if they will be affected by the proposed works. Ideally two or three emergence surveys should be carried out during the active season (May to late September).

Because bats are so mobile and move between a network of roosts depending on the time of year, food availability *etc.* it will also be necessary to carry out a visual survey of all potential bat roosting sites immediately prior to the commencement of work using scaffolding and an endoscope if necessary. Work on potential bat roosts should avoid the hibernation period between November and April inclusive.

### **10.2.3 Badgers**

The badger sett known east of the track is not likely to be affected by the proposed works. If any vegetation clearance or excavations are to be undertaken in this area a Badger survey should be carried out to identify the location of all sett entrances. Elsewhere on the site dense scrub may conceal setts and if signs of badgers are found during the works then further survey work or a watching brief may be necessary.

### **10.2.4 Bryophytes and lichens**

No rare bryophytes or lichens have been recorded at this site so far; none were listed in the records supplied recently by ERCCIS (2010). However, a survey has probably not yet been undertaken. If bryophytes and lichens on buildings will be affected by the proposed works then a survey should be undertaken before work starts. Rare species of calcicolous lichens and Bryophytes could exist on the lime mortar of the old buildings.

### 10.2.5 Dormice

If there is to be major clearance of woodland or scrub a detailed Dormouse survey should be undertaken prior to work. The survey should include a nut hunt in the area of woodland dominated by Hazel west of Big Wheel Mill.

### 10.3 Monitoring

The spread of Japanese Knotweed should be monitored and if it is treated with a herbicide then the area should be regularly checked for re-growth and this should be treated again as soon as possible.

The spread of scrub and the re-growth of scrub such as Bramble, Common Gorse and Willow on the open areas in the Tregargus Mill quarries should be monitored and controlled before it threatens the developing heathland.

The growth of Rhododendron should also be monitored and re-growth cut and treated as soon as possible.

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### 11.1 Primary sources

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#### Other

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### 11.3 Websites

<http://www.imagesofengland.org.uk/> English Heritage's online database of Listed Buildings

## 12 Appendices

### 12.1 List of vascular plant species found at Tregargus valley, May 2010.

Blue coded species were only seen in 2002 (Cornwall Environmental Consultants)

Scientific name	Common Name
<i>Acer pseudoplatanus</i>	Sycamore
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostis curtisii</i>	Bristle Bent
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Ajuga reptans</i>	Bugle
<i>Anemone nemoralis</i>	Wood Anemone
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Anthriscus sylvestris</i>	Cow Parsley
<i>Arum maculatum</i>	Lords-and-Ladies
<i>Asplenium adiantum-nigrum</i>	Black Spleenwort
<i>Athrium filix-femina</i>	Lady Fern
<i>Athyrium sylvestris</i>	Cow Parsley
<i>Bellis perennis</i>	Daisy
<i>Betula pubescens</i>	Downy Birch
<i>Blechnum spicant</i>	Hard Fern
<i>Brachypodium sylvaticum</i>	False Wood-brome
<i>Buddleja davidii</i>	Butterfly-bush
<i>Callitriche</i> sp.	Water-starwort
<i>Calluna vulgaris</i>	Heather
<i>Cardamine flexuosa</i>	Wavy Bittercress
<i>Cardamine pratensis</i>	Cuckooflower (double form)
<i>Carex pendula</i>	Pendulous Sedge
<i>Carex remota</i>	Remote Sedge
<i>Castanea sativa</i>	Horse Chestnut
<i>Centaurea</i> sp.	Knapweed
<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Ceratocarpus claviculata</i>	Climbing Corydalis
<i>Chamerion angustifolium</i>	Rosebay Willowherb
<i>Chrysosplenium oppositifolium</i>	Opposite-leaved Golden-saxifrage
<i>Circaea lutetiana</i>	Enchanters-nightshade
<i>Cirsium arvense</i>	Creeping Thistle

<i>Cirsium palustre</i>	Marsh Thistle
<i>Cirsium vulgare</i>	Spear Thistle
<i>Cochlearia officinalis</i>	Common Scurvy-grass
<i>Corylus avellana</i>	Hazel
<i>Cotoneaster</i> sp.	Cotoneaster
<i>Crataegus monogyna</i>	Hawthorn
<i>Crococsmia x crocosmiiflora</i>	Montbretia
<i>Cytisus scoparius</i>	Broom
<i>Dactylis glomerata</i>	Cock's-foot
<i>Deschampsia cespitosa</i>	Tufted Hair-grass
<i>Digitalis purpurea</i>	Foxglove
<i>Dryopteris affinis</i>	Scaly Male-fern
<i>Dryopteris dilatata</i>	Broad Buckler-fern
<i>Dryopteris filix-mas</i>	Male Fern
<i>Epilobium montanum</i>	Broad-leaved Willowherb
<i>Epilobium</i> sp.	Willowherb
<i>Equisetum arvense</i>	Field Horsetail
<i>Erica cinerea</i>	Bell Heather
<i>Erica tetralix</i>	Cross-leaved Heath
<i>Eupatorium cannabinum</i>	Hemp-agrimony
<i>Fagus sylvatica</i>	Beech
<i>Fallopia japonica</i>	Japanese Knotweed
<i>Festuca rubra</i>	Red Fescue
<i>Fragaria vesca</i>	Wild Strawberry
<i>Fraxinus excelsior</i>	Ash
<i>Galium aparine</i>	Cleavers
<i>Galium mollugo</i>	Hedge Bedstraw
<i>Galium mollugo</i>	Hedge Bedstraw
<i>Geranium robertianum</i>	Herb Robert
<i>Geum urbanum</i>	Wood Avens
<i>Glechoma hederacea</i>	Ground-ivy
<i>Glyceria declinata</i>	Small Sweet-grass
<i>Glyceria</i> sp.	Sweet-grass
<i>Hedera helix</i> ssp. <i>hibernica</i>	Atlantic Ivy
<i>Heracleum sphondylium</i>	Hogweed
<i>Holcus lanatus</i>	Yorkshire Fog
<i>Holcus mollis</i>	Creeping Soft-grass
<i>Hyacinthoides non-scripta</i>	Bluebell
<i>Hypericum androsaemum</i>	Tutsan
<i>Hypochoeris radicata</i>	Common Cat's-ear
<i>Ilex aquifolium</i>	Holly
<i>Iris pseudocorus</i>	Yellow Flag
<i>Juncus effusus</i>	Soft Rush
<i>Juncus tenuis</i>	Slender Rush

<i>Lemna minor</i>	Common Duckweed
<i>Lemna sp.</i>	Duckweed
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Lonicera nitida</i>	Wilson's Honeysuckle
<i>Lonicera periclymenum</i>	Honeysuckle
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Luzula campestris</i>	Field Wood-rush
<i>Luzula sylvatica</i>	Great Wood-rush
<i>Lysimachia nemoralis</i>	Yellow-pimpernel
<i>Oenanthe crocata</i>	Hemlock Water-dropwort
<i>Oxalis acetosella</i>	Wood Sorrel
<i>Pentaglottis sempervirens</i>	Green Alkanet
<i>Phalaris arundinacea</i>	Reed canary-grass
<i>Phyllitis scolopendrium</i>	Hart's-tongue Fern
<i>Plantago lanceolata</i>	Ribwort Plantain
<i>Poa annua</i>	Annual Meadow-grass
<i>Poa sp.</i>	Meadow-grass
<i>Polypodium sp.</i>	Polypody Fern
<i>Polystichum setiferum</i>	Soft Shield-fern
<i>Potentilla anserina</i>	Silverweed
<i>Potentilla reptans</i>	Creeping Cinquefoil
<i>Potentilla sterilis</i>	Barren Strawberry
<i>Primula vulgaris</i>	Primrose
<i>Prunella vulgaris</i>	Selfheal
<i>Prunus spinosa</i>	Blackthorn
<i>Pteridium aquilinum</i>	Bracken
<i>Quercus petraea</i>	Sessile Oak
<i>Quercus sp.</i>	Oak
<i>Ranunculus ficaria</i>	Lesser Celandine
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Rhododendron ponticum</i>	Rhododendron
<i>Ribes nigrum</i>	Black Currant
<i>Rosa sp.</i>	Wild Rose
<i>Rubus fruticosus agg.</i>	Bramble
<i>Rumex acetosa</i>	Common Sorrel
<i>Rumex acetosella</i>	Sheep's-sorrel
<i>Rumex obtusifolius</i>	Broad-leaved Dock
<i>Rumex sanguineus</i>	Wood Dock
<i>Rumex sp.</i>	Dock
<i>Sagina procumbens</i>	Procumbent Pearlwort
<i>Salix caprea</i>	Goat Willow
<i>Salix cinerea ssp. oleifolia</i>	Grey Willow
<i>Sambucus nigra</i>	Elder

<i>Scrophularia auriculata</i>	Water Figwort
<i>Scropularia nodosa</i>	Common Figwort
<i>Sedum anglicum</i>	English Stonecrop
<i>Senecio aquaticus</i>	Marsh Ragwort
<i>Senecio jacobaea</i>	Ragwort
<i>Silene dioica</i>	Red Campion
<i>Sonchus oleraceus</i>	Smooth Sow-thistle
<i>Stachys officinalis</i>	Betony
<i>Stellaria alsine</i>	Bog Stitchwort
<i>Stellaria holostoides</i>	Greater Stitchwort
<i>Stellaria media</i>	Chickweed
<i>Taraxacum officinale</i> agg.	Dandelion
<i>Teucrium scorodonia</i>	Wood-sage
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover
<i>Trifolium</i> sp.	Trefoil
<i>Ulex europaeus</i>	Common Gorse
<i>Umbilicus rupestris</i>	Navelwort
<i>Urtica dioica</i>	Nettle
<i>Vaccinium myrtilis</i>	Bilberry
<i>Veronica chamaedrys</i>	Germander Speedwell
<i>Veronica hederifolia</i>	Ivy-leaved Speedwell
<i>Veronica montana</i>	Wood Speedwell
<i>Veronica serpyllifolia</i>	Thyme-leaved Speedwell
<i>Vicia sativa</i>	Common Vetch
<i>Vicia sepium</i>	Bush Vetch
<i>Viola riviniana</i>	Common Dog-violet
<i>Wahlenbergia hederacea</i>	Ivy-leaved Bellflower

## 12.2 SSSI citation, damaging operations and recent condition assessment

**County:** Cornwall

**Site Name:** Tregargus Quarries

**Status:** Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981, as amended.

**Local Planning Authority:** Cornwall Council

**National Grid Reference:** SW 949541 **Area:** 1.8 (ha) 4.4 (ac)

**Ordnance Survey Sheet 1:50,000:** 200 **1:10,000:** SW 95 SW, SE

**Date Notified (under 1949 Act):** 1951

**Date of Last Revision:** 1973

**Date Notified (under 1981 Act):** 1986

**Date of Last Revision:** None

**Other Information:** GCR site. Boundary amended by deletion.

**Description and Reasons for Notification:** These quarries provide excellent exposures of two late-magmatic varieties of the varied St. Austell granite mass (of Permo-Carboniferous age). Fluorite granite predominates, but this is accompanied by irregular patches of non-megacrystic lithium-mica granite. The site is significant in illustrating that the contacts between the two rock-types are transitional and non-intrusive in nature and they may be accounted for by metasomatic over-printing of an original biotite granite by a lithium rich fluid. The biotite was replaced by a lithium mica while elsewhere high fluorine contents resulted in the crystallisation of fluorite.

**Operations likely to damage the special interest**

**Site name: Tregargus Quarries, Cornwall, OLD1000625**

**Ref. No. Type of Operation**

- 7 Dumping, spreading or discharge of any materials.
- 12 The introduction of tree and/or woodland management and changes in tree and/or woodland management, including afforestation and planting.
- 14 The changing of water levels and tables and water utilisation (including irrigation, storage and abstraction from existing water bodies and through boreholes).
- 20 Extraction of minerals.
- 21 Construction, removal or destruction of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, or the laying, maintenance or removal of pipelines and cables, above or below ground.
- 22 Storage of materials on or against rock faces or outcrops.
- 23 Erection of permanent or temporary structures, or the undertaking of engineering works, including drilling.
- 24 Modification of natural or man-made features, clearance of boulders, large stones, loose rock or scree and battering, buttressing or grading rock-faces and cuttings, infilling of pits and quarries.

**Most recent condition assessment by Natural England Team - Cornwall, Devon And The Isles Of Scilly - SSSI name - Tregargus Quarries**

Main habitat	Staff member responsible for unit	Unit ID	Unit area (ha)	Latest assessment date	Assessment description	Condition assessment comment	Reason for adverse condition
Earth heritage	David Hazlehurst	1003818	1.65	22 Oct 2008	Unfavourable no change	Site visit with Hannah Townley. Extensive vegetation encroachment is obscuring the features of interest.	Earth science feature obstructed

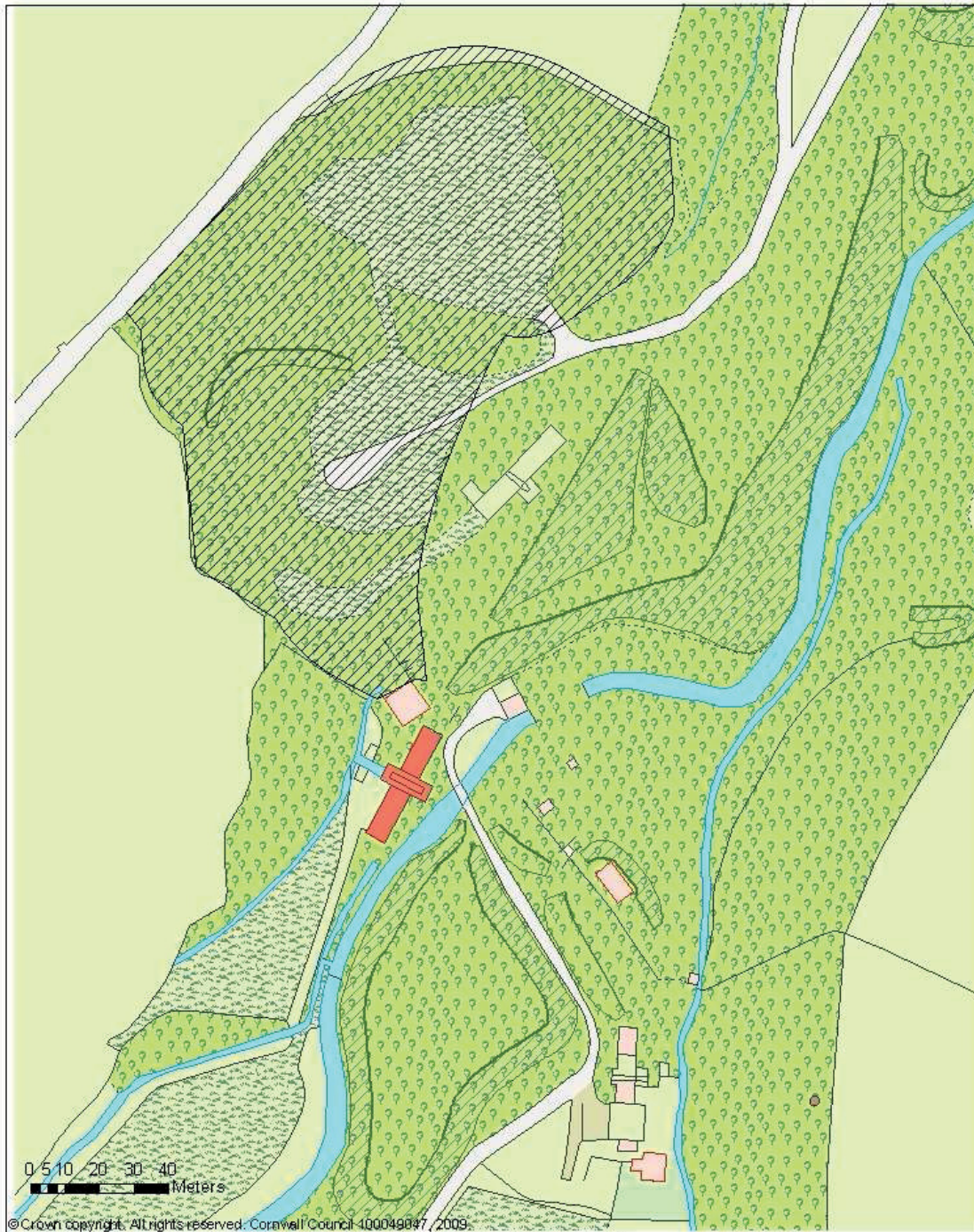


## **13 Project archive**

The HES project number is 20082180

The project's documentary, photographic and drawn archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file containing site records and notes, project correspondence and administration.
2. Digital photographs stored in the R:\Historic Environment (Images)\SITES.Q-T\Tregargus\Tregargus CMP images
3. This report text is held in digital form as: G:\Historic Environment (Documents)\HE Projects\Sites\Sites T\Tregargus Management Plan\CMS Report\Tregargus CMS Final.doc
4. The ecological report is held in digital form as: G:\Historic Environment (Documents)\HE Projects\Sites\Sites T\Tregargus Management Plan\Reports\Tregargus Valley Ecology.doc



<p><b>Title</b></p> <p><b>Designations</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old County Hall, Sticker Road, Truro, Cornwall, TR1 3AG tel: 01872 323900 fax: 01872 323883 email: hrr@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p><b>Scheduled Monuments and SSSIs</b></p>	<p>Originator</p> <p>Adam Clarke</p>	<p><small>In this document, the Copyright is attributed to the relevant person or organisation responsible for which it was originally prepared and for which Cornwall County Council was engaged to create it. Cornwall County Council accept no responsibility for the drawing or any other party who does the printing of which it was made.</small></p>
<p>Date</p> <p>17/05/2010</p>		

Fig 3. Designations affecting the Tregargus Valley project area. Black hatch – Site of Special Scientific Interest; Red – Scheduled Monument and Listed Building.

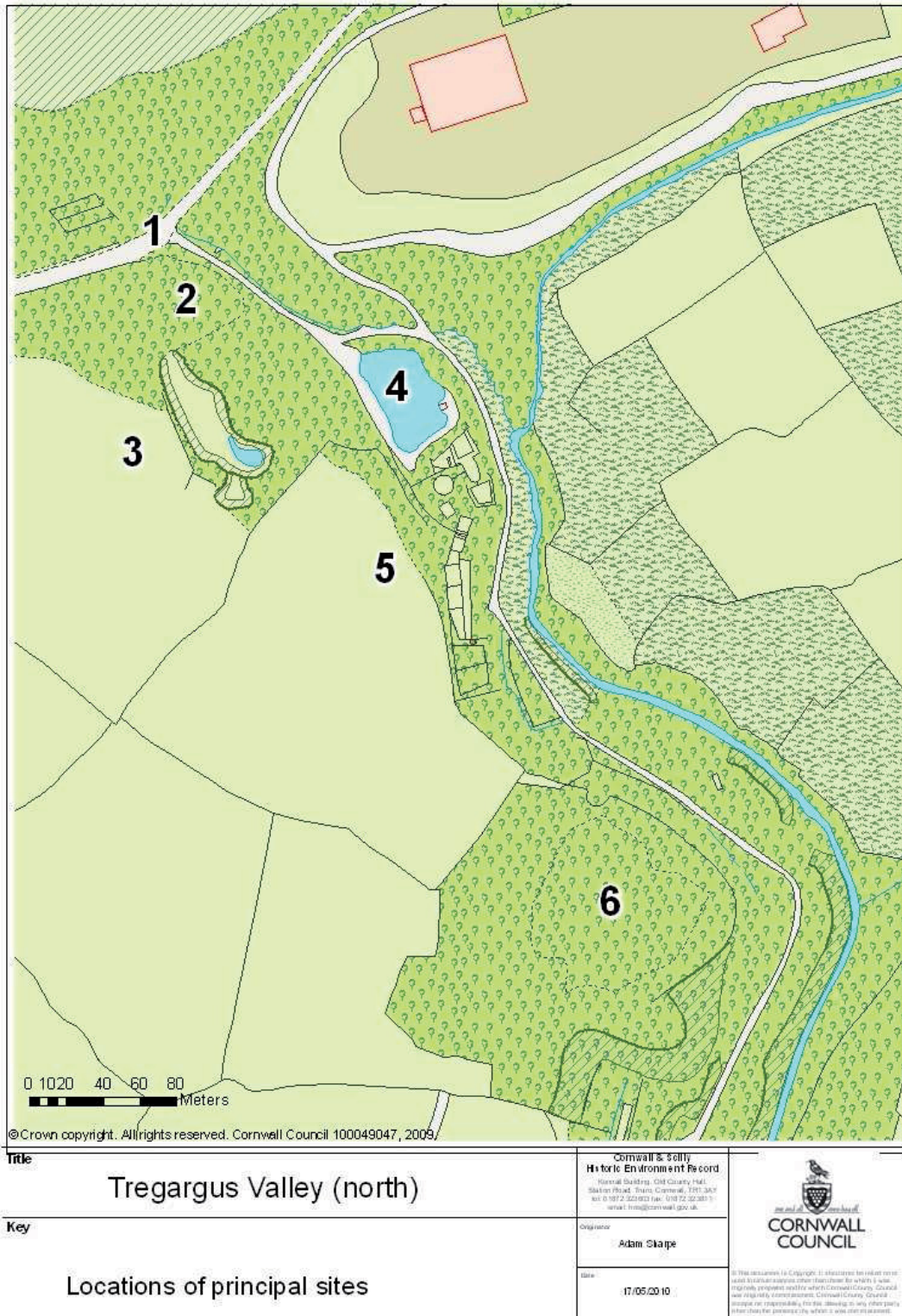


Fig 4. Locations of principal sites in the northern part of the Tregargus Valley. 1. Site entrance, 2. Small china stone quarries, 3. Wheal Arthur china stone quarry, 4. Top pond, 5. Wheal Arthur complex, 6. Rescrowsa china clay pit. Sites 1 to 4 lie outside the area managed by the Tregargus Trust.

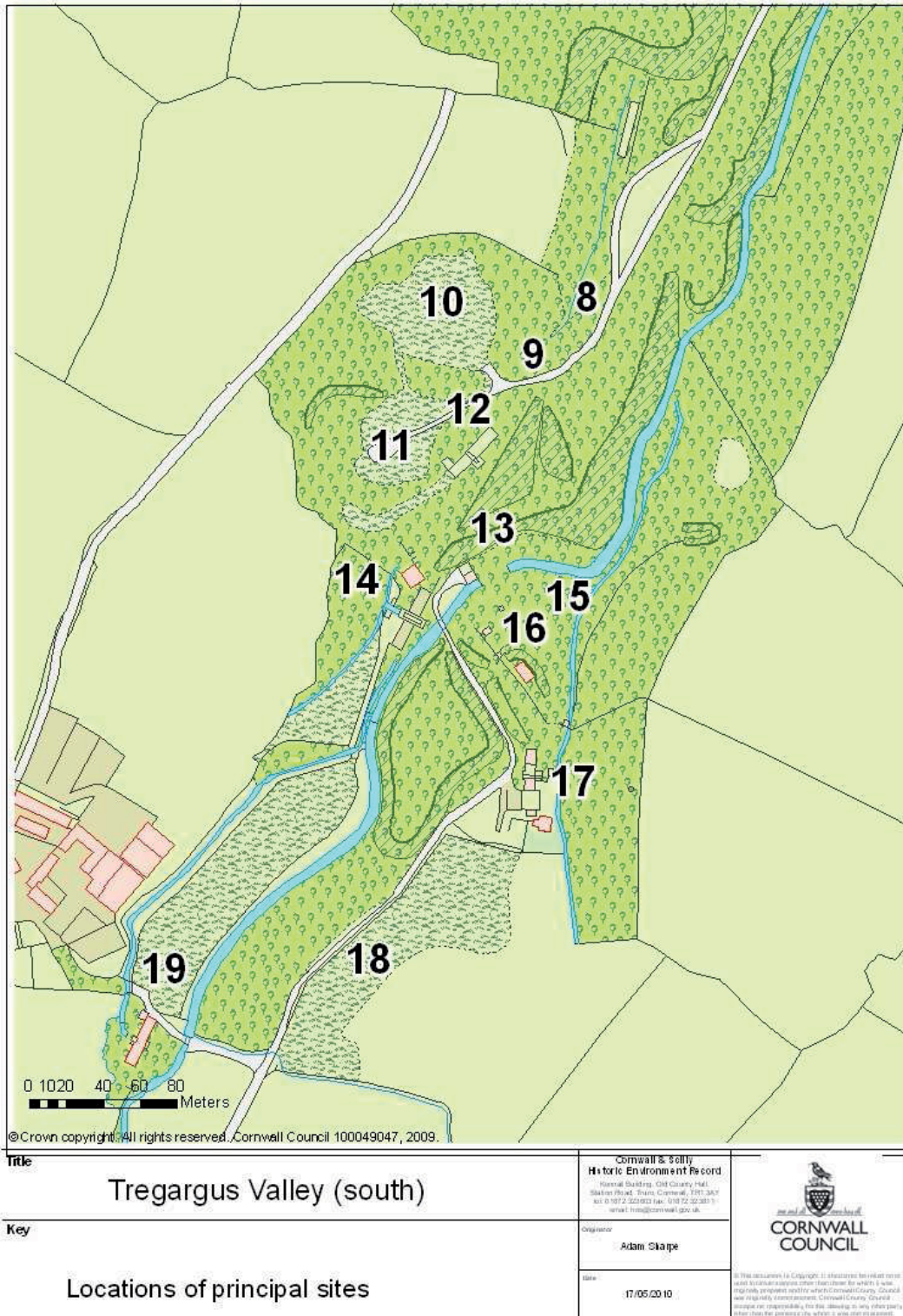
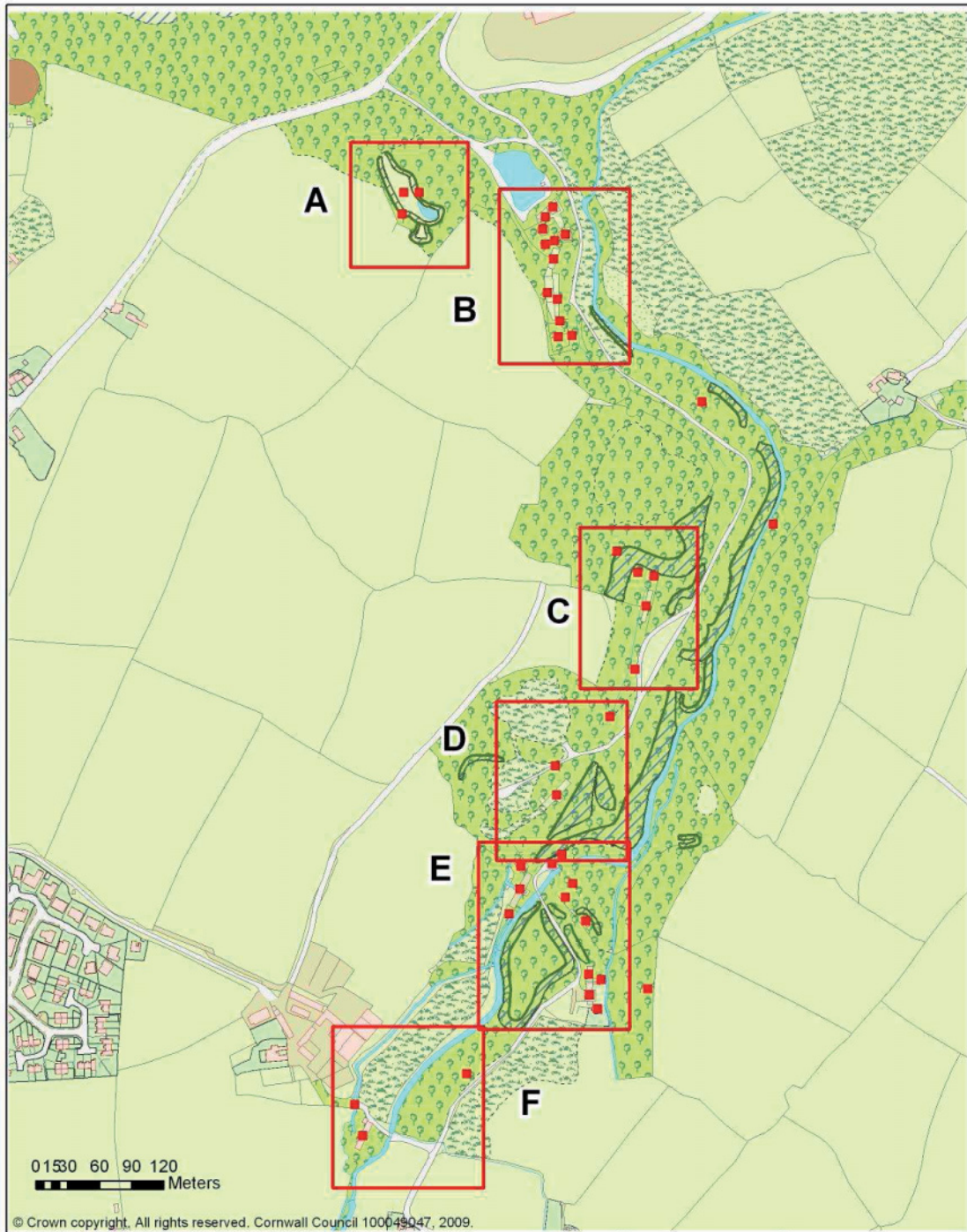


Fig 5. Locations of principal sites in the southern part of the Tregargus Valley. 7. Mica drags and adits, 8. Settling tanks, 9. Top Wheel Mill, 10. Tregargus Higher Quarry, 11. Tregargus Lower Quarry, 12. Blacksmith's Mill, 13. Smithy, 14. Big Wheel Mill, 15. Tin streamworking, 16. Concrete structures and powder house, 17. Trevear Mill complex, 18. Tin streamworking, 19. Mica or Lower Tregargus Mill.




<p><b>Title</b></p> <p>Inventory key maps</p>	<p><b>Cornwall &amp; Scilly Historic Environment Record</b>                  Kennall Building, Old County Hall,                  Station Road, Truro, Cornwall, TR1 3AY                  tel: 01872 323603 fax: 01872 323611                  email: her@cornwall.gov.uk</p>	
<p><b>Key</b></p> <p>Red rectangles indicate extents of inventory maps</p>	<p><b>Originator:</b></p> <p>Adam Sharpe</p>	<p><b>Date:</b></p> <p>17/05/2010</p> <p><small>© This document is Copyright. It should not be relied on or used in circumstances other than those for which it was originally prepared and for which Cornwall County Council was originally commissioned. Cornwall County Council accepts no responsibility for this drawing to any other party other than the person(s) by whom it was commissioned.</small></p>

Fig 6. Inventory key map – see Figs 6 to 11 for Maps A to F.

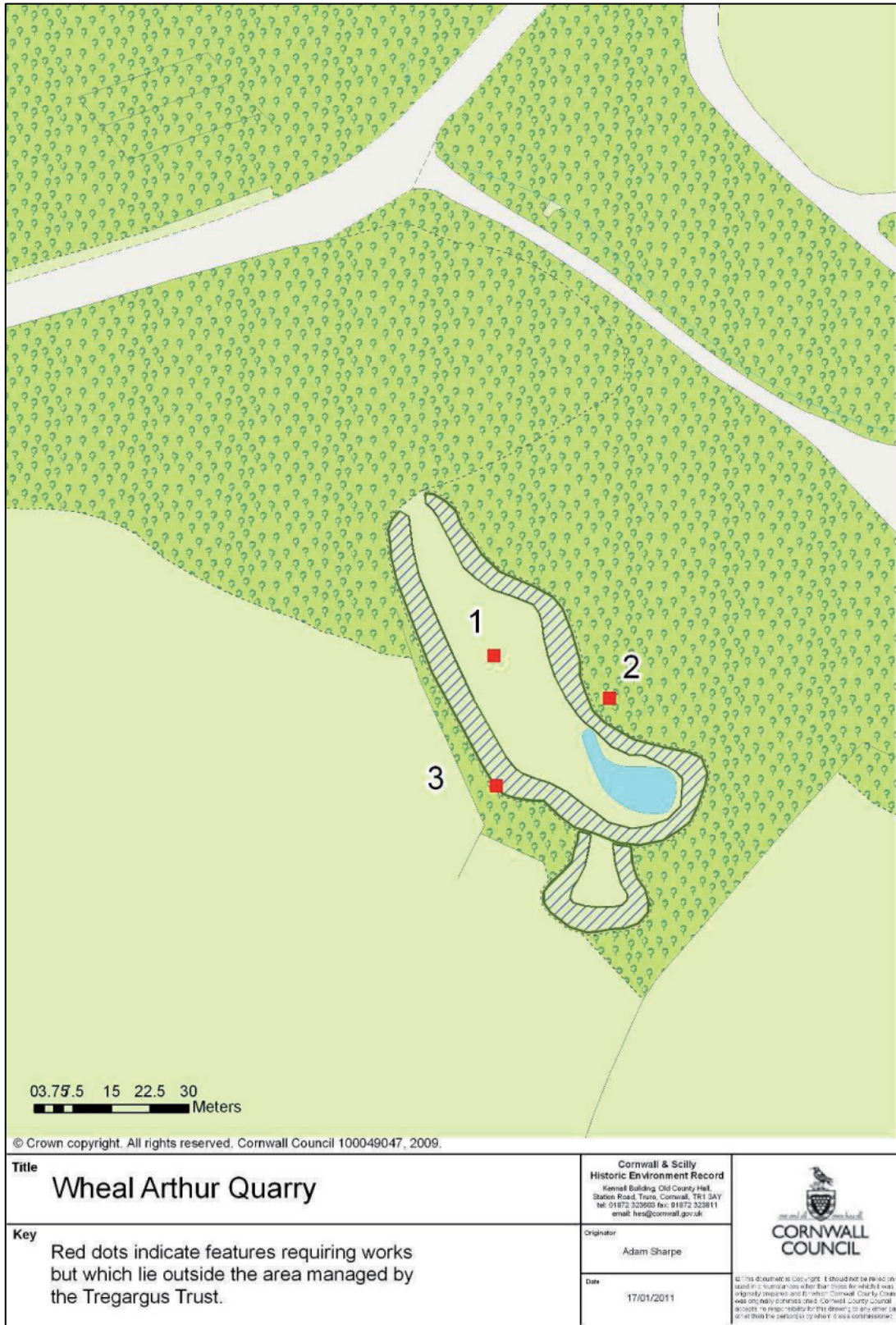
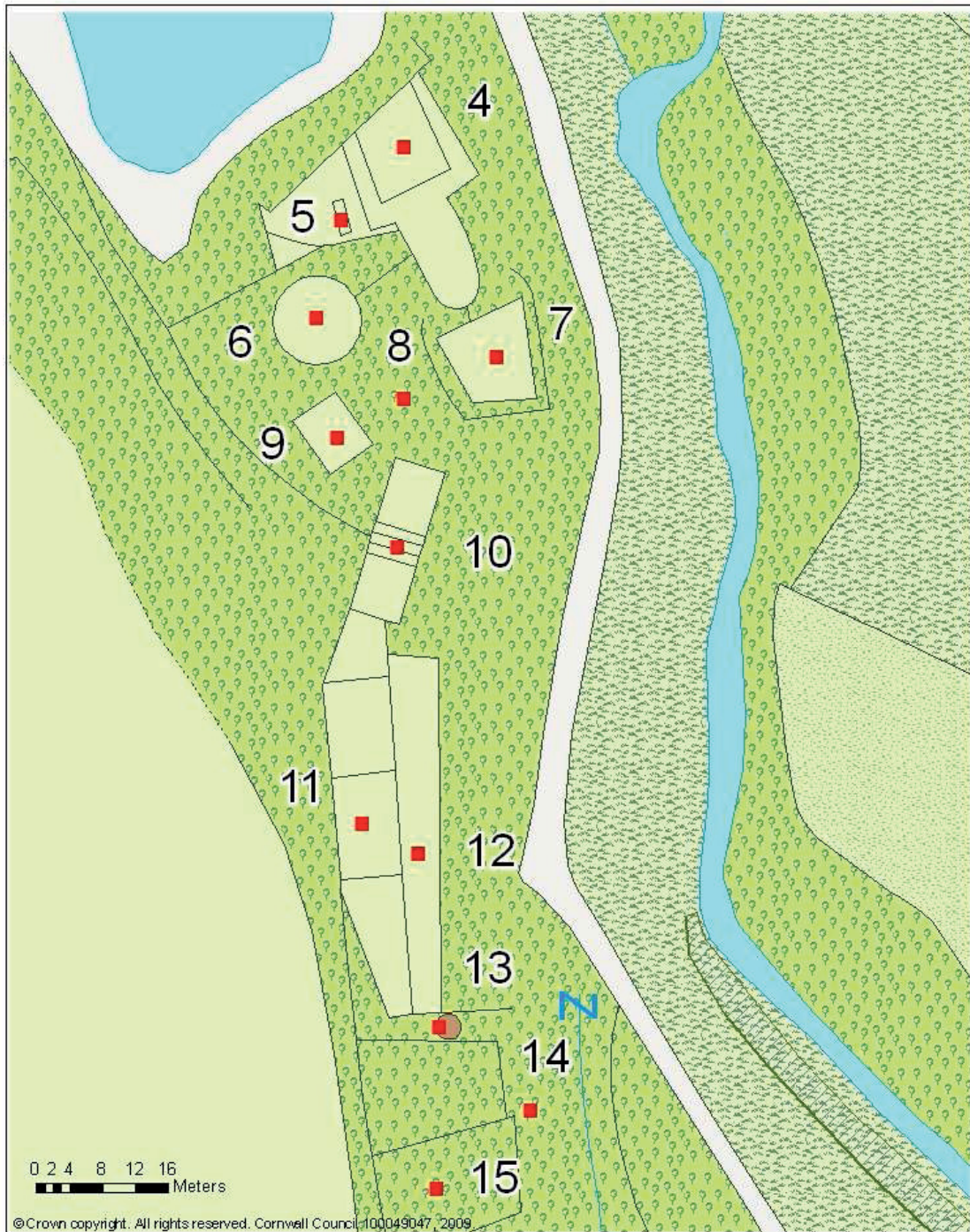


Fig 7. Map A. 1. Quarry, 2. Adit, 3. Adit.




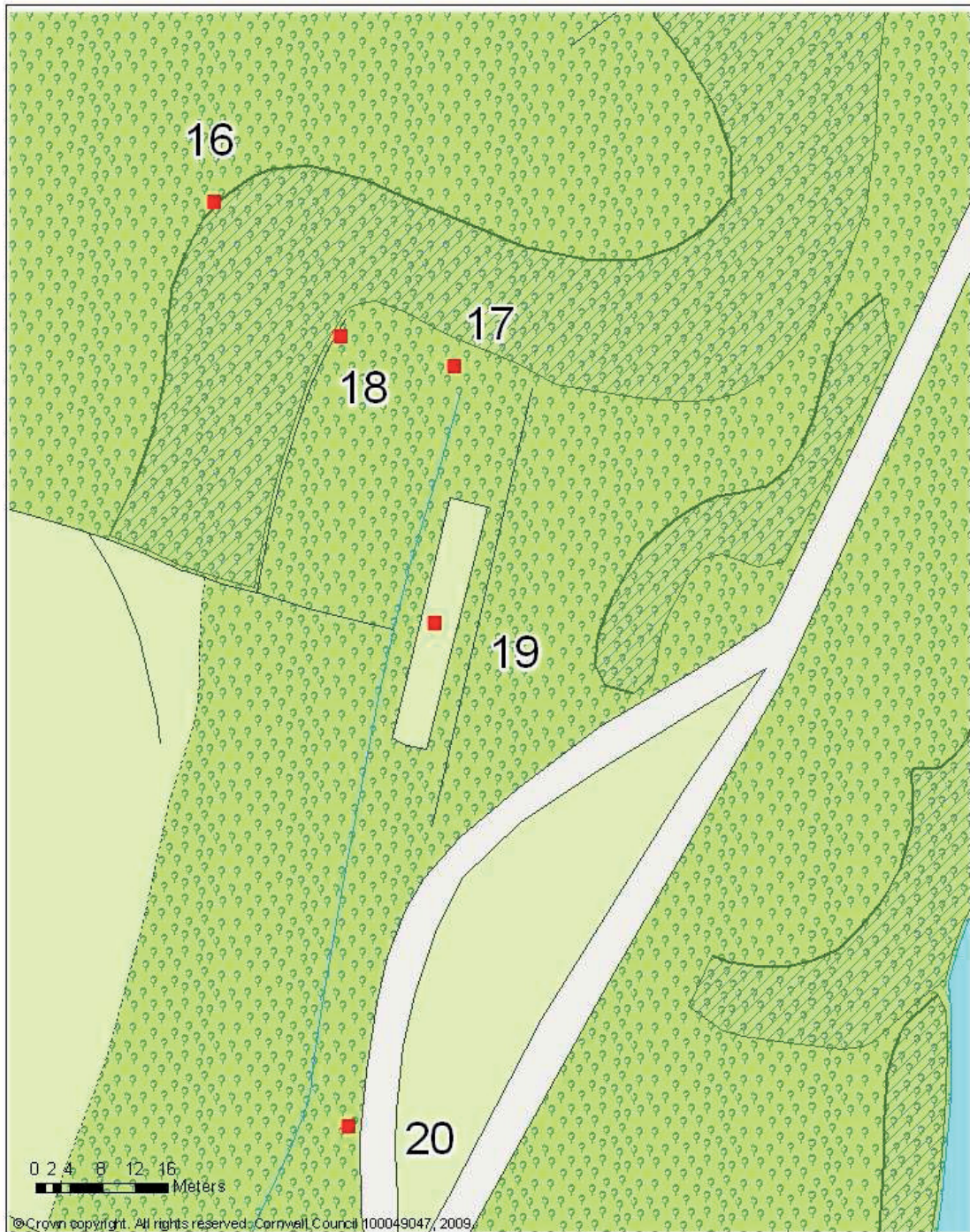
<p><b>Title</b></p> <p>Structures at Wheal Arthur</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old Quay, Mill, Sticker Road, St Austrey, Cornwall, TR1 3AF Tel: 01872 522903 Fax: 01872 522881 www.here@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator</p> <p>Adam Skape</p> <p>Date</p> <p>17/05/2010</p>	<p><small>In this document the Copyright in illustrations is retained solely by the author/creator, other than those for which it was originally prepared and for which Cornwall County Council now retains the copyright. Cornwall County Council accepts no responsibility for the drawing or any other parts other than the graphics for which it was responsible.</small></p>

Fig 8. Map B. 4. Settling tank, 5. Water wheel, 6. Tank, 7. Tank, 8. Shaft, 9. Tank, 10. China stone mill, 11. Dry, 12. Linbay, 13. Chimney, 14. Tramway, 15. Tanks. Features 4 and 5 lie just to the north of the boundary of the area managed by the Tregargus Trust.




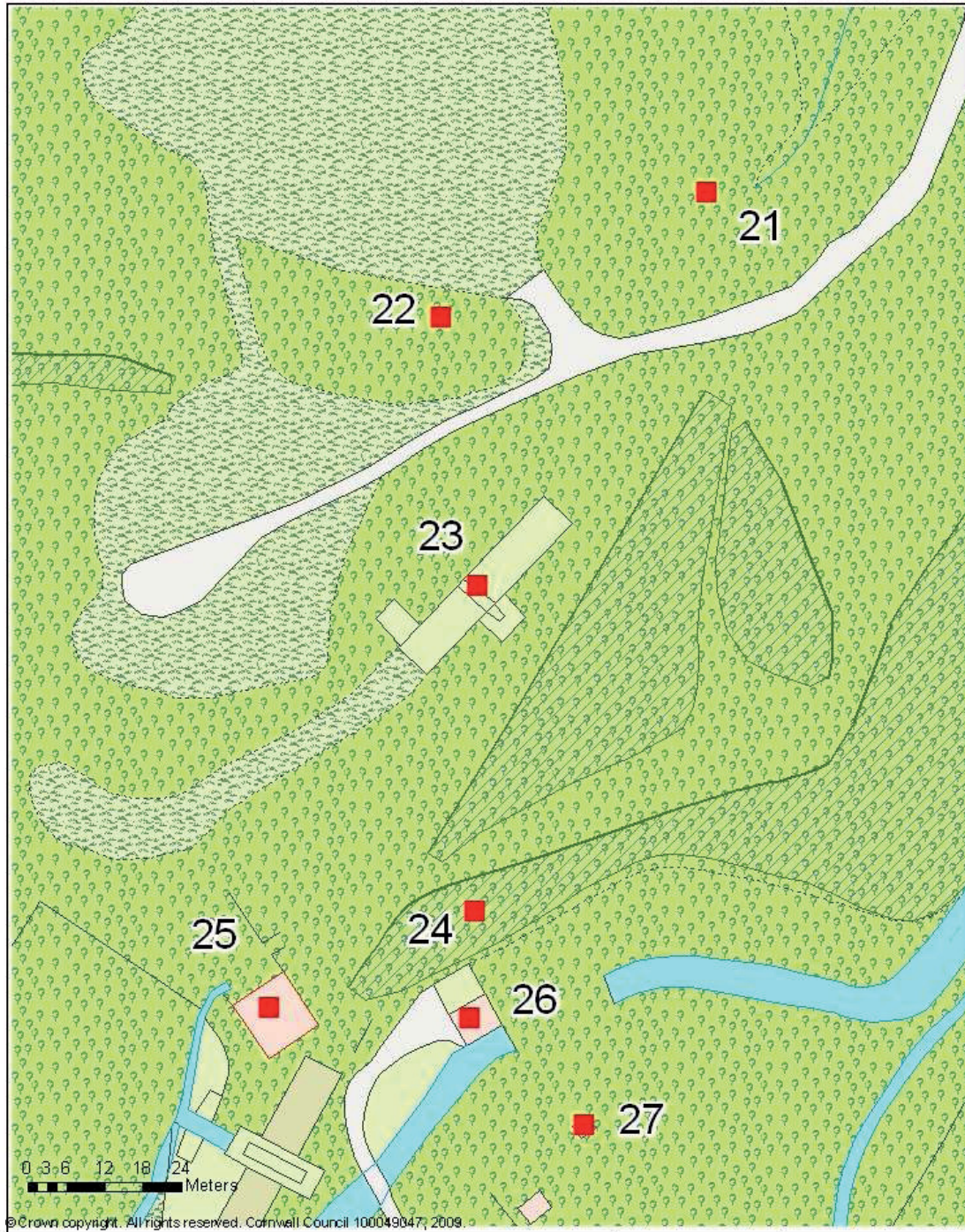
<p><b>Title</b></p> <p>Structures to the south of Wheal Arthur</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old County Hall, St Austine Road, St Austine, Cornwall, PL11 3AG Tel: 01872 522983 Fax: 01872 522987 email: hrr@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator Adam Skarpe</p>	<p>Date 17/05/2010</p> <p><small>© This document is Copyright © Cornwall Council and is subject to the terms and conditions of the Cornwall Council Open Access Licence. All rights reserved. No part of this document may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without the prior written permission of Cornwall Council.</small></p>

Fig 9. Map C.16. 16. Blacksmith's Shop, 17. Adit, 18. Adit, 19. Mica drags, 20. Settling tanks.






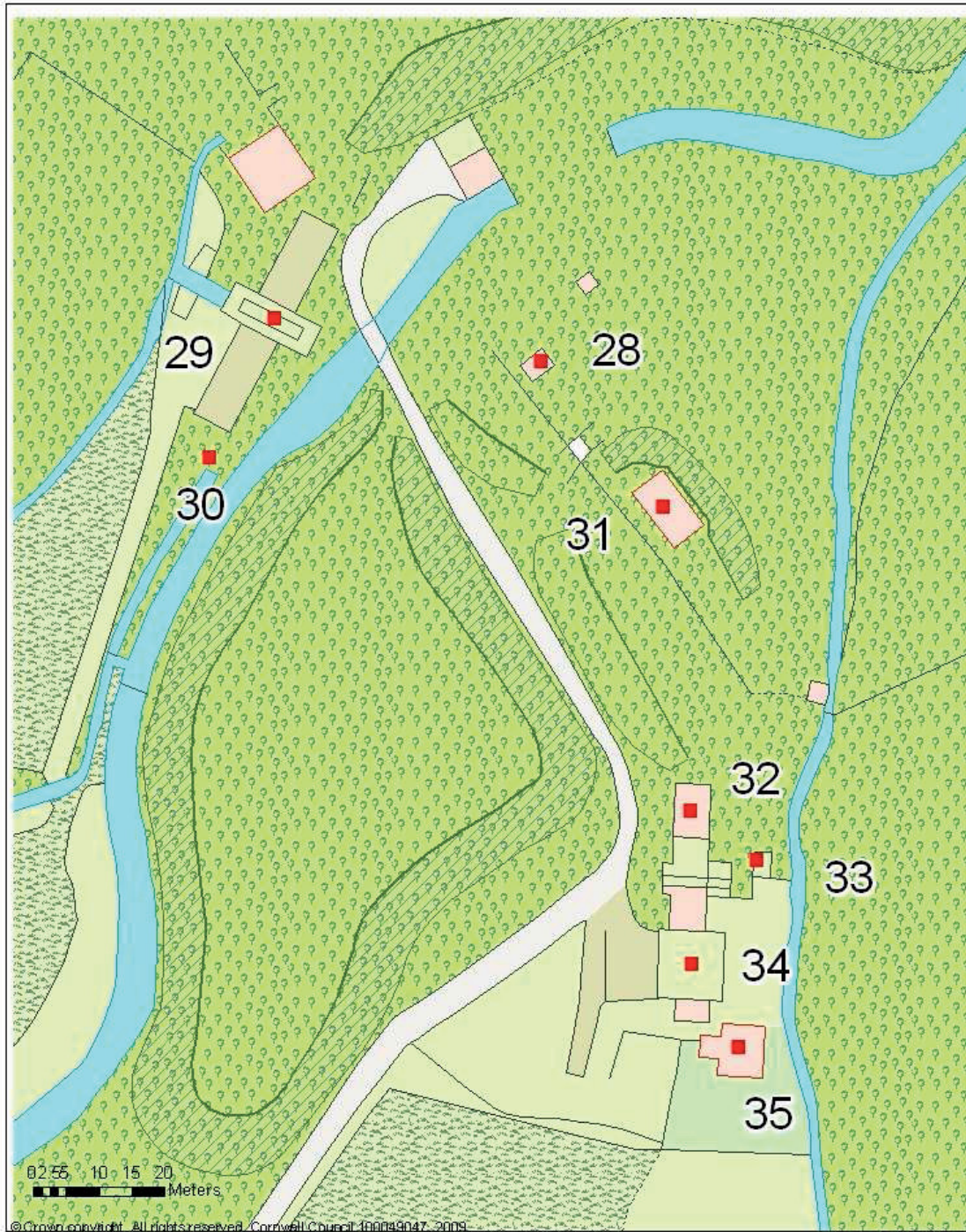
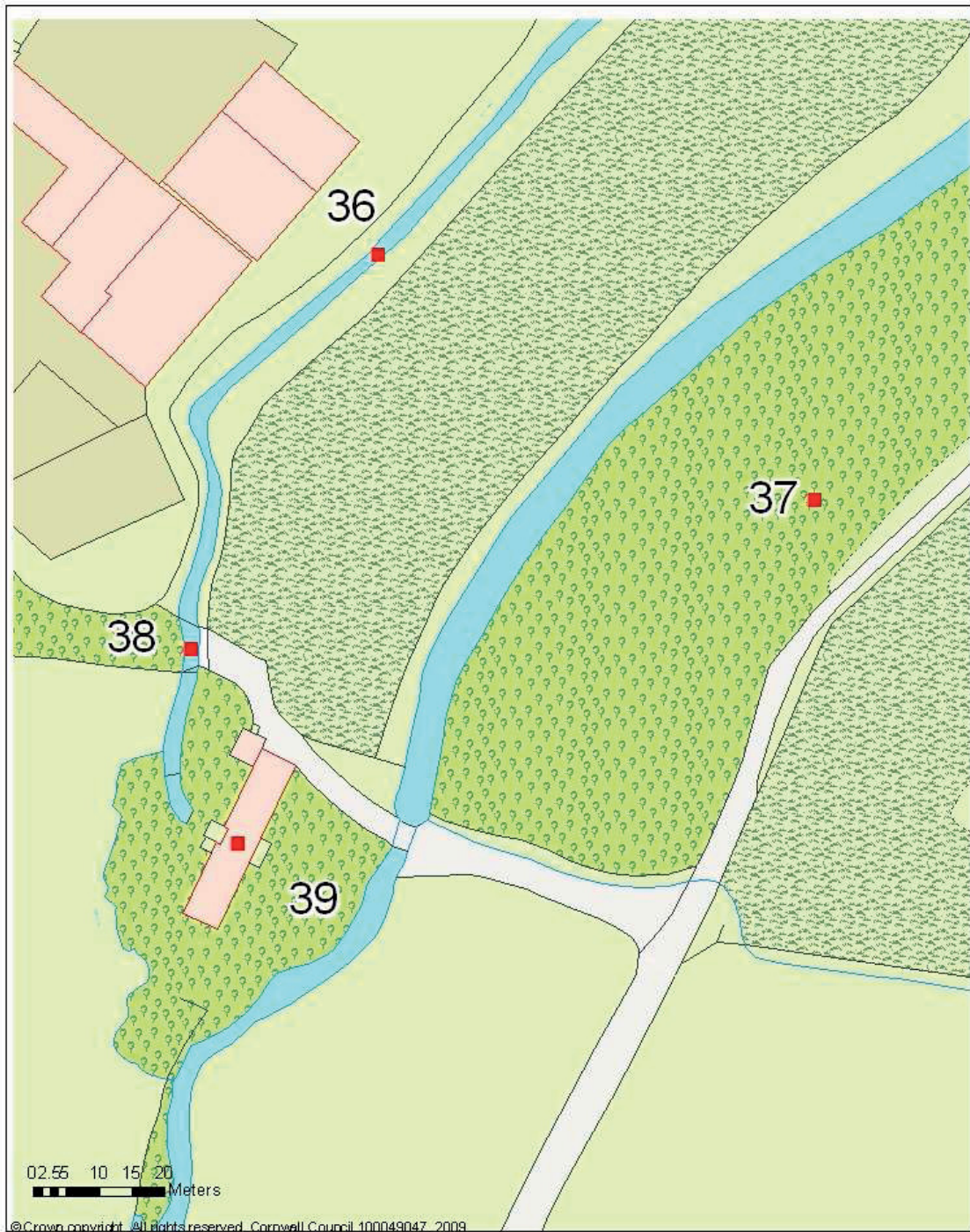
<p><b>Title</b> Structures to the north of Big Wheel Mill</p>		<p><b>Cornwall &amp; Scilly Historic Environment Record</b> National Building, Old County Hall, St Leonards Road, Truro, Cornwall, TR1 3AY Tel: 01872 522803 Fax: 01872 522803 email: htr@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>	
<p><b>Key</b> Red dots indicate structures requiring conservation works</p>				<p>Originator Adam Skape</p>
				<p>Date 17/05/2010</p>

Fig 10. Map D. 21. Structure, 22. Top Incline Mill, 23. Blacksmith's Shop Mill, 24. Chimney, 25. Winder house, 26. Blacksmith's Shop, 27. Powder house.



<p><b>Title</b></p> <p>Big Wheel and Trevear Mills</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings, Old County Hall, Sticker Road, St Austine, Cornwall, TR15 3AF Tel: 01872 522883 Fax: 01872 522883 mailto:hr@cornwall.gov.uk</p>	 <p>CORNWALL COUNCIL</p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator</p> <p>Adam Skarpe</p>	<p><small>© This document is Copyright © Cornwall Council and is subject to the terms and conditions of the Cornwall Council Open Access Licence. All rights reserved. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without the prior written permission of Cornwall Council.</small></p>
	<p>Date</p> <p>17/05/2010</p>	

Fig 11. Map E. 28. Blockwork structure, 29 Big Wheel Mill, 30. Adit, 31. Crib but, 32. Trevear china stone mill, 33. Tank, 34. Trevear pan kiln, 35. Trevear Cottage.




<p><b>Title</b></p> <p>Mica Mill</p>	<p>Cornwall &amp; Scilly Historic Environment Record Historic Buildings Unit Sticker Road, Truro, Cornwall, TR1 3AY Tel: 01872 522900 Fax: 01872 522881 www.hru@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p><b>Key</b></p> <p>Red dots indicate structures requiring conservation works</p>	<p>Originator</p> <p>Adam Skape</p> <p>Date</p> <p>17/05/2010</p>	<p><small>In this document, the Copyright in illustrations is retained and used in various ways, other than those for which it was originally intended, and for which Cornwall Council are not liable. Cornwall Council are not responsible for the design or any other parts of the document, or for the content of any other parts of the document, or for the content of any other parts of the document.</small></p>

Fig 12. Map F. 36. Leat, 37. Streamworks and adits, 38. Bridge/aqueduct, 39. Lower Tregargus/Mica Mill.

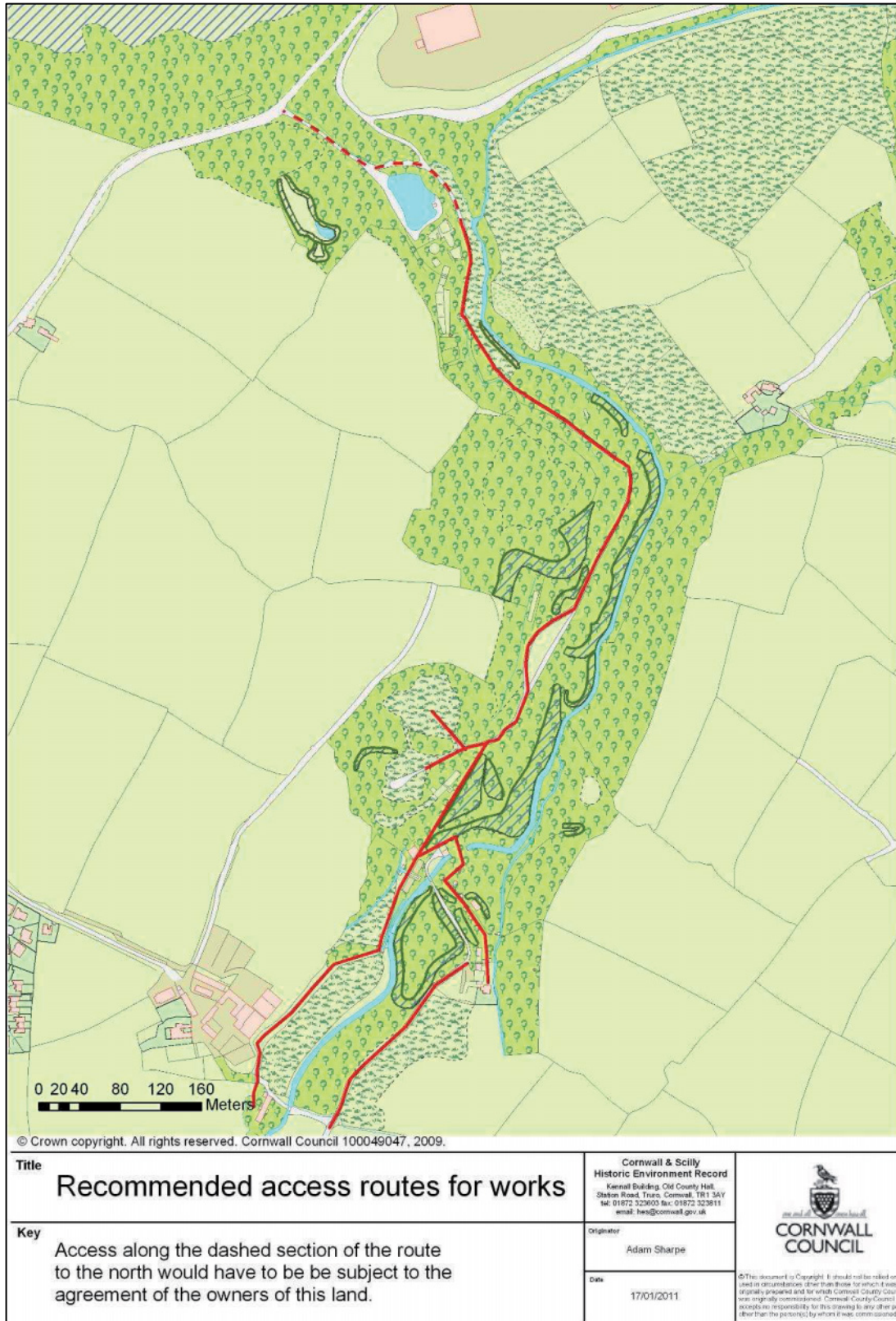
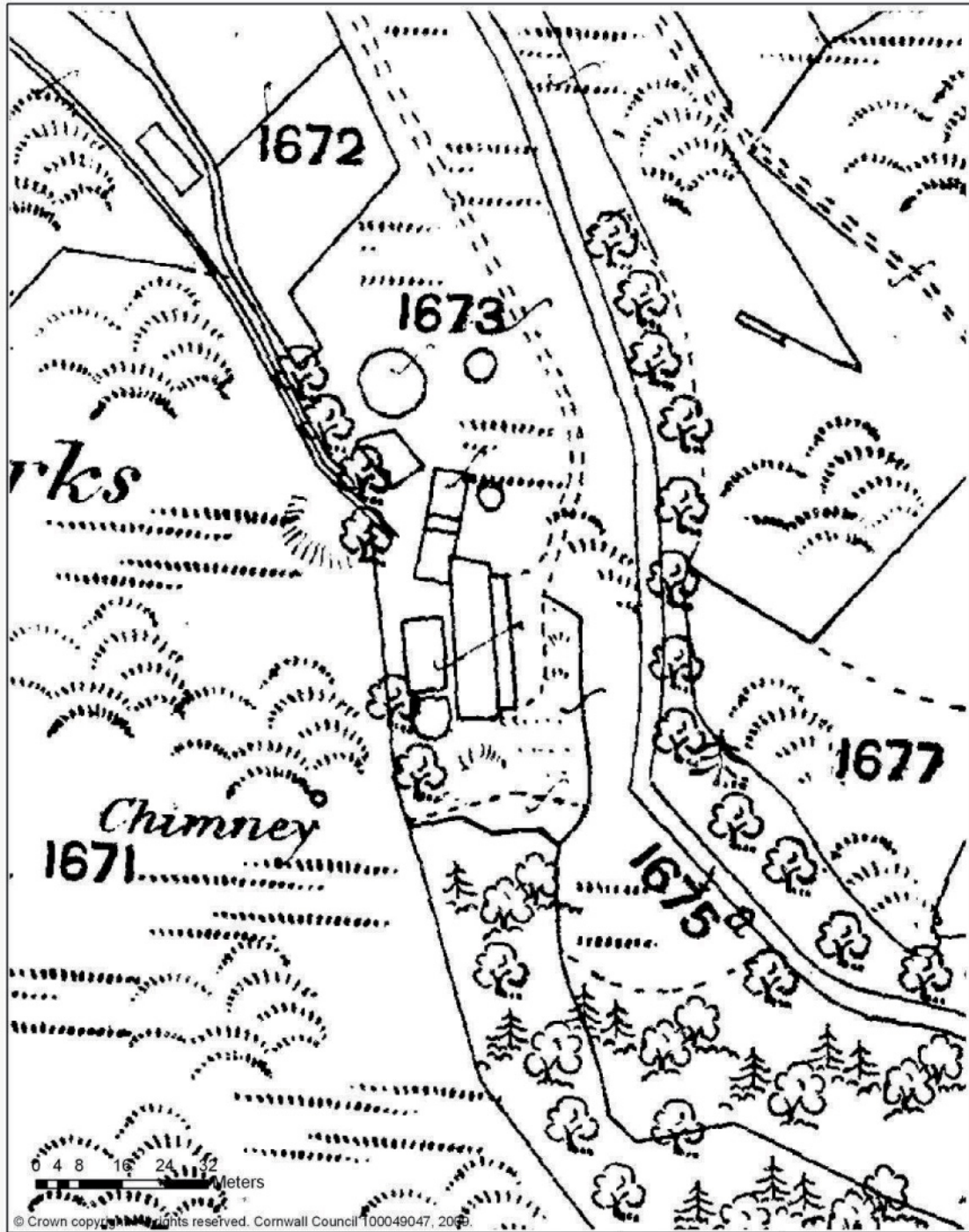


Fig 13. Suggested access routes to be used by contractors during conservation works to sites in the Tregargus Valley.



*Fig 14. An extract from the circa 1840 Tithe Map for St. Stephen in Brannel showing the section of the Barn River valley occupied by the Tregargus sites (centre). None of the structures described in this report are shown on this mapping. Block 1459 (upper centre) including the site of the Rescrowns china clay works was recorded as 'Moor and Clay Pits', whilst Block 1415 (lower centre), the site of the Higher and Lower Tregargus Quarries was recorded as 'Quarry Close'. Digitised image © Copyright Cornwall Council.*



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Title  
The Wheal Arthur Mill complex in 1880

Cornwall & Scilly  
Historic Environment Record  
Kennel Building, Old County Hall,  
Station Road, Truro, Cornwall, TR1 3AY  
tel: 01872 325603 fax: 01872 323811  
email: hes@cornwall.gov.uk



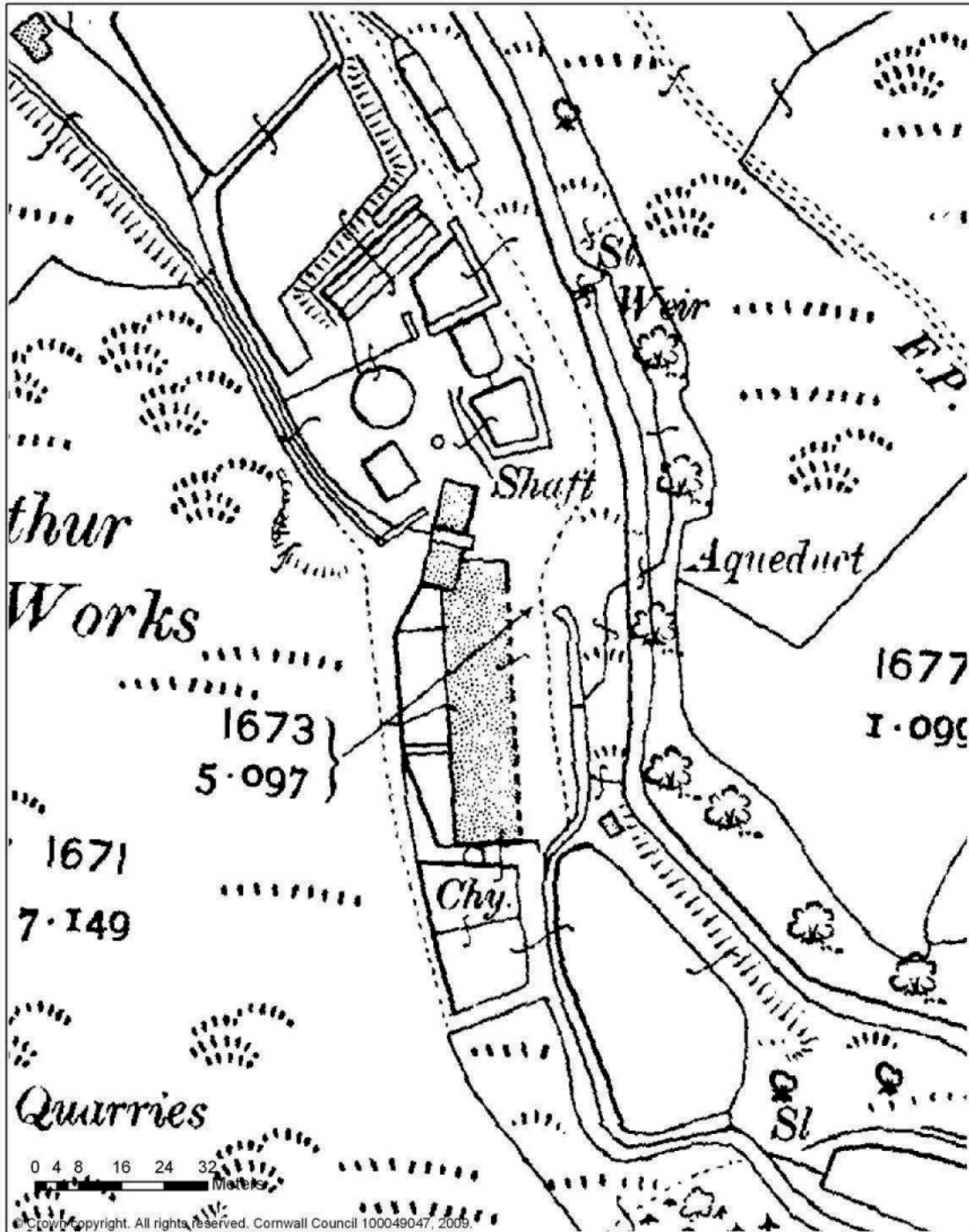
Key

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Fig 15. The Wheal Arthur complex in 1880.




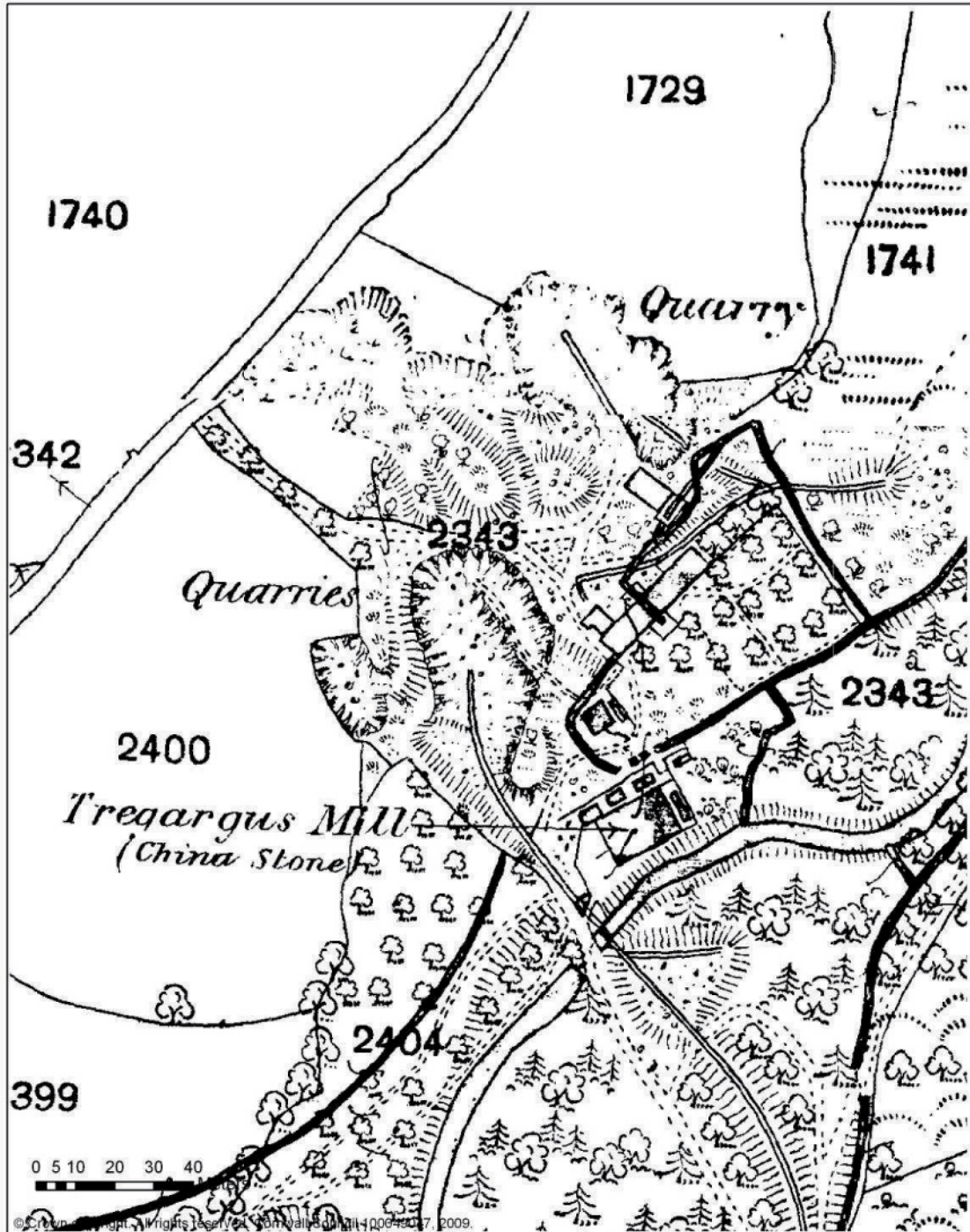
<p>Title</p> <p><b>The Wheal Arthur Mill complex in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennell Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY Tel: 01872 323603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p>Key</p>	<p>Originator</p> <p>Adam Sharpe</p>	<p>© This document is Copyright. It should not be relied on or used in circumstances other than those for which it was originally prepared and for which Cornwall County Council was originally commissioned. Cornwall County Council accepts no responsibility for this drawing to any other party other than the person(s) by whom it was commissioned.</p>
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Fig 16. The Wheal Arthur complex in 1908. The expansion and development of the site is clearly seen in comparison to the mapping drawn up less than three decades before (Fig 15).




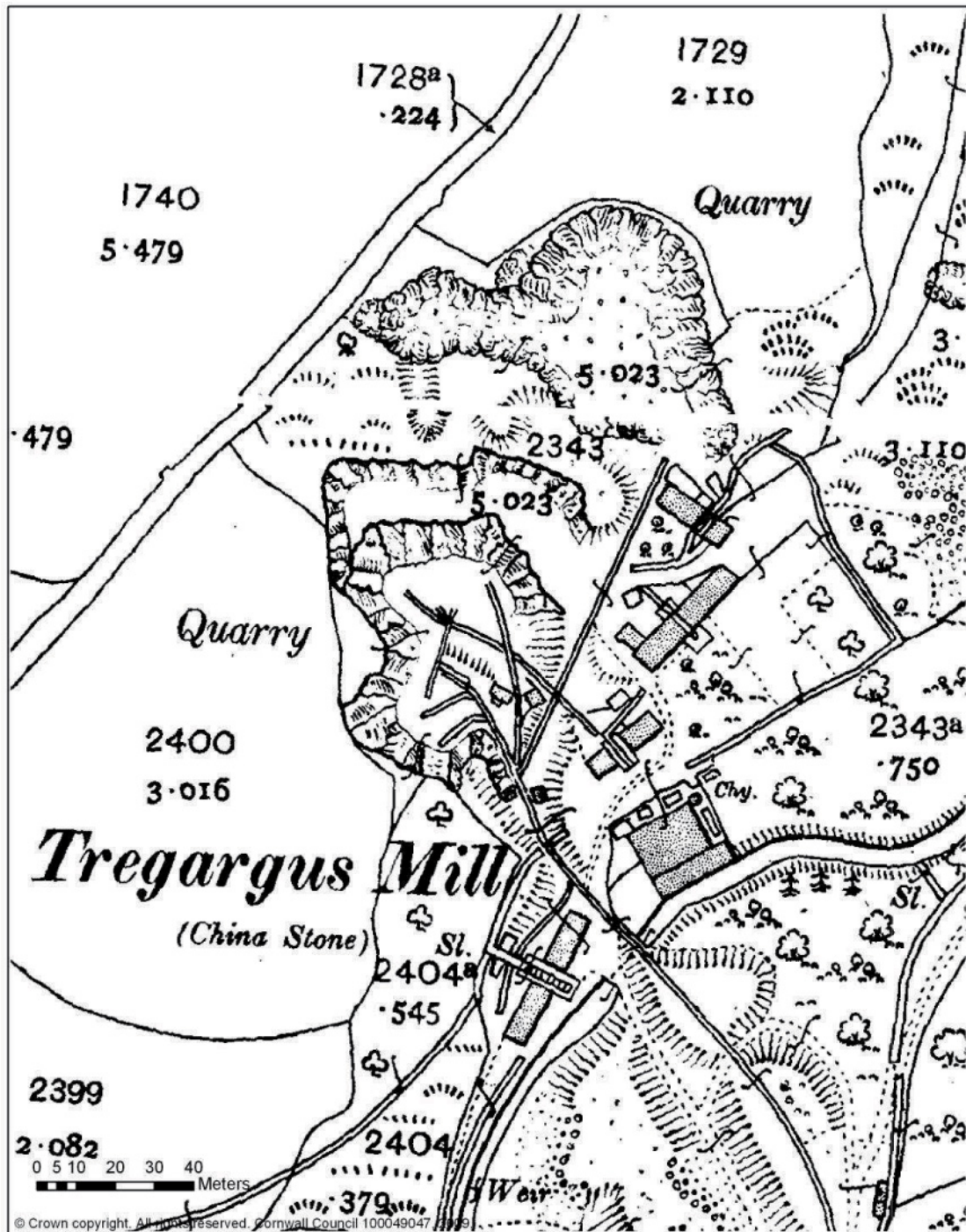
<p>Title <b>Big Wheel Mill and surrounding structures in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennel Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY tel: 01872 325603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p>Key</p>	<p>Originator Adam Sharpe</p>	<p>Date 17/05/2010</p>
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Fig 17. Higher and Lower Tregargus quarries with their associated structures in 1880. The stone quarried here was processed in Short Incline and Long Incline Mills. A further mill (labelled on the map) was sited near the stream, at the site now occupied by chimney 24. A tramway led south-east to Trevear Mill.






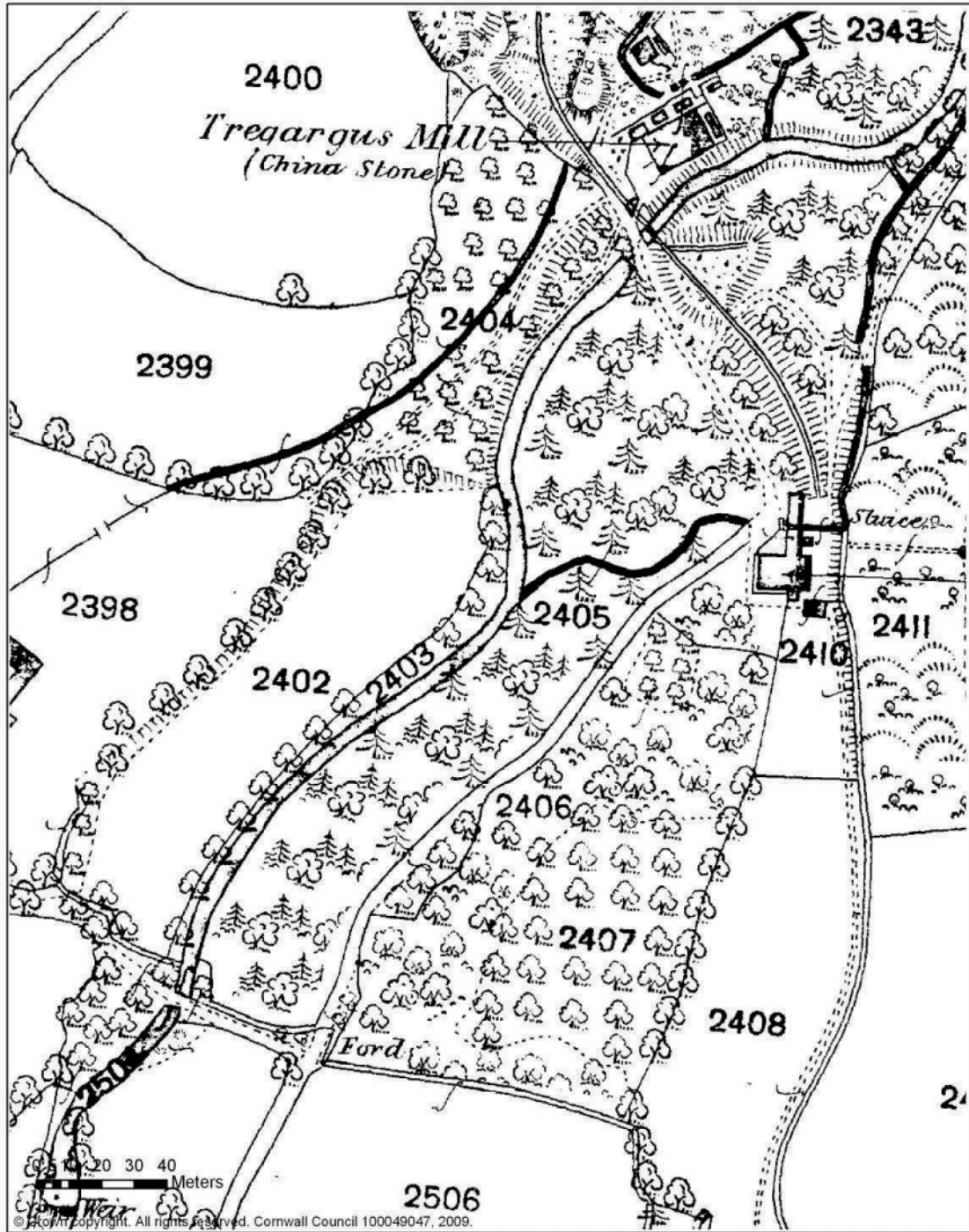
<p>Title <b>Big Wheel Mill and surrounding structures in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennell Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY Tel: 01872 323603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	
<p>Key</p>	<p>Originator Adam Sharpe</p>	<p>Date 17/05/2010</p>
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Fig 18. Higher and Lower Tregargus Quarries and associated structures in 1908. Two new mills had been added by this date: Blacksmith's Shop Mill and Big Wheel Mill, the leat and tramway networks had become far more complex.




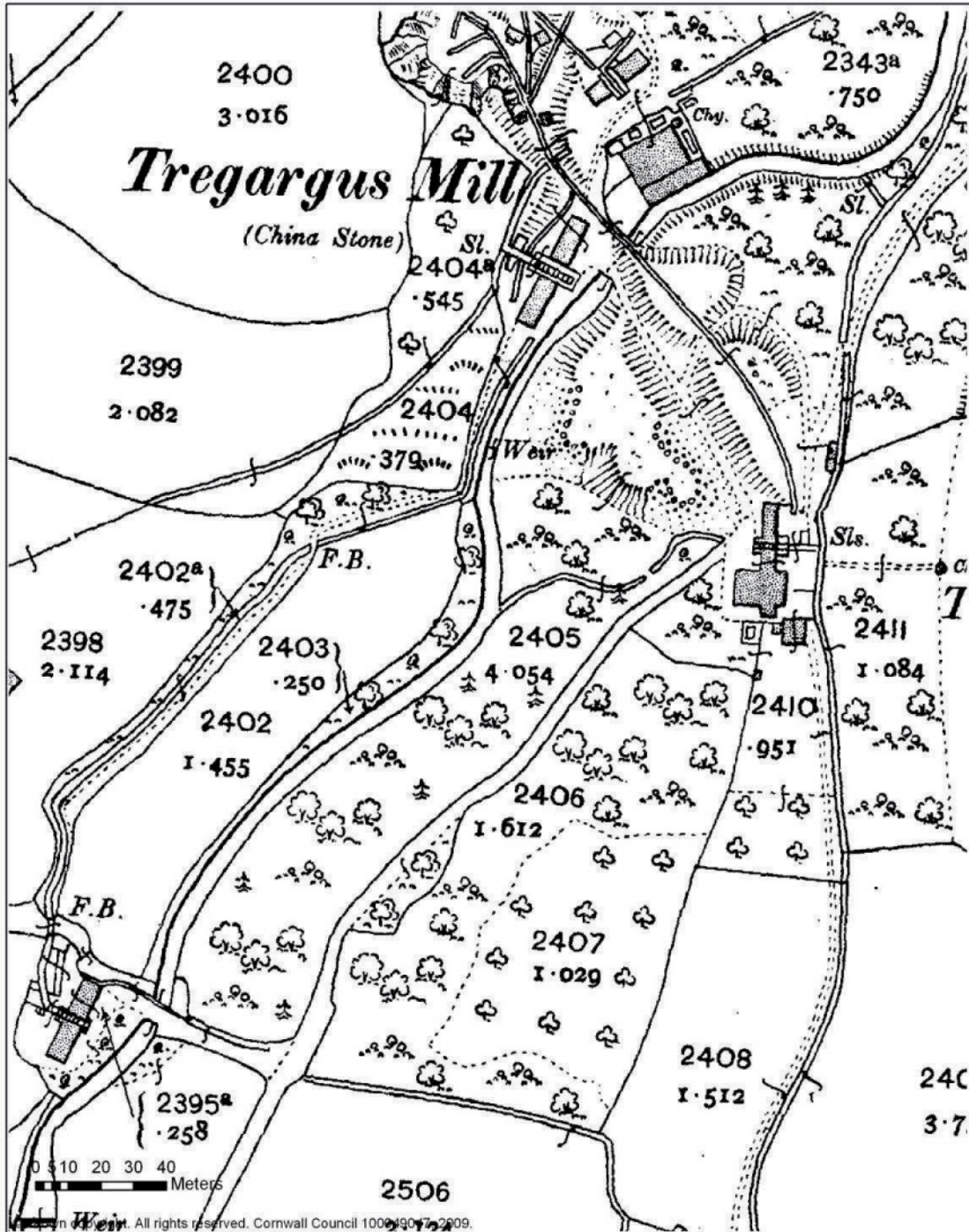
<p>Title</p> <p><b>Trevear and Mica Mills in 1880</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennel Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY tel: 01872 325603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
<p>Key</p>	<p>Originator</p> <p>Adam Sharpe</p>	
	<p>Date</p> <p>17/05/2010</p>	<p><small>© This document is Copyright. It should not be relied on or used in circumstances other than those for which it was originally prepared and for which Cornwall County Council was originally commissioned. Cornwall County Council accepts no responsibility for this drawing to any other party other than the person(s) by whom it was commissioned.</small></p>

Fig 19. Structures at the lower end of the project area in 1880. Lower Tregargus or Mica Mill had not been built at this date; Trevear Mill was supplied with stone from Lower Tregargus Quarry.




<p>Title</p> <p><b>Trevar and Mica Mills in 1908</b></p>	<p>Cornwall &amp; Scilly Historic Environment Record Kennell Building, Old County Hall, Station Road, Truro, Cornwall, TR1 3AY Tel: 01872 323603 fax: 01872 323811 email: hes@cornwall.gov.uk</p>	 <p><b>CORNWALL COUNCIL</b></p>
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Fig 20. The lower end of the project area in 1908. The Trevear Mill complex remained unchanged, but the Lower Tregargus/Mica Mill complex had been constructed to its south-west.



*Fig 21. An archive view of Big Wheel Mill, with Short Incline Mill, Top Wheel Mill and Blacksmith's Shop Mill in the background. British Geological Survey © NERC. All rights reserved. IPR/121-15CT*



*Fig 22. An archive view of the interior of Big Wheel Mill, showing two of its grinding pans. British Geological Survey © NERC. All rights reserved. IPR/121-15CT*

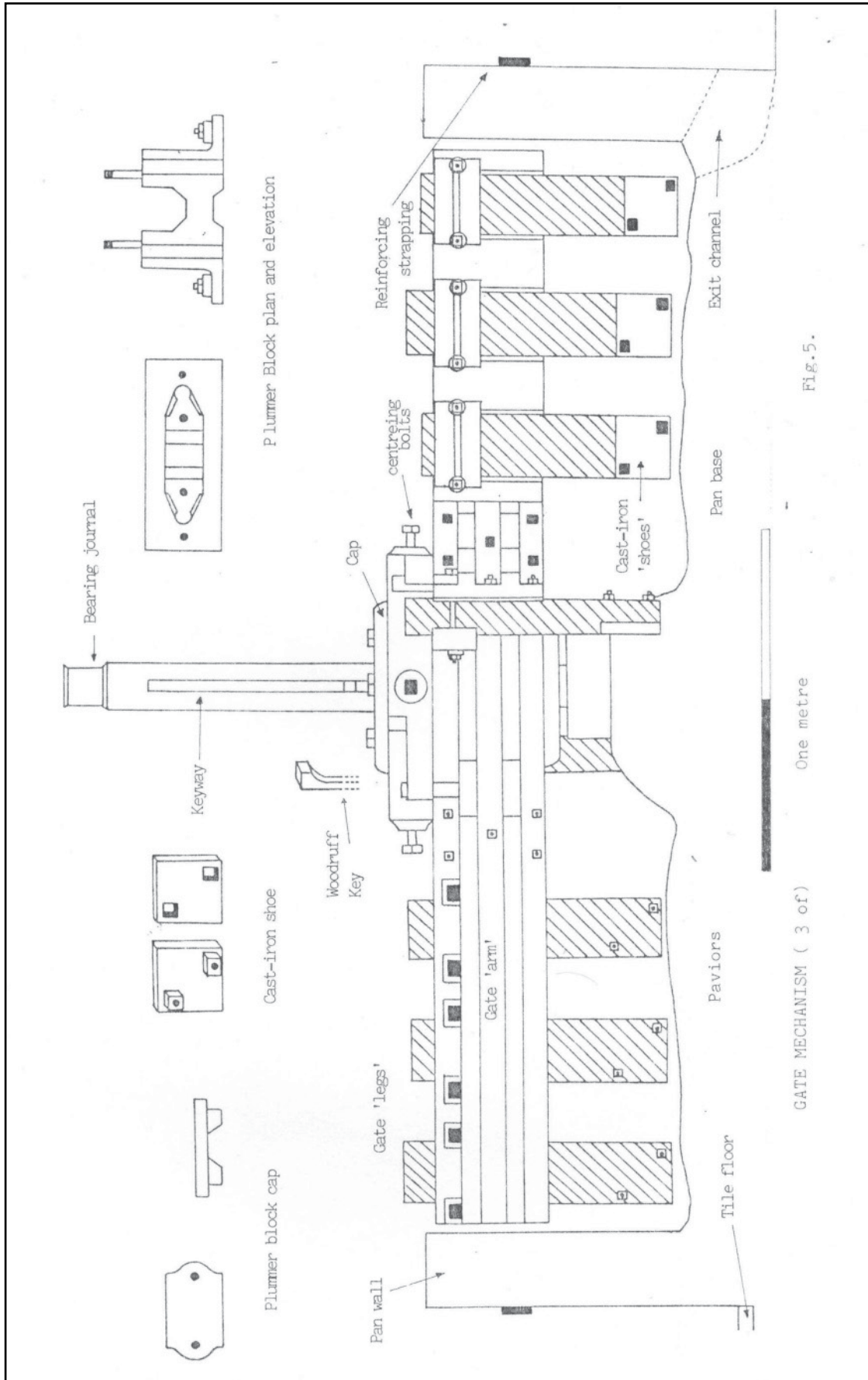


Fig 23. The arrangement of the components of a china stone grinding pan, in this case one of the surviving examples at Chapel Mill, St. Stephen in Brannel. The gate legs are vertically adjustable so that they can be lowered as the paviors in the pan base wear down. Source Sharpe and Smith 1985.

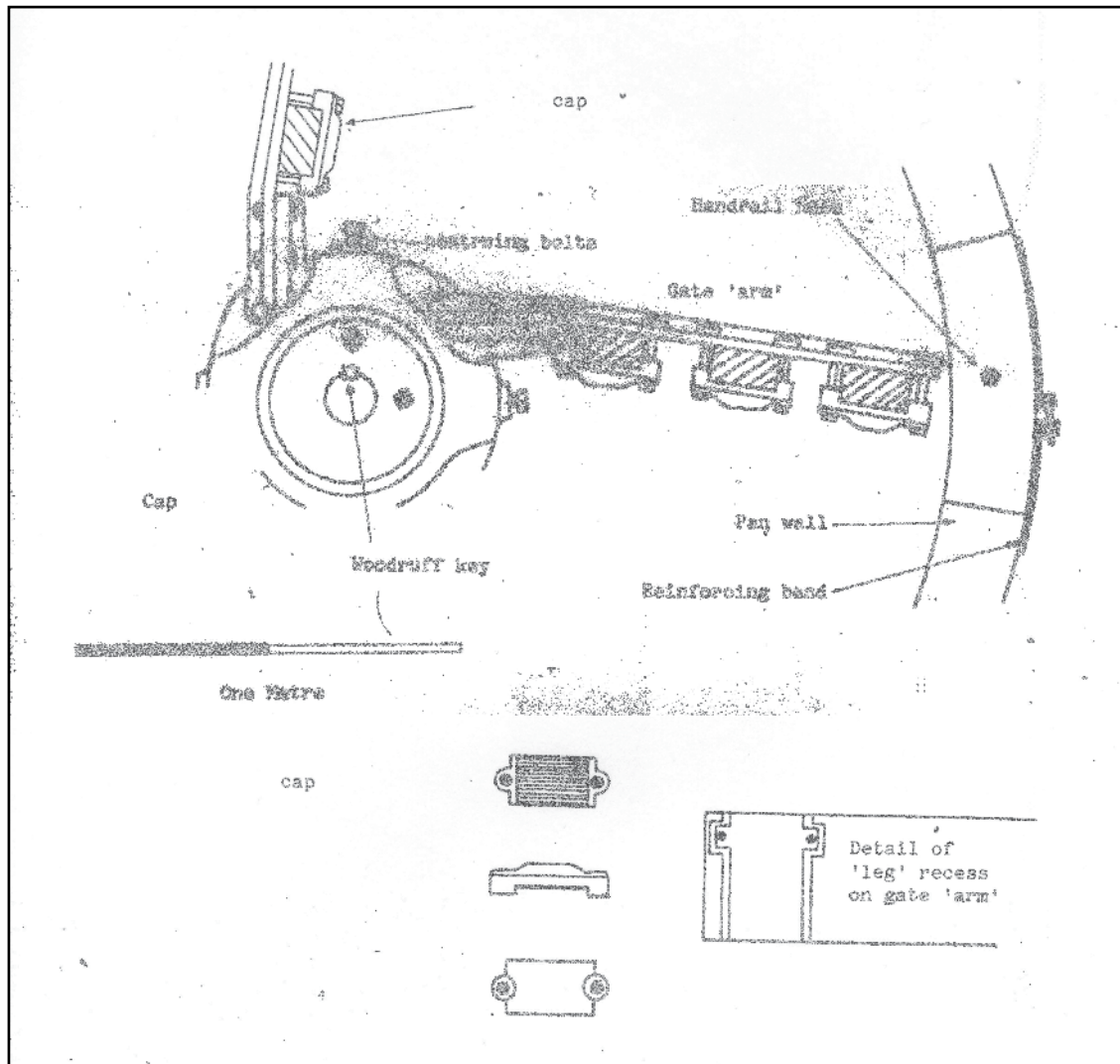


Fig 24. A plan of a typical grinding pan showing details of the gates and hub. Source: Sharpe and Smith 1985

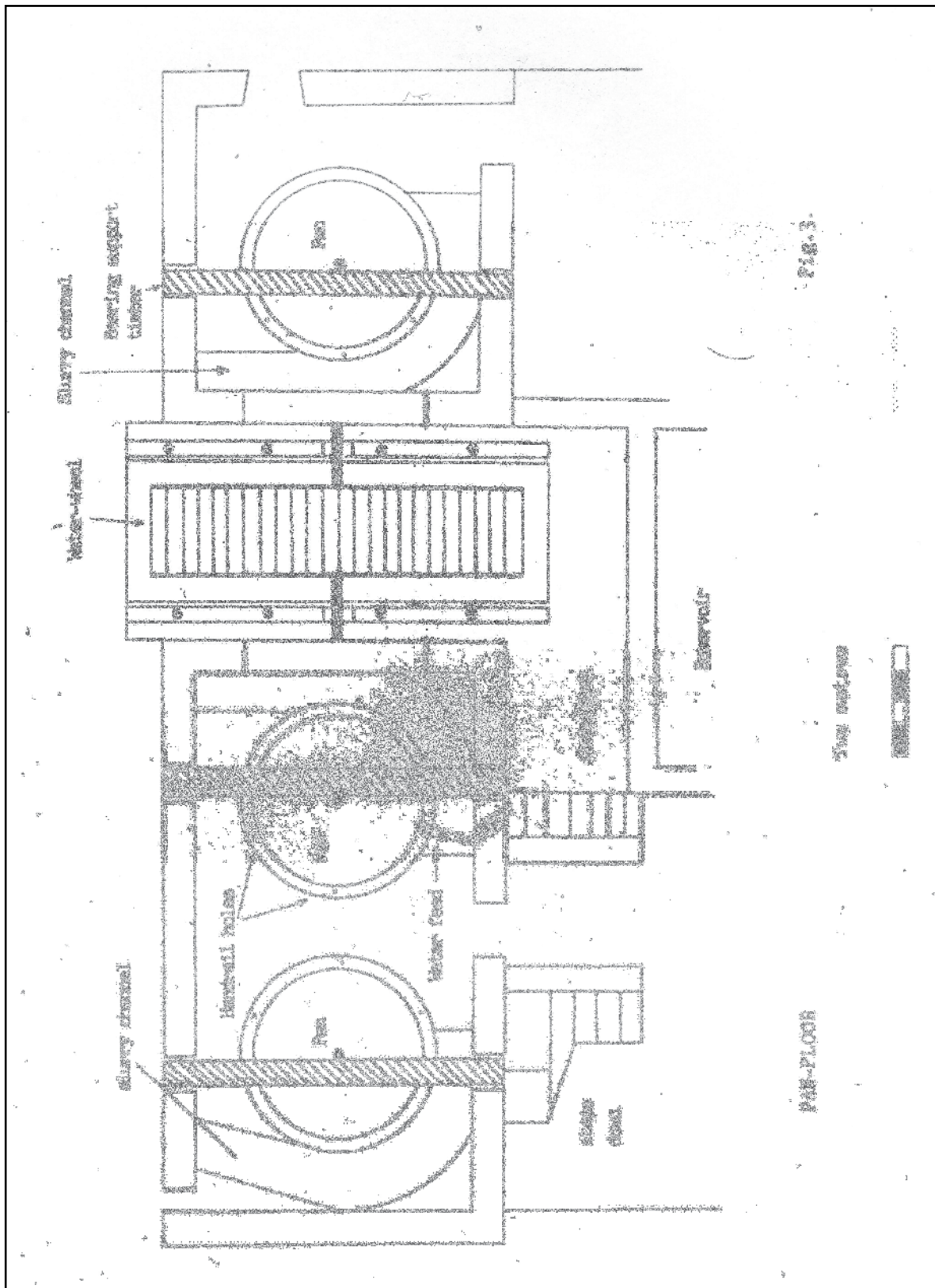


Fig 25. A typical arrangement of the ground floor of a china stone mill (Chapel Mill), showing the water wheel in its wheel-pit, the grinding pans flanking it and the bressmers over them which supported the upper ends of the vertical axles. Source: Sharpe and Smith 1985.

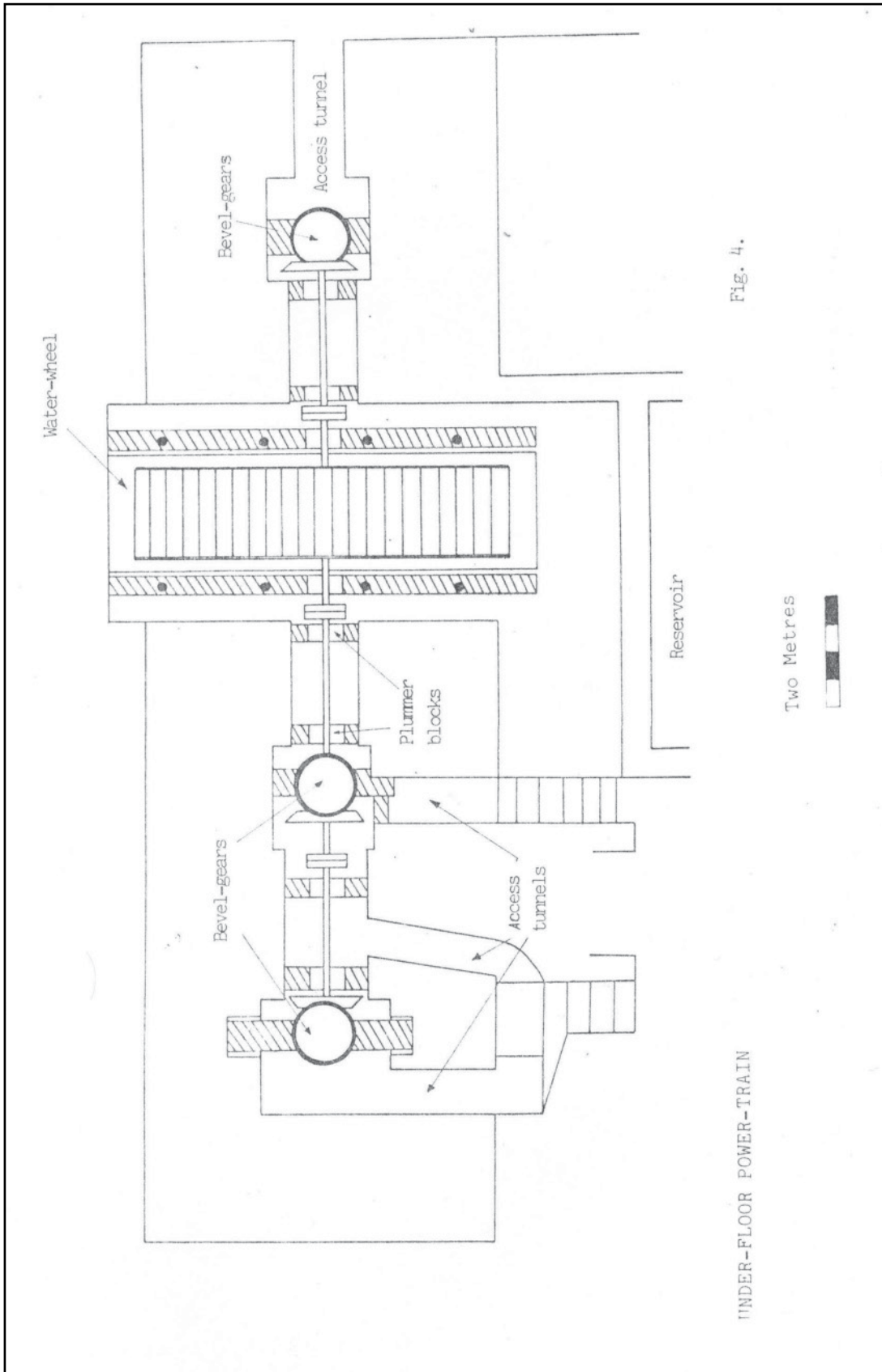


Fig 26. A typical under-floor arrangement in a china stone mill (Chapel Mill), showing the horizontal drive axles from the water wheel, the bevel gears which powered the axles running up to the grinding pans and the access tunnels from the exterior of the building. Source: Sharpe and Smith 1985.





*Fig 28. One of the bat-friendly galvanised steel grilles [3] fitted in the adits in Wheal Arthur Quarry [1]. The quarry is outside the area managed by the Tregargus Trust. HE Digital Image Archive.*



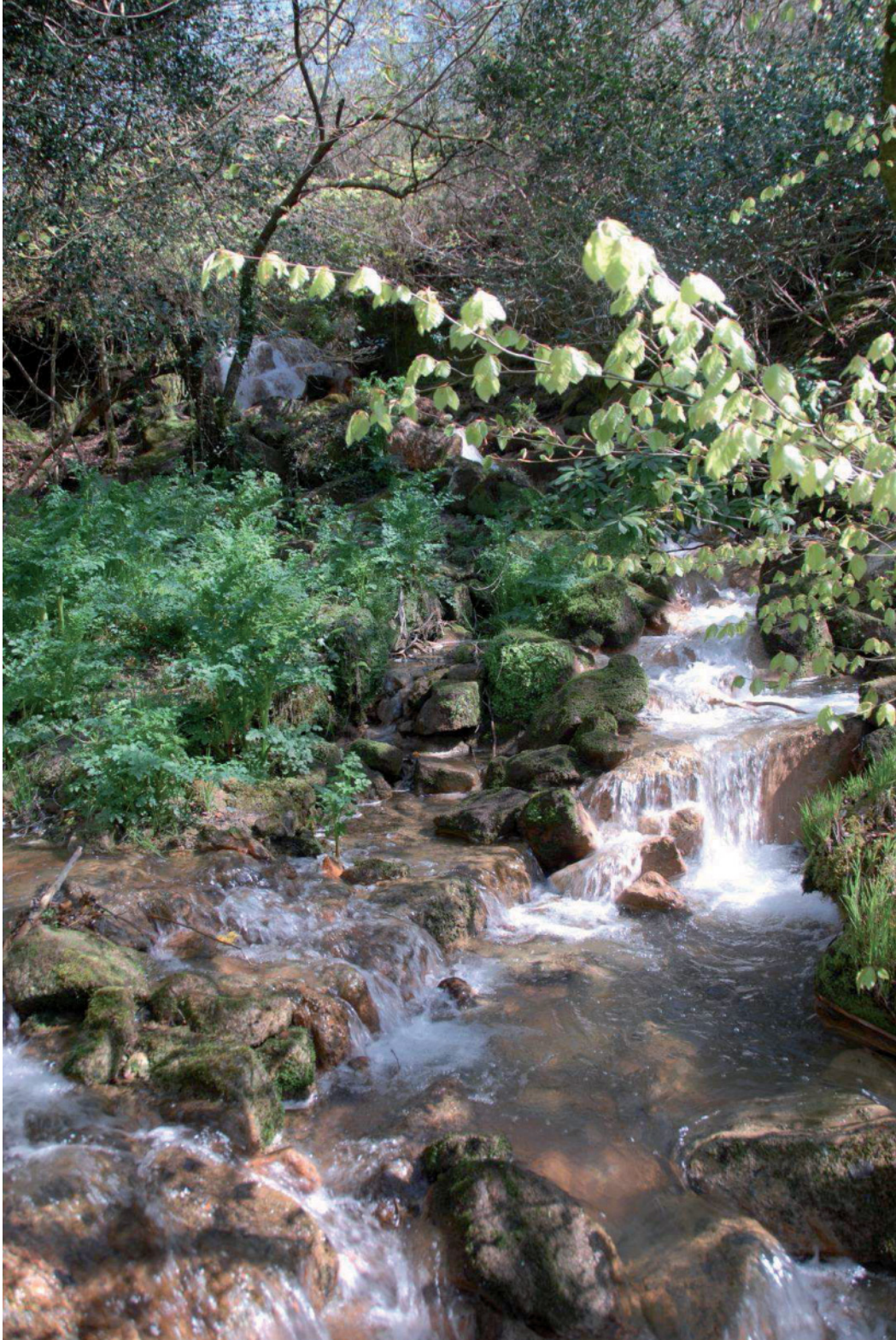
*Fig 27 A typical view in the secluded interior of Wheal Arthur Quarry [1]. The quarry lies outside the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 29. The pond and pump house just to the north of the Wheal Arthur complex. This site is just to the north of the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 30. The overflow water discharge from the pond above the Wheal Arthur complex, just to the north of the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 31. The cascade formed by the Barn River near the Wheal Arthur complex just to the east of the area managed by the Tregargus Trust. HE Digital Image Archive.*



*Fig 32. The Wheal Arthur complex from the south, with the dry [11] to the left and china stone mill [10] to the right. HE Digital Image Archive.*



*Fig 33. The china stone mill [10] at Wheal Arthur from the south-east, showing the vegetation which has grown up in the central wheelpit. HE Digital Image Archive.*



*Fig 34. The brick-built grinding pans in the northern section of Wheal Arthur china stone mill [10]. The crown of the central waterwheel can be seen in the background. HE Digital Image Archive.*



*Fig 35. The under-floor axle from the water wheel and one of the vertical axles driving the grinding pans in the southern section of Wheal Arthur china stone mill [10]. HE Digital Image Archive.*



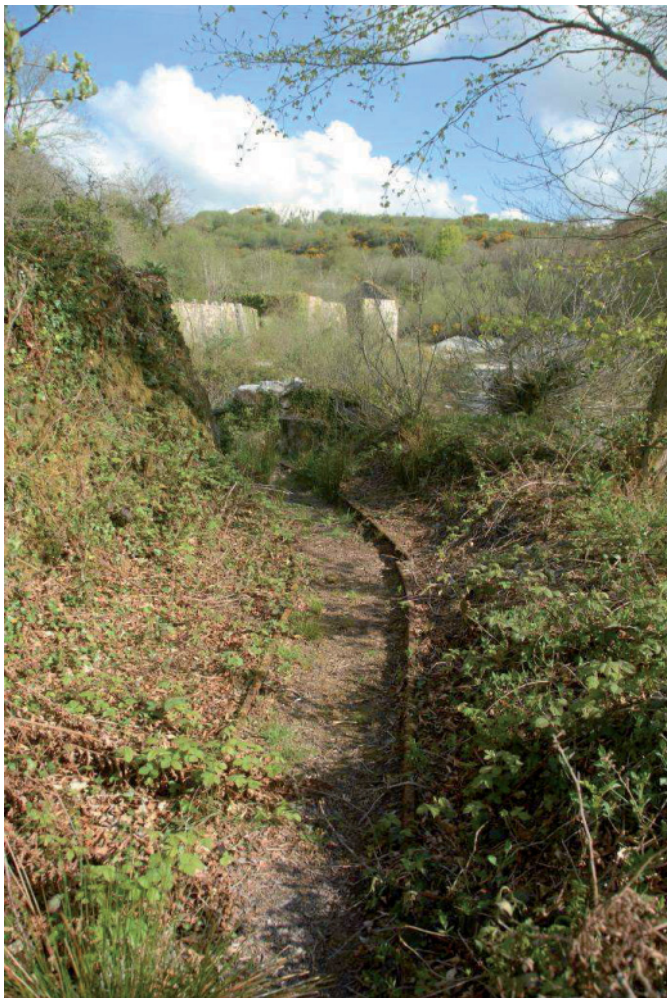
*Fig 36. The interior of the Wheal Arthur pan kiln [11], showing the area from which the hypocaust tiles were recently removed. HE Digital Image Archive.*



*Fig 37. The linbay [12] to the east of the Wheal Arthur dry [11], showing one of the bays which has been cleared out by the Tregargus Trust. HE Digital Image Archive.*



*Fig 38. The top of the cast iron rising main adjacent to the pumping shaft [8] at Wheal Arthur mill. HE Digital Image Archive.*



*Fig 39. The in situ tramway [14] to the east of the southern settling tanks at the Wheal Arthur complex. HE Digital Image Archive.*



*Fig 40. The pumping water wheel [5] at the northern end of the Wheal Arthur complex. HE Digital Image Archive.*



*Fig 41. The chimney [13] attached to the dry at the southern end of the Wheal Arthur complex. HE Digital Image Archive.*





*Fig 42. The mica drags [19] from the north, showing the regenerating stumps of some of the trees which formerly covered them. HE Digital Image Archive.*



*Fig 43. The northern end of the mica drags [19]. The entrance to its Adit [17] lies just beyond the clump of ferns. HE Digital Image Archive.*



*Fig 44. The overgrown and fragmentary remains of Top Mill [22] at the entrance to the infilled Tregargus upper quarry. HE Digital Image Archive.*



*Fig 45. The stump of the chimney [24] just to the north of the Barn River to the north-east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 46. The overgrown remains of the blacksmith's shop [16] at the southern entrance to Rescrowsa china clay pit. HE Digital Image Archive.*



*Fig 47. The remains of the blockwork-built crib hut [31] to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 48. The ruinous rendered blockwork building [28] to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 49. The overgrown remains of the masonry-constructed powder house [27] to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 50. The guard fencing on the tramway bridge to the east of Big Wheel Mill, with the crib but [31] in the background. HE Digital Image Archive.*



*Fig 51. The recently-consolidated tramway bridge over the roadway to the east of Big Wheel Mill. HE Digital Image Archive.*



*Fig 52. A typical scene next to the Barn River in the central part of the valley during the winter of 2009-2010. HE Digital Image Archive.*



*Fig 53. The infilled Lower Tregargus Quarry. The protected section of quarry face is below the trees at centre left. HE Digital Image Archive.*



*Fig 54. A sylvan scene on the revegetated spoil dumps just to the north of Rescrowsa china clay pit. HE Digital Image Archive.*



*Fig 55. The partially-collapsed entrance to the adit [18] leading into Rescrowsa china clay pit. HE Digital Image Archive.*



*Fig 56. Big Wheel Mill [29] from the north. The site of the winder house [24] is to its right under the trees. HE Digital Image Archive.*



*Fig 57. Big Wheel Mill [29] from the north-east, showing the overgrown water wheel and the eastern face of the building, partly cleared of ivy growth. HE Digital Image Archive.*





*Fig 58. Big Wheel Mill [29] from the east showing the vegetation growing over and adjacent to it. HE Digital Image Archive.*



*Fig 59. The remains of the brick-built grinding pans in the southern section of Big Wheel Mill [29]. HE Digital Image Archive.*



*Fig 60. The recently-conserved launder bridge and the launder to the west of Big Wheel Mill [29]. HE Digital Image Archive.*



*Fig 61. The northern section of the grinding floor of Big Wheel Mill [29] seen from the south-east. HE Digital Image Archive.*



*Fig 62. The southern end of Big Wheel Mill [29], showing the pipeline running just to the east of the mill. HE Digital Image Archive.*



*Fig 63. The iron launder serving the central water wheel at Big Wheel Mill, seen from the site of its reservoir just to the west. HE Digital Image Archive.*



*Fig 64. The remains of the timber canopy within which a bell was hung on the northern gable of Big Wheel Mill is typical of the detailing which could easily be lost if works are not undertaken. HE Digital Image Archive.*



*Fig 65. The ground level power vault running beneath Big Wheel Mill. HE Digital Image Archive.*



*Fig 66. The hub of the Big Wheel Mill central water wheel, seen from the power vault running under the building. HE Digital Image Archive.*



*Fig 67. The central water wheel, arched brick launder support and cast iron launder at Big Wheel Mill, seen from the north-west. HE Digital Image Archive.*



*Fig 69. The western end of the central water wheel at Big Wheel Mill, showing the almost complete loss of the buckets and very poor states of the iron spokes. HE Digital Image Archive.*



*Fig 68. The report author inspecting Big Wheel Mill water wheel circa 1985. HE Digital Image Archive.*



*Fig 71. The western end of the wheelpit at Big Wheel Mill, showing the laundry support and the very poor state of the water wheel. HE Digital Image Archive.*



*Fig 70. The southern side of the wheelpit at Big Wheel Mill. The water wheel spokes in the foreground demonstrate the need for very urgent remedial works. HE Digital Image Archive.*



*Fig 73. The now poorly-supported cast iron shrouds (rims) of the water wheel, increasingly at risk of severe damage through the likely collapse of the wheel. HE Digital Image Archive.*



*Fig 72. Another view of the very poor state of the water wheel spokes the Big Wheel Mill. HE Digital Image Archive.*





*Fig 74. Trevear Miller's Cottage [35] from the north. HE Digital Image Archive.*



*Fig 75. Trevear china stone mill from the east. HE Digital Image Archive.*



*Fig 76. Trees growing out of the stonework of the Trevear Mill reservoir [33] are already causing significant damage to it. Their collapse would also damage Trevear Mill immediately to the right. HE Digital Image Archive.*



*Fig 77. One of the brick-built grinding pans in the northern section of Trevear china stone mill. HE Digital Image Archive.*



*Fig 78. A stone-constructed grinding pan at Trevear Mill, showing the characteristic wear on its inner face. HE Digital Image Archive.*



*Fig 79. The southern end of the Trevear Mill dry, with its paired stoking doors. HE Digital Image Archive.*



*Fig 80. The internal face of the northern wall of Trevear Miller's Cottage [35], showing the surviving lime-washed plaster, but also the cracked granite lintels and lost masonry. HE Digital Image Archive.*



*Fig 81. The interior of the upper floor on the eastern wall of Trevear Miller's Cottage, showing the surviving plaster and the aperture for the bedroom fireplace. HE Digital Image Archive.*



*Fig 82. The former leat [36] leading down the western side of the site, forming a path from Big Wheel Mill [29] to Mica Mill [39]. HE Digital Image Archive.*



*Fig 83. The sluice in the leat [36] not far to the north of Mica Mill. HE Digital Image Archive.*



*Fig 84. The tramway bridge/aqueduct [38] immediately to the north of Mica Mill which carried leat [36] seen from the south-east. A more recent pipeline runs under the bridge. HE Digital Image Archive.*



*Fig 85. A view of the aqueduct/tramway bridge [38] seen from the south. The cast iron leat bridge has been infilled to form a path, whilst the deck of the tramway has been lifted, leaving only its support rails. HE Digital Image Archive.*



*Fig 86. The northern section of Mica Mill [39] seen from the north-east. The massive central wheelpit can be seen to the left. HE Digital Image Archive.*



*Fig 87. The central wheelpit at Mica Mill [39] seen from the east. The surviving spanning timbers can be seen in this view. HE Digital Image Archive.*



*Fig 88. Looking north along the grinding floor in Mica Mill [39], showing the well-preserved brick-built grinding pans. HE Digital Image Archive.*

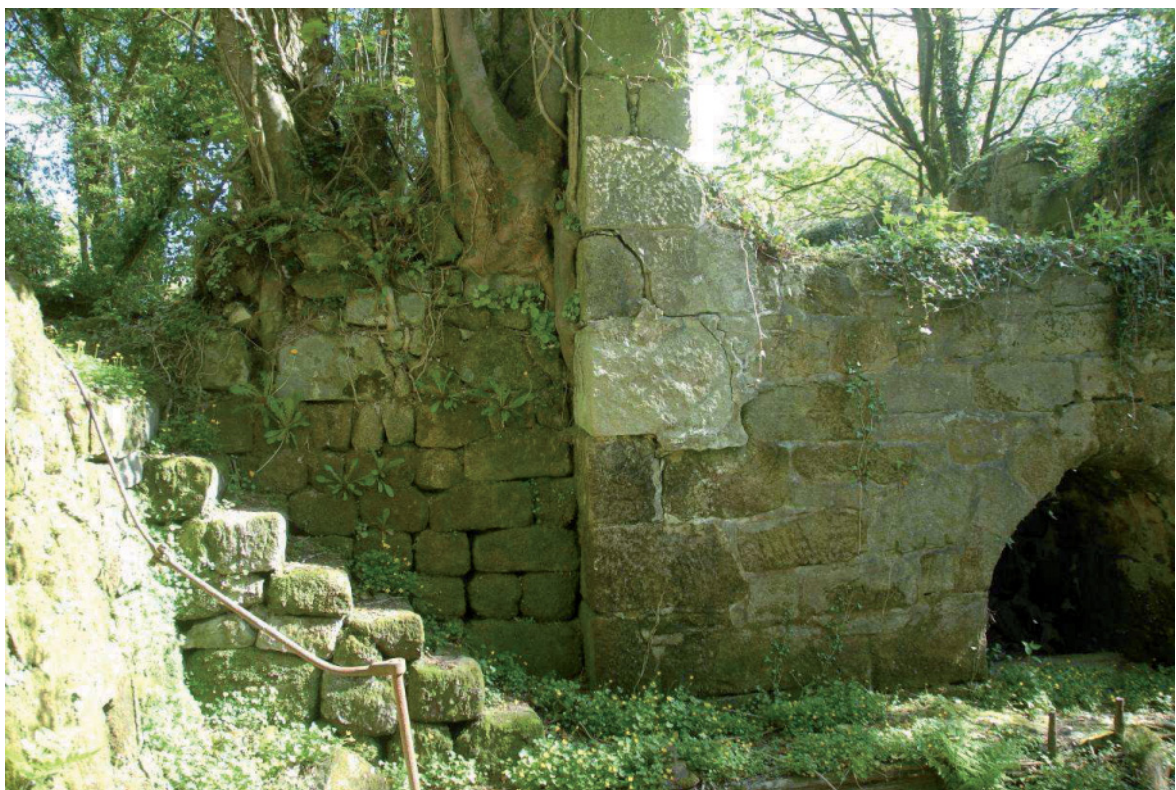


*Fig 89. The large central wheelpit at Mica Mill [39] seen from the south-west. HE Digital Image Archive.*





*Fig 90. The northern gable of Mica Mill [39] seen from the north-east. HE Digital Image Archive.*



*Fig 91. Tree roots have already started to dislodge the masonry at the western (left hand) end on the northern side of the wheelpit at Mica Mill [39] (centre of image). HE Digital Image Archive.*



*Fig 92. Tree roots infiltrating the masonry on the northern side of the wheelpit at Mica Mill exemplify the types of problems affecting sites at Tregargus which require urgent attention if this rare group of structures are not to suffer severe deterioration. HE Digital Image Archive.*

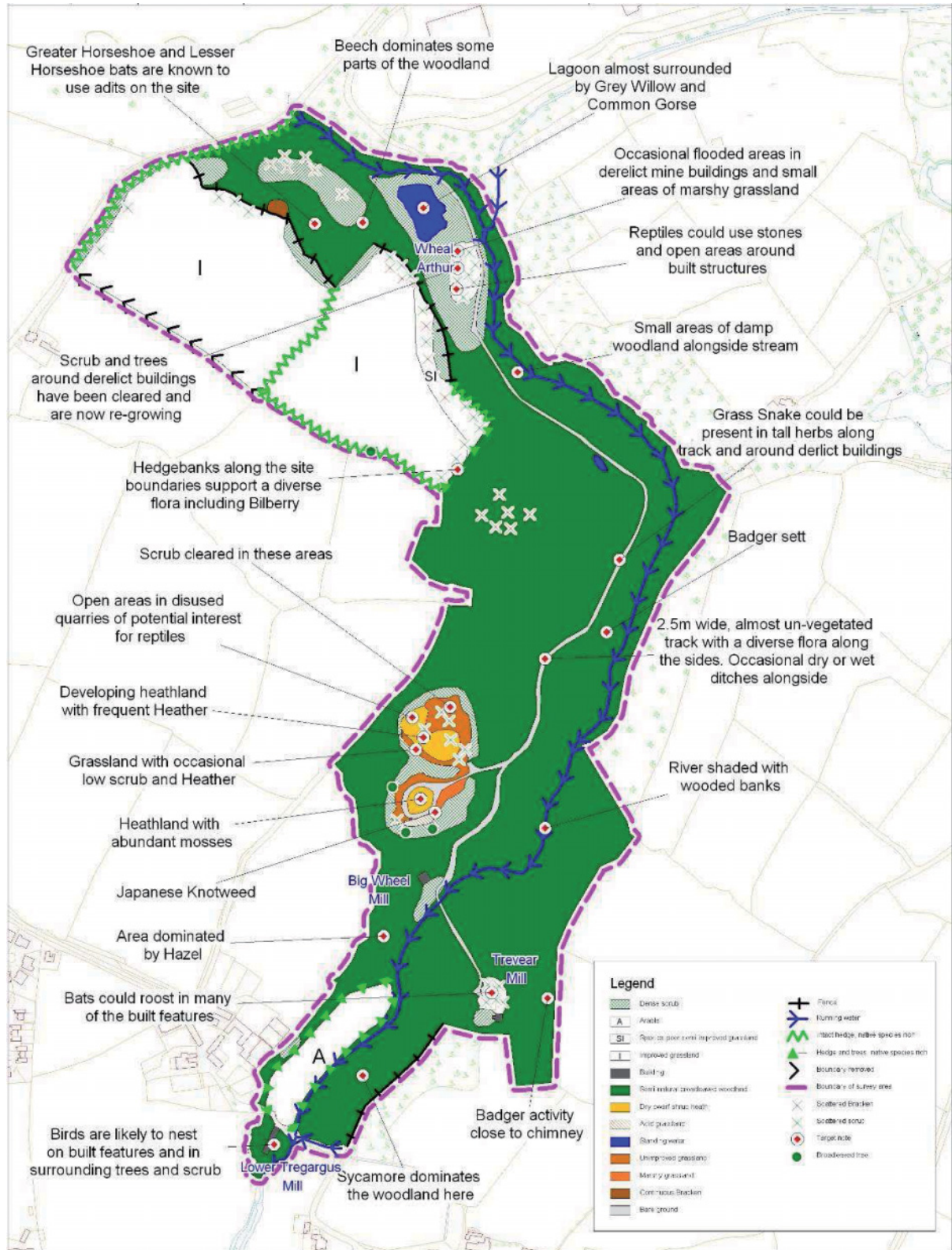


Fig. 93. Summary of Phase 1 habitats and features of nature conservation interest recorded in the 2010 ecological survey undertaken by Spalding Associates. This survey covers the area included in the 2002 archaeological assessment, extending a little beyond the area leased by the Tregargus Trust.

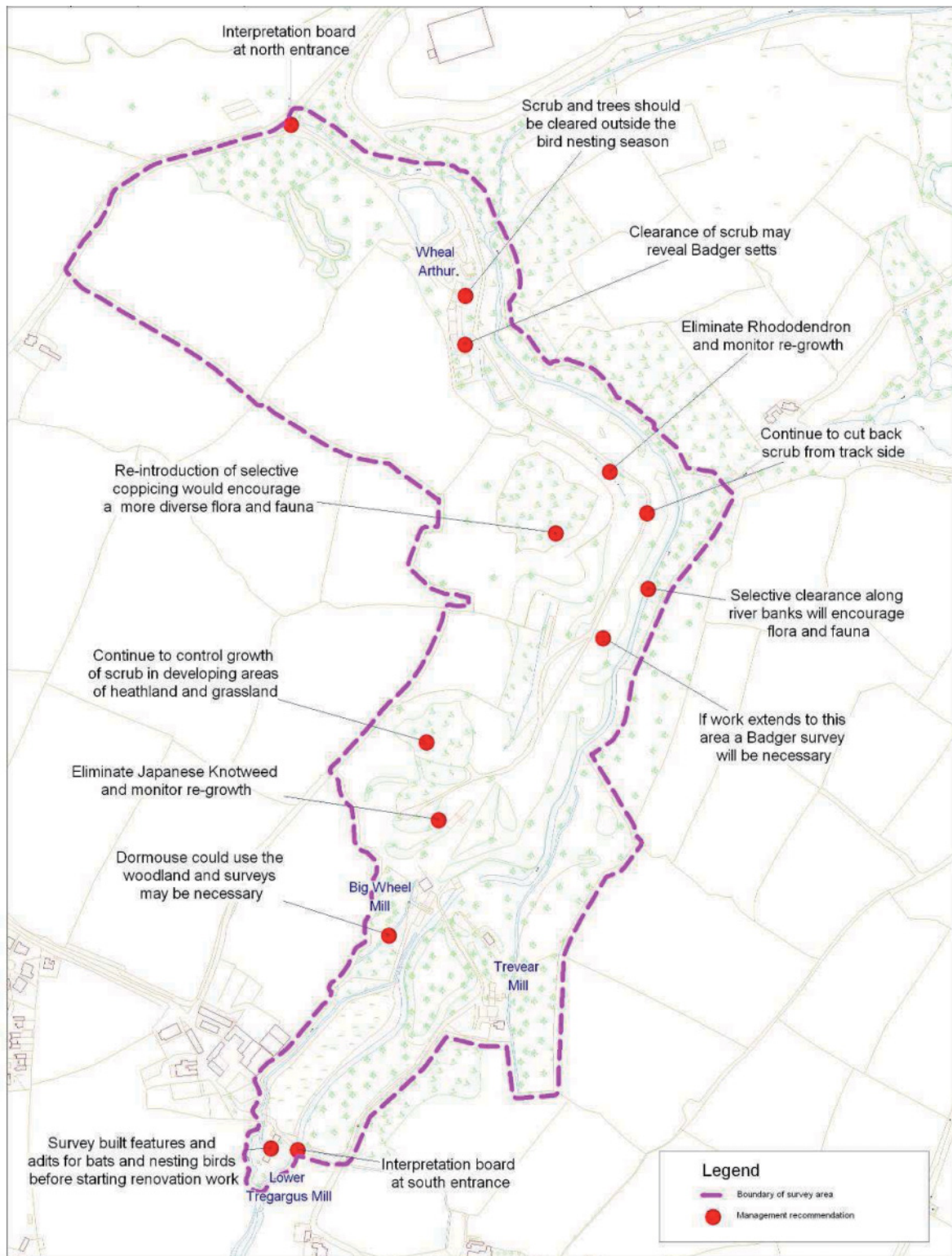


Fig 94. Summary of principal management recommendations from the 2010 ecological survey undertaken by Spalding Associates