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shaped your world

## Delve Deeper

# Kennall Vale Nature Reserve: Peaceful valley with an explosive secret!

Gwennap,  
Kennall  
Vale and  
Perran  
Foundry

If you wish to delve deeper into the history of Kennall Vale's links with Cornish Mining then this short guide will provide you with more information.



As you walk through Kennall Vale Nature Reserve, the sounds you're most likely to hear are rushing water, rustling leaves and the songs of woodland birds. This peaceful ambience belies the valley's past. From 1812 to 1910, it was the site of the Kennall Gunpowder Company. The air would have been filled with the sounds of industry and workers – and the occasional terrible explosion.

The gunpowder works harnessed the power of the fast flowing River Kennall which falls rapidly through the valley. At its height, the works was the most successful of its kind in Cornwall. It mainly supplied gunpowder for the mines and quarries in the thriving Gwennap industrial area, but also exported worldwide.

Kennall Vale lies within the wider Gwennap Mining District, one of the 10 Areas of the Cornish Mining World Heritage Site.

## What you can see today

Only a small proportion of the 56 structures of the original gunpowder works still survive. Most of them are easy to identify, like the seven pairs of granite Incorporating Mills and the leats that fed water to them. Other remains are harder to interpret because there is so little left, or their use has changed over the years.

On the audio trail, you can follow the gunpowder manufacturing process, from the mixing of the raw ingredients right through to its final packing.

## Did you know?

### Gunpowder - an elixir of everlasting life!

Gunpowder, known as 'black powder', was invented by the Chinese as far back as 850 A.D. The invention seems to have been discovered by accident by alchemists seeking the elixir of immortality. The first use of gunpowder in China for military purposes was in 919 A.D. It reached Japan, Islam and Europe in the 13th century.

## An important site at risk

Kennall Vale is now a reserve of both archaeological and wildlife importance, managed by the Cornwall Wildlife Trust. It is protected by law as a Scheduled Ancient Monument and the historic buildings and unpolluted river provide a habitat for a wide range of plants and animals.

The site is also currently classified as being at high risk due to the amount of erosion caused by the water, natural decay of the historic buildings, vandalism, and visitors straying from the paths. So please stay on the designated routes when you explore Kennall Vale.

## KENNALL VALE: AN EXPLOSIVE HISTORY

The Kennall Gunpowder Company was licensed in 1811/12 to manufacture mining and quarrying explosives. It became one of Cornwall's most important producers of gunpowder in the mid 1800s.



## Mines create market

By 1800, Cornwall's mining and quarrying industries were using some 4,000 barrels of gunpowder per annum, all of which was manufactured outside the county. The first gunpowder works in Cornwall was set up in 1809 in nearby Cosawes Wood, Ponsanooth. Although a small concern, it was successful. This encouraged Benjamin Sampson, Agent to the powerful Fox family & Perran Foundry, to set up a rival gunpowder works in Kennall Vale.

Sampson duly obtained licences for gunpowder manufacture in 1811/12 and became the manager of the works.

The first contemporary record of the company was in 1819, in a book called 'The Circle' by William Penaluna (1780 1864). He writes:

*'In Kennall Vale are gunpowder mills belonging to Messrs. Sampson and Co. Here are situated water-wheels constantly employed, two of which keep 14 tons of marble constantly turning (three tons and a half in a block), making four to five thousand barrels of gunpowder annually; some of the mills have occasionally blown up, but no life has been lost; it employs a fine fall of water of eighty four feet; possibly such a situation for convenience and security is without a parallel in the Kingdom.'*

## Expansion and export

The Kennall Vale Company continued to expand, eventually taking over the rival works at Cosawes Wood. By 1860, the company was employing about 50 men and had agencies and magazines all over Cornwall to supply local mines, quarries and safety fuse works. It supplied powder to depots in Plymouth, Aberystwyth, Middlesbrough, Stoke on Trent and Swansea, as well as overseas to Valparaiso, Melbourne, Auckland and Sydney.

## New explosives steal the thunder

The market for gunpowder began to decline in the 1880s with the invention of high explosives like gelignite and dynamite. The directors of the Kennall Gunpowder Company moved into this market in 1889, forming a new high explosives company the National Explosives Company in Hayle.

In 1898, they sold the Kennall Vale works to Britain's largest explosives manufacturing group, Curtis's and Harvey. It used the works to manufacture specialised types of cartridge and fuse powder until production ceased around 1910.

## KENNALL VALE'S FINE GRANITE

As well as the remains of the gunpowder works, there are several structures on the site that



Flooded quarry. Photo: Audio Trails

relate to quarrying in the early 1800s. These include a blacksmith's workshop with anvil and stone, an engine house, water storage tanks, a block of toilets and dumps of waste granite extending to the river bank.

The most dramatic remnant of quarrying is the flooded quarry (audio track 9), part surrounded by sheer rock faces. The quarry was opened in 1919 by James Richards who had previously quarried at Carncrees, two miles away.

The granite at Kennall Vale is particularly fine-grained, and was initially used to prepare memorials for the First World War. The granite was also used in the railway viaducts at

Trewedna and Ponsanooth, and in the stonework of the London Embankment.

## STEP BY CAREFUL STEP - MAKING GUNPOWDER

The raw ingredients of gunpowder are saltpetre, sulphur and charcoal. The saltpetre produces the oxygen and the sulphur and charcoal are the fuels.

At Kennall Vale, all three were imported from outside the county, usually via nearby Penryn, although in the early days some charcoal may have been manufactured on site.

### The gunpowder process

#### Safe House

Before use, the charcoal and sulphur were ground to a fine consistency in water mills, similar to grinding corn. These buildings were deemed 'safe' because the minerals had not been mixed to their explosive partnership. The saltpetre was refined separately – at Kennall Vale this was done in the company's own works.

#### Mixing House

In the Mixing House, the three ingredients were weighed out in the correct proportion. This varied according to the end use – and was often kept secret – but the average was 75% saltpetre, 15% charcoal and 10% sulphur. They were mixed together in a revolving wooden drum, adding a little water to produce a 'green charge'. Although not yet full strength, it was a dangerous mixture.

#### Incorporating Mills

The green charge was then loaded into a barrel and taken by horse and cart to one of the Incorporating Mills. These had two large edge runners of stone rotating on a stone bed. The mills were powered by waterwheels fed from a series of leats on both sides of the river.



Stone runner (millstone) beside the river. Photo: Audio Trails

The green charge was spread onto the mill bed, dampened with water, then thoroughly ground and mixed by the action of the runners. This could take up to four hours. When completed, the 'mill cake' was removed using wooden shovels.

So dangerous was this part of the manufacture that makers were forbidden to grind more than 42lbs in the same house at one time.

### Did you know?

#### Saltpetre's unsavoury ingredients!

Saltpetre was made by putting urine, manure, decomposing organic material and water in a concrete tank. Then it was covered and left for many months. The water gradually drained off, and more urine was added to dampen the mixture. The mixture was later dried in trays in the sun – as the water evaporated, potassium nitrate crystals (saltpetre) formed.

Until the 17th century, most of the ingredients for saltpetre came from dung- heaps or toilets, as well as pigeon droppings that were collected by royal decree! In later years, it was imported from Italy, India and China.

## Press House

The mill cake was taken to the Press House, where it was compressed with a hydraulic ram into a block about one inch thick.

## Breaking Down House

The press cake was then broken down into lumps in the Breaking Down House using wooden mallets.

## Corning House

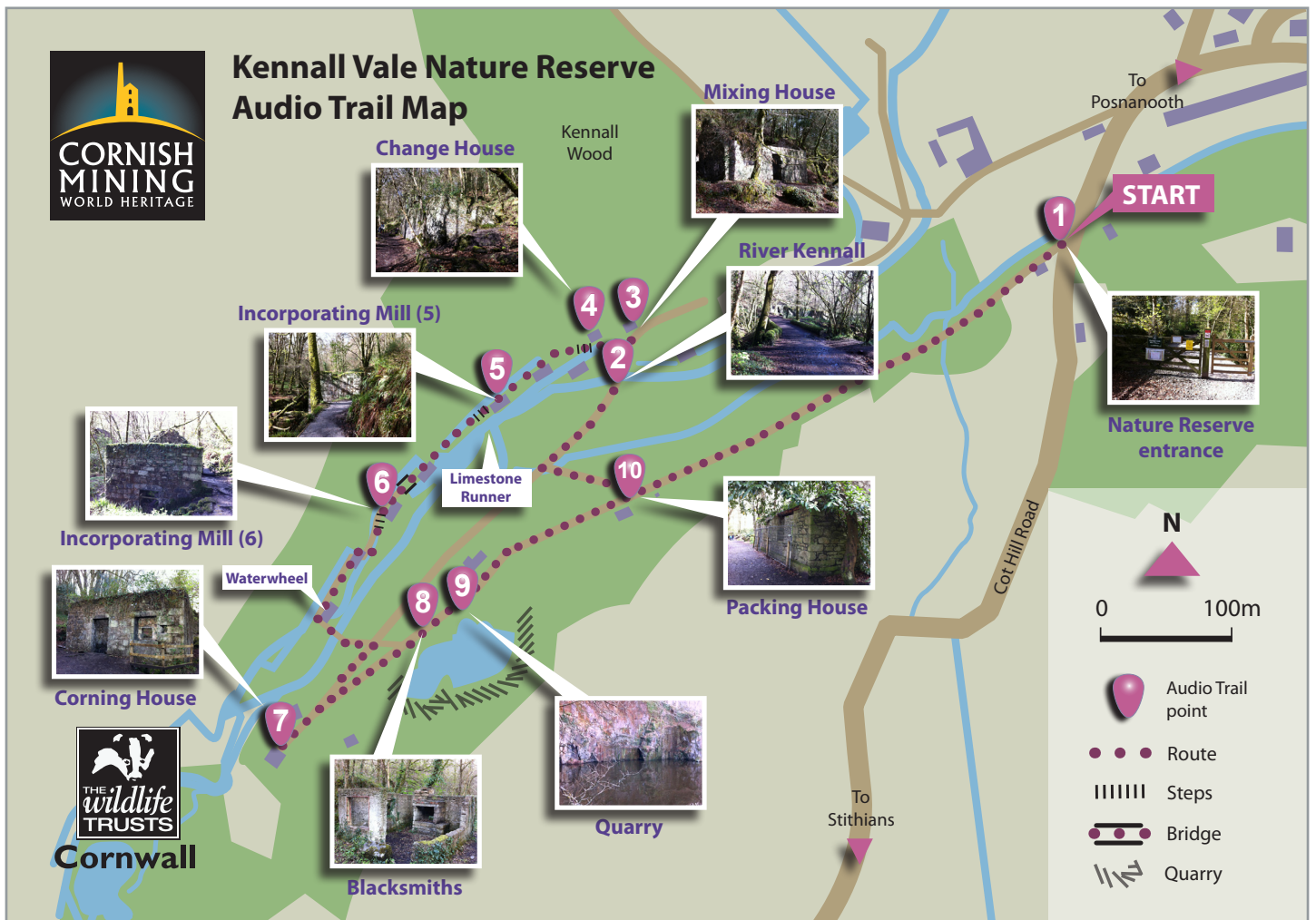
The Corning House or Granulating House further reduced the lump powder into grains, graded according to size by vibratory screens.

## Gloom Stove

The next stage was to dry the grains in the Gloom Stove. Here the powder was spread out over shelving which had steam heated pipes underneath.

## Dusting House

The dry powder was taken to the Dusting House where dust was removed and recycled to the Press House.



## Glazing Mill

In the Glazing Mill or Glossing House, the grain powder was placed in a rotating wooden drum and graphite was added to glaze and round the finished product.

## Packing House

The powder was then packed into wooden casks in the Packing House, ready for sale to local mines and quarries.

## Safety features



Thick walls. Photo: Audio Trails

The mill buildings incorporated several safety features. The walls were extremely thick, but the roof was made of light timber. This was so that in an explosion, the roof would blow off, but the walls would stay intact. The buildings themselves were spaced at least 45 metres apart – thought to be a safe distance between them in case of an explosion.

All the bearings of the machinery were of copper, lest heat should be generated by friction. The Incorporating Mills had an added safety feature – large drenching pans filled with water. These could be easily overturned to douse any fires.

Workers had to wear special woollen suits. Their own clothes – and any tobacco and matches – were left behind in the Change House.

## Paths and tracks

The raw materials and finished product were transported around the site by horse and cart. The two wheeled carts were enclosed and very narrow, in order to get up the narrow paths. Trackways and elevated paths linked the buildings, and several bridges crossed the river.

## The finished product

Initially the gunpowder at Kennall Vale was solely used for blasting rock. The name ‘powder’ is very misleading as the finished product was in fact granular. Powder would not pour into gun barrels easily, whereas granules would. The granules were also water resistant which was important when being used in wet conditions underground.

After 1830, the development of the safety fuse by William Bickford offered another market for the gunpowder makers – and one that Kennall was quick to offer. Fuse makers needed high quality powder with a fine grain, and Kennall Vale supplied several varieties to Cornish fuse factories. From about 1860, the company also supplied sporting powder for rifles and shotguns, and ‘bobbin’ powder, a specialised blasting product.

## ‘MELANCHOLY ACCIDENTS’ – DANGER, INJURY AND DEATH

At all the stages of gunpowder production, the mixture was unstable so the process was highly dangerous. There were many gory accidents, often reported in the press as ‘melancholy accidents’.

## Deaths caused by roast potatoes

The first known fatality at Kennall Vale was in February 1826. An old woman named Elizabeth

Rutter came to the Mixing House with a basket of hot roast potatoes for the three men working there. A spark ignited the raw gunpowder mix and the resulting explosion killed Elizabeth and one of the men.

### **Roof carried a mile away**

A terrible and dramatic accident happened in May 1838, when five mills blew up in succession. The explosions were so powerful that part of a roof was found a mile from the premises. One man was seriously injured and another killed, leaving a widow and up to 10 children. One of the newspaper reports describes the impact the explosion had on the surrounding area:

*'A most dreadful explosion occurred at the Kennall Gunpowder Mills, near Penryn, on Tuesday morning, the 10th instant. Five mills blew up in succession, and part of a roof was found a mile from the premises. The reports were most terrific and created the greatest alarm over an extensive tract of country. Nothing so severe ever happened at these mills before...'*

### **A lethal flash**

A report of an explosion in November 1887 in the Royal Cornwall Gazette shows how local people reacted to accidents in the works, and also the volatile nature of the explosives – one spark enough to cause disaster:

*'At a few minutes after eight o'clock on Monday morning the village of Ponsanooth, near Penryn was suddenly thrown into a state of most painful excitement by the loud report (heard for miles around) of an explosion at the Kennall Vale Gunpowder Company's Works. Within a very few minutes the entrance gates of the factory were besieged by a large crowd, all anxious for information, and dreading that the news would be of the most sorrowful kind. As the explosion occurred just before the men left for breakfast it was feared that there had been great loss of life. As the villagers congregated women shrieked and fainted and children cried bitterly...'*

*Only one man, William Dunstan was known to be at work within the building at the time of the explosion, and another, James Paddy, was engaged with a horse and cart taking powder to and from the building. Paddy was found lying in a water-course about fifteen yards from the front of the building. He was considerably burnt about the face and hands, was badly cut about the head, and had his right leg and right arm broken. Perfectly conscious when found, he stated that he had backed his cart to the door of the house for the purpose of discharging some gun-powder dust in barrels which he had brought to be pressed. Dunstan was within the house and about to receive the powder from him when he (Paddy) saw a flash and remembered no more. At first no trace was found of the poor man Dunstan, but very soon afterwards a leg was discovered about five yards from the house, and the remainder of his body under a bank on the further side of a road, some 30 yards from the building. Of course, life was extinct.'*

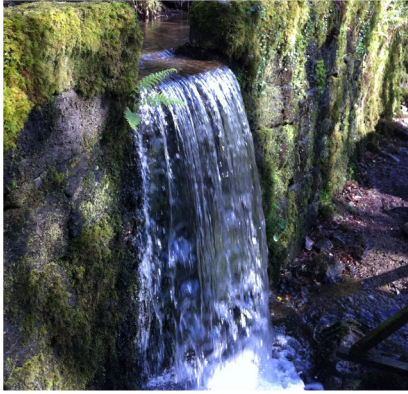
### **The most gruesome accident**

On 15th Jan 1841, the West Briton recorded perhaps the most gruesome event at Kennall Vale, when worker John Martin was killed:

*'...he was seen to go into the glossing mill to bring out some more powder, and presently afterwards the mill was blown up in the air with a tremendous explosion which was heard many miles around, and shook the houses a considerable distance off...The head of the deceased was discovered about a quarter of a mile from the spot, and other parts of his body were afterwards collected from different places.'*

## NATURE TAKES OVER

Many of the trees in the valley were planted as part of the gunpowder operation. In the event of an explosion, they were to help absorb shockwaves, and to provide a barrier to protect the nearby village from flying debris. Trees were also used for timber and charcoal production. The main trees today are beech, ash, oak and sycamore.



Mosses thrive at Kennall Vale.  
Photo: Audio Trails



Greater Horseshoe Bat.  
Photo: Cornwall Wildlife Trust

The buildings that were long ago abandoned by people have been colonised by wildlife. Ferns, mosses and liverworts cling to the old walls, thriving in the shady, damp conditions. Ivy creeps up the buildings, forming a dense thatch where birds nest, and providing a valuable food source with its berries.

The paths through the valley were cut so that horse and carts could bring in the raw ingredients of gunpowder, and take out the finished product. They now form sunny glades where wildflowers grow, and butterflies and bees feed on nectar. At dusk, you might see bats hunting for insects, including the rare brown long-eared, lesser horseshoe and greater horseshoe bat.

The stones in the river provide ideal perches for birds such as the dipper and grey wagtail which feed on water insects and worms.

## Cornwall Wildlife Trust

The site is managed by the Cornwall Wildlife Trust, along with 55 other nature reserves like it. Caring for the habitats, preserving historic buildings and maintaining footpaths is expensive work. You could help by joining the Trust or volunteering. Find out more on [www.cornwallwildlifetrust.org.uk](http://www.cornwallwildlifetrust.org.uk)

## OTHER PLACES TO VISIT

### Poldice

Poldice owes its strange lunar-like landscape to mining for tin and copper, and arsenic production. It also has an audio trail and children's activity sheets produced by the Cornish Mining World Heritage Site

[www.cornishmining.org.uk](http://www.cornishmining.org.uk)

### Gwennap Pit

A couple of miles from Kennall Vale is Gwennap Pit, an impressive open air amphitheatre near Redruth. It was made famous by Methodist founder John Wesley and is free to visit.

[www.gwennappit.co.uk](http://www.gwennappit.co.uk)

### Mineral Tramways

The Mineral Tramways offers over 37 miles of accessible cycling and walking trails around Portreath, Camborne and Redruth, including the famous Coast to Coast trail.

[www.cornwall.gov.uk](http://www.cornwall.gov.uk)

### Bike Barn and the Mineral Tramways Exhibition

Discover Cornwall's tramroad history by browsing the exhibition at the Bike Barn at Cambrose, where you can join a guided bicycle tour or hire your own bike.

[www.cornwallcycletrails.com/](http://www.cornwallcycletrails.com/)



## **The Royal Cornwall Museum (Truro)**

The museum holds a wealth of information and artefacts from Cornwall's history including a magnificent collection of minerals.

[www.royalcornwallmuseum.org.uk](http://www.royalcornwallmuseum.org.uk)

### **FIND OUT MORE**

'Cornish Explosives', by Bryan Earl, published by the Trevithick Society, 1978

'Kennall Vale, The gunpowder works', leaflet by the Cornwall Wildlife Trust

[www.gunpowderworks.co.uk/pdf/TG5\\_Gunpowder\\_manufacture.pdf](http://www.gunpowderworks.co.uk/pdf/TG5_Gunpowder_manufacture.pdf)

[www.dangerouslaboratories.org/foxfire5.html](http://www.dangerouslaboratories.org/foxfire5.html)

[www.worldheritagecornwall.com/Mining-service-industries/kennal-vale-gunpowder.htm](http://www.worldheritagecornwall.com/Mining-service-industries/kennal-vale-gunpowder.htm)

Much of the information in this guide was found in John R Smith's Archaeological and Historical Survey, 1986.

For more information on Cornish Mining visit [www.cornishmining.org.uk](http://www.cornishmining.org.uk)