

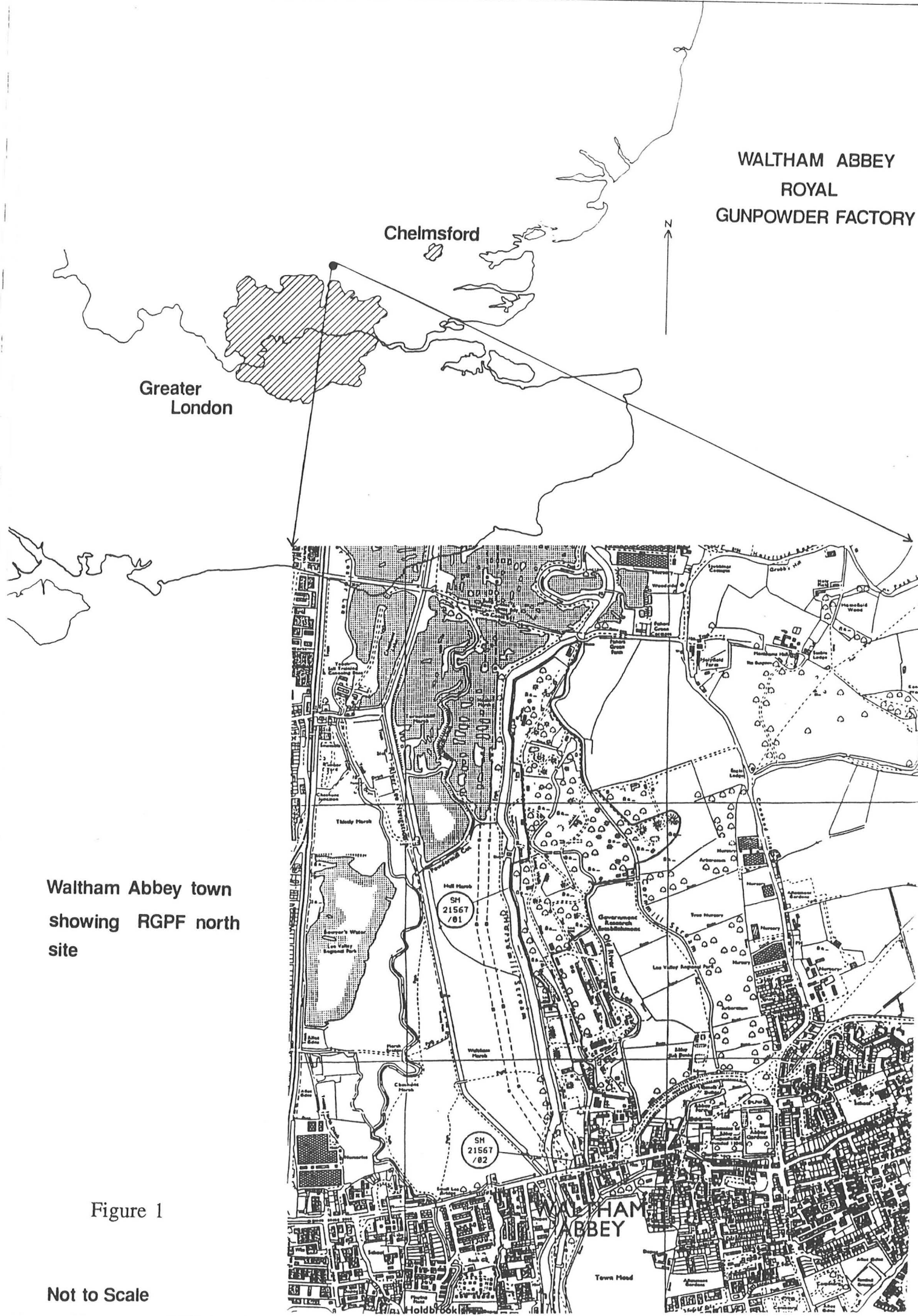
*THE
ROYAL GUNPOWDER FACTORY
WALTHAM ABBEY*

SCHEDULED ANCIENT MONUMENT AREA

ARCHAEOLOGICAL REPORT

JANUARY 1995

*SUBMITTED BY ADAM FORD
CONSULTANT ARCHAEOLOGIST TO
MINISTRY OF DEFENCE*



WALTHAM ABBEY
ROYAL
GUNPOWDER FACTORY

Chelmsford

Greater
London



Waltham Abbey town
showing RGPF north
site

Hill Marsh
SH
21567
/01

SH
21567
/02

WALTHAM
ABBAY

Town Hood

Holdbrook

Figure 1

Not to Scale



Figure 2

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Site Name: Waltham Abbey Royal Gunpowder Factory

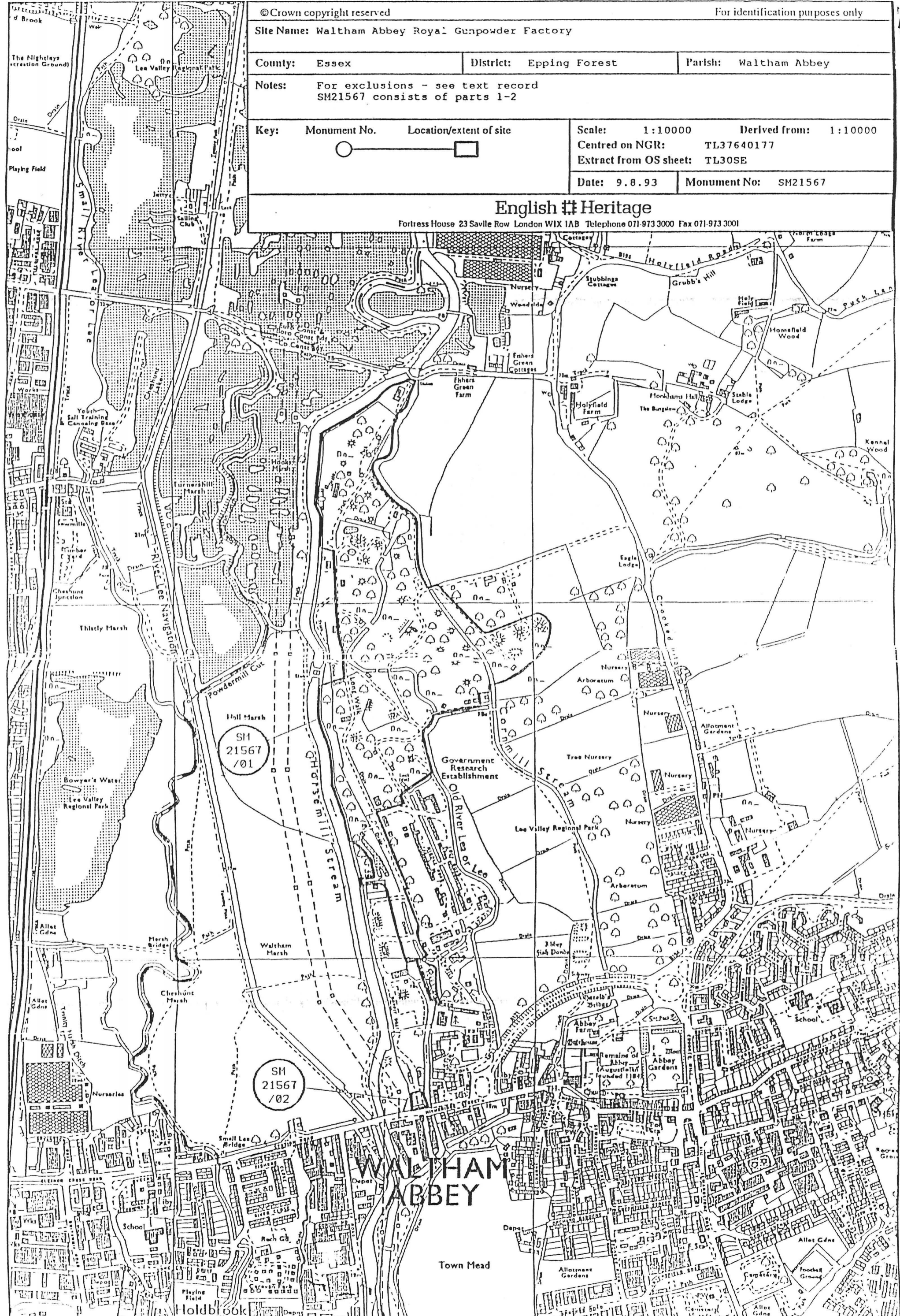
County: Essex	District: Epping Forest	Parish: Waltham Abbey
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Notes: For exclusions - see text record
SM21567 consists of parts 1-2

Key: Monument No. 	Location/extent of site 	Scale: 1:10000	Derived from: 1:10000
		Centred on NGR: TL37640177	
		Extract from OS sheet: TL30SE	
Date: 9.8.93	Monument No: SM21567		

English Heritage

Fortress House 23 Savile Row London W1X 1AB Telephone 071-973 3000 Fax 071-973 3001



SITE LOCATION

County	-	Essex
District	-	Epping Forest
Parish	-	Waltham Abbey

National Grid Reference.

Waltham Abbey Royal Gunpowder Factory
(North Site) (TL30SE) TL376 015

The Waltham Abbey Royal Gunpowder Factory, more recently known as the Ministry of Defence's Royal Armaments Research and Development Establishment (RARDE) is located immediately to the North of the historic Essex town of Waltham Abbey.

The North Site stretches for nearly two kilometres from Highbridge Street north/south along the Lea Valley to Fishers Green in the north. The perimeter fence encompasses almost 75 hectares (190 acres). The factory is bounded on three sides by waterways; the Horsemill Stream to the north and west and by the Cornmill Stream and Old River Lea to the east.

The Lower Island and South Site will not be covered in this report.

The surface geology is mixed river gravels overlying London clay.

The topography of the site has changed considerably over the last 300 years. Originally the land, excluding the New Hill area, was water meadow. As the factory developed, so the area was partially drained by ditches and canals and traversed by raised causeways and the higher level water system. The nature of explosive process buildings, generally surrounded by earth blast mounds, has also

given the site a dynamic appearance. The woodland which covers just over half the site is a product of the manufacture of gunpowder. Alder, Willow and Black Dog Wood (Alder Buckthorn) plantations were set and coppiced creating an on site supply of wood for charcoal, one of the three ingredients of gunpowder.

Report Area Location.

National Grid Reference TL 37600 01900.

This report covers the remaining area of the Scheduled Ancient Monument (SAM) not already considered in the Millhead/Island Site interim report (A.Ford 1995 in print). The section of monument covering the New Hill Nitroglycerine complex will be covered in the Area N report (forthcoming).

To the east the area is bounded by the Cornmill Stream and by the Horsemill Stream to the west. These two waterways join at the northern most point of the site at Fishers Green.

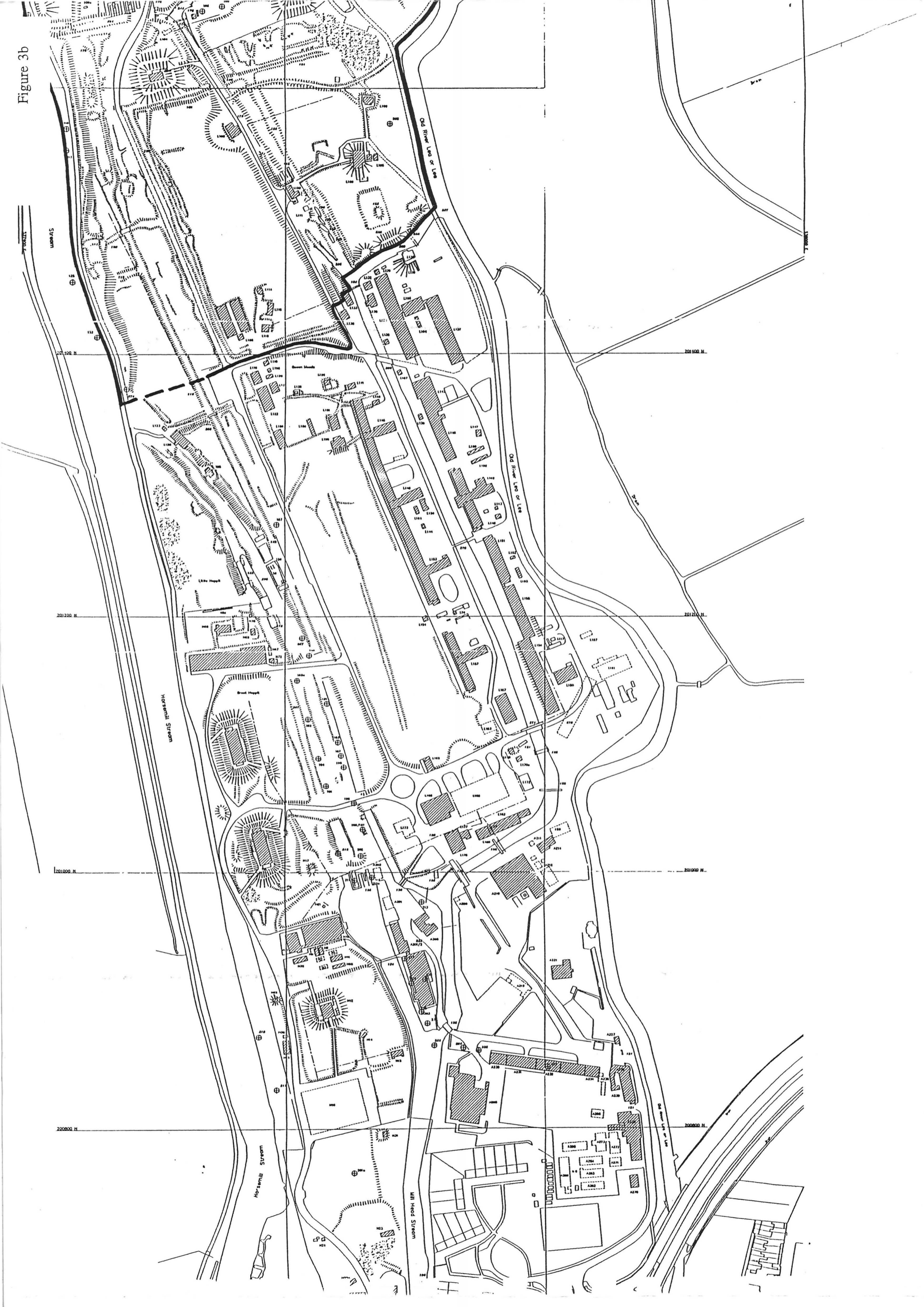
To the south a line can be drawn across the site approximately SW - NE following first the Loop Road and then the branch of Middle Stream which joins with the Old River Lea.

From there the boundary turns north and follows the Old River Lea along the western bank. It crosses the river at Bridge 9 and follows the east/west waterway ditch connects the Old River Lea to Cornmill Stream (please see figures 3a and 3b).

Figure 3a



Figure 3b



A BRIEF HISTORY OF THE ROYAL GUNPOWDER FACTORY,

WALTHAM ABBEY 1665 - 1994.

The Royal Gunpowder Factory has been involved in the research and manufacture of explosives for over 300 years. Initially producing Gunpowder, the site then developed to manufacture chemical based explosives and propellants and finally experimental development of explosive materials after the Second World War.

The first documented references to gunpowder production on the site came from two sources. One is a contract between Ralph Hudson a sub-tenant of the Waltham Mills, and the government, for the supply of gunpowder. The other is the first recorded death in the parish caused by an explosion within a mill, both date to 1665.

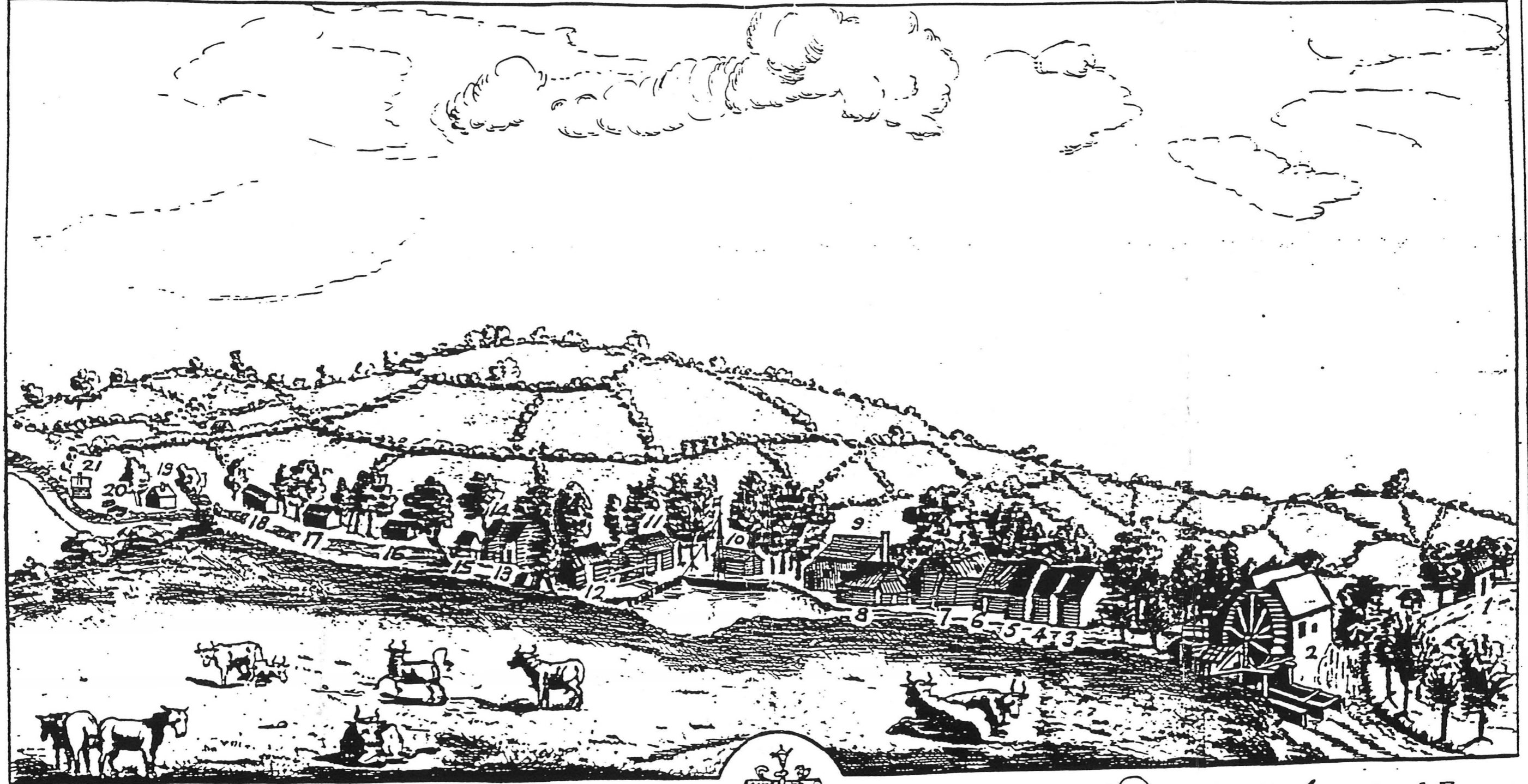
The early factory, based around a former fulling mill, probably situated to the south of the island site, quickly expanded to form the well established works depicted on the engraving by Farmer in 1735 (figure 4). The site continued to develop and became one of the principle suppliers of gunpowder to the Board of Ordnance. In the second half of the Eighteenth Century the Board became concerned about the quality, quantity and reliability of the black powder produced by these private firms. So much so that in 1759 the government purchased the Home Works at Faversham, the first Royal Gunpowder Factory. Later in 1787 they purchased the Waltham Abbey works. Almost immediately after, the demand for powder rose as a repercussion of the French Revolution and later the Napoleonic Wars. There was major expansion and investment including the development of the lower island site, a narrow strip of land to the south of the original site. In sharp contrast the first half of the Nineteenth Century, between 1820 and 1840 saw little new development.

This period of relative inactivity did not last, by the second half of the

- 1. A Horse Mill
- 2. The Corning and Glazing Engine
- 3. } Three Horse Mills
- 4. }
- 5. }
- 6. The Stables
- 7. The Coal Mill and Composition House

- 8. The Carpenters and Millwrights work house
- 9. The Clerks Counting house and the Watch house
- 10. The Loading house
- 11. } Two Stamping Mills
- 12. }
- 13. } Two Pump Mills
- 14. }

- 15. The Charging house
- 16. The old Composition house
- 17. The Store house
- 18. The Dusting house
- 19. The Little Stove
- 20. Three Sun Stoves, or drying Leads
- 21. The great Stove



To John Walton Esq. Proprietor of these Mills this Plate is  humbly dedicated by his Obedient humble Servant J. Farmer.

Jas. Munds. Esq.

R. West. delin. 1735

GENERAL VIEW OF THE FACTORY IN 1735
(FROM FARMER'S "HISTORY")

from Simmons W.H. 1963.

RECENT DEVELOPMENTS AND ARCHAEOLOGY.

The description of activities within the report area since the official closure of the establishment in 1992 will be separated into two main sections for ease; building works, referring to works on standing structures and ground works.

These sections will be further broken down into sub-sections. Due to the nature of the decontamination work and the layout of the report, the descriptions will not follow any temporal sequence but descriptions will follow a general trend, geographically from north to south.

Building Works.

- a) Surveys, condition reports and asbestos removal.

Since 1992 both the Royal Commission on the Historical Monuments of England and Carden and Godfrey have carried out architectural surveys of the buildings on site. The Royal Commission survey also included the canals, earthworks and services whereas Carden and Godfrey concentrated on the structural stability and general condition of all the standing structures (including numerous floor slabs).

Results of these surveys can be referred to in their reports.

Royal Ordnance also carried out a survey on most of the buildings. This involved the core sampling of all the process buildings to ascertain levels of explosive contamination.

All buildings have also been examined for asbestos contamination. All non structural asbestos ie, pipe lagging, general debris etc., has been removed by authorised specialist contractors. All structural asbestos has been retained.

Artifacts.

Since July 1993 an ongoing policy of removal of mobile artifacts has been implemented by the resident archaeologists. All artifacts have been labelled before removal to the artifact store in L168. Artifacts too large or heavy for removal have been labelled and recorded 'in situ'.

Vegetation.

Another ongoing exercise has been to remove trees and vegetation off buildings themselves or from within a 3 metre boundary around structures. The latter exercise is a long term objective.

Particular attention was paid to buildings 26 and S90 both 19th Century Boiler Houses for gunpowder drying stoves. Scaffolding was erected around them and vegetation was removed from their roofs. At the same time an examination of the roof conditions was carried out.

Mounds.

Many of the mounds have been locally sampled for explosive or asbestos contamination.

Two mounds adjacent to Newtons Pool were partially excavated to allow closer inspection of hidden sides of two associated retaining walls. These test trenches were backfilled as were all sample holes.

Thermal Decontamination.

The air ducting to the west of building 22a was thermally treated (burnt). This resulted in extensive distortion to the metal pipes and the discolouration and shattering of the window glass on the western elevation of the former Quinnan Stove. This was carried out prior to the scheduling order and before the importance of the building and the associated services was fully appreciated.

Clearance.

During near by groundworks some rubble possibly associated with the structures has been removed or relocated. Most of this has taken place under the supervision of or with the agreement of the site resident archaeologists and English Heritage.

Ground Works.

The most significant groundworks within the area must be the canal clearance. To the date of this report approximately 80% of the former canal system has been cleared. The work within the waterways system will be covered in a separate report.

Waste Tips and Contaminated Overburden.

The clearance of identified waste tips and contaminated overburdens has been the second most labour intensive groundwork operation in the report area.

Since the reopening of the site as a research establishment in 1945 no materials left the site. Combustible materials were disposed of on the Burning Ground, all others were rather indiscriminately deposited in the canals, ponds and other depressions over the site. In other areas the ground was made up by dumping demolition arisings or general site waste.

Although the nature of much of the waste is unknown it is assumed that levels of toxic materials within the waste is unacceptable. This assumption is borne out by the results of selected visual and laboratory investigations.

The main areas where waste dumps have been identified and removed are illustrated in figure 5.

All dumps marked red have been investigated and removed between winter 1992 and winter 1994/5 (refer to attached legend for details).

Steam Routes.

Description of location, reason and methodology of the clearance of steam routes will be covered in a later report.

Newtons Pool.

During the months August to November 1993 the area in and around Newtons Pool was the centre of activities within the SAM.

Information obtained from records through DRA (Defence Research Agency [formerly RARDE]) suggested that in the 1960's a charge of high explosives being proof tested in the pool failed to detonate. Repeated efforts to locate the charge failed. There was no alternative but to conduct a thorough search of the pool as part of the decontamination exercise.

The pool was drained and the accumulated silts were excavated and wet sieved.

An incredibly laborous process which reaped no reward, the charge was never found.

Previous to this operation Bridge 12, a 1970's steel section trough bridge was removed and replaced with the existing culvert bridge. The works involved the construction of a cofferdam in Cornmill Stream and the setting of two lines of sheet piles to either side of the proposed culvert.

Concern about the extent of excavation and the possible damage to the monument and especially to the known buried remains of an 18th Century Inn, the Turnpike and Chequer.

However, the line of the piles were set within the original brick revetment wall of the bridge so undisturbed contexts were not affected. A small number of timber piles were removed which were in direct line with the piles but others were carefully avoided. Approximately twelve piles were encased in concrete under the sluice.

Considering the activity within the pool area very little damage occurred.

Further ground works are planned in the SAM with the remediation of the Burning ground as the most involved project.

Gunpowder Drying Stove.

RCHM330 (TL 37425 02215).

During December 1993 decontamination works in the area of the early 20th Century Acid and Tetryl factories uncovered the foundations of a circular gunpowder drying stove. Careful machine excavation at 100mm scrapes followed by hand excavation of the fill resulted in the emergence of an impressive building foundation plan.

This area had been originally located outside the Scheduled Ancient Monument, and was tested as having higher than normal levels of sulphate/sulphur and metals contamination. Discovery of the remains and associated canal circuit led to an adjustment of the SAM boundary. Bricks and earthenware from the later Acid and Tetryl works, which were demolished in the late 1950's early 1960's, were found afore the foundations themselves.

The gunpowder drying stove is shown on a plan of the site from 1897 (O - B:21) and the foundations have been drawn and photographed from the above (WA 94 CS171 - CS176).

In November 1994 the remains were backfilled with the clean fill of the mound from Building H8 (demolished) to provide protection from the elements as well as physical abuse.

century the demand for cannon powders for larger guns and for moulded powders in greater quantities resulted in rapid changes and innovations.

It was also in the latter half of the Nineteenth Century that tentative production of the new chemical explosive, Guncotton, took place. Manufacture of the new liquid explosive Nitroglycerine soon followed and by the last decade of the Nineteenth Century, Cordite, a mixture of guncotton (Nitrocellulose) and nitroglycerine was in production. Cordite was such a successful explosive, it quickly became the main service propellant and by 1900 the majority of the old gunpowder buildings on site were converted to make cordite.

At the same time as the shift to chemical based explosives the works expanded south with the purchase of the Quinton Hill works in the 1880's now known as South Site.

Initially the South Site consisted of a guncotton factory but nitroglycerine and cordite production areas followed shortly afterward.

Back on the North Site an acid factory and nitroglycerine facility were built in 1890's. The wet guncotton was produced on the south site and barged up to the grand magazine where it was stored. Then it was moved down the site, north to south, from drying to mixing and pressing, finally resting at H12 the cordite reel magazine.

The First and Second World Wars naturally saw peaks in production and investment into the site. During the First World War the labour force rose to 5000 its greatest number, over half were women, working shifts to ensure continuous production.

A number of high explosive products were made at the RGPF even though the site was never a high explosive plant. Picric acid was produced in the 1870's and 1890's and later around 1910 tetryl (C.E or Composition Exploding) was produced. Between the Wars important research was carried out on the safe and efficient production of TNT and RDX.

The sites proximity to urban areas and the continent forced its closure as a production site in 1943 in favour of the new purpose built Ordnance sites in Scotland and the North West of England.

The site reopened in 1945 after the war as a government research establishment, initially set up to research into liquid fuels for rockets and other applications. A plant was also constructed to develop plastic propellants for use in rocket motors. Over the next 30 years research into propellants, plastic and rubber propellants, polymers, properties of high explosives and many other aspects of energetic and inert materials, took place on North and South Site.

By the 1960's Waltham Abbey was the sole government laboratory carrying out research on non nuclear explosives of every kind.

Many of the old cordite and gunpowder buildings were used as laboratories also some of the test beds were converted Nineteenth Century process buildings. A number of purpose built test beds were also constructed.

The site finally closed in June 1991 after 204 years of government service. Since 1992 a programme of decontamination and remediation has been carried out with the aim of putting the site to beneficial reuse in the public sector.

Unlike the other interim reports this will not include a section on the history of the report area. In this instance the area covers the majority of the site and so the general site history together with the more detailed references in the RCHME survey report will suffice.

Fig. 5



WASTE DUMPS.

- A. Tetryl and north acid factories.
- Accumulation of demolition arisings from the above complexes, heavily contaminated with various kinds of asbestos and explosives.
Excavated between October 1993 and June/July 1994 (intermittent).
- B. Nitroglycerine Drowning Pond.
- Partially filled/silted pond associated with Nitrator E2. Possible NG contamination.
Excavated August/September 1994.
- C. Demolition rubble from demolished Guncotton Stove Building 74a?
- Unknown contamination.
Excavated and cleared December 1994.
- D. Edmonsey Sluice.
- Localised area of ash dumped on eastern bank of Horsemill Stream.
Excavated June/August 1994.
- E. North Tip Burning Ground.
- Mixed waste tip, asbestos, laboratory glass, unidentified containers etc.
Excavated January/February 1993.
- F. Eastern and south eastern tips Burning Ground.
- Mixed rubble, asbestos and industrial waste tips.
Excavated between April 1993 and December 1993.

G. Barrel Graveyard.

- Area of barrel dump. Barrel contents unknown so barrels removed and soil dumped.

Cleared July/August/September 1993.

