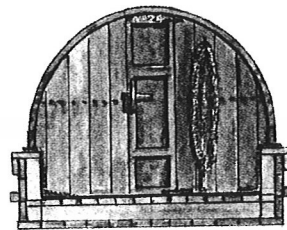
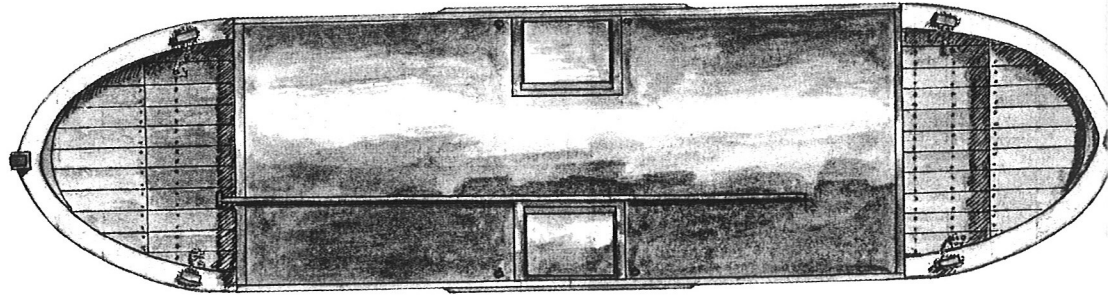
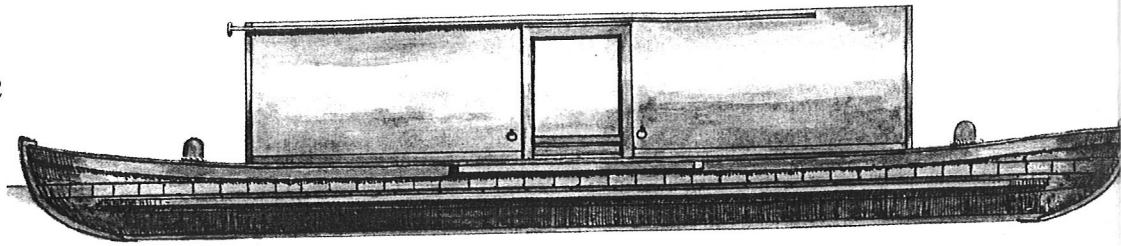
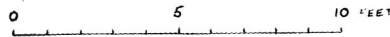


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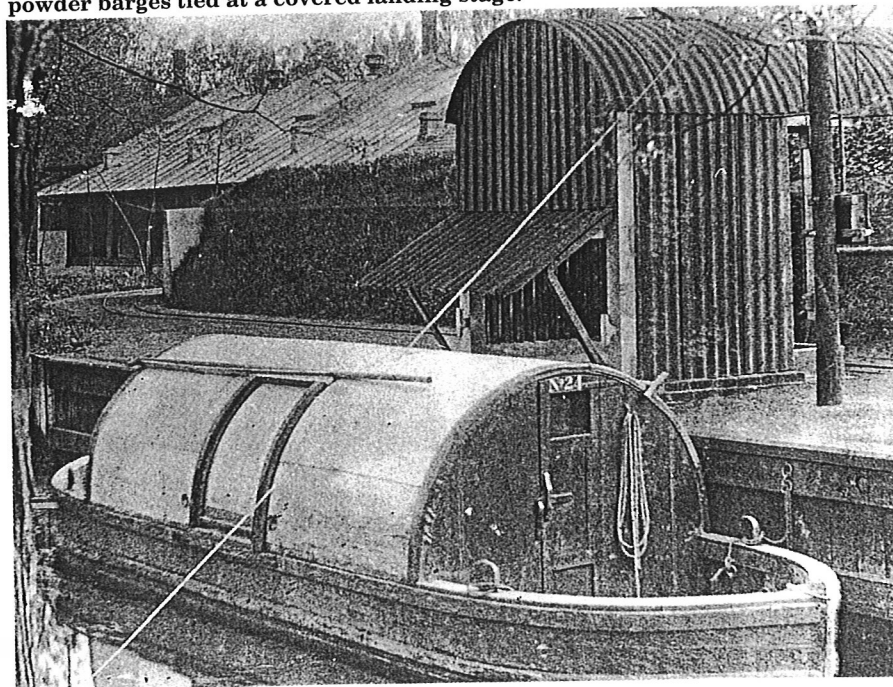
● One of the special barrel-roofed boats used on internal traffic.



Edward Paget-Tomlinson.

MENACING waterways

● Taken on 10th May 1904, this archive photograph shows one of the typical internal powder barges tied at a covered landing stage.

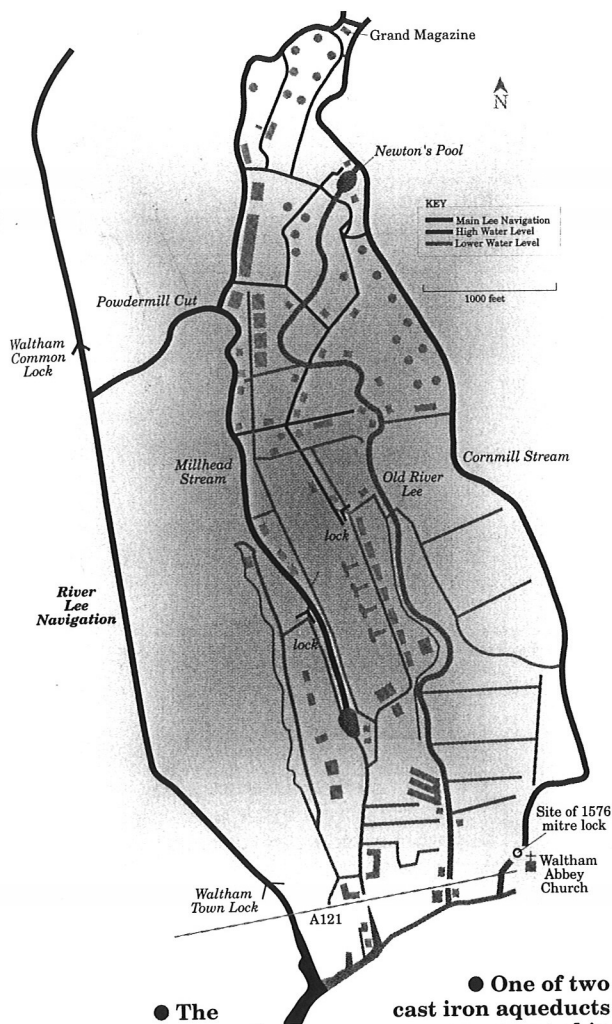


WAGM

By 1662 there was more gunpowder being made at Waltham Abbey "than in all England besides". The river Lee had made such developments possible - providing water transport for the supply of raw-materials, and the relatively safe distribution of finished products. Via the Lee and the Thames, gunpowder was carried by boats to the Royal Arsenal at Woolwich, and the great magazines at Purfleet.

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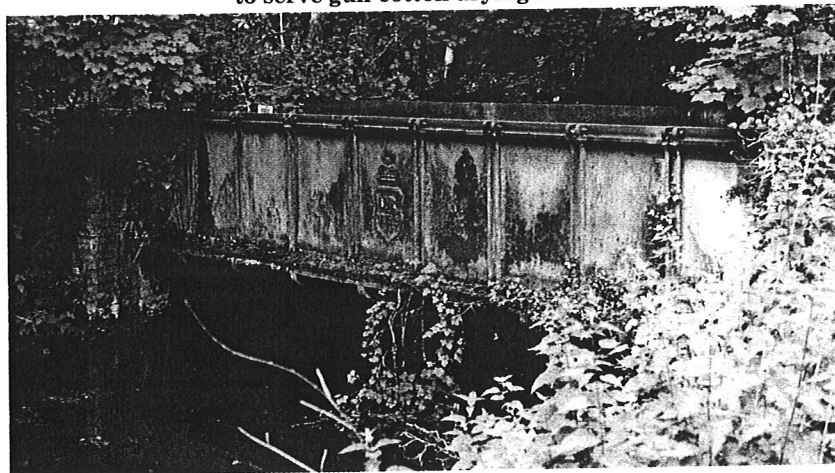


● The waterways of Waltham Abbey c.1945.

● One of two cast iron aqueducts constructed in 1878-9 carrying the royal cipher 'VR'.



● Footbridges of this unusual shape were typical of those across the Royal Gunpowder Mills' waterways. This one crosses a canal dug in 1903 to serve gun-cotton drying stores.



Christine Richardson

between them was by water. Therefore, a network of canals was created, crossing the area and linking with three ancient main channels, which also provided water-power for the gunpowder mills. Of those three main channels, two already had a significant past. The Old River Lee had been the through-route for navigation, with a type of flash-lock at what is now known as Newton's Pool. This caused the usual clashes between boatmen and millers, as a result of which the Cornmill Stream was improved to navigable standard and a pound-lock built to drop boats down to the old river. Not just any lock – the first one in Britain with mitred-gates at both ends, completed in 1576. Riots destroyed it in 1592, and it is thought that no trace remains. In 1767 Smeaton moved the Lee through-navigation to the west – and left the old by-passed channels to form the outline of the gunpowder mills' waterways.

The aftermath of the French Revolution led England into an almost continuous period of warfare, culminating in the battles against Napoleon. War meant that bulk supplies of munitions were needed, so many new buildings were added at

Waltham Abbey, and the canal system was enlarged considerably. Charcoal – one of gunpowder's three components – was brought by boat from Fernhurst in Sussex, and Faversham, Kent. Of the other two raw materials tons of saltpetre came up the rivers Thames and Lee from Bengal. Together with sulphur they were taken to the various production buildings via the site's canals. Damp gunpowder from Royal Navy ships was also carried, to be dried in steam-stoves.

By this time the production systems had evolved from south to north, with the finished gunpowder being stored in the Grand Magazine. From there it was loaded in to spritsail barges which used the Powdermill Cut to reach the Lee Navigation.

The peak of production during the Napoleonic Wars was in 1813, when 250 men were employed, and the canals were used by 9 powder-boats, 5 barges, 2 ballast-barges, and 6 punts. But demand for armaments slumped with Napoleon's final defeat at Waterloo and by 1822 the workforce was only 34. However, various conflicts in Britain's growing Empire meant that bulk production of explosives was often

required. More canals were gradually added to the network, with waterways on two levels linked by locks. Two cast-iron aqueducts carried one canal over the Old River Lee, both marked with the Royal VR cipher, and the dates 1878-9. A distinctive style of footbridge was built. They were a semi-circular shape and made of an open grid of wrought-iron. At each side were boot-scrapers to prevent grit being trodden onto the bridge that might fall on to passing explosives boats. Such detritus in gunpowder's raw materials could cause an explosion during the grinding processes.

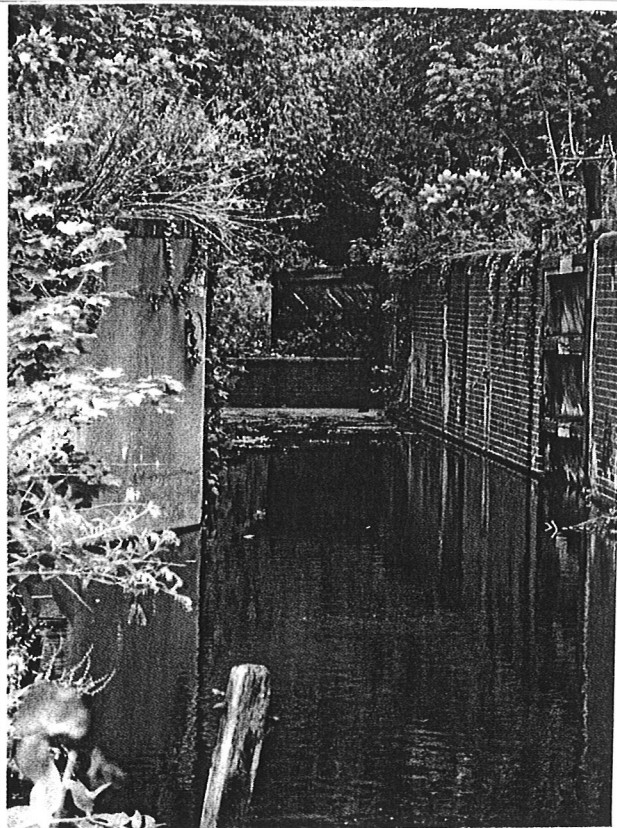
In 1869 there were 15 covered boats on the system, varying in length between 21ft and 30ft, and 5ft 11ins to 8ft 6ins beam – used to carry dangerous cargoes. Their barrel-shaped roofs were designed to stop explosive dust settling on them, and phosphor bronze nails and fittings were used to prevent sparks. There were also 16 open boats for general errands, carrying charcoal, timber, stores, and acting as ferries.

By now the spritsail barges were carrying over 40,000 barrels of gunpowder from the site every year. →



● The remains of two punt-ended barges.

Christine Richardson



Christine Richardson

MENACING *waterways* continued

● The substantially intact remains of a lock on Millhead Stream built in 1896 between the upper and lower systems when the change from gunpowder to cordite production generated extra barge traffic.

But evermore larger guns needed more efficient explosives and soon nitroglycerin was added to the dangerous products at Waltham Abbey. This required the on-site boats to carry acids and chemicals – supplied, stored and moved in dark-green glass carboys, covered in wicker. However, nitroglycerin is so volatile that even water-transport was not smooth enough; instead it was moved between processing buildings by gravity – slow-flowing along pipes and gutters.

Such volatility meant that nitroglycerin could not be safely used as an armament. Instead, after 1890, it was mixed with other elements to form cordite, a chillingly efficient explosive. As the products became more effective so did the carrying of them on the canals. By now the boats on the internal network had evolved into two types, both carvel-built in timber, double-ended and capable of holding a 5 ton cargo. (For a more detailed description see 'Royal Gunpowder', September 1998 *WW*.)

The boatmen pulled or poled their craft through a pretty, thickly wooded landscape. Before electricity was available they worked daylight hours only, as few of the buildings could have flames to provide artificial light. With structures spread thinly amongst 400 acres there was nothing fearful to see; only the knowledge that some buildings had floors covered with leather hides, nailed down with copper nails, and kept moist all the time to stop explosive dust spreading. Those producing cordite and nitroglycerin had floors of lead sheet, so that the dust could be seen and cleared up.

Boat crews were never hurried – it was policy that no one on the site was

pushed to do a certain amount of work in a day. People under pressure make mistakes. Nevertheless, at times of war when production targets were high there were tragedies at Waltham Abbey's Royal Gunpowder Mills. On 7th May 1894 one building exploded. The design of the area, and the blast-walls, should have contained the damage – but it did not. Three other buildings, also containing explosives, were completely destroyed. The blast was heard 12 miles away in Hyde Park, where people thought it was a gun-salute for the Queen. The trees were supposed to help contain a blast but they proved totally ineffectual. Seven men died – one was blown into a canal, five of the others over the river to the Essex marshes. Understandably the failure of the blast containment system caused considerable alarm amongst the workforce.

Unhappily, that was not the only catastrophe on the site. In 1902 there was a similar explosion, and twice in 1940 when the production pressures of World War II resulted in the devastation of cordite mixing-houses. But heavy workloads did not always result in mistakes. In 1917 the horrendous demands of the First World War caused the workforce to be increased to an all-time peak of 5,000 – the majority women working shifts to secure continuous production.

Explosives manufacture ceased in 1943, with production switched to areas of Britain out of the reach of enemy bombers. Many of the canals were infilled in the 1950s, but traces remain. The timber piling of their banks can be found, and the clay-

linings still retain any dampness, with marsh plants thriving.

The remaining waterways were put to non-navigable use in the 1960s during the research and development of non-nuclear explosives of every kind. Newton's Pool, the site of the 16th century flash-lock, now saw flashes of another kind when it was used to test the underwater effectiveness of new explosives – the results of which were recorded by high-speed cameras capable of 1,200,000 exposures per second.

The final closure of the Waltham Abbey site was on 30th June 1991. Since then the Ministry of Defence has carried out a decontamination programme, including the removal of dangerous materials from the canals – a task done without damaging the clay-puddle. The canal system survives partly as open waterways, partly as earthwork features, whilst others have been infilled and lost. But the Old River Lee still flows through the centre.

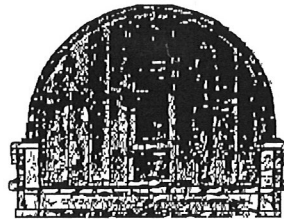
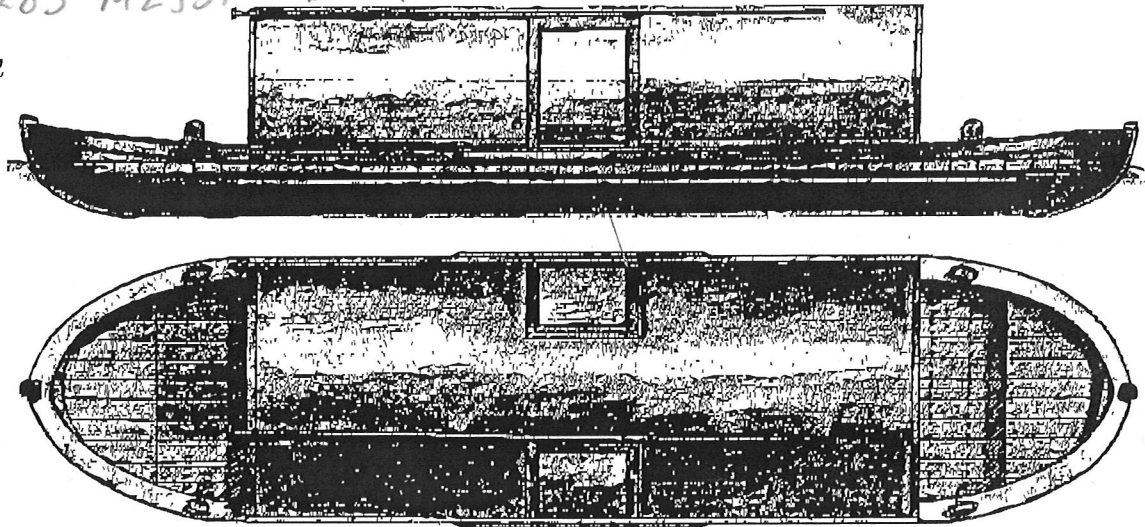
Now the site is being prepared for public access. The northern half is still thickly wooded and is an SSSI. The largest heronry in south-east England thrives among the willow, alder, and black dogwood originally planted for charcoal production.

The Royal Gunpowder Mills at Waltham Abbey will be ready for public visits from the year 2000. A number of sunken powder-boats and barges are in the remaining waterways their removal a future task when funding and manpower are available. And, in the long-term, boats may once again cruise the canal network – this time carrying visitors, not highly dangerous explosives. ■

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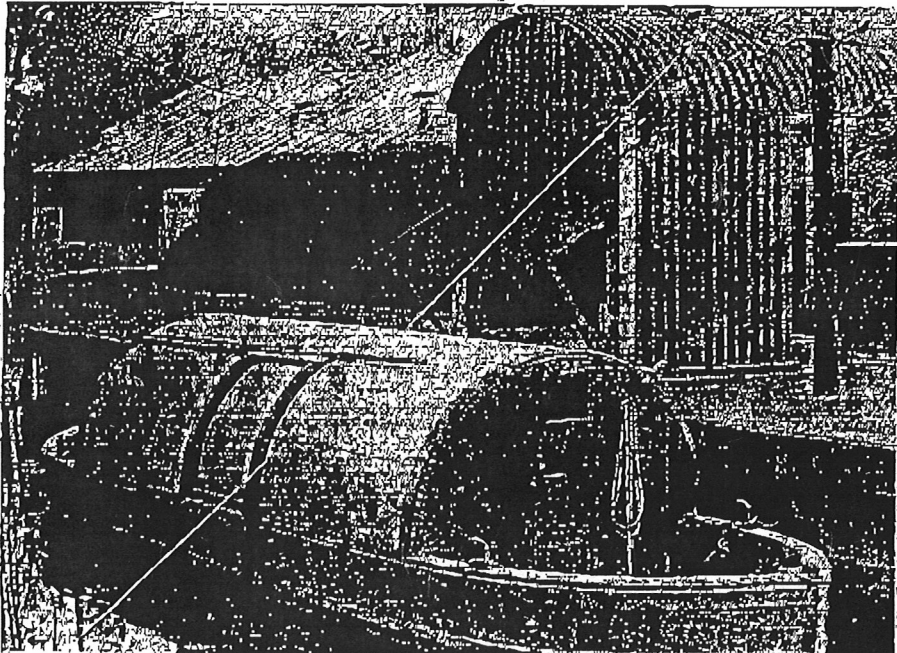
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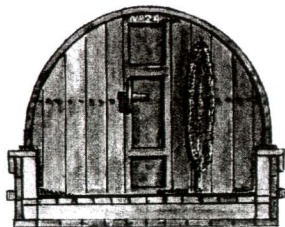
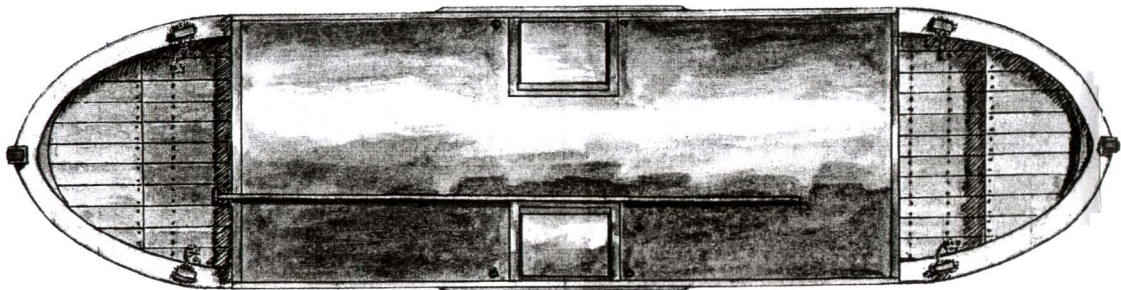
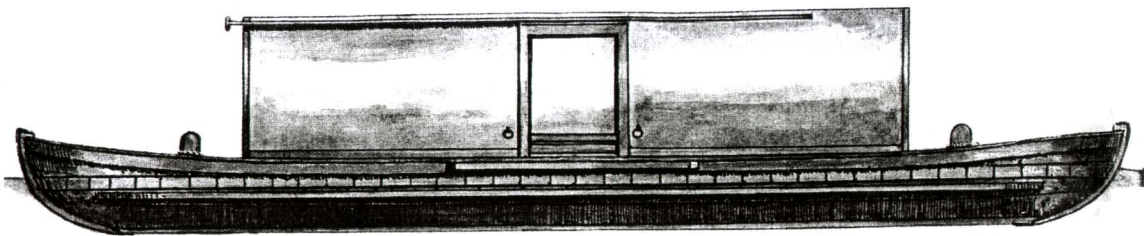
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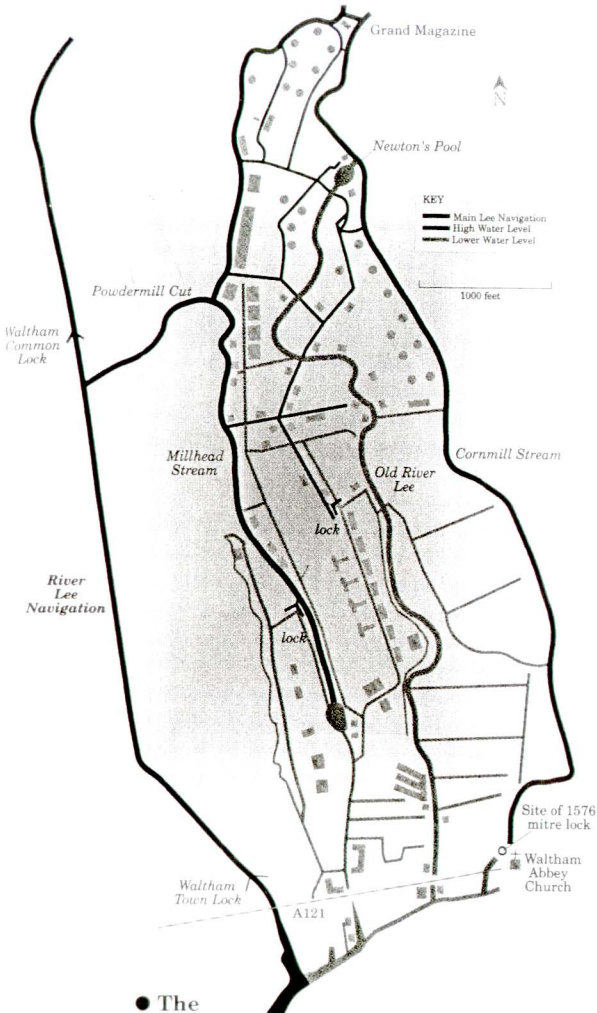
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