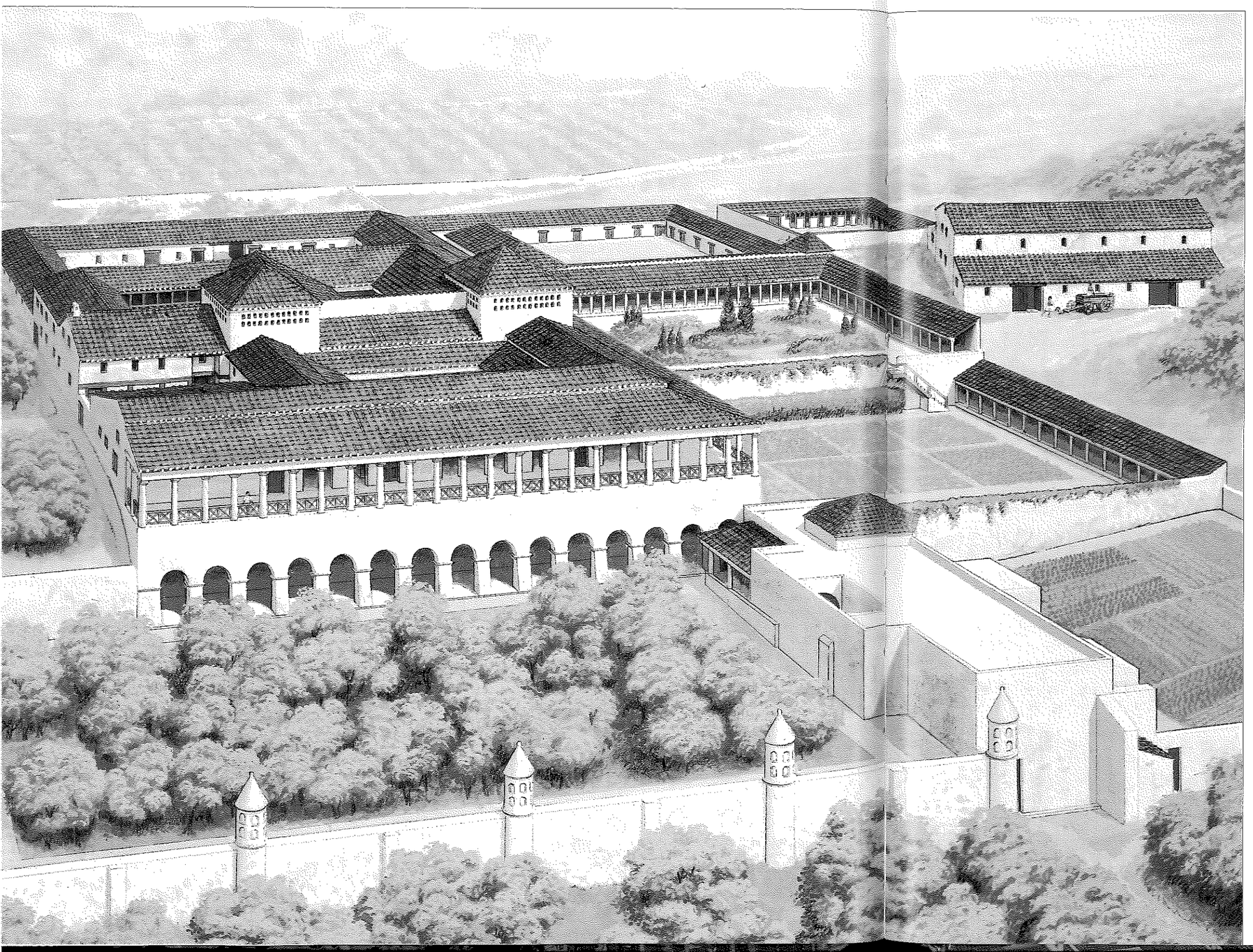
FOOD AND WATER

As Rome's population grew, the provision of food and water became increasingly important. By the imperial period the bureaucracy was in place to manage and maintain the supply of water via aqueducts, and to import large quantities of grain, wine and olive oil from the empire.



Population

There are many problems with trying to estimate the size of the population of Rome. What figures we have relate to the number of male adult citizens, and then only a proportion of them. They take no account of women, children under the age of ten or slaves. From the second century BC the population certainly increased, as Rome's power and influence grew. Estimates vary from 250,000 in the late Republic to 2 million in the later first and early second centuries AD. Most scholars now believe that a figure of 1,200,000 for the city in the second century AD is probable. Such a population posed enormous problems for the supply of basic foodstuffs and water.

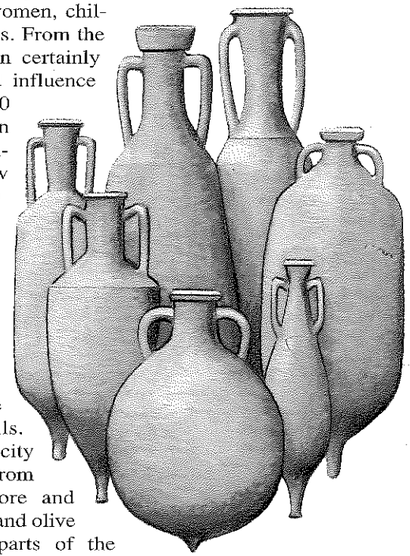
Food supply

Supplying food to the ever-growing city was a constant challenge to Roman organisational skills. At first, the hinterland of the city could meet most of its needs. From the late Republic, however, more and more food, especially grain, wine and olive oil, was imported from other parts of the Mediterranean.

Grain, the staple of the Roman diet, came from Egypt and North Africa. Wine was imported from Campania, Gaul and Spain in large quantities, and olive oil came from southern Spain and North Africa. The wine and olive oil were transported in amphorae – pottery jars – which varied in shape according to their contents and where they were made. The amphorae were transported up the Tiber to Rome by river barge, and unloaded at the major port area below the Aventine hill; this was known as the Marmorata (there were also port facilities further upstream near the Forum Boarium).

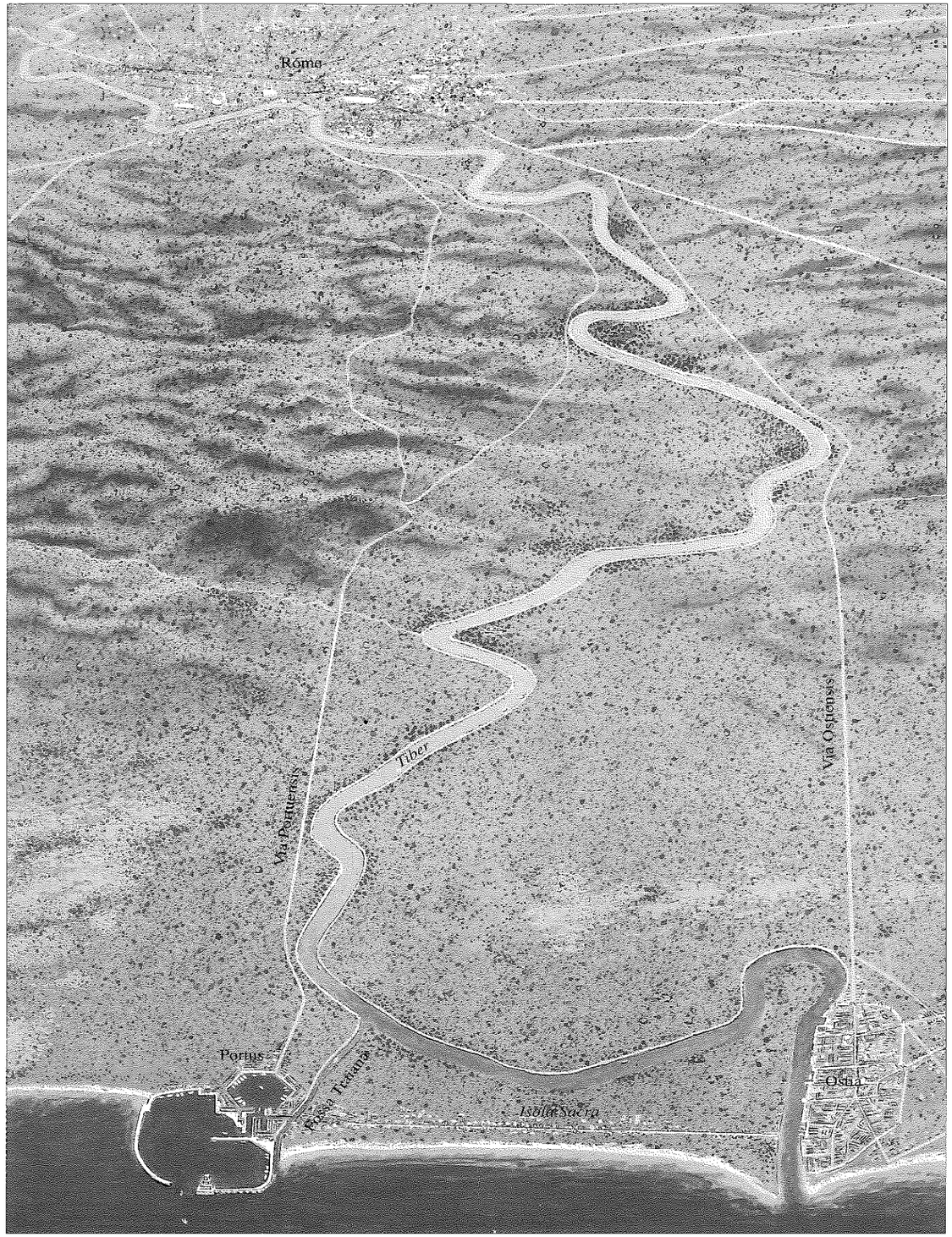
The amphorae were unloaded and emptied at the wharves, and their contents were stored in huge warehouses. Most of the amphorae were then thrown away. Beside the Tiber, there is a huge man-made hill of pieces of broken olive oil amphorae, mainly from Spain and North Africa. This is known as Monte Testaccio, and is 34 metres (112 feet) high and has a circumference of 1 kilometre (920 yards). It is thought to contain the fragments of at least 53 million amphorae.

Grain was distributed free to poorer citizens (that is, males over the age of ten). This practice started in the late Republic, but it was Augustus who organised the distribution into the *annona* (dole), under the control of an equestrian prefect. In 5 BC Augustus distributed free grain to 320,000 adult males, but no details of qualifications for this dole or its actual distribution are known.



△ Different kinds of amphorae, all of which were in use in the early Empire. These jars varied considerably in shape and size. They were used to transport mainly liquids (wine, olive oil and fish sauce), but some have been found on shipwrecks which contained whole olives or dried fruit. In the foreground is the round type of amphora which was used to transport olive oil from southern Spain, mainly to Rome and Gaul.

◁ A reconstruction of the villa at Settefinestre near Cosa to the north of Rome. This large and rather grand villa was at the centre of an estate from the early first century BC and is typical of the type of large slave-run estates which developed in the late Republic. Various additions were made about AD 100, including what is thought to have been a piggery.



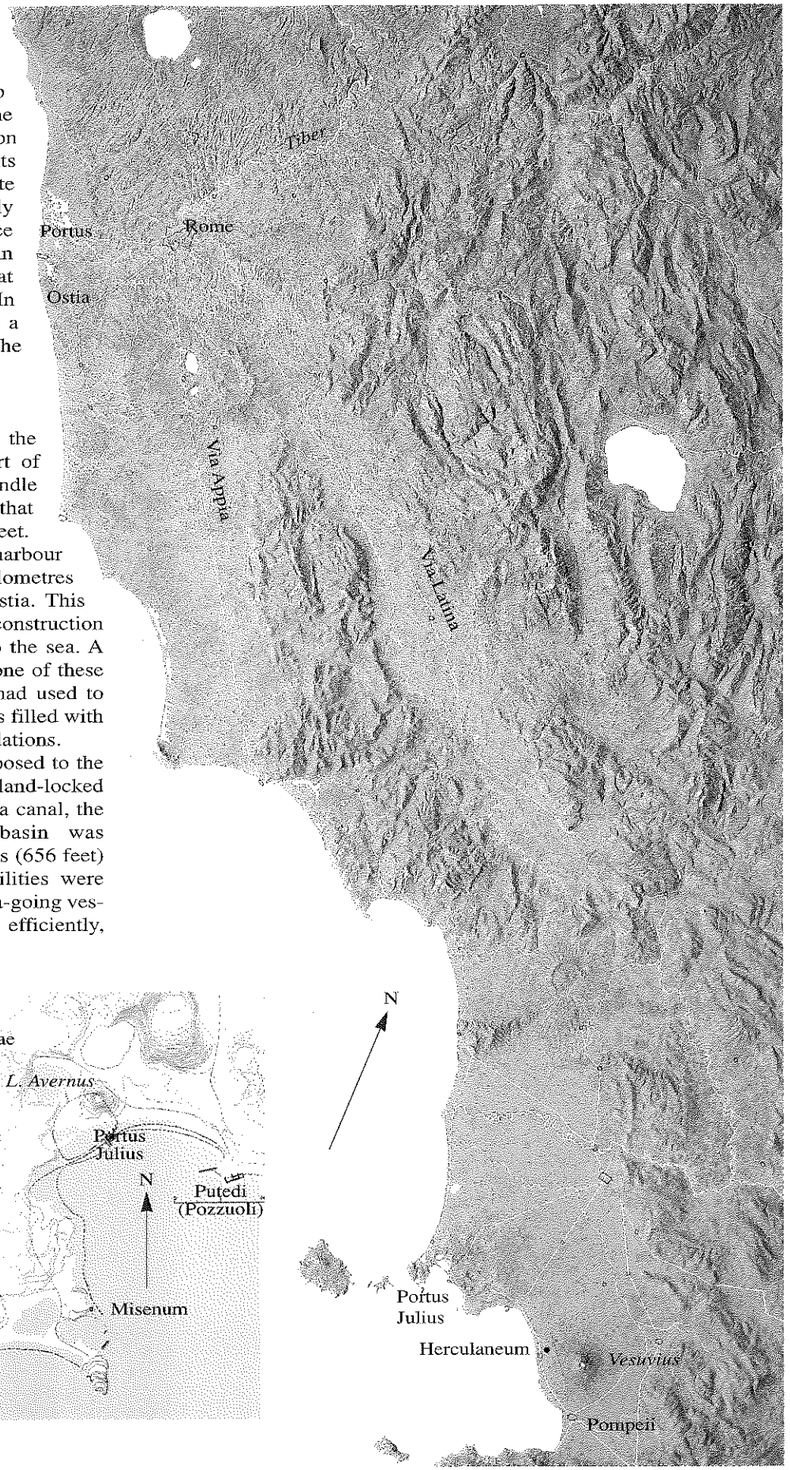
Puteoli and the grain fleet

The shipment of grain from Egypt may have been partly by a special fleet sailing from Alexandria to Puteoli (modern Pozzuoli) on the Bay of Naples. But the organization of this fleet is now unknown, and its actual existence is doubtful. Private contractors, however, were certainly involved in the grain transport. Once the ships arrived at Puteoli, the grain was loaded into smaller boats that then sailed up the coast to Ostia. In 37 BC Agrippa and Octavian built a second port at Puteoli, called the Portus Julius.

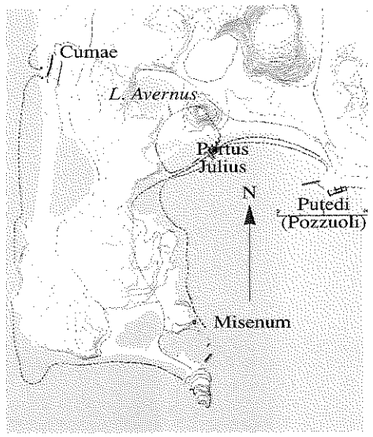
Ostia and Portus

Ostia is situated at the mouth of the Tiber, and served as the river port of Rome, but it could not easily handle large sea-going vessels like those that might have made up the grain fleet. Claudius built a new all-weather harbour much closer to Rome at Portus, 3 kilometres (about 2 miles) to the north of Ostia. This was a huge project, involving the construction of two great moles jutting out into the sea. A lighthouse was built at the end of one of these moles: a large ship that Caligula had used to transport an obelisk from Egypt was filled with concrete and sunk to form its foundations.

Claudius's harbour was very exposed to the weather, and Trajan built a new land-locked inner basin, linked to the Tiber by a canal, the Fossa Traiana. Trajan's new basin was hexagonal and measured 200 metres (656 feet) across. Warehouses and other facilities were also provided. Large numbers of sea-going vessels could thus be handled very efficiently, much closer to Rome.



▷ A detail of the northern part of the Bay of Naples, showing the location of the harbours at Puteoli.



▷▷ A map showing the west coast of Italy from the Bay of Naples in the south up to Rome in the north.

◁ An aerial view of the Tiber from Ostia up to Rome, showing the location of Portus to the north. The Tiber had a particularly meandering course between Rome and Ostia.

In the early imperial period, Ostia was a bustling, commercial town, full of warehouses for storing grain and other goods. As Portus grew in importance, so Ostia declined.

The aqueducts

Until the later fourth century BC, Rome was supplied with water from wells, springs and rainwater collected in cisterns. But in 312 BC the first of Rome's aqueducts was built, the Aqua Appia, by the censor Appius Claudius Caecus; by the time of Trajan, Rome was supplied by ten major aqueducts.

Many of the city's aqueducts drew water from sources in the Anio valley to the east of Rome. In 272 BC the Anio Vetus was built with funding from the spoils taken from the defeated Pyrrhus, King of Epirus. As its name implies, the intake for the aqueduct was from the Anio river, above Tivoli.

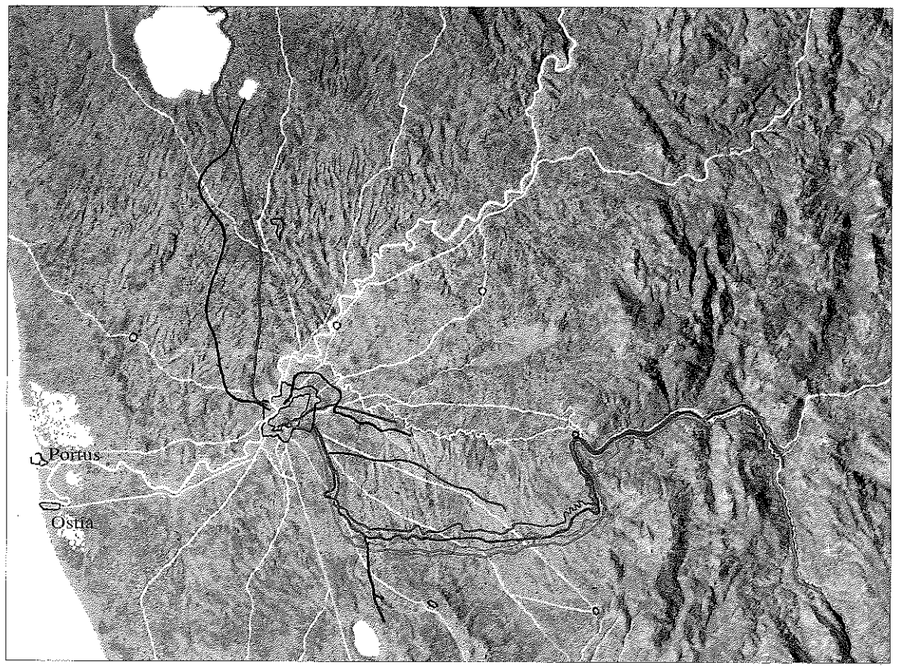
In 144 BC the Aqua Marcia was constructed, and quickly became renowned for the purity of the water it carried. This water was drawn from springs in the Anio valley. For the upper part of its course the channel of the Aqua Marcia was mainly subterranean, but once it left the hills at Tivoli it was carried across the flat plain to the city on an elevated, arcaded structure. This was the first such structure, and was an astonishing engineering achievement; it cost more than 180,000,000 sesterces. As the construction of these arcades was so expensive, the channels for the Aqua Tepula (built in 125 BC) and the Aqua Julia (33 BC) were built on top of the Marcia on the approach to Rome, to form a triple-decker in the arcaded section.

The Aqua Virgo was constructed in 19 BC. This aqueduct was the only one to enter Rome from the north, though it was also fed by springs in the Anio valley. The Virgo was constructed by Agrippa to supply his large public baths on the Campus Martius, the first time that an aqueduct had been constructed for this specific purpose.

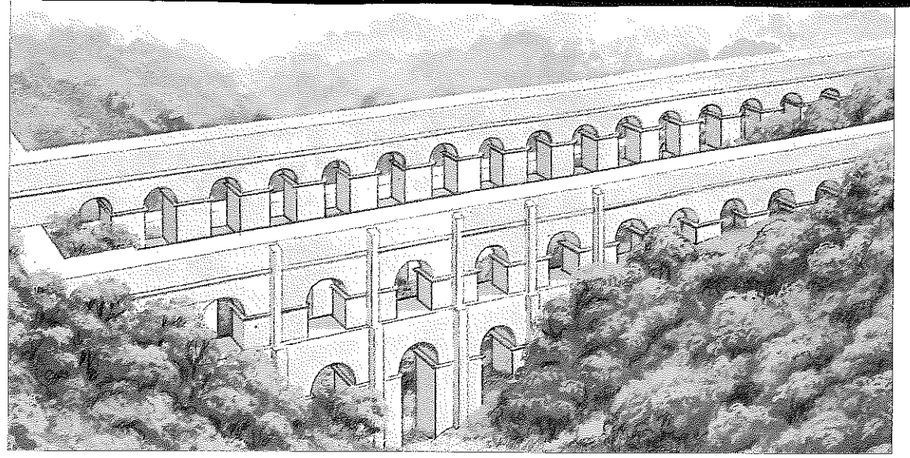
The Aqua Alsietina was built by Augustus in 2 BC, to supply his Naumachia on the west bank

▽ The wharves on the Tiber in the Marmorata quarter after excavation at the end of the 19th century. Note the ramps and mooring dogs.

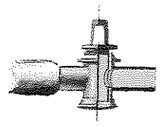
▷ A map showing the course of the ten great aqueducts of Rome. The first, the Aqua Appia, was built in 312 BC. The last major aqueduct was the Aqua Traiana, although one further aqueduct, the Aqua Alexandrina, was built in AD 226.



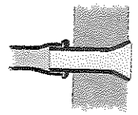
Aqua Appia
Aqua Anio Vetus
Aqua Marcia
Aqua Tepula
Aqua Julia
Aqua Virgo
Aqua Alsietina
Aqua Claudia
Aqua Anio Novus
Aqua Traiana



◁ A reconstruction of high level arcades carrying aqueduct channels across the Fosso della Noce, a tributary of the Anio river. The arcade in the foreground carried the Aqua Marcia; the one in the background carried the Aqua Claudia. This aqueduct survives as an 11-arch structure rebuilt by Septimius Severus.

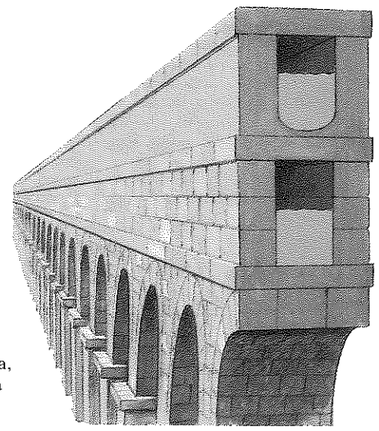


A valve which enabled domestic supplies to be turned off or diverted. Taps and valves of this kind were rare in Roman water systems and the water usually ran 24 hours a day.

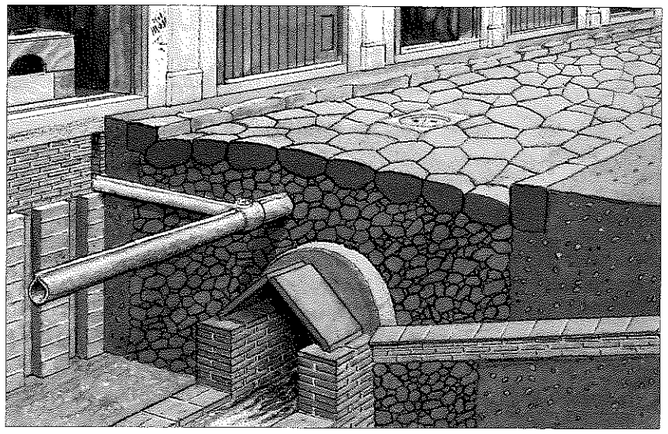


This bronze nozzle, or *calix*, was made in several standard sizes and was used to connect domestic houses to the mains water supply.

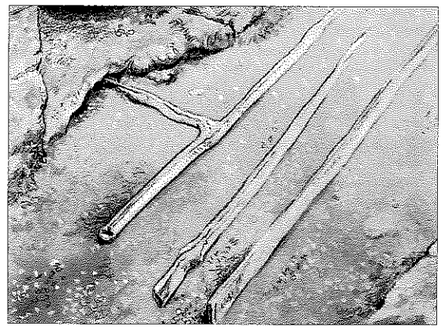
▷ A reconstruction cross-section of the arcade and channels of the Aqua Claudia, with the channel of the Aqua Anio Novus on top.



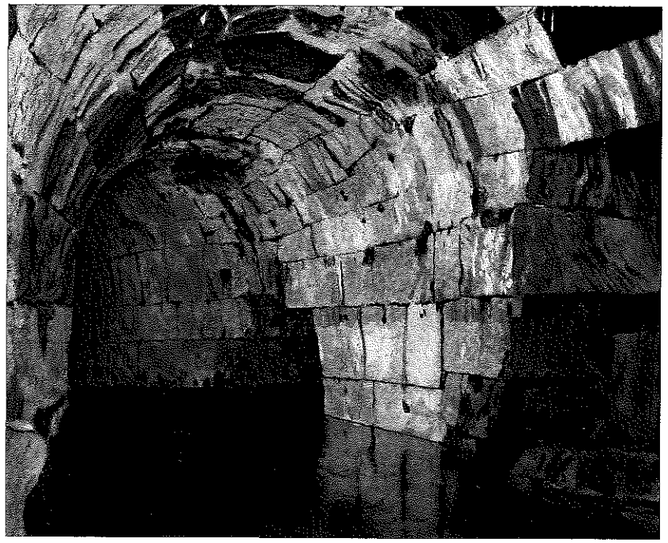
▽ A view of the arcade carrying the Aqua Claudia and Aqua Anio Novus as it approaches Rome from the south-east.



△ A reconstructed view of the water system beneath a street. The drain ran under the middle of the street. The lead pipes carrying the freshwater supply ran under both the road and the pavement. Branch pipes were taken off the main line at intervals to supply public and private buildings.



△ A view of lead pipes still in place at Pompeii.



△ An interior view of the Cloaca Maxima. It was covered with a vault in about 100 BC.

of the Tiber: this was a great artificial lake used for the staging of mock sea-battles and other large-scale aquatic entertainments.

The two greatest aqueducts in terms of volume of water carried were the Aqua Claudia and the Aqua Anio Novus, both completed by AD 52. The Claudia was fed by springs in the Anio valley upstream from those serving the Marcia. The Anio Novus, like the Anio Vetus before it, was fed by the Anio river itself.

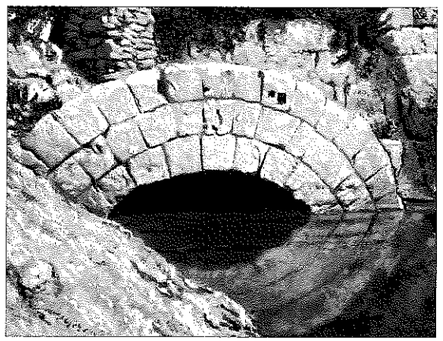
The last of the great aqueducts to supply Rome was constructed under Trajan: the Aqua Traiana. This entered the city at the Janiculum hill, safeguarding the water supply to inhabitants of the west bank if supplies from across the river were cut. A large *castellum*, or receiving tank, was found on the Via Aurelia, and the channels radiating from it seem to have served every quarter of the city, especially the Baths of Trajan on the Esquiline hill. From the third century its waters also powered grain mills just below the crest of the Janiculum; these apparently produced much of Rome's flour.

Frontinus and the Cura Aquarum

Under Augustus, Agrippa had headed a government department overseeing the maintenance and general running of the city's aqueduct system, the Cura Aquarum. The most famous holder of this post was Frontinus. Frontinus was in charge of Rome's water supply under the emperor Nerva, and wrote a book on the subject, *De Aquis Urbis Romae*. This gives historical details and descriptions of the aqueducts of Rome up to his day. He provides information on the problems of providing water to such a large city, and the regular maintenance that the system required. He also gives much valuable legal information relating to water supply. It is clear that corruption was a problem here as in many other aspects of Roman life.

Sewers

The sewers carried away effluent from the baths, overflow water from the streets, and sewage and waste from both houses and streets. They usually ran underneath the street and



▷ The outlet of the Cloaca Maxima into the Tiber, pictured before the construction of the modern embankment.

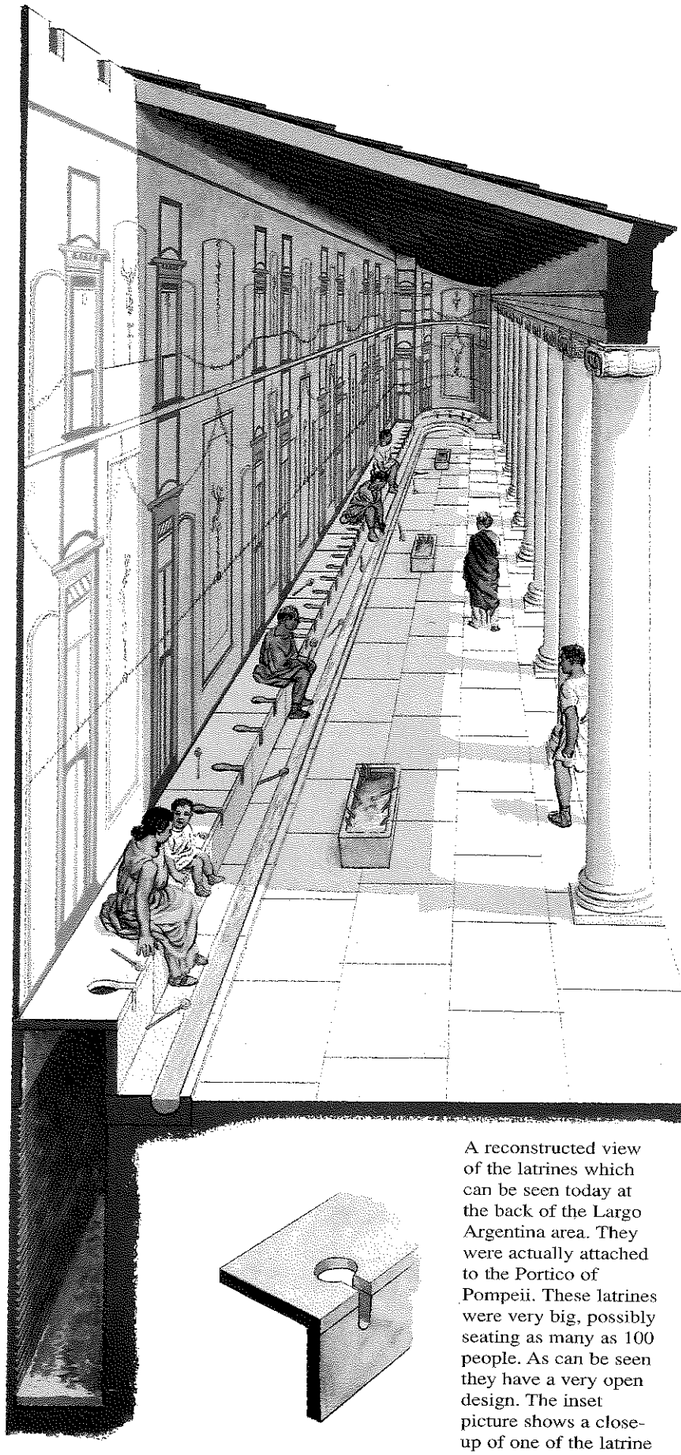
could be flushed by the overflow from public fountains. Very few houses were attached to a mains sewer. Instead, waste was collected in internal cess-pits that could be emptied periodically and the contents sold for fertilizer. Roman drains and sewers lacked traps to prevent gases like hydrogen sulphide and methane escaping, and thus had no inbuilt protection against odour or the danger of explosions. Equally, the sewers could back up when the level of the Tiber rose during floods. Sewage and waste water which normally drained into the Tiber would then be forced back into the network and up any domestic connections to it.

The Cloaca Maxima

The most famous Roman drain is the Cloaca Maxima, whose original construction is attributed to Tarquinius Priscus. This was originally an open ditch to help drain the marshy site of the city, particularly in the Forum Romanum area. Although it was intended to carry off surplus water, it inevitably also carried sewage. In the later Republic, the Cloaca Maxima was enclosed in a subterranean channel; in part it is still in use today. As the crow flies, its length is over 900 metres (985 yards), but its course meanders because of diversions around buildings. Its size is remarkable: in places it is 4.2 metres (13 feet 9 inches) high and 3.2 metres (10 feet 6 inches) wide, and Roman writers agree that it was large enough for a wagon load of hay to pass through. Agrippa is reported to have sailed in a boat through the underground world of Rome's drainage system on a tour of inspection.

Public toilets

Later Roman historical sources record 144 public latrines in Rome, though only a few are known from archaeological evidence. One example, dating from Hadrian's reign, is above shops in the Forum Julium, and others are in the Largo Argentina area near the Theatre of Pompey. Latrines were basic facilities in bath buildings, and were flushed with waste water from the baths themselves. Many private dwellings in Rome, particularly the high-rise dwellings, did not have latrines; they lacked the running water supply that made flush latrines practical.



A reconstructed view of the latrines which can be seen today at the back of the Largo Argentina area. They were actually attached to the Portico of Pompeii. These latrines were very big, possibly seating as many as 100 people. As can be seen they have a very open design. The inset picture shows a close-up of one of the latrine seats.