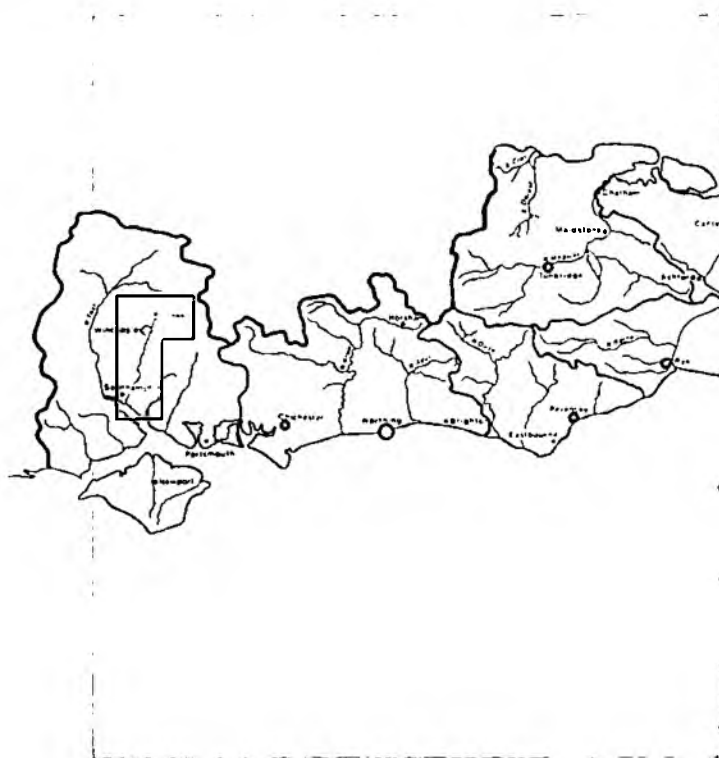
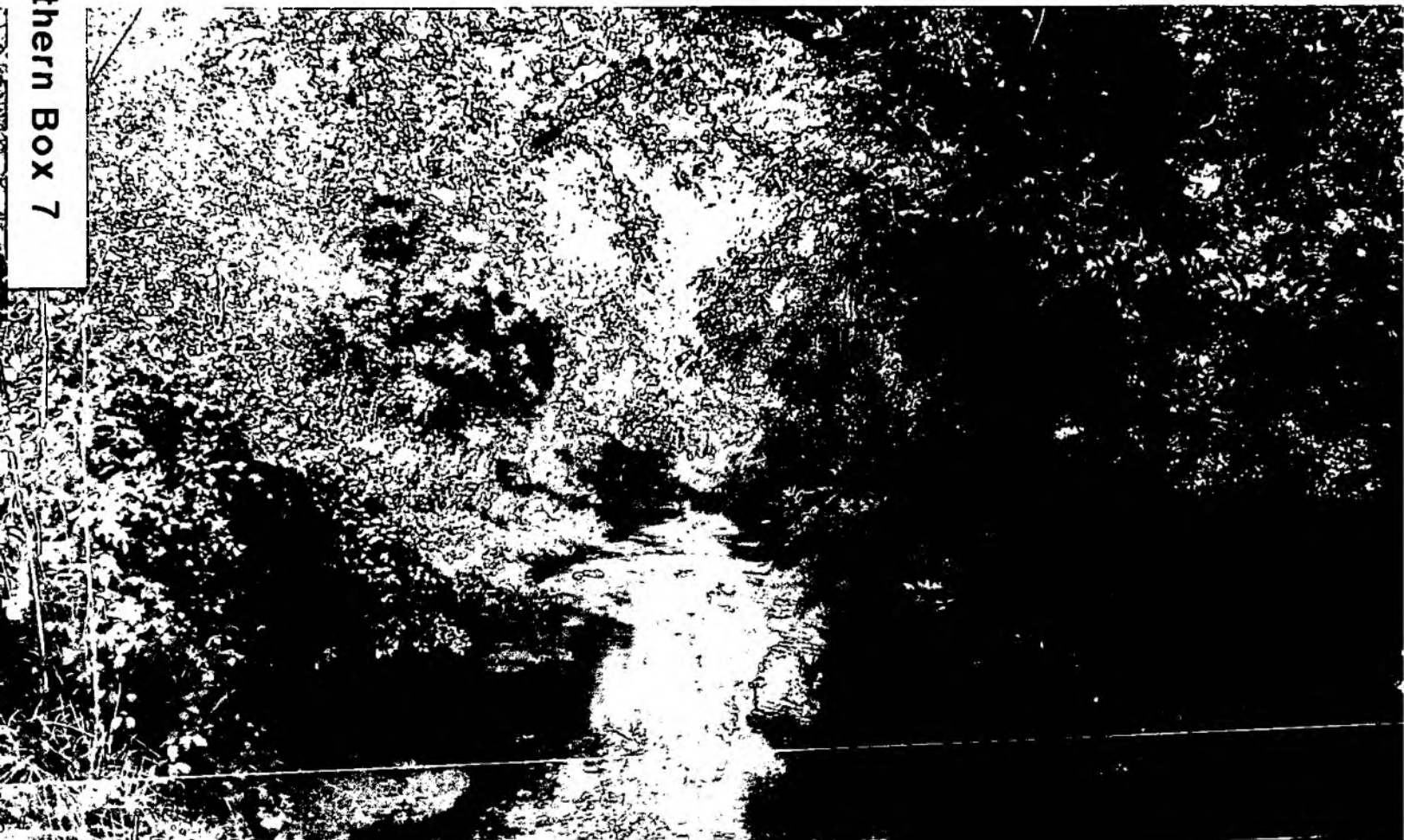


THE RIVER ITCHEN



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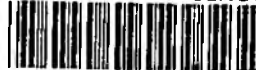


NRA

*National Rivers Authority
Southern Region*

*Guardians of
the Water Environment*

ENVIRONMENT AGENCY



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THE RIVER ITCHEN

COURSE AND GEOLOGY

The River Itchen is perhaps the best example of a chalk ground-water fed river that exists anywhere in the world. It rises on the Upper Chalk as three spring-fed tributaries; the Candover Stream, the River Alre, and the Cheriton Stream. These flow from three points of the compass to unite just West of New Alresford.

The accepted source is at Kilmeston just South of New Cheriton. This stretch of the river before it joins the other tributaries is known not only as the Cheriton Stream, but as the Upper Itchen or the Tichborne. It has been suggested that the River Meon upstream of Warnford was once a tributary of the River Itchen and was later captured by the Meon which had the advantage of a more direct route to the sea.

From Alresford the river flows West to Winchester where it collects the Nun's Walk Stream from the North West. It then flows southwards through the outskirts of Eastleigh collecting a small tributary, the Bow Lake which drains from Fishers Pond to the East. The river enters the tidal estuary at Woodmill where it is also joined by the Monks Brook. This principal tributary drains the expanding conurbation of Chandlers Ford, Eastleigh and Swaythling. The total catchment area of the Itchen is 400 sq. km, of which 360 sq. km is chalk. In addition Monks Brook drains a catchment of 49 sq. km.

The underlying rocks form part of the northern flank of the geological structure known as the Hampshire Basin. Its rocks slope gently, or dip, from

the North to the South. The oldest rock is the Cretaceous Chalk, a porous, fine grained limestone which outcrops over the whole of the valley to the North of Eastleigh. Rain soaks into the chalk rock rather than running off and then gradually percolates through the pores or small fissures under the influence of gravity until it issues from springs in the valleys. The chalk thus forms a massive natural underground reservoir or aquifer. Chalk rock is in itself split into three main subdivisions, these being the Upper, Middle and Lower Chalk. Most of the catchment is Upper Chalk but there is an inlier of Lower Chalk in the St. Catherine's Hill area to the East of Winchester.

It is the very permeable chalk with its natural storage capacity that gives the river its special character. The river has few tributaries and these seem to fall on a right angle grid pattern, reflecting the structure of the underlying chalk. The shape of the river (drainage pattern) contrasts sharply with that of rivers on impermeable clay catchments, such as the River Medway, where rainfall flows overland, creating a host of tributaries with a branching pattern. Chalk streams are therefore described as having a low drainage density, whereas for Wealden rivers the density is high.

From Eastleigh to the sea the river flows over younger sands, silts and clays of Tertiary origin. These are much more impermeable than the Chalk.

The landscape of the Itchen catchment was sculpted in the last Ice Age. Although it is unlikely that the ice sheet reached so far South, the ground would have been frozen. Under these permafrost conditions, frost action and rapid runoff from rainfall would have shaped the dry valleys that exist today.

At that time the Itchen is thought to have been a tributary of the 'Solent River' which flowed from the River Frome in Dorset to Littlehampton when the Isle of Wight was still connected to the mainland. A sea level rise of 45 metres some 10,000 years ago dis-

rupted this river system when the sea breached a ridge between the Isle of Wight and Purbeck. Southampton Water is a drowned, low-lying valley dating from that time.

WATER QUALITY

The remarkably high quality of natural chalk streams owes much to the geology. Rain is filtered by the chalk as it percolates through to the underground reserves. The crystal clear springs have an almost constant temperature, varying little with the seasons. The quality of chalk stream waters, coupled to their hardness and alkalinity, accounts for their capacity to assimilate effluents. This capacity is important in South Hampshire where there has been continuing development based on good communication links.

Increases in population have resulted in three large sewage treatment works discharging directly to the lower and tidal reaches of the river. The largest is the Chickenhall sewage treatment works at Eastleigh which has a consented dry weather flow of up to 30,000 m³/d. The two others at Portswood and Woolston discharge to the estuary and have consented dry weather flows of 27,700 m³/d and 15,000 m³/d respectively. Above Winchester, near Headbourne Worthy about 4,100 m³/d of treated effluent are discharged to the river.

Sewage from Winchester is cleansed, after settlement, by utilising the natural properties of the chalk and over 9 MI/d (2 mgd) of effluent reaches the river by an unusual and indirect route. The very fine grain nature of the chalk allows settled sewage to be discharged to the ground by the 'soakaway' method. The chalk is an excellent physical and biochemical filter, removing viruses, bacteria, and organic load almost entirely and reducing inorganic pollution significantly. The effluent has been discharged to the ditches on the side of St. Catherine's Hill for over 100 years

leaving the nearby River Itchen unaffected. The net result is that water taken from the river for public supply is subsequently returned in high quality and in the same general location from which it was taken.

The NRA sets stringent conditions on the quality and quantity of all permitted effluents to ensure that river and ground-water quality are preserved to high standards. The standards for rivers are known as Environmental Quality Objectives. Altogether 55 km of the River Itchen and its tributaries above Eastleigh have an objective of Class 1A (water of the highest quality, suitable for potable supply abstraction, game and other high class fisheries and of high amenity value). Between Eastleigh and the tidal limit there is a 4 km length of river which has an objective of Class 1B (high water quality, suitable for game and high class fisheries). The downstream tributaries, the Monks Brook, Allington Lane Stream, and Bow Lake are also Class 1B. To ensure that quality objectives are met, the NRA limits the strength and quantity of effluent and prescribes a minimum residual flow for the river (the lowest flow which will not prejudice its well-being). This prescribed flow is set to give a satisfactory dilution for effluent as well as being sufficient to attract salmon and sea trout into the estuary and to enable them to pass upstream. At times of low flow, the NRA pumps underground water into the headwaters to support the river and to achieve the minimum residual flow. This is particularly important to ensure that the water quality below Eastleigh is maintained at a sufficiently high standard to be abstracted for public water supply above Swaythling.

HYDROLOGY AND RESOURCES

Annual rainfall varies from about 750 mm in the South of the catchment to more than 900 mm in the North, giving an average rainfall of 875 mm per

annum. In the summer the evaporation always exceeds the rainfall, but in the winter the rain percolates down through the chalk and moves underground to springs in the river valley, a process that may take many months. The maximum flow in any year is typically only 3 to 4 times the minimum, unlike most of the Wealden rivers where the ratio can be as high as 500 to 1.

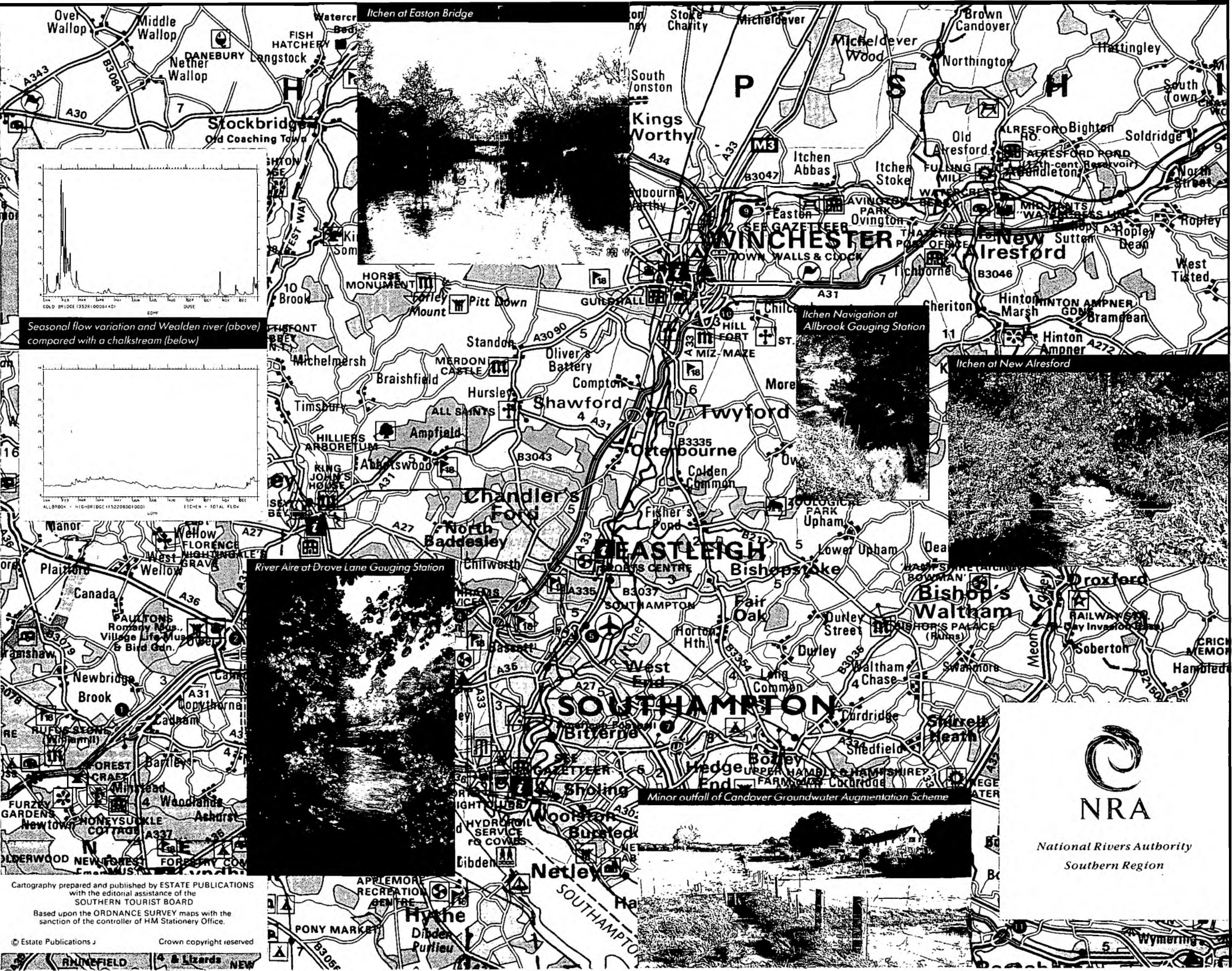
Underground reserves of water which saturate the chalk are known as aquifers. The NRA collects information about the levels of groundwater by taking measurements from over 250 wells and boreholes in the area.

The Rivers Test and Itchen provide much of the water used for public water supply in Hampshire but about 21,230 MI (4,700 million gallons) are pumped annually by Southern Water Services Ltd from boreholes sunk into the chalk aquifer at Otterbourne. There are smaller groundwater abstractions at Totford, Easton, Winchester and Twyford. The water quality is extremely high and little treatment is required.

At Otterbourne, Southern Water also abstracts up to 45 MI/d (10 mgd) of river water. Similarly at Gaters Mill, just near the M27, Portsmouth Water Company abstracts up to 45 MI/d (10 mgd). This is several kilometres downstream of Chickenhall sewage treatment works, so that the effluent is well diluted by the river and is partly reabstracted.

The licences which permit water to be taken at these locations are known as 'Licences of Right' because the abstractions existed before the Water Resources Act (1963). This Act was the first attempt to preserve the quantity of water in the environment in England and Wales. At that time established abstractions were licensed to continue taking the same amount as previously and at the same location.

There are a number of licensed private abstractions within the catchment. Most are for general agricultural purposes, but a small number are for spray irrigation and industrial use.



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National Rivers Authority
Southern Region

Applications for abstraction licences must be made to the NRA which considers the potential environmental effects and any effects on other lawful water users. Licences which are granted normally impose restrictions which ensure that water is only taken from the right places and at times when it can be spared.

One important consideration is whether water will be exported from the river system or 'consumed'. Some uses such as spray irrigation, evaporative cooling or bottling mineral water are almost entirely consumptive. In the case of public water supply and general industry, about 80% of the water is returned to the river.

Watercress growing, fish farming and non-evaporative cooling return almost all of the water at the same point from which it was taken, so the overall effects on flow are small, despite the large quantities involved. In all, there are sixteen watercress farms in the Alresford and Micheldever area accounting for about 25% of UK production. There are four commercial fish farms on the upper reaches of the Itchen at sites near Itchen Abbas, Avington and New Alresford.

In order to preserve the river in the face of the wide range of demands for water and for the disposal of effluents, the NRA and its predecessors developed two groundwater schemes to boost river flows when necessary. These utilise water from boreholes in the Candover and Alre catchments.

The schemes take advantage of the time lag between rain falling on the Chalk Downs and it finding its way to the water table. Underground water reserves reach their peak when river flows are declining at the onset of summer. By siting boreholes at sufficient distance from the river and piping the pumped water to the river, winter rainfall can be 'borrowed' to enhance low summer flows. Groundwater was used in this way in the drought years of 1976, 1989 and 1990.

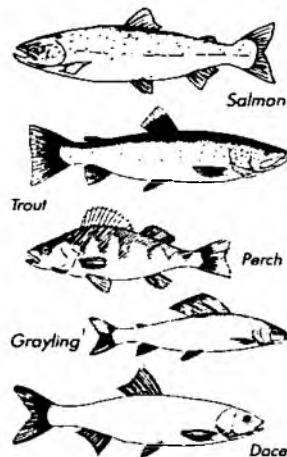
Groundwater schemes have many advantages over surface reservoirs which are the only

means of boosting river flows in impermeable catchments such as the Medway and Ouse. Groundwaters collect rain over a far larger area and to a greater depth, they do not suffer from evaporation, they supply high quality, cool water free from the algal growths that trouble surface reservoirs and their development does not affect the landscape.

The NRA monitors river flows using specially designed gauging weirs. There is an ultrasonic flow gauge at Riverside Park above Woodmill and continuous flow gauging stations near Allbrook and Easton, and on each of the three upper tributaries. The longest flow record, dating from 1959, is at Allbrook (which roughly coincides with the Chalk/Tertiary geological boundary) where average flow is 5.3 m³/sec.

FISHERIES

The salmon and trout fisheries on the River Itchen are among the finest in the South of England and the fine trout fisheries of the upper and middle reaches have been managed by riparian owners for hundreds of years.



Chalk streams are renowned for the abundance and diversity of water life on which fish feed. Unlike the soft, acidic waters of the Wealden streams, chalk water provides ample calcium with which shrimps, snails and other creatures can build external skeletons. Some eight species of stonefly nymphs, twenty species of mayfly nymphs, thirty-eight species of caddis and sixty-seven other

species of invertebrates have been recorded from the River Itchen. In consequence there are fine brown trout fisheries throughout the upper and middle reaches of the river.

From its source to Bishopstoke the river is designated as a salmonid fishery under the EEC Fisheries Directive which reinforces the duty to ensure that water quality objectives are met and secures the free passage of migratory fish into and within the river.

The lower reaches are an important rod and line fishery for salmon and sea trout, which enter the tidal river early in spring, depending on rainfall and flow. The main upstream spawning migration is generally at the end of the fishing season. The eggs are laid in gravel nests known as redds, mainly between Bishopstoke and Winchester.

Woodmill, at the top of the tidal Itchen estuary is the site of an ancient salmon net fishery with private rights pre-dating Magna Carta. In 1979 a new fish pass with an electronic fish counter was constructed to record the passage of migratory fish.

The NRA uses the data to establish the size of the salmon population in the lower reaches of the river. Another fish pass and counter at Gaters Mill near the M27 enables fish movements to be related to environmental variables such as river flow, daylight conditions or water temperature. This will be an invaluable aid to preserving the salmon and sea trout fishery in the face of future demands on the river.

Young salmon are bred and released to the headwaters to enhance stocks. Since 1985 these 'parr' have been implanted with microtags to help the NRA develop a better understanding of the movements of migratory fish when they leave the river and go to sea to feed. Adult fish carrying tags have since been recorded off the West of Ireland and in home waters.

Radio tracking of 36 salmon tagged with micro-transmitters was carried out in 1990 to study migratory fish behaviour in the estuaries.

There is some coarse fishing



Salmon rearing

for dace, roach, perch and grayling, principally between Woodmill and Gaters Mill on the East bank, although the fisheries are privately owned.

FLOOD DEFENCE

For much of its length, the River Itchen is not one stream but two, three or even four separate channels running parallel to each other. The braided channels and cross channels have a considerable number of structures to regulate flows and levels. These result in a very controlled river with high retention levels. Many sluices are operated by riparian owners though some, such as the automatic outfall sluice at Woodmill, are owned and operated by the NRA.

Three historic uses of the river gave rise to this multiplicity of channels, these being the harnessing of water power for milling, the use of water meadow systems to promote the early growth of pasture, and the development of the river for navigation.

Traditional water-based industry included wool processing, paper making, tanning, flour and grist milling, as well as the generation of electricity. The last working mill ceased operation in the 1960s.

The valley floor contains evidence of extensive systems of surface irrigation, the true 'water meadows'. High level 'carriers' (which often still exist) supplied water to the meadows which were drained via low level channels. For many reasons, including reduced demand for early pasture, the systems have become derelict.

Between Winchester and Eastleigh, the former Itchen Navigation flows parallel to, or coincident with the river. In the 12th Century the river was possibly navigable for small craft beyond Alresford. An Act for making the river navigable for boats and barges was passed in the reign of Charles II.

Subsequently a new navigation channel was cut from Woodmill to Winchester under Acts of 1795, 1792, 1811 and 1822. This fell into disuse many years ago and, although partly filled, can still be traced on large scale maps.

Over a permeable chalk catchment it is only heavy rain falling directly onto the river or on paved and tarmac areas that affects flows. In consequence there are only moderate fluctuations in level.

Historic flooding occurred in Winchester in 1852, 1903, 1928 and 1947. Allbrook and Bishopstoke flooded in 1891 and 1928 and Kingsworthy in 1935.

More recently some urban areas have flooded, particularly on the Monks Brook which drains mainly from sand and clay soils. The Brook flooded four times in the first half of this century. Following serious flooding in Chandlers Ford and Swaythling in 1960 a scheme was carried out to improve the flood carrying capacity of the Brook.

The NRA and riparian owners clear weed on the Cheriton Stream and the River Alre in order to control stream levels and prevent flooding.

REFERENCES

The 'Hampshire' collection, Winchester City Reference Library.

Proceedings of the Hampshire Field Club – particularly TW.

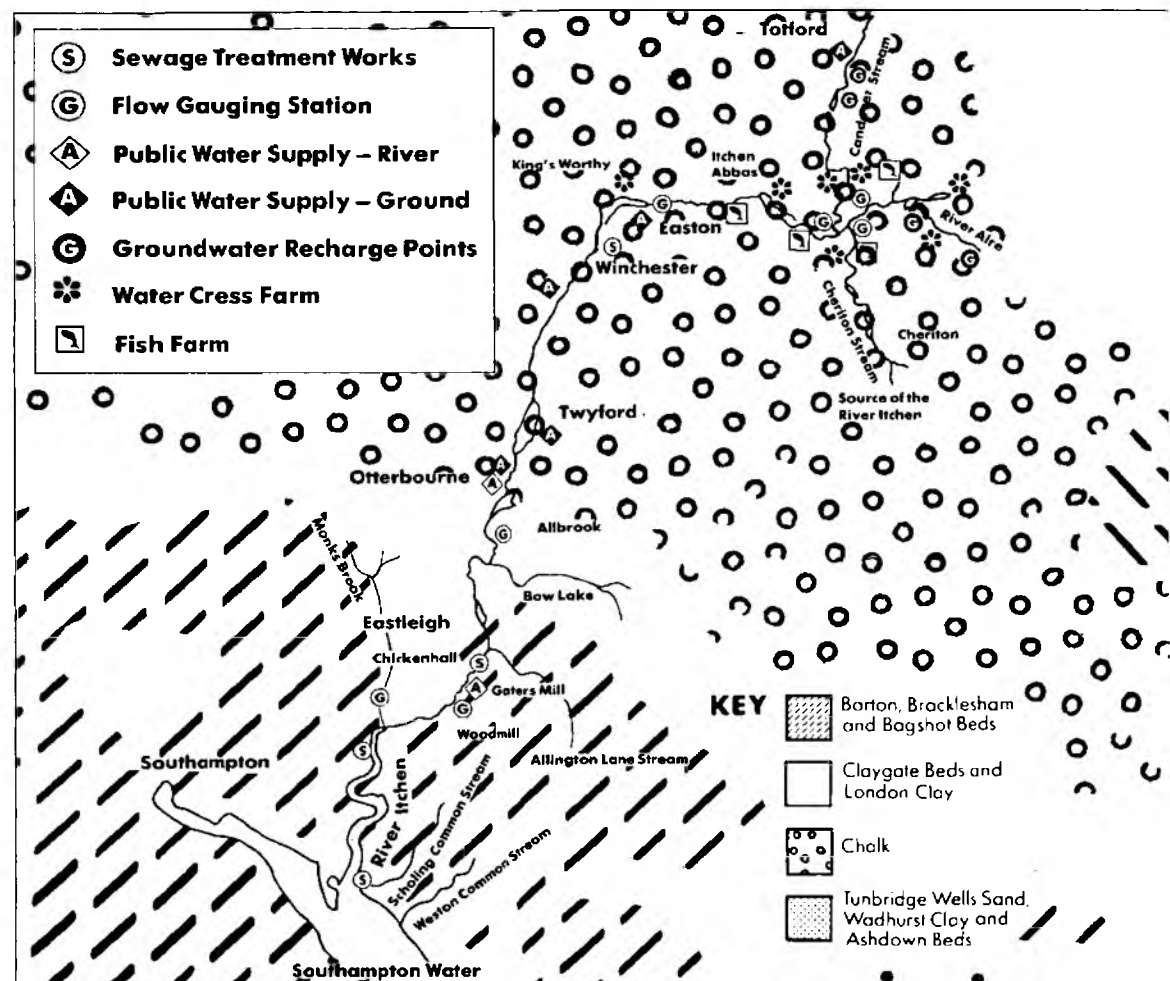
Shore, circa 1900.

'Survey of Agriculture of Hampshire' (Vancouver).

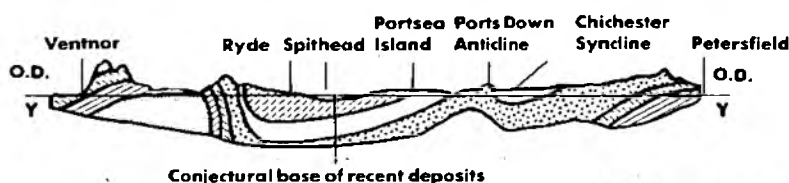
The Dorset volume of 'Land Utilisation Survey of Britain' and 'Agriculture' by Lord Arncliffe.

'Hampshire', by R. Murdie, and 'Canals of Southern England', by Hadfield.

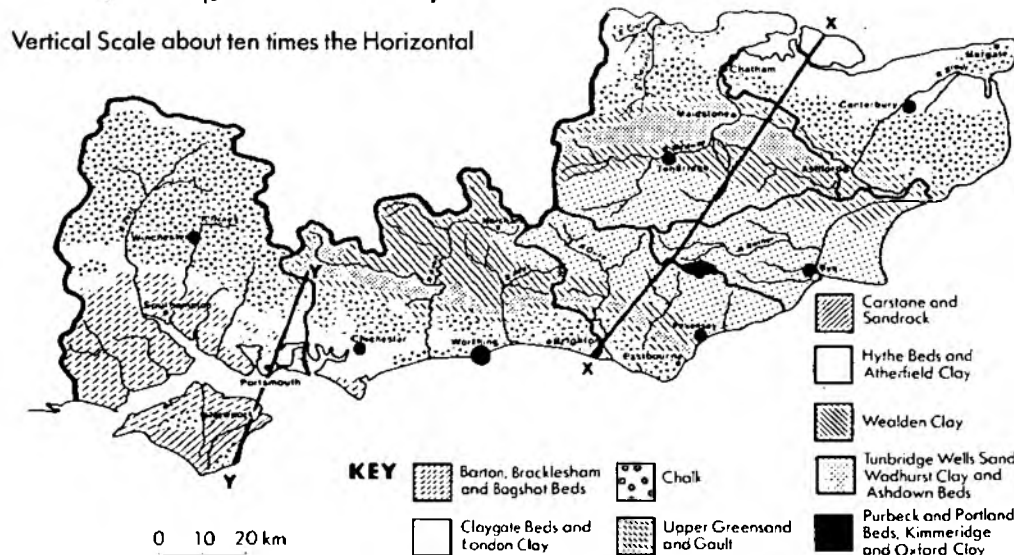
Information on the Candover and Alre Groundwater Schemes is available from the NRA on request.



Sections showing the general relations of the rocks along the lines Y-Y' drawn on the map



Vertical Scale about ten times the Horizontal



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