Geo Factsheet

www.curriculum-press.co.uk Number 200

Hampshire's Chalk Rivers - issues and management

Characteristics of chalk rivers

There are 35 chalk streams in Hampshire, many of which drain into the rivers Test and Itchen *(see Table 1)*. They have general characteristics:

- Sourced from groundwater and springs
- Stable water temperatures (spring water of the Test is 11°C)
- Regular **regimes** - flash floods are rare because rainwater infiltrates the chalk
- The source of the river varies with the level of the watertable, creating **winterbournes**
- Channels are often braided and gravel-based
- Clear, sediment-free channels because groundwater is filtered though chalk and the gravel beds
- High levels of biodiversity, typically more than 50 aquatic species per kilometre:
  - o within the fast flowing channels, water crowfoot, water-starworts and lesser water parsnip grow in patches streamlined by water, supporting invertebrates and crayfish.
  - o along the margins, watercress grows as water levels decrease through the summer

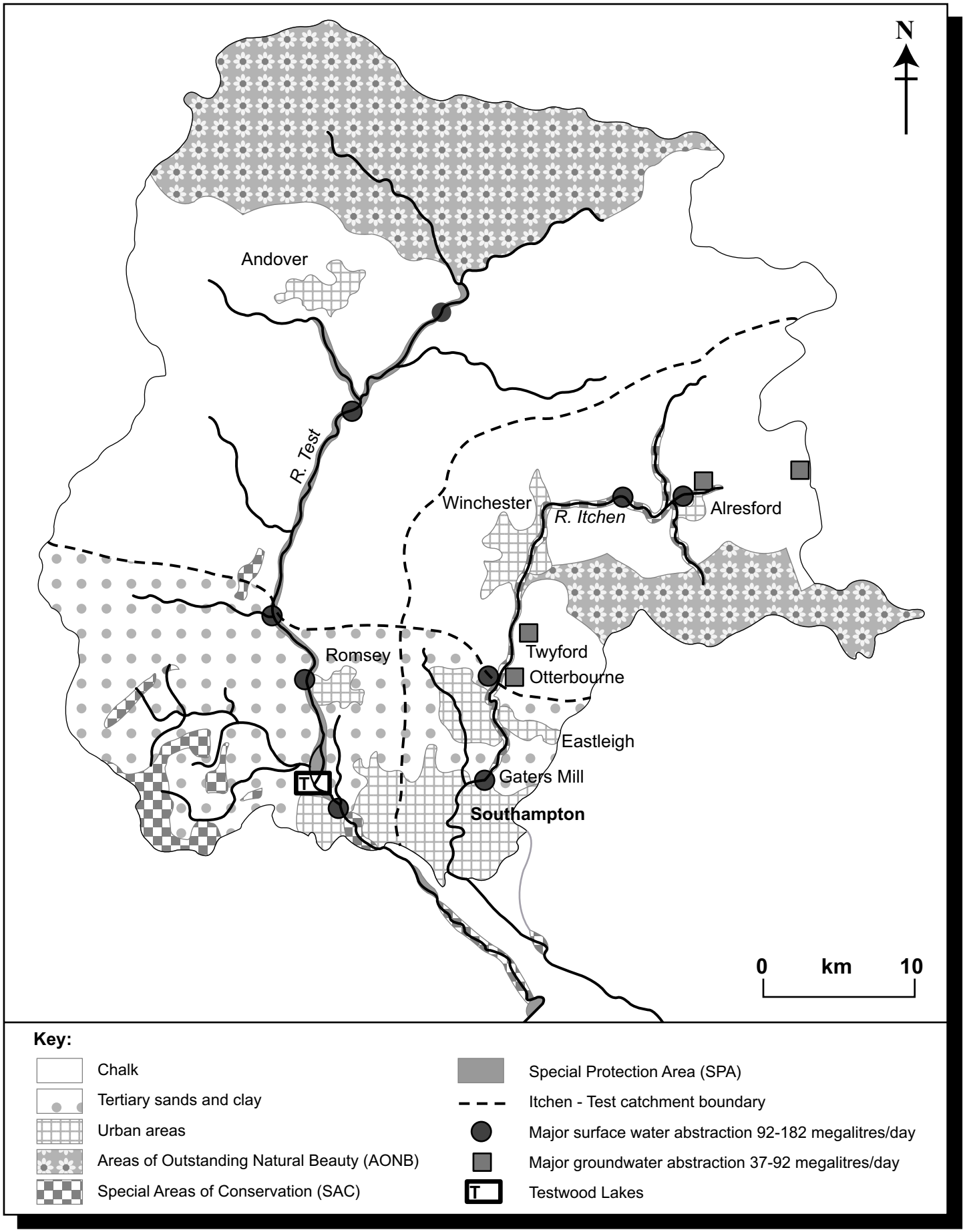
The headwaters begin as springs 70-100m above sea level in the Hampshire Downs, but have winterbourne sections which dry up in late summer due to a drop in the watertable caused by naturally reduced precipitation and increased evaporation. In the middle sections their courses are braided and fed from groundwater, flowing in well-defined valleys. Only south of Romsey, for the last few kms, is the River Test a single channel.

In the lower reaches, both rivers flow in wide floodplains over Tertiary sand and clay deposits, until finally entering the Solent estuary. A combination of steeper topography, clay soils and impermeable geology means that they respond more quickly to rainfall i.e. they are more **flashy**.

Table 1

Characteristics	R Test	R Itchen
River length (km)	64	45
Area of catchment (km^2)	1250	470
Annual rainfall (mm)	796	824
Discharge (cumecs)	11.8	4.3
Properties at risk of flooding	2500	1500
Geology	80% chalk, with Tertiary deposits downstream	
Landuse	40% arable; 32% grassland; 16% woodland; urban 9%; other 4%	
Population	Mostly rural catchment, pop. 700,000 (30% in Southampton)	
Ramsar sites (wetlands)	2	
Special Areas of Conservation (SACs)	6	
National Nature Reserves (NNR)	9	
Sites of Special Scientific Interest (SSSI)	40	
Area of Outstanding Natural Beauty (AONB)	2	
Environmentally Sensitive Areas (ESA)	1	
National Parks	1 and 1 proposed	

Fig. 1 River basin characteristics.

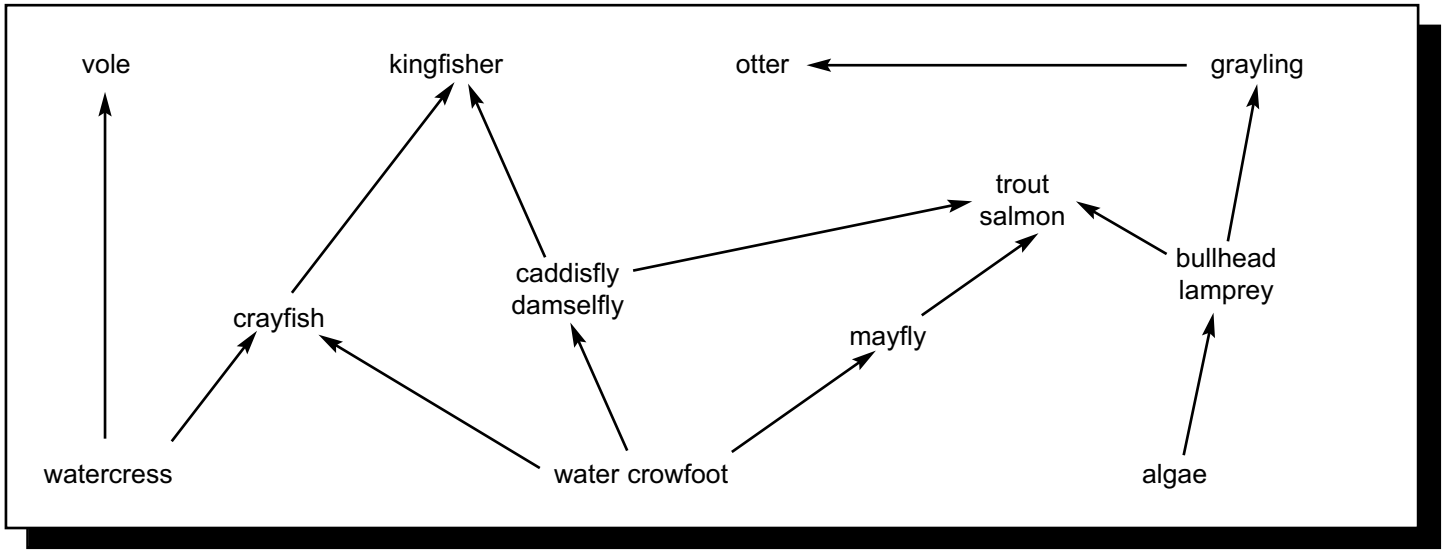


Source: Test and Itchen Catchment Flood Management Plan - Scoping Report Jan 2006, Environment Agency

Typical flora and fauna in chalk rivers

Biodiversity is high in chalk streams because of the variety of habitats such as the winterbournes, in-channel habitats, channel margins, riparian zones and the lower course where geology changes. Many calcicole (lime-loving) species support large varieties of other wildlife, especially invertebrates. A typical chalk stream food web is shown in *Fig. 2*.

Fig. 2 Typical food web in River Itchen



Pressures and potential impacts on chalk rivers

Chalk catchments have undergone significant land use changes in the past 100 years and both valleys and channels have been modified. Many of the pressures shown in *Table 2* are interrelated.

Table 2 Human pressures and impacts on chalk rivers

Pressure		Possible impacts
Abstraction from the aquifer to meet agricultural and urban demands - increased from 250 to 600 litres per person per day since 1985.		• Low flow conditions reduces health of *Ranunculus* (channel-growing weed vital for trout and salmon) • Increased concentration of pollutants
Agriculture:	Drainage of floodplains for arable crops Winter ploughed fields Polluted runoff Livestock damage of riverbanks Watercress farming	• Lower watertable • Damage to wetland and riverine habitats, especially siltation of river bed • Lower water quality and eutrophication from nitrates • Poached (trampled) soils causing soil erosion and sedimentation in rivers
Flood defence:	Channel and banks engineering Weed cutting Excessive drainage of catchment	• Damaged riparian and riverine habitats • Low watertable and therefore low flow conditions leading to sedimentation
Urbanisation:	Growth of Winchester, Andover, Eastleigh and Southampton	• Increased flood risk due to impermeable surfaces • Habitat loss • Increased abstraction impacts to meet urban demand • Pollution causing lower water quality standards
Effluent discharge:	Sewage Watercress farms Endocrine disruptors Increased water temperature	• Eutrophication • Excessive algal growth • Pollution • Loss of biodiversity
Fisheries management:	Weed cutting Fish stock controls Fish farming	• Gravel scour • Fish population changes • Loss of habitat • Escape of farmed fish, spread of disease
Recreation:	Walking, canoeing, boating	• Disturbance

MANAGEMENT

A) Management of biodiversity

Biodiversity can be managed using a variety of approaches, such as conservation designations for particular species, habitat improvements, soft engineering to allow chalk streams to behave naturally and legislation to reduce pollution.

Example 1: Fisheries and the management of diffuse pollution

Both the Test and Itchen are world-renowned for their trout and salmon fishing due to the water quality and weed in the channels, but the environment has become degraded due to excessive amounts of sediment entering the system and the practice of weed cutting for flood control. Bad land management and poor livestock control at riverbanks result in excess sediment carried into the rivers but they do not have periodic high flows which can act as a natural scouring mechanism.

Apart from sediment, phosphorus and nitrates reduce water quality. This pollution is seasonal and reflects discharge levels. Phosphorus levels become concentrated in autumnal low flow conditions encouraging weed growth, but diffuse nitrate pollution decreases through the growing season as runoff decreases and plant uptake increases.

An integrated Landcare project, one of only five in the country, has been set up to restore the conservation value of the Itchen-Test catchment (see Table 3). A 6km corridor has been identified where the issues are most severe.

Table 3 Impact and management of diffuse pollution

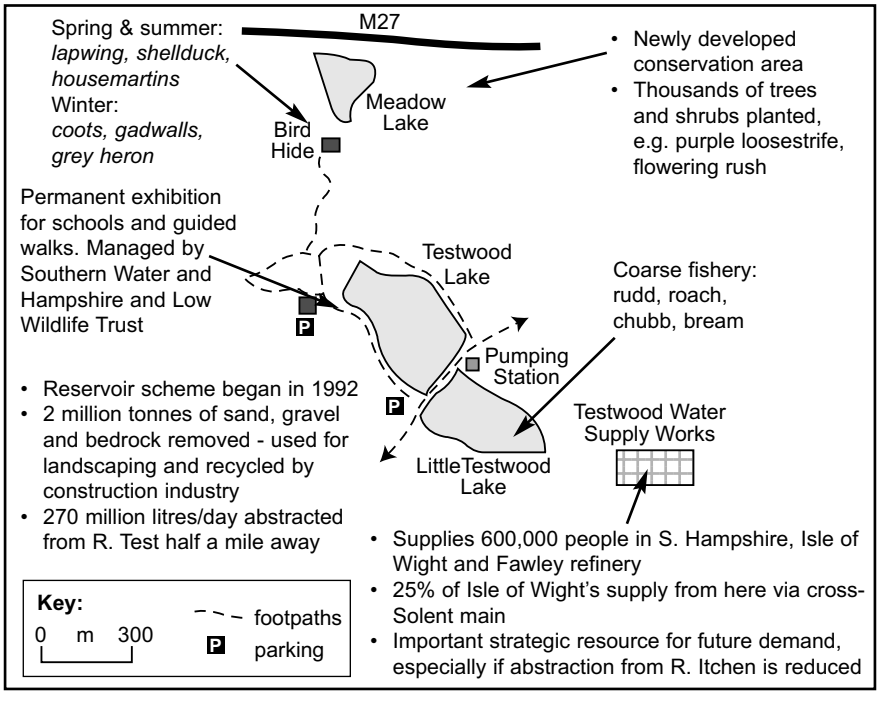
Impacts of diffuse pollution	Management goals of the Landcare Project	Landcare strategies
Water quality Increased nitrate levels in Itchen Excessive phosphorus levels in both rivers High sediment levels High pesticide levels	• Farming that is profitable and sensitive to the environment • Clean rivers and streams • Reduce localised flooding and soil erosion • Well managed soils that stay on the land • Sustainable levels of clean water in the chalk aquifer • Improved biodiversity across the catchments • Healthy populations of wild trout and salmon	• Demonstration farms • Contour planting • Terracing • Grassed waterways • Spring ploughing • Conservation tillage • Buffer zones • Creation of sediment traps • Creation of wetlands • Identify high risk areas of erosion • Water supply to livestock within fields • Partners exchange expertise: *National Farmers Union (NFU)* *DEFRA* *Hampshire County Council* *Environment Agency* *Natural England* *Hampshire and Isle of Wight Wildlife Trust*
Local flooding Runoff from bare fields and urban surfaces, roads and drains		
Loss of biodiversity Salmon and crayfish particularly affected by road and farm chemicals and high sediment levels		
Fisheries Poor egg survival of salmon and trout due to silt in the gravel spawning beds		

Example 2: Reed beds and integrated management at Testwood Lakes

The lower Test has small (37ha) but nationally famous reed beds (Phragmites australis) where the water table is at or above ground level for most of the year. It is designated as a Wetland of International Importance under the ***Ramsar*** *Convention and as a Special Protection Area (SPA) under the EU Birds Directive. The adjoining Southampton suburb is actually named Redbridge (Reedbridge) where there are reed beds that are still harvested for use in thatching. However, their main function today is as a water supply for the Southampton district and Fig. 3 shows how water supply, wildlife conservation and recreation can all be successfully managed at one site.*

These reedbeds will be at risk from climate change as sea level rises and saltwater makes further incursion upstream. At present, habitat diversity in the lower Test is seen in the transition from fen meadows upstream, through brackish floodplain grassland, saltmarsh, reedbed to estuarine mudflats and this sequence depends on the balance between freshwater input and tidal extent. If the tidal limit extends further upstream and is coupled with a reduction in freshwater from the Test, then the ecosystems will change.

Fig. 3 Testwood Lakes - an example of successful environmental management of multiple demands - abstraction, conservation, amenity and recreation.



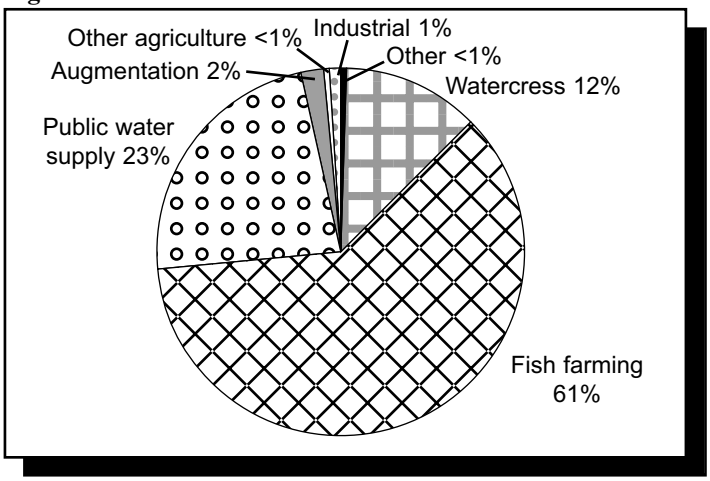
B) Water supply and abstraction issues

Chalk aquifers are dependent on rainfall for recharge so water supply can be problematic during drought conditions. For example, between Nov 2004 and March 2006 the region received only 72% of normal rainfall, causing concern for water suppliers. Water from chalk aquifers is generally of a high quality because as water percolates through the porous rock, it is naturally purified and contaminants are removed. Any remaining impurities are removed at the treatment centres. The River Itchen has poorer water quality than other rivers in the region as it receives water from drains and diffuse pollution due to overland flow from agricultural fields.

Catchment Abstraction Management Strategies (CAMS) are strategies for managing water resources at a local level. 1810 million litres a day are abstracted from the Test-Itchen catchment, of which 27% of licensed abstraction is from groundwater sources. Three quarters of all water usage is by agriculture (fish farming 61%, watercress 12% - *see Fig. 4*) but these activities are described as being non-consumptive because the water returns to the channels in the locality. Other uses are the washing of banknote paper at Overton, employing several hundred people and some industries and farms own their own abstraction bores.

Water Level Management Plans (WLMP) are used in conjunction with CAMS to manage water levels for the competing demands in the catchment. The challenge is to set water levels sufficiently high for water quality, in-channel vegetation and fish communities whilst not increasing local flood risk levels.

Fig. 4 Water abstractors in the Test-Itchen CAMS area.



C) Flooding issues - winter 2000-01

Between September and November 2000, the region suffered a series of storms which resulted in saturated ground. The watertable in the chalk rose, causing localised groundwater flooding, dependent on local topography, and flows from springs increased. Although rainfall then decreased from these extreme levels, groundwater levels remained very high. The local nature of flooding made prediction very difficult but there were 120 villages in Hampshire which experienced flooding of 850 properties.

Case Study: Hambledon, Meon Valley, east of Itchen

Hambledon has a high groundwater flood risk of 1 in 10 years. Despite being 2km away from a permanent stream, in 2000-01 flood water ran along the main street for two months at a depth of 50cm and a speed of 10 knots.

The Parish Council devised a ***Floodwater Management Plan*** *using a communication cascade system to keep the community and professionals informed at all times. E-mail, the internet, noticeboards and the parish magazine gave access to information and many volunteers kept a watchful eye on vulnerable residents, particularly the elderly. The issue of manpower was a major constraint because the flood was not classified as needing civil emergency resources and so the village had to rely on volunteers to do heavy work such as lifting sandbags.*

Long term response to flood risk in Hampshire

The Environment Agency subsequently developed the following flood management strategies.

- **Flood Steering Group.** Stakeholders - Environment Agency, Hampshire County Council, District Councils, Southern Water, Hampshire Association of Town and Parish Councils. Purpose is to review and identify flood risks and consider and prioritise flooding solutions.
- **Flood Action Plan.** All parishes in Hampshire have developed their own as advised by the Environment Agency.
- **Community Catchment Liaison Meetings.** Professional bodies and local residents meet to maintain local involvement and improve communication.

The Environment Agency has used the model *(Fig. 5)* to identify the key stages in the flood management process.

Fig. 5 Flood risk model

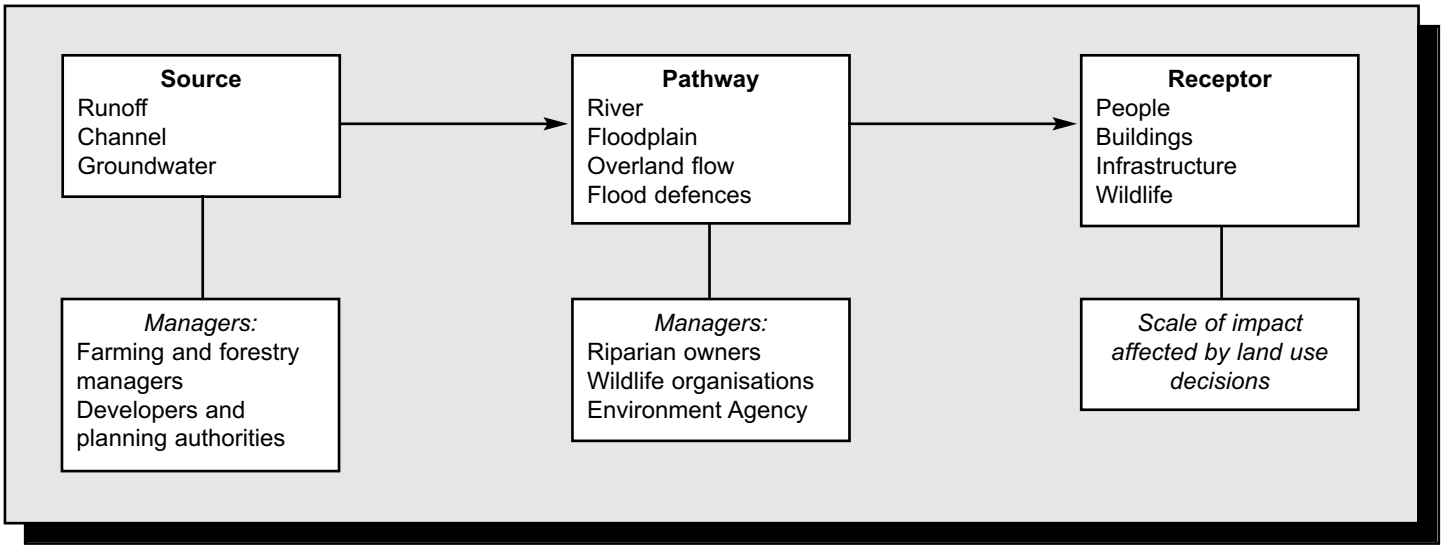


Table 5 Management plans currently in operation within the Test-Itchen catchment

Management Plans within the Test-Itchen catchment	Purpose
Water Framework Directive's River Basin Plan	Large catchment area plans incorporating wide range of issues
River Itchen Sustainability Study	A holistic integrated long-term management review
Catchment Abstraction Management Strategy (CAMS)	Management of water level at a local scale
Water Level Management Plans (WLMP)	For riverine SSSIs - to regulate water levels for the integrated management of conservation (on land and in channel), agriculture and flood defence
Catchment Flood Management Plans (CFMP)	Sustainable and integrated flood management at catchment scale on a longterm basis, in response to climate change and land use pressures
Hampshire Biodiversity Partnership (32 organisations with an interest in conservation)	Biodiversity Action Plan (BAP) - raise awareness, set targets, monitor habitats
Hampshire Salmon Programme (partnership between the Environment Agency, the Test and Itchen Association and fisheries)	Salmon Action Plans to improve stock levels and habitats and enforce fisheries legislation
Landcare Project	To reduce diffuse pollution impacts by sustainable land management practices
South East Plan	Regional strategy by SEERA for managed growth up to 2026

D) Integrated management of the Test-Itchen catchment

Just as the pressures faced by the Test-Itchen catchment are interconnected, so management needs to take a holistic integrated approach *(see Table 5)*. This has been achieved by the River Itchen Sustainability Study (RISS) which has brought together all the major stakeholders: Environment Agency, Southern Water, Portsmouth Water, Hampshire County Council, Defra, Eastleigh Borough Council, Winchester City Council and Natural England.

The future management of these two rivers and their catchments will be through the EU **Water Framework Directive (WFD**) and in particular, River Basin Management Plans. These have to be in place by 2009 and reviewed every 6 years. The Water Framework Directive requires all inland and coastal waters to reach at least "good ecological and good chemical status" by 2015 and so catchment managers are required to consider both quantity and quality issues for both surface and groundwater supplies. All other programmes such as CAMS will fit within the WFD framework.

Glossary

Abstraction	*The removal of water from surface rivers or groundwater stores*
Diffuse pollution	*Pollution from a large area, such as runoff from agricultural fields*
Flashy rivers	*Rivers which respond quickly to inputs of rainfall*
Ramsar site	*Wetland of international importance*
Regime	*The annual pattern of discharge*
Winterbourne	*The upper reaches of chalk streams which dry up in summer due to a fall in the watertable*
Water Framework Directive (WFD)	*European legislation requiring management on catchment basis*

Useful Websites

- *www.riveritchensustainability.org.uk/* River Itchen Sustainability Study
- *www.hampshirebiodiversity.org.uk* Hampshire Biodiversity Plans
- *www.landcareuk.net* Test and Itchen Landcare Project
- *www.environment-agency.gov.uk* the State of England's Chalk Rivers

Acknowledgements

This Factsheet was researched by Debbie Milton with help from Kim Adams. They both teach at Peter Symonds College, Winchester.

ISSN 1351-5136