

Notes from Halcrow Study (1992-4)

Sir William Halcrow (March 1994) *Chichester Chalk Investigation Vol 1 Final Report*. NRA, Souther Region.London

Objectives included establishing the relative effects of low rainfall and regional abstraction on streams flows in the Ems and Lavant. The potential to further development of the aquifer has. The benefits of seasonal operation of certain licences and. the options of redistribution within group licences.

Studies were also carried out to examine the relationship between rainfall and recharge during severe drought.

Initially data were reviewed to develop the simulation model. Groundwater water abstraction from the Chichester chalk increased 41 per cent in 16 years from a level of 54 MI/d in 1974 to 76 MI/d in 1989. To 1992 there was a reduction to 61MI/d. The model suggested no worsening of effects over this period in the Ems but some impacts on flows in the Lavant . **What about catchment abstraction up to 1974?**

Report refers to eight previous related investigations. Reference in this report not been made further to these as information from them is consolidated in the Halcrow report and it in the Entec Report undertaken more recently (Entec 2006).

Hydro geological features

Recharge to the chalk block takes place through the unconfined chalk. The majority of the recharge flows south sustaining the Lavant and Ems. Tertiary deposits, including Reading Beds and London clays overlie the chalk block to the south of a line running West from Arundel to Westbourne. Spring flows occur at Fishbourne where springs rise within a small area at the chalk/tertiaries contact.

The first large-scale usage of water from the chalk block for public supply appears to be in 1874 at Fishbourne and Bognor. Several others were subsequently developed, all being originally operated independently. In 1963 these were taken over by the Portsmouth Water Company who subsequently commissioned a range of new sources including Walderton, Westergate, Lavant and Brick Kiln Farm. **EA files wanted for each major site to see when commissioned.**

Ems

Longcroft (1963) reported the head to be a mile north of Stoughton (when good re-charge) Modern maps show it to be at Mitcham pond – investigations during winter confirmed this. The river has two branches with the one to the West recovering quicker following a drought (Rudkin 1984). The conclusion in the report is that the fishery had been manager for trout for over a century which would have involved stocking. There are suggestions of problems to the fisheries related to low flow going back to 1866 (Sperling) - this was suggested to be related to draining but Halcrow concluded that it was more likely to be a result of the aftermath of the great drought of 1857 to 1860 (clear in Borehole observations at Chilgrove). Clear evidence of watercress farming at Aldsworth & Westbourne. Many sluices in vicinity of Broadwash Bridges indicate extensive watermeadows.

“ the history of management of the river suggests that flows were more reliable in early times. The fact that the Aldsworth branch recovers quicker after a drought is also circumstantial evidence of any impact of abstraction on the River EMS itself” Why??NH

Lavant

Halcrow reported that there are no flow data recorded before 1971 making it difficult to establish whether flows have declined (EA have provide the author with regular spot gaugings for two sites in 1962-3). Circumstantial evidence indicates that there has been a decline. The Graylingwell record (from 1971) shows no flow throughout 1973, 1976 and 1989 - no mention was made of such a year-round failure in any historical references uncovered in the study. Records for at least five water mills on the river were established during the study, and 4-500 acres of water meadows were managed between East Dean & Chichester. There is little fisheries interest due to intermittent flow and no SSSIs or second Tier sites.

Returns

States returns from effluent plants made to Lavant from the Lavant SW. The Ems is augmented by PWC when flows are low in compliance with licence (1.1MI/d if continue to abstract when flows drop below 2.77 MI/d at Westbourne).

Model

Calibration of the model gave very good agreement with field data in terms of seasonal response of the aquifer to changes in recharge and abstraction. They concluded that the model was suitable for re-evaluating the effects of individual and collective groundwater abstraction sources on stream flows. **Has this been refuted by Entec study and overtaken by events for Phase 2?**

Drought studies

Rainfall from 1834 at Chilgrove House gauge was used. 'The record has been used to set the context of the contemporary drought in terms of rainfall deficit and to provide a means of evaluating the origin of the recent depletion of groundwater levels and low river flows'.

Re 1990-92 drought - reported a rainfall shortage in the region of 20-30% - this translates into a reduction in recharge of 50% due to extreme evaporation and would have impacted flows.

In relation to catchment flow balances – cut back in regional abstractions from 24 MI/d in 1989 to 16 in 1992 resulted in a reduced impact on the flows from a reduction of 8 MI/d to 6

In conclusion, the drought studies show spring flows are all reduced to varying degrees due to abstraction. In the EMS the situation has been steady up until the conclusion of the study but had increased in the 20 years on the Lavant. They conclude that the situation is stable on the EMS we know increasing risk to flows. On the Lavant they suggest that peak flows are most affected by abstraction and in the winterbournes sections the number of months with no flow at all in any one year has typically increased by one month as a result of abstraction over the period 1973-92.

Volume 2

No notes taken

David J Solomon Files

Butler (1972) Maps from 1595 show courses of river around south of Chichester.

Also text re 1595 map - *It is walled about in a circular form, and is wash'd on every side, except the north, by the little river Lavant; the course of which stream is very unaccountable, being sometimes quite dry, but at other times (and that very often in the midst of Summer) so full, as to run with some violence. It hath four gates opening to the four quarters of the world, from whence the streets lead directly, and so cross in the middle; where the market is kept, and where Bishop Robert Read built a fine stone Piazza . . .*

William Camden, Britannia: or a Chorographical Description of Great Britain and Ireland, 2nd edn. revised with large additions by Edmund Gibson, 1722 (first published 1586).

Serraillier (1979)...fascinating old pictures, with several of the river, especially of the ponds at East Dean & Singleton, and the sheep dipping...

Halcrow 1992 Inception Report

The Inception Report details progress of the investigation to date and includes the results of the data collation and review exercises.

The Chichester Chalk Block

Figure 1.1 illustrates the hydrogeology of the Chichester Chalk Block. The block is defined by the River Ems catchment to the west, the scarp slope of the chalk outcrop to the north and the River Arun to the east.

The northern half of the block is predominately Chalk outcrop with the beds dipping south beneath strata of Tertiary age. **The superficial deposits consist of soliflucted, chalky-flint Coombe Deposits which cover the Chalk-Tertiary boundary and extend up the valley of the River Lavant;** glacial stream fan gravels overlying the Tertiary strata around Chichester and aeolian silt Brickearth deposits found on the Portsdown and Littlehampton anticlines.

The geological strata have been subject to extreme folding which has produced east-west trending synclines and anticlines in the block. These structural features have an important influence on the pattern of groundwater flow.

Recharge takes place through the unconfined Chalk supporting groundwater flow north to scarp springs and south towards the Chichester syncline. The groundwater divide separating these two flows is believed to lie approximately 1km south of the chalk escarpment ridge. **In the west of the block groundwater flows south supporting the River Ems and the River Lavant** and discharges to the Chichester Creeks. In the east southerly flows are diverted by the Chichester syncline to discharge through springs in the area around Swanbourne Lake.

The Chalk aquifer comprises a significant resource which is developed for public water supply and private purposes such as industrial, watercress and fish farming.

EXISTING HYDROLOGICAL AND HYDROGEOLOGICAL DATA

Meteorological Data

Daily rainfall and potential evapotranspiration data are required for the estimation of recharge to the aquifer system. Rainfall data are in the form of daily and monthly records provided by NRA Southern Region from their comprehensive rain gauge network.

The general coverage and duration of records provide a sound data base for the development of a recharge model for the area. The record span varies from a maximum of 158 years at Chilgrove House, to a minimum of 13 years at Courtwick 2.

Rain gauge sites are well distributed across the study area and sites with continuous daily records that span the modeled period from 1973 to 1992.

There is one Crown exempt abstraction in the area located at Ford Prison for which no returns are available for this site. **Is this still the case?**

River Abstraction and Return Flows

The only surface abstraction licence found was a licence on the River Ems for 0.045MI/d (3409m³/year) issued in August 1966. This is a non-consumptive licence however, with very small quantities of water taken for fish farming and watercress purposes and returned to the river. Not considered to be significant because return flows occur in the immediate vicinity of the abstraction.

Effluent Returns

Information regarding effluent returns was obtained from Southern Water Services for two sites possibly relevant to the modeling study; **Lavant sewage treatment works (STW) on the River Lavant (NGR SU864079) and West Mundham STW on the River Ems**. The former has had a dry weather flow discharge consent to the river of 1.7MI/d since 1983 and the latter a consent to discharge 14m³ per day to surface deposits. Although no return data are available for either site, only the effluent returns from the Lavant STW are likely to be sufficiently large to warrant their estimation and inclusion in the model.

Aquifer Parameters

Chalk transmissivity (T) and storativity (S) are needed as input parameters for the model. Spot values were determined by analysis of information from a number of sources including pump tests, previous reports and approximation calculations using discharge and drawdown data.

The calculations performed to obtain T values used Logan's approximation equation:

$$T = \frac{1.22Q}{s} \text{ where } T = \text{transmissivity (m}^2\text{/d) } s = \text{drawdown (m)}$$

This method was applied to discharge and drawdown data for pump test reports where no conventional analysis was possible. Geophysical logs giving details of lithology and the main flow horizons have been collected for six sites in the model area. The basic lithology of the Chalk is also given in six borehole logs collected from the Third Progress Report of the South Downs Investigation (1979).

The lowest T values averaging 50m²/d occur where dissolution enlargement of Chalk fissures has been limited by little through flow or recharge such as in the north, close to the escarpment or in the south under the Tertiary deposits. In contrast, high T values of 2000m²/d and 3000m²/d occur in the unconfined sections of the Chalk where throughput is high, such as along the valleys of the River Ems and River Lavant. High T values also occur where groundwater is discharging such as in the areas around the Fishbourne Springs and Swanbourne Valley. Analysis of pump tests conducted in the Park Bottom and Swanbourne Lake areas have indicated an extremely high value of transmissivity of the order of 9000m²/d.

Unfortunately, no reliable storativity values are available from the data review.

Pumping test results from Lavant Pumping Station (April-October 1975) provided a useful comparison of T and S values at different times of the year, but the storage values in the range of 0.06 to 0.19 are well outside typical values attributed to the Chalk. Not seen by NH

River Flow

River flow data are available as mean daily values from the following gauging stations:

- Walderton on the River Ems.
- Westbourne on the River Ems.
- Greylingwell on the River Lavant.
- Upper Weir on the Park Bottom Stream.
- Lower Weir on the Park Bottom Stream.

HISTORICAL AND ENVIRONMENTAL INVESTIGATIONS Introduction

Broadly the aims of this part of the study were to:

- describe the history of the watercourses and their management. This will allow interpretation of any impacts of groundwater abstraction, and aid in establishing targets for mitigation.
- establish the environmental issues associated with the groundwater abstractions, including fisheries, nature conservation and visual amenity.
- identify sources of information of water levels, streamflow etc as possible inputs to the groundwater model or to aid in its calibration.

Sources of information include NRA and SWS records and personnel, Portsmouth Water Company, County Records Office, County Library, local historians, Estate records and representatives, and published works.

Work initially concentrated on the history of the Rivers Ems and Lavant (and Swanbourne Lake). Local nature conservation issues will be investigated shortly. Some preliminary findings are briefly described in the following sections.

The River Ems

The study of the Ems will be greatly enhanced by the interest taken in the river by a local historian, Mr David Rudkin. Contact has been made with Mr Rudkin who has published a pamphlet on the river, and a meeting arranged.

There are two mills on the river, at Westbourne and Lumley. Records of their operation sought.

Trout fishing on the river was excellent:

"Ems rises above Racton, where is good trouting, but preserved:" (Where to Fish, 1928).

"...on the River Ems, the fishing appears to be preserved and the fishing rights let and for this purpose there are small dams and other obstructions to hold up the water...." (Letter from Clerk of the South West Sussex Rivers Catchment Board to MAP, December 1940, held at County Records Office).

"...on the Stansted Estate from which trout up to 4 lbs are taken. A pool above Stansted in a few hours produced 11 1/2 brace of from 3/4 lb to 3 lb, taken by the writer...." (GF Salter, writing the Victorian County History of Sussex, 1973).

Trout are known to have survived in the lower river until recent years. The NRA are planning an electric fishing survey within the next few weeks to establish the current status (Ian Johnson, Sussex area Fisheries Officer).

The River Lavant

The River Lavant has always been an intermittent stream for most of its length, **though records of its use for agricultural purposes suggest that it was very much more reliable formerly than it is today.** There are remains of extensive water meadow systems in the Singleton/West Dean area. The

first edition of the OS 25" maps (about 1880) indicate numerous "sheep washes" on the upper river, and contemporary photographs show sheep being immersed in a sizeable stream with bank-high flows. A water driven mill operated at Westhampnett. Towards the end of the great drought of the 1850's, the miller requested a reduction in his rent in view of the shortage of water; he claimed he had been able to operate the mill on only 21 days in the previous five months (memorandum dated 17/12/1858, in Goodwood Estate collection at County Records Office).

TABLE 2.2 LICENSED PUBLIC WATER SUPPLY GROUNDWATER ABSTRACTIONS

No	Name	Period of Abstraction	Approximate Current Abstraction for Water Year 1991/92
1	Walderton	1973-1992	15.0 MI/d
2	Woodmancote	IRREGULAR	NIL
3	Funtington	1973-1992	1.2 MI/d
4	Fishbourne	1973-1992	6.9 MI/d
5	Brickkiln Farm	1989-1992	2.0 MI/d
6	Lavant	1973-1992	8.4 MI/d

Sussex Archaeological Collection Vol 18 1866 (3. *The River Ems.*)

The incumbent of Westbourne writes thus to the Editor: "I may mention a fact on the Rivers of Sussex, which seems to have escaped your notice, as it also did that of Mr. Longcroft, in his pamphlet on the Ems. (See Suss. Arch. Coll., vol. xvi., pp. 263-268.) In Holinshed, ed. 1577, p. 21, is the following sentence: 'The *Emille* cometh first between Racton and Stansted, then down to Ernildsworth or Emmesworth, and so into the Ocean, separating Sussex from Hampshire. The *Racon* riseth by, east of Racton or Racodunum.'

" The rivulet rising in Stoughton, called by Mr. Longcroft the Ems, is, in fact, the old Racon, whence Racton. The Emille, or modern Ems, rises somewhere in Idsworth, finds its way through Stanstead, and joins the other stream in the upper part of Westbourne village, where the Stanstead forcing-engine now stands. **Both streams were formerly more considerable than at present. Old people can remember trout-fishing where there is now only rain water-shed in winter. This change has, in part, been brought about by drainage.** The western Lavant flowing down from Horndean to Havant, formerly a considerable but intermittent stream, has for the last seven years ceased to flow altogether, except after heavy rains.

" The ancient name of Emsworth is Newtibrigge—a fishing hamlet to Warblington. The Warblington registers are lost, but in ours, where the name frequently occurs from 1550 to 1600, it is Emmesworthe."

John H Sperling, Westbourne Rectory.

3. THE RIVER EMS

3.1 General History

The name of the river is believed to be derived from the name of the village "Emsworth", and not the other way around (Eikwall 1928). In Holinsheds Chronicle (1577) the stream coming from Stated to Aldsworth pond is referred to as the Emille (Emsworth was then often known as Emilsworth), while the Western branch flowing through Walderton is called the Racon. Longcroft (1863) stated that the head of the river was about a mile north of Stoughton, but indicated that the river flowed at this point only "when the rainfall on the east, north and west of the spot where stands the gate which I have mentioned, exceeds the ordinary absorbent capacity of the soil on which it descends". Modern maps generally show the perennial head at Mitchower pond, mid-way between Stoughton and Walderton. At the time of a site visit on February 25 1993 the channel at Stoughton was dry, but showed signs of having recently held surface run-off. The stream was flowing strongly at Walderton. Rudkin (1984) found the stream dry down to a spot downstream

of Broadwash Bridge in October (1983?), and provided the following useful description of the recovery of the stream during the following winter (1983/84):-

"At Christmas the River Ems was completely dry above Woodmancote and also the Aldsworth Ponds were dry. The Brickkiln Ponds still had a good supply of water which fact suggested that the spring which maintained it were substantial. In fact I could find no-one who could remember the Ponds drying out. There had been some rain during the Autumn and by the turn of the year, the water level began to rise so that by the middle of January the Brickkiln Ponds began to overflow into the stream which fed the Aldworth Pond and this pond began to fill. As soon as there was water in the Aldworth Pond swans, shelduck, coots and moorhens were in possession. By January 23rd this pond had filled and there was a copious flow over the weir resulting in a good flow of water in the stream from Aldworth to the Westbourne Mill. This indicates that the Aldsworth supply of water into the Ems above Westbourne is initially of more consequence after a dry season than the Ems above Westbourne.

Continuing my observations through the winter of 1984 I observed that by February 3rd springs in the bed of the Ems had brought water up to the Sheepwash (Common Road). The next day I was surprised and delighted to find the river flowing through Racton Park. At the same time I was surprised to discover that the reach through Lordington was still dry. This made a further examination necessary. From where did this flow of water come? Actually it was flowing down the watercourse which joined the Ems right at the north end of Racton Park. This water-course was being supplied by a copious spring somewhere on the western side of the road to Walderton and just below Lordington House. On the same day there was a small flow below Walderton village which was slowly fighting its way down the Ems riverbed towards Lordington. This came from the spring behind the Barley Mow at Walderton. Some of this flow could have been seeping through to the supply at Racton Park. At this same time the whole course of the river was dry up to Mitchamer Pond although there was a small flow through Stoughton village and this pond was beginning to fill.

Observations on February 8th revealed quite a welcome change in the situation. The Ems, all the way from the spring just below Mitchamer Farm down to the sea at Emsworth, was running. Mitchamer Pond was almost full being supplied mainly by the spring just below Stoughton village in what appears to me to be the original and natural course of the Ems running on the north side through the meadows just to the north of the road through Stoughton and into Mitchamer Pond.

By February 12th, Mitchamer Pond had filled to overflowing, so bringing to life the short reach through Mitchamer Farm and indicating a continuous flow from Stoughton to the sea. Strange to say that at the same time the gully which I had suggested through Stoughton and running beside the road, had stopped running. This might suggest that if we prefer to designate a source of the Ems above Mitchamer Pond, at which point the maps show the start of the river, we could the spring just below Stoughton village which supplies the natural course into Mitchamer Pond. Exactly where the Ems rises will depend on the disposition of the weather. To me it must be the highest point up the

Ems Valley from which there can be a continuous flow to the sea at some time. It must be noted that this study of the Ems took place through the unusually dry summer, autumn and winter of 1983-84. Nevertheless "February Fill Dyke" had lived up to its proverbial reputation."

The Ems has long been impounded, harnessed and diverted for a variety of purposes including water power (see section), fishing (see section), water supply, watercress growing, and water meadows. Rudkin (1984) gives details of the history of a pumping station at the downstream end of the "Canal", an artificial channel carrying the Ems westwards to its confluence with the Aldsworth stream at Westbourne. This was water powered in 1786 when it was described as a "curious hydraulic machine,.... It throws up seven hogsheads of water an hour..." The purpose of the pumping station was to supply water to reservoir on the nearby Stansted estate, for domestic purposes and to provide the head for a large ornamental fountain. The lift involved was about 140 ft. In 1855 the hydraulic pump was replaced with a steam engine, which operated until 1907. The Stansted source of supply was then switched to Aldsworth pond, and the water was pumped using an oil engine.

Westbourne Mill was also used to pump a water supply to the Commonsides area of Westbourne early this century.

Old maps show extensive watercress beds in the spring-fed channels below Broadwash Bridge, beside Aldsworth Pond, and in Westbourne.

In and around the river in the area of Broadwash Bridge are numerous sluice and hatch structures which suggest an extensive water meadow system.

3.2 Mills

Rudkin (1984) suggests that there was once a mill at Lordington, a little downstream of Walderton, but no other details have been located. If there were a water mill there any records of the reliability of its water supply would be of great interest as nowadays the stream there is frequently dry.

Westbourne Mill was recorded in the Domesday Book, and continued to operate until 1933. According to the Victoria County History, the rent of the three Westbourne Mills in 1327 was only 40 shillings "because they sometimes stand idle for want of water"; in 1663 part of the rent of one of them was remitted because it had stood idle for a month and 20 days.

Lumley Mill, at the downstream end of Westbourne, was a large wooden building that was destroyed by fire in 1915. In the early 19th century the mill was owned by Edward Tollervey, who greatly expanded his business by supplying provisions to the Navy at Portsmouth. His prosperity was shortlived, however, as Longcroft (1863) records:-

3.3 Fish and fishing

It is likely that the Ems naturally held brown trout, eels, and a range of small fish species such as bullheads and minnows. However, for well over 100 years the river has been extensively managed as a trout fishery, which is likely to have involved some restocking. Although their original purpose is obscure, Aldsworth Pond and Brickkiln Pond are likely to have been stocked and fished. Several retaining weirs on the Aldsworth Stream downstream of the pond, and an impoundment known as Lords fish pond on the Ems itself, were apparently created specifically for fishing. The Canal and the Mill ponds also held good fish, as well as the stream itself in its lower reaches.

The following extracts provide some insight into the quality of the fishing in former times.

"Ems rises above Racton, where is good trouting, but preserved." (WheretoFish, 1928).

"..... on the River Ems, the fishing appears to be preserved and the fishing rights let and for this purpose there are small dams and other obstructions to hold up the water...." (Letter from Clerk of the South West Sussex Rivers Catchment Board to MAP, December 1940, held at County Records Office).

"The streams in West Sussex are numerous and are all strictly preserved and

well stocked, notably the canal on the Stansted Estate from which trout up to 4 Ibs are taken. A pool above Stansted in a few hours trouting produced 11 Vi brace of trout from ½ Ib to 3 Ib, taken by the writer..... " (GF Salter, writing in the Victorian County History of Sussex, 1973).

Although Brickkiln ponds appear not to dry-out completely (Rudkin 1984), and the Canal is now protected by the discharge of a "compensation flow" at times of low natural flow, the other locations mentioned above have dried out in recent years. While there are likely to be small numbers of trout remaining in the lower reaches, few would appear upstream of Westbourne Mill Pond and the Canal.

Problems with low flows affecting fishing are not an entirely new phenomenon, however, :-

"Both streams (the Ems and the Aldsworth Stream) were formerly more considerable than at present. Old people can remember trout fishing where there is now only rain water-shed in winter. This change has, in part, been brought about through drainage. The Western Lavant flowing down from Horndean to Havant (not to be confused with the Chichester Lavant) formerly a considerable stream, has for the last seven years ceased to flow altogether, except after heavy rains " (Sperling 1866).

Despite Mr Sperling's suggestion that drainage was blame, the likely explanation was the aftermath of the great drought of 1857-1860, the effects of which are readily apparent from the records of groundwater level from Chilgrove Well a few miles to the north.

Roach occur in fair numbers in the Westbourne-Lumley area of the river, but their origin is unknown.

4 RIVER LAVANT

4.1 General history

The Lavant has been well-recorded as an intermittent stream for hundreds of years. Camden and Gibson (1722) wrote of Chichester:-

"It is wall'd about in a circular form, and is wash'd on every side, except the north, by the little River Lavant; the course of which stream is very unaccountable, being sometimes quite dry, but at other times (and that very often in the midst of Summer) so full, as to run with some violence".

A Victorian poet alluded to the occasional violence of the Levant's flow:-

"I've seen thy waters with a torrent's force Resistless, and
with loud and rushing sound Dash forwards in their wild
impetuous course As if they scorned thy channel's narrow
bound."

(Crockers Poems - The Lavant. 1859).

Another poet also alluded to the tendency of the river to dry:-

"You ask me why in summer time Lavant owns no
classic Nymph: Alack! at Summer's golden prime
Naiads there would find no lymph!"

(Rev. T A Holland, 1845).

The origin of the name of the river is obscure; Ekwall (1928) suggests it may come via Old English from the Latin "Labor", to glide. In any event the name Lavant is used locally to mean an intermittent stream. However, this is a case of the river name becoming adopted as a common noun, and not the other way around as is sometimes suggested.

Serious flooding in the Chichester and Mid-Lavant areas has been recorded on numerous occasions. In Spershott (1880) the following entries are recorded:-

Year 1763. The water of the Lavant run all around the city, occasioned by its overflowing the Bank at St James' in the night, which flow'd the lower rooms in St. Pancras, run rapidly into the Lane to St. Michals Fair field, so into the Lighten, and flow'd by the Bishops Garden field, and found its way round to North Gate & c as in 1713 just 50 years before, and if periodical, may again be expected in 1813".

Year 1809. February the water of the Lavant run all around the city as in the year 1763 which may be expected once in 50 years.

Newbury (1987) in his excellent book on the Lavant quotes local recollections of flooding in Mid Lavant:-

"At one time the rivulet used to flood regularly on to the recreation ground and most houses around that area most winters. In 1937 there was the worst flood for years. Cars had be pulled out of the water by horses."

Nearby also gives details of floods in the St. Pancras area in 1839, 1852, 1894 and 1960.

In the absence of flow records before 1971 it is difficult to establish whether there has been any decline in the flows, or the periods when flow is present, in the Lavant. However, there is good circumstantial evidence that flows were formerly more reliable. The records from the Graylingwell Gauging Station, which start in 1971, show that the river failed to flow at all in 1973, 1976 and 1989. No mention is made of such a failure in many of the historical records located in this study. Records exist of at least five water mills on the river. That mentioned in the Domesday Book at Singleton occurs in no recent records. A mill at Mid Lavant is also mentioned in Domesday, and is also shown on the 1839 Tithe map about half a mile upstream of the bridge. The 1851 Tithe Apportionment states that it was 1 furlong SE of the Church, and had an outside wheel. It has long since disappeared. East Lavant Mill was recorded in Domesday, and Andrews and Drury's 1807 maps shows it; no more recent records could be found. Westhampnett Mill was yet another Domesday site, though in this case it operated until recent times. Until the 1850's it operated by water power only, but in that year a steam engine was installed to allow operation at times when water was in short supply - this was done in many large mills throughout the country. A memo in the County Records Office Collection (GWD MS ES112) from the miller, Mr Sadler to his landlord reads:-

"December 17th 1858.

Mr Sadler called to request that his Grace would take the Rent of the Mill into consideration, in connection with the great deficiency of water; and stated that he has only worked the Mill 21 days during the last 5 months.

The consumption of water is about 1200 gallons for a full days work of Steam Engine."

This was of course at the time of the great drought which is clearly apparent from the Chilgrove Well records. It can be inferred from the above memo that the stream had been flowing at some time during 1858.

The existence of extensive water meadow systems in the valley also testifies to a reasonably reliable availability of water early in the year.

Young (1813) recorded that there were between four and five hundred acres of water meadow between East Dean and Chichester.

Serraillier (1979) shows photographs of sheep being worked in the river at Singleton and Lavant. The farmer was taken in June 1909, and the author stated that most local shepherds used this sheep wash in time to clean the wool before shearing. Although this practice ceased after the first World War it is again suggestive of a reliable stream flow in early summer.

There is little fisheries interest in the Lavant due to its intermittent nature. A pollution incident some years ago in the lowermost reaches killed numbers of sticklebacks and eels, and Newbury (1987) records the following extract from the Brighton Gazette of February 24 1825:-

"On Saturday last a fine trout was caught in that part of the River Lavant which runs through the garden of Colonel Brereton under the walls of the south part of the city. The fish was taken by gardeners. It weighed upwards of 4 lb and was 22 inches in length; three others were observed in company, but they decamped when we consider that this river is dry for four or five months of year, the circumstances are worthy of notice."

It is likely that the fish were sea trout; those fish are often seen in the lowermost reaches of rivers even where they do not spawn.

No Sites of Nature Conservation Interest or of Special Scientific Interest appear to exist in association with the Lavant.

REFERENCES.

Allison W B and Francis M D (1922). Arundel Castle and Town. Arundel Art Company, pp 64 + XXXII.

Martin I and Whyberd D W (1978). The Swanbourne Lake Island - an artificial construction. MS held at Arundel Castle Library. 10 pp.

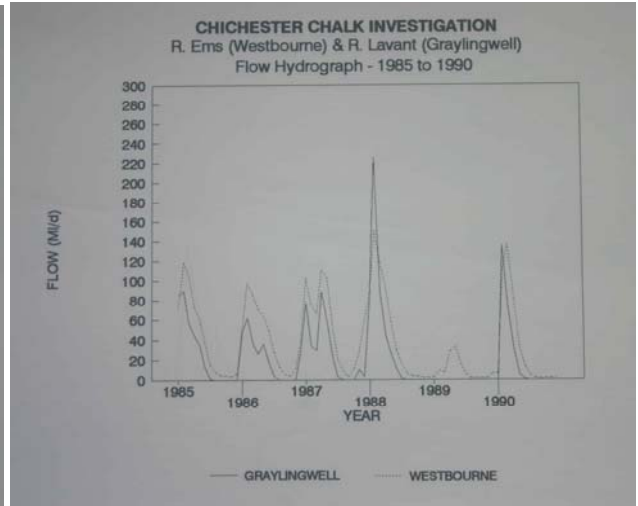
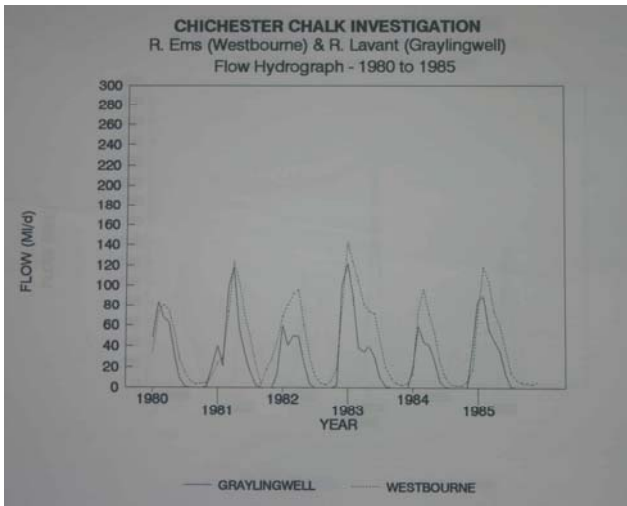
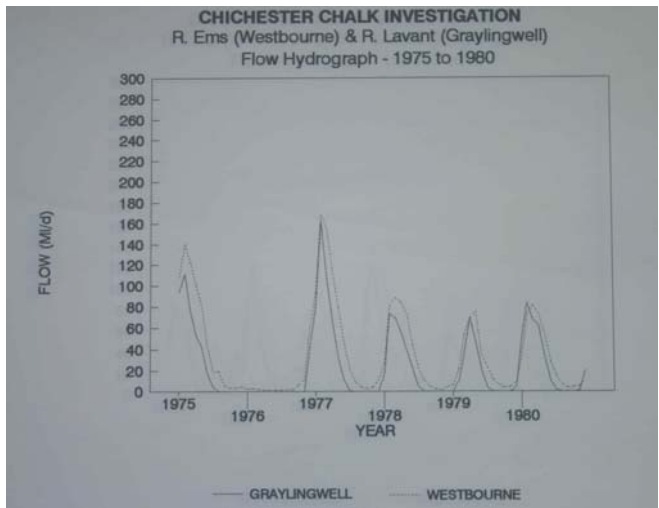
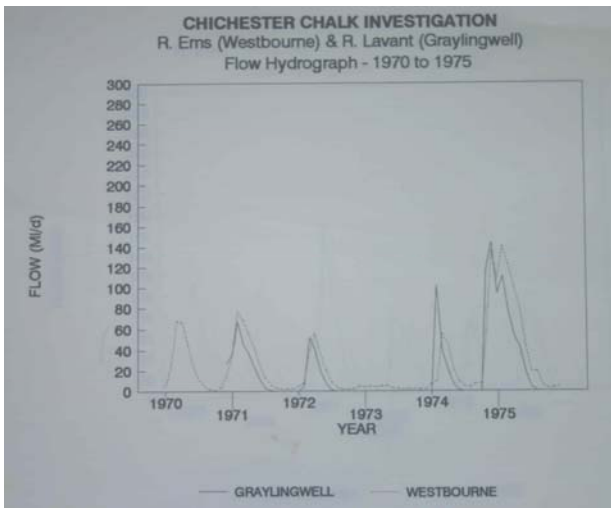
Rofe, Kennard and Lapworth (1990). Arundel/Swanbourne Lake Resources Study - First Stage Report to NRA.

Thorne J (1844). Rambles by Rivers. London, Charles Knight & Co. 244pp.

Butler D J (1972) <i>The Town Plans of Chichester 1595-1898</i> . W Sussex County Council, Chichester.	DJS
Serrailier I (1979) <i>All Change at Singleton for Charlton, Goodwood, East & West Dean</i> . Phillimore, London & Chichester.	DJS
Newbury K (1987) <i>The River Lavant</i> . Phillimore. Chichester.	DJS – photocopied in entirety
Longcroft C J (1863) <i>The Valley of the Ems</i> . Vacher & Sons, Westminster, London	

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Longcroft 1863says 4 mills still in existence – 1 at north end of Westbourne, another at Lumley and two tidal mills at Nutbourne & Hermitage. ‘*The fishery was, doubtless, at Emsworth*’. Says course was separated so as to feed Lumley mill. Said mill was large, ‘with stores of great extent’. In 1802 bought by Edward Tollervey who was ‘not content with the profit obtained upon his flour, he built bakehouses..’ ‘From Lumley Mill the Ems is again divided; the eastern stream forming the boundary of the counties of Southampton & Sussex, and the western stream serving the water mill at emsworth’.



CHICHESTER CHALK INVESTIGATION
R. Ems (Westbourne) & R. Lavant (Graylingwell)
Flow Hydrograph - 1990 to 1992

