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Review Of Groundwater Abstraction  
For Licensing Purposes

Midlands Region

May 1997

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Produced By  
Groundwater Management  
Midlands Region

V

ENVIRONMENT AGENCY



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SECTION A

# GROUNDWATER RESOURCE ASSESSMENT :1996 REVISION

## 1 : Trent Catchment :Sherwood Sandstones

Groundwater Unit/Index	Groundwater Unit/Name	Assessed Recharge	Licensed Abstraction	Actual Abstraction	Unit Classification
<b>Burton-on-Trent - Ashby-de-la-Zouch - Nuneaton</b>					
F.0.1	Diseworth	17.15	2.05	0.80	D
F.0.2	Coalville	10.41	1.17	0.70	D
F.0.3	Ashby	5.70	0.001	0.001	D
F.0.4	Burton	25.70	14.27	5.96	B(TL)
F.0.5	Measham	24.30	12.11	6.31	B(TL)
F.0.6	Warton	11.73	0.41	0.27	D
F.0.7	Nuneaton	4.08	0.25	0.03	D
<b>Nottingham - Doncaster -</b>					
F.10.1	Hatfield	54.56*	78.73	73.89	A
F.10.2	Blyth	72.84*	95.53	68.90	A
F.10.3	Retford	29.88*	53.88	44.74	A
F.10.4	Thoresby	56.36*	75.13	55.55	A
F.10.5	Ravenshead	140.11*	150.84	150.20	A
F.10.6	Wollaton	24.34*	35.71	18.19	D
<b>Derby Area</b>					
F.2.1	Derby North	7.39	0.00	0.00	D
F.2.2	Muggington	9.97	3.33	0.07	D
F.2.3	Kirk Langley	6.08	0.45	0.45	D
<b>Stoke-on-Trent - Ashbourne</b>					
F.3.1	Shirley	38.16	0.60	0.24	D
F.3.2	Mayfield	51.80	4.14	3.55	D
F.3.3	Alton	26.10	13.66	11.52	C
F.3.4	Greatgate	14.64	11.02	7.05	A
F.3.5	Tea	15.07	11.92	8.74	B
F.3.6	Forsbrook	30.00	30.76	19.13	A
F.3.7	Spot	7.52	5.52	5.24	A
F.3.8	Leek	23.89	27.36	26.87	A
<b>Stoke-on-Trent - Stafford - Wolverhampton</b>					
F.4.1	Bishops Wood	28.60	7.97	2.34	D
F.4.2	Hatton	27.04	43.84	38.57	A
F.4.3	Tittensor	9.10	10.35	4.78	B(TL)
F.4.4	Oulton	4.57	0.06	0.06	D
F.4.5	Hardiwick	7.45	0.27	0.24	D
F.4.6	Hopton	14.16	0.03	0.06	D
F.4.7	Rugeley	55.31	24.60	16.08	D
F.4.8	Teddesley	45.09	21.75	14.26	D
F.4.9	Coven	35.34	14.02	7.15	D
<b>Lichfield - Birmingham</b>					
F.5.1	Lichfield	38.41	44.15	39.22	A
F.5.2	Shenstone	52.68	42.36	37.73	A
F.5.3	Sutton	17.20	6.13	3.57	A
F.5.4	Birmingham	34.98	38.88	12.30	D
F.5.5	Meriden	2.22	0.01	0.01	A

## 2 : Severn Catchment : Sherwood Sandstones

Groundwater Unit Index	Groundwater Unit Name	Assessed Recharge	Licensed Abstraction	Actual Abstraction	Unit Classification
<b>North Shropshire</b>					
F.6.1	Whittington	5.69	6.18 [11.15]+	5.27	A
F.6.2	Knockin	37.60	13.31	11.56	D
F.6.3	Alberbury	1.37	21.51	14.64	A
F.6.4	Ensdon	8.43	3.27 [10.06]+	11.87	D
F.6.5	Merrington	21.42	4.18 [16.58]+	1.64	D
F.6.6	Stanton	21.42	12.24 [16.98]+	9.48	D
F.6.7	Radmoor	21.63	6.62 [25.03]+	9.43	D
F.6.8	Longdon	28.74	13.79	7.72	D
<b>East and South Shropshire</b>					
F.7.1	Market Drayton	30.69	10.79	8.23	D
F.7.2	Wistanswick	17.08	3.00 [ 5.34]+	2.74	D
F.7.3	Sambrook	46.25	19.63 [21.13]+	13.18	D
F.7.4	Adeney	26.83	24.23	24.60	A
F.7.5	Aqualate	25.96	11.70	8.71	B(TL)
F.7.6	Cosford	29.27	42.01	34.41	A
F.7.7	Worfield	82.07	45.26	30.61	A
F.7.8	Wellings	8.77	7.39	6.51	A
<b>West Midlands</b>					
F.8.1	Wombourne	49.05	69.37	53.51	A
F.8.2	Stourbridge	23.95	56.42 [69.75]#	48.04	A
F.8.3	Kidderminster	64.85	64.28	50.28	A
F.8.4	Stourport	14.46	14.37	11.45	A
F.8.5	Astley	19.24	8.34	3.51	D
F.8.6	Ombersley	18.09	6.45	7.20	A
F.8.7	Bromsgrove	40.00	45.47	31.84	A
F.8.8	Longbridge	5.47	2.15	1.85	D
<b>Lower Severn and Avon</b>					
F.9.1	Oxenhall	16.57	7.41	3.34	D
F.9.2	Bromsberrow	7.17	9.10	6.80	A
F.9.3	Warwick	8.77	9.69	3.26	B (TL)
F.9.4	Avon (Confined)	0.00	13.69	9.05	A
F.9.6	Whitley	2.18	2.37	2.06	B (TL)

All quantities are in ML/d.

Licences are for the period up to 31/12/96.

Actual abstractions are for the year 1/4/95 to 31/3/96.

[ ]+ These rates include the average daily rates authorised over any five year period by the Shropshire Groundwater Scheme Licence. The estimated long term average scheme actual abstraction rates are significantly less; they are included in the figures which are not bracketed, which are the rates to be considered for licensing purposes. UPPER SEVERN AREA, HOWEVER MUST, LIAISE VERY CLOSELY WITH GROUNDWATER SECTION OVER ANY APPLICATIONS IN THESE UNITS.

[69.75]# This rate includes the Norton Artificial Recharge authorised one year abstraction total. The rate to be considered for licensing purposes, which excludes this licence, is 56.42.

### 3 : Permo-Carboniferous (Coventry Area)

Groundwater Unit Index	Groundwater Unit Name	Assessed Recharge	Licensed Abstraction	Actual Abstraction	Unit Classification
D.9.3	Coventry	46.10	45.02	22.90	A
D.9.4	Meriden	21.70	5.79	5.36	C
D.9.5	Kenilworth	22.40	7.29	5.54	C

### 4: Lower Magnesian Limestone

Groundwater Unit Index	Groundwater Unit Name	Assessed Recharge	Licensed Abstraction	Actual Abstraction	Unit Classification
E.1.2	Maltby	25.97	3.24	1.55	B
E.1.3	Bolsover	59.55	20.58	11.75	B
E.1.4	Mansfield	16.79	2.54	1.76	B
E.1.5	Hucknall	25.42	2.24	2.18	B

### 5 : Carboniferous Limestone (Peak District)

Groundwater Unit Index	Groundwater Unit Name	Assessed Recharge	Licensed Abstraction	Actual Abstraction	Unit Classification
D.3.3	Alstonefield	-	0.14	0.13	C
D.3.4	Matlock	-	59.47	55.81	C
D.3.5	Buxton	-	13.62	6.19	C

All quantities are in Ml/d.

Licences are for the period up to 31/2/96.

Actual abstractions are for the year 1/4/95 to 31/3/96.

### UNIT CLASSIFICATION

### (FOR LICENSING PURPOSES)

- A: NO RESOURCES AVAILABLE
- B: SPECIAL STUDY AND PRESUMPTION AGAINST LARGE LICENCES
- C: SPECIAL STUDY; NO PRESUMPTION
- D: RESOURCES AVAILABLE
- (TL): INDICATES TIME LIMITED LICENCES ARE ONLY CONSIDERED THROUGHOUT THE UNIT (APPLIES ONLY TO B UNITS). TIME LIMITED LICENCES CAN HOWEVER ALSO BE ISSUED FOR PARTS OF C AND D UNITS.

## **KEY TO UNIT CLASSIFICATIONS:**

### **Current Licensing Classification:**

- A: NO RESOURCES AVAILABLE
  - B: SPECIAL STUDY AND PRESUMPTION AGAINST LARGE LICENCES
  - C: SPECIAL STUDY; NO PRESUMPTION
  - D: RESOURCES AVAILABLE
- (TL): INDICATES TIME LIMITED LICENCES ARE ONLY CONSIDERED THROUGHOUT THE UNIT (APPLIES ONLY TO B UNITS). TIME LIMITED LICENCES CAN HOWEVER ALSO BE ISSUED FOR PARTS OF C AND D UNITS.

The above classification ( A to D) and descriptions have been in use since November 1991. Prior to that date, the following classification scheme was in operation:

### **Historical Licensing Classification:**

- A: NO RESOURCES AVAILABLE
  - B: SPECIAL STUDY AND PRESUMPTION AGAINST LARGE LICENCES
  - C: SPECIAL STUDY; NO PRESUMPTION
  - E: RESOURCES AVAILABLE
- (TL): INDICATES TIME LIMITED LICENCES ARE ONLY CONSIDERED THROUGHOUT THE UNIT (APPLIES ONLY TO B UNITS).

To avoid confusion, unit classifications under this earlier system are denoted by an asterisk in the classification history relating to each groundwater management unit.

### **Abbreviations:**

- ST: Severn Trent Water
  - Y: Yorkshire Water Services
  - A: Anglian Water Services
  - SS: South Staffordshire Water
  - C: Cheadle Water Company
- 
- NR: No abstraction return
  - NEW: Licences issued after the 31/12/96

Licences are for the period up to 31/12/96.

Actual abstractions are for the year 1/4/95 to 31/3/96.

All quantities are in Ml/d.

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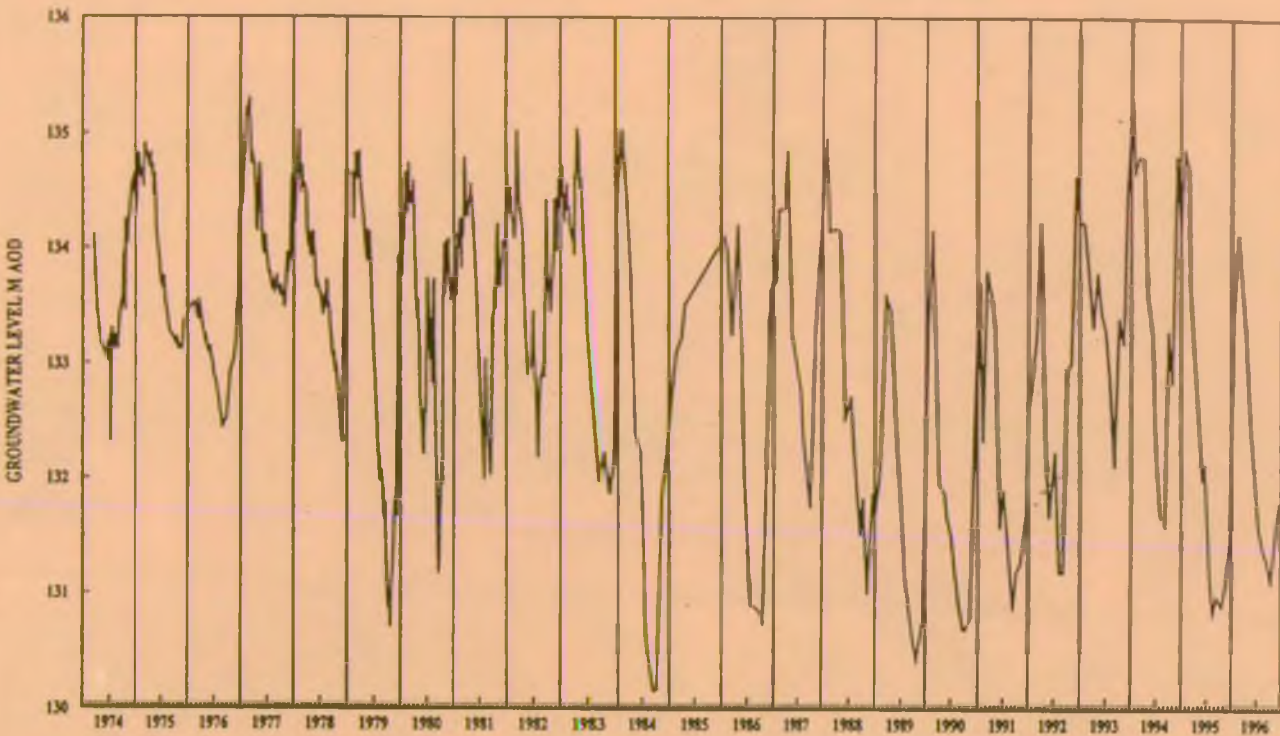


## **SECTION B**

### **1. Sherwood Sandstones - Trent Catchment**



**GROUNDWATER UNIT; DISEWORTH (F0.1) [Fig 4]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WHITWICK	SK43061581	1653

## GROUNDWATER UNIT: DISEWORTH (F0.1) [Fig 4]

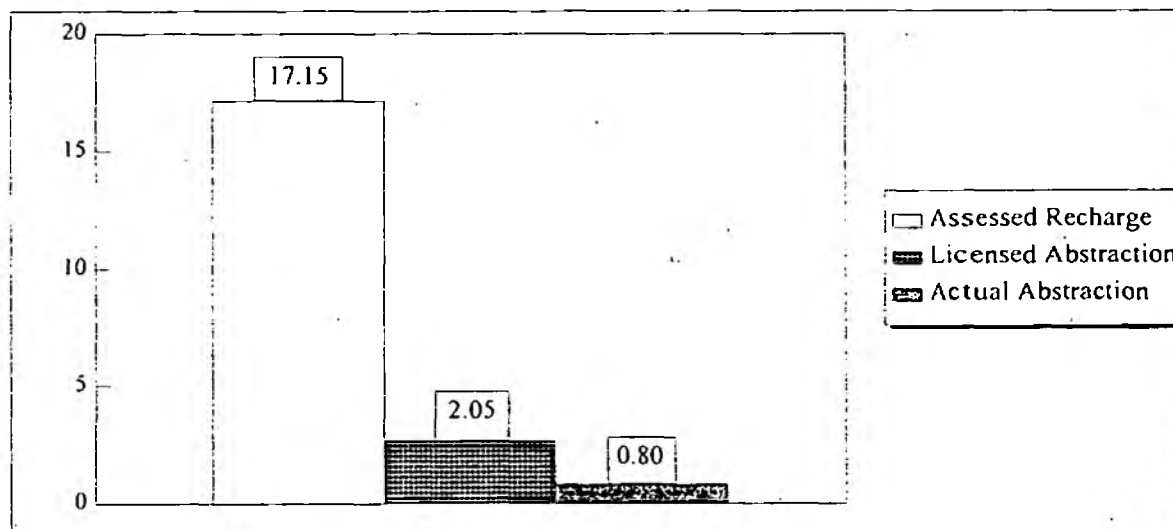
Licence.No	Licensed Abstraction	Actual Abstraction
36/12	0.007	0.007
36/84 (Castle Donnington, No 4)+	0.45	0.00
36/150	0.05	0.016
57/61 (Holly Hayes) (ST)	1.53	0.77
57/71	0.005	0.005
57/75	0.0006	0.0006
57/77	<u>0.005</u>	<u>0.005</u>
	<u>2.05</u>	<u>0.80</u>

+ Licence of 2.25 includes four sources, only one (No 4) abstracts from the Sherwood Sandstones.

Public Water Supply	1.53	0.77
Private Water Supply	0.52	0.03

### SUMMARY

#### Resource Balance



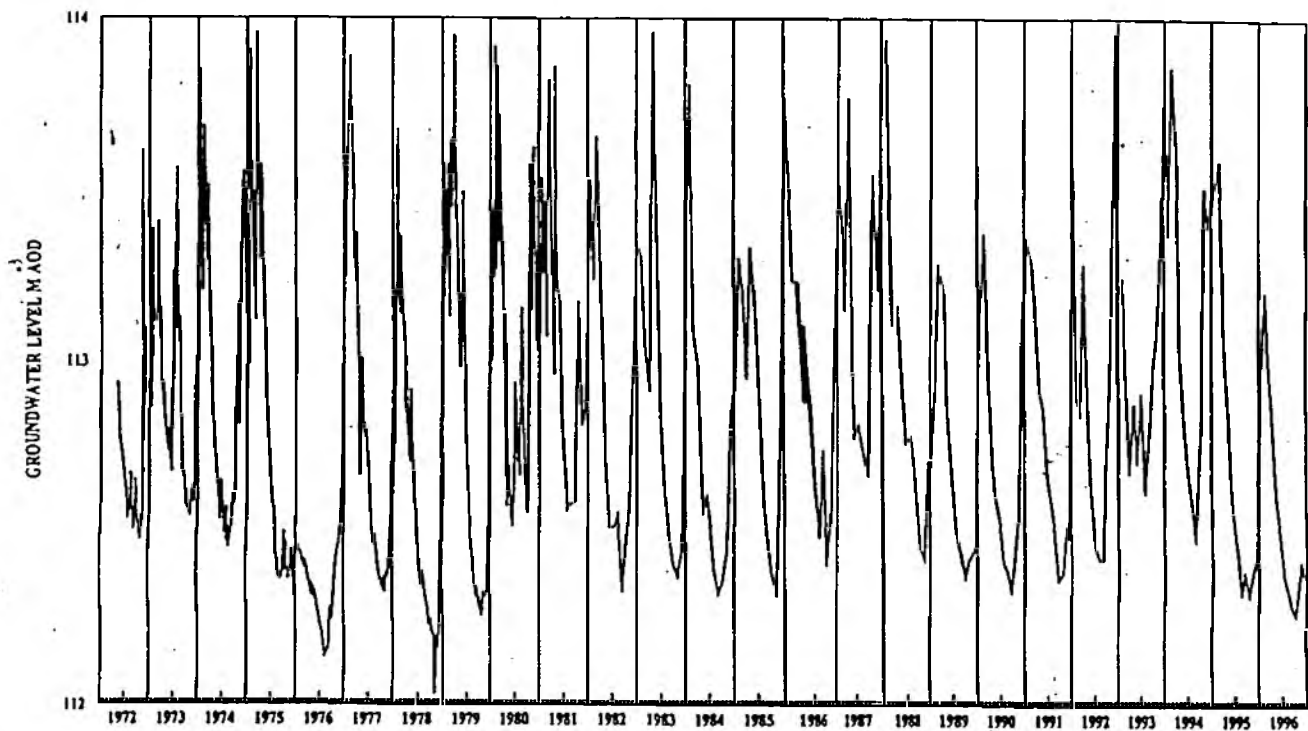
#### Unit Classification: D

Only very limited development has taken place up to the present time hence little is known about the aquifer in terms of borehole yields and quality. No objection, in principle, to new licence applications.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# **GROUNDWATER UNIT: COALVILLE (F0.2) [Fig 4]**



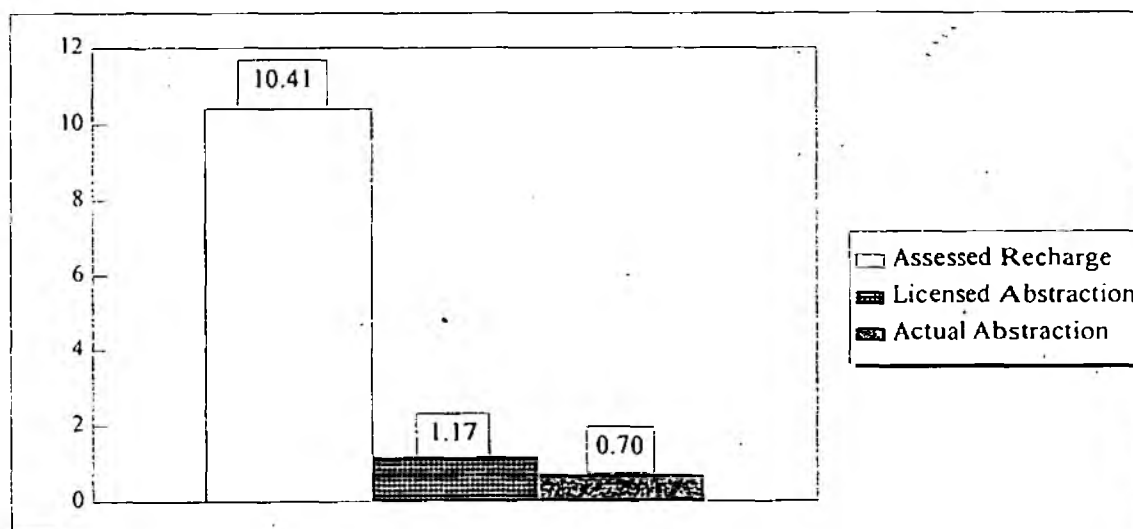
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		COTTAGE FARM-EBSTOCK	SK40430904	1212

## GROUNDWATER UNIT: COALVILLE (F0.2) [Fig 4]

<u>Licence No</u>	<u>Licensed Abstraction</u> $\circ$	<u>Actual Abstraction</u>
57/60 (Broomleys) (ST)	1.13	0.70
20/97	<u>0.041</u>	<u>0.00</u>
	<u>1.17</u>	<u>0.70</u>
Public Water Supply	1.13	0.70
Private Water Supply	0.04	0.00

### SUMMARY

#### Resource Balance



#### Unit Classification: D

Only limited development has taken place up to the present time hence little is known about the aquifer in terms of borehole yields and quality. No objection, in principle, to new licence applications.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

**GROUNDWATER UNIT : ASHBY (F 0.3) [Fig 4]**

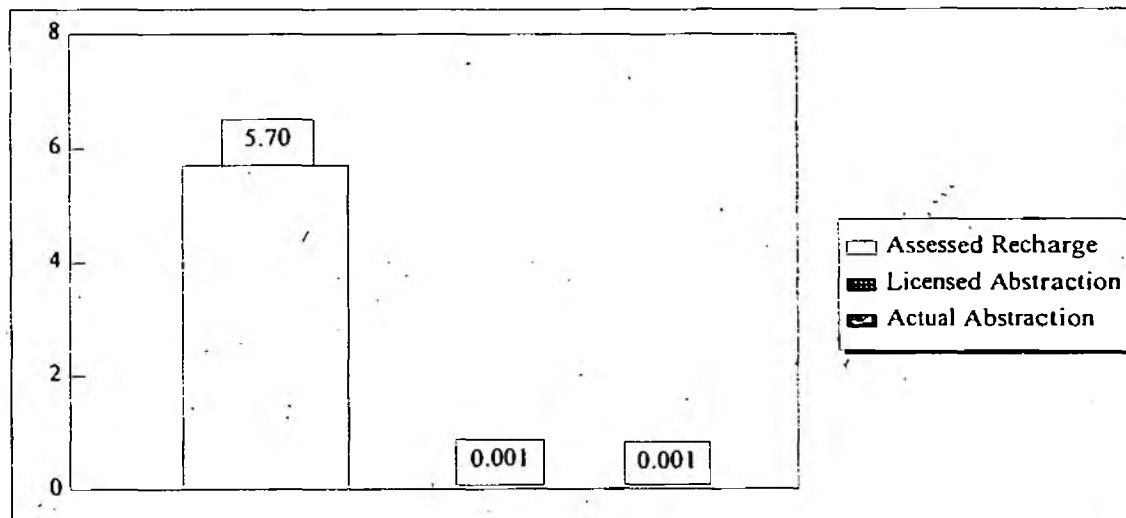
There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: ASHBY (F0.3) [Fig 4]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
23/41	0.0005	0.0005
36/111	<u>0.0002</u>	<u>0.0002</u>
	<u>0.001</u>	<u>0.001</u>

### **SUMMARY**

#### Resource Balance



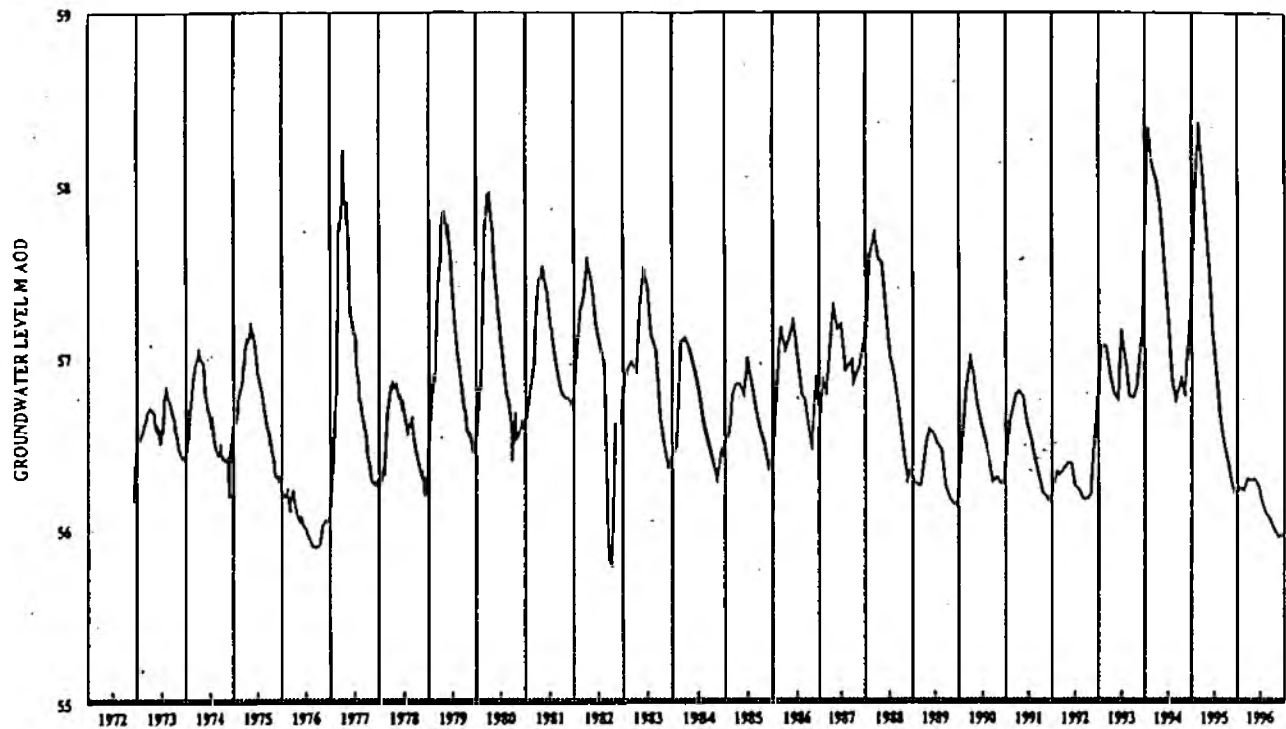
#### **Unit Classification: D**

Aquifer is both fragmented and very thin, the potential for successful development is therefore very low. No objection in principle to new licence applications but baseflow protection will have to be taken into consideration.

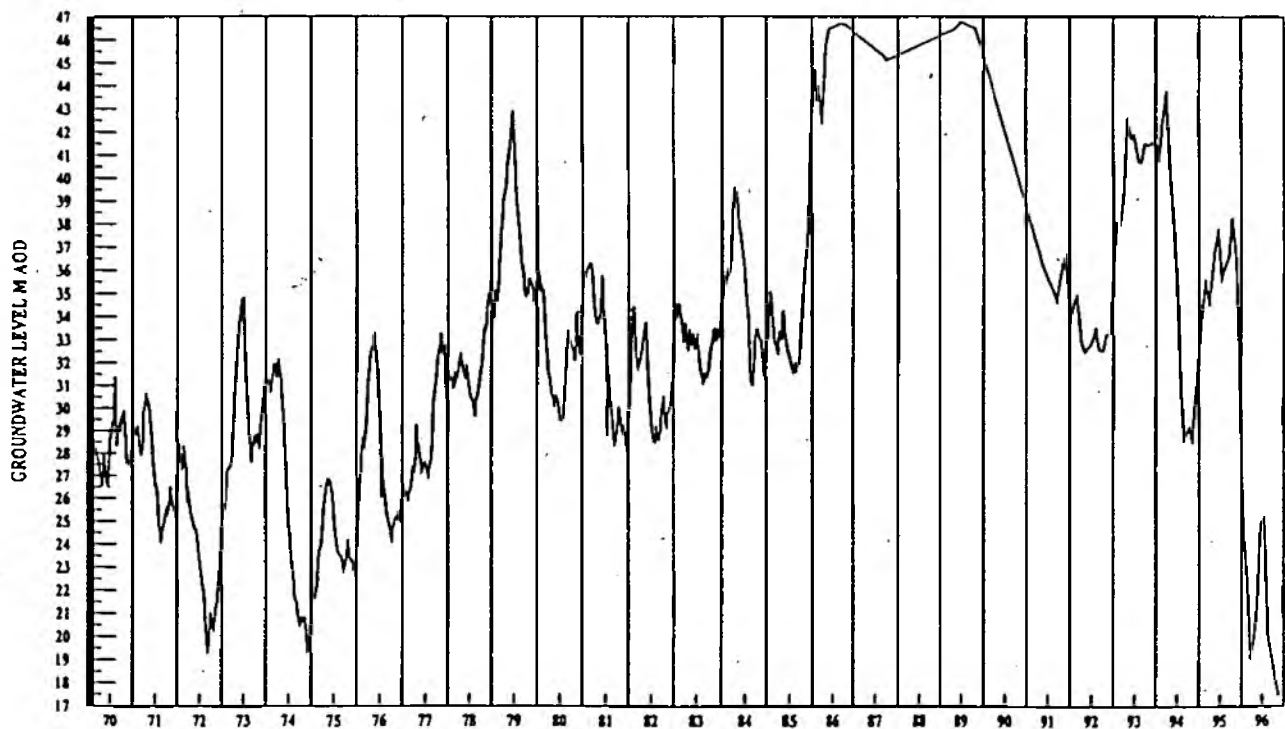
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: BURTON (F0.4) [Fig 4]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		ROYLE FARM	SK25431898	1014



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BRANSTON ORDNANCE	SK23462155	1019



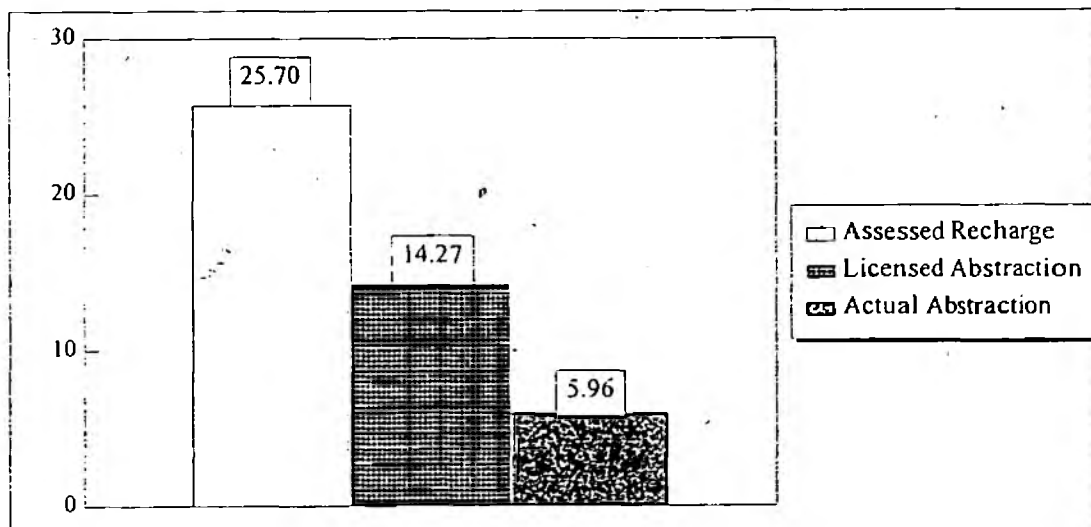
## GROUNDWATER UNIT: BURTON (F0.4) [Fig 4]

Licence No	Licensed Abstraction	Actual Abstraction
24/14	0.003	0.003
24/16	0.00005	0.00005
24/21	0.009	0.009
24/23 (Carlsberg Tetley, No 3)*	0.025	0.00
24/47	7.27	4.60
24/59	0.0002	0.0002
24/64	1.92	0.00
24/70	0.36	0.17
24/79	0.55	0.49
36/32 (Sandilands/Milton) (ST)	4.11	0.67
36/45	0.009	0.009
36/97	0.003	0.003
36/98	0.0009	0.0009
36/102	<u>0.002</u>	<u>0.002</u>
	<u>14.27</u>	<u>5.96</u>
Public Water Supply	4.11	0.67
Private Water Supply	10.16	5.28

\* Licence of 0.43 includes three sources, only one (No 3) abstracts from the Sherwood Sandstones.

### SUMMARY

#### Resource Balance



## **GROUNDWATER UNIT: BURTON (F0.4) [Fig 4]**

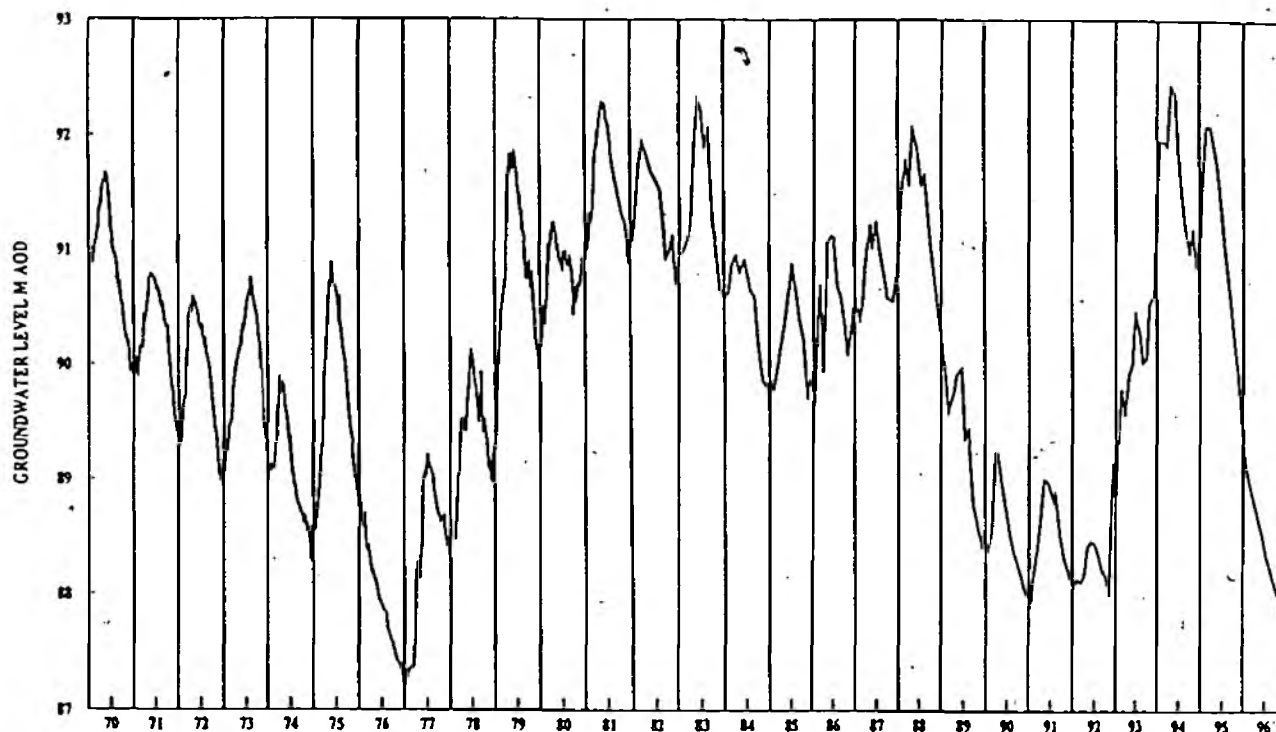
### **Unit Classification: B(TL)**

Borehole yields and groundwater quality are highly variable in the confined and unconfined aquifer. There are no objections in principle to new licence applications in the unconfined area, although baseflow protection may be required for large development proposals. Recent pumping tests in the confined aquifer have demonstrated uncertainty over the link with the recharge area, with consequent doubts over the long term sustainable yield. A detailed study will be carried out over the next few years to improve the hydrogeological understanding of this area. Until this work is completed, new or varied licences in the confined aquifer will be time-limited, and there will be a presumption against large developments.

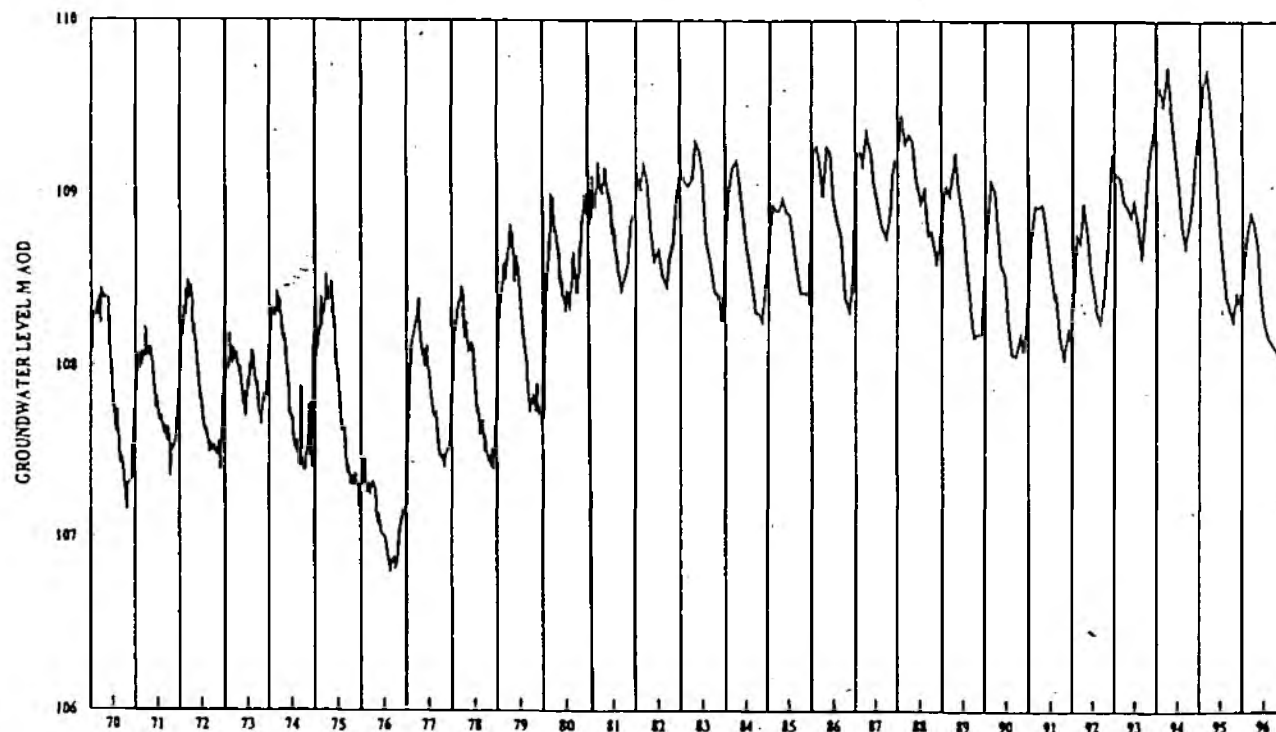
### **Classification History**

1/10/83 - 30/9/91	E*
1/10/91 - 1/12/95	D
1/10/95 -	B(TL)

# GROUNDWATER UNIT: MEASHAM (F0.5) [Fig 4]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CRANCEWOOD	SK27311414	1021



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		UNIGATE SLEAFSTONE	SK36901012	1017

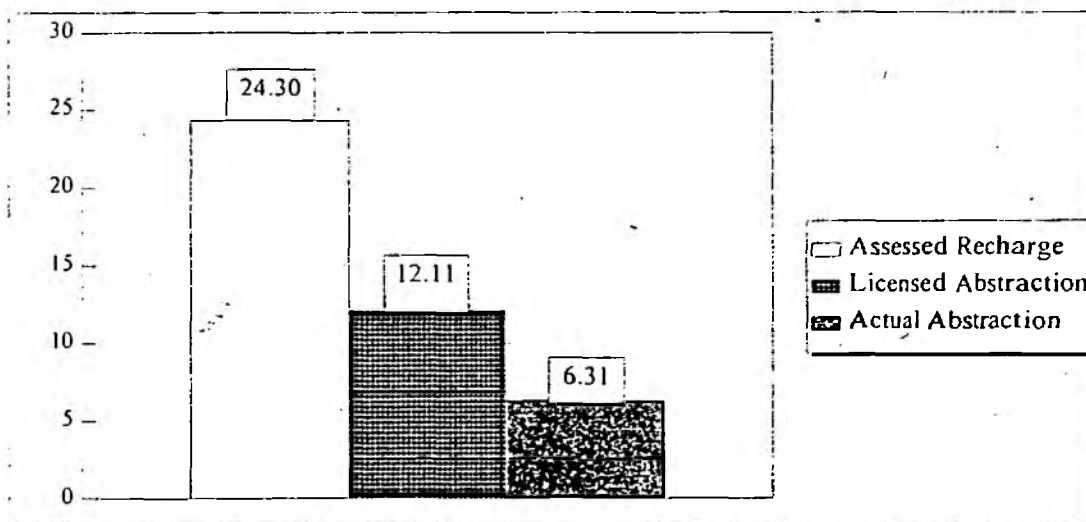
## GROUNDWATER UNIT: MEASHAM (F0.5) [Fig 4]

Licence No	Licensed Abstraction	Actual Abstraction
20/102	0.02	0.0004
22/4 (Chilcote) (SS)*	( 10.05)	6.04
23/9	0.005	0.005
23/14	0.002	0.002
23/20 (Acresford) (ST)	1.56	0.00
23/27	0.001	0.0007
23/28	0.0001	0.0001
23/30	0.0005	0.0005
23/32	0.005	0.005
23/72	0.012	0.006
23/73	0.19	0.013
23/84	<u>0.27</u>	<u>0.24</u>
	<u>12.11</u>	<u>6.31</u>
Public Water Supply	11.61	6.04
Private Water Supply	0.50	0.27

\* Chilcote forms part of a group licence with Trent Valley and Fradley which are in the Lichfield Unit. The amount given in brackets is the proportion of the group licence allocated to Chilcote.

### SUMMARY

#### Resource Balance



## GROUNDWATER UNIT: MEASHAM (F0.5) [Fig 4]

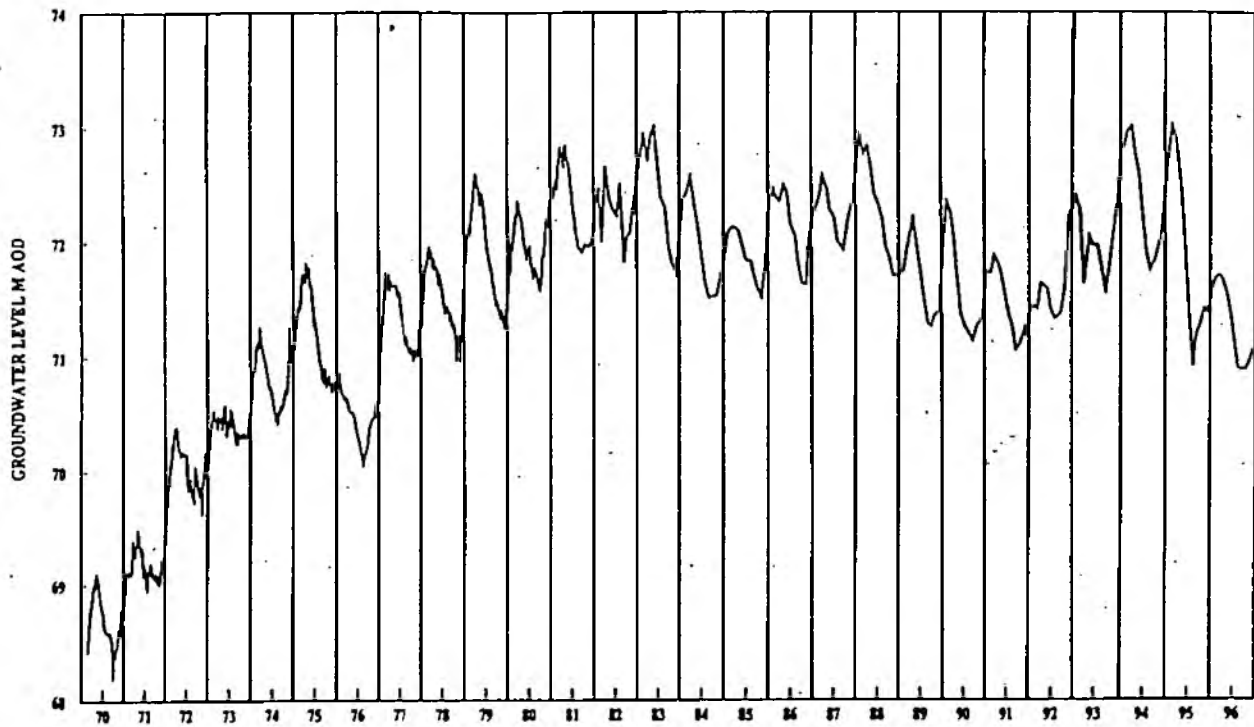
### Unit Classification: B (TL)

Yields are generally good, but quality can be variable. The aquifer is made up of interlayered sandstones and mudstones, and pumping tests demonstrate that this gives rise to complex hydrogeological conditions. Interference effects spread quickly and to great distances, and impacts on baseflow are difficult to quantify. Although in principle resources are available for licensing, adequate protection must be afforded to baseflow in the River Mease and its tributaries. A precautionary approach must be adopted towards new licences whilst a study is carried out into the potential long term impacts of further groundwater development. Licences will be time limited (typically for 5 years) whilst the study is completed.

### Classification History

1/10/83 - 30/9/91	E*
1/10/91 - 30/4/97	D
1/05/97 -	B(TL)

# GROUNDWATER UNIT: WARTON (F0.6) [Fig 4]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		NEWTON REGIS	SK28170738	1211

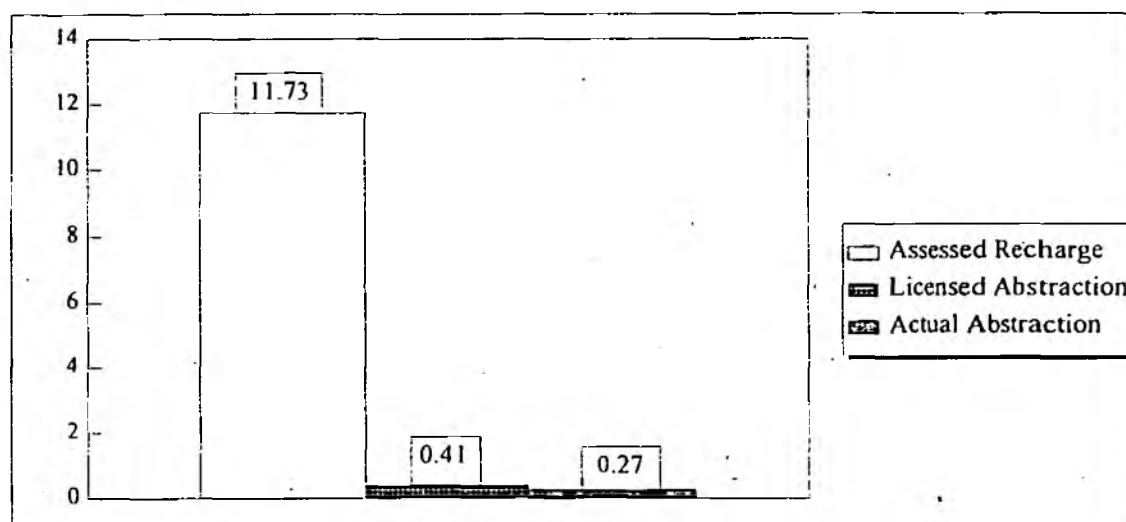
## GROUNDWATER UNIT: WARTON (F0.6) [Fig 4]

Licence.No	Licensed Abstraction	Actual Abstraction
19/79	0.04	(NR) 0.04
20/51 (Lodge Farm, No. 1)+	0.0007	0.0007
20/99	0.01	0.01
21/7	0.002	0.002
21/10	0.012	0.012
21/38	0.15	0.00
21/43	0.009	0.009
23/23	0.001	0.001
23/79	<u>0.19</u>	<u>0.19</u>
	<u>0.41</u>	<u>0.27</u>

+ Licence includes two sources, only one (No 1) abstracts from the Sherwood Sandstones.

### SUMMARY

#### Resource Balance



#### Unit Classification: D

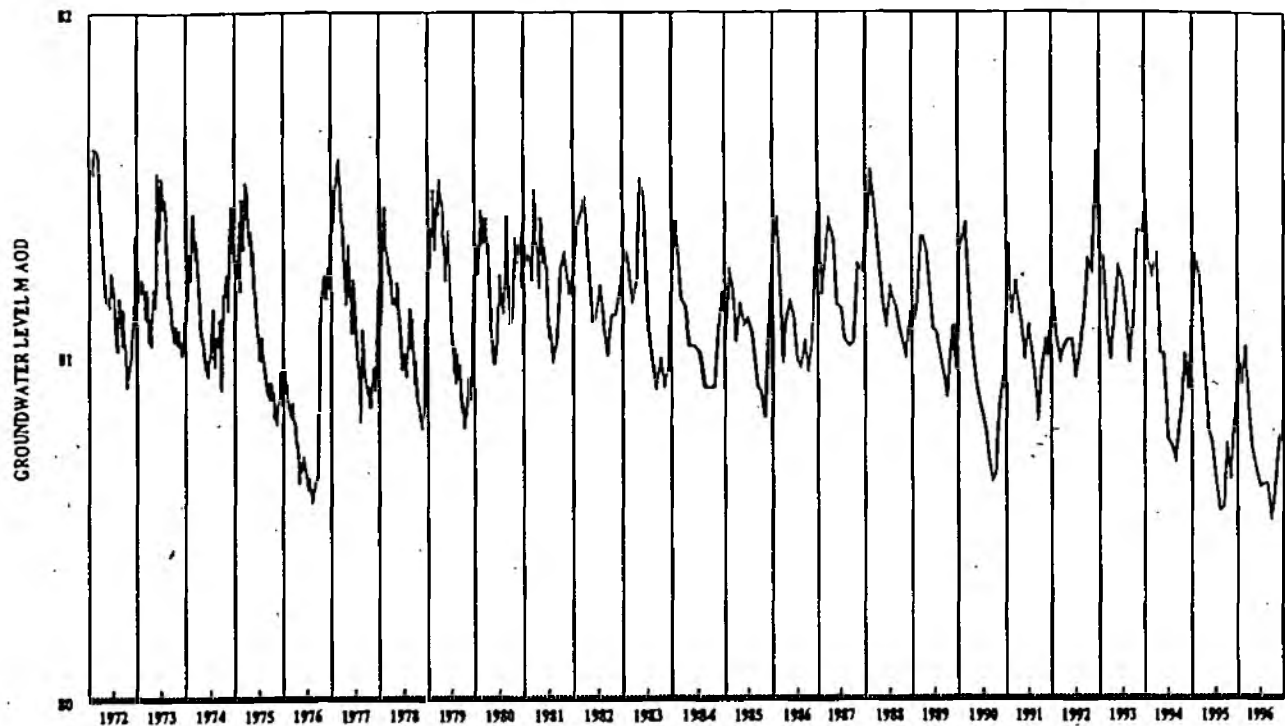
Information relating to this aquifer is sparse, although trial boreholes drilled approximately 30 years ago gave encouraging yields, but quality was variable. Lack of development is probably due to remoteness from population centres rather than major quality problems in the aquifer. No objection in principle to some large scale development provided that protection is given to baseflow.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D



# **GROUNDWATER UNIT: NUNEATON (F0.7) [Fig 4]**



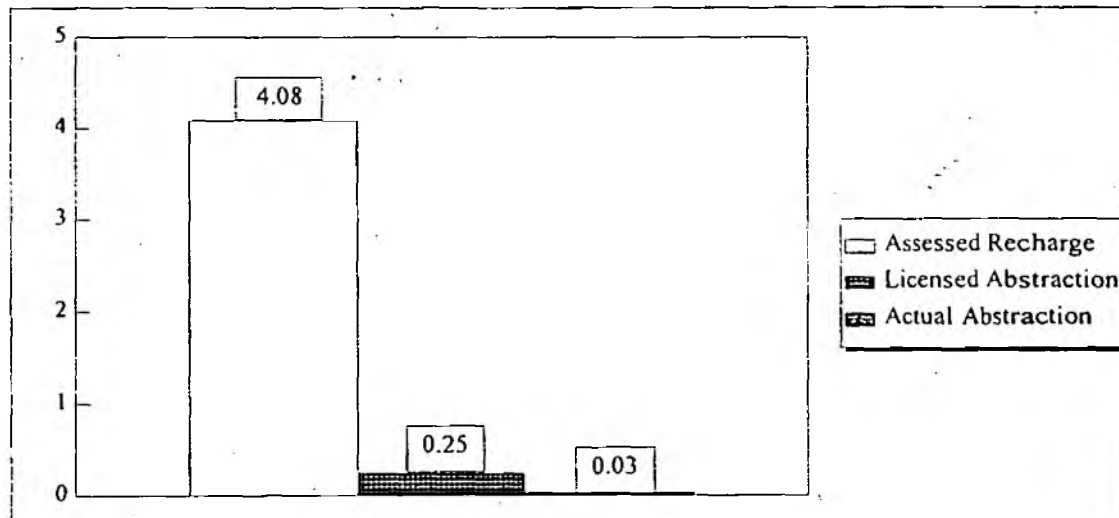
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		COWBURNS	SP36089105	1213

## GROUNDWATER UNIT: NUNEATON (F0.7) [Fig 4]

Licence No	Licensed Abstraction	Actual Abstraction
19/5	0.068	0.002
20/95	0.18	0.03
	0.25	0.03

### SUMMARY

#### Resource Balance



#### Unit Classification: D

The unit has been more extensively used in the past, including some small public water supply sources. No objection in principle to limited development.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# REVISION OF NOTTINGHAMSHIRE/SOUTH YORKSHIRE GROUNDWATER UNITS: EXPLANATORY NOTE

## Introduction

The development of the Nottingham Triassic Sandstone Model and its counterpart, the Doncaster Model, have resulted in a much better understanding of the flow patterns in the whole of the Nottinghamshire/South Yorkshire Aquifer Block. The original concept of an aquifer management unit required it to be largely self contained with no major groundwater inflows or outflows. It had been felt for some time that the Nottinghamshire/South Yorkshire units, set up as far back as 1979, did not meet this criterion. A research contract was let, therefore, to use the mathematical models to examine cross boundary flows between the existing units and to determine new unit boundaries if this was appropriate.

It was not anticipated that the review would enable any additional abstraction licences to be offered, as both licensed and actual rates of abstraction in the aquifer block generally remain in excess of recharge. However it has given the opportunity to rationalise the long term annual average recharge figures (1941-1970), upon which policy has been dependant for 17 years, with the figures produced by the models on a rolling basis. Whilst the concept of a regularly changing recharge figure may be more difficult to understand, it is considerably easier to defend one figure than be called upon to explain why a model value and the long term figure are different. Since the model calculates the flows between nodes, the cross boundary flows can be determined and accrued as part of the unit water balance.

The units which emerged from the reappraisal of the model results are shown in Figures 1 and 2. To avoid confusion, they have been named and numbered differently from the old units which they now replace.

## Recharge

The recharge figure is calculated for each kilometre square by accumulating the quantities of water from the following sources :-

- 1) **Precipitation Recharge** - The quantity of water falling on the ground surface which reaches the permanent water table, forming an addition to the groundwater reservoir.
- 2) **Urban Recharge** - The quantity of water leaking from the public supply distribution system which forms an addition to the permanent water table.
- 3) **Drift Leakage** - The quantity of water entering or leaving the aquifer system by head dependant leakage through the lower permeability overlying formations.
- 4) **Mercia Mudstones Leakage** - The quantity of water contributed from the Mercia Mudstones by Head Dependant Leakage.

- 5) **Cross Boundary Flows** - Groundwater which flows either from or to the adjacent groundwater units across the nominal unit boundaries.

These quantities can only be determined in retrospect as the model uses real meteorological data. The recharge figure is therefore calculated as the mean recharge since 1969/70, when the model commences. It should be noted, however, that the figures will contain artifacts due to the major changes in groundwater head which have occurred since that time, which affect head dependant leakages. For example between 1970-80, groundwater levels were low and so the head dependant leakage was large and towards the aquifer. As a result of recent cut-backs by Yorkshire Water Services, groundwater levels are recovering and the head dependant leakages are reducing or even reversing in some places. The mean figure calculated for the on-going annual average head dependant leakage will mask this change and give a figure close to zero. As the time period since the last change increases, the average will tend to the latest condition but this may take some time.

### **Approach to Licensing**

The modelling work has demonstrated that the aquifer can no longer be considered simply in terms of discrete management units. Although such units are necessary for accounting purposes, the aquifer must be viewed as a dynamic system with a finite resource. Any abstraction proposal must be considered in relation to long term sustainability of aquifer levels and the impacts on river flows and environmentally sensitive areas. Decisions to grant or refuse licences cannot be taken on the basis of policy alone. It must also be recognised that the resources of the area are still under pressure, and the approach to licensing will allow for review in the light of actual experience.

The revised recharge figures produced by the model show that licensed abstractions exceed the long term recharge for the whole of the Nottinghamshire/South Yorkshire Sherwood Sandstone Aquifer. The Hatfield and Retford units are also over-abstacted, and the remaining units to the north of Nottingham have levels of actual abstraction in excess of 80% of the assessed recharge. The tangible results of this historical situation have been falling groundwater levels, loss of baseflow to watercourses flowing across the aquifer, and adverse effects on recreational/environmental areas.

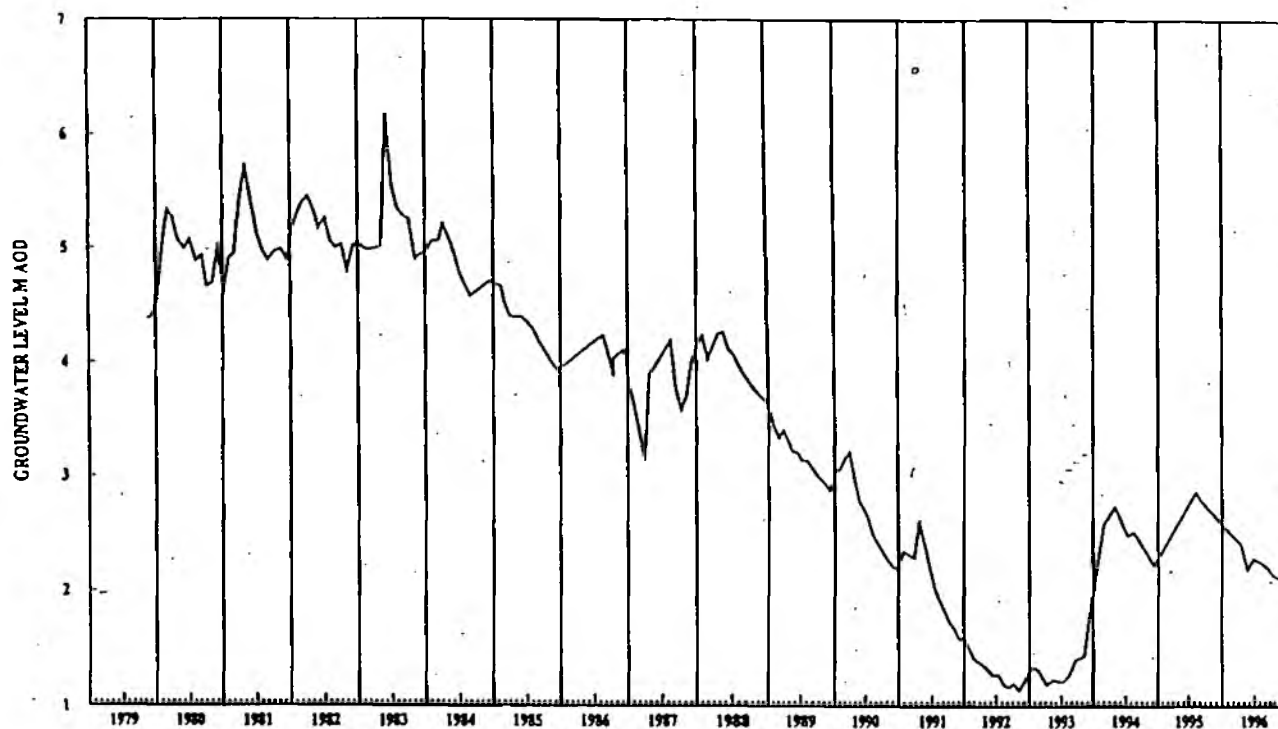
Initial predictive work using the model indicates that rates of pumping, allowing for reductions programmed in the future (primarily in public water supply licences), represent an upper limit on abstraction levels. In order to strike an acceptable balance between the Environment Agency's duty to secure the proper use of water resources and its environmental responsibilities, the general approach towards licensing of groundwater abstraction in the area is as follows :-

- 1) There is no scope for further licences to be granted beyond existing commitments except for schemes which result in environmental benefit, or as in 4 and 5 below.
- 2) Renewal of time limited licences up to 31<sup>st</sup> October 2003 will be considered for existing users on the basis of demonstrable and reasonable need.
- 3) Modifications to existing permanent licences may be acceptable provided proposals include reduced quantities, or time limited components are introduced. In some areas

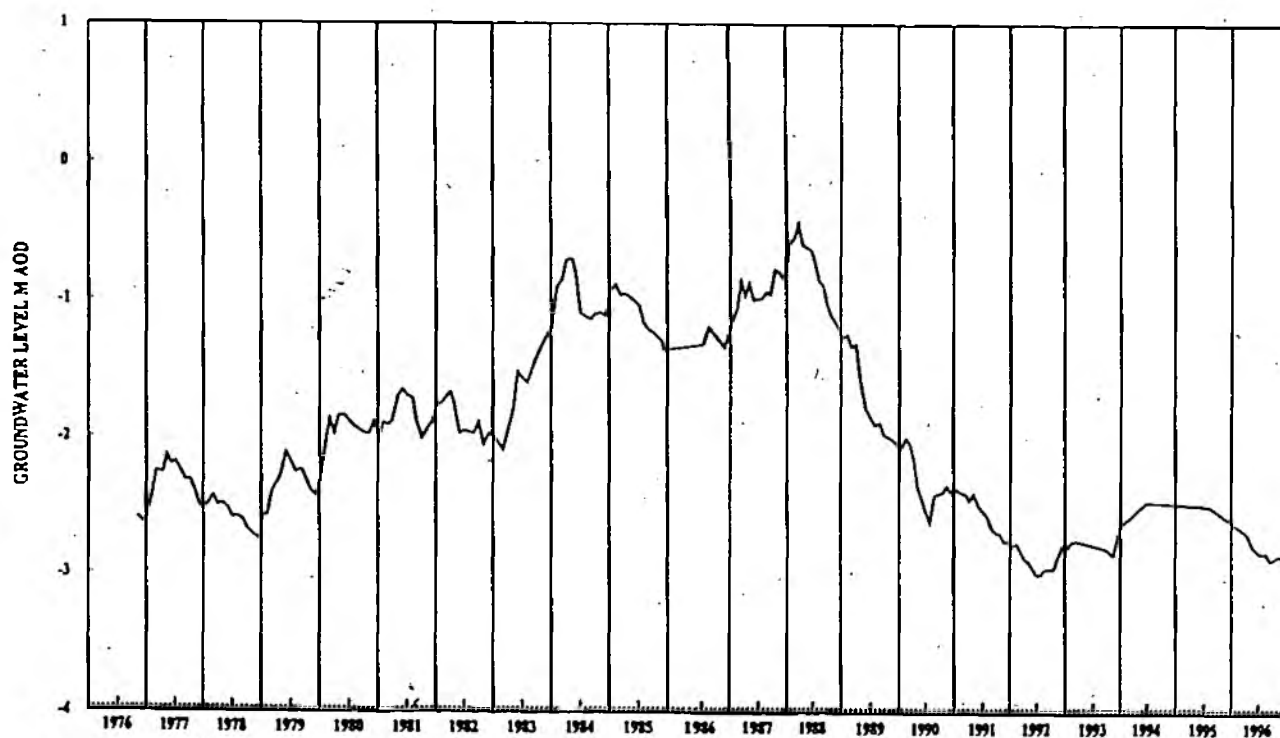
these licence variations may also require reductions in historic levels of actual abstraction, in order to arrest falling groundwater levels, restore baseflow to watercourses and protect environmentally sensitive areas.

- 4) The existing policy of granting small licences [not exceeding 3,650 m<sup>3</sup>/a] for agricultural or industrial purposes where no other supply [eg: mains water] is available at reasonable cost will continue.
- 5) New and increased licences can be considered in those parts of the Wollaton unit, centred on Nottingham, where reduced levels of abstraction have led to a slow but progressive rise in groundwater levels. Large proposals may, however, have to be time-limited to cater for any potential future uptake of existing authorised abstraction volumes.
- 6) Rationalisation of abstractions across sources is permissible subject to there being no risks identified.

# GROUNDWATER UNIT: HATFIELD (F10.1)



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SANDALL BEAT	SE61470401	1792



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BRIAR HOLME CARR (R.E.)	SE67851059	1852

# GROUNDWATER UNIT: HATFIELD (F10.1)

Licence No	Licensed Abstraction	Actual Abstraction
82/4	0.39	0.33
82/6	0.20	0.18
82/7	0.034	0.00
82/8	0.029	0.013
82/38 ~	0.01	(NEW) 0.01
83/3	0.005	0.005
83/4	0.009	0.010
83/9	0.005	0.005
83/10* (Armthorpe) (Y)	(9.09)	3.67
83/11	0.009	0.009
83/12* (Austerfield) (Y)	)	5.38
83/12* (Hatfield) (Y)	)	7.79
83/12* (Finningley) (Y)	) (71.37)	8.13
83/12* (Nutwell) (Y)	)	5.00
83/12* (Rossington Bridge) (Y)	)	8.23
83/12* (Thornham) (Y)	)	11.42
83/14	1.64	0.009
83/15	1.87	1.23
83/16	0.011	0.011
83/19	0.002	0.002
83/21	0.001	0.001
83/23	0.014	0.014
83/24	0.009	0.009
83/28	0.009	0.008
83/30	0.47	0.16
83/31	0.006	(NR) 0.006
83/33	0.25	0.16
83/37	0.36	0.38
83/43	0.093	0.093
83/48	0.0002	0.0002
83/50	0.004	0.004
83/62	0.003	0.003
83/90	0.016	(NR) 0.016
83/100* (H. Woodhouse) (Y)	(9.09)	8.44
82/102	0.062	0.062
83/105* (Boston Park) (Y)	(9.09)	7.71
83/106	0.001	0.001
83/107* (Litleworth) (Y)	(4.55)	2.88
83/113	1.17	(NR) 1.17
83/151	0.004	0.004
83/154	0.01	0.005
83/166	0.01	0.01
83/198 (replacement for 83/13)	1.71	0.88
83/217	0.01	0.01
83/225 (replacement for 83/222)	0.41	0.41
84/3	<u>0.006</u>	<u>0.006</u>
	<u>78.73</u>	<u>23.89</u>



## GROUNDWATER UNIT: HATFIELD (F10.1)

\* Group licence covering 11 sources (including Highfield Lane in F10.2) is 83.00; 12.00 is allocated to Highfield Lane based on historic levels of actual abstraction with the remaining 71.00 allocated to the sources in this unit. Individual or sub-group licences are given in brackets.

~Granted under small licence policy.

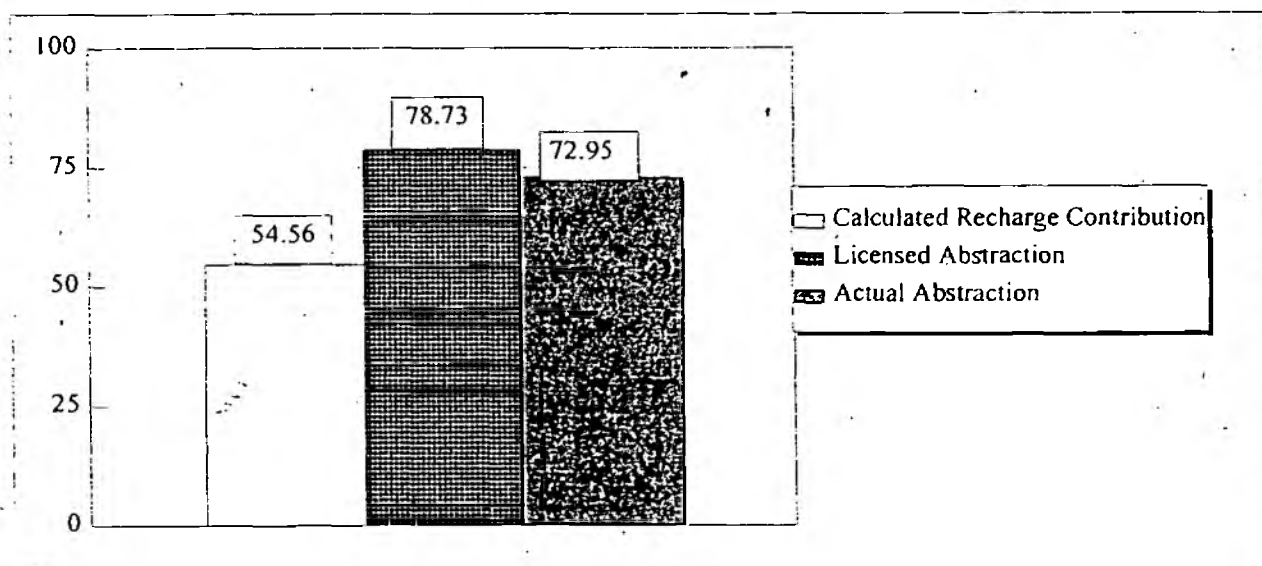
Public Water Supply	71.00	68.65
Private Water Supply	7.73	5.23

### SAND/GRAVEL WASHING LICENCES

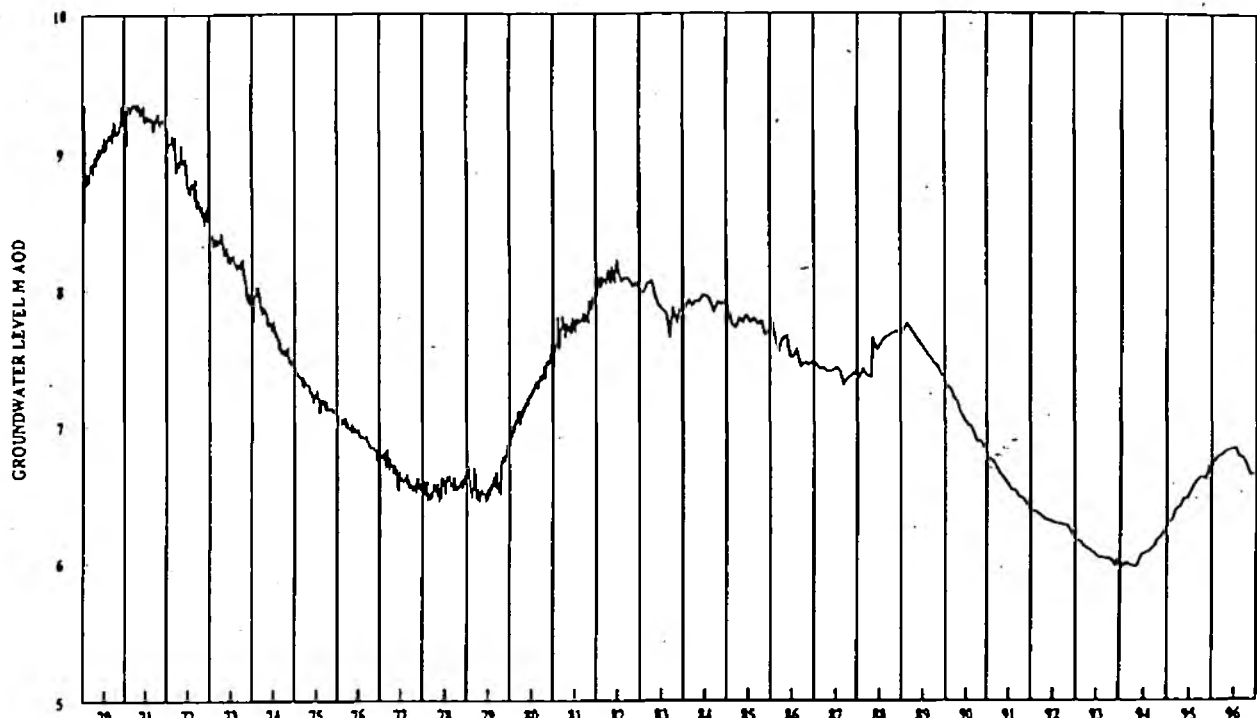
Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
82/4	0.33	50	0.16
83/30	0.01	50	0.003
83/37	0.38	50	0.19
83/113	1.17	50	0.59
			0.94

### SUMMARY

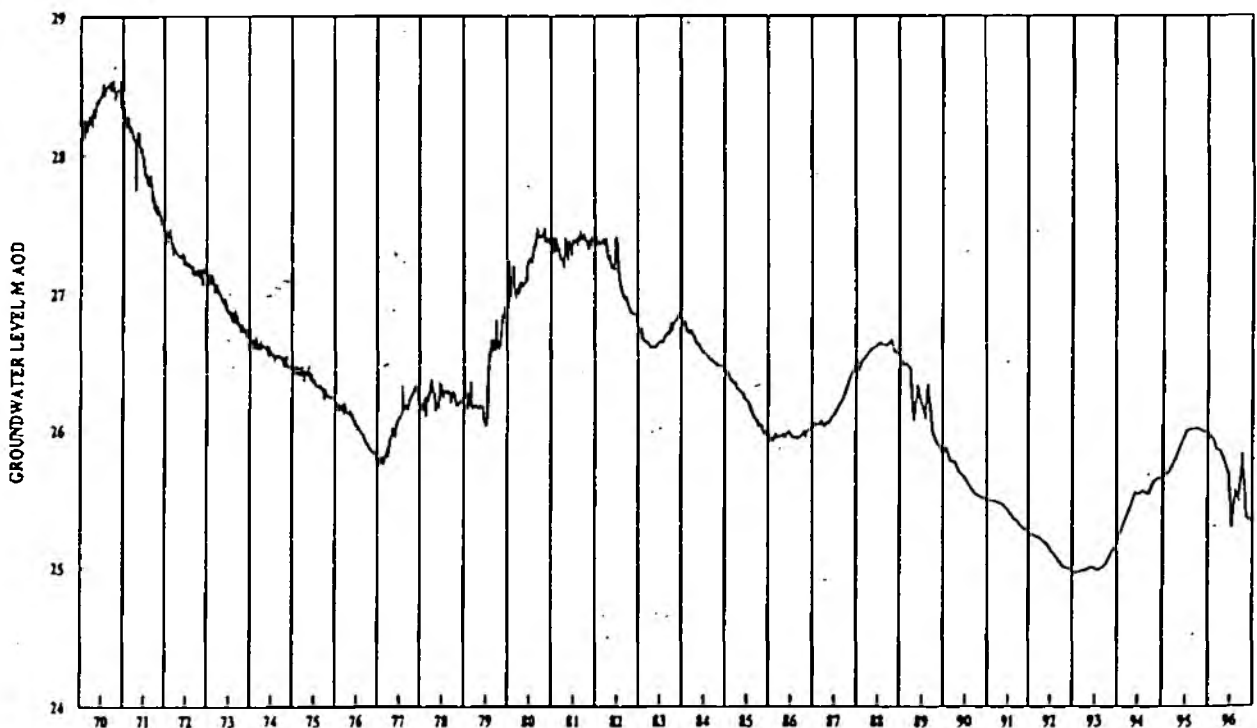
#### Resource Balance



# GROUNDWATER UNIT: BLYTH (F10.2)



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SWINNOW WOOD	SK63089354	1716



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CROSSLEY HILL	SK61918369	1722

## GROUNDWATER UNIT: BLYTH (F10.2)

Licence No	Licensed Abstraction	Actual Abstraction
69/4	0.77	0.35
69/34 (Lea Road) (A)	6.82	5.76
69/178	0.01	0.008
69/182	4.11	0.004
69/183	0.32	0.004
69/227	4.00	3.31
69/228	0.82	0.85
69/229	2.74	3.02
69/239	0.10	0.01
69/246~	0.01	(NEW) 0.01
74/4 (Everton) (A)	11.37	7.99
74/6	1.00	0.84
74/7	0.83	0.00
74/9	0.005	0.005
74/37	0.005	0.005
74/46	0.48	0.47
74/55 ** (Barnby Moor) (ST)	(10.00)	0.32
74/60	0.17	0.15
74/64	3.32	2.02
74/66** (Hayton) (ST)	(10.00)	9.50
75/8 (Sunnyside) (ST)	3.87	1.58
75/24	0.009	0.009
75/30	0.009	0.009
75/31	0.009	0.009
75/32	0.009	0.009
75/36	0.001	0.000
75/54 (Chequer House) (ST)	11.39	10.65
75/64	0.56	0.39
75/67	0.62	0.37
75/70	0.20	0.21
75/73	1.38	0.93
75/75	0.37	0.26
75/77	0.37	0.21
75/81	0.20	0.16
75/89	0.25	0.22
75/91	0.38	0.33
75/92	0.03	0.03
75/93 +(Manton) (ST)	7.44	3.05
76/6	0.007	0.007
77/1	0.19	0.13
77/7	0.006	0.006
77/8	0.17	0.088
77/11	0.0006	0.0006
77/14	0.10	0.05
77/20	0.09	0.00
77/25	0.12	0.13
77/27	0.10	0.11
77/28	0.40	0.15

## GROUNDWATER UNIT: BLYTH (F10.2)

77/33	0.19	0.23
77/36	0.40	0.25
77/38	0.22	0.18
77/41	0.20	0.11
77/42	0.19	0.28
77/43 (replacement for 77/3)	4.98	0.00
78/3	1.25	0.00
78/5	0.013	0.013
78/23	0.20	0.20
78/25	0.41	0.30
78/26	0.056	0.05
78/27	0.10	0.076
80/32	0.057	0.00
82/10	0.11	0.063
83/12* (Highfield Lane) (Y)	<u>12.00</u>	<u>13.29</u>
	<u>95.53</u>	<u>68.90</u>

\* Additional source from Group licence in F10.1

\*\* Group licence, covering 2 sources, is 10.00; Hayton component reduces to 5.00 on 01.01.2002

+ Manton licence (time limited until 31/3/99) is for 18.60 MI/d, and includes a provision for compensation discharge to the River Ryton. 7.44 MI/d is equivalent to 40% of the licensed volume which is allocated to the Sherwood Sandstones; the remaining 60% is allocated to the Lower Magnesian Limestone of the Bolsover Unit (E1.3).

--Granted under small licence policy.

Public Water Supply	62.89	52.14
Private Water Supply	32.64	16.76

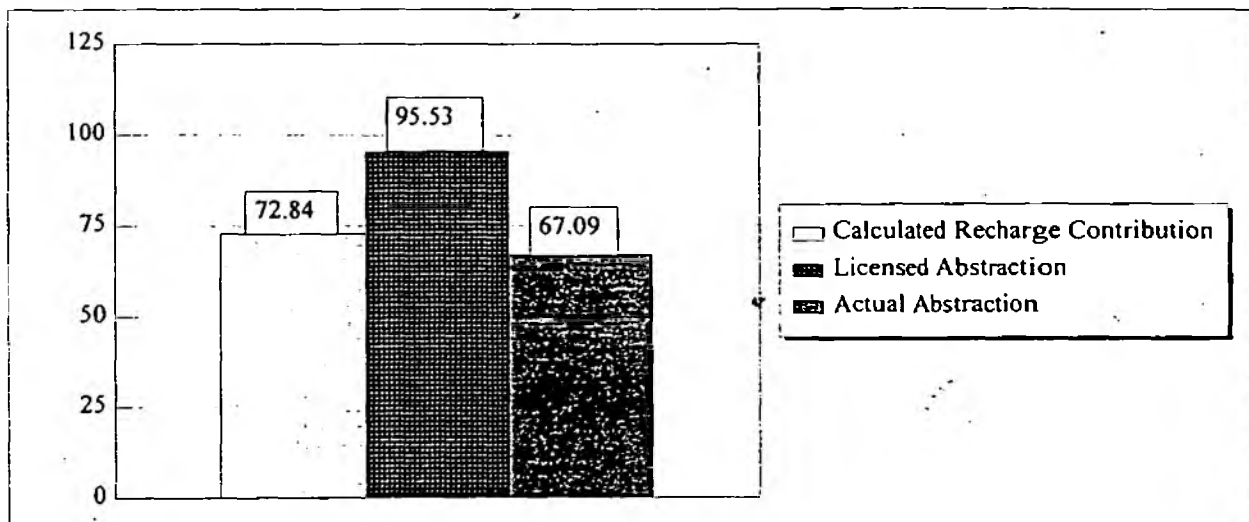
### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
74/6	0.84	95	0.80
74/7	0.00	95	0.00
74/37	0.005	60	0.003
74/64	2.02	50	1.01
77/20	0.00	50	0.00
78/3	0.00	95	0.00
			1.81

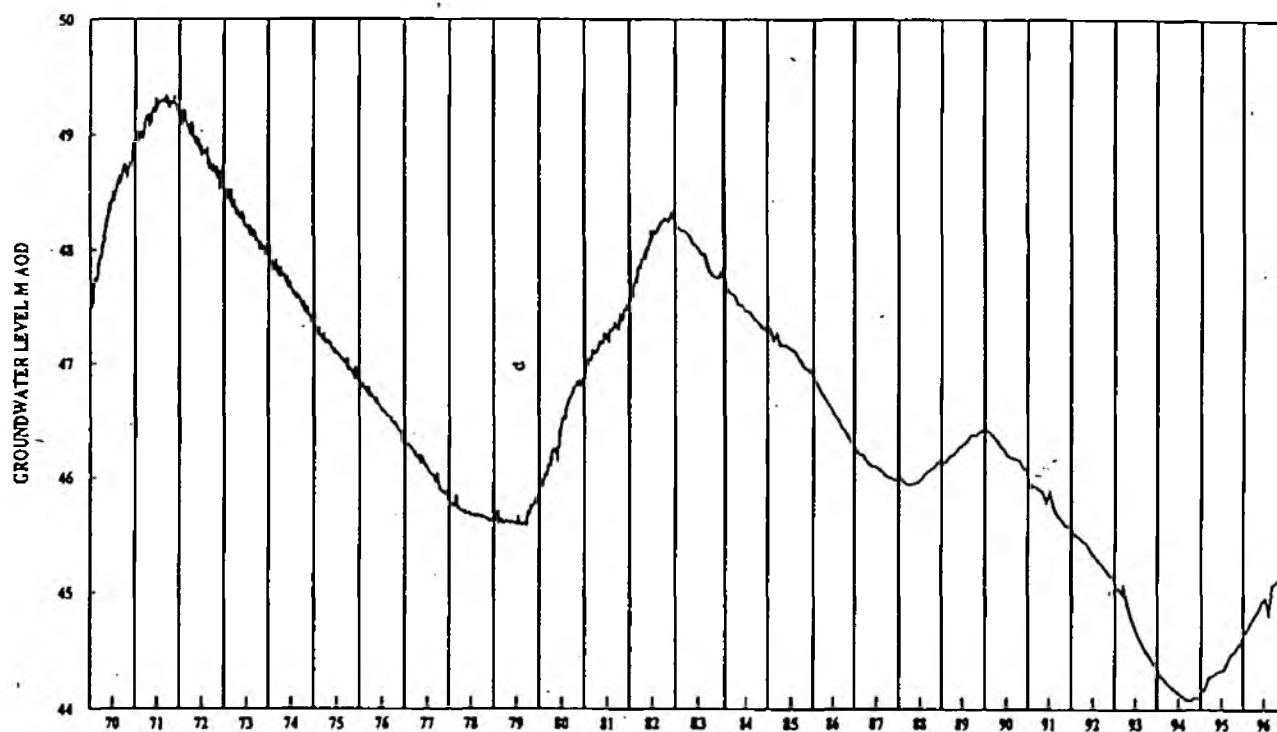
## GROUNDWATER UNIT: BLYTH (F10.2)

### SUMMARY

#### Resource Balance



# **GROUNDWATER UNIT: RETFORD (F10.3)**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		DUCHESS PLANTATION	SK58157525	1729



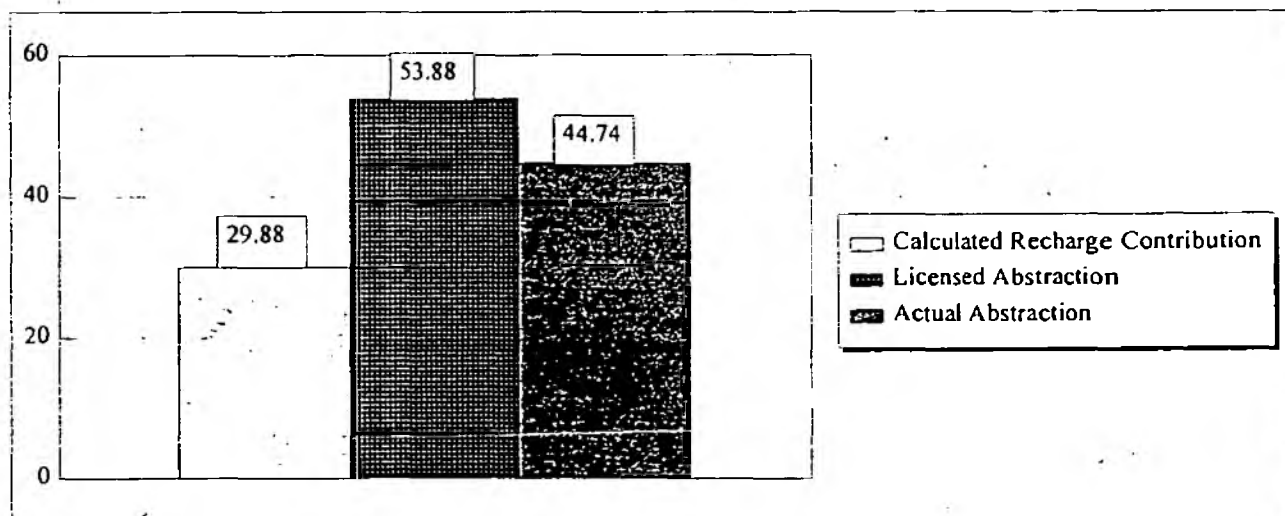
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		GAMSTON	SK70357658	1747

## GROUNDWATER UNIT: RETFORD (F10.3)

Licence No		Licensed Abstraction	Actual Abstraction
73/1	(Elkesley) (A)	22.73	22.14
73/2		0.62	0.74
73/6		0.009	0.009
73/15		0.069	0.087
74/3	(Ordsall) (A)		
74/3	(Whisker Hill) (A)	13.64	10.47
74/5	(Grove) (A)	13.64	9.42
74/11		0.004	0.004
74/19		0.59	0.055
74/22		0.012	0.012
74/24		1.04	0.46
74/40		0.10	0.028
74/49		0.37	0.37
74/50		0.19	0.18
74/61		0.31	0.31
74/63		<u>0.56</u>	<u>0.52</u>
		<u>53.88</u>	<u>44.74</u>
Public Water Supply		50.01	41.97
Private Water Supply		3.87	2.77

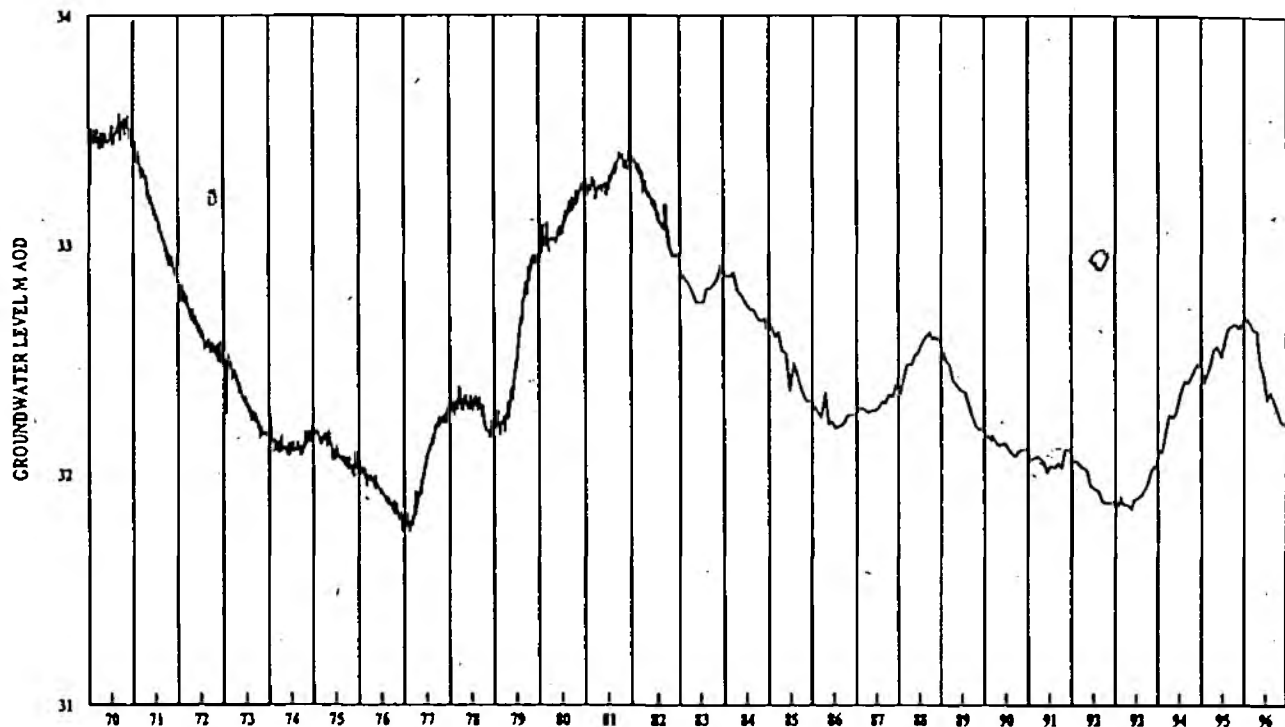
### SUMMARY

#### Resource Balance

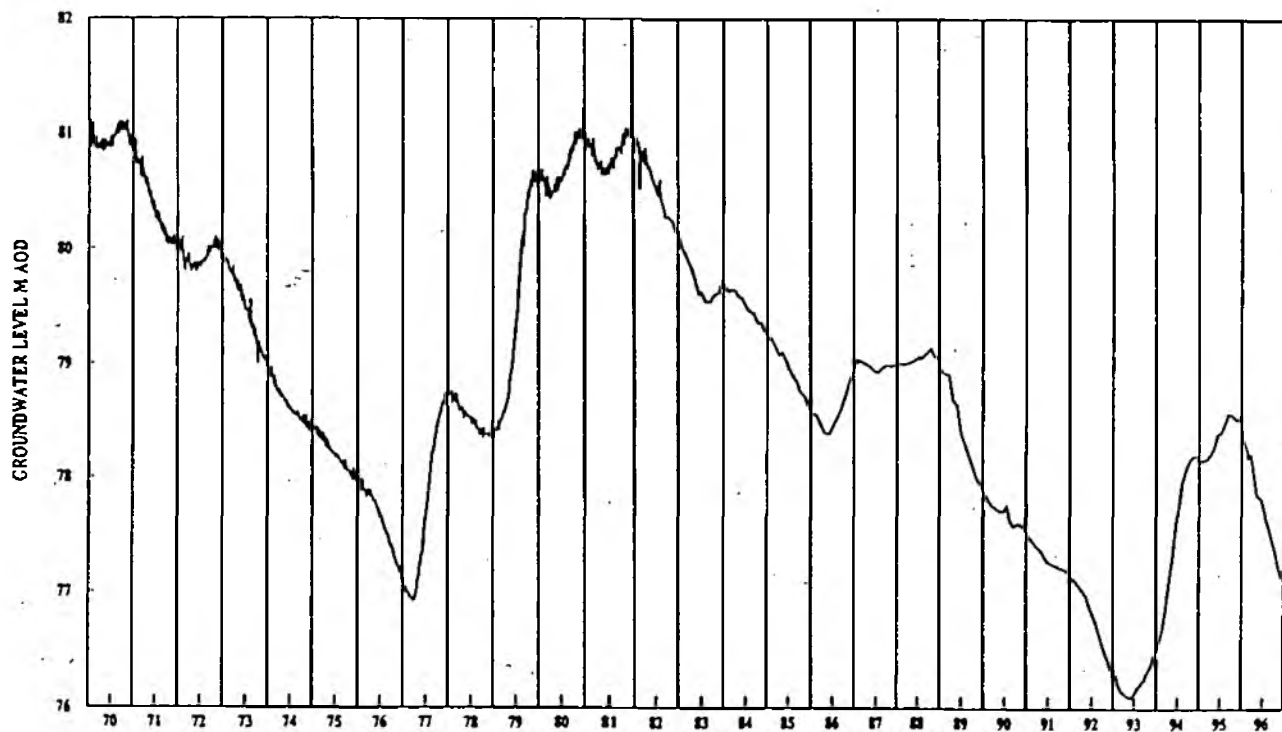




# GROUNDWATER UNIT: THORESBY (F10.4)



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		MORRIS DANCERS	SK64557255	1730



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		PEAFIELD	SK64345602	1732

## GROUNDWATER UNIT: THORESBY (F10.4)

Licence No	Licensed Abstraction	Actual Abstraction
64/47 (Markham Clinton) (ST)	22.73	19.44
69/35 (Newton on Trent) (A)	9.09	7.02
70/1* (Boughton) (ST)	(20.46)	8.67
70/31	0.62	0.198
70/75	3.29	2.58
70/81 ( replacement for 70/70)	2.93	2.93
71/1** (Budby) (ST) )	15.44	7.71
71/41** (Budby Forest) (ST) )	(10.00)	6.59
72/3	0.16	0.084
72/21	<u>0.41</u>	<u>0.33</u>
	<u>75.13</u>	<u>55.55</u>

\* Group licence, covering 9 sources (8 in F10.5), is 74.03; individual licences given in brackets

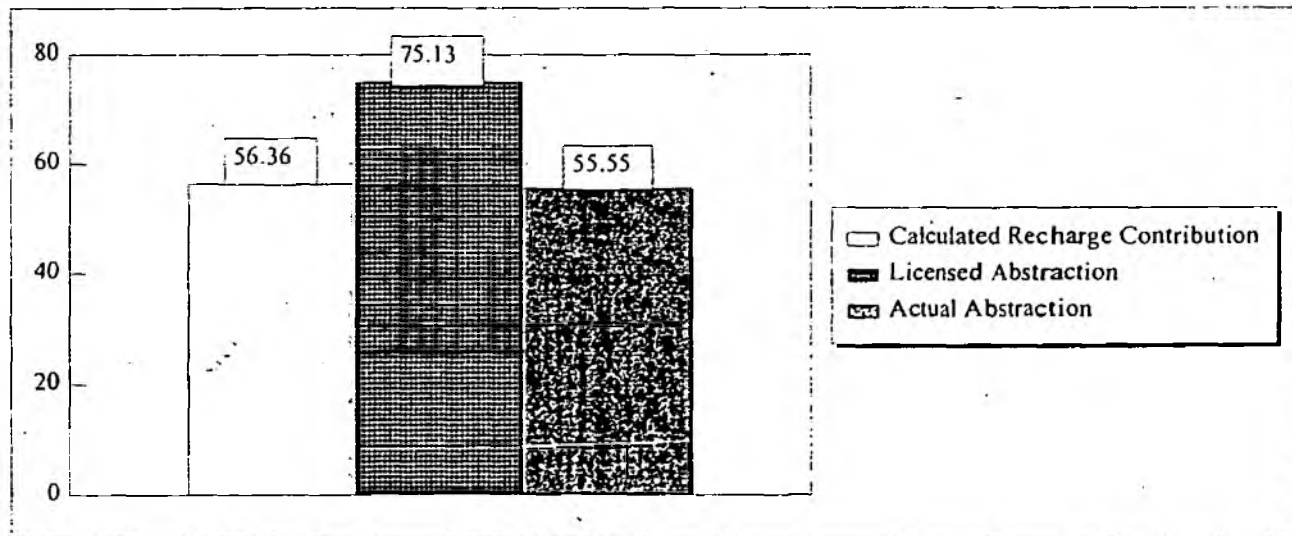
\*\* Joint licence of which no more than 10.0 can be abstracted at Budby Forest

CROWN EXEMPTION : Rampton Hospital : 0.15

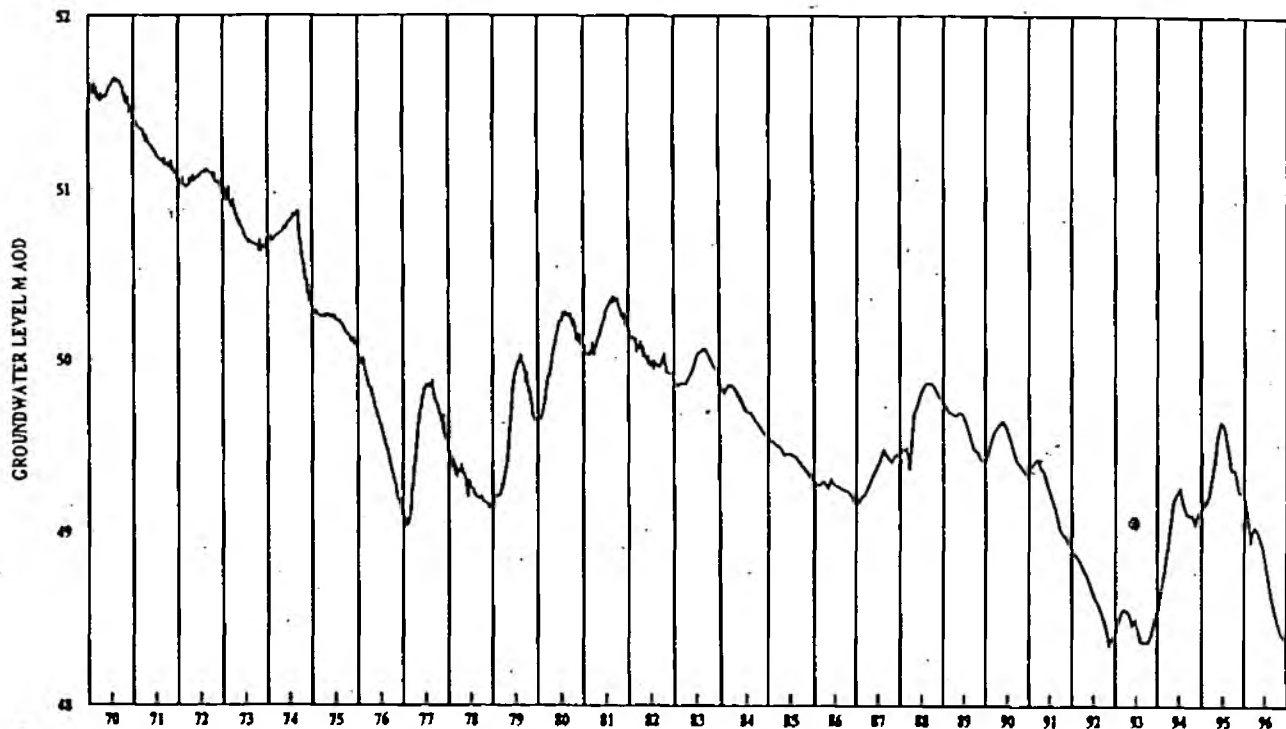
Public Water Supply	67.72	49.42
Private Water Supply	7.41	6.13

### SUMMARY

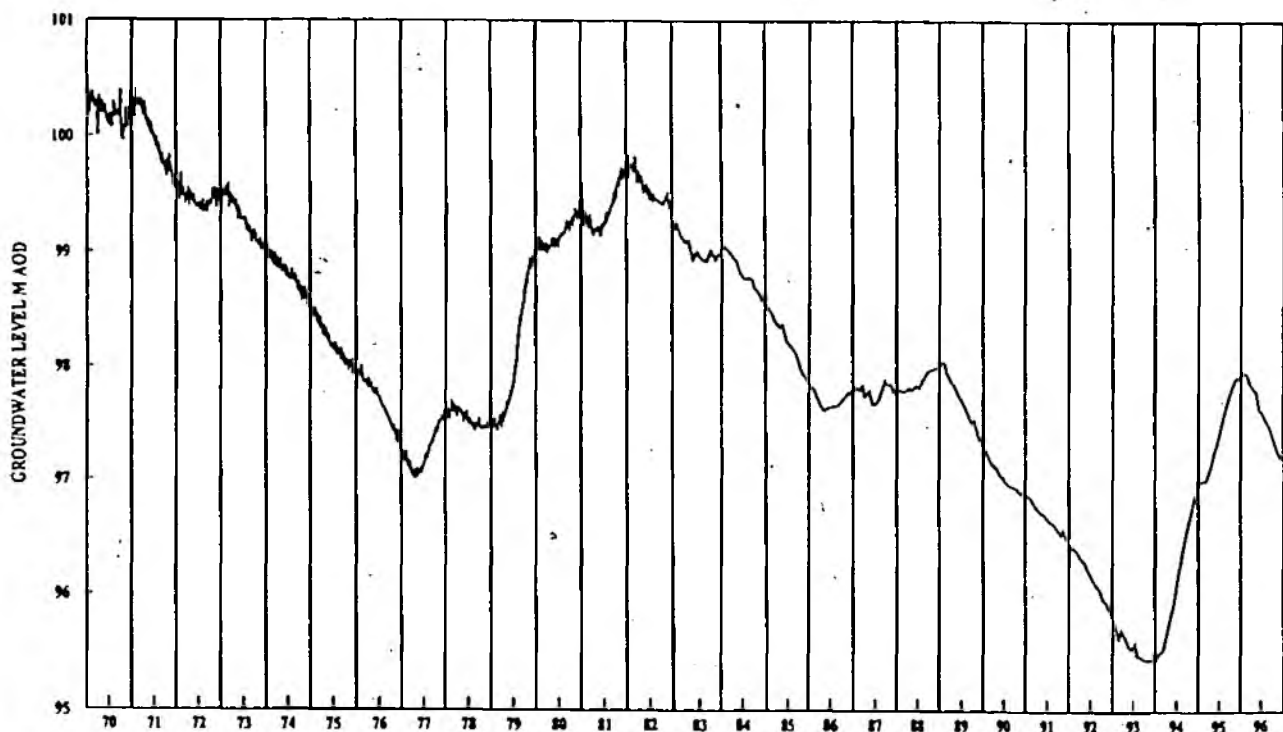
#### Resource Balance



# GROUNDWATER UNIT: RAVENSHEAD (F10.5)



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		OXTON	SK62435190	1738



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		KIGHILL	SK55575315	1740

# GROUNDWATER UNIT: RAVENSHEAD (F10.5)

Licence.No	Licensed Abstraction	Actual Abstraction
63/4** (Bestwood) (ST)	) (14.04)	) 8.25
63/4** (Papplewick) (ST)	)	)
63/85* (Normans Hollow) (ST)	(4.00)	0.00
63/87	0.007	0.00
63/103 (replacement for 63/10)	1.25	1.25
64/9	0.002	0.002
64/24	0.004	0.004
64/44** (Burton Joyce) (ST)	(25.07)	13.12
64/45** (Lambley) (ST)	(15.04)	7.34
64/46** (Salterford) (ST)	(3.42)	0.00
64/48** (Farnsfield) (ST)	(9.09)	2.55
64/49** (Epperstone) (ST)	(4.01)	2.17
64/54	1.25	0.76
64/62	0.027	0.00
64/76	0.012	0.012
64/124	0.009	0.009
64/151	3.50	3.41
64/196	0.33	0.24
64/197	0.21	0.21
64/198	0.69	0.69
64/199	1.23	1.11
64/200	0.15	0.15
64/203	0.47	0.33
64/204	0.36	0.32
64/205	0.23	0.22
64/212	0.14	0.14
64/214	0.25	0.14
64/215	0.16	0.18
64/216	0.17	0.146
64/217	0.30	0.34
64/218	0.21	0.20
64/220	0.27	0.26
64/221	0.17	0.091
64/227 + (Blidworth) (ST)	(3.00)	1.87
64/228 + (Far Baulker) (ST)	(9.00)	8.89
64/229** (Halam) (ST)*	(30.08)	19.60
64/230	0.18	0.19
64/237	0.01	(NR) 0.01
64/238	0.14	0.07
64/243	0.35	0.33
64/246	0.007	0.007
64/247	0.33	0.107
64/260	0.13	0.128
64/268	0.44	0.294
67/14** (Clay Lane) (ST)	(4.00)	1.73
69/36 (South Scarle) (A)	0.93	0.00
69/120** (Caunton) (ST)	(12.03)	6.56
70/2* (Rufford) (ST)	(15.00)	13.16

## GROUNDWATER UNIT: RAVENSHEAD (F10.5)

70/9	1.25	0.35
70/12	0.009	0.011
70/20	0.002	0.002
70/56	0.22	0.20
70/59	0.17	0.16
70/62	0.32	0.322
70/63	0.14	0.097
70/64	0.27	0.13
70/65 * (Amen Corner) (ST)	(15.00)	9.53
70/66 * (Clipstone) (ST)	(8.00)	0.00
70/67* (Rainworth) (ST)	(6.00)	2.71
70/68* (Ompston) (ST)	(25.00)	26.16
70/69* (Rushley) (ST)	(3.00)	0.00
70/71* (Clipstone Forest) (ST)	(10.00)	9.60
70/72	0.82	0.84
70/77	0.027	0.027
70/79 (replacement for 70/5)	3.11	0.50
70/80 (replacement for 70/8)	2.50	2.50
70/82	0.20	0.20
71/34	<u>0.32</u>	<u>0.29</u>
	<u>150.84</u>	<u>150.18</u>

\* Group licence, covering 9 sources (1 in F10.4), is 74.03; individual licences given in brackets

\*\* Group licence, covering 10 sources, is 62.49; individual licences given in brackets.

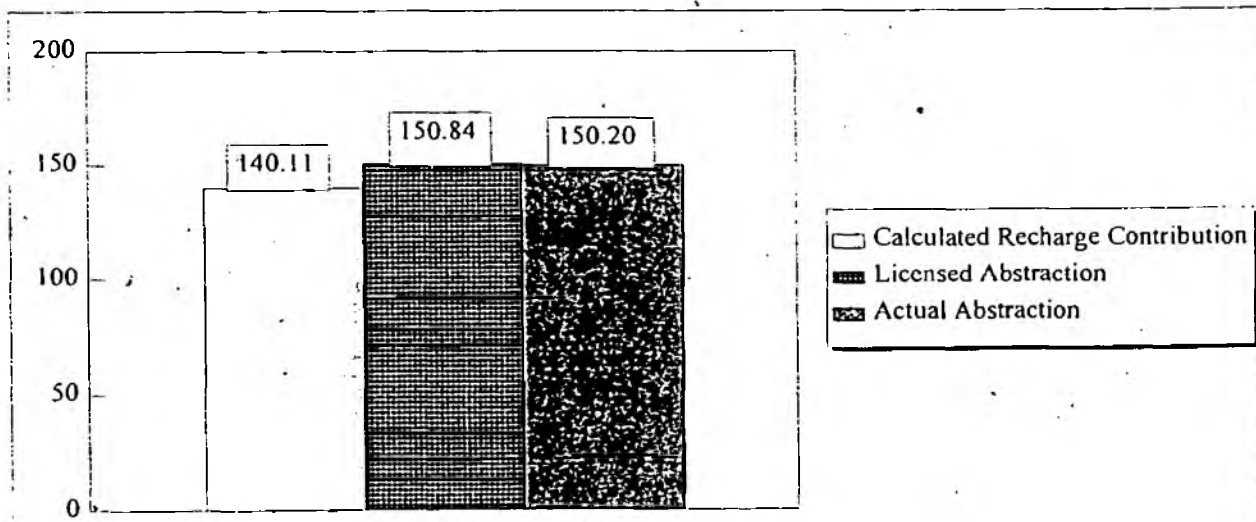
+ Group licence for Blidworth and Far Baulker is 11.50; individual licences given in brackets.

CROWN EXEMPTION : RAF Syerston : 0.028

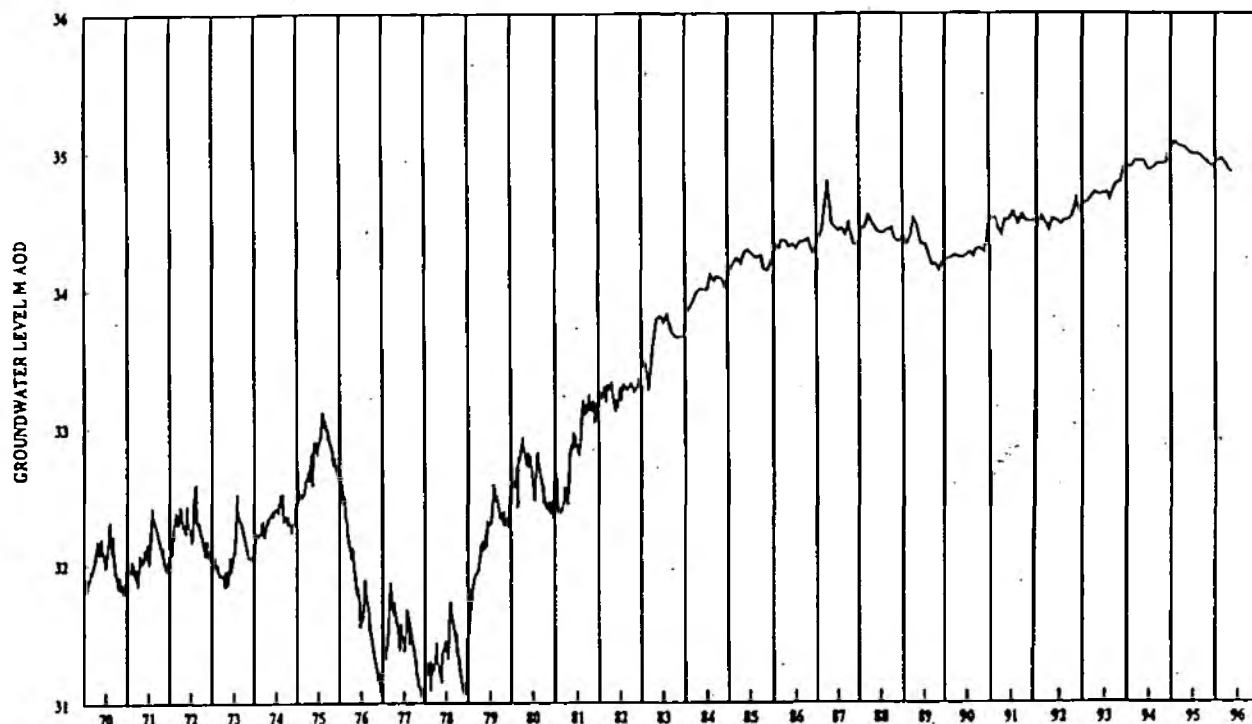
Public Water Supply	128.49	133.22
Private Water Supply	22.35	16.95

### SUMMARY

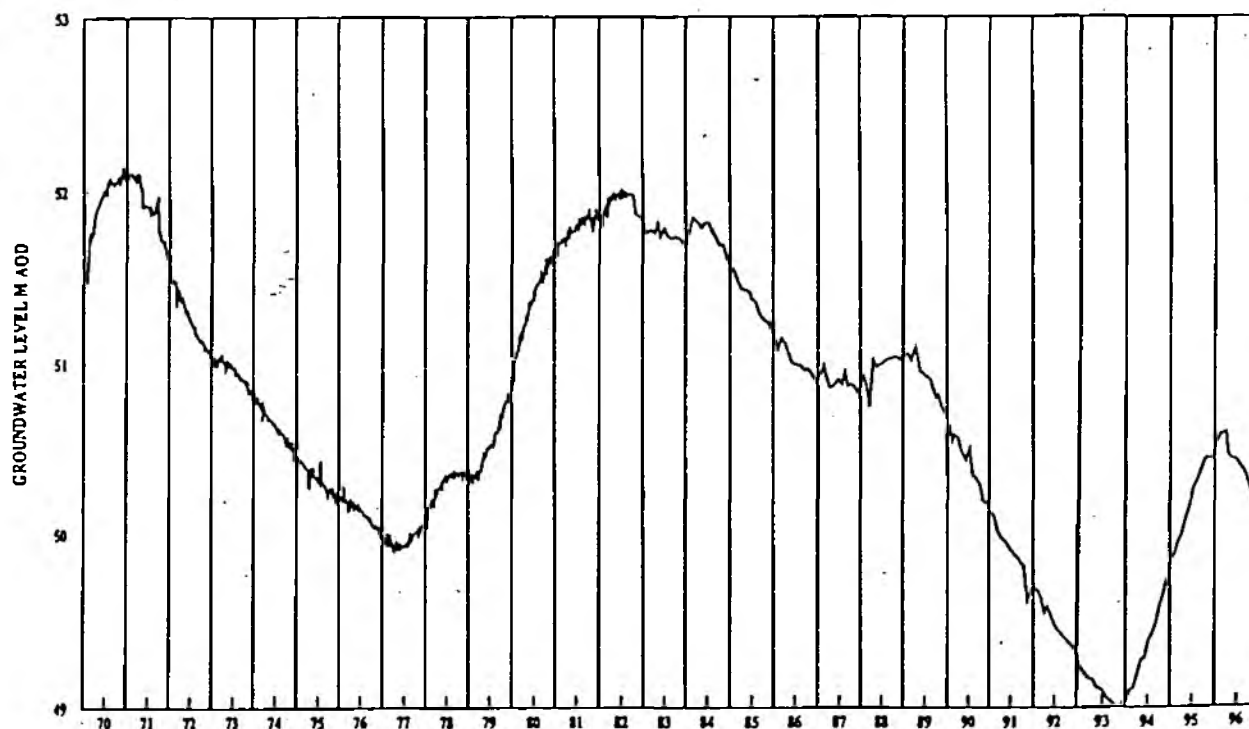
#### Resource Balance



# GROUNDWATER UNIT: WOLLATON (F10.6)



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SHIPSTONES BREWERY	SK5574201	1743



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		HAZEL HILL	SK56634639	1737

# GROUNDWATER UNIT: WOLLATON (F10.6)

<u>Licence No</u>	<u>Licensed Abstraction</u>		<u>Actual Abstraction</u>
61/46	0.87		0.88
61/48	0.002		0.002
62/1	0.40		0.0402
62/5	2.18		1.27
62/7	0.27		0.008
62/66	0.027		0.034
62/67	1.00		0.70
62/69	0.82		0.65
62/74	0.009	(NEW)	0.009
62/75	0.82	(NEW)	0.82
63/3 (Basford) (ST)	5.46		0.64
63/14	1.12		0.35
63/15	1.05		0.51
63/17	0.19		0.051
63/26	0.25		0.12
63/27	3.11		2.89
63/28	0.0008		0.0008
63/30	0.93		0.73
63/31	0.041		0.041
63/32	0.09		0.00
63/56	0.66		0.60
63/90	0.005	(NR)	0.005
63/98	1.37		0.77
63/101	1.06	(NEW)	0.31
64/3	1.37		0.59
64/6	0.045		0.006
64/11	0.93		0.60
64/16	4.36		0.00
64/18	0.87		0.00
64/59	0.13		0.016
64/117	0.03		0.00
64/226	0.89		0.72
64/233	0.82		0.786
64/244	0.18		0.39
64/249	0.27		0.18
64/257	1.34		1.11
64/266	0.59		0.41
64/269	0.15		0.14
64/278	1.52	(NEW)	1.52
66/21	0.45		0.25
67/71	0.03	(NEW)	0.03
	<u>35.71</u>		<u>18.19</u>

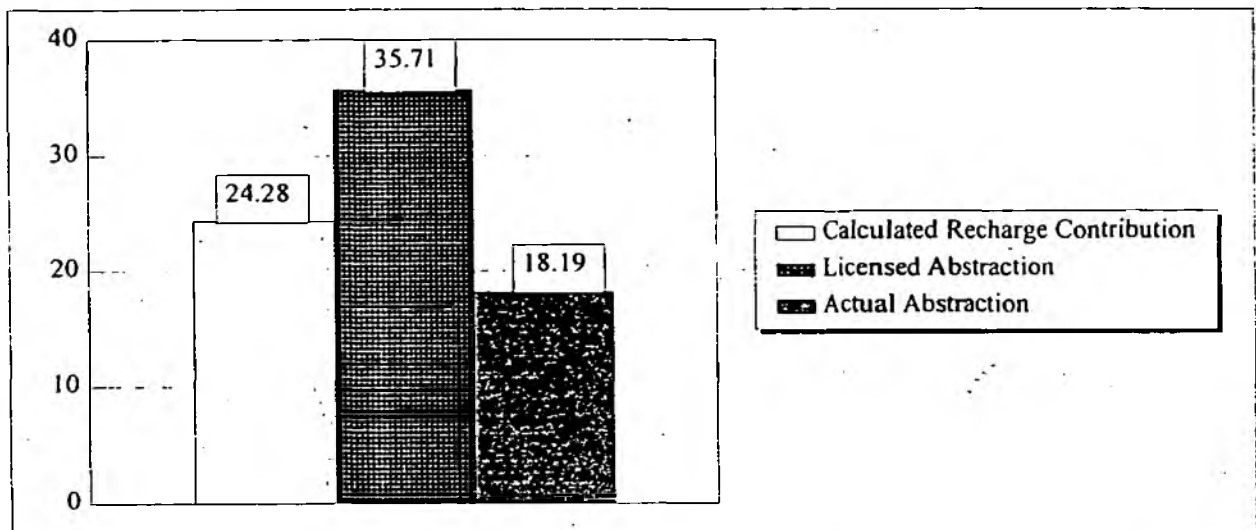
CROWN EXEMPTION : Bestwood Lodge : NR

Public Water Supply	5.46	0.64
Private Water Supply	30.25	17.55

## GROUNDWATER UNIT: WOLLATON (F10.6)

### SUMMARY

#### Resource Balance





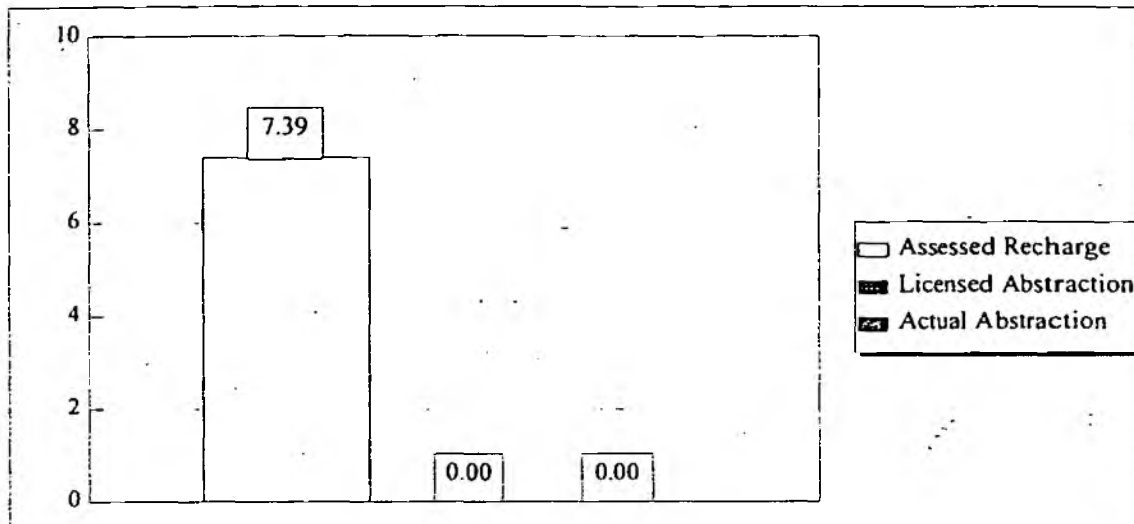
**GROUNDWATER UNIT : DERBY NORTH (F 2.1) [Fig 3]**

There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: DERBY NORTH (F2.1) [Fig 3]

### SUMMARY

#### Resource Balance



#### Unit Classification: D

Aquifer is known to be of limited thickness and highly faulted. A few small industrial sources have been supported by this unit in the past. No objection in principle to new licence applications. Borehole yields are invariably poor; little information is available on groundwater quality.

#### Classification History

1/10/83 - 30/09/91	E*
1/10/91 -	D

**GROUNDWATER UNIT : MUGGINGTON (F 2.2) [Fig 3]**

There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: MUGGINGTON (F2.2) [Fig 3]

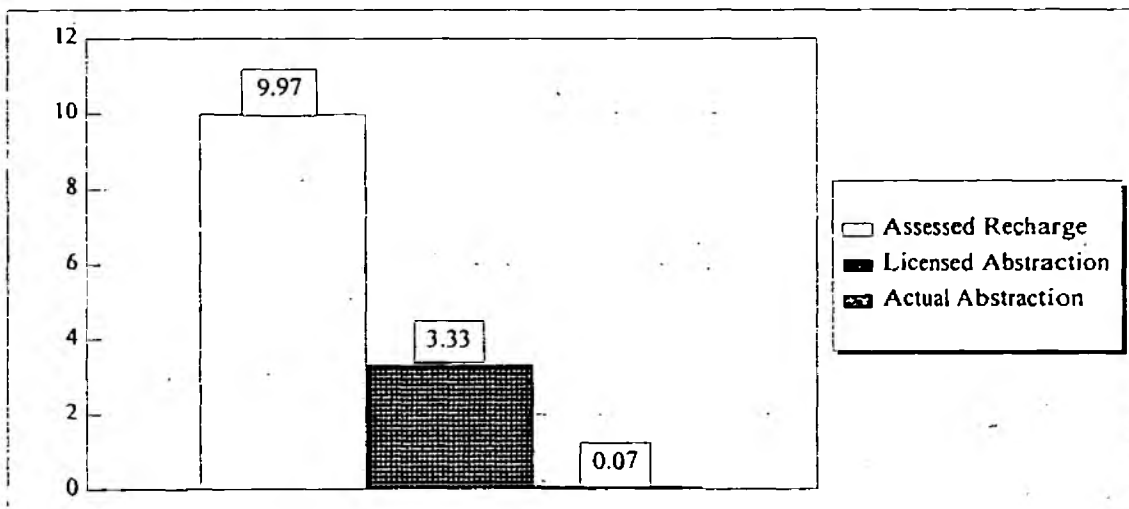
Licence No	Licensed Abstraction	Actual Abstraction
47/28	0.045	0.045
47/32	<u>3.28</u>	<u>0.49</u>
	<u>3.33</u>	<u>0.53</u>

### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
47/32	0.49	95	0.47

### SUMMARY

#### Resource Balance



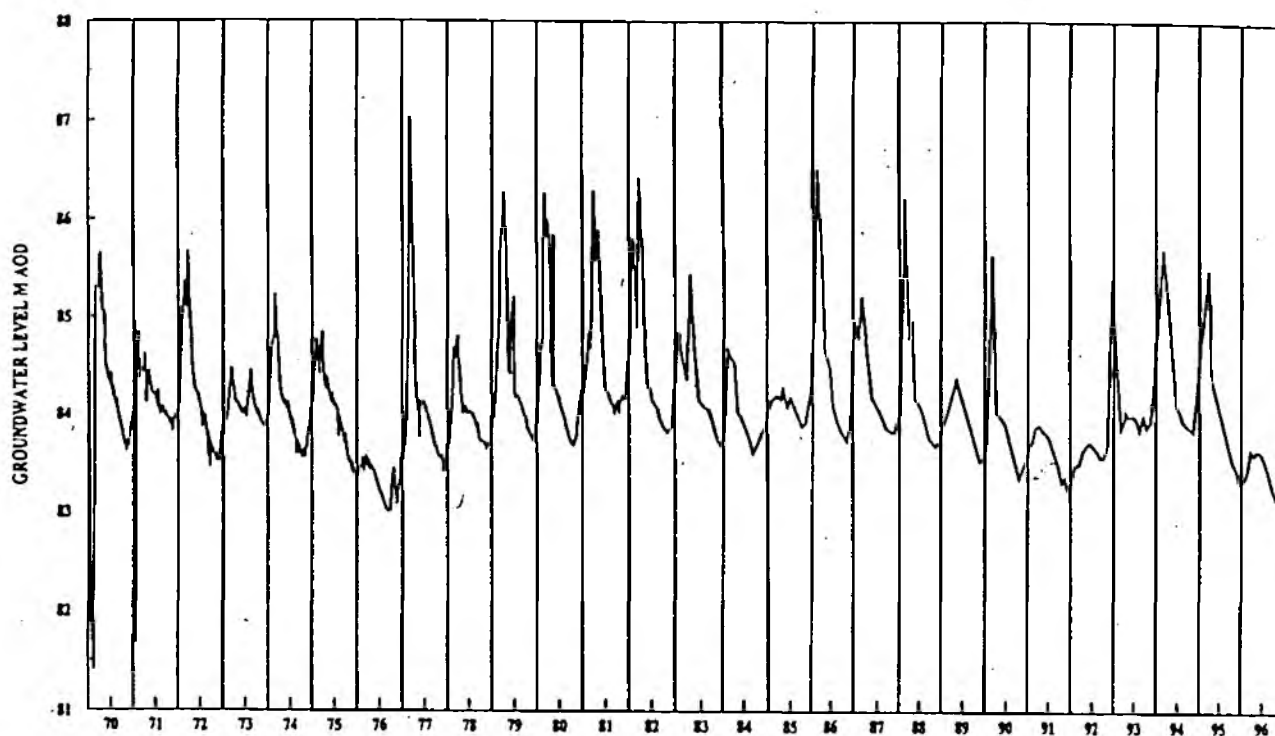
#### Unit Classification: D

Aquifer is extensively fragmented and has limited thickness. No objection in principle to new applications but baseflow protection has to be considered.

#### Classification History

1/10/83 - 30/09/91	E*
1/10/91 -	D

# **GROUNDWATER UNIT: KIRK LANGLEY (F2.3) [Fig 3]**



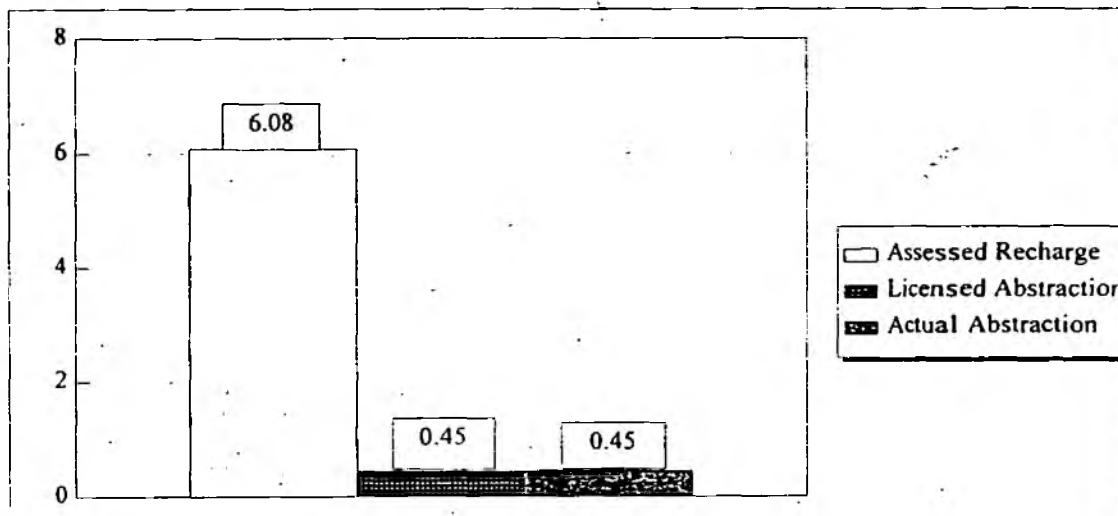
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SANDY LAKE	SK30023839	1401

## - GROUNDWATER UNIT: KIRK LANGLEY (F2.3) [Fig 3]

Licence No	Licensed Abstraction	Actual Abstraction
36/14	0.002	0.002
36/168	0.43	(NEW) 0.43
47/34	<u>0.014</u>	<u>0.014</u>
	<u>0.45</u>	<u>0.45</u>

### SUMMARY

#### Resource Balance



#### Unit Classification: D

Unit is extensively fragmented and has limited thickness. No objection in principle to new applications but baseflow protection has to be considered.

#### Classification History

1/10/83 - 30/09/91	E*
1/10/91 -	D

# **GROUNDWATER UNIT: SHIRLEY (F3.1) [Fig 5]**



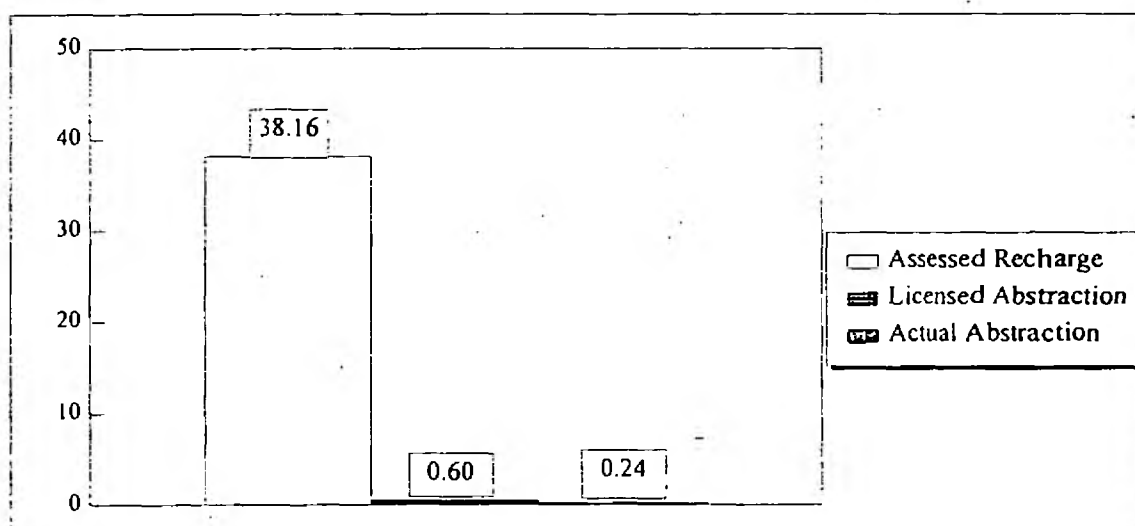
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BURTON SHUTTS	SK25394431	1412

## GROUNDWATER UNIT: SHIRLEY (F3.1) [Fig 5]

Licence No	Licensed Abstraction	Actual Abstraction
33/6	0.58	0.23
34/9	0.007	0.007
34/10	0.001	0.001
47/4	0.002	0.002
47/20	0.005	0.005
47/25	0.002	0.002
47/31	<u>0.006</u>	<u>0.006</u>
	<u>0.60</u>	<u>0.24</u>

### SUMMARY

#### Resource Balance



#### Unit Classification: D

The resource balance indicates that this unit has substantial potential for development. However, borehole yields are extremely low as illustrated by the abandoned STW sources at Ladyhole, Rodsley and Yeldesley. No objection in principle to new licence applications, but baseflow protection has to be taken into account.

#### Classification History

1/10/83 - 30/09/91	E*
1/10/91 -	D



**GROUNDWATER UNIT : MAYFIELD (F 3.2) [Fig 5]**

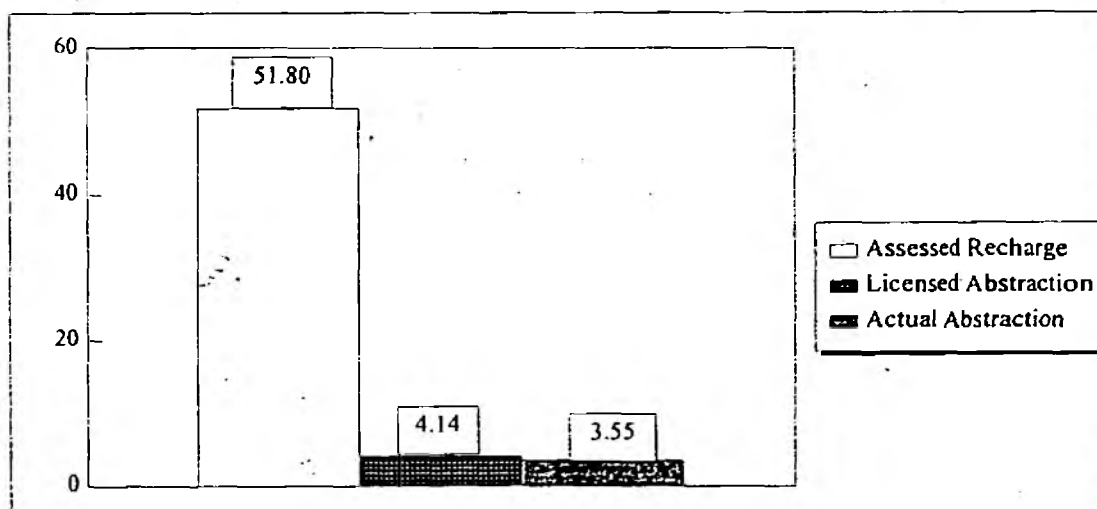
There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: MAYFIELD (F3.2) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
29/1	0.005	0.005
29/3	0.002	0.002
29/4	0.02	0.02
29/5	0.01	0.01
29/13	0.0006	0.001
29/14	0.002	0.002
29/19	0.001	0.001
29/35	0.016	0.016
29/38	0.0006	0.0006
29/43	2.14	2.66
29/44 (Mayfield) (SS)	0.52	0.51
29/54	0.005	0.005
29/69	0.0003	0.00
33/11	0.014	0.014
33/13	0.0005	0.0005
33/27	0.002	0.002
33/50 (Cubley) (ST)	1.10	0.00
33/91	0.27	(NEW) 0.27
33/92	<del>0.03</del> 4.14	(NEW) <del>0.03</del> 3.55
Public Water Supply	1.62	2.66
Private Water Supply	2.52	0.90

### SUMMARY

#### Resource Balance



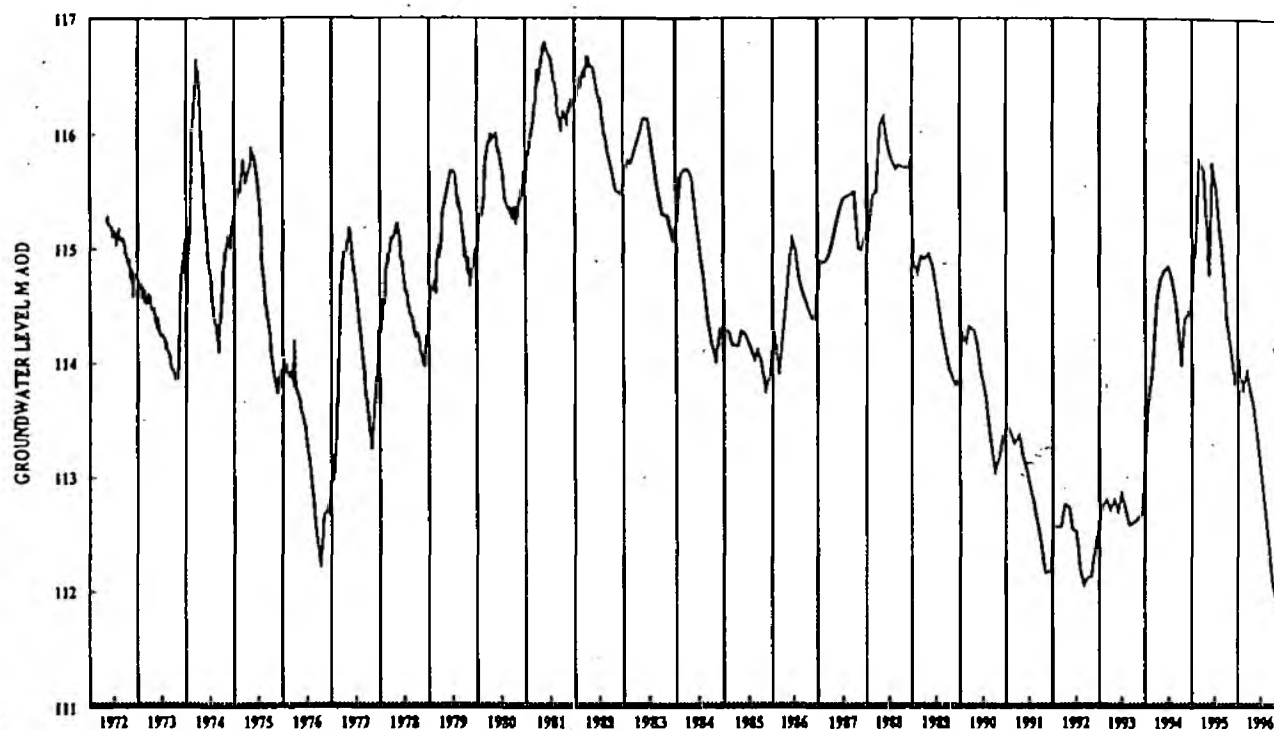
### Unit Classification: D

The resource balance indicates that this unit has substantial potential for development. As in the adjacent Shirley Unit, however, borehole yields are extremely low, as illustrated by the STW and SS sources; STW have abandoned their source at Sturston due to very poor yield. No objection in principle to new licence applications, but baseflow protection has to be taken into consideration.

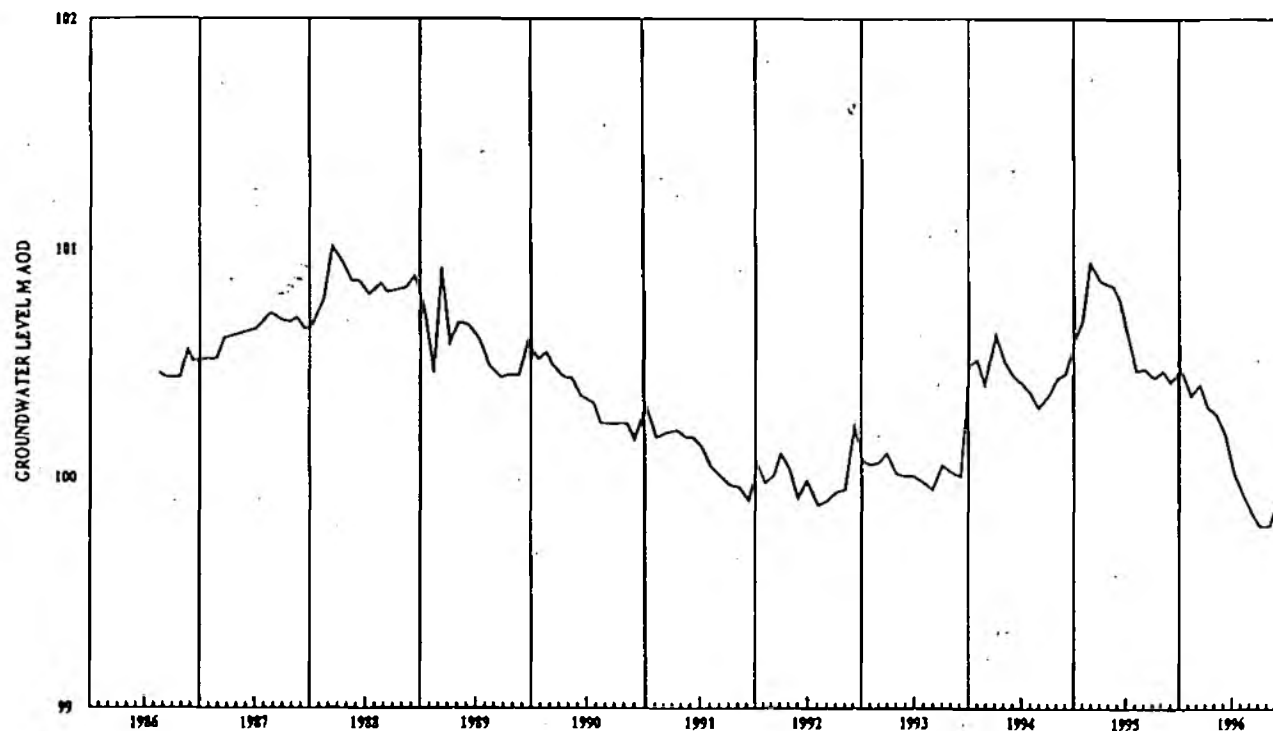
### Classification History

1/10/83 - 30/09/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: ALTON (F3.3) [Fig 5]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WOOTTON LODGE	SK09684397	1405



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		ALTON TOWERS	SK06764321	1456

## GROUNDWATER UNIT: ALTON (F3.3) [Fig 5]

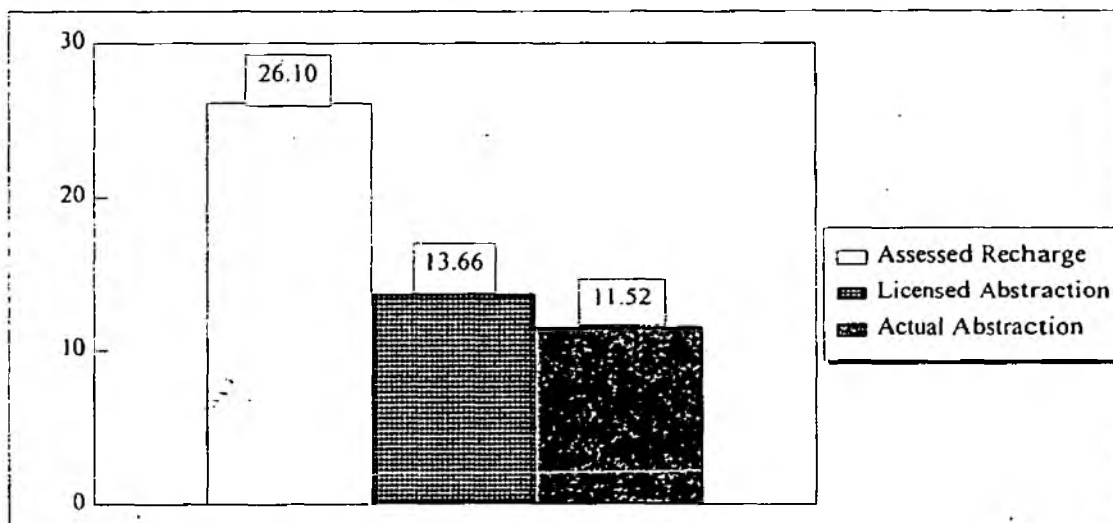
Licence No	Licensed Abstraction	Actual Abstraction
30/64	0.002	0.002
30/113	0.0009	0.0009
30/115 (Hulme) (SS)*	( 4.11)	0.75
30/126	0.005	0.005
30/127	0.005	0.005
30/140 (Eastwall) (ST)	0.93	0.78
30/163	0.25	0.13
30/167 (Crumpwood) (SS)*	( 7.05)	6.99
30/169	0.0002	0.0002
30/205	0.53	0.34
32/13 (Monkhouse) (C)	<u>2.84</u>	<u>2.53</u>
	<u>13.66</u>	<u>11.52</u>

\* aggregate licence must not exceed 9.09 Ml/d

Public Water Supply	12.86	11.03
Private Water Supply	0.80	0.49

### SUMMARY

#### Resource Balance



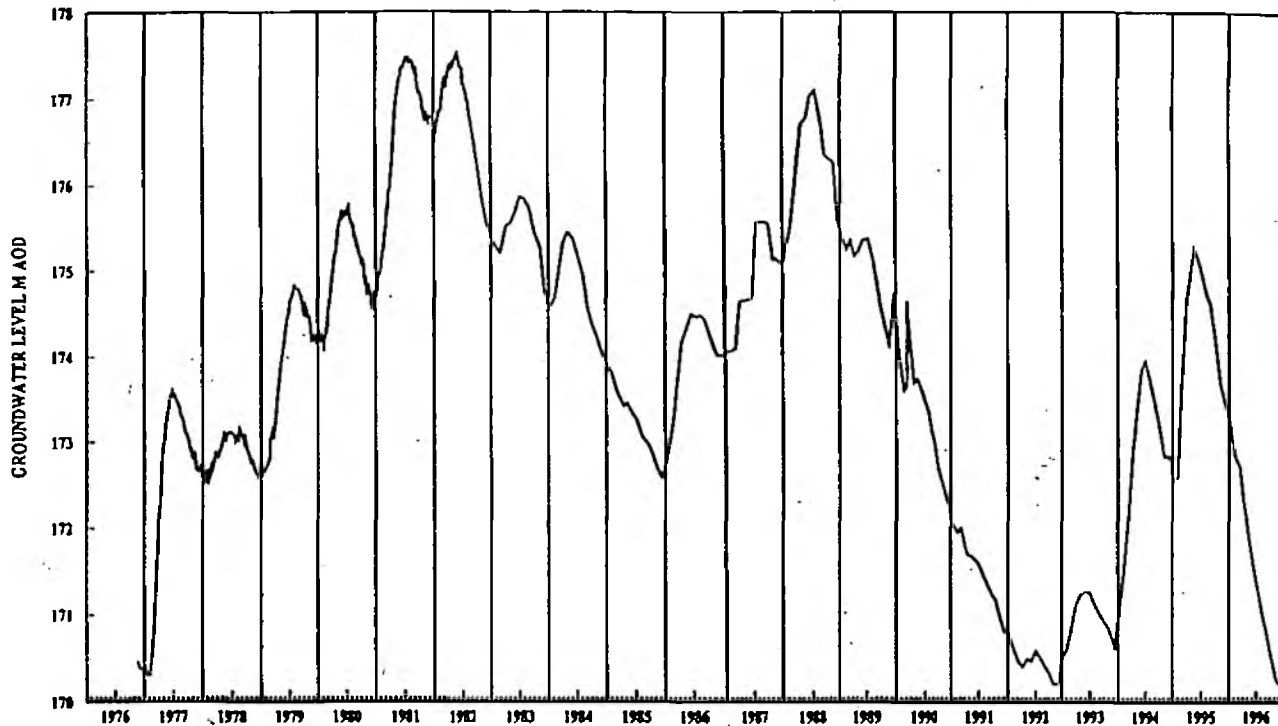
#### Unit Classification: C

Borehole yields and groundwater quality are variable; yields are very good in the Churnet Valley but poor away from the valley bottom. New licences can be considered but medium to large licences will have a compensation flow component in order to protect baseflow in the Rivers Churnet and Dove. No further licences, however, can be issued to the west of the River Tean in order to protect the limited recharge supporting the Monkhouse PWS abstraction.

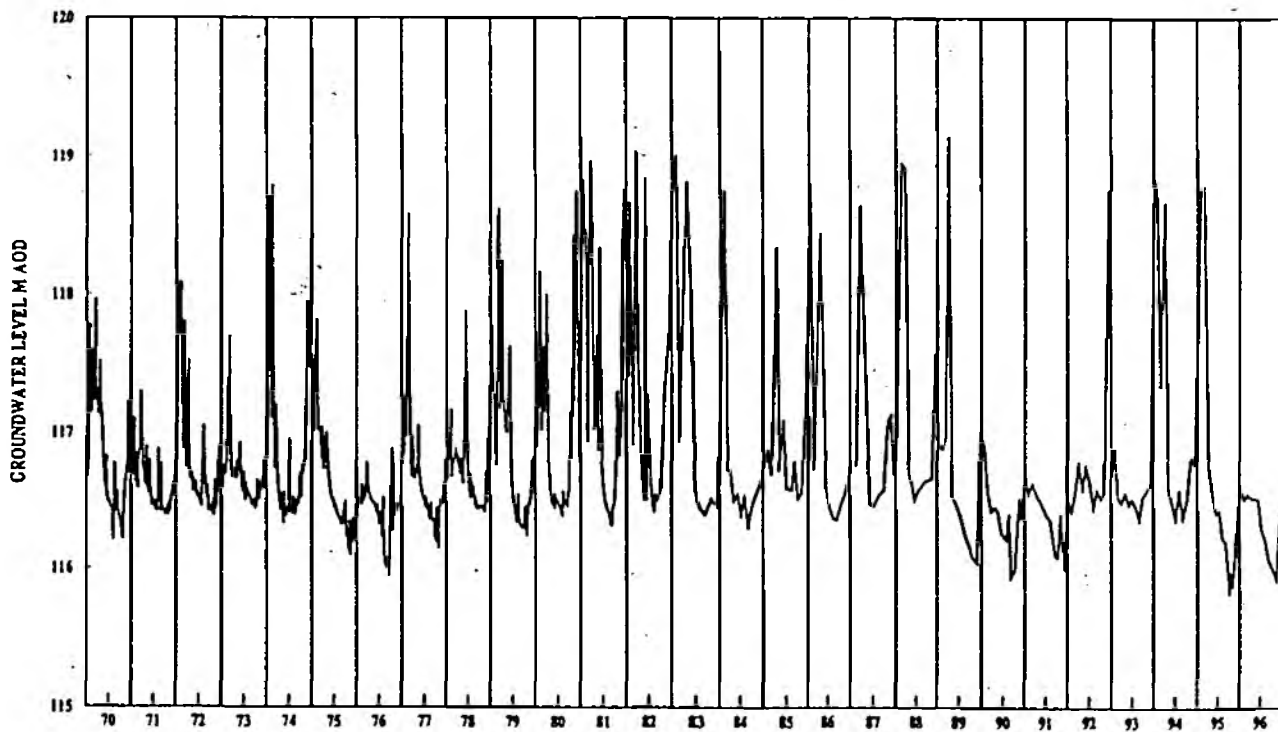
#### Classification History

1/10/83 - 30/9/90	E*
1/10/90 - 30/9/91	C*
1/10/91 -	C

# GROUNDWATER UNIT: GREATGATE (F3.4) [Fig 5]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SUNNYBANK FARM	SK03584064	1446



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		STUBWOOD WELL	SK09714000	1408

## GROUNDWATER UNIT: GREATGATE (F3.4) [Fig.5]

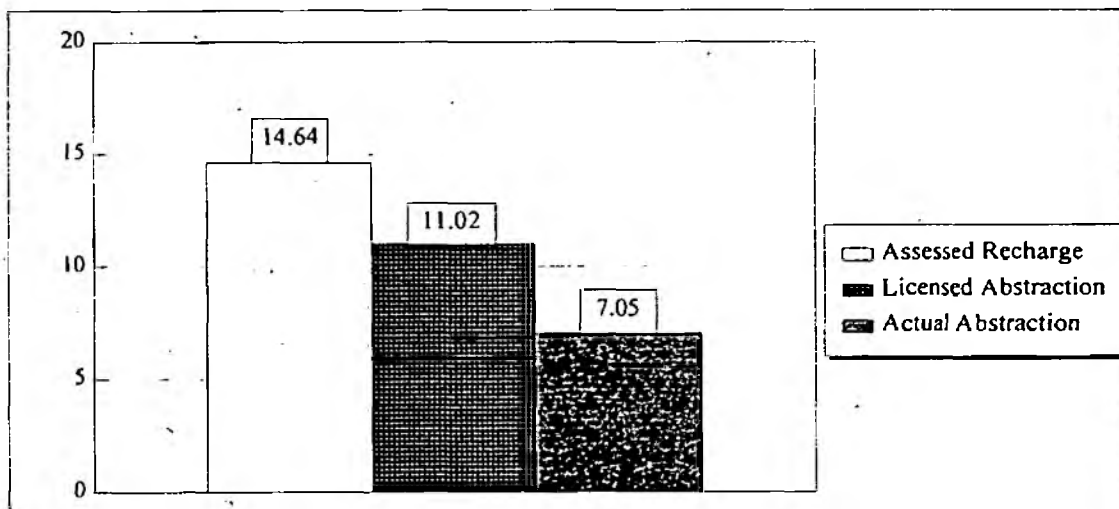
Licence No	Licensed Abstraction	Actual Abstraction
31/9	2.18	1.07
31/11	0.002	0.002
31/14	0.005	0.005
31/17 (Greatgate) (ST)	8.75	6.42
31/26	<u>0.085</u> <u>11.02</u>	<u>0.09</u> <u>7.58</u>
Public Water Supply	8.75	6.42
Private Water Supply	2.27	1.16

### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
31/9	1.07	50	0.53

### SUMMARY

#### Resource Balance



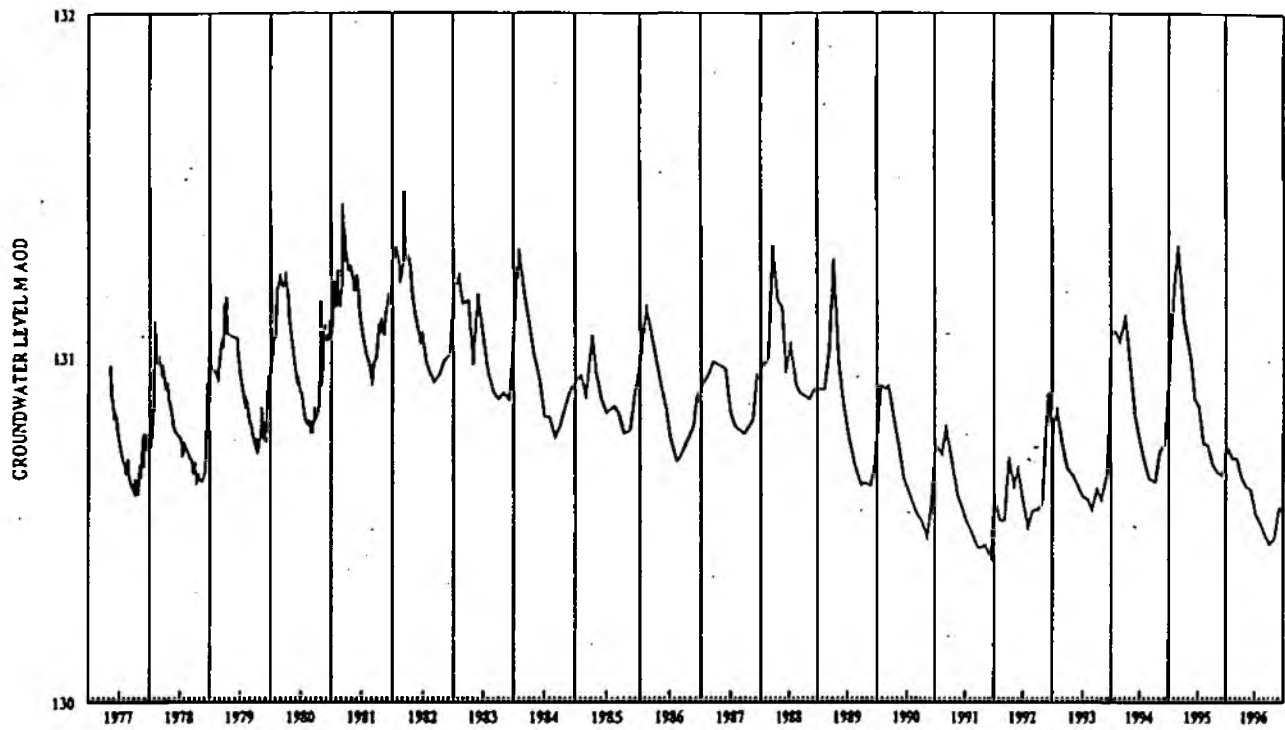
#### Unit Classification: A

Major low flow problems are still associated with the Croxden Brook and its tributaries in the vicinity of Greatgate PS. At times, parts of these streams dry up completely. No new licence applications can be considered, no matter how small.

#### Classification History

1/10/83 - 30/9/90	B *
1/10/90 - 30/9/91	B(TL)*
1/10/91 - 30/9/92	B(TL)
1/10/92 -	A

# GROUNDWATER UNIT: TEAN (F3.5) [Fig 5]



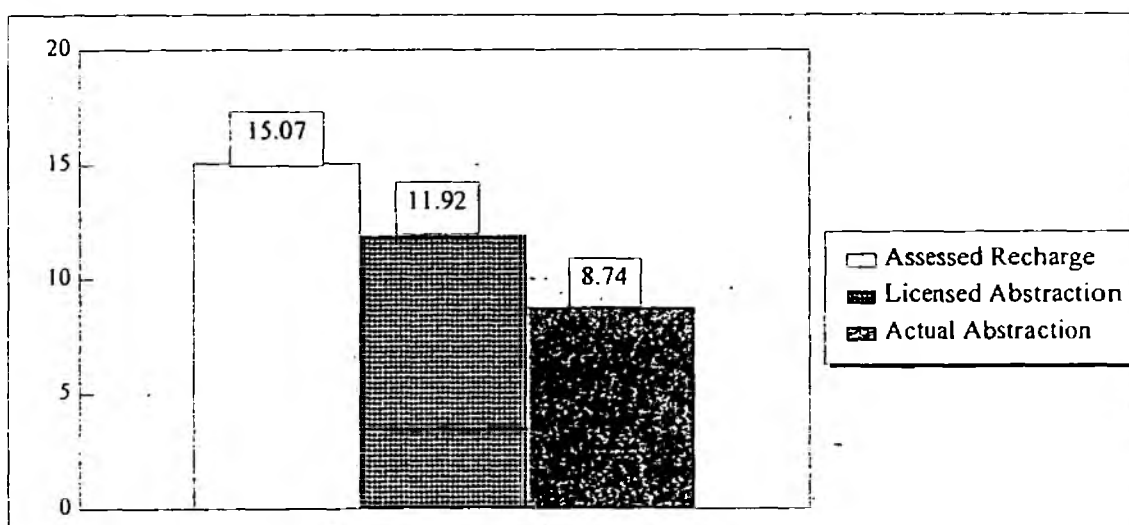
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		UPPER TEAN	SK00763972	1447

## GROUNDWATER UNIT: TEAN (F3.5) [Fig 5]

Licence No	Licensed Abstraction	Actual Abstraction
32/2	0.023	0.023
32/7	0.041	0.041
32/14 (Draycott) (ST)	4.55	2.90
32/27	1.91	1.13
32/28 (Tea) (ST)	<u>5.40</u>	<u>4.65</u>
	<u>11.92</u>	<u>8.74</u>
Public Water Supply	9.95	7.55
Private Water Supply	1.97	1.19

### SUMMARY

#### Resource Balance



#### Unit Classification: B

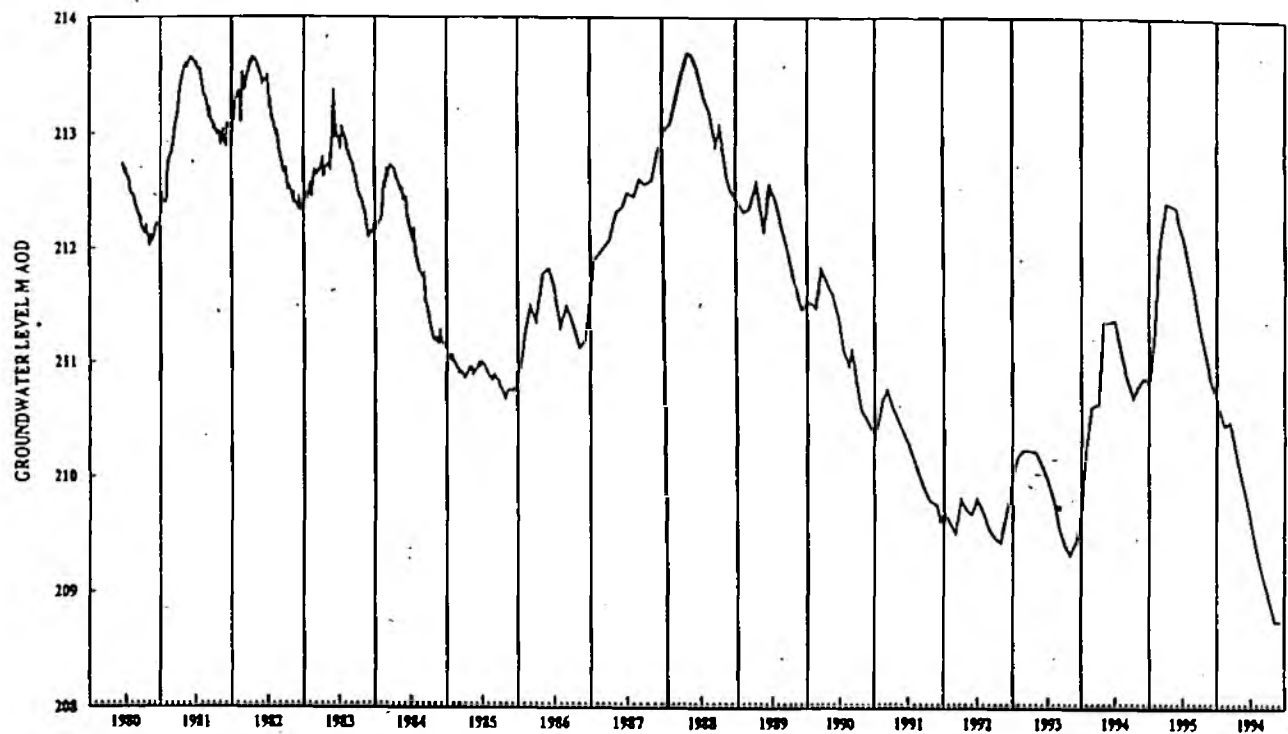
Assessed recharge probably enhanced by influent conditions in the River Tea in the vicinity of Tea PS. No objection in principle to new licence applications provided that baseflow protection is considered. The presumption against large licences reflects the fact that 80% of the assessed recharge is currently licensed.

#### Classification History

1/10/83 - 30/09/85	D*
1/10/85 - 30/09/87	C*
1/10/87 - 30/09/91	E*
1/10/91 - 30/11/94	D
1/12/94 -	B



# **GROUNDWATER UNIT: FORSBROOK (F3.6) [Fig 6]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		HARDTWICK FARM	SJ95714371	1034

## GROUNDWATER UNIT: FORSBROOK (F3.6) [Fig 6]

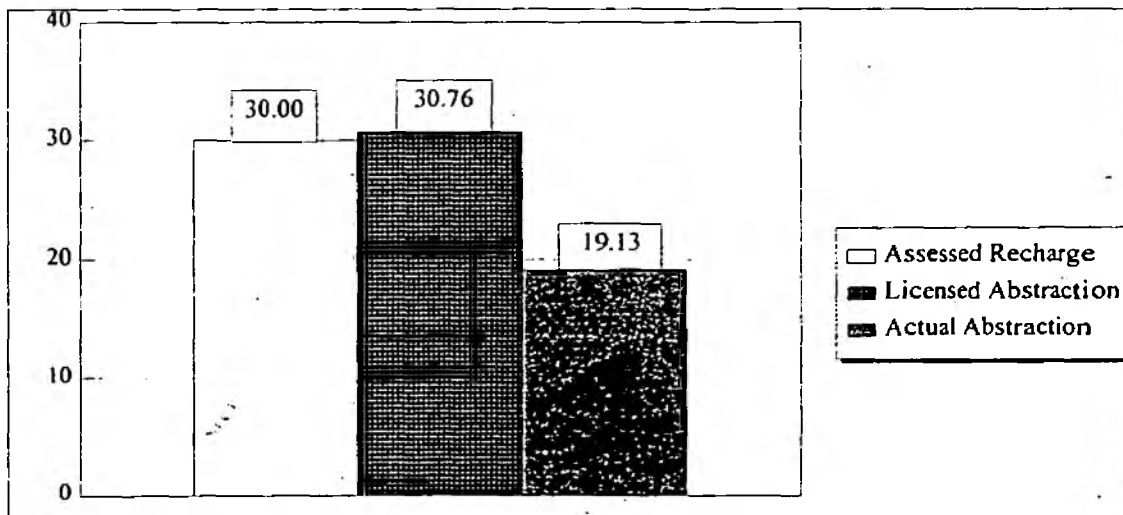
Licence No	Licensed Abstraction	Actual Abstraction
1/215* (Mossgate) (ST)	( 3.41)	1.99
6/5	0.002	0.002
6/6	0.0006	0.0006
6/28	0.002	0.002
6/51* (Sheepwash) (ST)	( 4.56)	4.15
6/51* (Wallmyres) (ST)	( 2.51)	1.17
6/54* (Meir) (ST)	( 4.33)	0.00
6/55* (Cresswell) (ST)	( 13.64)	9.78
6/62	0.001	0.001
6/67* (Fulford) (ST)	( 3.27)	1.42
6/82	0.96	0.61
32/22	<u>0.004</u>	<u>0.004</u>
	<b>30.76</b>	<b>19.13</b>

\*Aggregate licence, covering 6 sources is 29.79; individual licences given in brackets

Public Water Supply	29.79	18.51
Private Water Supply	0.97	0.62

### SUMMARY

#### Resource Balance



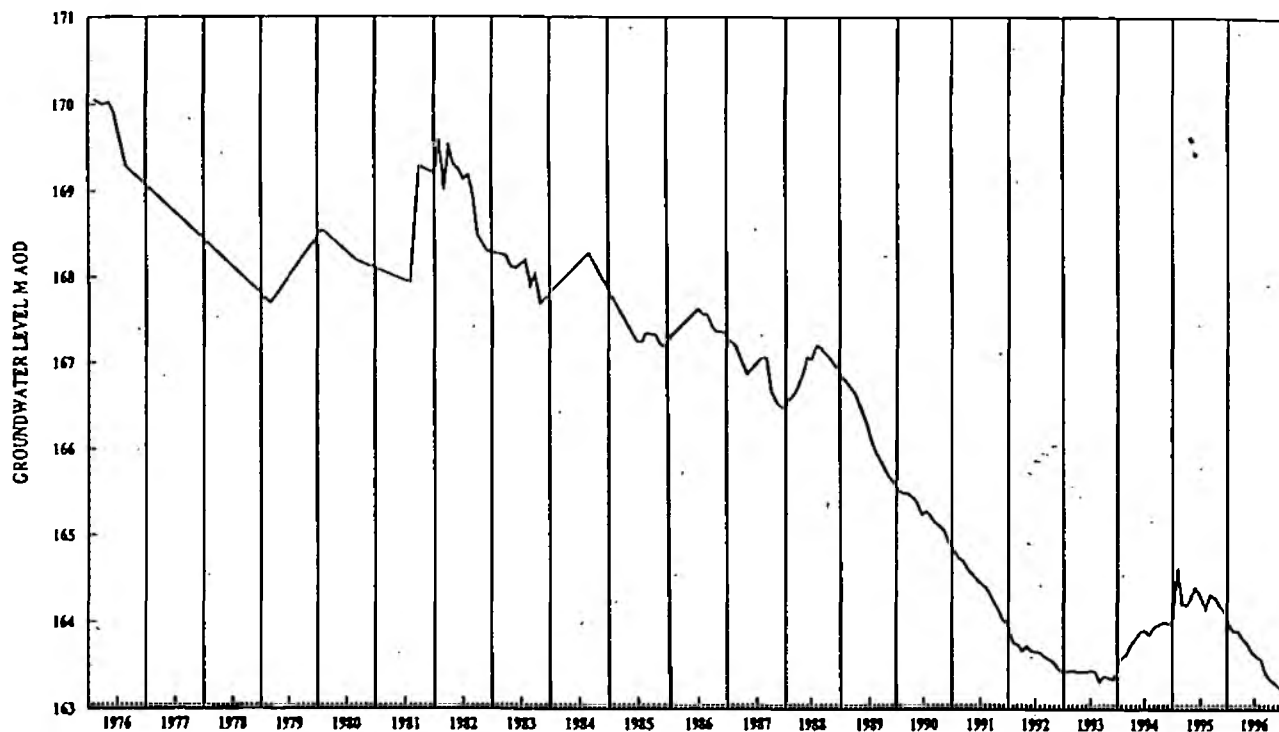
#### Unit Classification: A

The outcrop of this aquifer unit underlies the headwaters of the River Blithe which feeds into Blithfield Reservoir. There are downstream protected rights on this river and any remaining baseflow must therefore be protected. Concern remains over the relatively high unused component of the STW licences, as utilisation of this would further reduce baseflow. Consideration will, however, be given to applications by STW to drill replacement boreholes provided that there is no increase in actual abstraction.

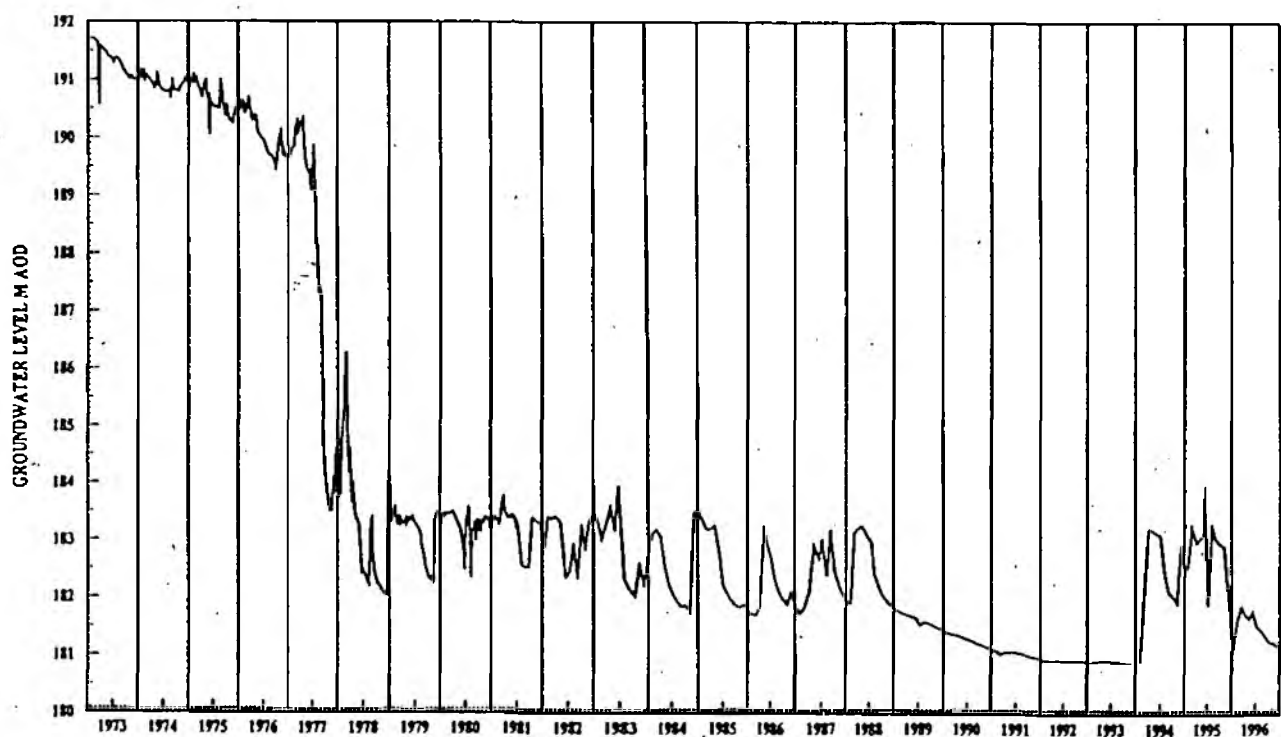
#### Classification History

1/10/83 - 30/9/89	D*
1/10/89 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: SPOT (F3.7) [Fig 6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SQUIRRELS LEAP	SJ92653745	1063



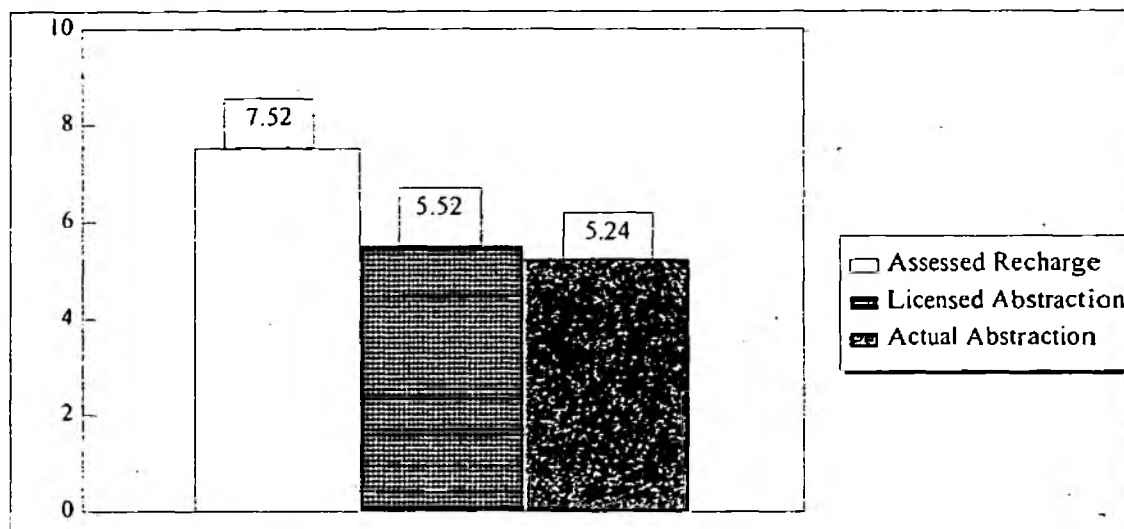
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		ROUGH CLOSE	SJ92723900	1004

## GROUNDWATER UNIT: SPOT (F3.7) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
1/13	0.007	0.007
1/34	0.009	0.009
1/61	0.002	0.002
1/200* (Spot) (ST) )		1.27
1/202* (Blacklake Plantation) (ST) )	(5.50)	2.86
1/202* (Moddershall) (ST) )		<u>1.09</u>
	<u>5.52</u>	<u>5.24</u>
*Aggregate licence covering 3 sources		
Public Water Supply	5.50	5.22
Private Water Supply	0.02	0.02

### SUMMARY

#### Resource Balance



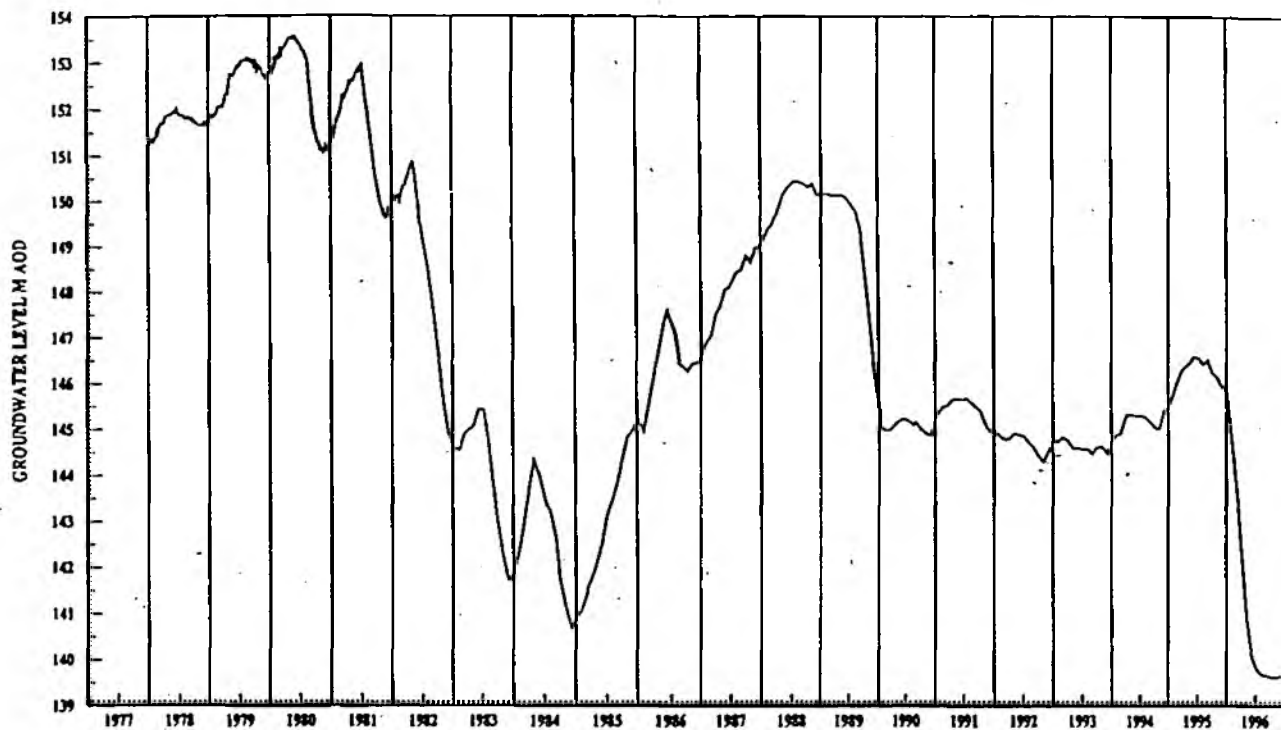
#### Unit Classification: A

Continuing high level of abstraction has caused falling groundwater levels and derogation of shallow private water supplies in parts of Moddershall village. It is likely that further pumping will reduce the remaining baseflow component draining out of the unit in the vicinity of Moddershall village. Assessed recharge is probably too high and needs to be revised.

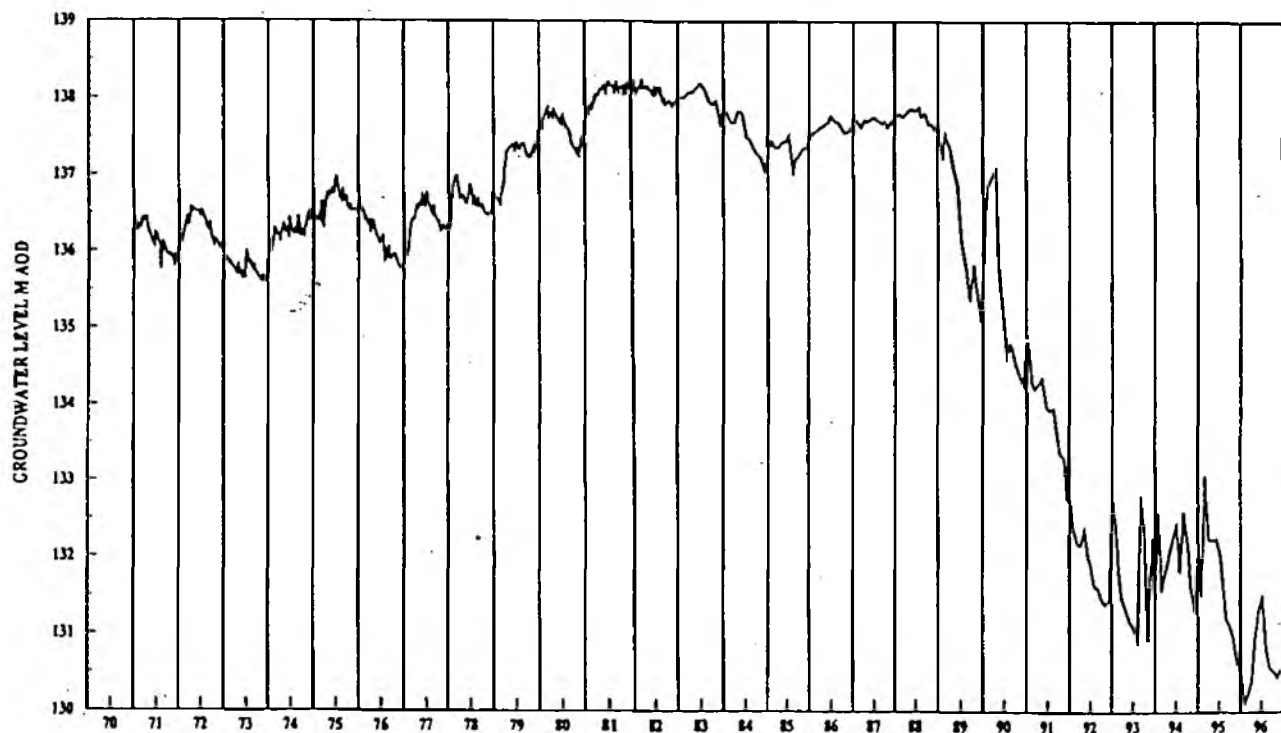
#### Classification History

1/10/83 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: LEEK (F3.8) [Fig 5]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		HIGH UP FARM	SJ97335813	1445



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SAINT EDWARDS	SJ97645362	1407

## GROUNDWATER UNIT: LEEK (F3.8) [Fig 5]

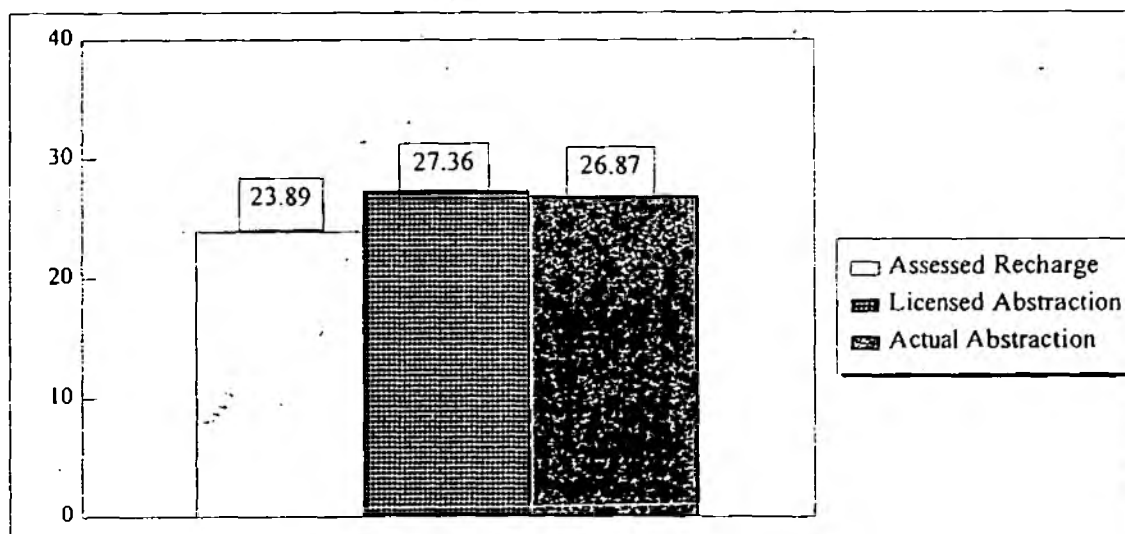
Licence No	Licensed Abstraction	Actual Abstraction
30/15	0.009	0.009
30/23	0.005	0.005
30/47	0.002	0.002
30/66	0.0002	0.0002
30/68	2.49	0.39
30/117	0.20	0.00
30/158	0.005	0.005
30/160* (Pool End) (ST)	)	7.22
30/183* (Highgate) (ST)	) (12.49)	4.73
30/184* (Abbey Green) (ST)	)	0.00
30/195* (Wall Grange) (ST)	) (13.62)	14.51
	27.36	26.87

\*Aggregate licence, covering 4 sources, is 24.65 in any one year, and 23.00 as a rolling 5 year average.  
Individual group licences given in brackets.

Public Water Supply	24.65	26.45
Private Water Supply	2.71	0.41

### SUMMARY

#### Resource Balance



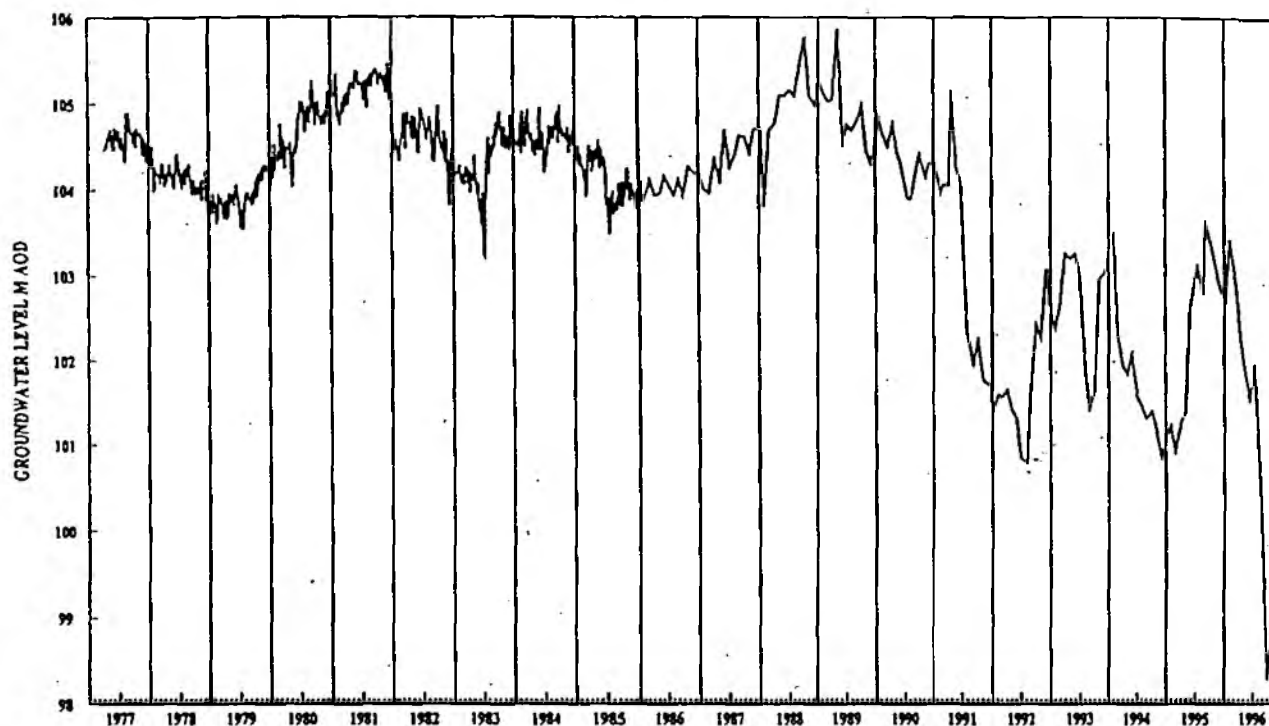
#### Unit Classification: A

The unit is overlicensed and supports high rates of PWS abstraction. No further licences can be considered, and more conjunctive use of groundwater and surface water is required to ease the high rate of groundwater abstraction. Groundwater levels declined rapidly in the south of the unit as abstraction rates at Wall Grange have increased. The levels are now beginning to stabilise. The Abbey Green borehole remains disused due to localised water quality problems.

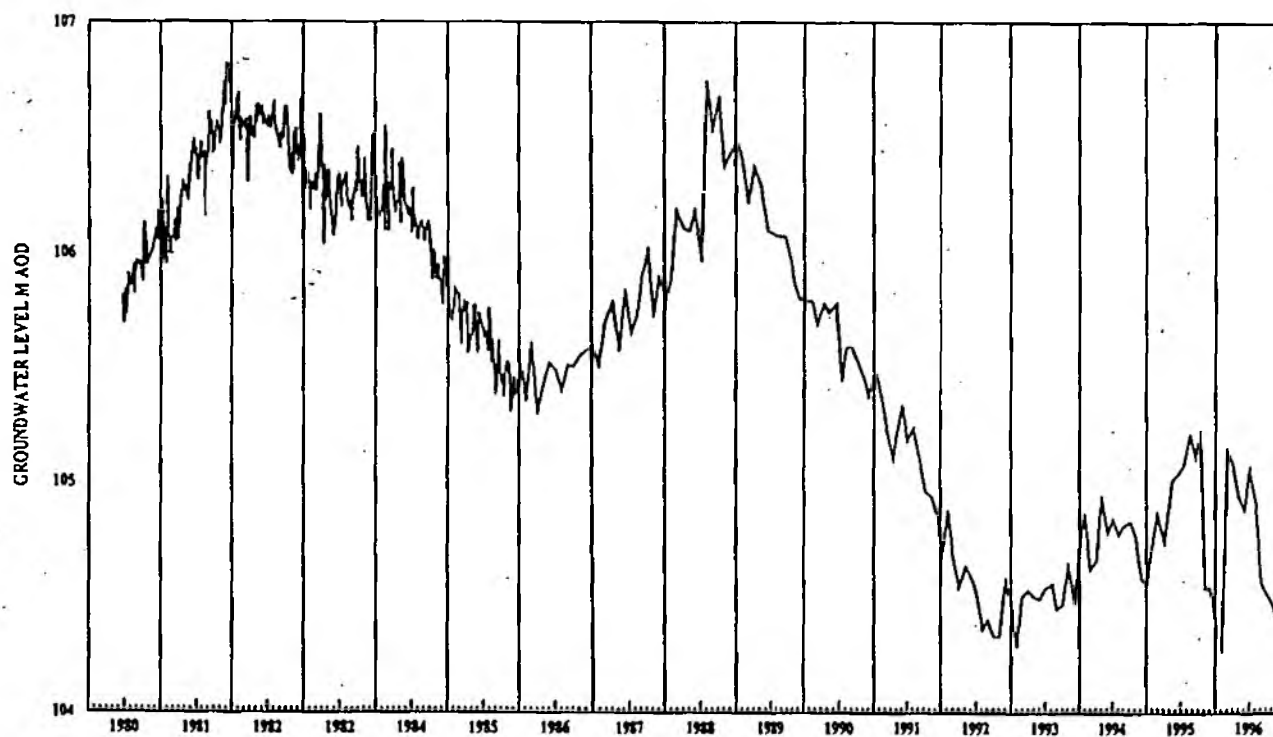
#### Classification History

1/10/83 - 30/9/84	D*
1/10/84 - 30/9/89	B*
1/10/89 - 30/9/90	B(TL)
1/10/90 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: BISHOPS WOOD (F4.1) [Fig 6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CROXTON (ECCLESTONE)	SJ78893180	1023



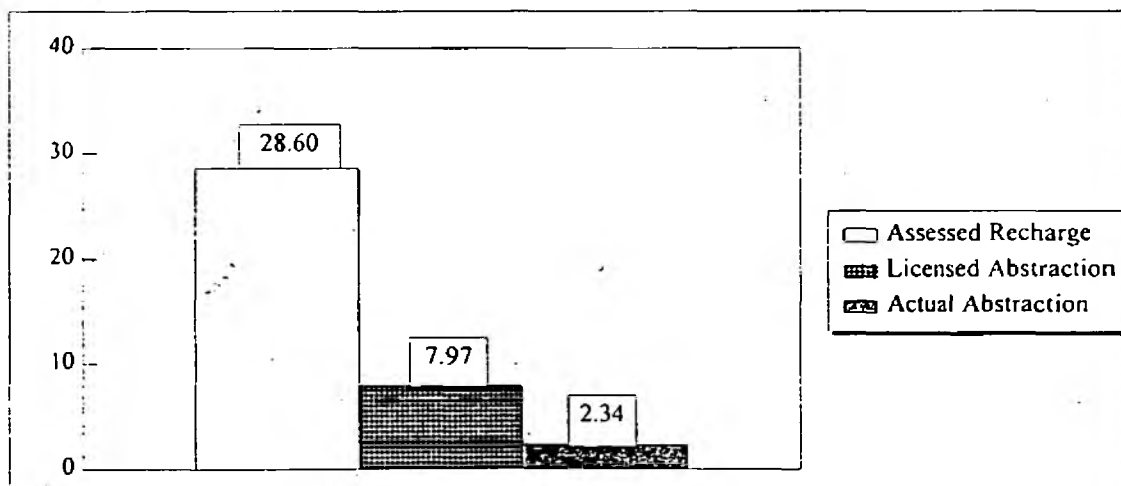
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		GREATWOOD FARM	SJ77923120	1033

## GROUNDWATER UNIT: BISHOPS WOOD (F4.1) [Fig 6]

Licence.No	Licensed Abstraction	Actual Abstraction
2/3	0.014	0.014
2/16	0.009	0.009
2/47	0.005	0.005
2/51	0.0004	0.0004
2/53	0.005	0.005
2/56	0.009	0.009
2/89	0.033	0.033
2/93 (Croxtan) (ST)	3.64	1.27
2/101	0.001	0.001
2/110	0.0001	0.00004
2/117	0.003	0.003
2/126 (Burntwood) (ST)	1.81	0.96
2/129 (Jugbank) (ST)	2.41	0.00
4/153 (S)	0.007	0.007
4/640 (S)	0.001	0.001
4/1015 (S)	<u>0.025</u>	(NR) <u>0.025</u>
	<u>7.97</u>	<u>2.34</u>
(S = Severn Catchment)		
Public Water Supply	7.86	2.23
Private Water Supply	0.11	0.11

### SUMMARY

#### Resource Balance



#### Unit Classification: D

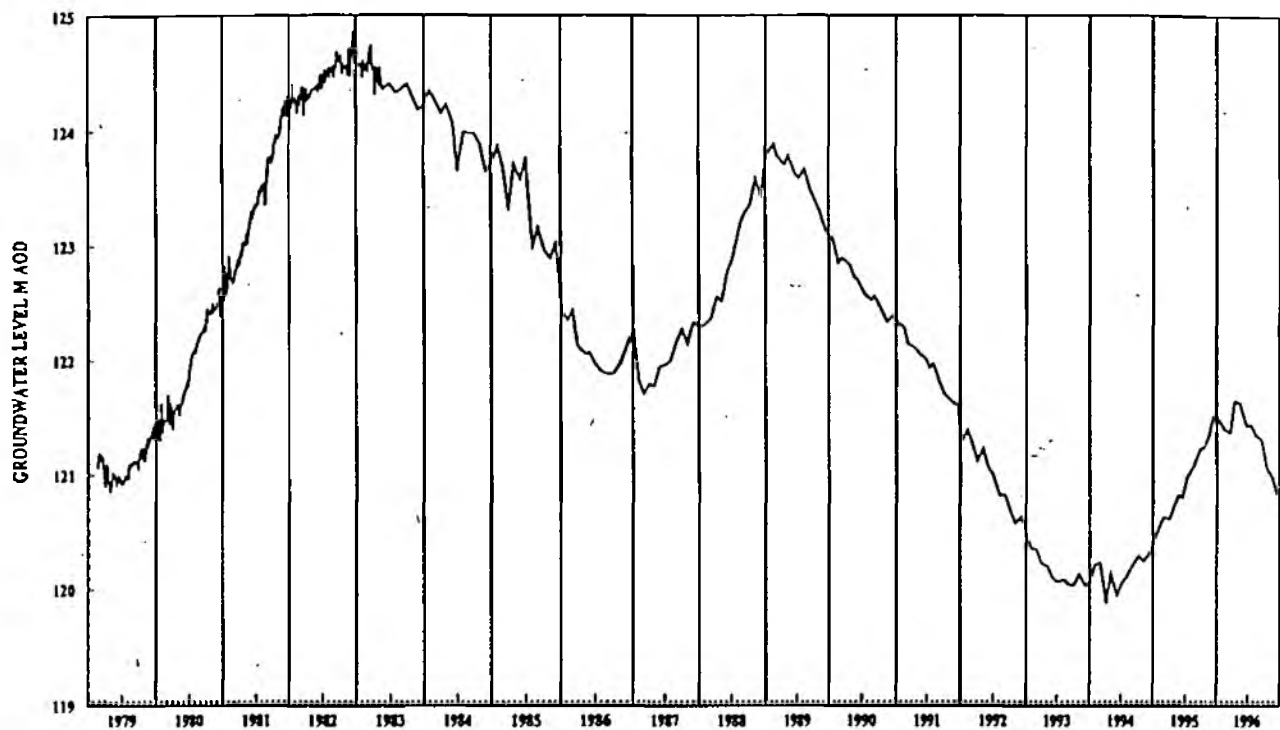
The outcrop of this aquifer unit underlies the headwaters of the River Sow and groundwater gives appreciable baseflow support during dry weather. There is no objection in principle to new applications provided that baseflow protection is taken into account. Within this unit both borehole yields and groundwater quality can be highly variable.

#### Classification History

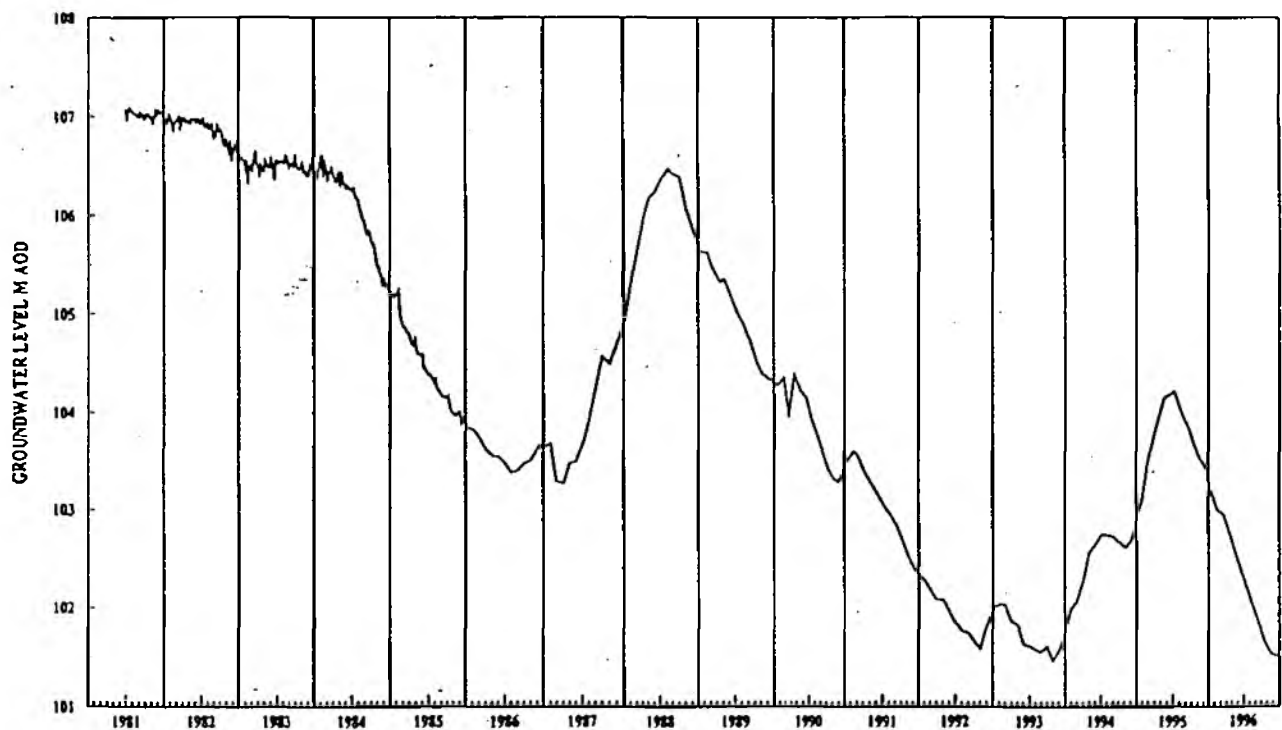
1/10/83 - 30/9/90	E*
1/10/90 - 30/9/91	C*
1/10/91 -	D



# GROUNDWATER UNIT: HATTON (F4.2) [Fig 6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		STABHILL	SJ84993672	1029



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SHELTON UNDER HARLEY	SJ82223935	1043

## GROUNDWATER UNIT: HATTON (F4.2) [Fig 6]

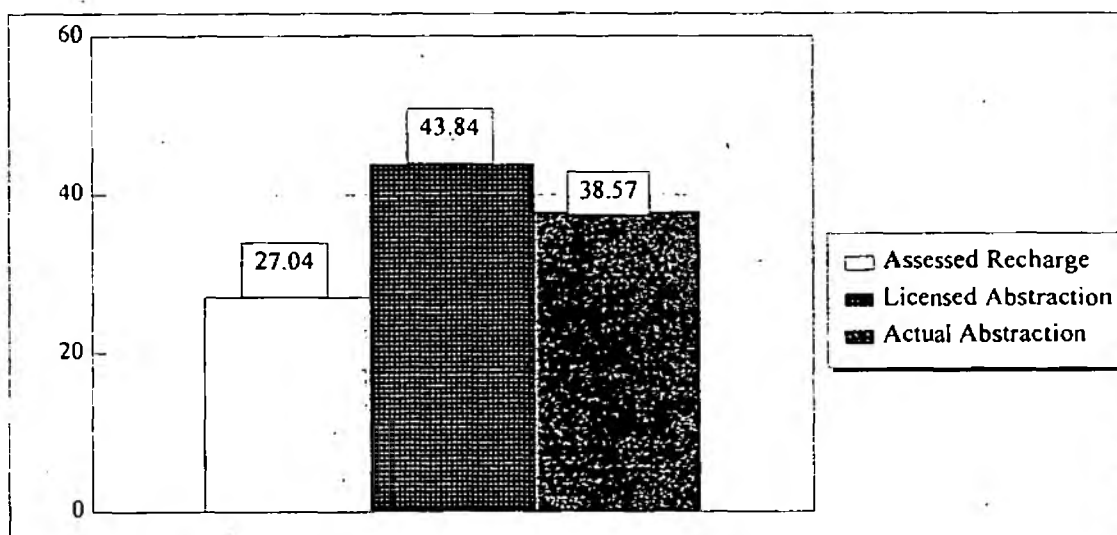
Licence No	Licensed Abstraction	Actual Abstraction
2/9	0.012	0.012
2/38	0.02	0.02
2/94* (Hatton) (ST)	( 19.32)	19.31
2/95* (Mill Meece) (ST)	( 18.18)	10.07
2/116	0.023	0.02
2/128* (Whitmore) (ST)	( 10.00) (0.99)+	(7.66) (1.47)+
2/139	<u>1.74</u>	<u>0.00</u>
	<u>43.84</u>	<u>38.57</u>
Public Water Supply	42.04	38.51
Private Water Supply	1.80	0.05

\* Aggregate licence, covering 3 sources is 42.04; individual licences given in brackets. -

+ Amount used for compensation flow into the Meece Brook.

### SUMMARY

#### Resource Balance



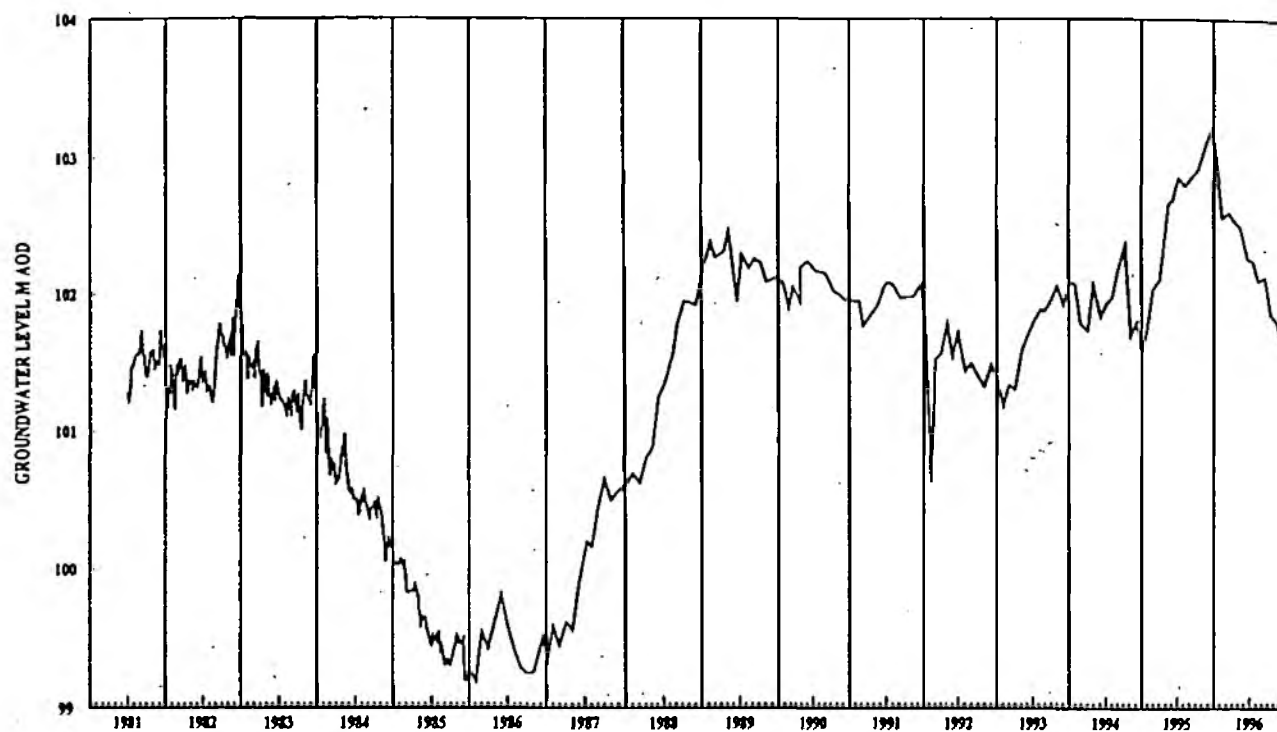
#### Unit Classification: A

The resource balance indicates that this unit is overlicensed and overabstracted. However, recharge to the aquifer is significantly enhanced by influent conditions associated with the Meece Brook. This brook is supported during periods of low flow by a compensation discharge clause in the Whitmore licence. No further groundwater development can be considered.

#### Classification History

1/10/83 - 30/9/87	A*
1/10/87 - 30/9/89	D*
1/10/89 - 30/9/90	B(TL)*
1/10/90 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: TITTENSOR (F4.3) [Fig 6]



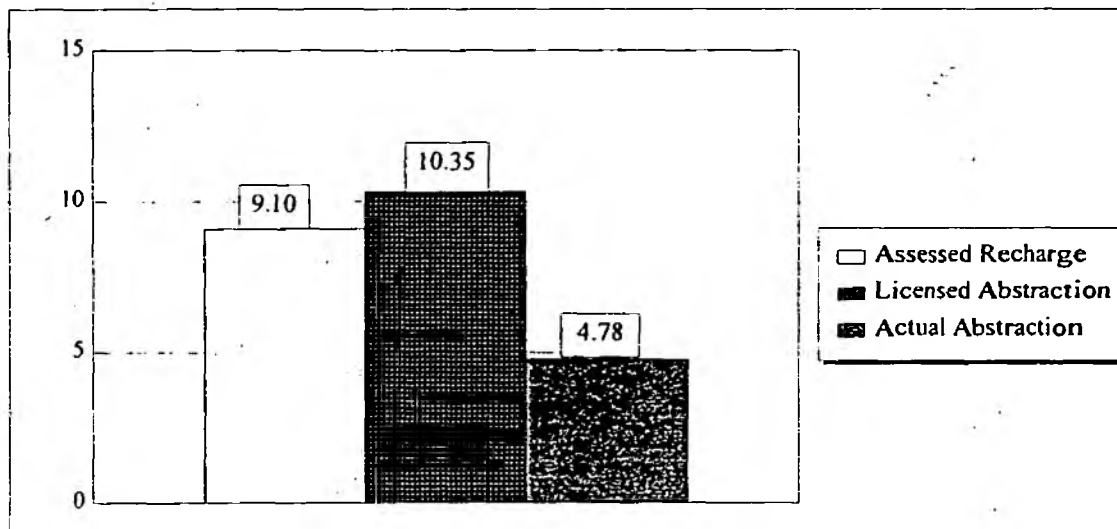
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WING HOUSE	SJ76113676	1044

## GROUNDWATER UNIT: TITTENSOR (F4.3) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
1/142 (Swynnerton) (ST)	10.25	4.74
1/233	<u>0.10</u>	<u>0.04</u>
	<u>10.35</u>	<u>4.78</u>
Public Water Supply	10.25	4.74
Private Water Supply	0.10	0.04

### SUMMARY

#### Resource Balance



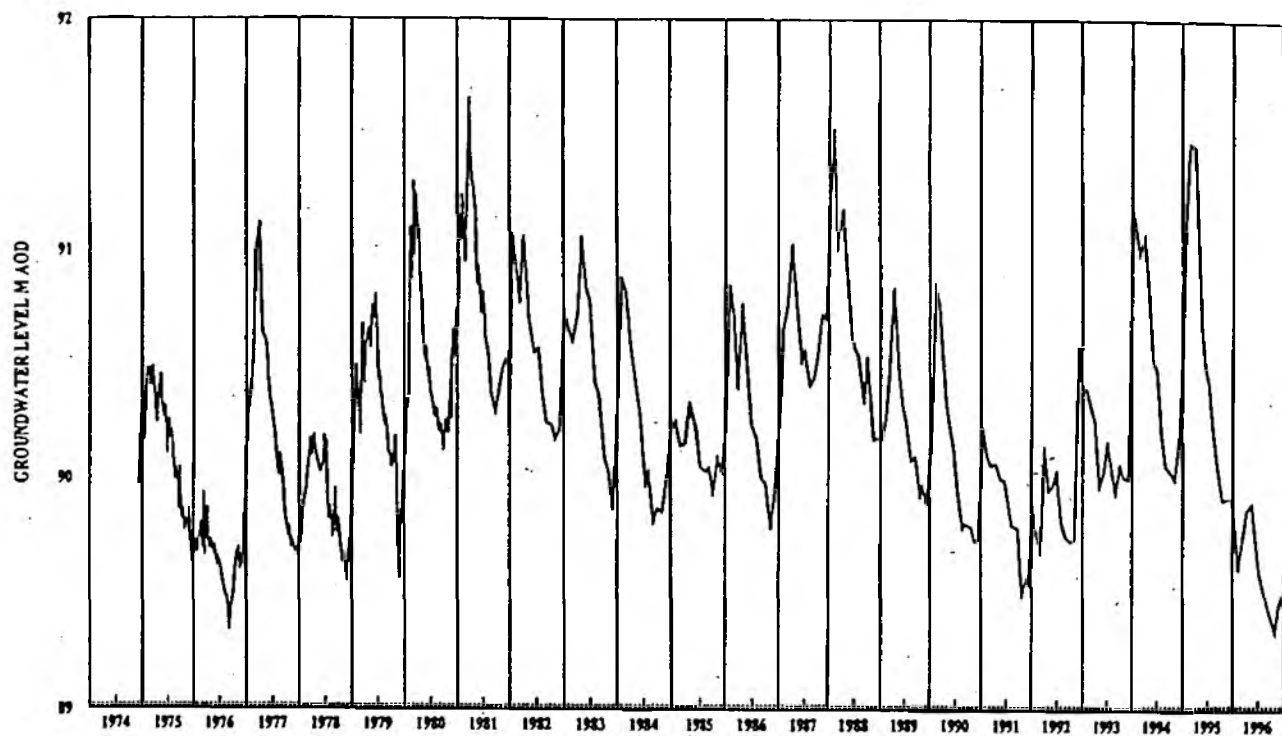
#### Unit Classification: B(TL)

Historically, derogation complaints have been received in the Groundslow Fields area due to the influence of Swynnerton PS. Although the licensed abstraction at Swynnerton exceeds the long term recharge, actual abstraction is less than half of this figure. Consideration can therefore be given to small licence applications, particularly in parts of the unit which are in close proximity to the River Trent. Any future licences will be time-limited to allow for 'claw-back' in the event that abstraction rates at Swynnerton increase.

#### Classification History

1/10/83 - 30/9/85	B*
1/10/85 - 30/9/90	A*
1/10/90 -	B(TL)

# **GROUNDWATER UNIT: OULTON (F4.4) [Fig.6]**



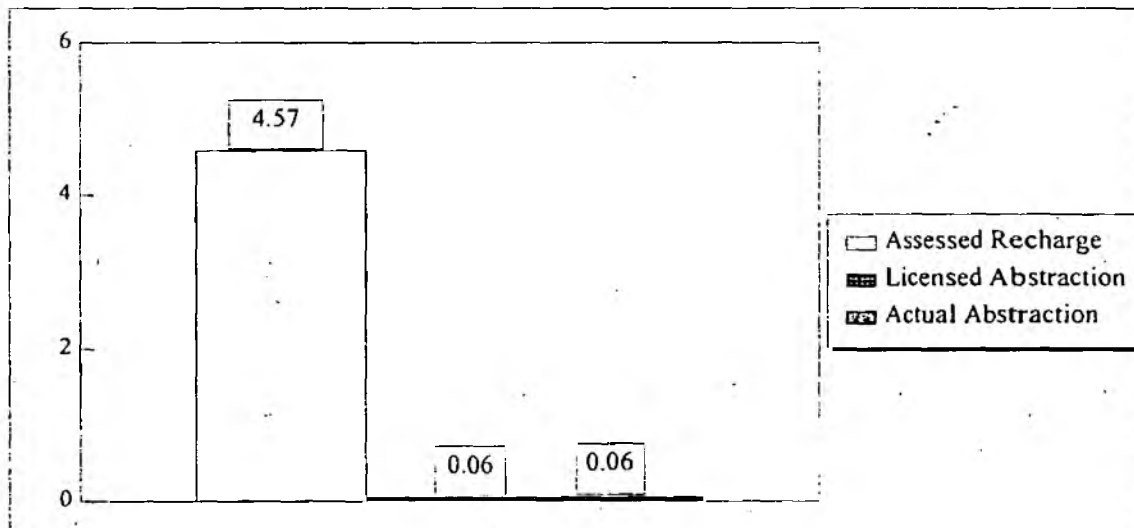
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		STONE	SJ89733475	1005

## GROUNDWATER UNIT: OULTON (F4.4) [Fig 6]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
1/132	0.022	(NR) 0.022
1/144	0.034	0.034
1/170	<u>0.005</u>	<u>0.005</u>
	<u>0.06</u>	<u>0.06</u>

### SUMMARY

#### Resource Balance



#### Unit Classification: D

In the past there have been licensed abstractions for both PWS and industrial usage in Stone. Yields and groundwater quality are generally good in the southern part of this unit but yields are very poor north of the Swynnerton Fault. No objection in principle to new applications.

#### Classification History

1/10/83 - 30/9/85	B*
1/10/85 - 30/9/91	E*
1/10/91 -	D

**GROUNDWATER UNIT : HARDIWICK (F 4.5) [Fig 6]**

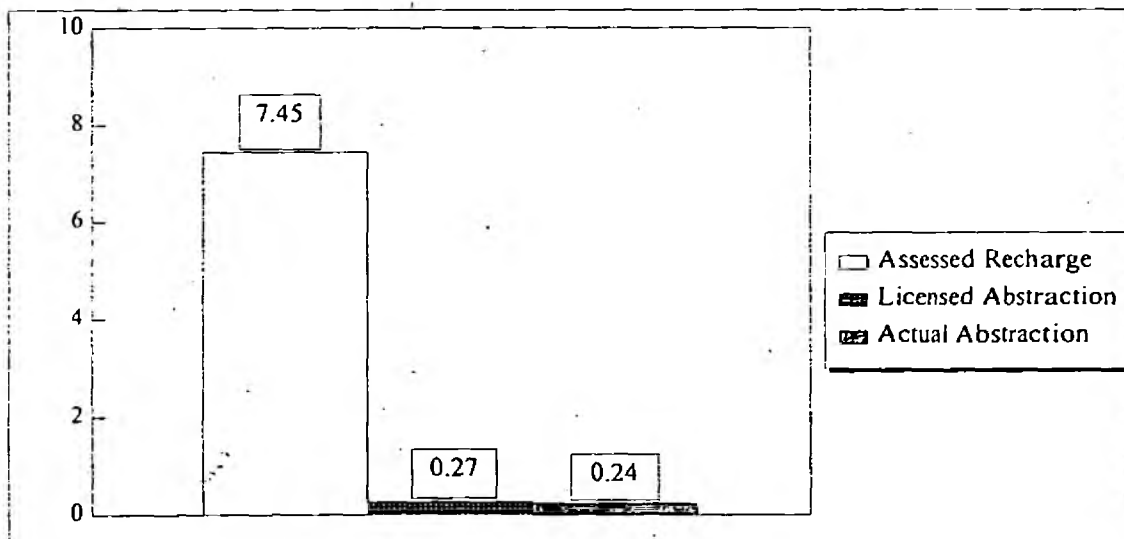
There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: HARDIWICK (F4.5) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
1/58	0.009	0.009
1/60	0.007	0.007
1/74	0.005	0.005
1/99	0.005	0.005
1/151	0.14	(NR) 0.14
1/152	0.011	0.011
1/154	0.012	0.012
1/155	0.009	0.009
1/158	0.009	0.012
1/160	0.01	0.01
1/161	0.019	(NR) 0.019
1/184	0.002	0.002
1/184	0.032	0.001
1/257	<u>0.001</u>	<u>0.001</u>
	<u>0.27</u>	<u>0.24</u>

### SUMMARY

#### Resource Balance



#### Unit Classification: D

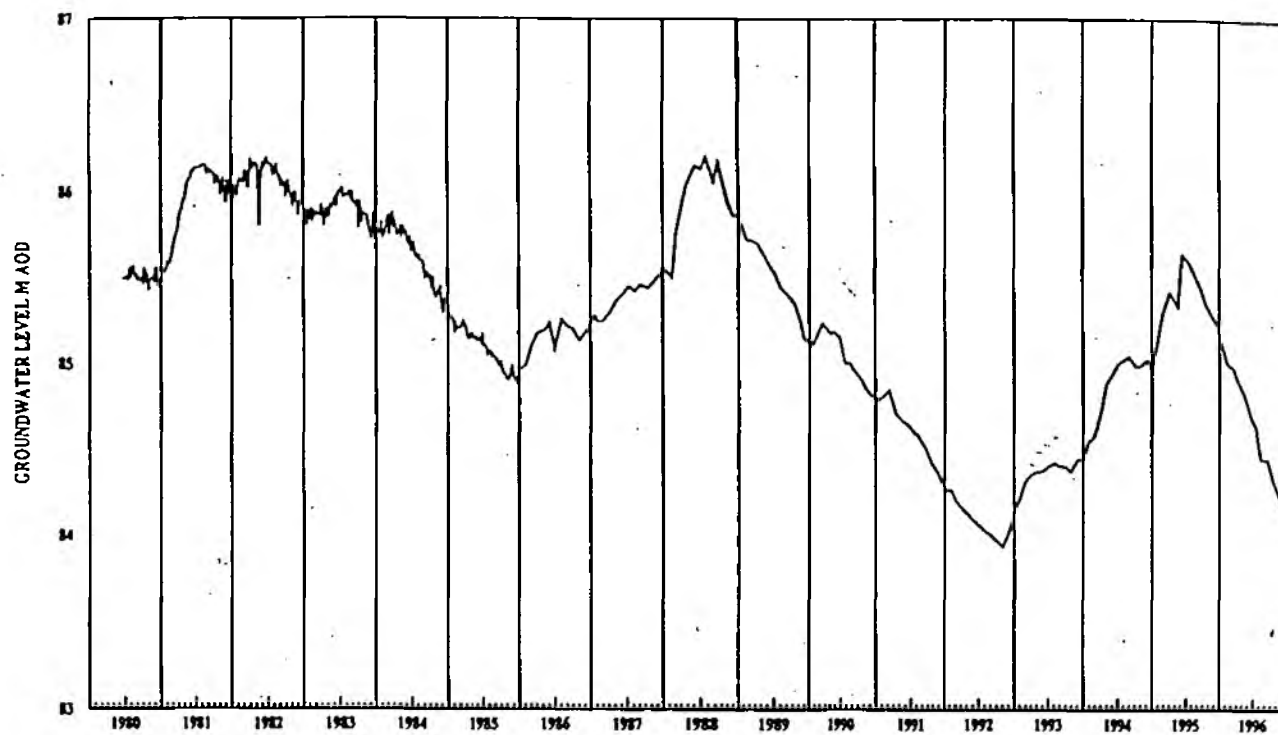
Hydrogeological information in this unit is sparse. The outcrop area is both long and narrow in a north-south direction. Trial boreholes drilled by the old Staffordshire Potteries Water Board indicated high chloride levels. There is no objection in principle to small licence applications.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D



# GROUNDWATER UNIT: HOPTON (F4.6) [Fig 6]



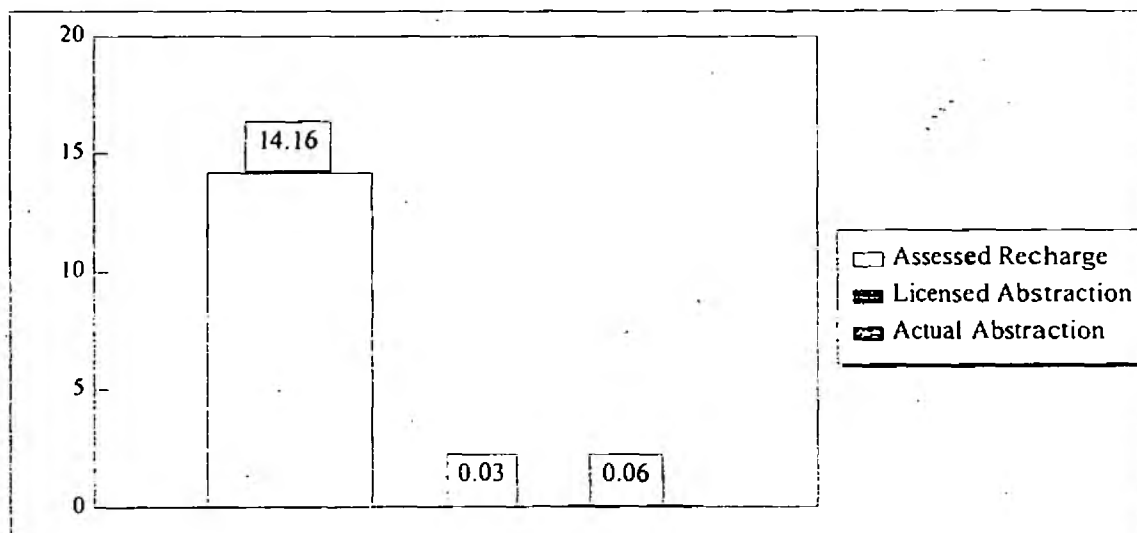
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BRICKHOUSE FARM	SJ95142467	1031

## GROUNDWATER UNIT: HOPTON (F4.6) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
1/89	0.014	0.014
1/201	0.012	0.04
1/206	<u>0.005</u>	<u>0.005</u>
	<u>0.03</u>	<u>0.06</u>

### SUMMARY

#### Resource Balance



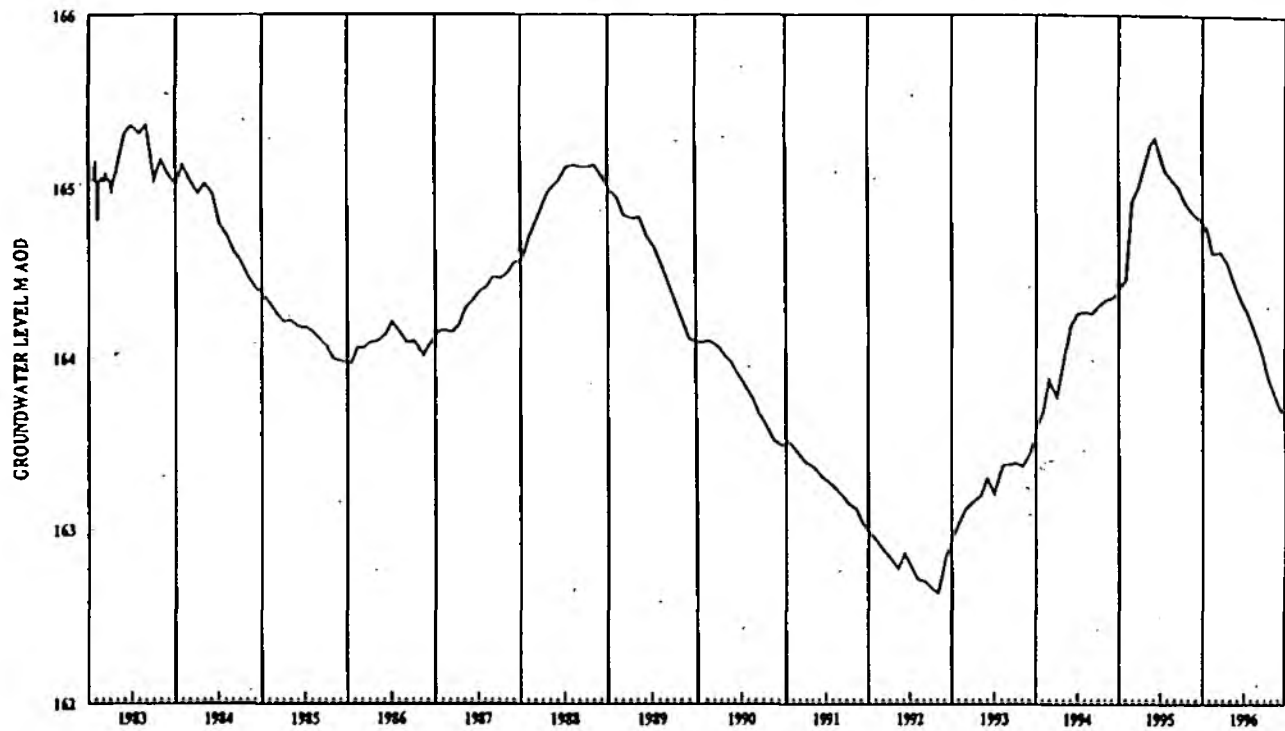
#### Unit Classification: D

Whilst the resource balance indicates that this unit should be capable of supporting a much higher rate of abstraction there are localised areas of high chloride concentrations. Quality considerations may therefore be a hindrance to further groundwater development. No detailed information is available on the relationship between the outcrop area and the confined area, to the west of the Hopton Fault (immediately east of Stafford), and a lowering of the existing positive head across the fault may increase subsidence in the vicinity of the old brine mines under Stafford. Any new application will therefore have to be carefully assessed with these factors in mind.

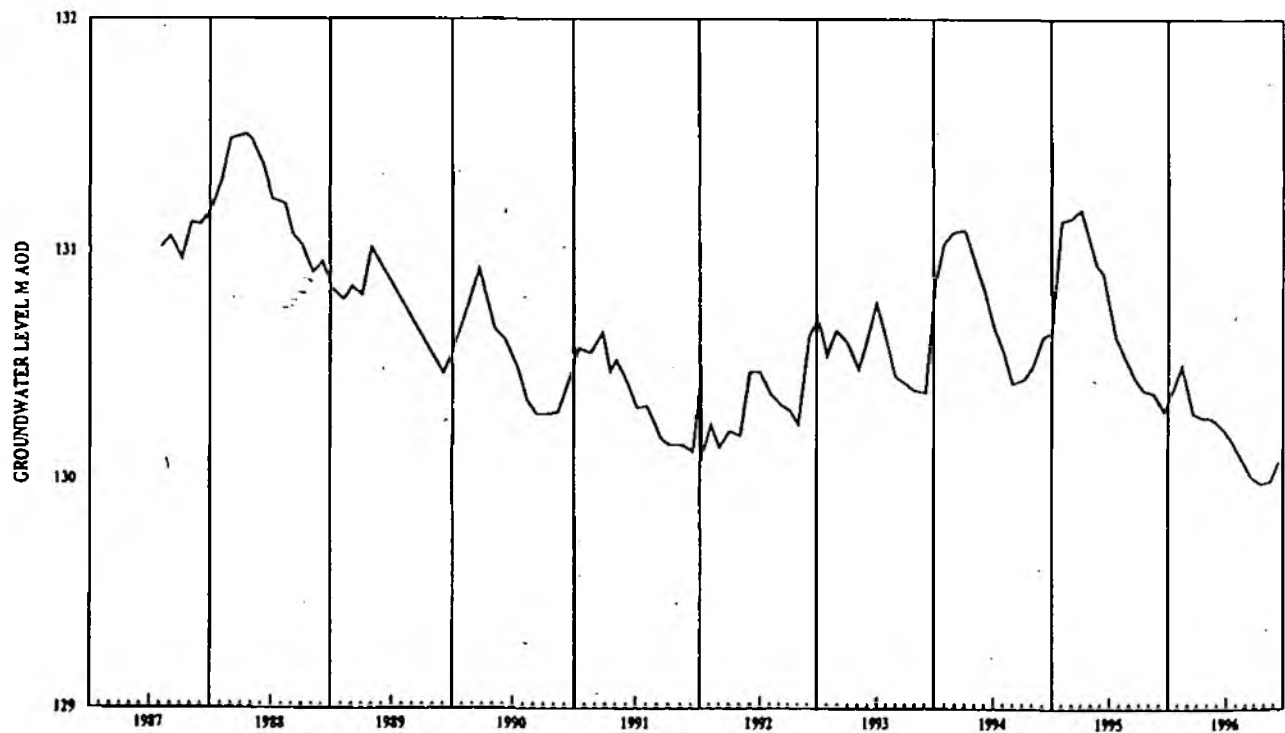
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: RUGELEY (F4.7) [Fig 6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SHERBROOKE VALLEY B.H.	SJ98321662	1047



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		DRY PITS	SJ98511879	1051

## GROUNDWATER UNIT: RUGELEY (F4.7) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
4/4 (Shugborough) (ST)*	( 4.55)	1.80
5/12 (Brindley Bank) (SS)+	( 2.18)	1.84
5/12 (Moors Gorse) (SS)+	( 5.45)	4.87
5/12 (Slitting Mill) (SS)+	( 5.45)	6.00
5/16	0.011	0.011
5/36	2.40	0.00
5/37	3.82	1.50
5/38	0.18	0.00
5/41	0.55	0.05
6/17	<u>0.005</u>	<u>0.005</u>
	<b>24.60</b>	<b>16.08</b>

\* Group licence for Shugborough and Milford (Teddesley Unit F4.7) is 12.91.

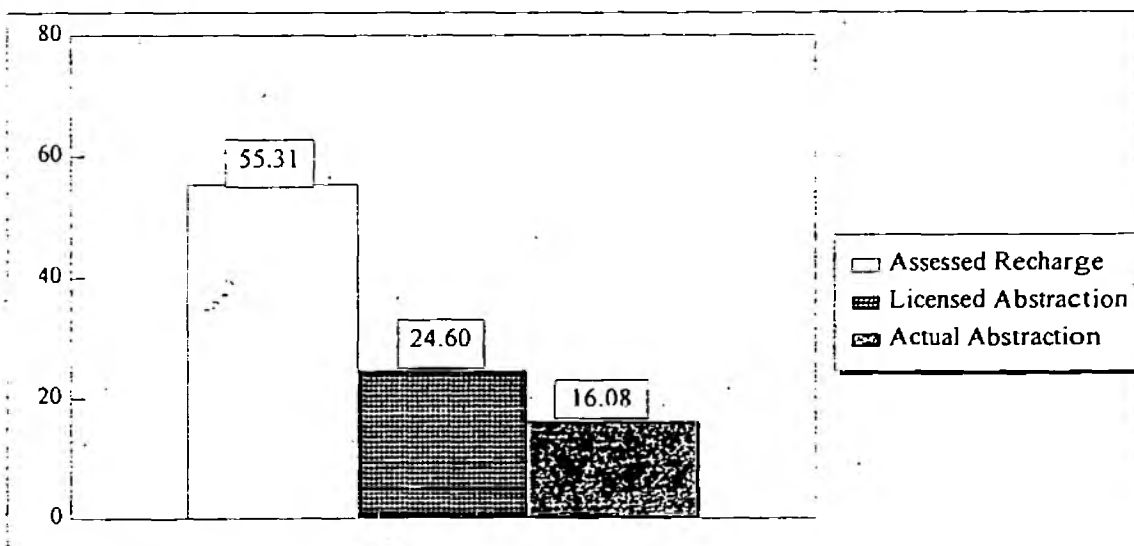
Individual licence for Shugborough given in brackets.

+ SSW sources - the 'licensed' abstractions quoted are the Company's unofficial breakdown of the group licence. Two other sources, Maple Brook and Seedy Mill, in Lichfield Unit (F5.1), are also in this group licence. Individual source licences within the group are based on very high pump capacities.

Public Water Supply	17.63	14.51
Private Water Supply	6.97	1.57

### SUMMARY

#### Resource Balance



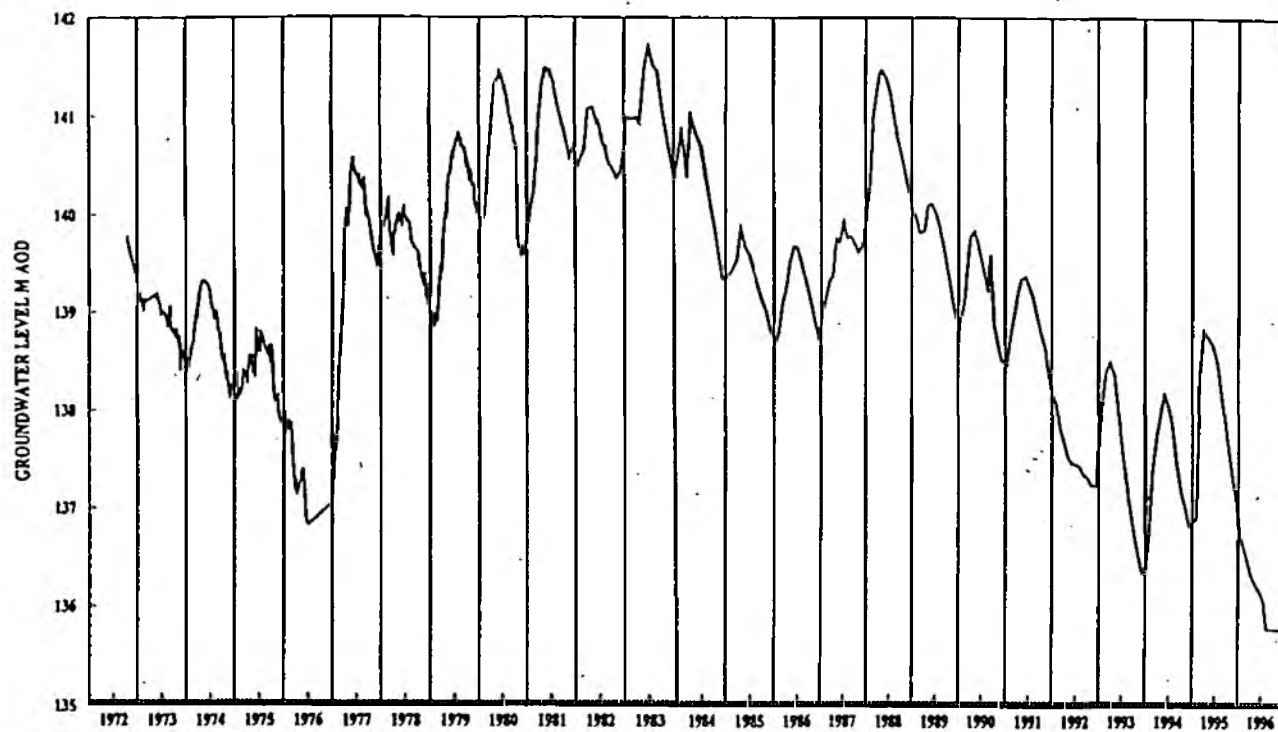
#### Unit Classification: D

Borehole yields and groundwater quality are variable, but tend to be poor on parts of Cannock Chase. No objection in principle to new applications but those on the Chase will have to be looked at very critically in order to afford protection to this environmentally sensitive area. Baseflow protection for streams such as the Rising Brook will be required. Two new boreholes at Slitting Mill produced relatively poor yields.

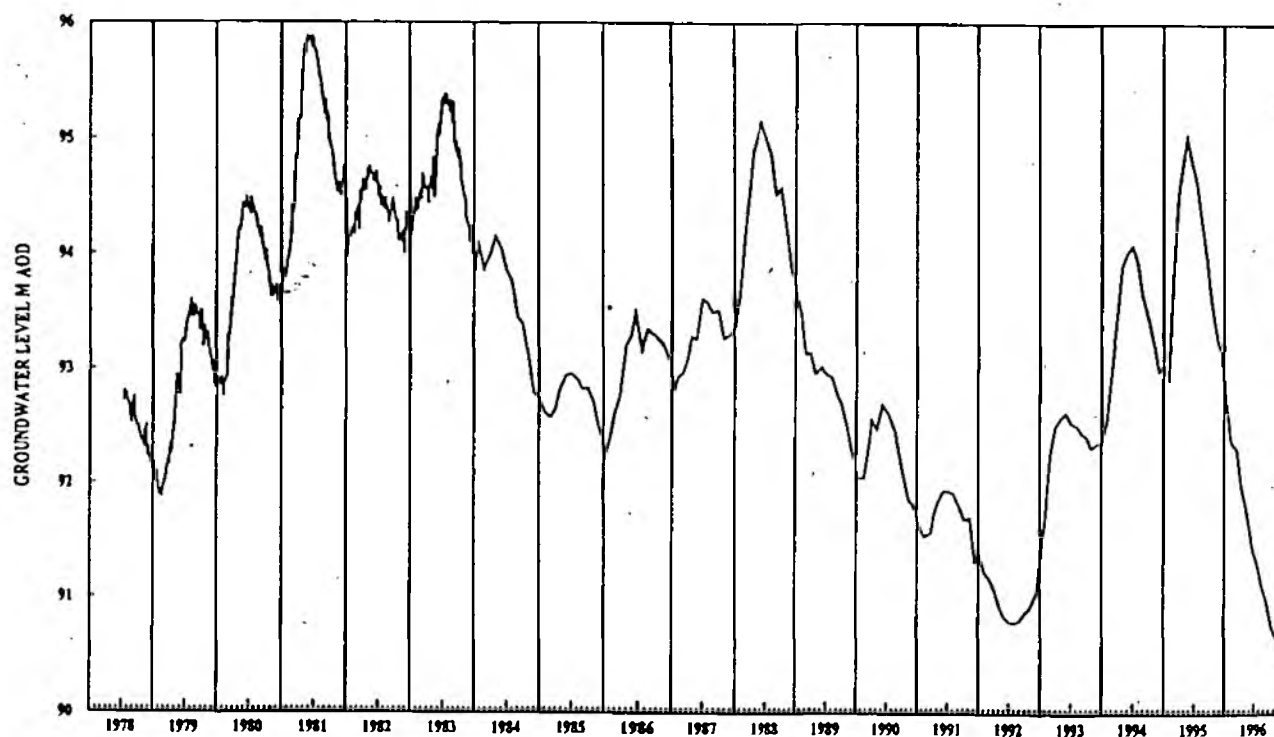
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: TEDDESLEY (F4.8) [Fig6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BEDNALL HEAD	SJ97101753	1008



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BUILDINGS FARM	SJ95492010	1026

## GROUNDWATER UNIT: TEDDESLEY (F4.8) [Fig6]

Licence No	Licensed Abstraction	Actual Abstraction
3/7	0.023	0.023
3/9	0.02	0.02
3/11	0.012	0.012
3/21	0.005	(NR) 0.005
3/36	0.001	0.001
3/52	0.025	0.025
3/72+ (Somerford) (SS)	( 3.82)	3.30
3/84	1.12	2.39
3/130	0.003	0.003
3/161	0.91	0.47
3/162	0.001	0.001
3/163	0.001	0.001
3/170	0.06	0.00
3/176	0.66	0.00
3/185	0.006	0.006
3/185	0.19	0.07
3/192 (Bednall) (ST)	3.31	1.67
3/193	0.025	0.025
3/198	0.02	0.01
4/4* (Milford) (ST)	( 11.45)	8.90
4/11	<u>0.09</u>	<u>0.09</u>
	<u>21.75</u>	<u>17.01</u>

\* Group licence for Milford and Shugborough (Rugeley Unit F4.7) is 12.91. Individual licence for Milford given in brackets.

+ Group licence for Somerford and Slade Heath (Coven Unit F4.9) is 8.74. Individual licence for Somerford given in brackets.

Public Water Supply	18.58	13.87
Private Water Supply	3.17	3.14

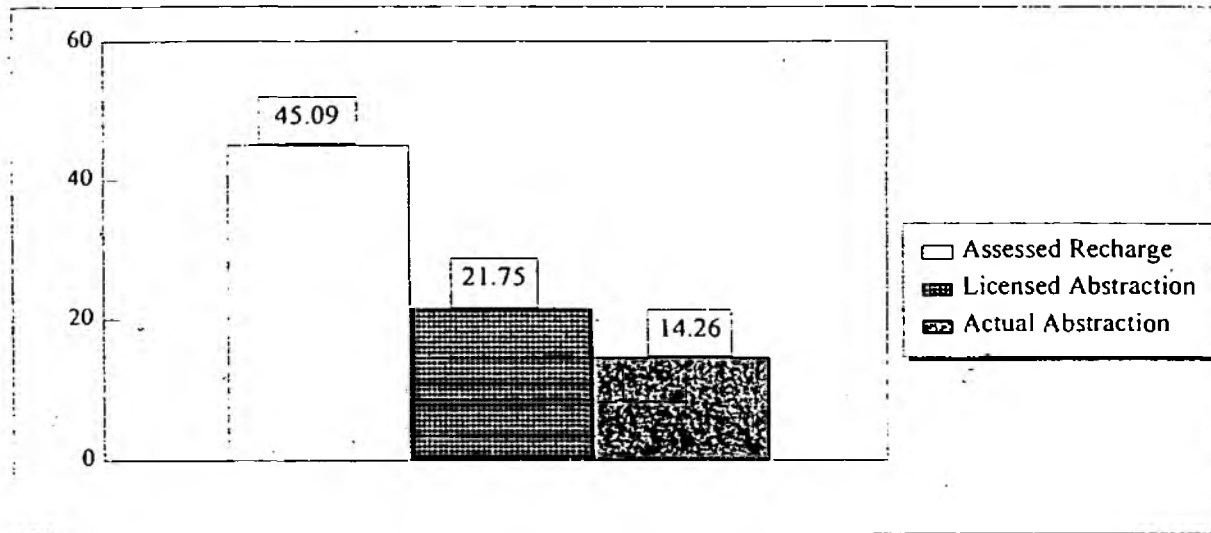
### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
3/84	2.39	95	2.27
3/176	0.00	50	<u>0.00</u>
			<u>2.27</u>

## GROUNDWATER UNIT: TEDDESLEY (F4.8) [Fig6]

### SUMMARY

#### Resource Balance



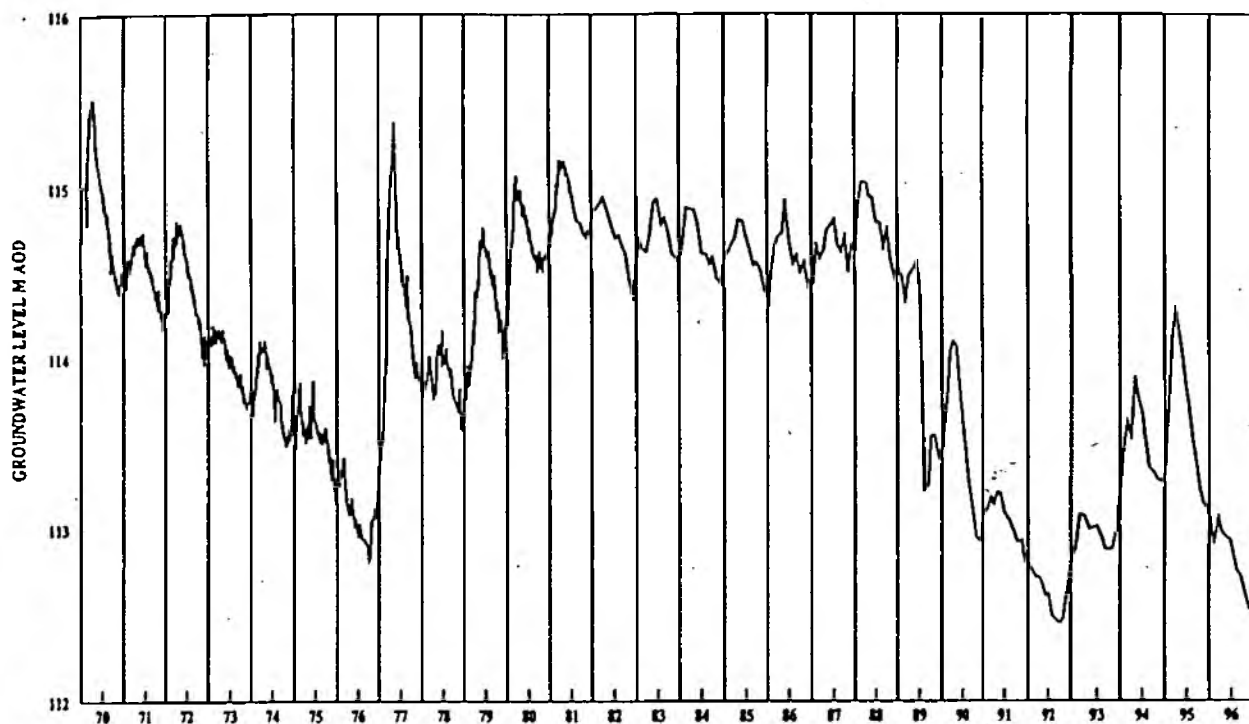
#### Unit Classification: D

Borehole yields and groundwater quality can be highly variable due to the complex geology. Some areas within this unit, especially along the western flanks of Cannock Chase, are environmentally very sensitive. Consideration can still be given to new licence applications, but some baseflow support may be required as there are flow restrictions on the River Penk.

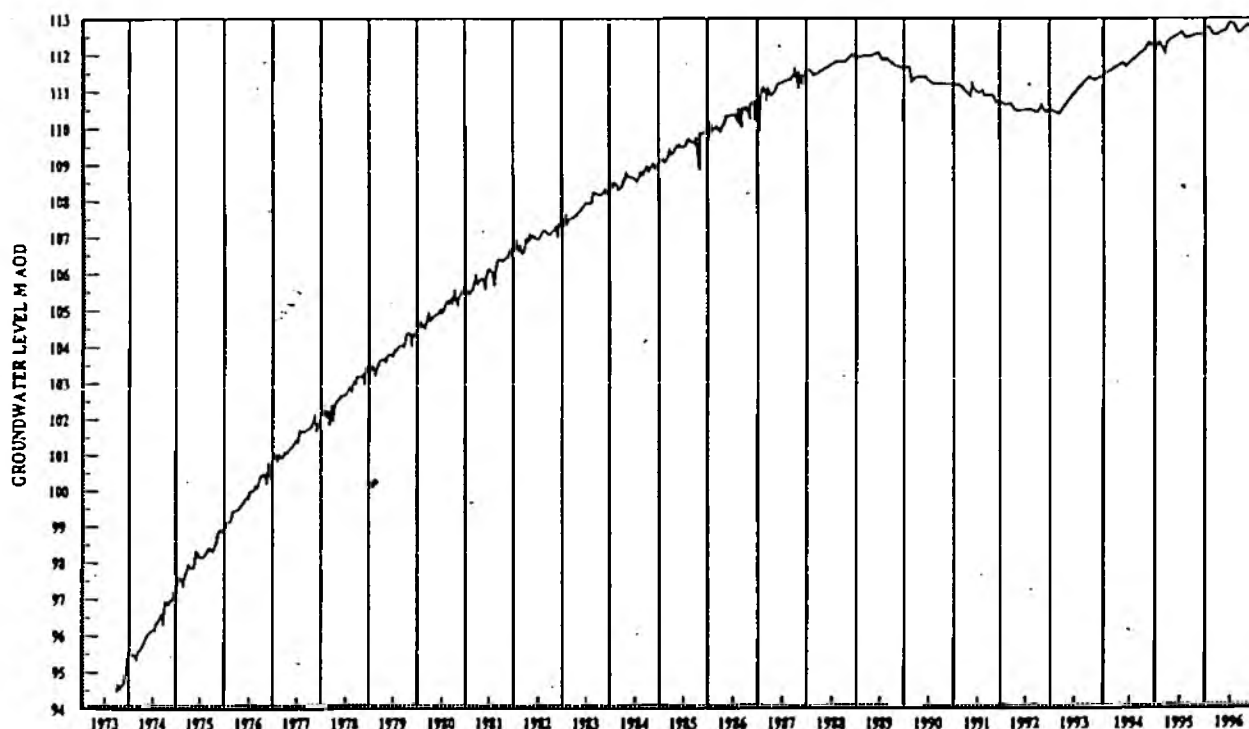
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: COVEN (F4.9) [Fig 6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		POUR CROSSES	SJ95800970	1007



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		OXLEY GAS WORKS	SJ91680054	0294



## GROUNDWATER UNIT: COVEN (F4.9) [Fig 6]

Licence.No	Licensed Abstraction	Actual Abstraction	
3/3	0.005		0.005
3/19	1.64		0.96
3/72* (Slade Heath) (SS)	( 4.92)		3.94
3/78	0.012		0.012
3/117	0.015		0.015
3/118	0.016		0.016
3/120	0.02	(NR)	0.02
3/125	1.37		1.25
3/141	0.11		0.08
3/174	1.12		0.80
3/178	1.10		0.00
3/187	0.76		0.00
3/189	0.10		0.01
3/195	0.002		0.002
3/196	0.54		0.29
3/208	0.009		0.009
3/215	0.08		0.02
3/218	0.02		0.02
6/198 (S)	<u>2.18</u>		<u>0.09</u>
	<u>14.02</u>		<u>7.55</u>
Public Water Supply	4.92		3.94
Private Water Supply	9.10		3.61

(S) Severn catchment

\*Group licence for Slade Heath and Somerford (Teddlesley Unit, F4.8) is 8.74. Individual licence for Slade H given in brackets.

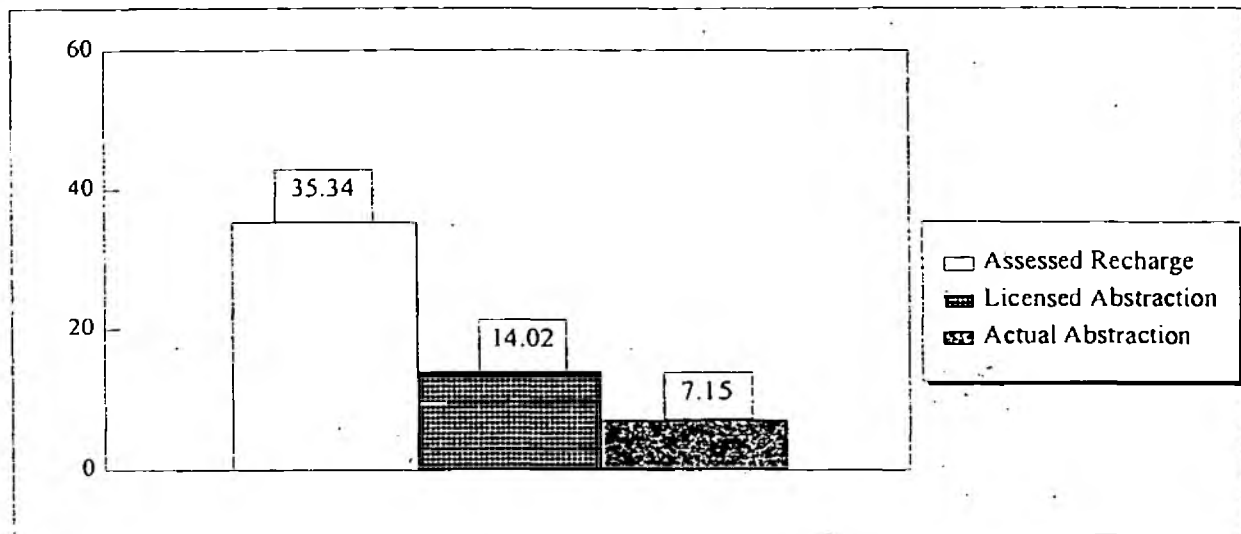
### SAND/GRAVEL WASHING LICENCES

Licence.No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
3/174	0.80	50	0.40

## GROUNDWATER UNIT: COVEN (F4.9) [Fig 6]

### SUMMARY

#### Resource Balance



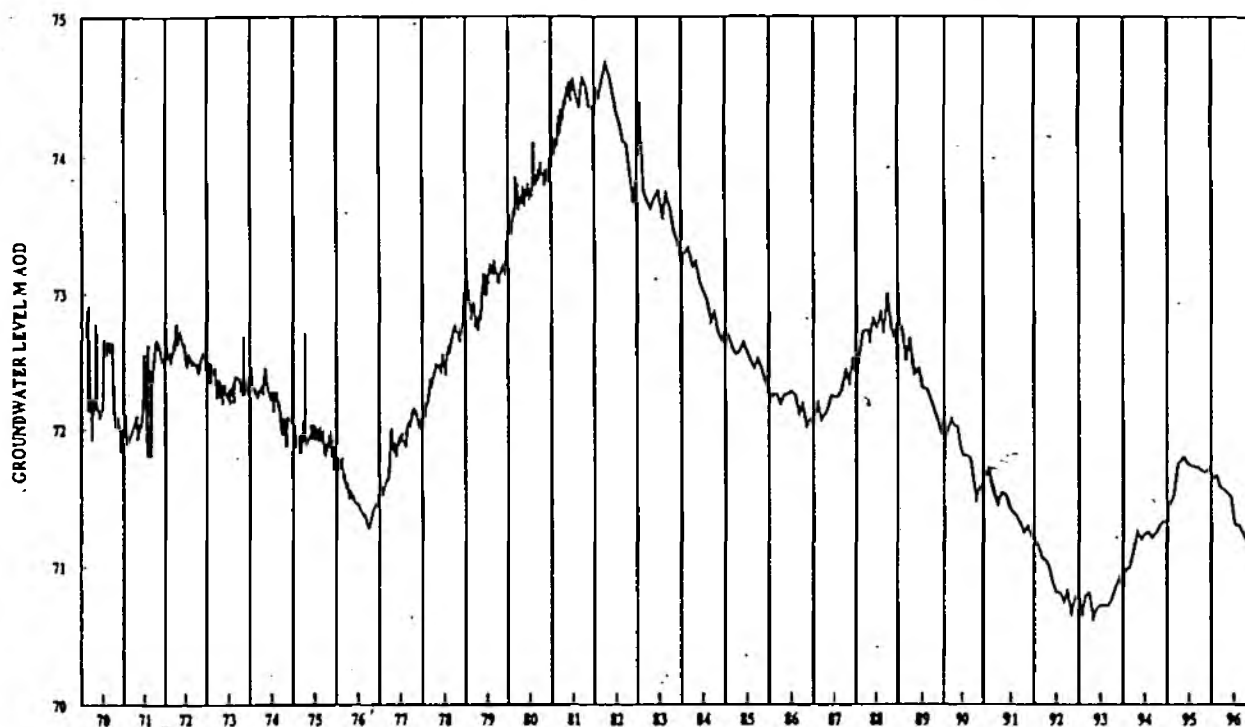
#### Unit Classification: D

Borehole yields and groundwater quality are generally good and consideration can be given to new licence applications. However, baseflow support for the River Penk and its upper tributaries is likely to be required.

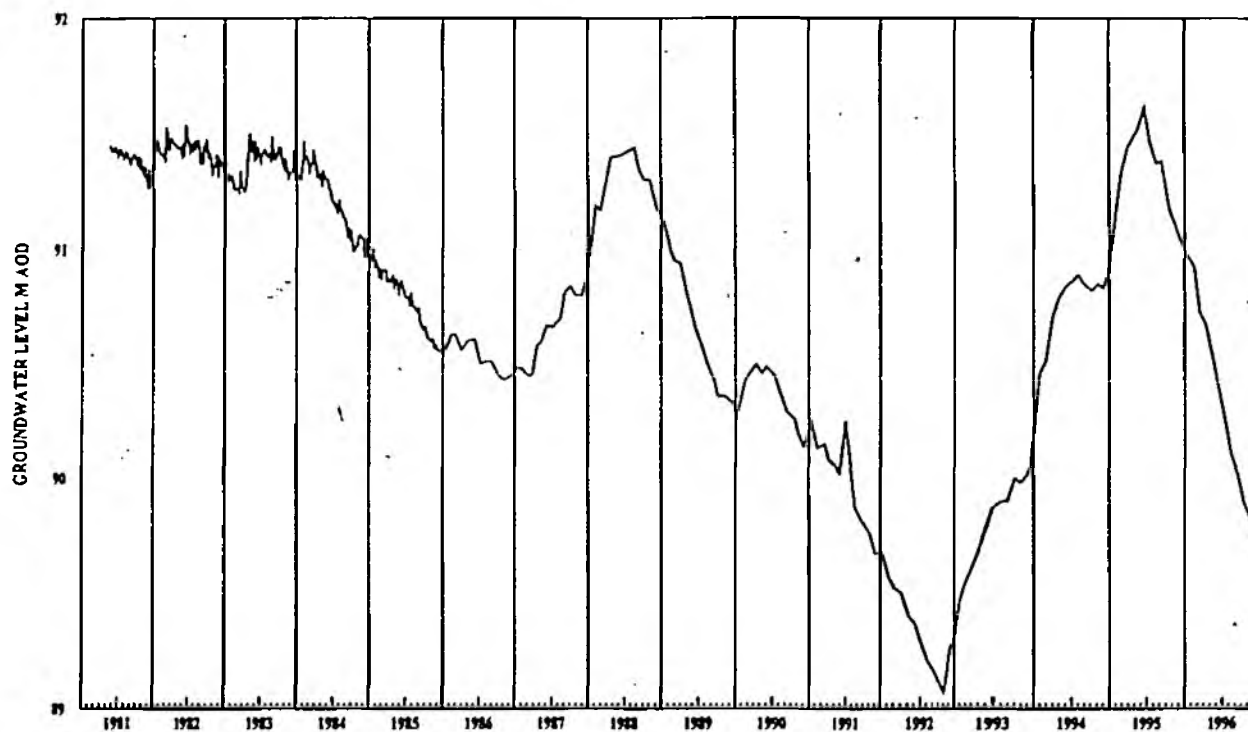
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: LICHFIELD (F5.1) [Fig 6]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WILTILL	SK11750901	1013



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WHITTINGTON HEATH	SK15500648	1223

## GROUNDWATER UNIT: LICHFIELD (F5.1) [Fig 6]

Licence No	Licensed Abstraction	Actual Abstraction
5/12* (Maple Brook) (SS)	( 6.72)	7.01
5/12* (Seedy Mill) (SS)	( 6.82)	6.27
7/25^ (Sandfields Tunnel) (SS)	6.95	3.69
7/55	0.003	0.003
7/74	0.27	0.27
7/88 (ALF)	0.74	0.62
7/90	0.02	(NR) 0.02
17/36	0.03	(NR) 0.03
17/67	0.03	0.016
22/4 + (Trent Valley) (SS)	( 20.00)	15.33
22/4 + (Fradley) (SS)	( 7.00)	5.99
22/7	0.009	0.009
22/14 (Swinfen Farms No1 & 2)	0.23	0.06
22/17	0.025	0.005
22/36	0.44	0.41
22/38	<u>0.17</u>	<u>0.12</u>
	<u>44.15</u>	<u>39.86</u>

\* The SSWC sources (licence 5/12) form part of a group licence involving three additional sources in the Rugeley Unit (F4.7); the 'licensed' abstractions quoted, in brackets, are the Company's unofficial breakdown of these licences. Individual licences in the group are based on very high pump capacities.

+ Daily maximum licences are bracketed. Group licence for the two sources must not exceed 21.69 Ml/d.

^ Sandfields Tunnel forms a joint licence with Hopwas which draws on the Hamstead Beds (Upper Carboniferous). Hopwas has a maximum limit of 2.95 Ml/d.

Public Water Supply	42.18	38.29
Private Water Supply	1.97	1.57

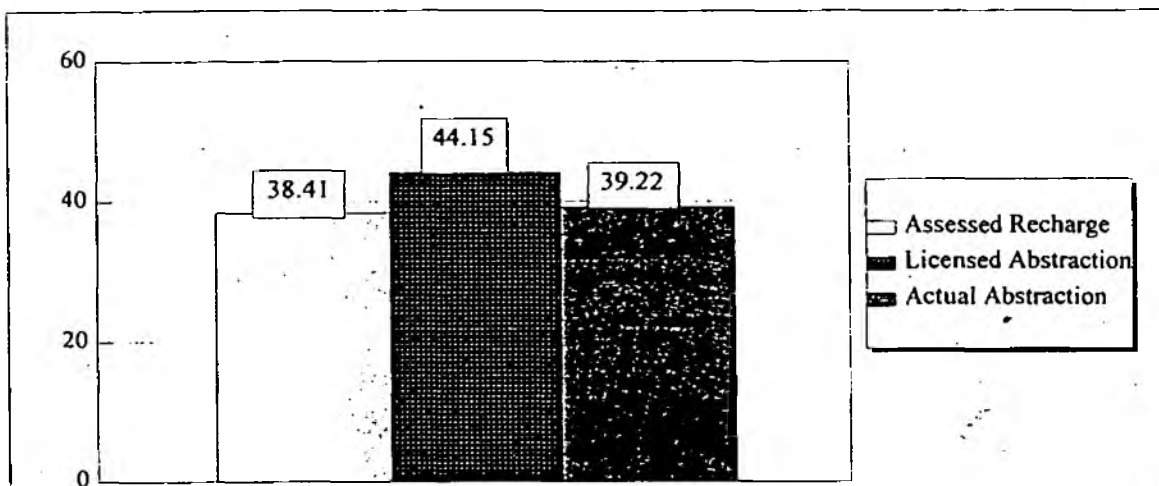
### SAND/GRAVEL WASHING LICENCES AND 'ALF' LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
22/36	0.41	50	0.21
7/88 (ALF)	0.62	70	<u>0.43</u>
			<u>0.64</u>

## GROUNDWATER UNIT: LICHFIELD (F5.1) [Fig.6]

### SUMMARY

#### Resource Balance



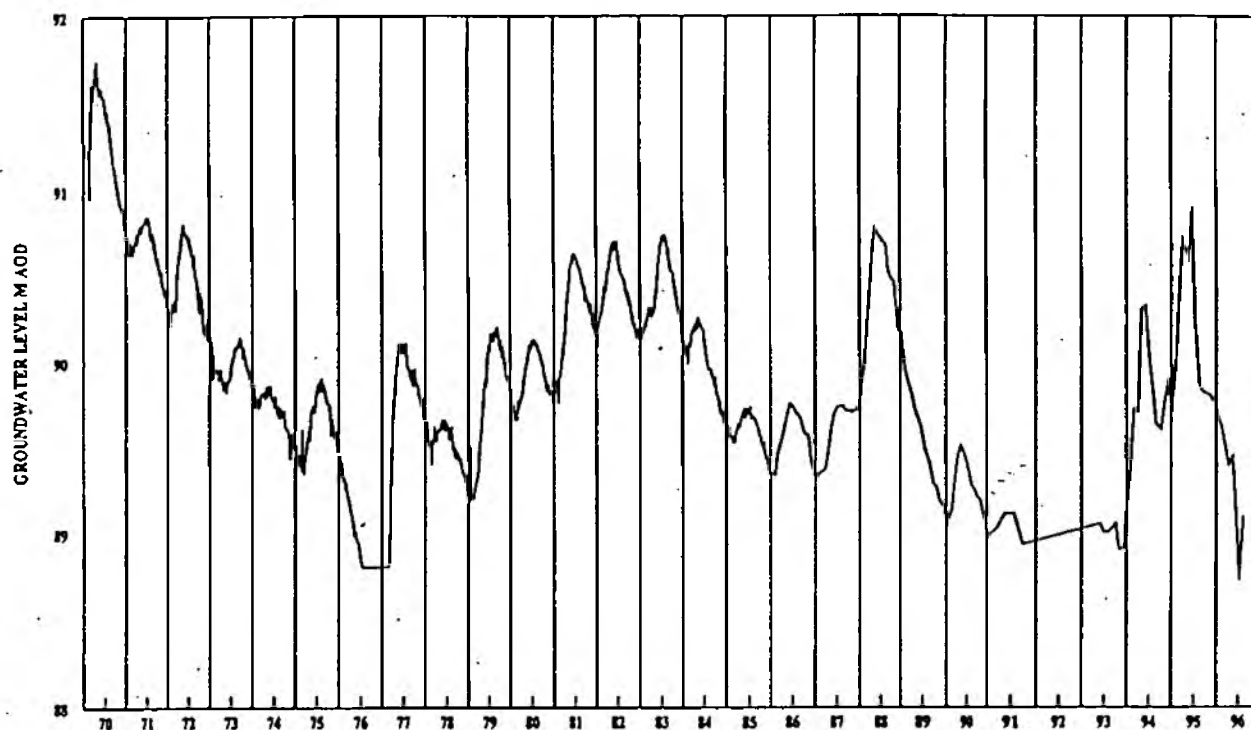
#### Unit Classification: A

The unit is overlicensed and overabstracted and baseflow in some watercourses has virtually been eradicated. Damage to some environmentally sensitive areas is a recurrent problem. No new licence applications can be considered. An increase in the existing Fradley licence to 10Ml/d, from boreholes in the confined aquifer, has been agreed with South Staffordshire Water, subject to an overall reduction and re-distribution of the volumes abstracted for PWS within this unit and the adjacent Shenstone Unit (F5.2).

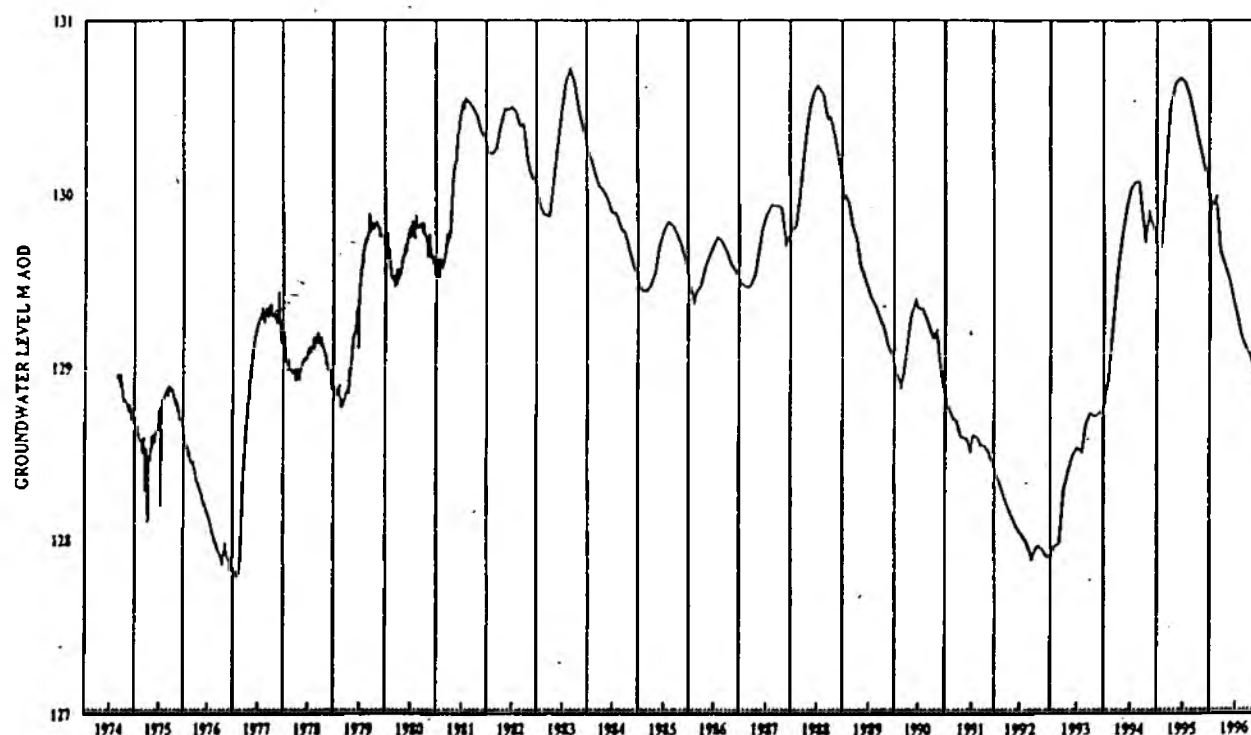
#### Classification History

1/10/83 - 30/9/85	D*
1/10/85 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: SHENSTONE (F5.2) [Fig 4]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WEEPORD FLATS (SHALLOW)	SKJ4370461	1200



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		NUTTALLS FARM	SK06650111	1203

## GROUNDWATER UNIT: SHENSTONE (F5.2) [Fig 4]

Licence.No	Licensed Abstraction	Actual Abstraction
7/6	1.82	2.03
17/6 * (Bourne Vale) (SS)	( 6.82)	5.36
17/6 * (Little Hay) (SS)	( 5.91)	4.69
17/6 * (Pipe Hills) (SS)	( 13.64)	12.74
17/6 * (Sandhills) (SS)	( 5.68)	6.41
17/6 * (Shenstone (SS)	( 6.82)	5.39
17/21	0.037	0.01
17/26	0.028	(NR) 0.028
17/27	0.014	0.002
17/28	0.063	0.076
17/37	0.19	0.19
17/39	0.093	0.00
17/40	0.025	0.02
17/41	0.50	0.56
17/42	0.19	0.17
17/47	0.025	0.017
17/48	0.25	0.16
17/49	0.055	0.055
17/58	0.045	0.05
17/62	0.008	0.008
17/63	0.01	0.01
17/68	0.012	0.012
22/54	0.048	0.048
22/62	<u>0.075</u>	<u>0.07</u>
	<u>42.36</u>	<u>38.09</u>

\* Group licence, covering 5 sources, is 38.87; individual licences given in brackets

Public Water Supply	38.87	34.66
Private Water Supply	3.49	3.43

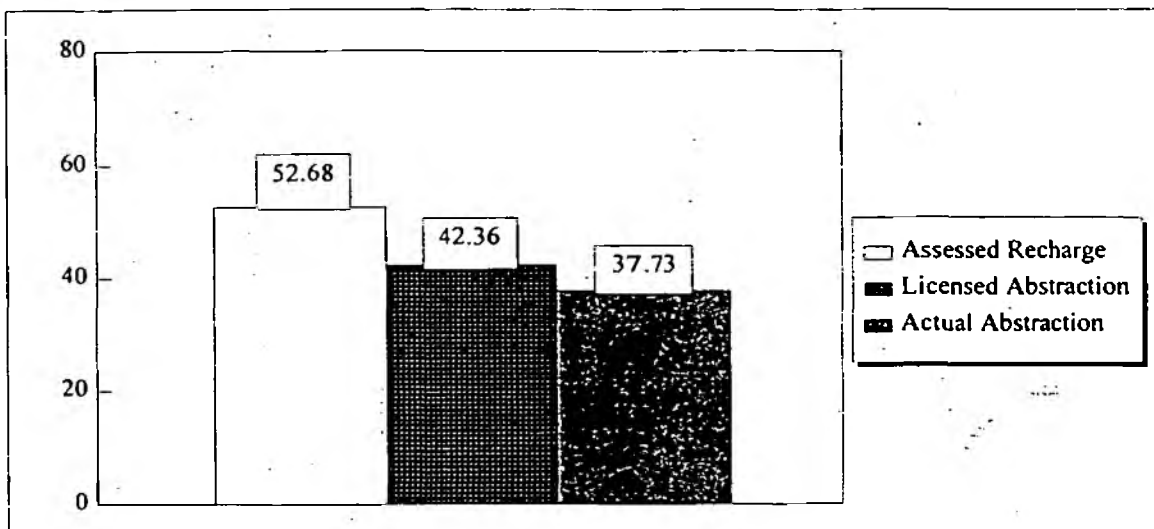
### SAND/GRAVEL WASHING LICENCES

Licence.No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
17/39	0.00	50	0.00
17/41	0.56	50	0.28
17/48	0.16	50	<u>0.08</u>
			<u>0.36</u>

## GROUNDWATER UNIT: SHENSTONE (F5.2) [Fig 4]

### SUMMARY

#### Resource Balance



#### Unit Classification: A

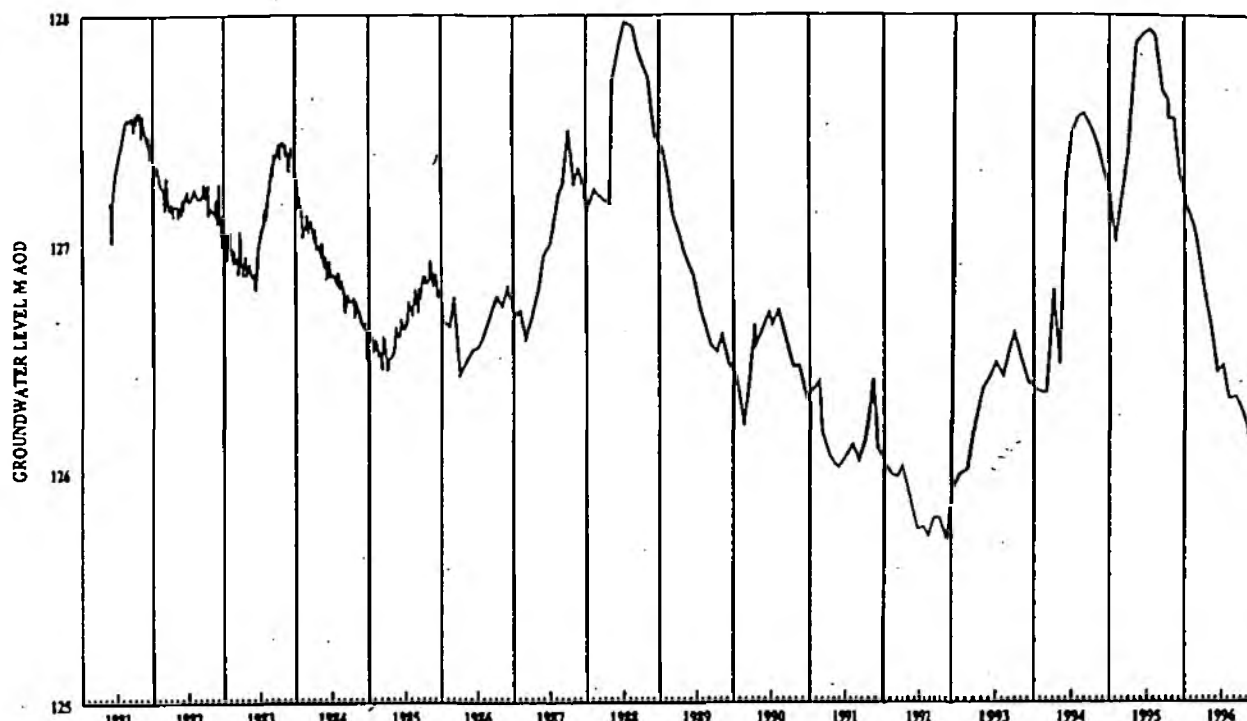
Due to low flow problems associated with the Black Brook and its tributaries no more licences can be considered in this unit. Flow in the main watercourses is heavily dependent on discharge from WRWs.

#### Classification History

1/10/83- 30/9/84	B*
1/10/84 - 30/9/89	E*
1/10/89 - 30/9/90	B*
1/10/90 - 30/9/91	B(TL)
1/10/91 -	A



# **GROUNDWATER UNIT: SUTTON (F5.3) [Fig 4]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SUTTON PARK BH	SP10249611	1222

## GROUNDWATER UNIT: SUTTON (F5.3) [Fig 4]

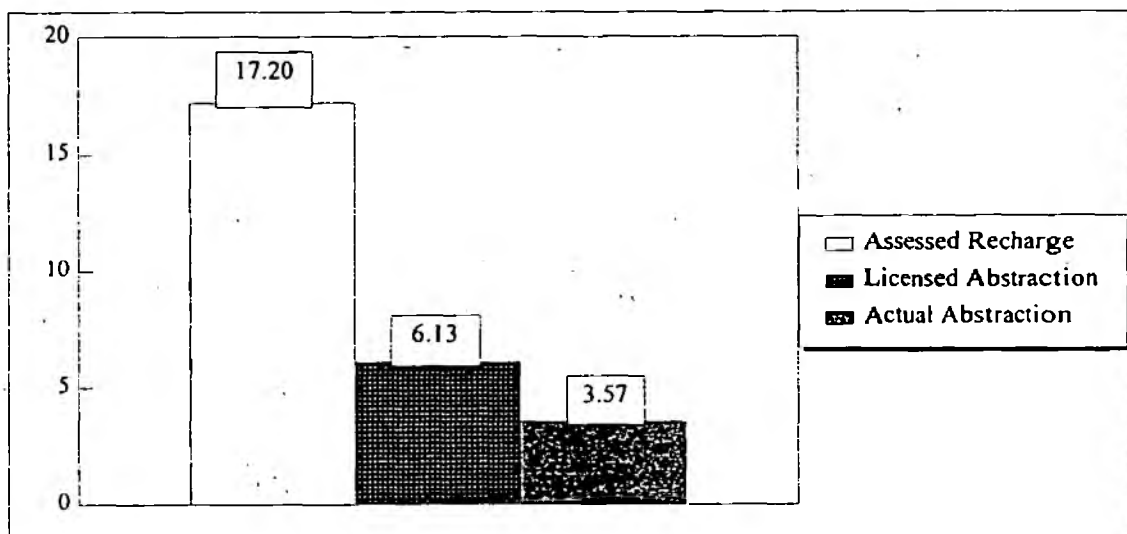
Licence.No	Licensed Abstraction	Actual Abstraction
10/8	1.00	0.21
10/35	0.13	0.09
16/67 * (Wheatmoor Farm) (SS)	( 3.00)	2.07
16/68 * (St George's Barracks) (SS)	( 3.00)	1.20
	<u>6.13</u>	<u>3.57</u>

\* Aggregate licence, covering 2 sources, is 5.00; individual licences given in brackets.

Public Water Supply	5.00	3.27
Private Water Supply	1.13	0.29

### SUMMARY

#### Resource Balance



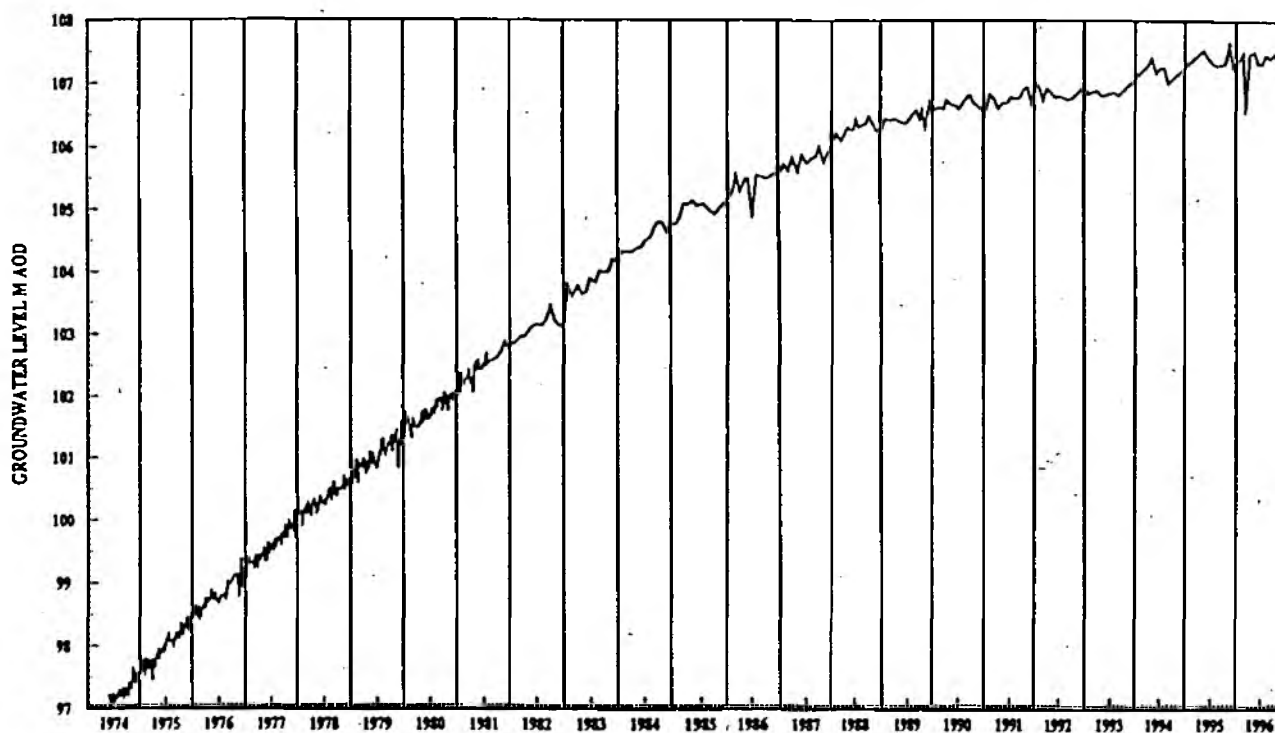
#### Unit Classification: A

Licences issued in 1993 for the two PWS sources are time limited for 7 years in order to determine any long term effect on water levels in the area to the west, ie towards Sutton Park, which is a SSSI. Until this appraisal is completed no further licences can be considered.

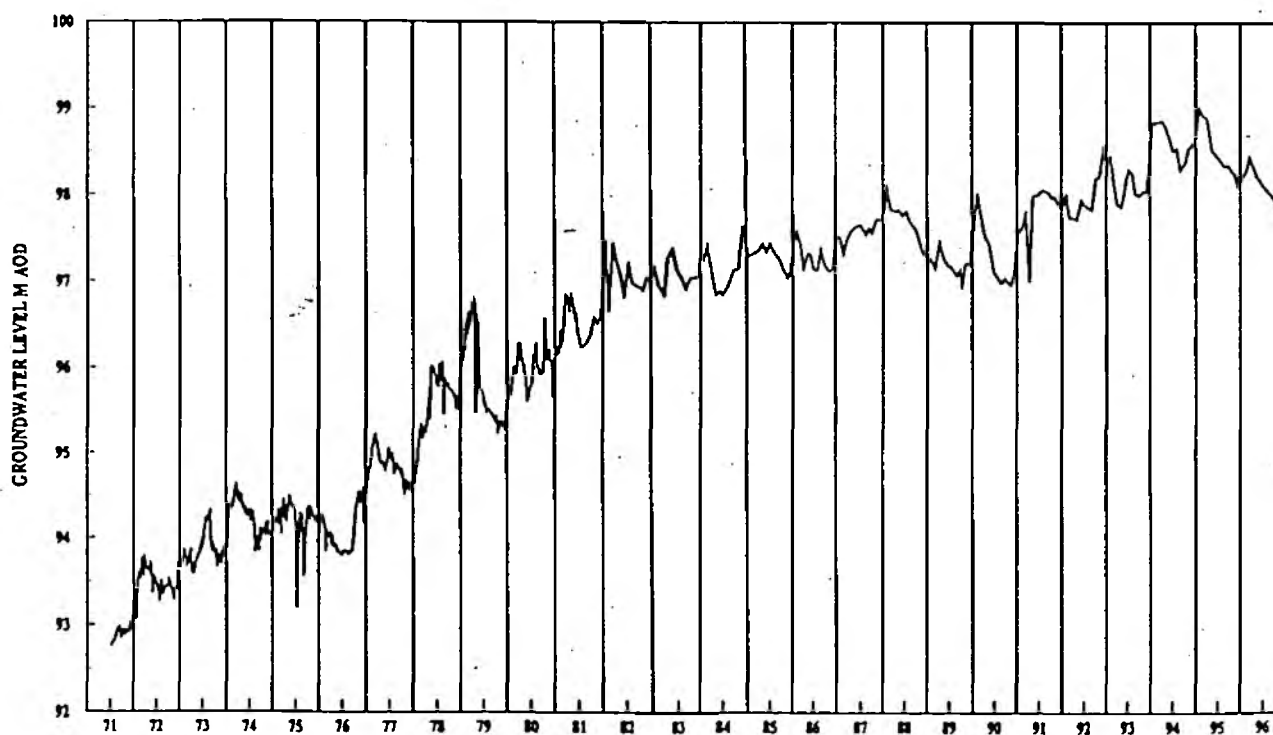
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 - 30/9/92	D
1/10/92 -	A

# GROUNDWATER UNIT: BIRMINGHAM (F5.4) [Fig 4]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CONSTITUTION HILL	SP06708759	1208



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		UPPER TRENTY	SP08348623	1214

## GROUNDWATER UNIT: BIRMINGHAM (F5.4) [Fig 4]

Licence No	Licensed Abstraction	Actual Abstraction
8/91	0.76	0.46
8/97	0.31	0.18
8/99	0.12	0.07
8/107	0.06	0.04
8/114	0.045	0.00
8/139	5.60	2.13
8/140	1.32	0.00
8/142	0.93	0.05
8/229	0.21	0.11
8/231	0.35	0.22
8/233	0.41	0.41
8/237	1.56	0.29
8/253	0.11	(NR) 0.11
9/19	0.15	0.0005
9/23	0.75	0.27
9/24	8.17	(NR) 0.00
9/47	0.055	0.004
9/50	0.19	0.08
9/51	0.15	0.00
9/57	0.06	0.12
9/61	0.062	(NR) 0.06
9/64	0.11	0.00
9/66	0.12	0.06
9/79	0.62	0.28
9/98	0.82	0.13
9/99	4.20	1.60
9/102	0.36	0.09
9/103	0.16	0.13
9/104	0.10	(NEW) 0.02
9/105	0.18	(NEW) 0.08
9/106	0.04	(NEW) 0.00
9/107	0.59	(NEW) 0.00
10/17	1.87	0.00
10/18	0.02	0.02
10/33	4.97	1.44
10/36	0.06	0.06
10/37	0.22	0.00
10/39	8.00	0.00
12/20	0.50	0.31
12/20	1.36	0.12
12/60	<u>1.20</u>	<u>0.36</u>
	<u>38.88</u>	<u>9.30</u>

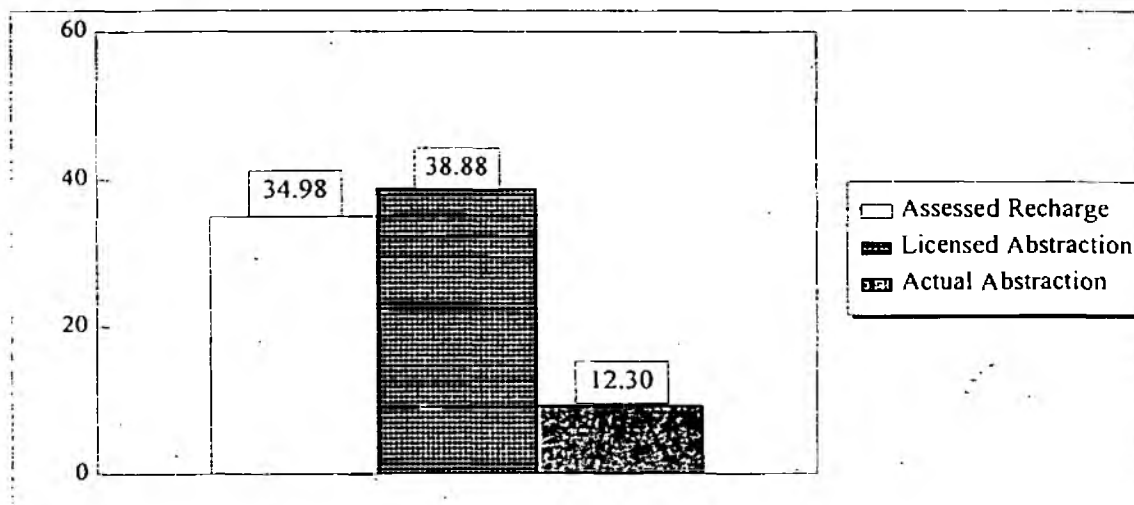
In addition, approximately 3.00 is pumped to waste in order to control rising groundwater levels.

+ 3.00  
= 12.30

## GROUNDWATER UNIT: BIRMINGHAM (F5.4) [Fig 4]

### SUMMARY

#### Resource Balance



#### Unit Classification: D

Active encouragement is given to any new licence applications. Groundwater levels are still rising due to reduced abstraction and leakage from water mains and sewers. Yields are invariably good but groundwater quality is extremely variable with some contamination of groundwater resulting from industrial processes.

Assessed resources do not take into account recharge from leaking sewers and mains water pipelines.

#### Classification History

1/10/83 - 30/9/84	B*
1/10/84 - 30/9/91	E*
1/10/91 -	D

**GROUNDWATER UNIT : MERIDEN (F 5.5) [Fig 4]**

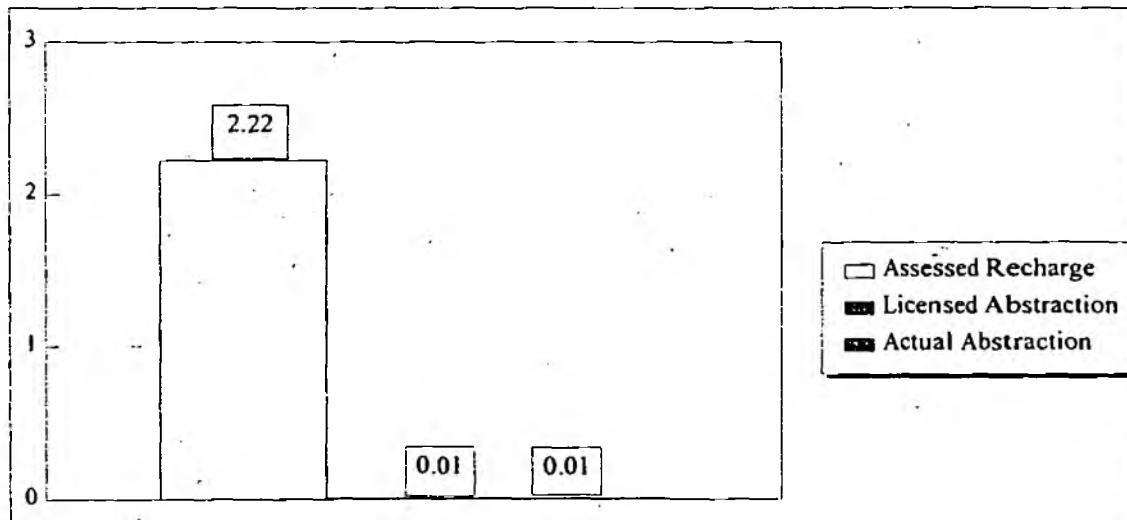
There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: MERIDEN (F5.5) [Fig 4]

Licence No	Licensed Abstraction	Actual Abstraction
11/16	0.01	0.01

### SUMMARY

#### Resource Balance



#### Unit Classification: A

Little is known about yields and groundwater quality in this small unit. The unit does supply a limited amount of baseflow to the tributaries of the River Blythe which is a public water supply river and must be protected. No new licences can be considered no matter how small.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 - 1/10/92	D
1/10/92 -	A

## **SECTION B**

### **2. Sherwood Sandstones - Severn Catchment**



## GROUNDWATER UNIT: WHITTINGTON (F6.1) [Fig 8]



## GROUNDWATER UNIT: WHITTINGTON (F6.1) [Fig 8]

Licence No	Licensed Abstraction	Actual Abstraction
3/5	0.009	0.009
3/28	0.009	0.009
3/32	0.009	0.009
3/65	0.014	0.014
3/67	0.005	0.005
3/72	0.012	0.012
3/73	0.012	0.012
3/76	0.012	0.012
3/80	0.007	0.007
3/94	0.005	0.005
3/131	0.009	0.009
3/132	0.002	0.002
3/140	0.011	0.011
3/153	0.009	0.009
3/154	0.009	0.005
3/178	0.005	0.005
3/179 (Kinsall) (ST)*	) 5.00	4.41
3/179 (Rednal) (ST)*	)	0.71
3/193	0.01	0.01
3/198	0.76	(NEW) 0.20
4/1118 (SGS)+	( 0.90)	0.00
	<u>6.81</u>	<u>5.47</u>

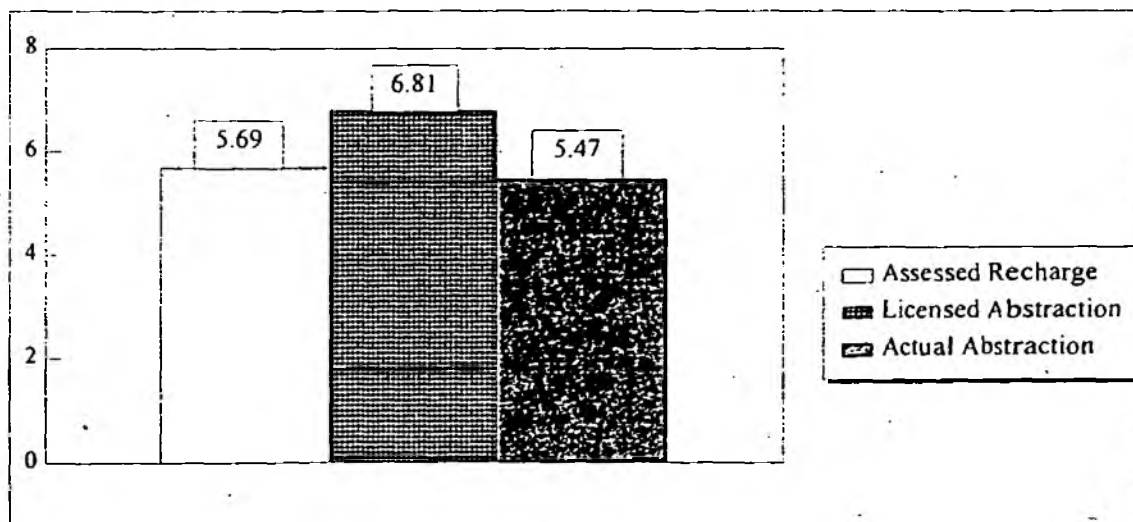
\* Group licence for the two sources is 5.00, the individual maximum quantity for Rednal is 1.80.

+ 0.90 represents the long term anticipated actual rate of abstraction. In any one year the licence is 11.51 and over a five year period it is 5.10.

Public Water Supply	5.90	5.12
Private Water Supply	0.91	0.35

### SUMMARY

#### Resource Balance



## GROUNDWATER UNIT: WHITTINGTON (F6.1) [Fig 8]

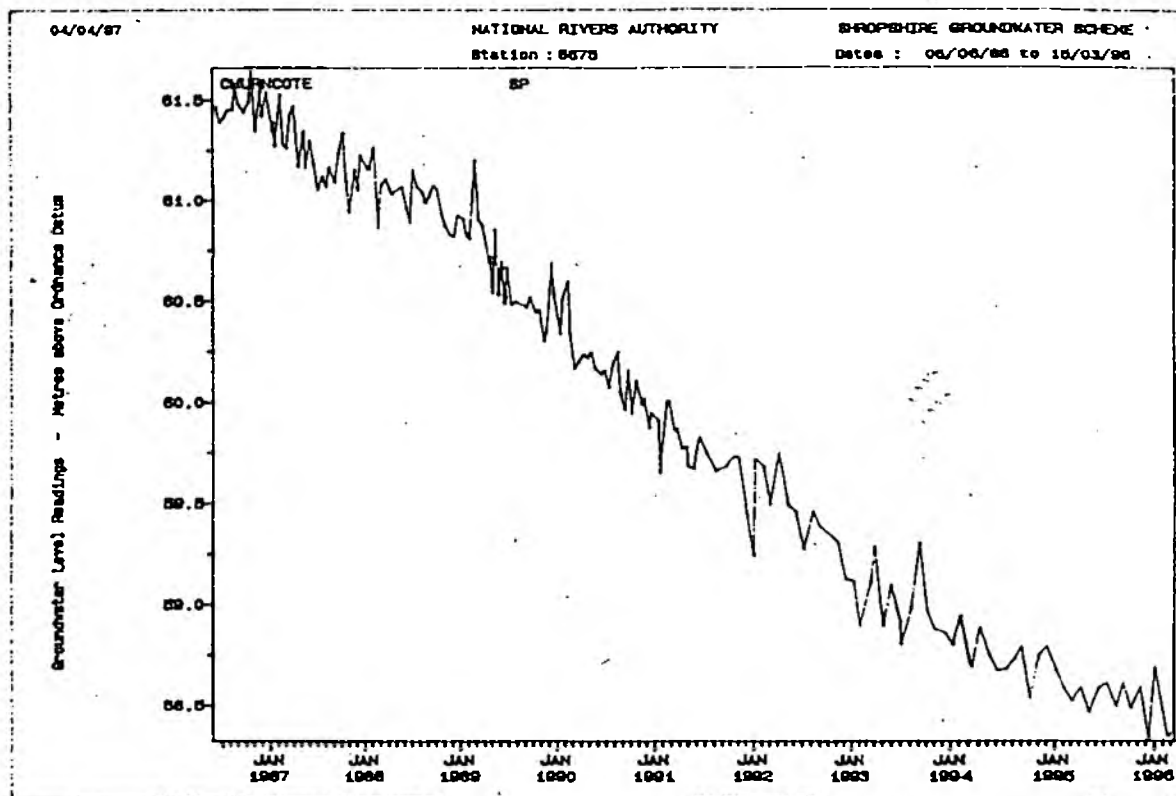
### Unit Classification: A

No additional groundwater development can be considered in this unit. Full exploitation of the PWS licences will take actual abstraction over the assessed recharge. Groundwater flow within the unit is northwards towards the River Dee (Welsh Region) which is an important water supply river and also has a high environmental status. The River Perry in this area is not dependent on baseflow discharge from the sandstone due to the thick drift cover, which blankets the aquifer. There is an existing agreement between both Regions whereby pumping from SGS must be curtailed when the level in an observation borehole at Eastwick (SJ 3808 3828) falls below an agreed level; the current level is only marginally above this but no SGS development has taken place.

### Classification History

1/10/83 - 30/9/84	C*
1/10/84 - 30/9/89	B*
1/10/89 - 30/9/92	B(TL)
1/10/92 -	A

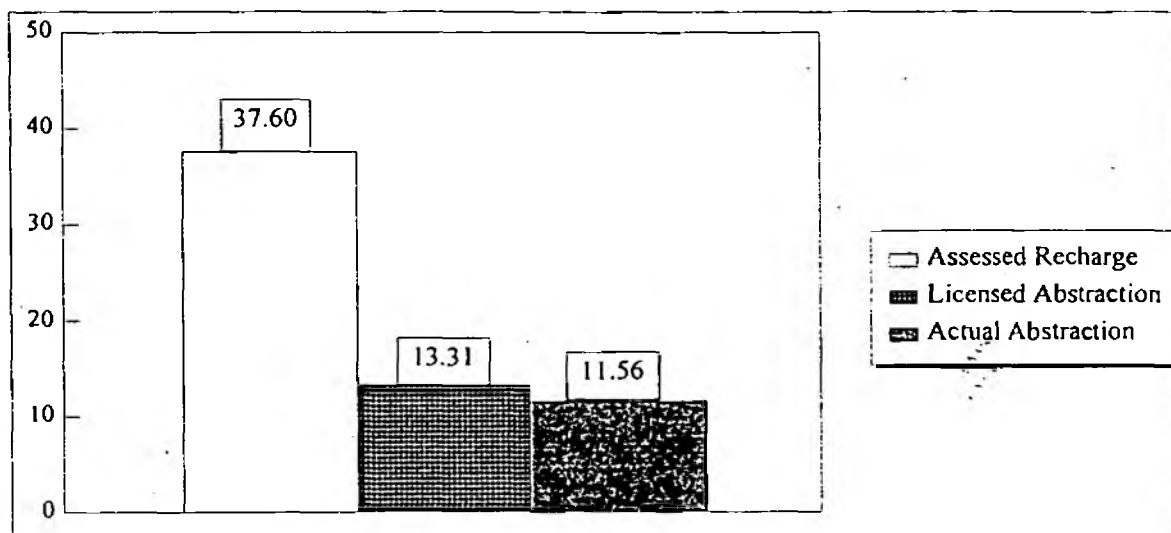
## GROUNDWATER UNIT: ALBERBURY (F6.3) [Fig 7]



## GROUNDWATER UNIT: KNOCKIN (F6.2) [Fig 8]

### SUMMARY

#### Resource Balance



#### Unit Classification: D

No objection to small licence applications, but for large proposals the need to protect baseflow will have to be considered. Some unacceptable reduction in baseflow has already occurred in the vicinity of Kinnerley. STW have been granted a small time-limited increase to the Kinnerley licence, subject to requirements for local groundwater and surface water monitoring, and provision of compensation water.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

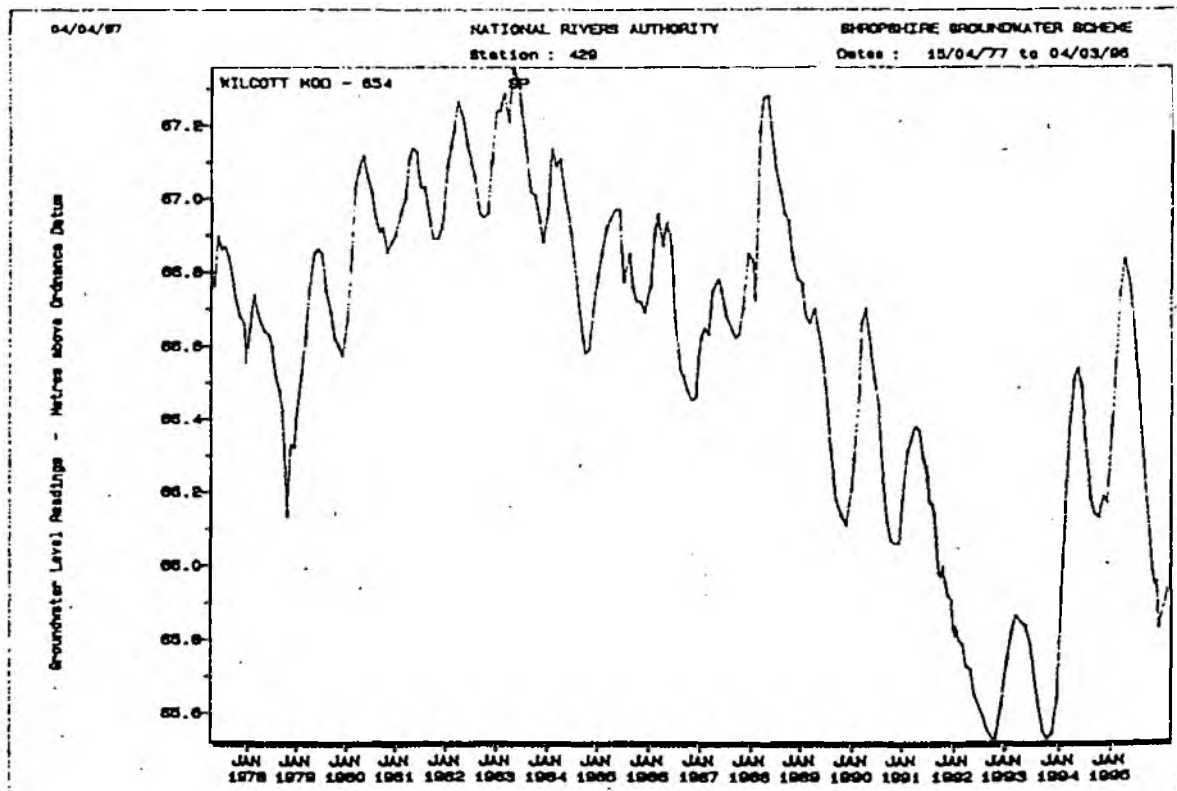
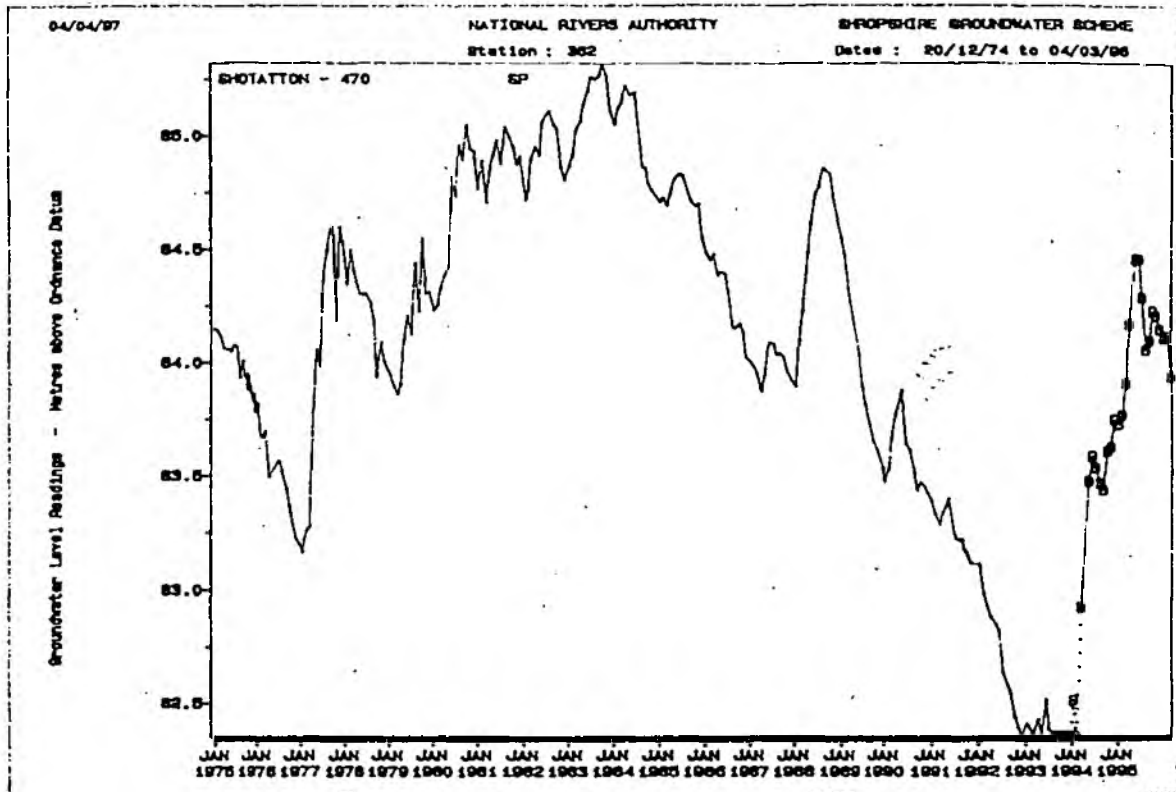
# GROUNDWATER UNIT: KNOCKIN (F6.2) [Fig 8]

1/351	0.005	0.005
1/391	0.005	0.005
1/420	0.0001	0.000
1/424	0.014	0.014
1/436	0.002	0.002
1/501	0.10	0.04
1/546 (Kinnerley) (ST)	5.01	4.87
1/553	0.31	0.29
1/601	0.005	0.005
1/611	0.002	0.002
1/614	0.006	0.006
1/619	0.003	(NEW) 0.003
1/620	0.03	(NEW) 0.03
1/621	0.19	(NEW) 0.19
1/624	0.29	(NEW) 0.29
3/8	0.009	0.009
3/9	0.002	0.002
3/49	0.006	0.006
3/54	0.005	0.005
3/58	0.12	(NR) 0.125
3/79	0.90	0.067
3/84	0.005	0.005
3/129 (Ruyton)(ST)	5.32	4.45
3/143	0.001	0.001
3/177	0.31	0.38
3/180	0.27	0.23
3/191	0.019	0.019
3/195	0.69	(NEW) 0.06
3/199	<u>0.02</u>	(NEW) <u>0.02</u>
	<u>13.31</u>	<u>11.56</u>
Public Water Supply	10.33	9.32
Private Water Supply	2.97	2.24

# GROUNDWATER UNIT: KNOCKIN (F6.2) [Fig 8]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
1/4	0.014	0.014
1/6	0.007	0.007
1/50	0.014	0.014
1/69	0.002	0.002
1/77	0.001	0.001
1/81	0.005	0.005
1/85	0.001	0.001
1/90	0.025	0.025
1/93	0.001	0.001
1/98	0.005	0.005
1/105	0.007	0.007
1/120	0.003	0.003
1/123	0.011	0.011
1/124	0.005	0.005
1/128	0.009	0.009
1/129	0.006	0.006
1/132	0.002	0.002
1/137	0.007	0.007
1/138	0.009	0.009
1/140	0.012	0.012
1/141	0.001	0.001
1/142	0.002	0.002
1/143	0.009	0.009
1/154	0.005	0.005
1/156	0.002	0.002
1/167	0.09	0.06
1/180	0.005	0.005
1/189	0.006	0.006
1/207	0.009	0.006
1/226	0.005	0.005
1/233	0.009	0.009
1/234	0.009	0.009
1/251	0.0002	0.0002
1/255	0.002	0.002
1/280	0.009	0.009
1/283	0.009	0.009
1/296	0.004	0.004
1/308	0.005	0.005
1/310	0.005	0.005
1/311	0.012	0.012
1/312	0.009	0.009
1/313	0.005	0.005
1/314	0.068	(NR) 0.068
1/317	0.005	0.005
1/319	0.006	0.006
1/327	0.011	0.011
1/328	0.005	0.005
1/341	0.005	0.005

## GROUNDWATER UNIT: KNOCKIN (F6.2) [Fig 8]

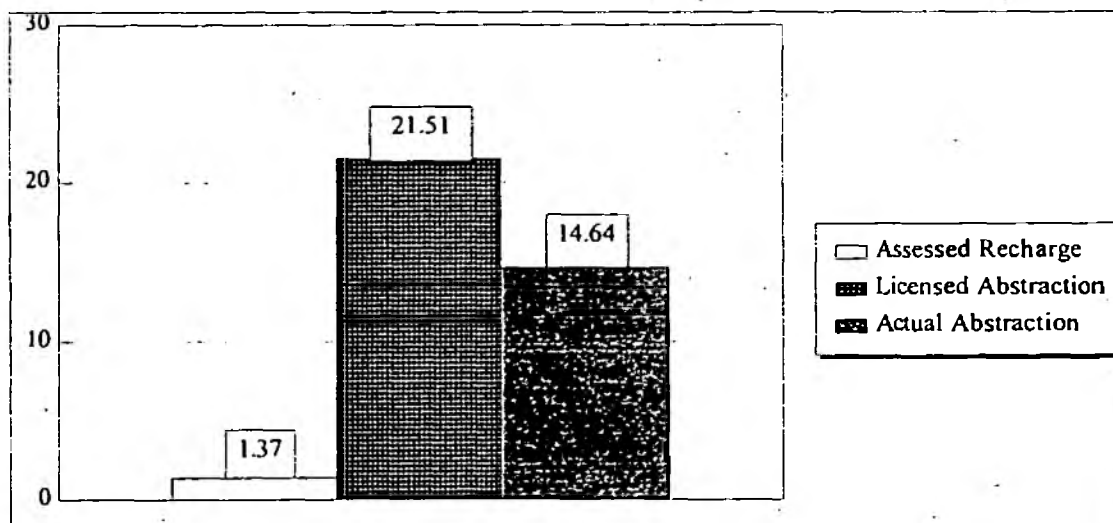




## GROUNDWATER UNIT: ALBERBURY (F6.3) [Fig 7]

Licence No	Licensed Abstraction	Actual Abstraction
1/80	0.005	0.005
1/121	0.014	0.014
1/186	0.011	0.011
1/223	0.016	0.016
1/523	0.046	0.046
2/88	0.019	0.019
2/149	0.0005	0.0005
2/400 (Ford) (ST)	4.20	4.18
2/401 (Eyton) (ST)	4.20	3.72
2/417	0.001	0.001
2/506 (Shelton) (ST)	13.00	6.63
2/589	<u>0.001</u>	<u>0.001</u>
	<u>21.51</u>	<u>14.64</u>
Public Water Supply	21.40	14.53
Private Water Supply	0.11	0.11

### SUMMARY



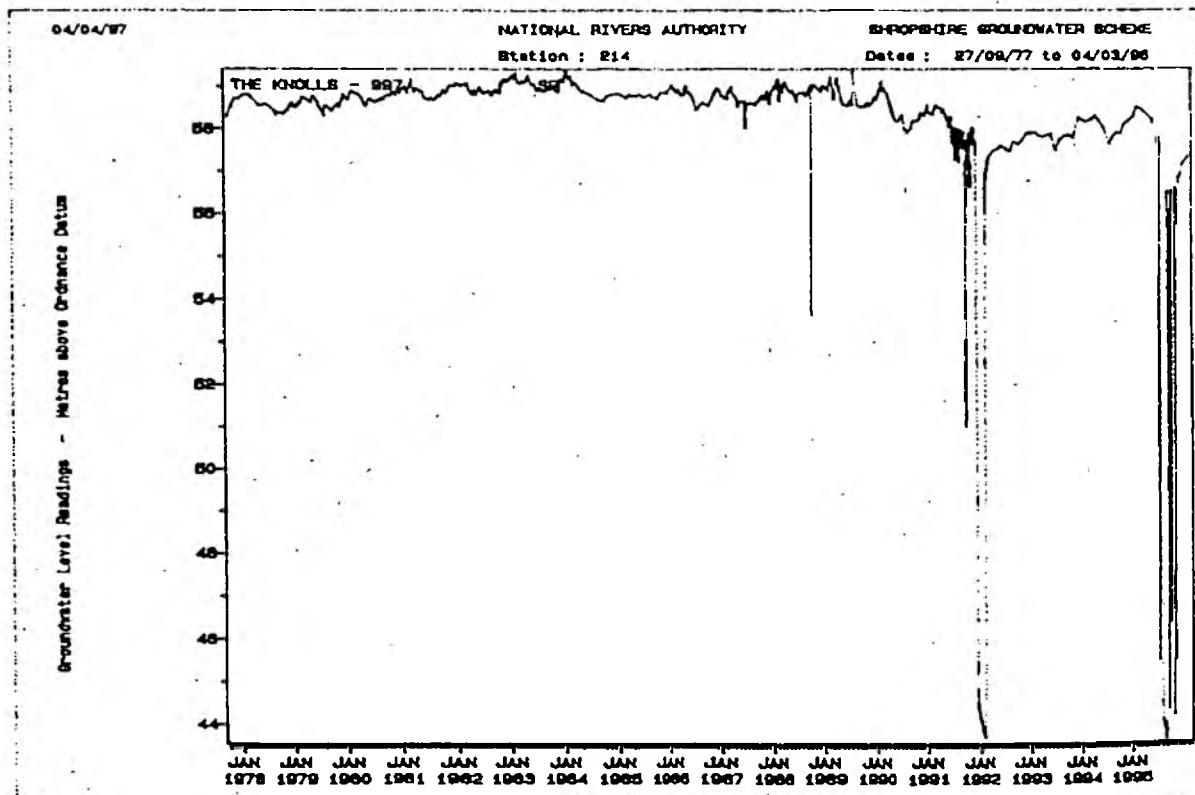
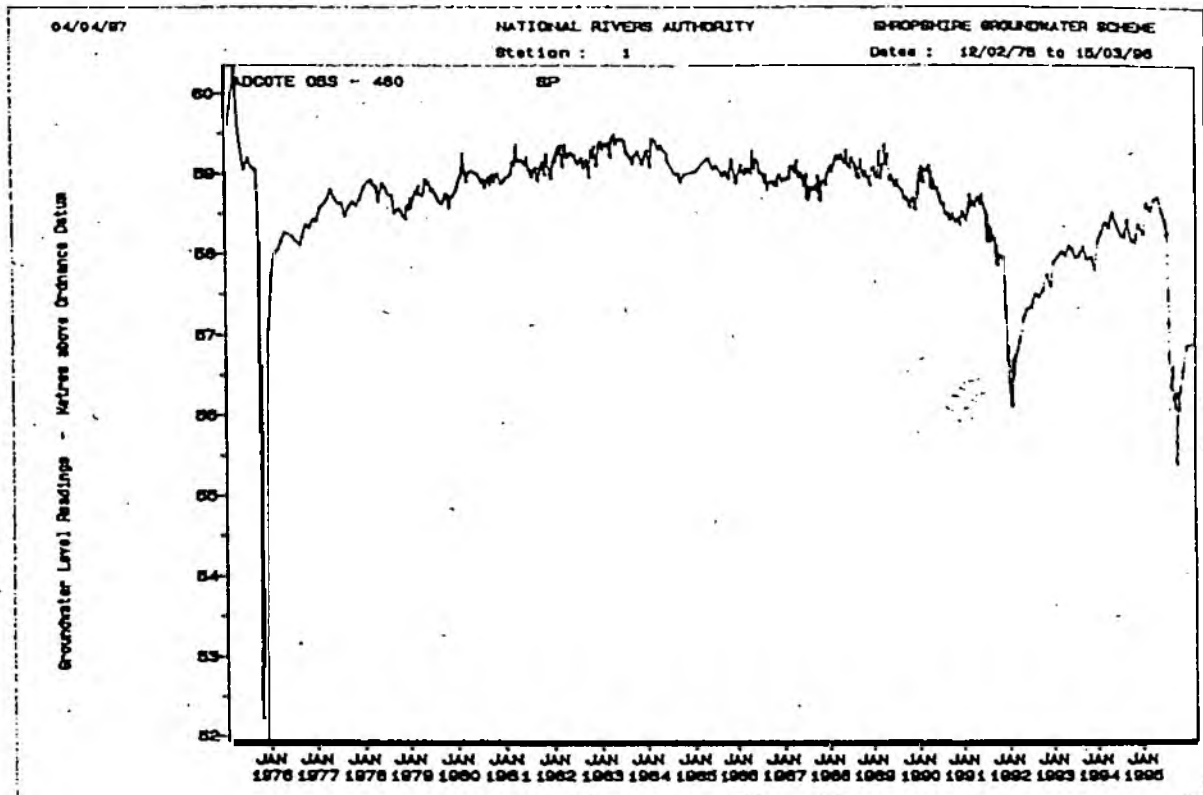
### Unit Classification: A

Whilst the resource balance of this unit indicates that it is grossly overlicensed and overabstracted, the PWS boreholes obtain a significant portion of their yield indirectly from the River Severn. All three PWS sources have a time limited component in their licence, which reflects the uncertainty as to where the water originates, ie either from the river, the aquifer or both. Churncote observation borehole shows steadily declining water levels, indicating that at least to some extent the boreholes are drawing on groundwater storage. No further groundwater development can be considered until the PWS licences have been fully appraised. The time limits within these licences will expire on the 1st April 1998.

### Classification History

1/10/83 - 30/9/90	B*
1/10/90 - 30/9/91	A*
1/9/91 -	A

## GROUNDWATER UNIT: ENSDON (F6.4) [Fig 8]



## GROUNDWATER UNIT: ENSDON (F6.4) [Fig 8]

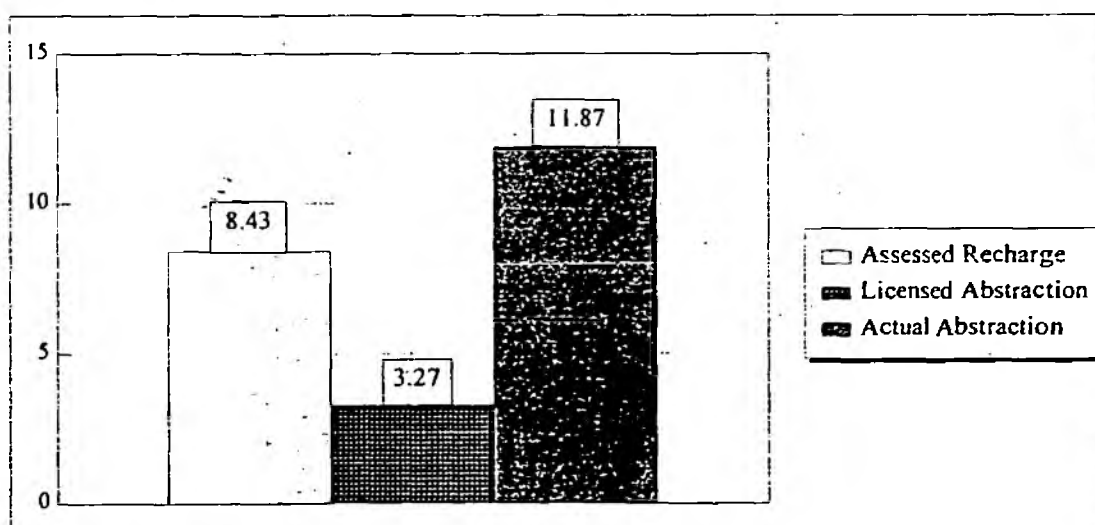
<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
1/126	0.0005	0.0005
1/127	0.003	0.002
1/302	0.027	0.027
1/303	0.009	0.009
1/305	0.009	0.009
1/497	0.01	0.01
1/559	0.50	0.26
1/610	0.06	0.02
2/8	0.005	0.005
2/62	0.004	0.004
2/340	0.018	0.018
2/385	0.29	0.19
2/591	0.44	(NEW) 0.44
2/601	0.49	(NEW) 0.49
3/45	0.009	0.009
3/187	0.30	0.30
4/1118 (SGS)*	( 1.10)	10.07
	<u>3.27</u>	<u>11.87</u>

\* 1.10 represents the long term anticipated actual rate of abstraction. In any one year the licence is 17.81 and over a five year period it is 7.78

Public Water Supply	( 1.10)	10.07
Private Water Supply	3.27	1.80

### SUMMARY

#### Resource Balance



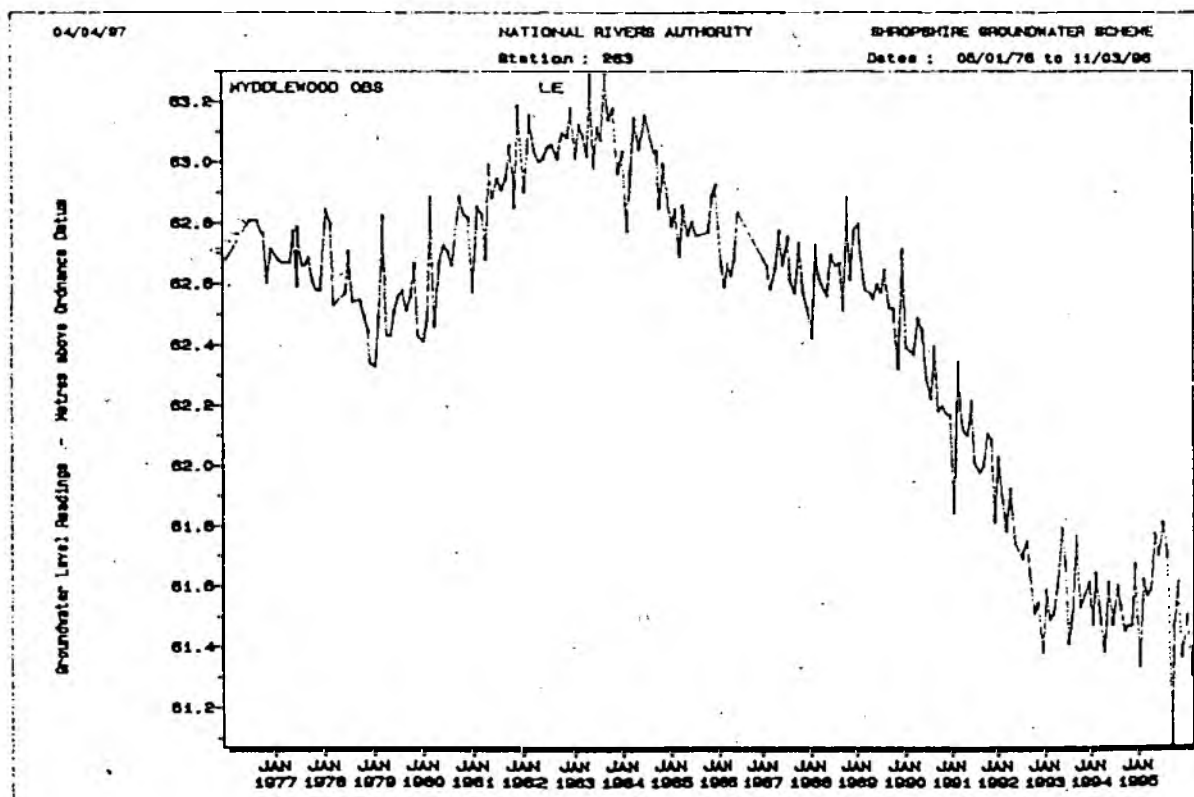
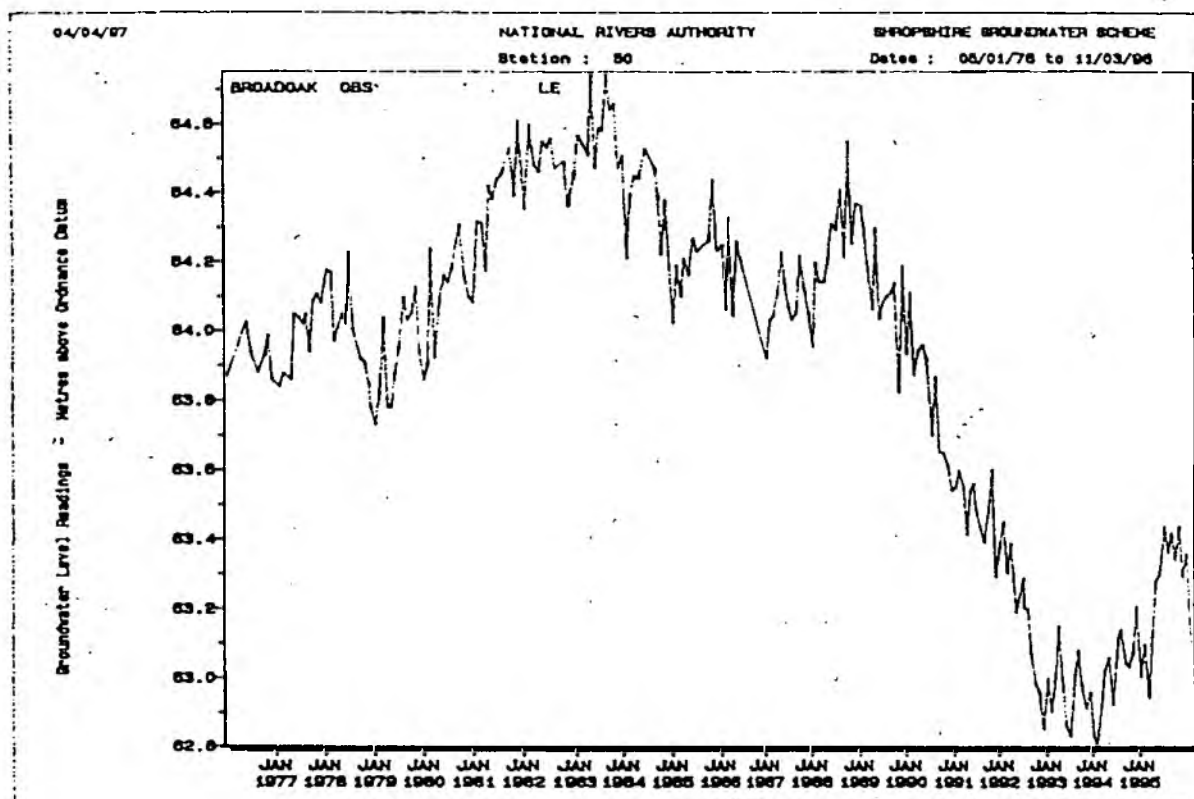
### Unit Classification: D

No objection to new licence applications but any new proposals must take into account the presence of existing SGS boreholes. The aquifer is largely confined beneath glacial drift and effects of pumping can be widespread.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

## GROUNDWATER UNIT: MERRINGTON (F6.5) [Fig 8]



# GROUNDWATER UNIT: MERRINGTON (F6.5) [Fig 8]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
2/32	0.016	0.016
2/39	0.009	0.009
2/45	0.019	0.019
2/51	0.007	0.020
2/53	0.012	0.004
2/70	0.004	0.006
2/78	0.006	0.014
2/82	0.014	0.016
2/96	0.044	0.044
2/113	0.016	0.016
2/140	0.048	0.027
2/165	0.007	0.007
2/195	0.02	0.02
2/201	0.011	0.01
2/210	0.14	0.11
2/211	0.002	0.002
2/248	0.007	0.007
2/263	0.002	0.002
2/290	0.018	0.018
2/407 (Bomere Heath) (ST)	1.20	0.96
2/429	0.005	0.005
2/440	0.014	0.015
2/508	0.28	0.17
2/509	0.045	0.001
2/580	0.02	0.005
2/590	0.045	(NEW) 0.008
2/594	0.002	(NEW) 0.003
3/31	0.009	0.009
3/81	0.0004	0.0004
3/85	0.009	0.010
3/126	0.01	0.01
3/137	0.005	0.005
4/238	0.01	0.01
4/290	0.034	0.007
4/607	0.012	0.012
4/696	0.018	0.018
4/738	0.025	0.020
4/948	0.0002	0.0002
4/1118 (SGS)*	( 2.00)	0.00
4/1318	0.006	0.006
4/1386	0.03	(NEW) 0.03
	<u>4.18</u>	<u>1.64</u>

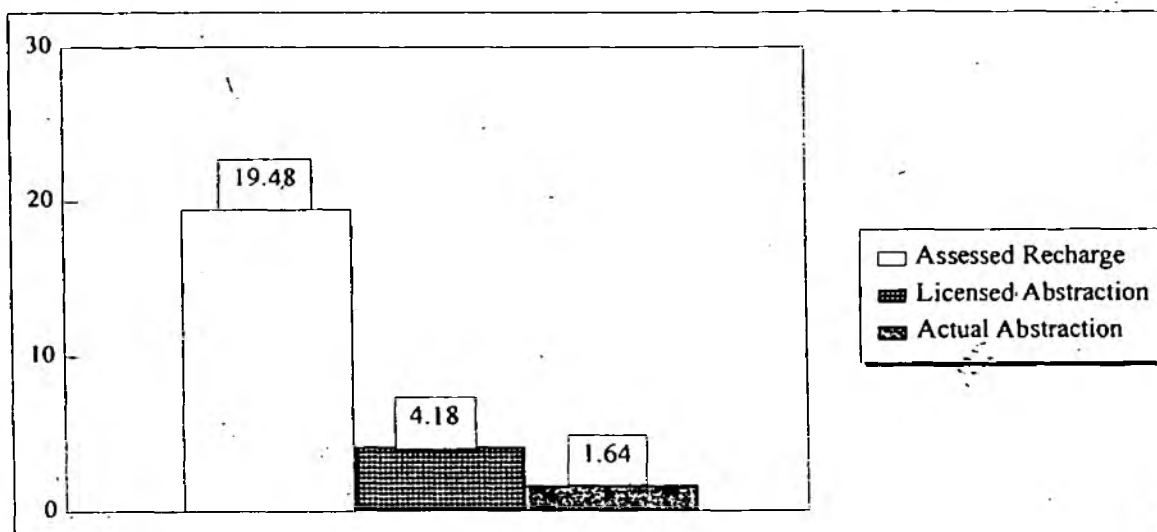
\* (2.00) represents the long term anticipated actual rate of abstraction. In any one year the licence is 28.69 and over a five year period it is 12.48.

Public Water Supply	3.20	0.96
Private Water Supply	0.98	0.64

## GROUNDWATER UNIT: MERRINGTON (F6.5) [Fig 8]

### SUMMARY

#### Resource Balance



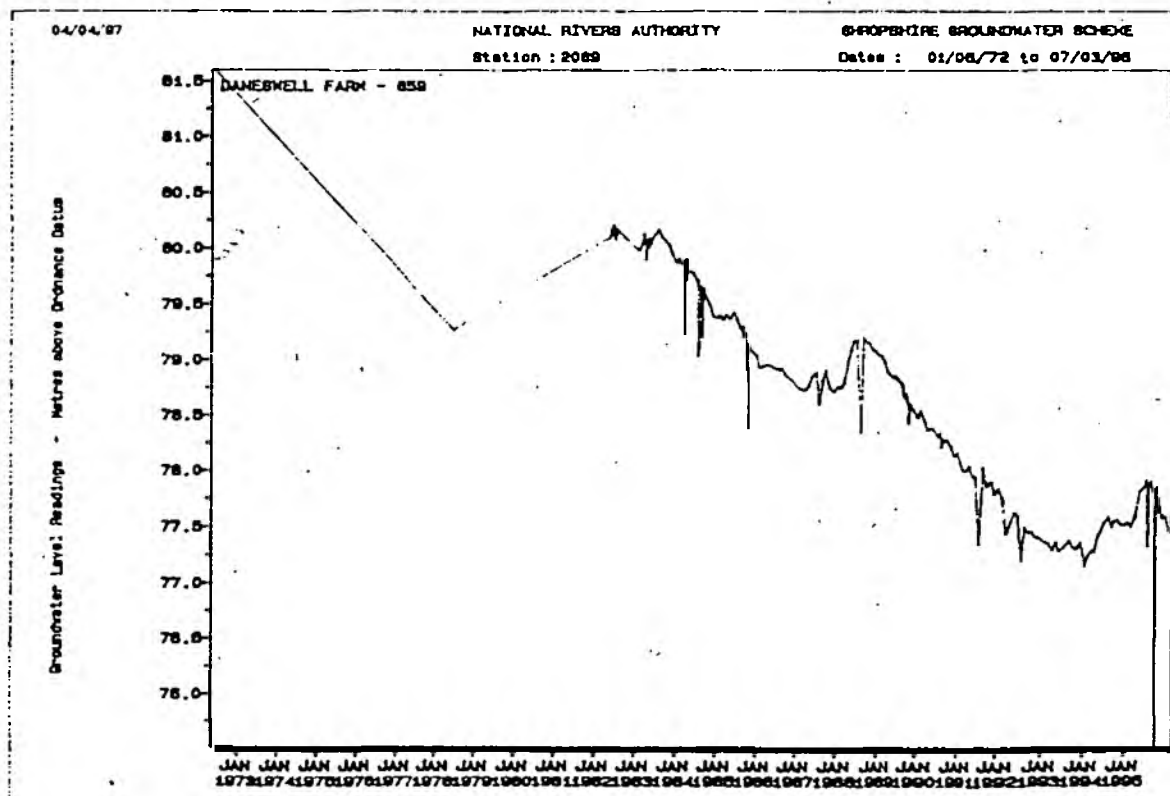
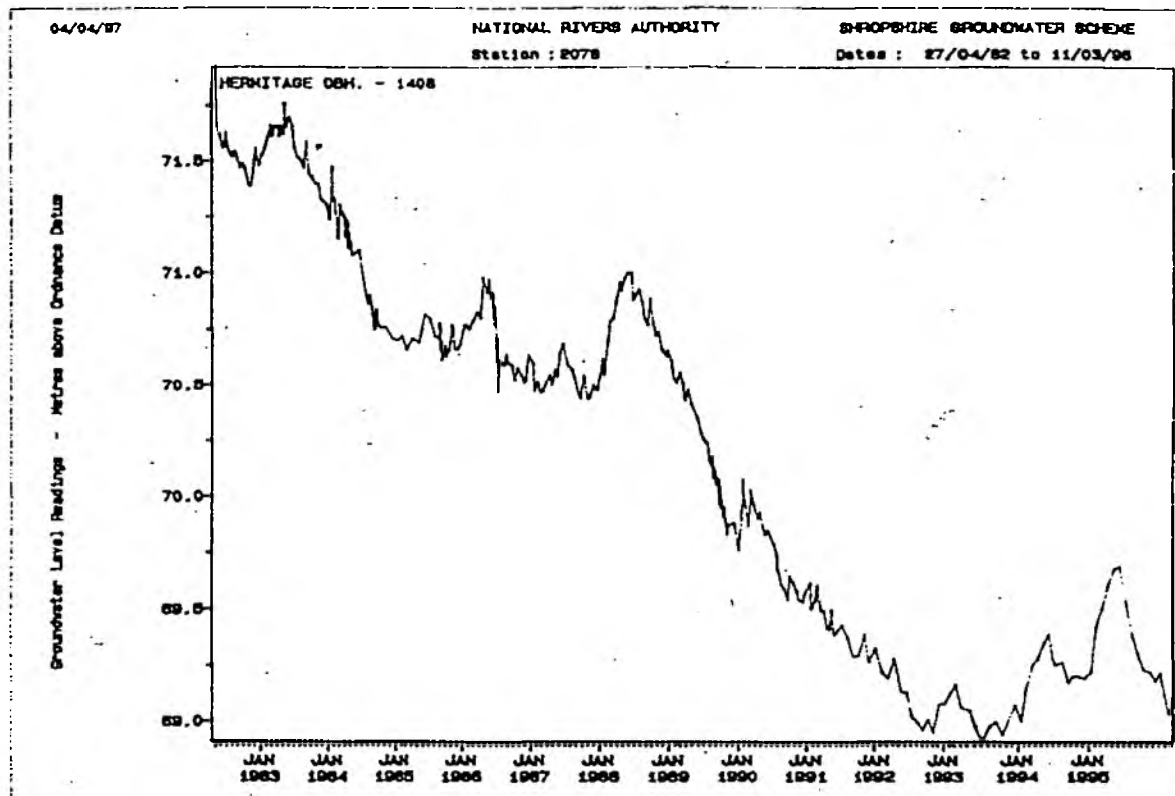
#### Unit Classification: D

Development of SGS abstraction boreholes within this unit commenced in 1993/94 with commissioning scheduled for 1997/98. No objection in principle to small permanent licences; time limited licences may, however, have to be considered for medium to large applications.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 - 30/9/92	A
1/10/92 -	D

# GROUNDWATER UNIT: STANTON (F6.6) [Fig 8]



# GROUNDWATER UNIT: STANTON (F6.6) [Fig 8]

Licence No	Licensed Abstraction	Actual Abstraction
4/43	0.057	0.04
4/55	0.013	0.013
4/63	0.007	0.007
4/66	0.01	0.01
4/67	0.009	0.009
4/70	0.005	0.005
4/71	0.001	0.001
4/117	0.005	0.005
4/134	0.005	0.005
4/146	0.002	0.002
4/158	0.002	0.002
4/198	0.009	0.009
4/285	0.003	0.003
4/355 (Preston Brockhurst) (ST)	1.96	1.45
4/421	0.0002	0.0002
4/442	0.006	0.006
4/482	0.0002	0.0002
4/564	0.02	0.02
4/588	0.001	0.001
4/661	0.002	0.002
4/747	0.018	0.018
4/770	0.001	0.001
4/807	0.011	0.011
4/813	0.002	0.002
4/821	0.002	0.002
4/833	0.014	0.014
4/916	0.009	0.009
4/942	0.005	0.005
4/986 (Lee Brockhurst) (ST)	7.49	6.21
4/988	0.002	0.002
4/990	0.015	0.015
4/1095	0.009	0.009
4/1096	0.007	0.007
4/1118 (SGS)*	( 0.60)	0.00
4/1138	0.12	0.10
4/1146	0.016	0.016
4/1153	0.25	0.17
4/1159	0.019	0.020
4/1168	0.014	0.014
4/1193	0.16	0.00
4/1194	0.45	0.20
4/1205	0.03	0.03
4/1266	0.25	0.33
4/1291	0.003	0.00
4/1308	0.14	0.10
4/1324	0.12	0.08



## GROUNDWATER UNIT: STANTON (F6.6) [Fig 8]

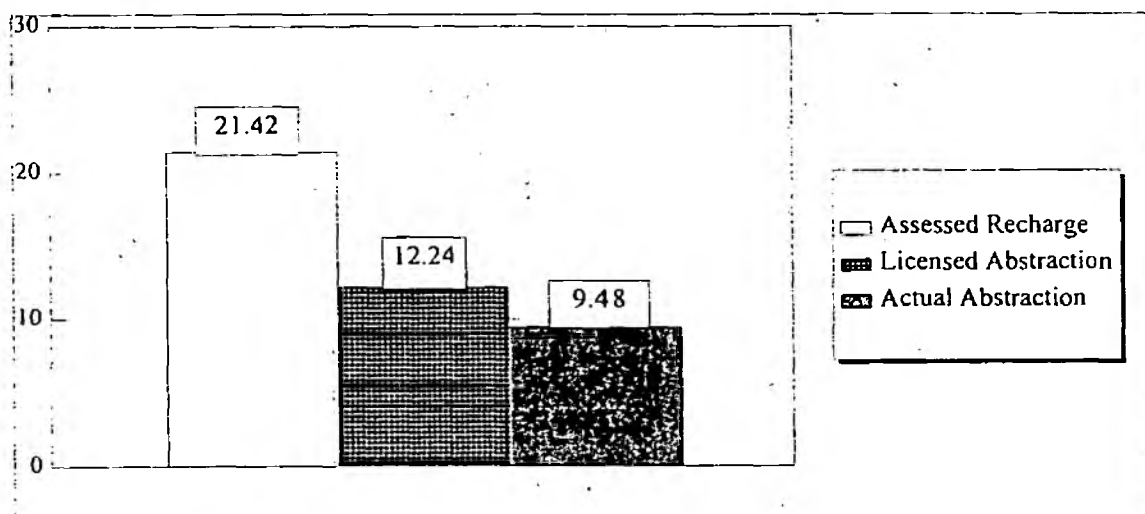
4/1342	0.18	0.13
4/1350	0.01	0.01
4/1358	0.16	0.11
4/1365	0.002	0.002
4/1384	0.00005	(NEW) 0.00005
4/1385	<u>0.019</u>	(NEW) <u>0.019</u>
	<u>12.24</u>	<u>9.24</u>

\* 0.60 represents the long term anticipated actual rate of abstraction. In any one year the licence is 11.85 and over a five year period it is 5.05.

Public Water Supply	10.05	7.66
Private Water Supply	2.19	1.57
Crown Exemption: RAF Shawbury:	0.24	

### SUMMARY

#### Resource Balance



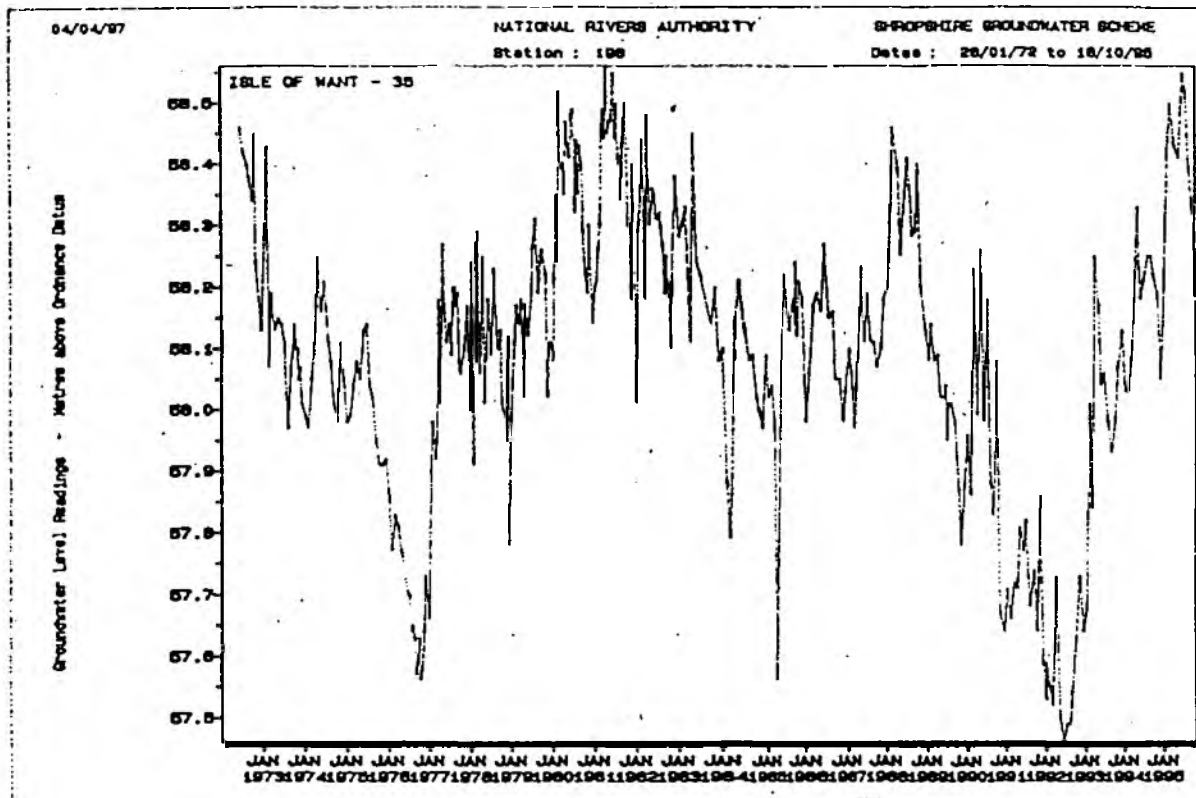
### Unit Classification: D

No objection to new licence applications. For large applications the need to protect baseflow must be considered. Any new proposal must also take into account licensed but not yet developed SGS boreholes. Pumping at Lee Brockhurst is causing local derogation, although the licence contains a protected sources clause to cover such effects.

### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: RADMOOR (F6.7) [Fig 8]



## GROUNDWATER UNIT: RADMOOR (F6.7) [Fig 8]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
4/9	0.005	0.005
4/20	0.009	0.009
4/50	0.003	0.003
4/72	0.005	0.005
4/91	0.007	0.007
4/142	0.002	0.002
4/143	0.005	0.005
4/159	0.019	0.019
4/204	0.0003	0.0003
4/272	0.001	0.000
4/341	0.012	0.012
4/344	0.014	0.014
4/371	0.007	0.007
4/378	0.005	0.005
4/436	0.005	0.005
4/441	0.005	0.005
4/444	0.005	0.005
4/446	0.005	0.005
4/471	0.009	0.009
4/507	0.001	0.007
4/522	0.002	0.002
4/542	0.0002	0.0002
4/552	0.005	0.005
4/556	0.002	0.002
4/597	0.002	0.002
4/619	0.005	0.005
4/634	0.007	0.007
4/654	0.003	0.003
4/663	0.009	0.009
4/680	0.004	0.004
4/681	0.018	0.018
4/682	0.005	0.005
4/684	0.018	0.018
4/685	0.005	0.005
4/719	0.005	0.005
4/728	0.001	0.001
4/729	0.001	0.001
4/751	0.007	0.007
4/752	0.003	0.003
4/826	0.003	0.003
4/827	0.002	0.002
4/828	0.016	0.016
4/830	0.001	0.001
4/836	0.006	0.006
4/846	0.003	0.003
4/857 (Hodnet) (ST)	0.91	0.19
4/938	0.009	0.009

# GROUNDWATER UNIT: RADMOOR (F6.7) [Fig 8]

4/1035	0.17		0.26
4/1093	0.26		0.15
4/1099	0.22		0.10
4/1100	0.023		0.02
4/1101	0.027	(NR)	0.027
4/1102	0.30		0.03
4/1113	0.25	(NR)	0.25
4/1115	0.027	(NR)	0.03
4/1118 (SGS)*	( 2.30)		6.62
4/1126	0.31		0.31
4/1135	0.27		0.27
4/1141	0.005		0.00
4/1143	0.011		0.01
4/1154	0.005		0.00
4/1158	0.20		0.14
4/1170	0.20		0.13
4/1185	0.21		0.15
4/1206	0.25		0.12
4/1218	0.001		0.001
4/1219	0.004		0.004
4/1236	0.003		0.003
4/1272	0.003		0.003
4/1274	0.008		0.008
4/1299	0.10		0.08
4/1313	0.004		0.004
4/1329	0.009		0.009
4/1333	0.004		0.004
4/1339	0.20		0.16
4/1347	0.05	(NR)	0.05
4/1375	0.0006	(NEW)	0.0006
13/360	<u>0.03</u>		<u>0.001</u>
	<u>6.62</u>		<u>2.43</u>

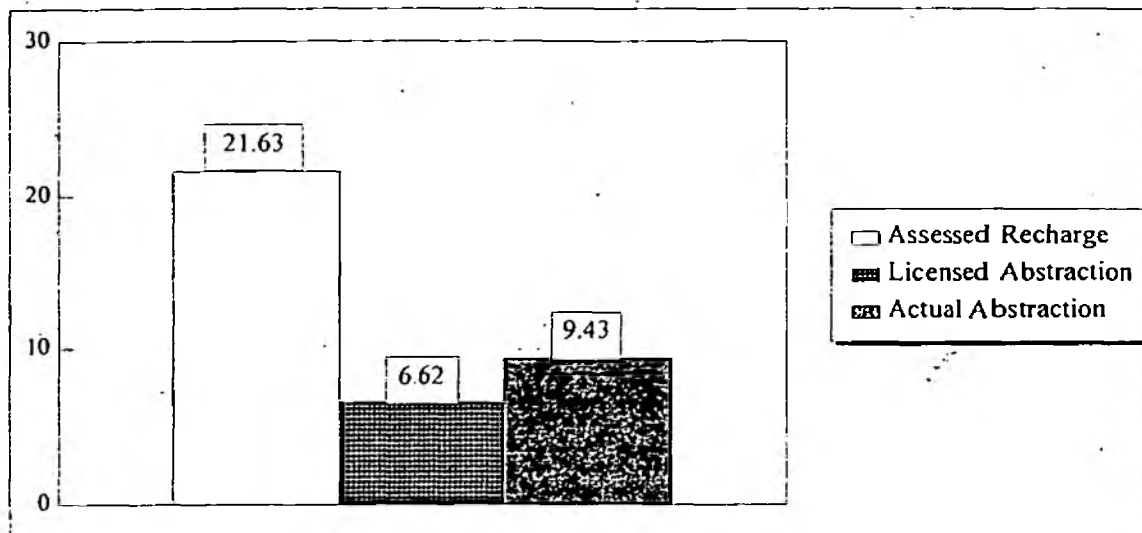
\* 2.30 represents the long term anticipated actual rate of abstraction. In any one year the licence is 42.66 and over a five year period it is 18.52.

Public Water Supply	3.21	0.19
Private Water Supply	3.41	9.23

## GROUNDWATER UNIT: RADMOOR (F6.7) [Fig 8]

### SUMMARY

#### Resource Balance



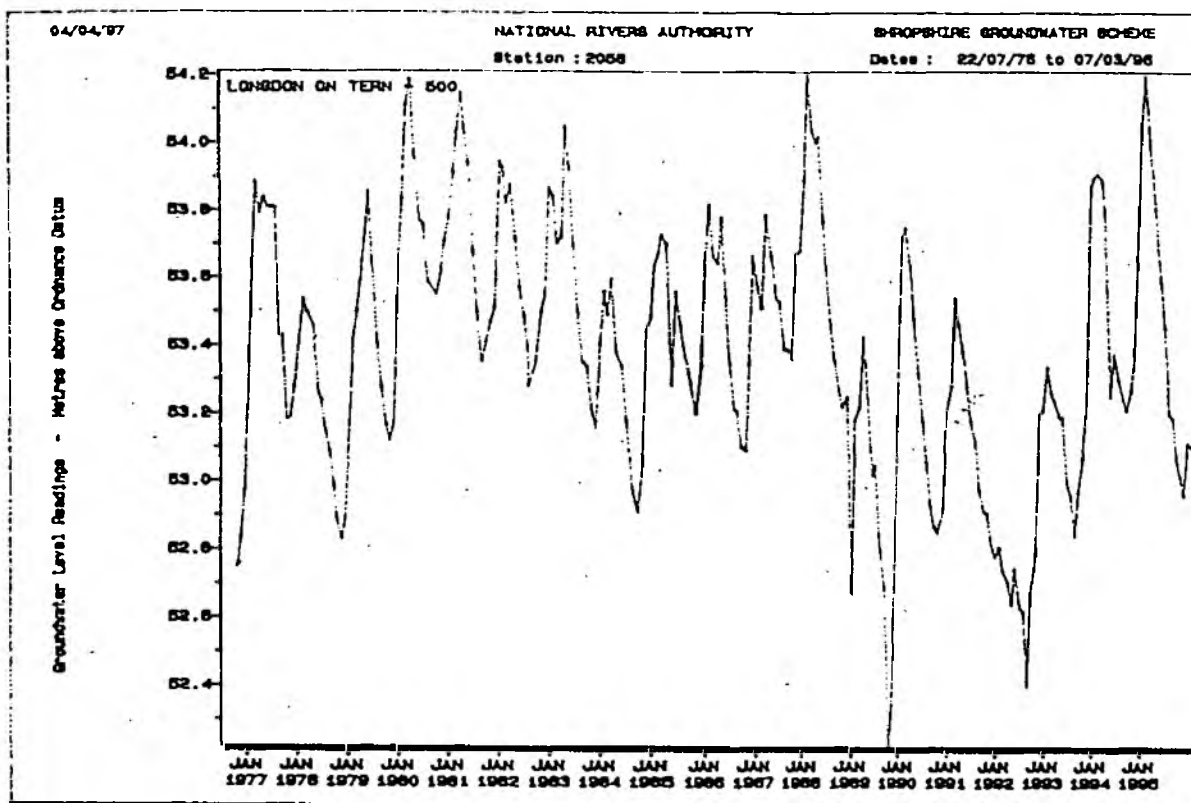
#### Unit Classification: D

No objection in principle to new small licence applications. For large applications baseflow protection will have to be considered. Any new proposal must also take into account the presence of SGS boreholes, some of which have already been developed.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

## GROUNDWATER UNIT: LONGDON (F6.8) [Fig 8]



## GROUNDWATER UNIT: LONGDON (F6.8) [Fig 8]

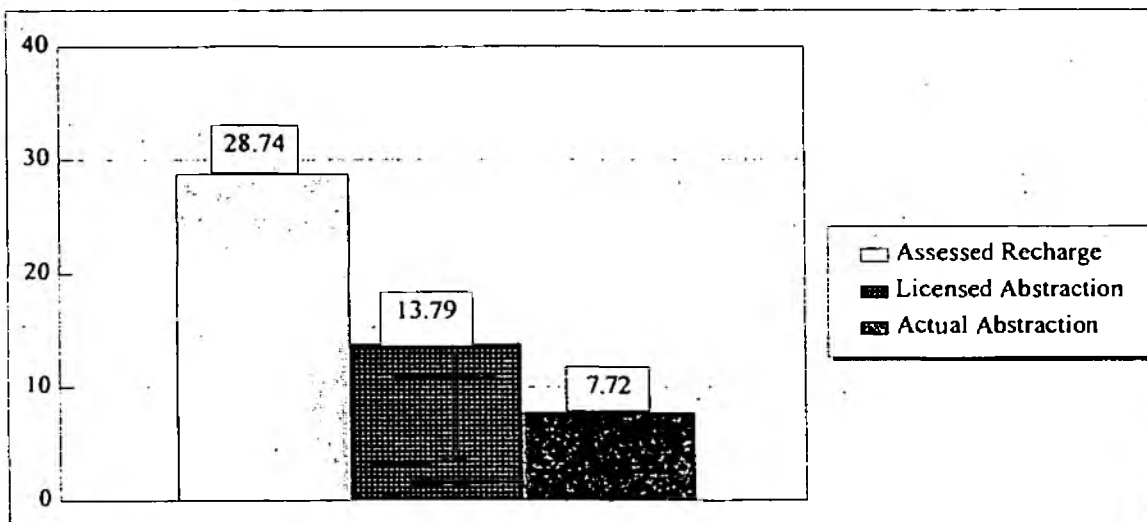
Licence No	Licensed Abstraction	Actual Abstraction
2/11	0.027	0.027
2/57	0.014	0.014
2/66	0.001	0.001
2/150	0.017	0.017
2/180	0.009	0.009
2/185	0.002	0.002
2/215	0.003	0.003
2/253	0.003	0.003
2/254	0.007	0.007
2/303	0.011	0.011
2/309 (Uckington) (ST)	3.82	1.27
3/321	0.006	0.006
2/452	0.014	0.014
2/487	0.32	0.22
2/561	0.14	0.00
4/38	0.007	0.007
4/157	0.005	0.005
4/174 (Woodfield) (ST)	7.96	5.08
4/186	0.005	0.005
4/221	0.007	0.007
4/256	0.007	0.007
4/258	0.060	0.05
4/264	0.006	0.006
4/336	0.005	0.005
4/340	0.126	0.014
4/388	0.002	0.002
4/391	0.002	0.002
4/392	0.003	0.003
4/396	0.005	0.005
4/397	0.003	0.003
4/481	0.007	0.007
4/487	0.37	0.34
4/518	0.001	0.001
4/519	0.002	0.002
4/616	0.027	0.027
4/652	0.011	0.011
4/674	0.009	0.009
4/675	0.005	0.005
4/733	0.0005	0.0005
4/757	0.0009	0.0009
4/760	0.005	0.005
4/787	0.009	0.009
4/797	0.004	0.004
4/835	0.011	0.011
4/870	0.011	0.011

## GROUNDWATER UNIT: LONGDON (F6.8) [Fig 8]

4/894	0.017	0.017
4/964	0.008	0.008
4/1000	0.018	0.018
4/1059	0.001	0.001
4/1060	0.001	0.001
4/1092	0.25	0.24
4/1215	0.06	0.06
4/1235	0.0004	0.0004
4/1282	0.30	0.10
4/1327	<u>0.06</u>	<u>0.033</u>
	<u>13.79</u>	<u>7.72</u>
Public Water Supply	11.78	6.35
Private Water Supply	2.01	1.36

### SUMMARY

#### Resource Balance



#### Unit Classification: D

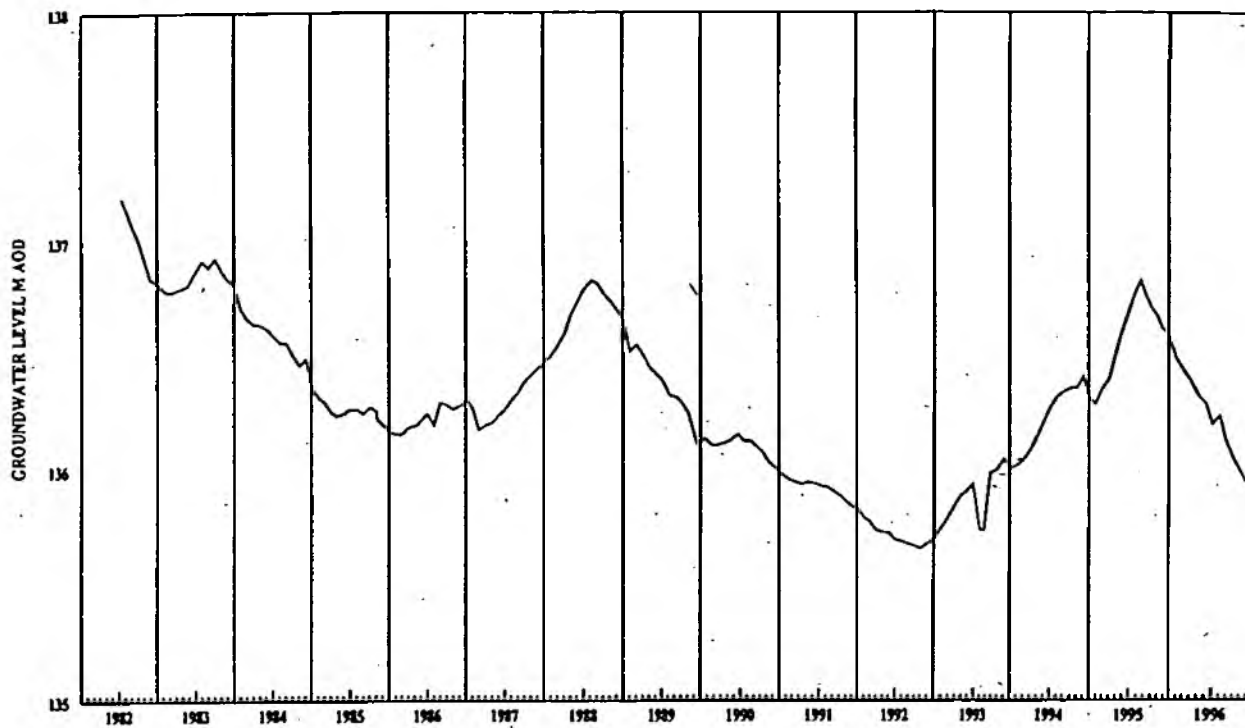
No objection in principle to new licence applications. Protection of baseflow may have to be considered in the eastern part of the unit. Borehole yields are known to be variable across this unit, as the aquifer thickens from northwest to southeast. There are localised areas of high chloride concentration, such as in the Woodfield PWS source. STW are currently investigating increasing the licence at Uckington to 10MI/d.

#### Classification History

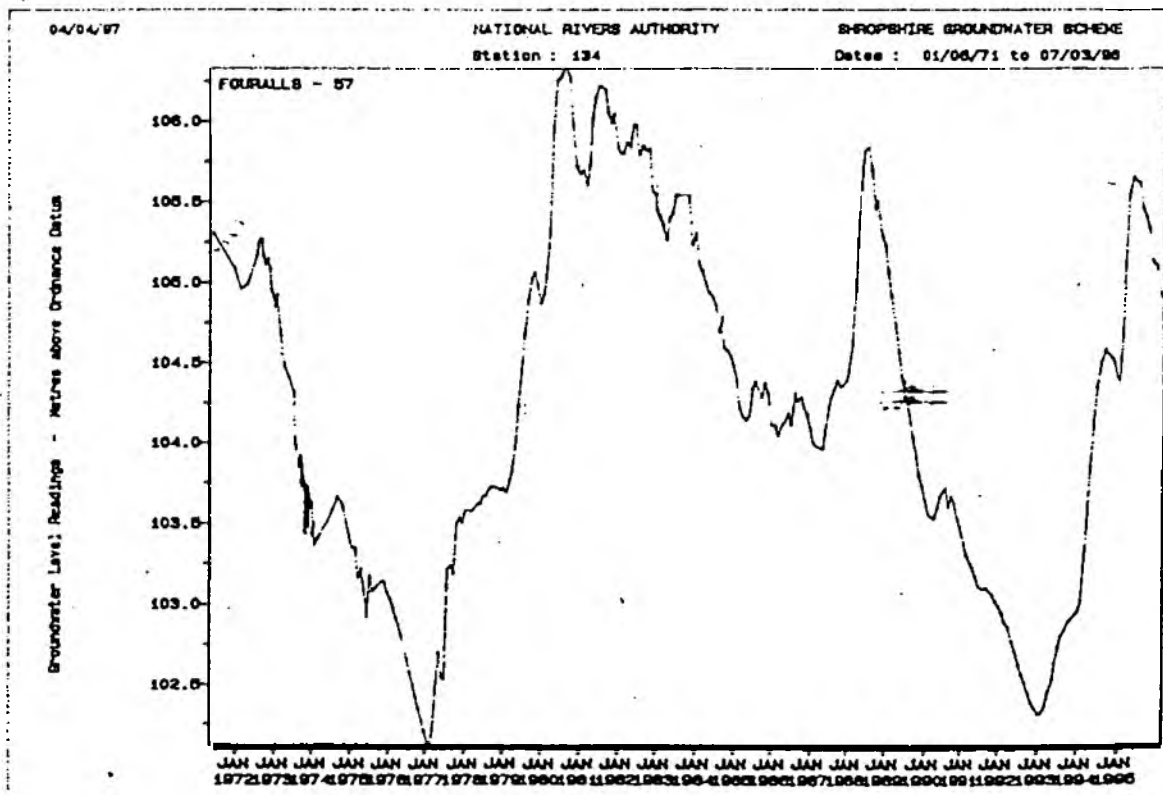
1/10/83 - 30/9/91	E*
1/10/91 -	D



**GROUNDWATER UNIT: MARKET DRAYTON (F7.1) [Fig 8]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		WOORE	SJ73134234	0447

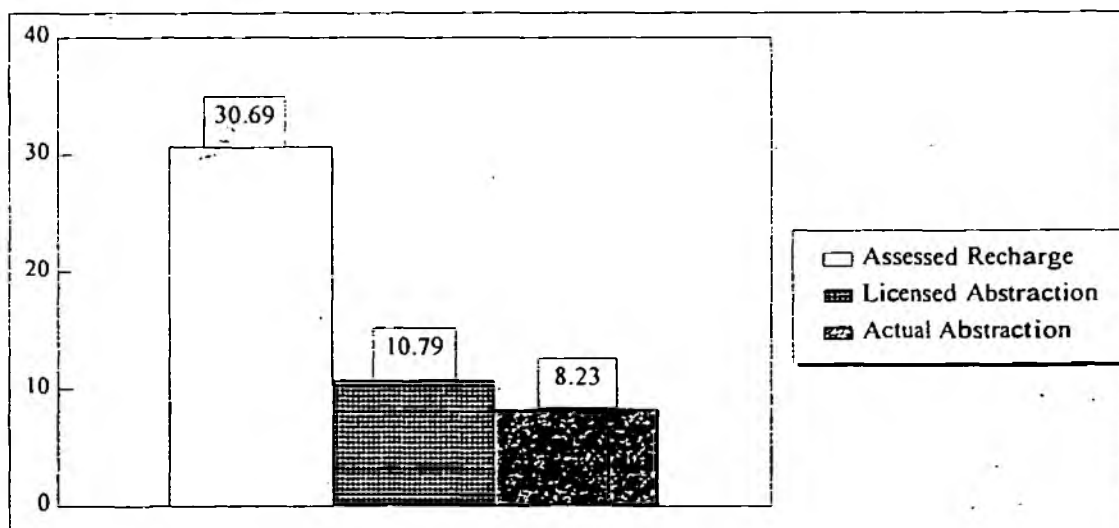


## GROUNDWATER UNIT: MARKET DRAYTON (F7.1) [Fig 8]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
4/4	0.011	0.011
4/119 (Bearstone) (NW)	4.98	3.46
4/133	0.12	(NR) 0.12
4/273	0.08	0.004
4/297	0.015	0.015
4/547	0.0002	0.0002
4/569	0.0007	0.0007
4/628	0.001	0.001
4/848	0.018	0.018
4/849	0.009	0.009
4/939 (Shifford's Bridge) (ST)	2.27	1.84
4/1162	0.027	0.027
4/1187	0.02	0.02
4/1199	0.35	0.33
4/1201	0.56	0.30
4/1229	0.026	0.03
4/1244	0.271	0.23
4/1289	0.034	0.007
4/1300	2.00	1.77
4/1376	<u>0.04</u>	(NEW) <u>0.04</u>
	<u>10.79</u>	<u>8.23</u>
Public Water Supply	7.25	5.30
Private Water Supply	3.54	2.93

### SUMMARY

#### Resource Balance



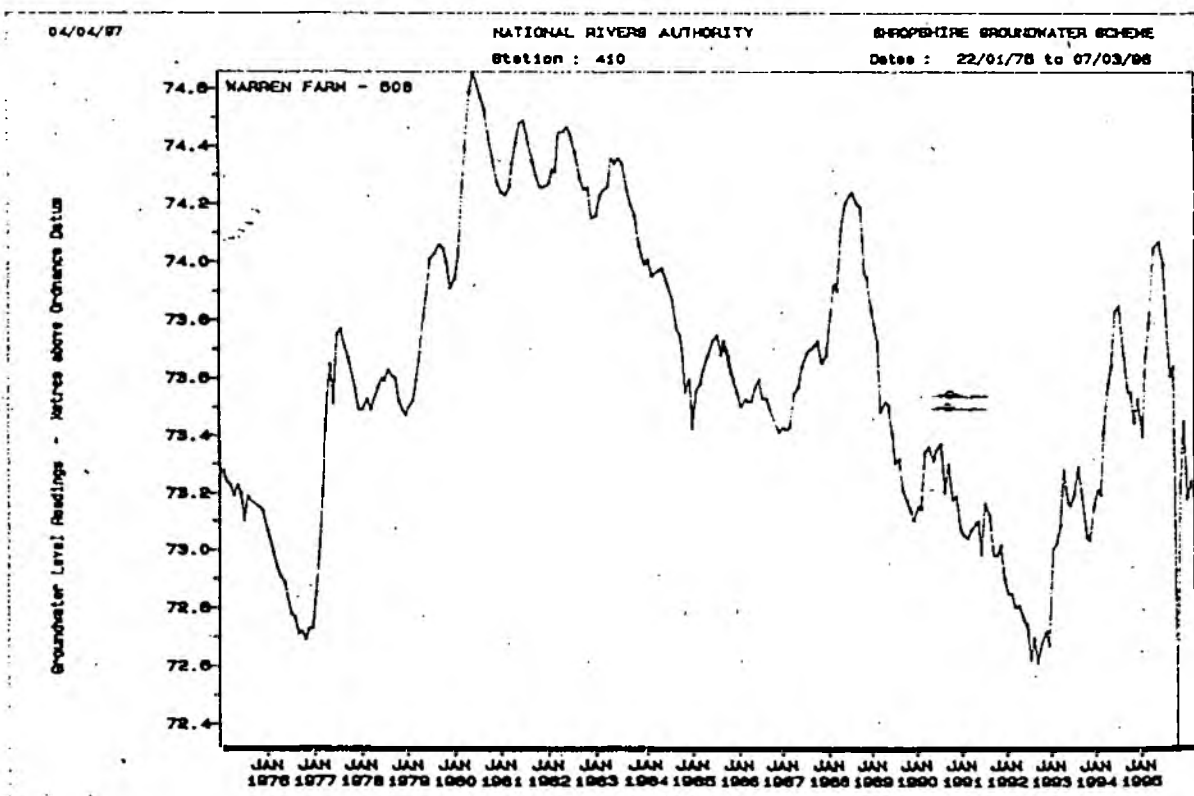
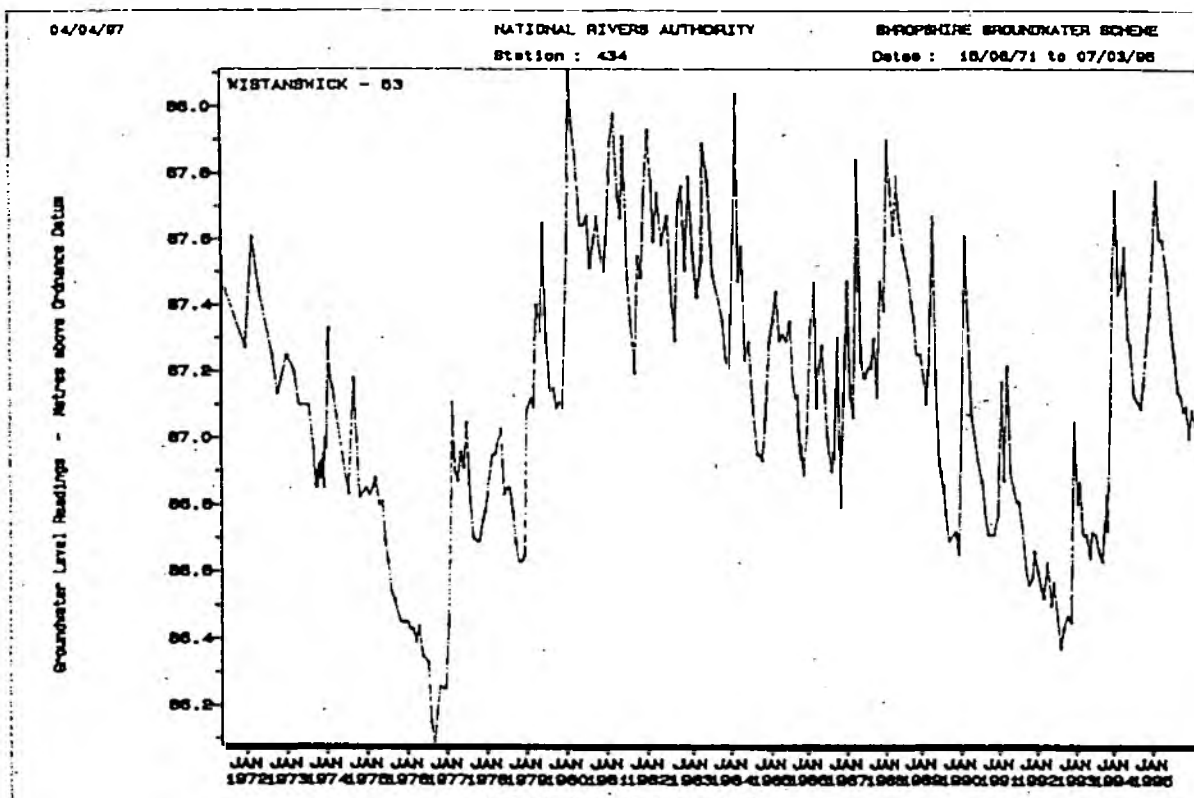
#### Unit Classification: D

No objection in principle to new licence applications. Consideration will however, given, to baseflow protection when large applications are made.

#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: WISTANSWICK (F7.2) [Fig 8]



## GROUNDWATER UNIT: WISTANSWICK (F7.2) [Fig 8]

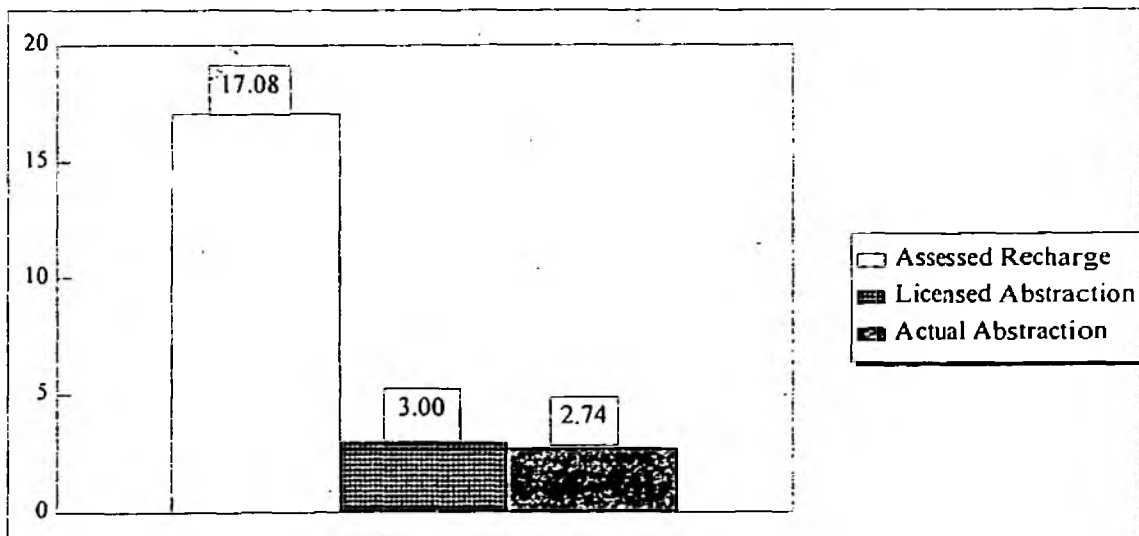
Licence No	Licensed Abstraction	Actual Abstraction
4/13	0.002	0.002
4/31	0.005	0.005
4/32	0.018	0.018
4/35	0.005	0.005
4/140	0.017	0.017
4/144	0.005	0.005
4/216	0.009	0.009
4/220	0.014	0.014
4/354	0.023	0.023
4/370	0.001	0.001
4/432	0.009	0.009
4/703	0.005	0.005
4/754	0.002	0.002
4/997	0.0003	0.0003
4/1091 (Stoke-on-Tern) (ST)	2.25	1.23
4/1118 (SGS)*	( 0.40)	1.20
4/1207	0.052	0.03
4/1372	<u>0.18</u>	(NEW) <u>0.18</u>
	<u>3.00</u>	<u>2.74</u>

\* (0.40) represents the long term anticipated actual rate of abstraction. In any one year the licence is 6.14 and over a five year period it is 2.51.

Public Water Supply	2.65	2.42
Private Water Supply	0.35	0.32

### SUMMARY

#### Resource Balance



## GROUNDWATER UNIT: WISTANSWICK (F7.2) [Fig 8]

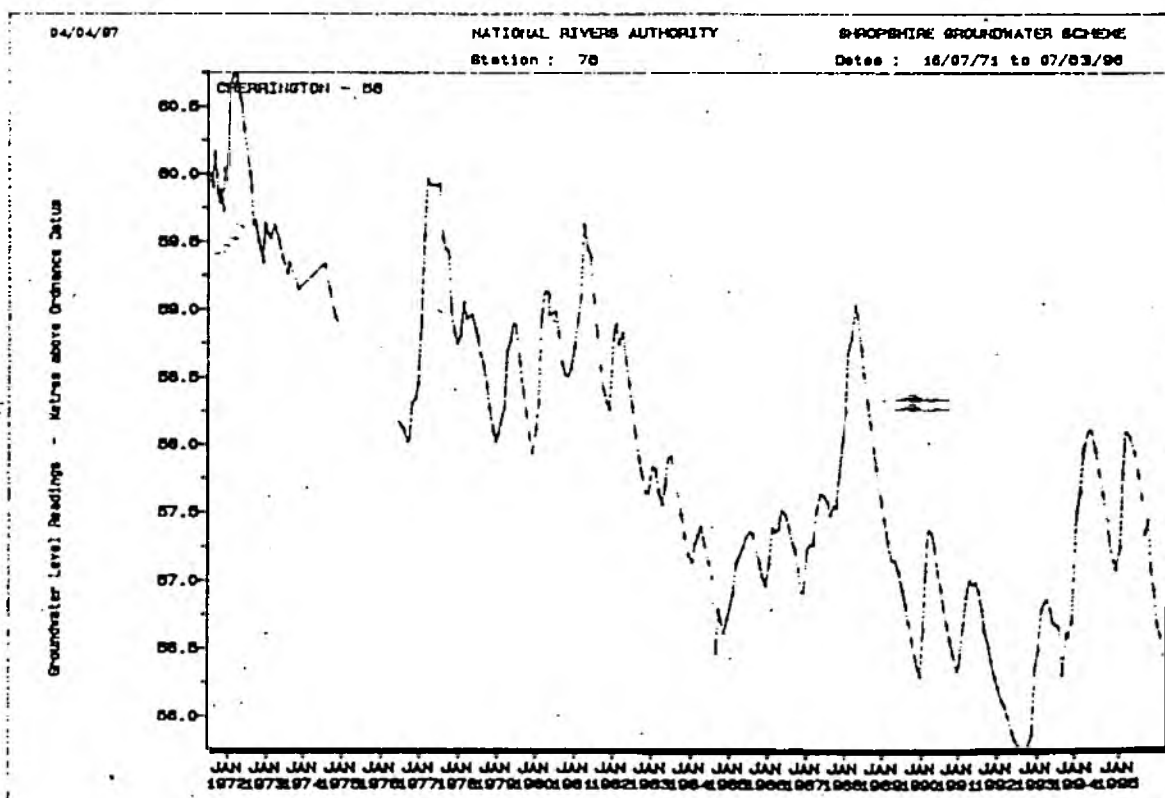
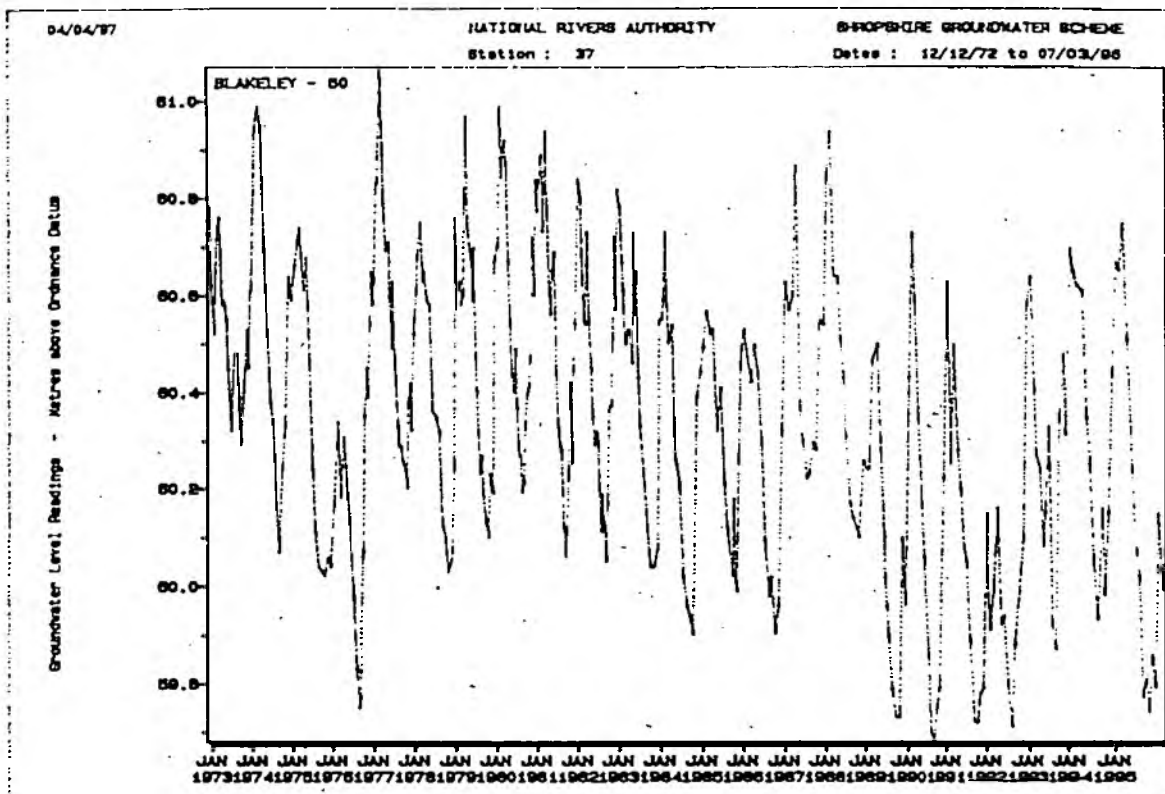
### Unit Classification: D

No objection in principle to new licence applications. Little information is available on borehole yields and groundwater quality. Any new proposals must take into account the presence of SGS boreholes, some of which have already been developed. Protection of baseflow is critical throughout the unit.

### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# **GROUNDWATER UNIT: SAMBROOK (F7.3) (WEST AND EAST)** **[FIG 8]**



# GROUNDWATER UNIT: SAMBROOK (F7.3) (WEST AND EAST)

[FIG 8]

Licence No	Licensed Abstraction	Actual Abstraction
4/2	0.009	0.009
4/3	0.009	0.009
4/8	0.005	0.005
4/12	0.005	0.005
4/24	0.012	0.012
4/30	0.018	0.018
4/47	0.005	0.005
4/61	0.005	0.005
4/76	0.005	0.005
4/107	0.012	0.012
4/108	0.005	0.005
4/110	0.013	0.013
4/147	0.009	0.009
4/151	0.01	0.01
4/152	0.011	0.011
4/162	0.005	0.005
4/199	0.005	0.005
4/212	0.011	0.011
4/213	0.005	0.005
4/299	0.005	0.005
4/300	0.011	0.011
4/312	0.002	0.002
4/330	0.014	0.014
4/335	0.003	0.003
4/383	0.009	0.009
4/384	0.018	0.018
4/405	0.005	0.005
4/426	0.001	0.001
4/475	0.002	0.002
4/483	0.005	0.005
4/514	0.009	0.009
4/530	0.014	0.014
4/550	0.002	0.002
4/551	0.013	0.013
4/562	0.009	0.009
4/578	0.019	0.019
4/600	0.011	0.011
4/621 (Great Soudley) (ST)	0.45	0.00
4/632	0.021	0.00
4/655	0.007	0.007
4/671	0.44	0.31
4/672	0.50	0.05
4/688	0.004	0.004
4/692	0.005	0.005
4/705	0.014	0.014
4/709	0.002	0.002

**GROUNDWATER UNIT: SAMBROOK (F7.3) (WEST AND EAST)****[FIG 8]**

4/727	0.005	0.004
4/758	0.009	0.009
4/767	0.003	0.003
4/771	0.005	0.005
4/778	0.005	0.005
4/780	0.005	0.005
4/809	0.023	0.023
4/810	0.009	0.009
4/832	1.51	1.38
4/934 (Weston Jones) (ST)	9.09	7.04
4/971	0.012	0.005
4/976	0.004	0.004
4/983	0.004	0.004
4/995 (Puleston Bridge) (ST)	3.70	1.14
4/1065	0.17	0.23
4/1074	0.16	0.10
4/1098	0.09	0.00
4/1107	0.005	0.005
4/1118 (SGS)*	( 0.30)	0.00
4/1163	0.23	0.17
4/1173	0.02	0.007
4/1174	0.001	0.001
4/1186	0.32	0.16
4/1192	0.31	0.31
4/1208	0.35	(NR) 0.38
4/1209	0.019	0.02
4/1284	0.32	(NR) 0.32
4/1294	0.041	0.00
4/1321	0.002	0.002
4/1325	0.005	0.005
4/1328	0.018	0.018
4/1331	0.34	0.45
4/1332	0.50	0.39
4/1341	0.008	0.008
4/1357	0.005	0.005
4/1367	0.032	(NEW) 0.022
4/1380	<u>0.25</u>	(NEW) <u>0.25</u>
	<u>19.63</u>	<u>13.18</u>
Public Water Supply	13.54	8.18
Private Water Supply	6.09	5.00

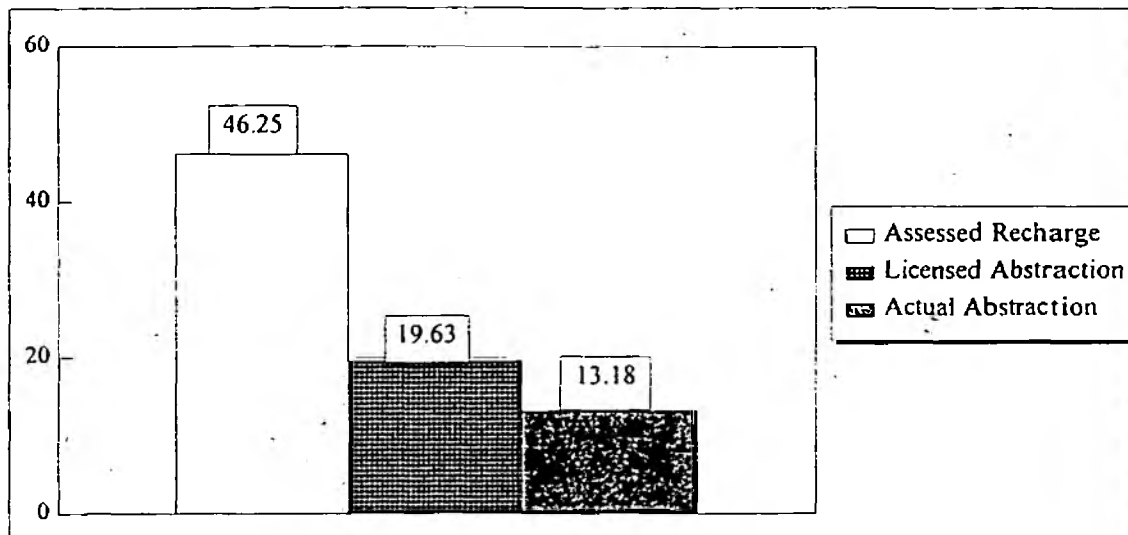
\* 0.30 represents the long term anticipated actual rate of abstraction. In any one year the licence is 5.01 and over a five year period it is 2.15.



## GROUNDWATER UNIT: SAMBROOK (F7.3) (WEST AND EAST) [FIG 8]

### SUMMARY

#### Resource Balance



#### Unit Classification: D

A detailed study led to a subdivision of this unit for more effective groundwater management:

For Sambrook (East) new licences will be considered but, in order to safeguard or improve flow in the Meese and some of its tributaries (especially the Lonco Brook) stringent compensation flow conditions will be added.

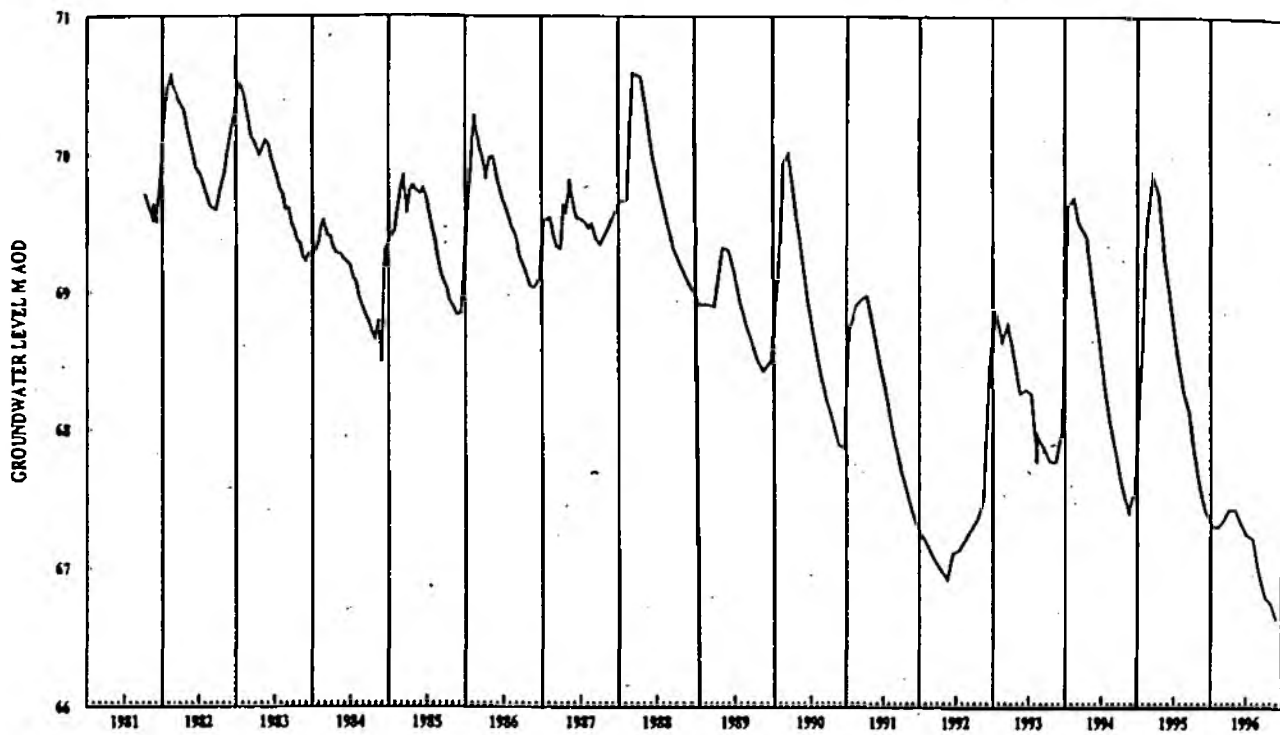
For Sambrook (West) compensation flow conditions will not always be required in the case of small licences but will probably be needed for large groundwater developments.

Any proposal must take into consideration SGS boreholes which have yet to be developed.

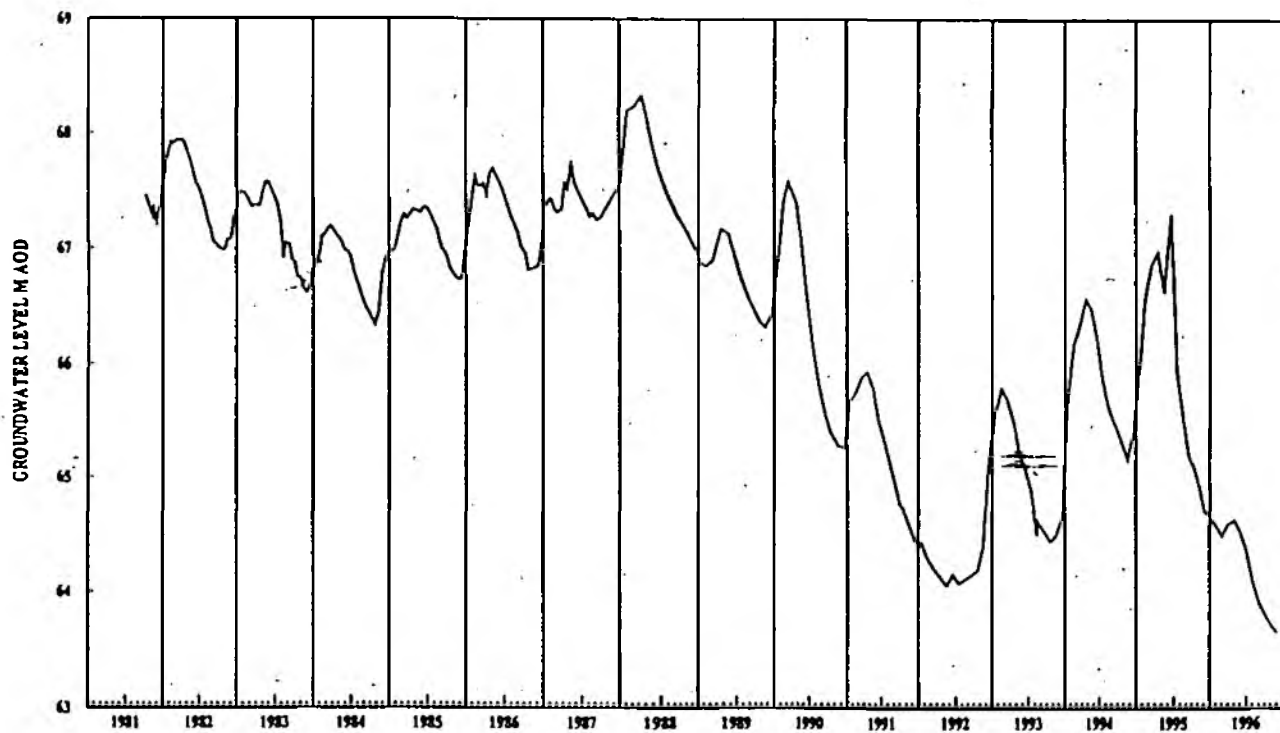
#### Classification History

1/10/83 - 30/9/85	E*
1/10/85 - 30/9/89	C*
1/10/89 - 30/9/91	E*
1/10/91 -	D

# **GROUNDWATER UNIT: ADENEY (F7.4) [Fig 8]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CHESWELL	SJ77711706	0495



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		EDMOND MARZE	SJ72452002	0496

# **GROUNDWATER UNIT: ADENEY (F7.4) [Fig 8]**

<b>Licence No</b>	<b>Licensed Abstraction</b>	<b>Actual Abstraction</b>
4/28	0.16	0.16
4/29	0.023	0.035
4/100	0.069	0.003
4/268	0.007	0.007
4/293* (Lilleshall) (ST)	( 6.55)	3.83
4/329	0.009	0.009
4/337	0.002	0.002
4/343	0.003	0.003
4/465* (Newport) (ST)	( 3.61)	0.00
4/484	0.007	0.007
4/492	0.014	0.014
4/697	0.018	0.018
4/731	0.004	0.004
4/792	0.001	0.001
4/866	0.011	0.011
4/888	0.091	0.086
4/1008* (Rodway) (ST)	( 11.23)	8.86
4/1036	0.33	0.42
4/1049	0.15	0.21
4/1081	0.20	0.12
4/1112	0.015	0.005
4/1169* (Edgmond Bridge) (ST)	( 13.50)	9.14
4/1182	0.51	0.68
4/1184	0.32	0.08
4/1203	0.25	0.25
4/1240	0.019	0.015
4/1241	0.37	(NR) 0.37
4/1281	0.0076	0.007
4/1345	<u>0.25</u>	(NR) <u>0.25</u>
	<u>24.23</u>	<u>24.60</u>

\* Aggregate licence, covering 4 sources, is 21.39; individual licences are given in brackets.

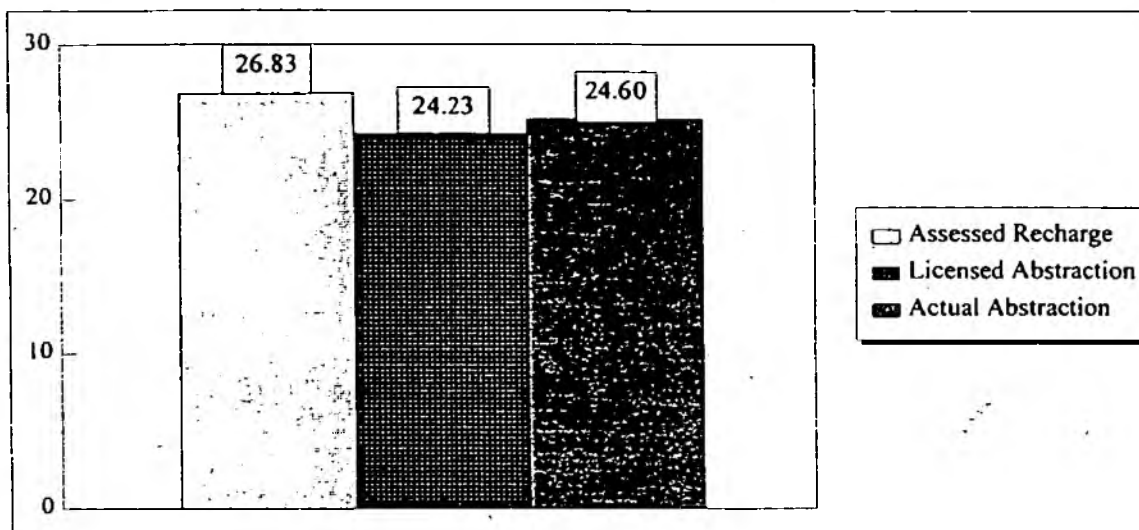
Crown Exemption: COD Donnington (Estimate): 0.60

Public Water Supply	21.39	21.83
Private Water Supply	2.84	2.77

## GROUNDWATER UNIT: ADENEY (F7.4) [Fig 8]

### SUMMARY

#### Resource Balance



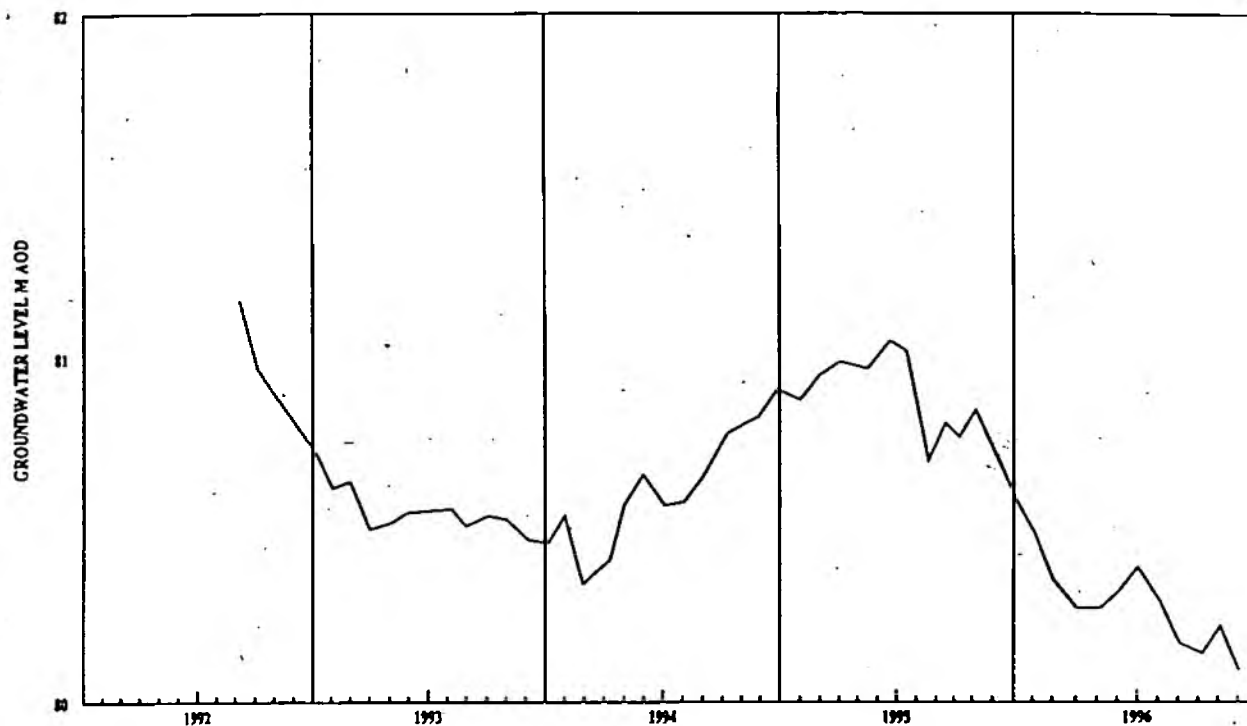
#### Unit Classification: A

This unit is heavily licensed and supports a high rate of actual abstraction. No additional groundwater development can be considered. The clause in the Edgmond Bridge licence, which requires compensation discharge into the River Strine, has been instigated as abstraction from the borehole has progressively increased.

#### Classification History

1/10/83 - 30/9/85	B*
1/10/85 - 30/9/86	E*
1/10/86 - 30/9/89	D*
1/10/89 - 30/9/90	B*
1/10/90 - 30/9/91	A*
1/10/91 -	A

# **GROUNDWATER UNIT: AQUALATE (F7.5) [Fig 8]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		GNOSALL	SJ80862053	1067

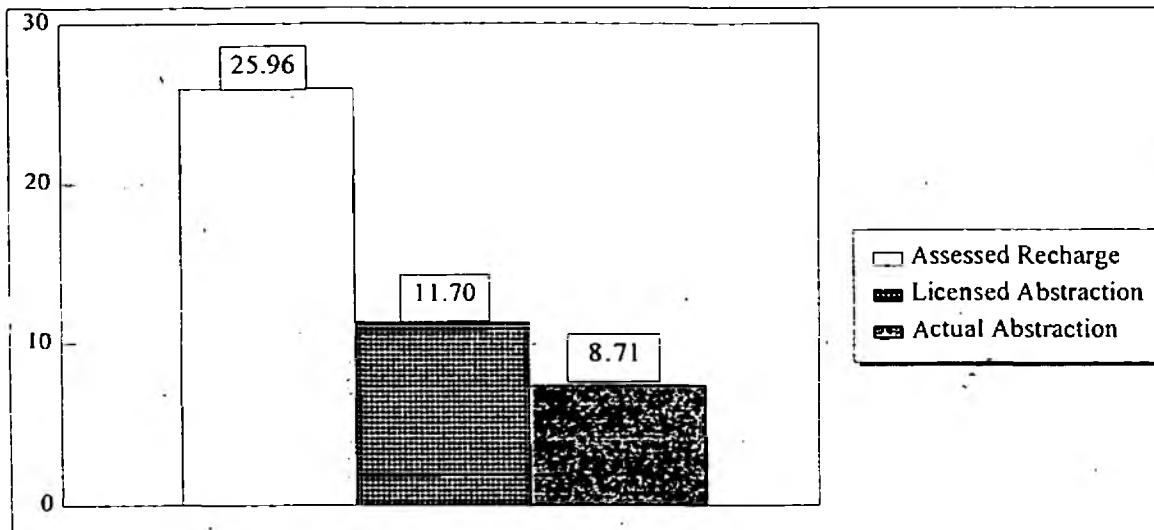
## GROUNDWATER UNIT: AQUALATE (F7.5) [Fig 8]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
3/6 (T)	0.005	0.005
3/49 (T)	0.023	0.023
3/71 (T) (The Hollies) (ST)	9.09	6.32
3/91 (T)	0.009	0.009
3/154 (T)	0.11	0.10
3/222	0.02	0.02
4/23	0.009	0.009
4/41	0.014	0.014
4/54	0.023	0.023
4/56	0.014	0.014
4/148	0.0002	0.0002
4/149	0.002	0.002
4/228	0.023	0.023
4/317	0.004	0.004
4/472	0.014	0.014
4/473	0.008	0.008
4/498	0.014	0.014
4/537	0.009	0.009
4/592	0.52	0.64
4/603	0.007	0.007
4/618	0.0001	0.0001
4/670	0.021	0.013
4/739	0.005	0.005
4/740	0.008	0.008
4/946	0.009	0.009
4/989	0.005	0.005
4/1082	0.14	0.12
4/1105	0.25	0.23
4/1150	0.15	0.15
4/1166	0.055	0.02
4/1264	0.37	0.35
4/1297	<u>0.77</u>	<u>0.54</u>
	<u>11.70</u>	<u>8.71</u>
(T = Trent Catchment)		
Public Water Supply	9.09	6.32
Private Water Supply	2.61	2.39

## GROUNDWATER UNIT: AQUALATE (F7.5) [Fig 8]

### SUMMARY

#### Resource Balance



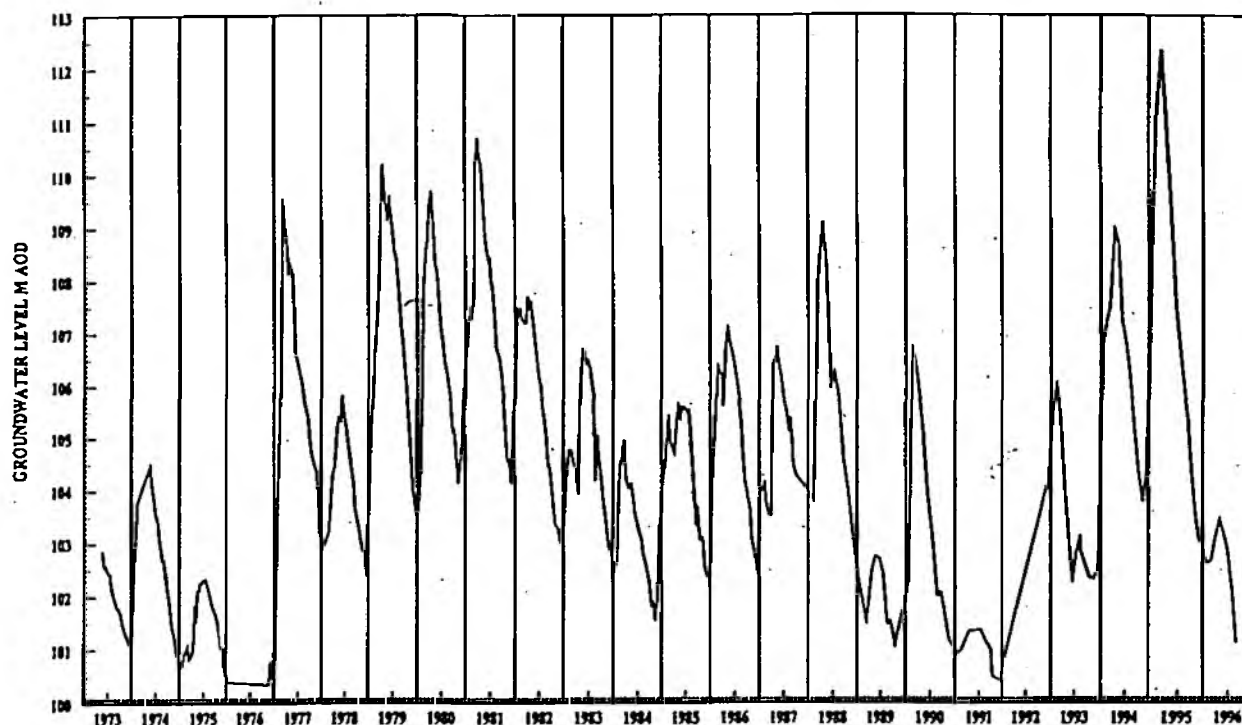
#### Unit Classification: B (TL)

Within this unit it is imperative to protect baseflow in the surface watercourses feeding Aqualate Mere, which is an important SSSI, National Nature Reserve, Nature Conservation Review Site and a proposed Ramsar site. There will be a presumption against any large groundwater development proposals and new proposals or licence variations must be supported by a full Environmental Appraisal. Licences will normally be time-limited and are likely to include compensation flow conditions.

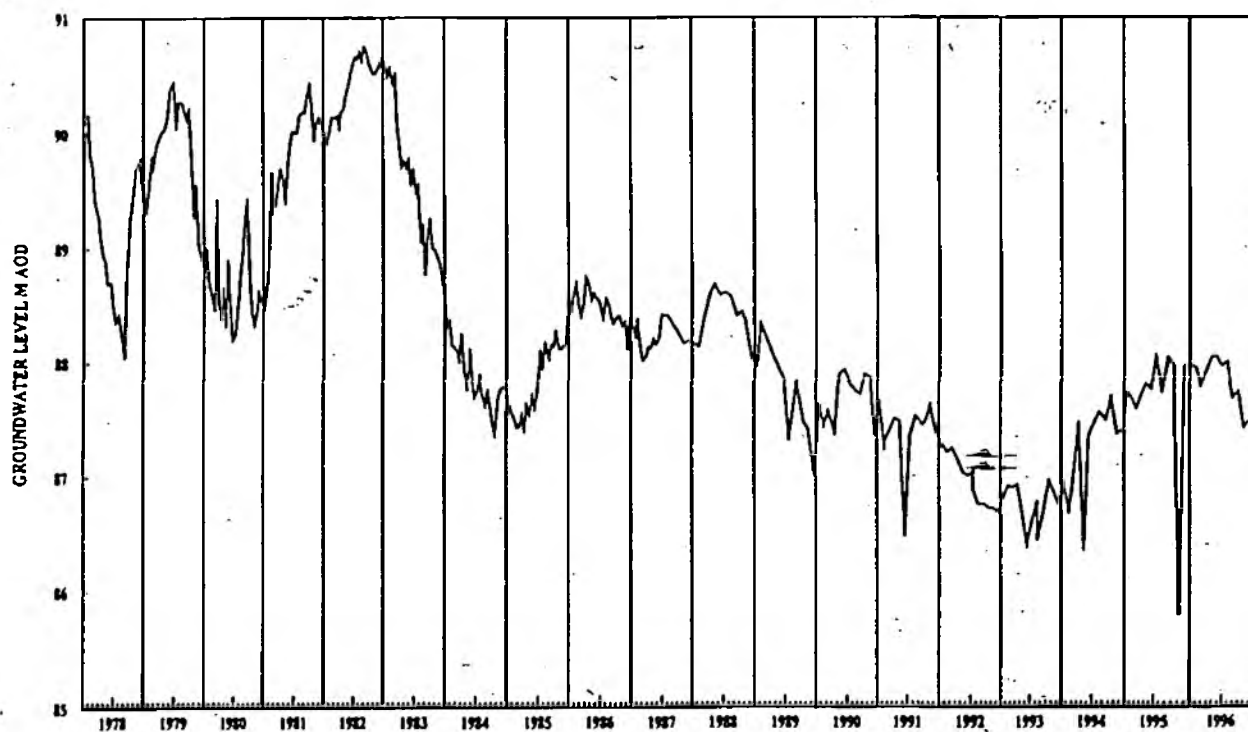
#### Classification History

1/10/83 - 30/09/85	E*
1/10/85 - 30/09/89	C*
1/10/89 - 30/09/90	E*
1/10/90 - 30/09/91	A*
1/10/91 - 08/11/95	A
8/11/95 -	B(TL)

# GROUNDWATER UNIT: COSFORD (F7.6) [Fig 8]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SHIPNAL (WESTON HEATH WELL)	SJ77351342	0458



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		LIZARD WOOD NO.1	SJ77990933	0229

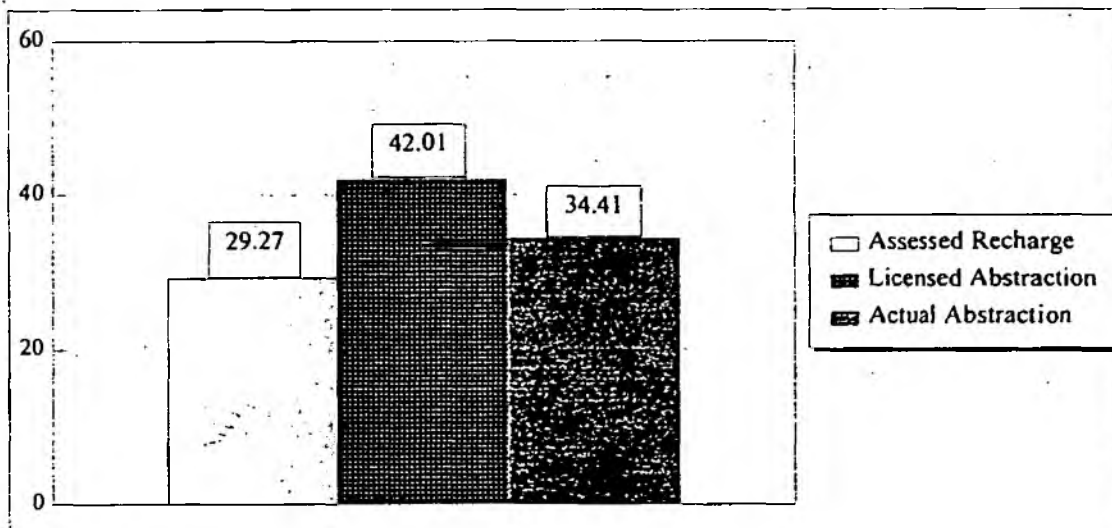


## GROUNDWATER UNIT: COSFORD (F7.6) [Fig 8]

Licence.No	Licensed Abstraction	Actual Abstraction
5/4	0.009	0.009
5/8	0.016	0.016
5/23	0.016	0.016
5/44 (Sheriffhales) (ST)	5.13	2.83
5/112	0.018	0.018
5/114	0.027	0.007
5/124 (Cosford) (ST)	)	10.13
5/124 (Neachley) (ST)	) 20.46	8.66
5/124 (Hell Bank) (ST)	)	0.00
5/128 (Lizard Mill) (ST)	) 15.93	7.30
5/128 (Shifnal) (ST)	)	5.36
5/190	0.32	0.03
5/218	<u>0.08</u>	<u>0.03</u>
	<u>42.01</u>	<u>34.41</u>
Public Water Supply	41.52	34.28
Private Water Supply	0.49	0.13

### SUMMARY

#### Resource Balance



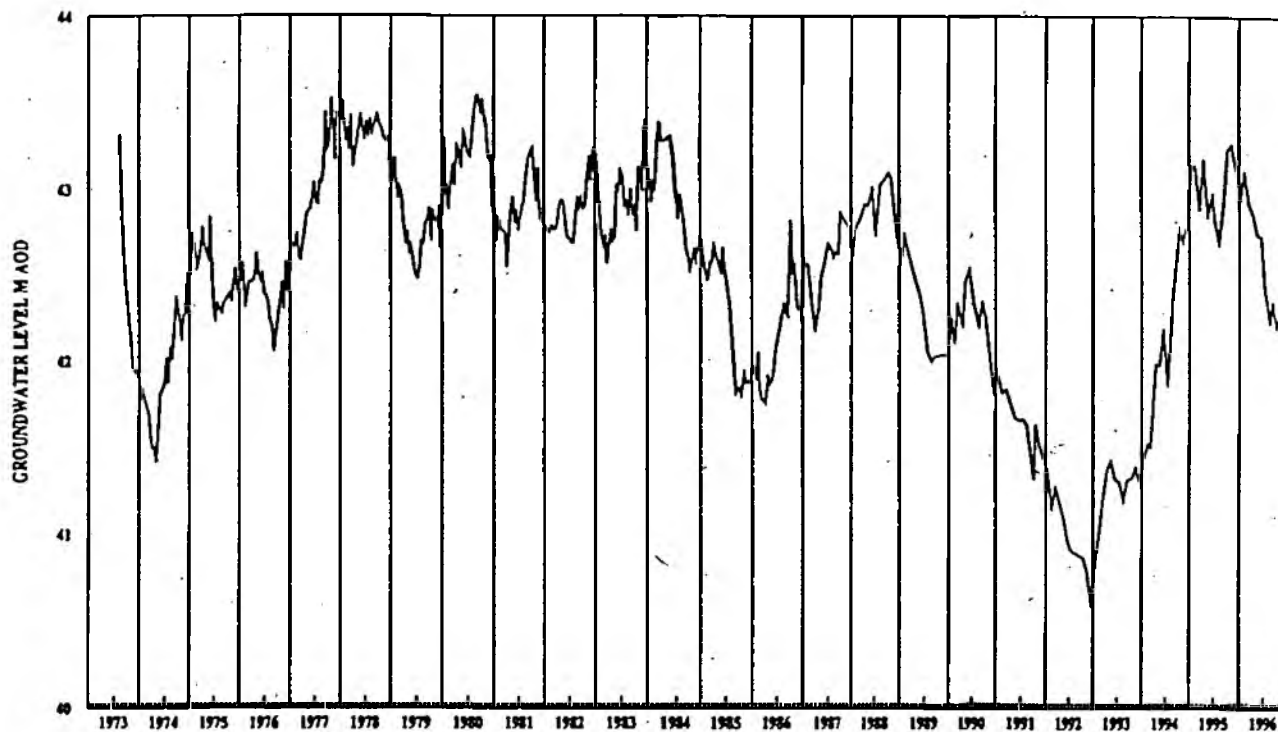
#### Unit Classification: A

Existing levels of abstraction exceed the long term rate of recharge, largely due to a very high rate of pumping for PWS. As a consequence, baseflow in the upper reaches of the River Worfe and its tributaries has become severely depleted, leading to environmental problems and difficulties for surface water abstraction licence -holders. Associated depletion of pool/lake levels has also been recorded. A significant reduction in abstraction is required and initiatives to assist in achieving this objective will be supported.

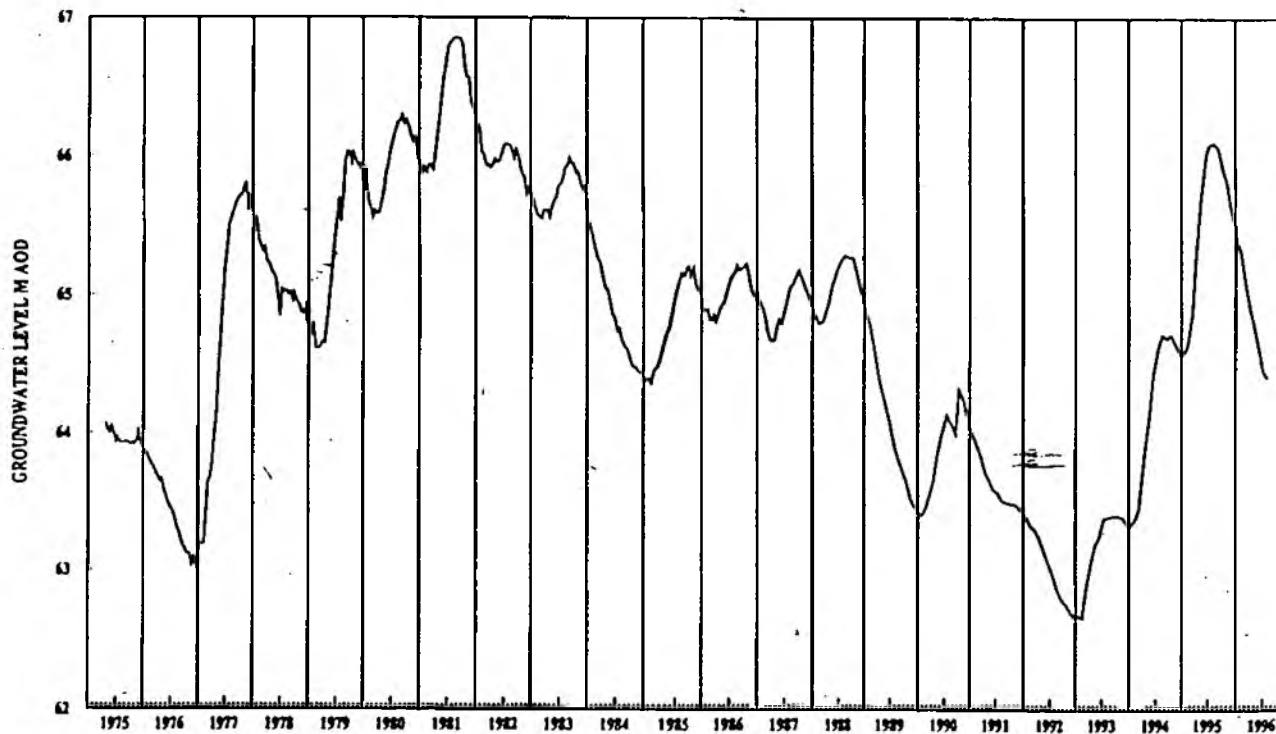
#### Classification History

1/10/83 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: WORFIELD (F7.7) [Fig 8]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CHESTERTON	SO77519738	0076



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		STANMORE COTTAGE	SO74639230	0375

# GROUNDWATER UNIT: WORFIELD (F7.7) [Fig 8]

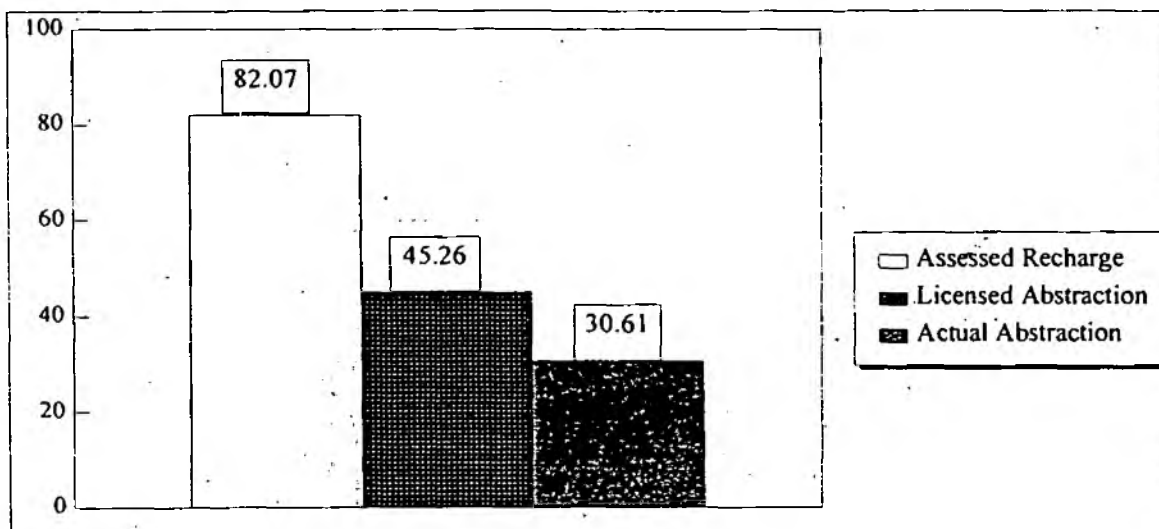
Licence No	Licensed Abstraction	Actual Abstraction
2/225	0.0003	0.0003
2/233	0.001	0.001
2/291	0.001	0.001
2/292	0.0004	0.0004
2/376	0.005	0.005
2/481	0.20	0.12
2/562	0.025	0.021
5/18	0.009	0.009
5/21	0.005	0.005
5/22	0.009	0.009
5/31 (Copley) (ST)	4.98	4.65
5/36	0.15	0.18
5/50	0.014	0.014
5/71	0.002	0.002
5/76	0.002	0.002
5/93	0.0001	0.0001
5/106	0.009	0.009
5/125 (Hilton) (ST)	)	12.06
5/125 (Stableford) (ST)	)	2.49
5/125 (Rindleford) (ST)	) 22.79	0.00
5/125 (Roughton) (ST)	)	0.00
5/129 (Grindleforge) (ST)	) 13.64	8.63
5/129 (Beckbury) (ST)	)	0.00
5/148	0.008	0.008
5/151	0.11	0.13
5/152	0.11	0.11
5/154	0.084	0.005
5/159	0.02	0.02
5/160	0.023	0.023
5/169	0.019	0.019
5/173	0.14	0.14
5/174	0.47	0.37
5/176	0.12	0.16
5/177	0.17	0.04
5/182	0.31	0.24
5/183	0.12	0.12
5/194	0.27	0.21
5/195	0.06	0.06
5/198	0.003	0.003
5/201	0.53	0.30
5/202	0.04	(NR) 0.04
5/205	0.20	0.05
5/208	0.19	0.18
5/209	0.008	0.008
5/216	0.007	0.007
5/219	0.25	0.02
5/220 (replacement for 5/18)	0.001	0.001
6/162	0.015	0.015
6/260	0.14	0.12
	<u>45.26</u>	<u>30.61</u>

## GROUNDWATER UNIT: WORFIELD (F7.7) [Fig 8]

Public Water Supply	41.41	27.83
Private Water Supply	3.85	2.78

### SUMMARY

#### Resource Balance



#### Unit Classification: A

The resource balance for this unit shows that just over half of the assessed recharge is currently licensed. However, there are continuing problems regarding low flows in the middle reaches of the River Worfe and in some of its tributaries. New licences can only be considered provided that the aggregate licensed volumes for the Worfield and Cosford units does not exceed 65Ml/d. Any proposals which would result in a net increase in actual abstraction would require a compensation flow to be discharged. At present, the limit of 65Ml/d is exceeded, and so no further licences can be issued.

#### Classification History

1/10/83 - 30/9/91	C *
1/10/91 -	A

## GROUNDWATER UNIT: WELLINGS (F7.8)

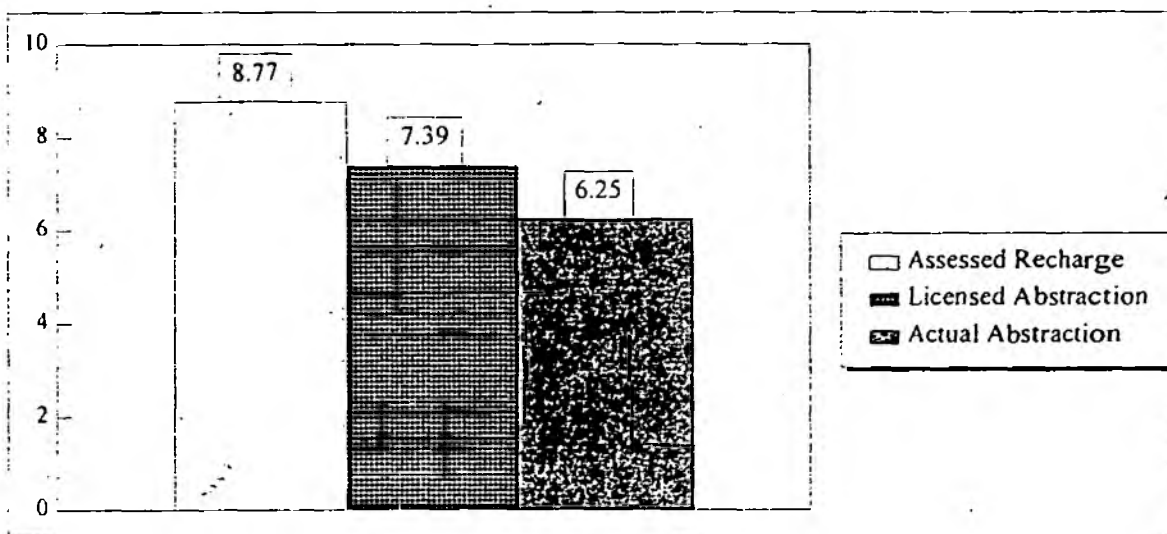
Licence No	Licensed Abstraction	Actual Abstraction
4/949 (Wellings)	6.83	5.97
4/1123	0.55	0.52
4/1161	0.012	0.016
	<u>7.39</u>	<u>6.51</u>
Public Water Supply	6.83	5.97
Private Water Supply	0.56	0.54

### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
4/1123	0.52	50	0.26

### SUMMARY

#### Resource Balance



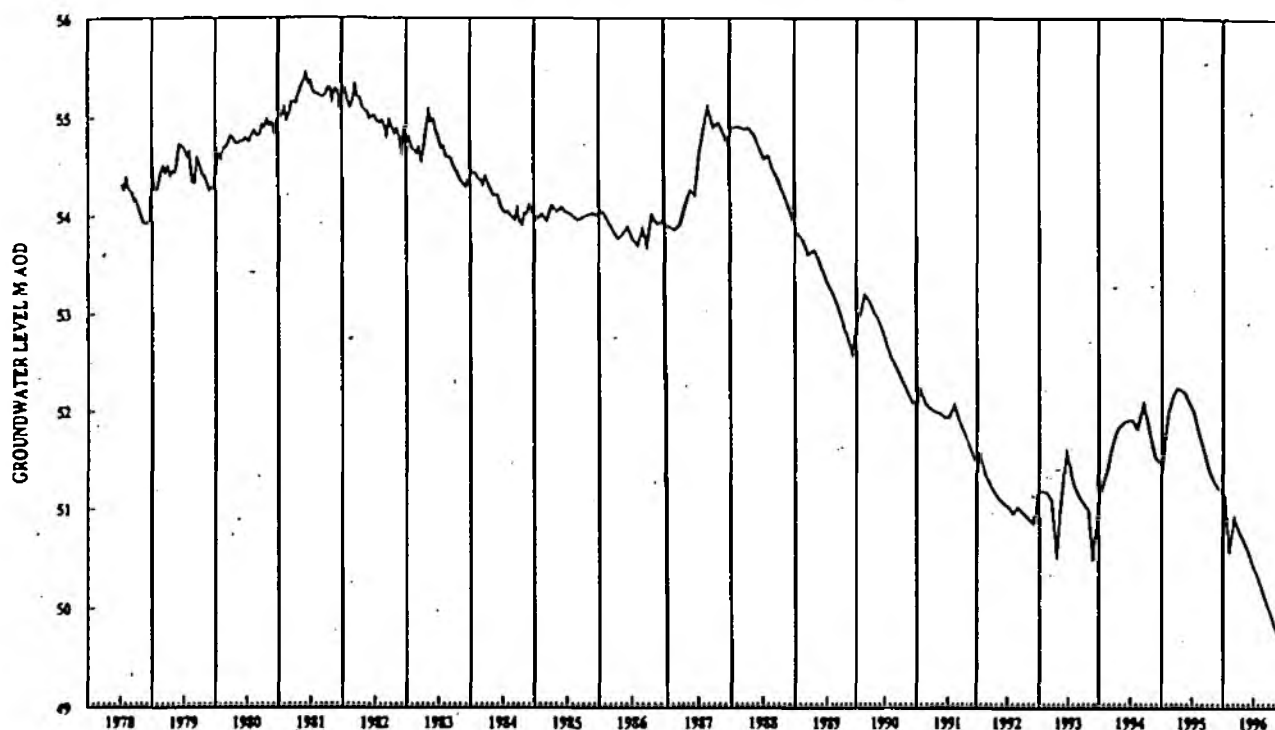
#### Unit Classification: A

No additional groundwater development can be considered in this unit in order to protect baseflow at the headwaters of the River Tern.

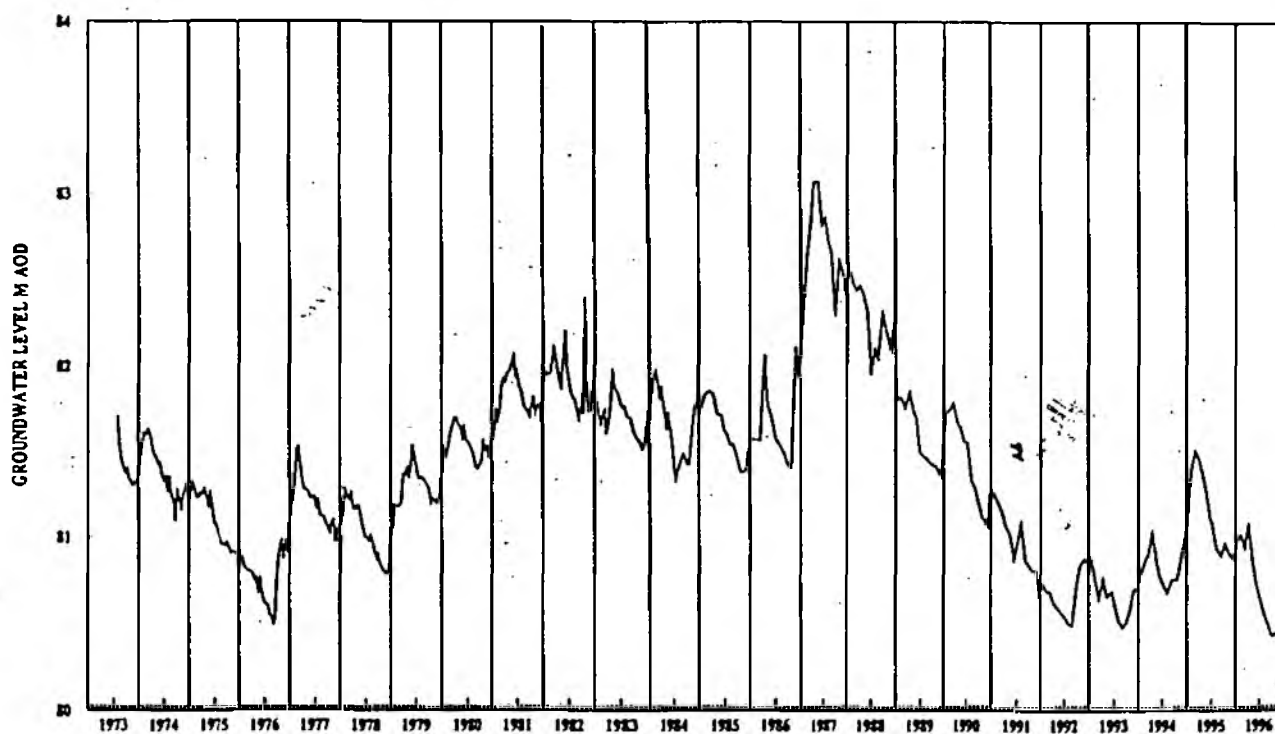
#### Classification History

1/10/83 - 30/9/89	B*
1/10/89 - 30/9/95	A*
1/10/91 -	A

# GROUNDWATER UNIT: WOMBOURNE (F8.1) [Fig 8]

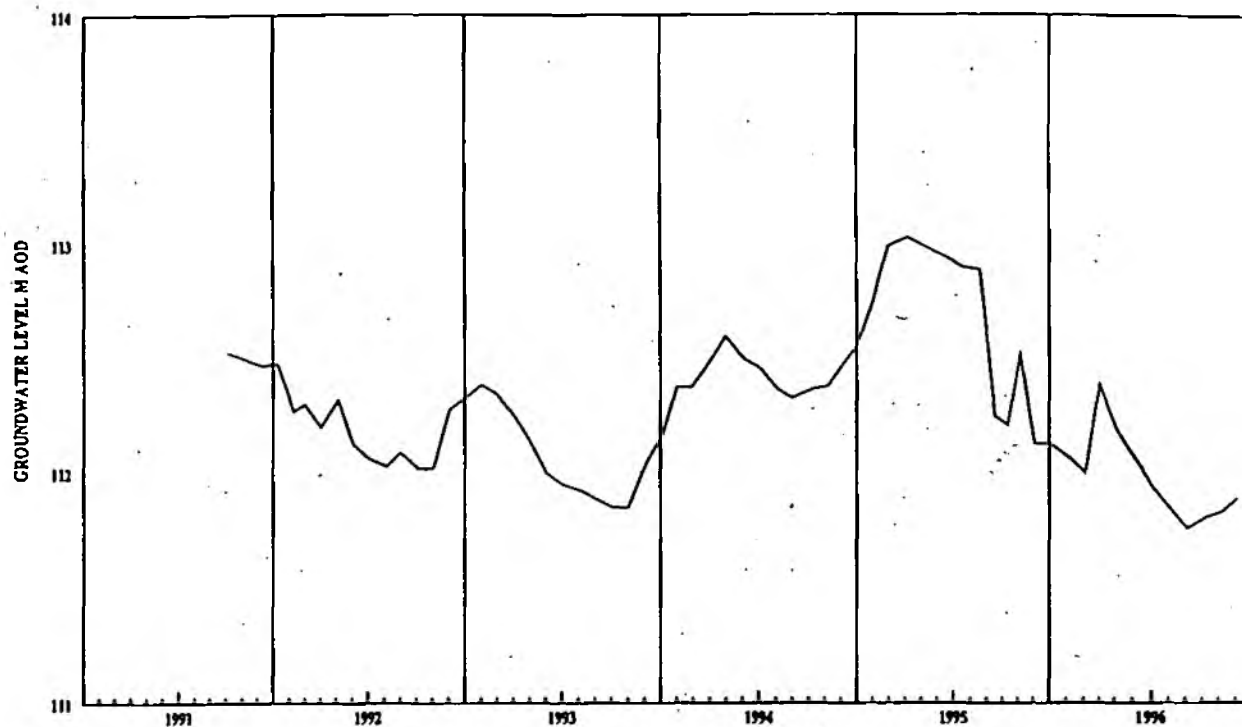


ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CHECK HILL	SO86028820	0074



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		FURNACE GRANGE	SO84499655	0138

# GROUNDWATER UNIT: WELLINGS (F7.8)



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		CLOWES WOOD	SJ77463882	1065

## GROUNDWATER UNIT: WOMBOURNE (F8.1) [Fig 8]

Licence No	Licensed Abstraction	Actual Abstraction
5/3 (Tom Hill) (ST)	6.84	5.01
5/15	0.12	0.05
6/1	0.12	0.11
6/2	0.14	0.14
6/6	0.80	0.60
6/13	0.25	0.06
6/21	0.12	0.13
6/26	0.06	0.05
6/30	0.16	0.00
6/31	0.12	0.11
6/82 (Tettenhall) (ST)	5.58	0.36
6/83 (Dimmingsdale) (ST)	15.72	13.43
6/84 (The Bratch) (ST)	10.62	9.71
6/140 *(Ashwood) (SS)	( 18.18)	17.17
6/140 *(Hinksford) (SS)	( 6.81)	5.80
6/276	0.062	0.05
6/277	0.19	0.17
6/286	0.14	0.12
6/288	0.0002	0.0002
6/291	0.96	0.42
6/296	0.06	0.00
6/303	<u>0.14</u>	<u>0.02</u>
	<u>67.19</u>	<u>53.51</u>

\* The SSWC licence (6/140) covers 7 sources, including an additional two in the Stourbridge unit (F8.2) and three in Kidderminster (F8.3). The aggregate licence is 89.55; the 'licensed' abstractions quoted in brackets are the company's unofficial breakdown of the licence.

Public Water Supply	63.75	51.48
Private Water Supply	3.44	2.02

### Watercress Beds/Trout Pool Licences:

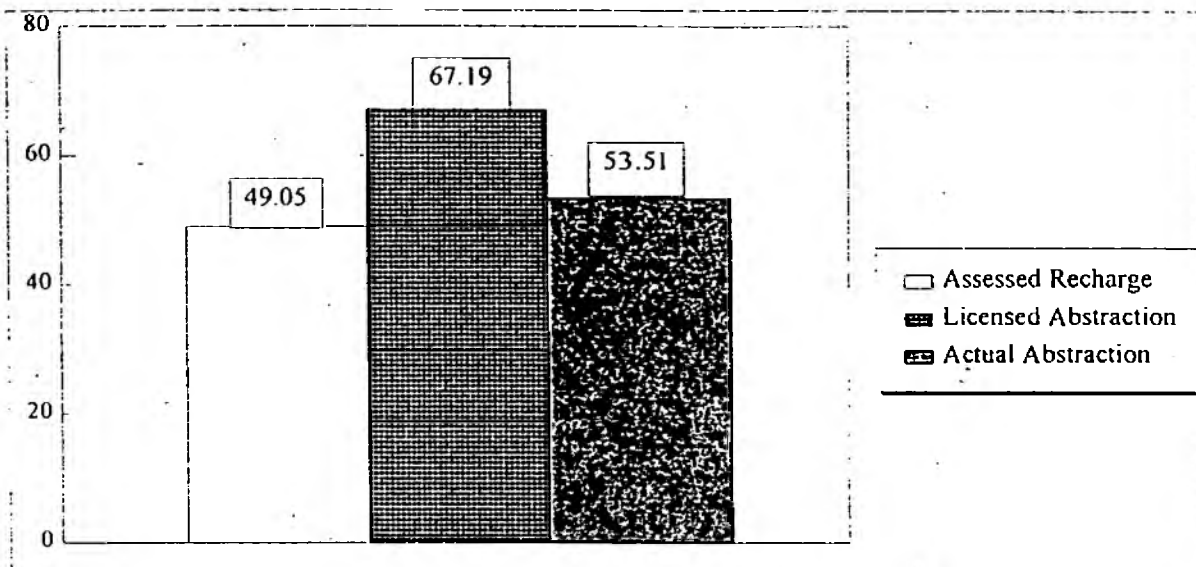
Licence No	Actual Abstraction	% Returned to Aquifer	Quantity Returned to Aquifer
6/30	0.00	50.00	0.00



## GROUNDWATER UNIT: WOMBOURNE (F8.1) [Fig 8]

### SUMMARY

#### Resource Balance



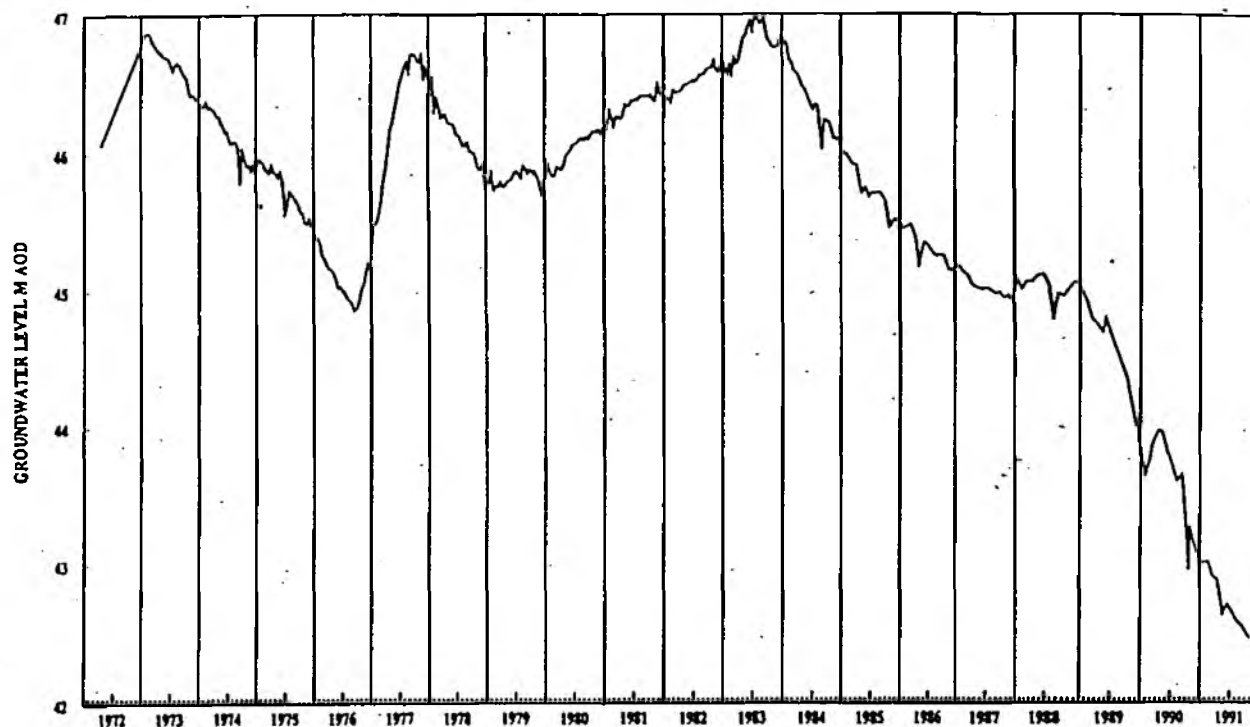
#### Unit Classification: A

Historically this unit has supported a high rate of public water supply abstraction, which has lead to a depletion of baseflow with resultant environmental problems. Some consideration may be given to new boreholes in Wolverhampton, where there is a localised rising groundwater level problem (due to reduced abstractions, largely by industrial users), provided that the pumped water is eventually returned to the Smestow Brook. In general, however, a reduction in both licensed and actual abstractions is required in this unit. Any proposed changes in public water supply licences will have to take into account the need to introduce some compensation clause into the revised licence. The relatively small component of existing time limited abstractions are to be extended to March 2002, to allow completion of a hydrogeological modelling exercise incorporating the adjoining Stourbridge and Kidderminster units.

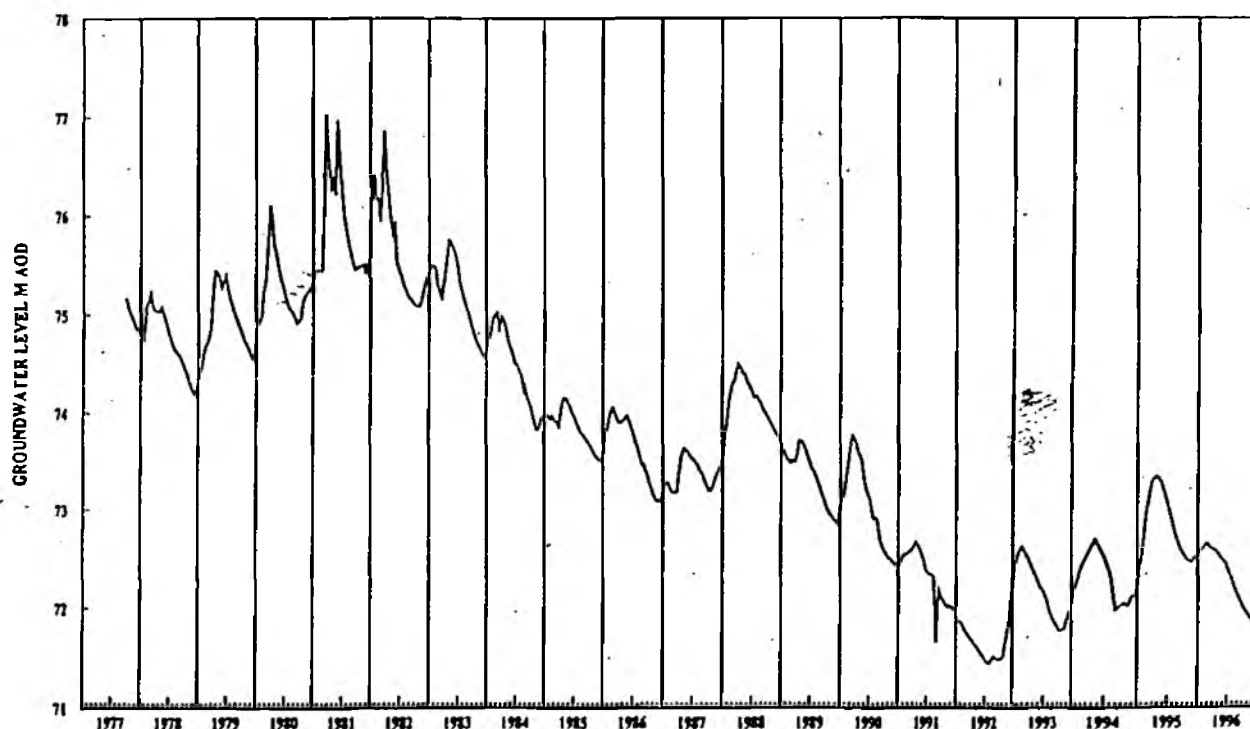
#### Classification History

1/10/83 - 30/9/89	B*
1/10/89 - 30/9/90	B(TL)
1/10/90 - 30/9/91	A*
1/10/91 -	A

# GROUNDWATER UNIT: STOURBRIDGE (F8.2) [Fig 9]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		KINGS LODGE	SO84328541	0209



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SWINFORD COMMON	SO89808322	0389

## GROUNDWATER UNIT: STOURBRIDGE (F8.2) [Fig 9]

Licence No	Licensed Abstraction	Actual Abstraction
6/14	0.54	(NR) 0.54
6/67	0.14	0.01
6/94 (Tack Lane) (ST)	)	8.91
6/94 (Mill Meadow) (ST)	)	0.00
6/94 (Coalbourne Brook) (ST)+	)	0.00
6/95 (Racecourse Lane) (ST)	6.57	5.03
6/140 (Kinver) (SS)*	( 15.91)	12.21
6/140 (Prestwood) (SS)*	( 15.91)	19.91
6/182	0.10	0.04
6/254* (Norton Site 1) (ST)+	( 10.67)	1.16
6/299	<u>0.24</u>	<u>0.22</u>
	<u>56.42</u>	<u>48.04</u>

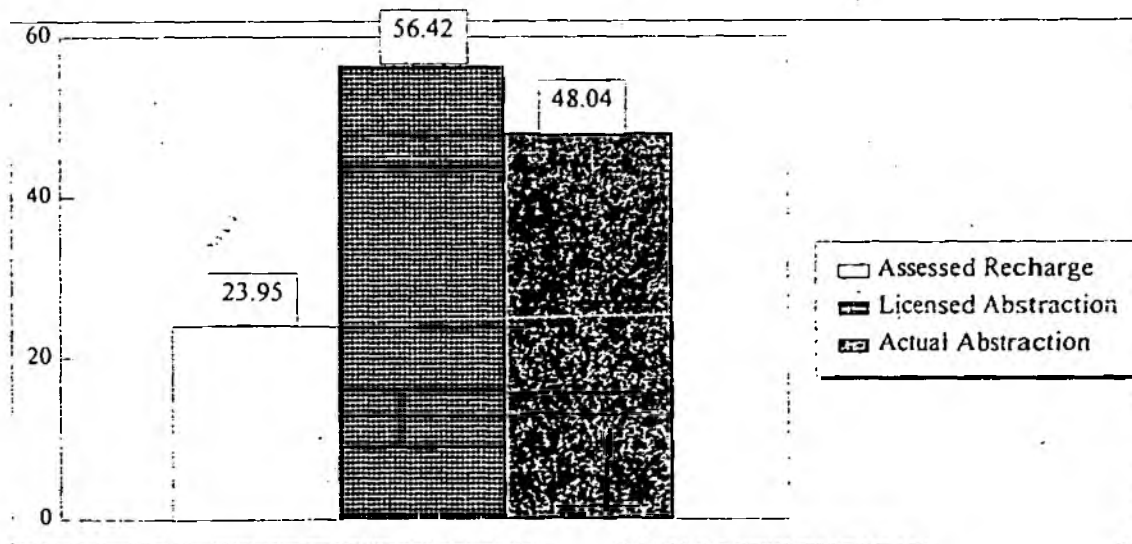
\*The SSWC licence (6/140) covers 7 sources, including an additional two in the Wombourne unit (F8.1) and three in Kidderminster (F8.3). The group licence is 89.55; the 'licensed' abstractions quoted in brackets are the company's unofficial breakdown of the licence.

+ Artificial recharge and emergency use only, see also Kidderminster F8.3.

Public Water Supply	55.40	47.22
Private Water Supply	1.02	0.81

### SUMMARY

#### Resource Balance



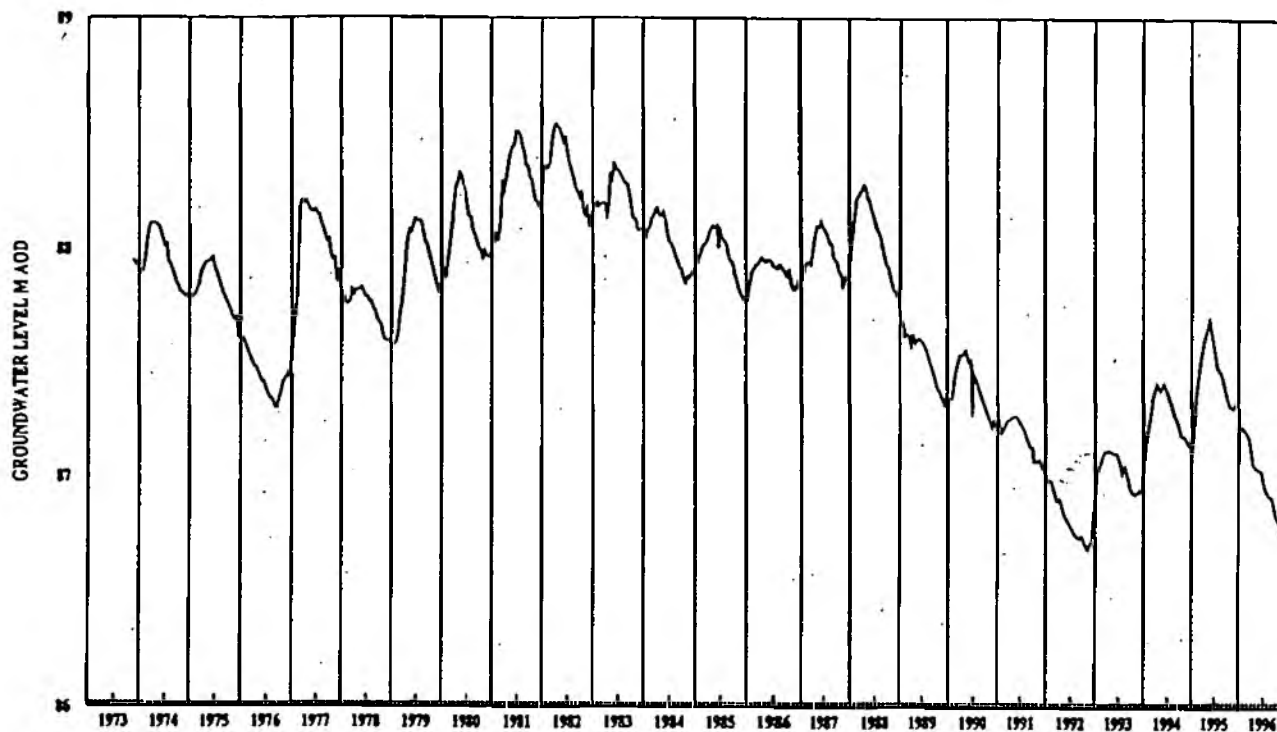
#### Unit Classification: A

No further groundwater development can be considered in this unit as it is grossly overlicensed and overabstracted. Every opportunity to significantly reduce such a high rate of abstraction should be taken.

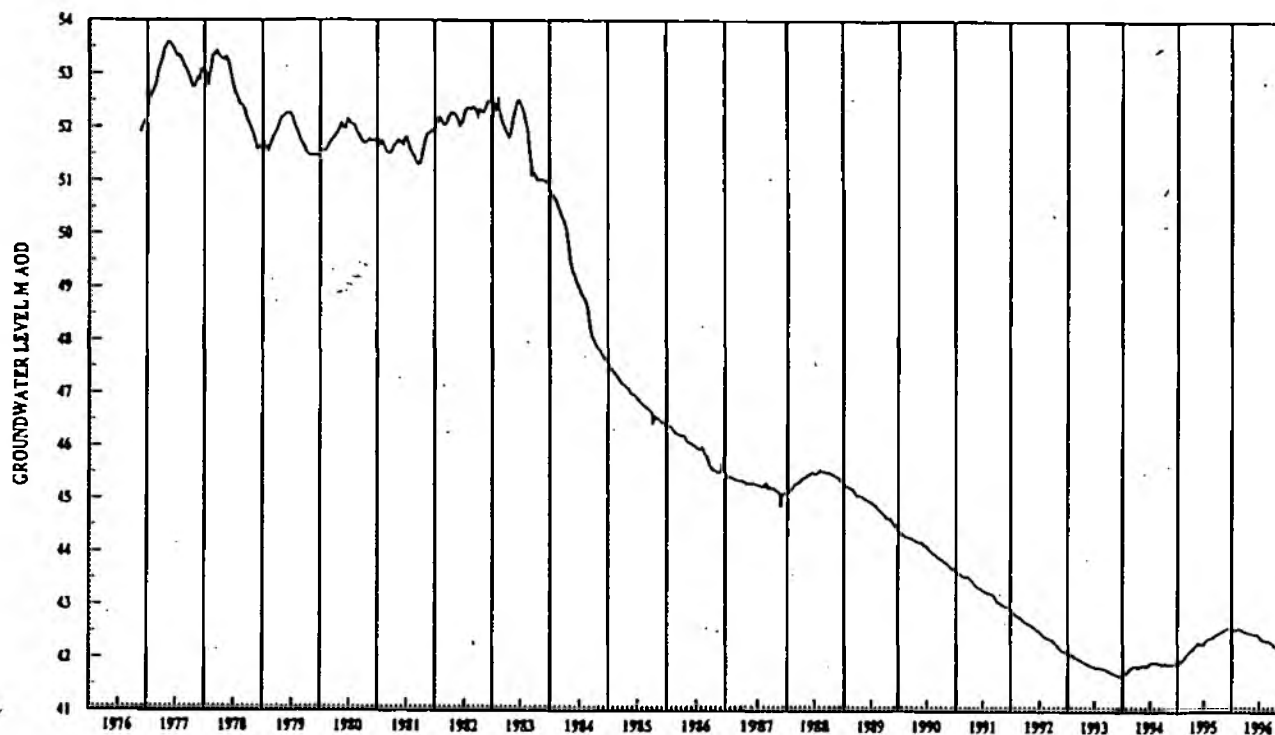
#### Classification History

1/10/83 - 30/9/91	A*
1/10/91 -	A

# **GROUNDWATER UNIT: KIDDERMINSTER (F8.3) [Fig 9]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		YIELDINGTREE COTTAGES	SO89997761	0453



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		IVERLEY HOUSE FARM	SO86988145	0199

# GROUNDWATER UNIT: KIDDERMINSTER (F8.3) [Fig 9]

Licence No	Licensed Abstraction	Actual Abstraction
6/11	0.77	0.05
6/18	0.23	0.09
6/24	0.09	0.01
6/34	0.68	0.43
6/35	0.011	0.01
6/59	0.25	0.16
6/61	0.007	0.007
6/72	0.44	0.15
6/76	0.0005	0.0005
6/89	0.16	0.16
6/90	0.009	0.009
6/96	0.002	0.002
6/101	0.22	(NR) 0.22
6/140* (Churchill) (SS)	( 10.00)	9.28
6/140* (Cookley) (SS)	) ( 13.64)	11.63
6/140* (Hagley) (SS)	) ( 9.09)	8.63
6/165 (Bellington) (ST)	11.36	7.64
6/166 (Green Street) (ST)	7.08	4.52
6/166 (Summerfield) (ST)	0.33	0.04
6/194	0.002	0.002
6/209	0.012	(NR) 0.01
6/214	0.019	0.02
6/216	0.22	(NR) 0.22
6/219	0.003	0.003
6/228	0.002	0.002
6/231	0.012	(NR) 0.012
6/235	0.13	0.15
6/243	0.16	0.02
6/245	0.41	0.36
6/252	0.091	(NR) 0.09
6/254** (Norton) (ST)	( 13.33)	0.00
6/264	0.075	0.05
6/275	0.12	0.13
6/282+ (Beech Tree Lane) (ST)	( 4.44)	0.09
6/289	0.68	0.35
6/290	0.018	0.018
6/295	0.05	0.018
6/297	0.06	0.02
7/137	0.075	0.07
7/140	0.002	0.00
7/158 (Chaddesley Corbett) (ST)	6.83	5.17
7/229	0.13	0.13
7/232	0.19	0.12
7/240	0.037	0.012
8/125	0.006	0.006
8/139	0.002	0.002

## GROUNDWATER UNIT: KIDDERMINSTER (F8.3) [Fig 9]

8/403	0.012	(NR)	0.012
8/475 (Hartlebury) (ST)	0.41		0.00
8/480	<u>0.15</u>		<u>0.15</u>
	<u>64.28</u>		<u>50.28</u>

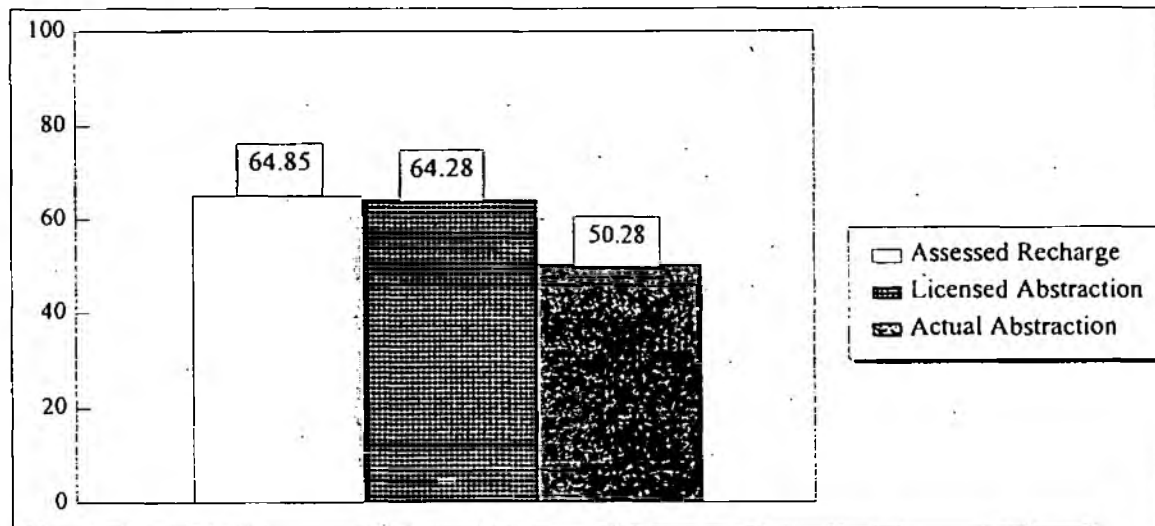
\*The SSWC licence (6/140) covers 7 sources, including an additional two in the Wombourne unit (F8.1) and two in Stourbridge (F8.2). The group licence is 89.55; the 'licensed' abstractions quoted in brackets are the company's unofficial breakdown of the licence.

+ Emergency use only

\*\* Artificial recharge and emergency use only, see also Stourbridge (F8.2).

Public Water Supply	58.74	47.02
Private Water Supply	5.54	3.26

### SUMMARY



## GROUNDWATER UNIT: KIDDERMINSTER (F8.3) [Fig 9]

### Unit Classification: A

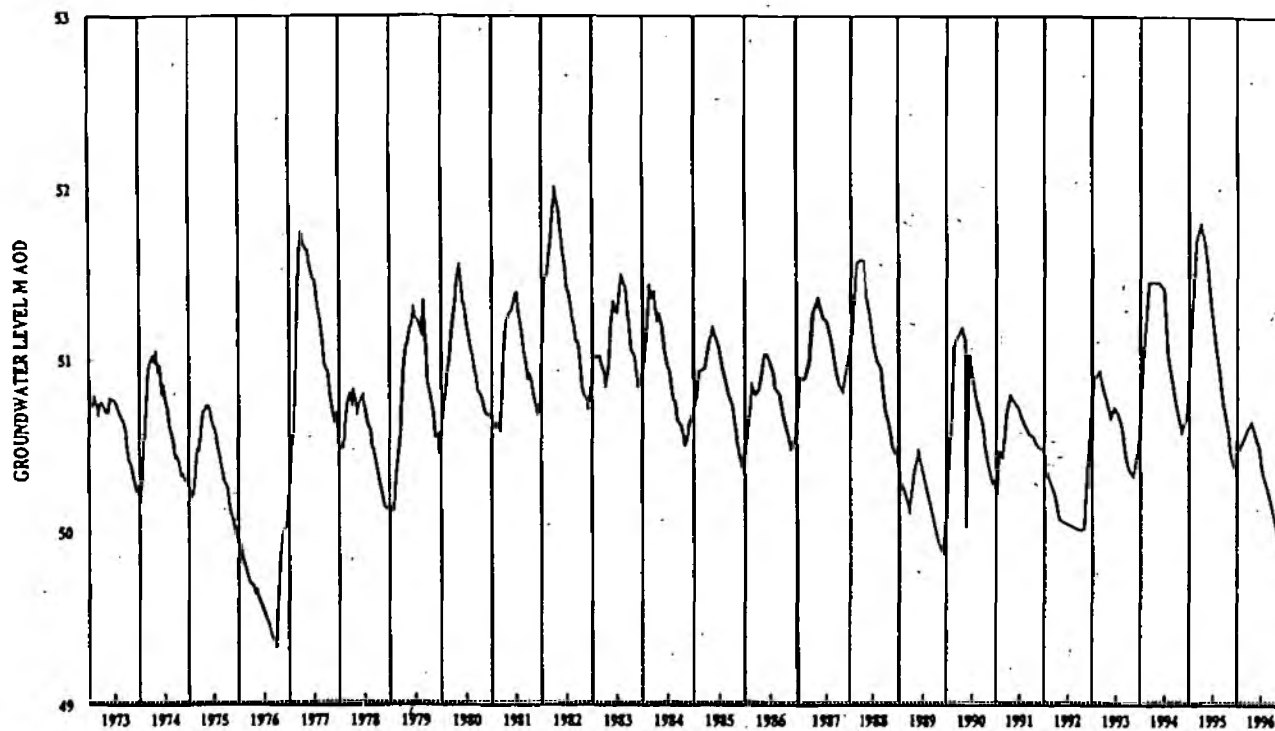
A very high rate of PWS abstraction has progressively led to a depletion of baseflow over some parts of the unit and especially in the area to the northeast of Kidderminster. Many watercourses, together with some large pools, have dried up. A major reduction in both licensed and actual abstraction is required together with the introduction of compensation flow boreholes in some areas. The Environment Agency has constructed augmentation boreholes for the Harborough Pools system, and in the Blakedown Valley as short term, ameliorative measures.

The unit is to be the subject of a special modelling study which may result in a sub-division of the unit, and will assist in determining future licensing policy. Existing time limited licences are to be extended to a common expiry date, whilst the study is completed.

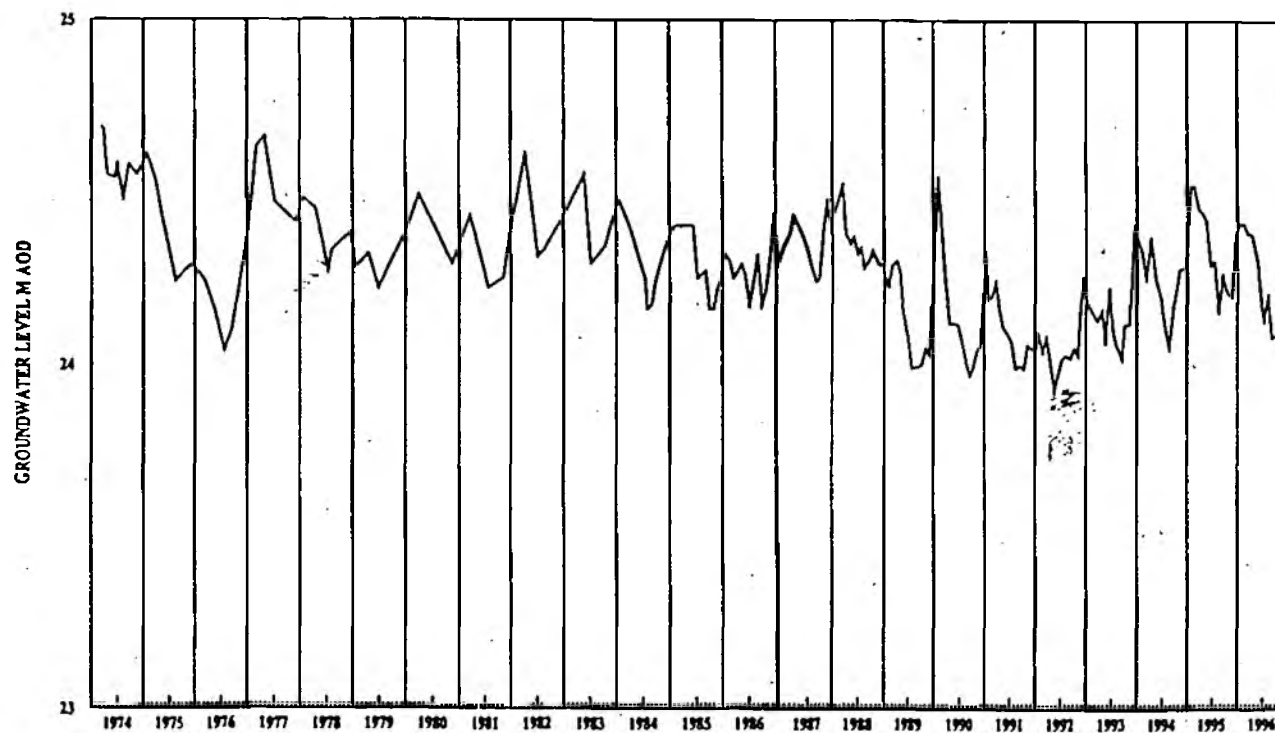
### Classification History

1/10/83 - 30/10/85	D*
1/10/85 - 30/10/89	B*
1/10/89 - 30/10/90	B(TL)
1/10/90 - 30/9/91	A*
1/10/91	A

# GROUNDWATER UNIT: STOURPORT (F8.4) [Fig 9]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		THE WOODLANDS HARTLEBURY	S084557100	0441



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		QUAYLES CARPETS	S082457273	0329



## GROUNDWATER UNIT: STOURPORT (F8.4) [Fig 9]

Licence No	Licensed Abstraction	Actual Abstraction
6/15	0.05	0.03
6/29	1.23	0.27
6/42	0.019	0.019
6/161	0.75	0.35
6/279	0.94	0.80
6/287	0.23	0.13
6/298	0.49	0.00
8/14	0.62	0.62
8/80	0.0005	0.0005
8/131	0.0003	0.0003
8/411	0.65	0.12
8/458* (Blackstone) (ST)	( 12.00 - 3.00)	( 11.88 - 2.97)
8/499	<u>0.39</u>	<u>0.21</u>
	<u>14.37</u>	<u>11.45</u>
Public Water Supply	( 12.00)	( 11.88)
Private Water Supply	5.37	2.54

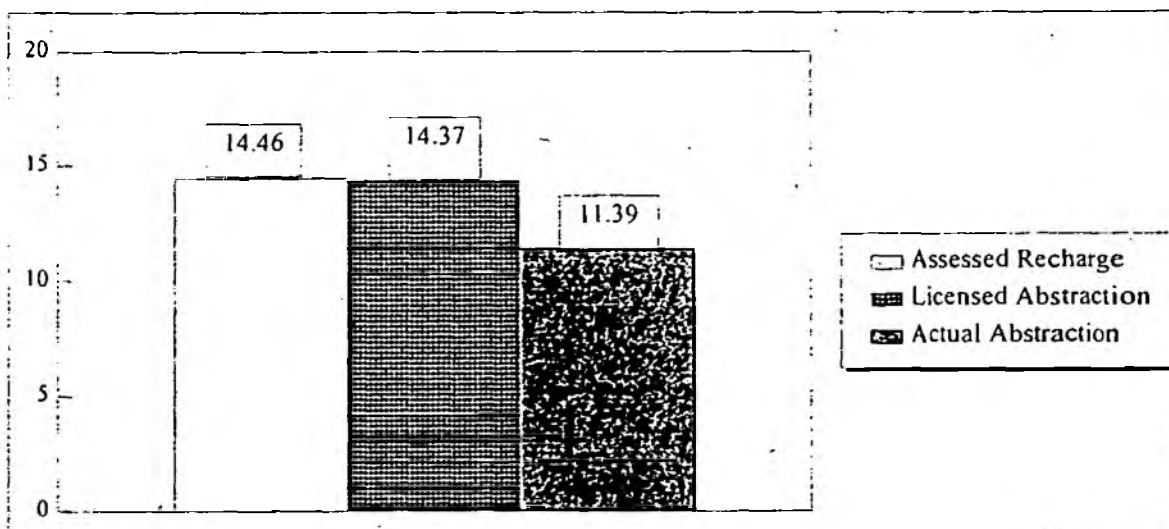
+ Assumes 25% contribution from the River Severn via induced recharge. The licence abstraction therefore is effectively only 9.00 giving a total of 14.37, whilst the actual groundwater abstraction is effectively only 8.91 giving a total of 11.45.

### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
8/411	0.12	50	0.06

### SUMMARY

#### Resource Balance



## **GROUNDWATER UNIT: STOURPORT (F8.4) [Fig 9]**

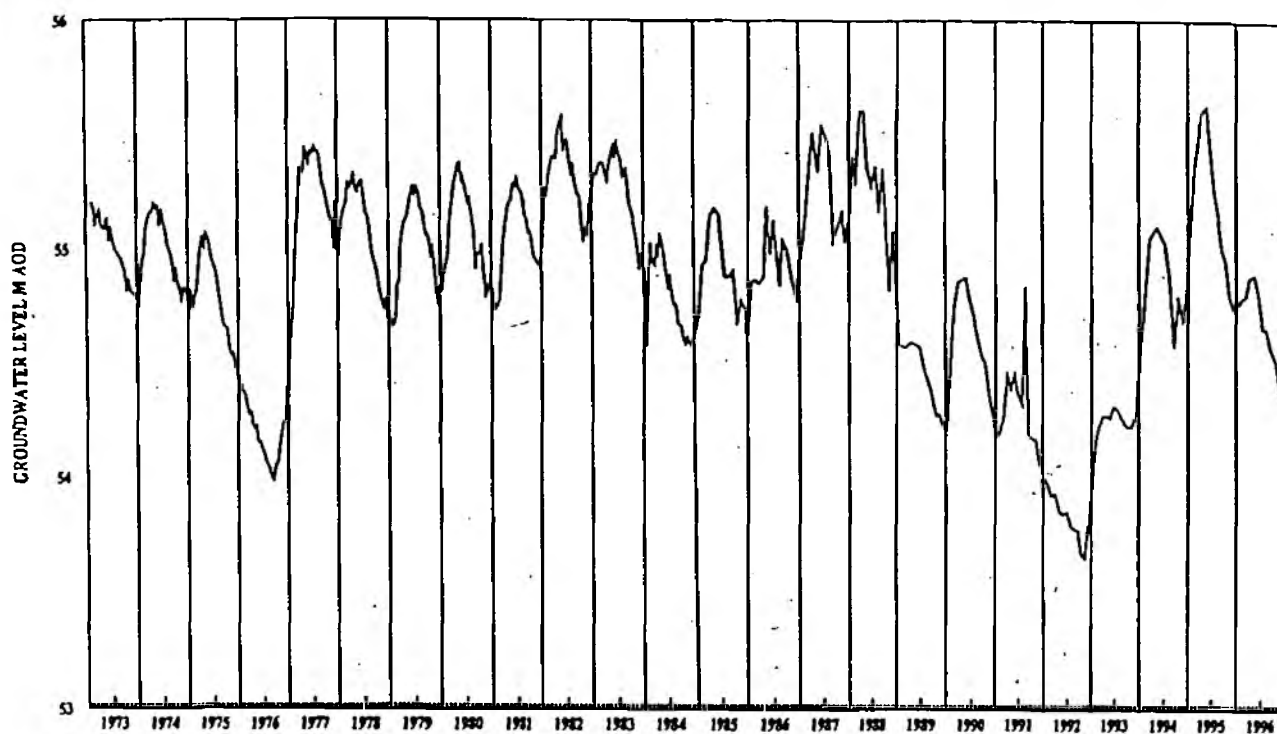
### **Unit Classification: A**

Stream flow depletion is now being recorded in part of this unit. No more licences can therefore be issued which result in an increase in licensed abstractions; some consideration will however be given to extending existing time-limited licences, either on a permanent basis or for a further time-limited period. This includes the time limited component of the Blackstone licence which expires in 1998.

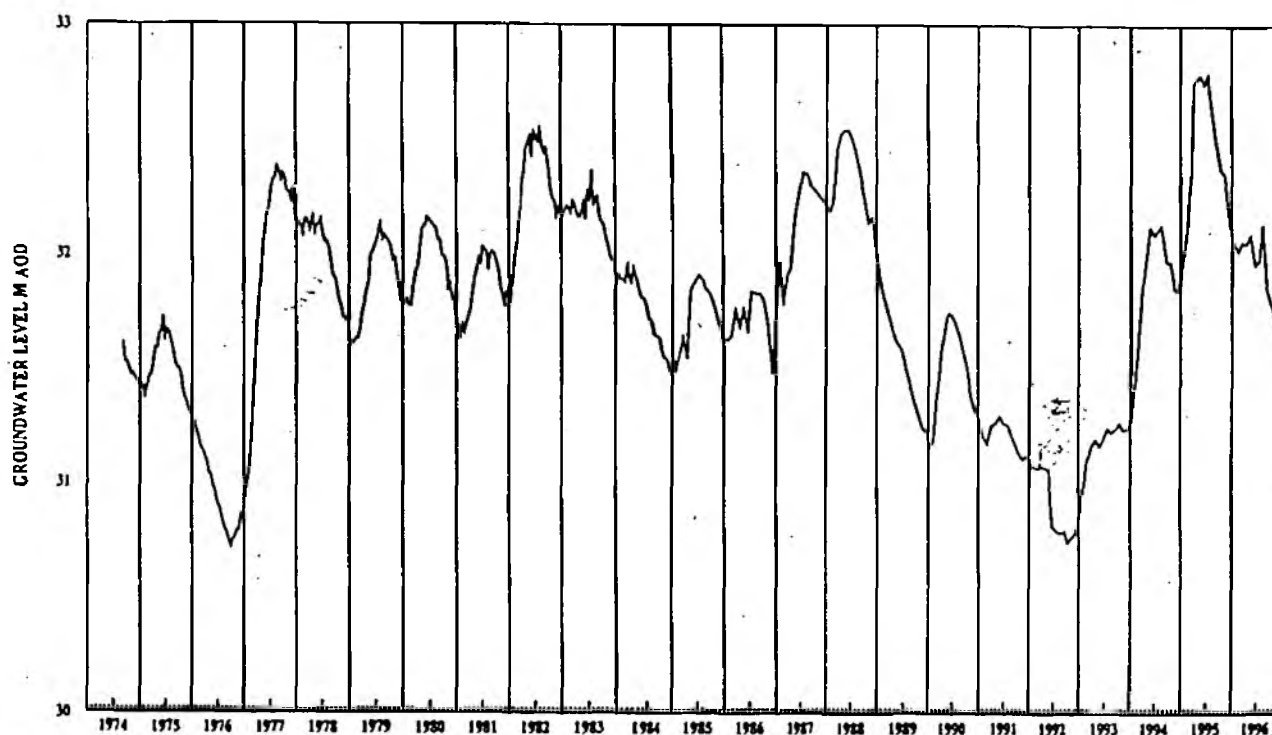
### **Classification History**

01/10/83 - 30/9/91	B*
01/10/91 - 31/3/92	C
01/04/92 -	A

# **GROUNDWATER UNIT: ASTLEY (F8.5) [Fig 9]**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		LITTLE WITLEY	SO78376355	0227



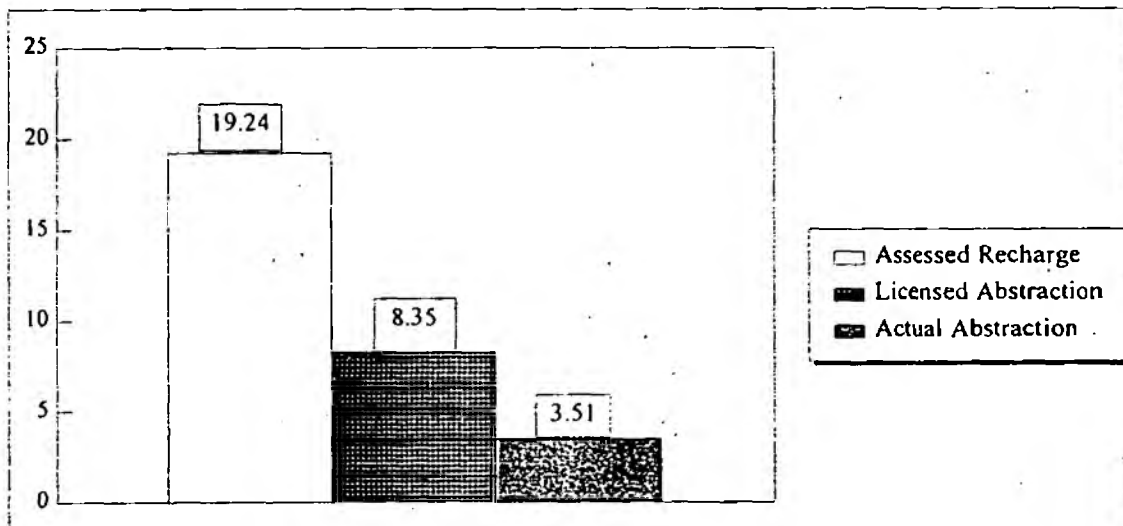
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SHRAWLEY NO.1	SO79916633	0364

## GROUNDWATER UNIT: ASTLEY (F8.5) [Fig 9]

Licence No	Licensed Abstraction	Actual Abstraction
8/107	0.002	0.002
8/153	0.0001	0.0001
8/218	0.009	0.01
8/317 (Astley) (ST)	8.00	3.22
8/436	0.19	(NR) 0.19
8/460	<u>0.14</u>	<u>0.10</u>
	<u>8.34</u>	<u>3.51</u>
Public Water Supply	8.00	3.22
Private Water Supply	0.34	0.29

### SUMMARY

#### Resource Balance



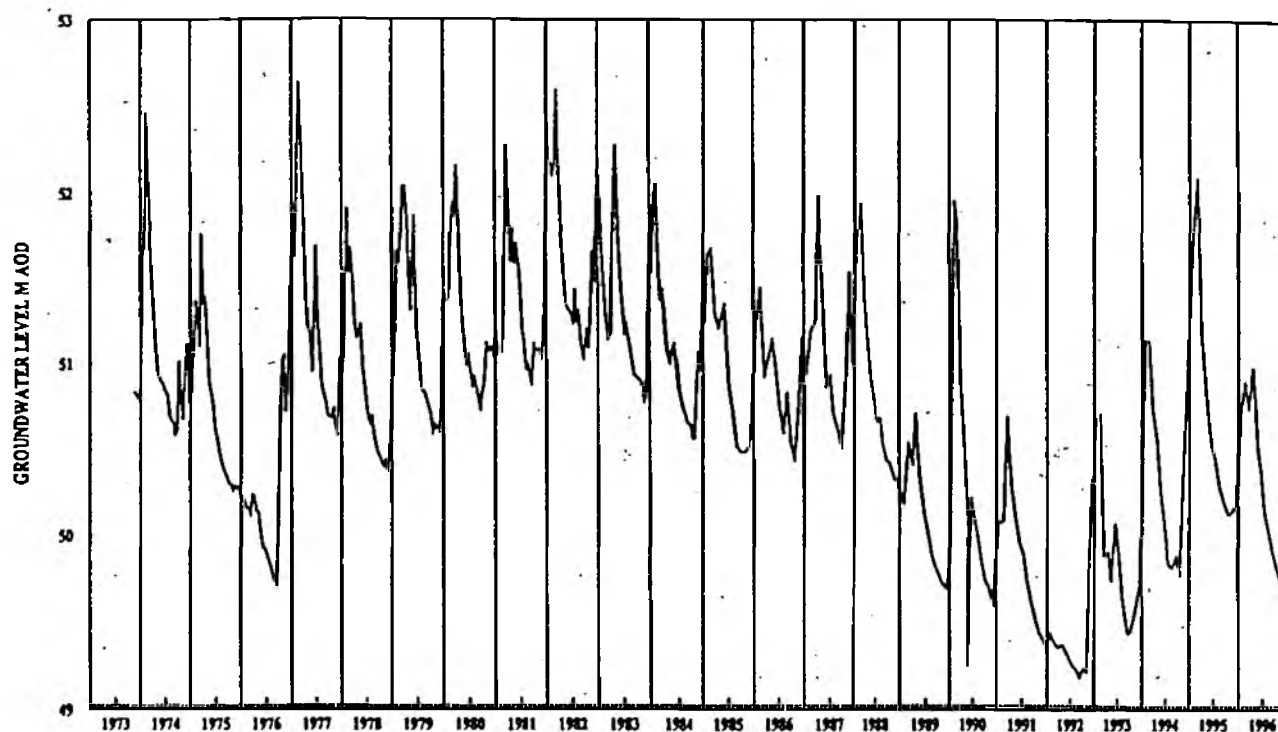
#### Unit Classification: D

No objection in principle to new licence applications. Baseflow support will have to be considered in parts of the unit.

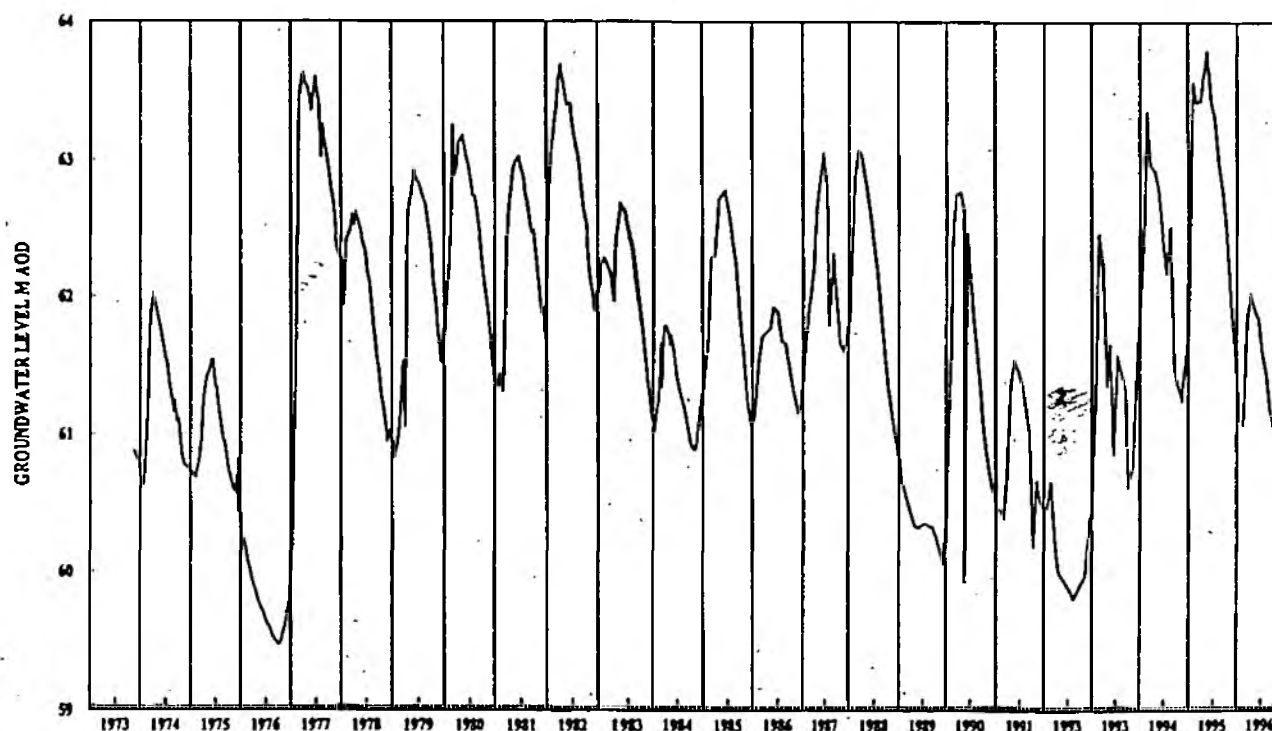
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: OMBERSLEY (F8.6) [Fig 9]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		LOWER ACTON FARM	SO84786750	0239



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		PIPSTILE FARM UPHTAMPTON	SO83556469	0317

## GROUNDWATER UNIT: OMBERSLEY (F8.6) [Fig 9]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
7/1	0.019	0.019
7/8	0.002	0.002
7/48	0.001	0.001
7/56	0.001	0.001
7/75	0.002	0.002
7/76	0.002	0.002
7/78	0.010	0.010
7/97	0.005	0.005
7/103	0.0005	0.0005
7/151	0.0004	0.0004
7/176	0.003	0.003
7/178	0.004	0.004
7/179	0.003	0.003
7/184	0.014	0.014
7/185	0.0014	0.001
7/191	0.0007	0.0007
7/192	0.025	0.07
7/245 (Westwood) (ST) +	5.50	2.84
7/246* (Dunhampton) (ST) +	4.25	3.97
8/16	0.0003	0.0003
8/37	0.003	0.003
8/50	0.002	0.002
8/58	0.005	(NR) 0.005
8/60	0.0009	0.0009
8/61	0.003	0.003
8/115	0.0005	0.0005
8/226	0.016	0.016
8/273	0.007	0.007
8/274	0.001	0.001
8/320	0.076	0.00
8/335	0.005	0.005
8/336	0.005	0.005
8/345	0.002	0.002
8/346	0.002	0.002
8/347	0.00002	0.00002
8/390	0.0003	0.0003
8/407	0.006	0.006
8/500	0.10	0.10
8/502	0.005	0.005
8/503	0.06	0.05
8/504 (Ombersley) (ST) +	3.50	0.00
8/508	0.001	0.001
8/514 (replacement for 8/405)	<u>0.05</u>	<u>0.05</u>
	<u>6.45</u>	<u>7.20</u>

\* The licence for Dunhampton includes the compensation flow component.

+ The aggregate limit on these three sources is 6.0 Ml/d (as from 1/1/95).

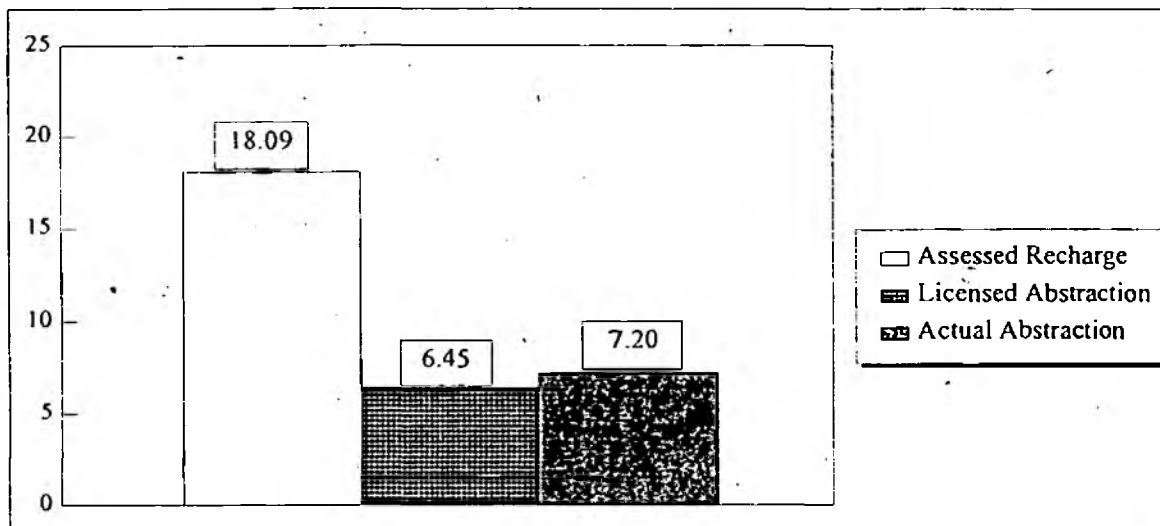
Public Water Supply	6.00	6.80
Private Water Supply	0.45	0.40

## GROUNDWATER UNIT: OMBERSLEY (F8.6) [Fig 9]

Public Water Supply	6.00	6.80
Private Water Supply	0.45	0.40

### SUMMARY

#### Resource Balance



#### Unit Classification: A

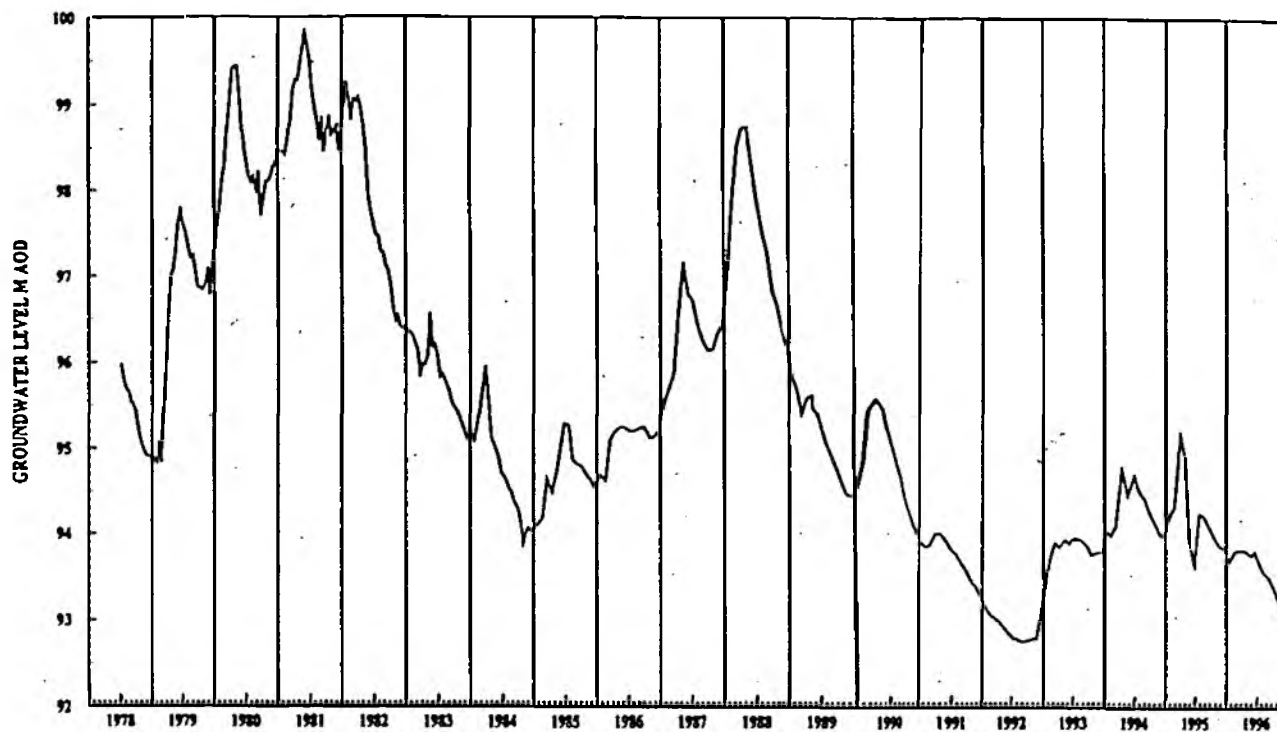
The aquifer is multilayered and in parts semi-confined. Effects of pumping from the public water supply sources have been extensive leading to derogation of other sources and reduction in baseflow in the Hadley Brook and its tributaries. The Dunhampton licence includes a requirement for compensation discharges to these streams, triggered by flows at the Wards Bridge Gauging Station.

The PWS sources in the unit are now linked by a group licence which will reduce levels of actual abstraction. The impacts of these lower abstraction rates will need to be assessed before the licensing policy for this unit can be re-appraised. The Ombersley licence is time-limited until 31 April 1999; the option exists to delete these boreholes from the group licence if their operation demonstrates unacceptable environmental impacts.

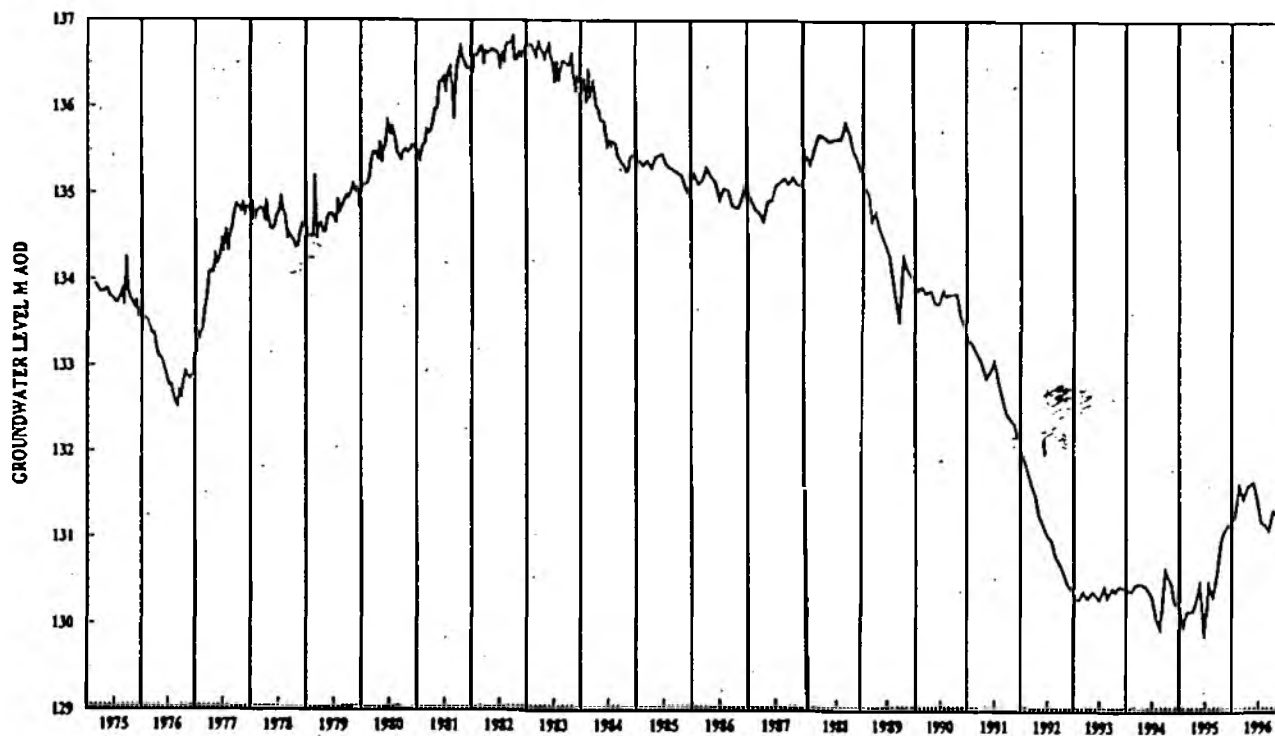
#### Classification History

1/10/83 - 30/9/89	D*
1/10/89 - 30/9/90	C*
1/10/90 - 30/9/91	B*
1/10/91	A

# GROUNDWATER UNIT: BROMSGROVE (F8.7) [Fig 9]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BURCOTT LAKE BROMSGROVE	SO96837161	0059



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		FAIRFIELD NO.2	SO99657567	0125



## GROUNDWATER UNIT: BROMSGROVE (F8.7) [Fig 9]

Licence No	Licensed Abstraction	Actual Abstraction
7/20	0.62	0.42
7/22	0.011	0.011
7/101	0.009	0.009
7/131 (Burcot) (ST)	( 5.50)	3.36
7/133 (Washingstocks) (ST)	( 4.50)	2.43
7/134 (Wildmoor) (ST)	( 8.18)	5.44
7/135 (Sugarbrook) (ST)	( 10.50)	6.96
7/170	0.11	0.00
7/194	0.024	0.012
7/195	0.076	0.013
7/236 (Whitford) (ST)	( 4.50)	3.14
7/244 (NRA)	0.58	0.46
15/183 (Brookhill) (ST)	( 7.95)	4.59
19/113 (Webheath) (ST)	( 7.25)	4.99
19/133	<u>0.037</u>	<u>0.00</u>
	<u>45.47</u>	<u>31.84</u>

The seven PWS sources are limited to a group licence of 44.00 reducing to 39.00 on 31/3/97; individual source licences are given in brackets.

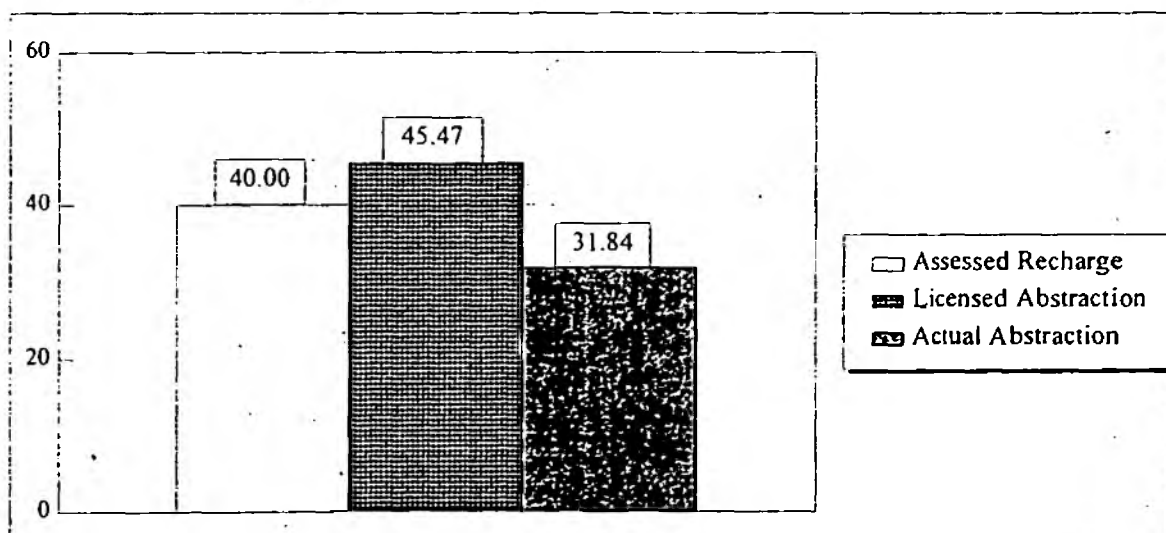
Public Water Supply	44.00	30.92
Private Water Supply	1.47	0.92

### SAND/GRAVEL WASHING LICENCES

Licence No	Actual Abstraction	% Return to Aquifer	Quantity Returned to Aquifer
7/170	0.00	90	0.00

### SUMMARY

#### Resource Balance



## **GROUNDWATER UNIT: BROMSGROVE (F8.7) [Fig 9]**

### **Unit Classification: A**

This unit is over-licensed and historical levels of abstraction have virtually eradicated baseflow. This has led to major problems in the watercourses especially the Battlefield Brook and the Bow Brook. Some environmental damage of wetland areas dependant on a high water table has also been reported. The Environmental Agency's compensation flow borehole for the Battlefield Brook only alleviates the problem, it does not cure it.

### **Classification History**

1/10/83 - 30/9/91	A*
1/10/91 -	A

**GROUNDWATER UNIT : LONGBRIDGE (F 8.8) [Fig 9]**

There are currently no groundwater observation boreholes in this unit.

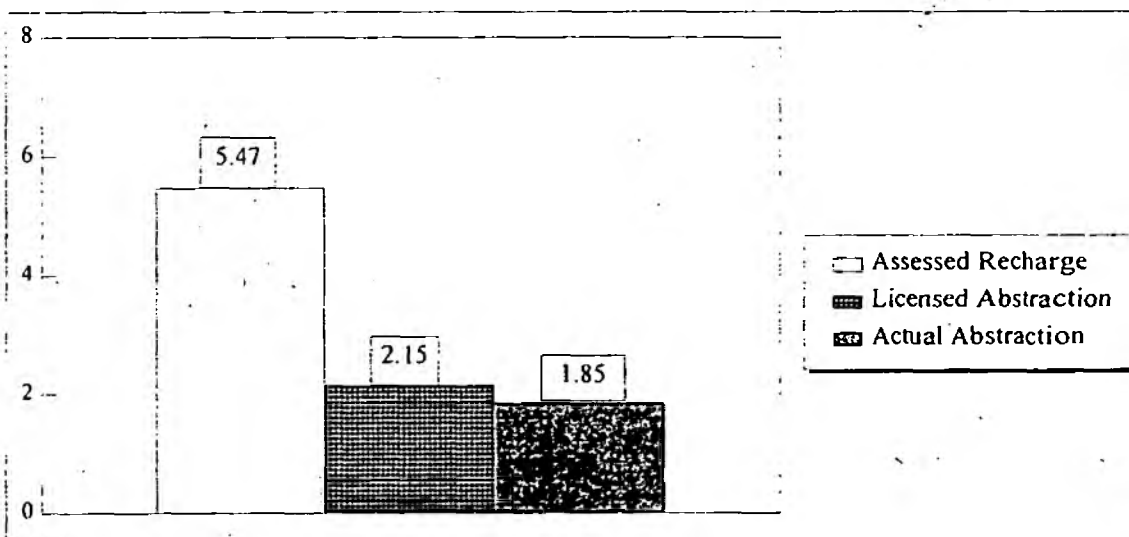
## GROUNDWATER UNIT: LONGBRIDGE (F8.8) [Fig 4]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
9/21 (T)	1.80	1.80
12/57 (T)	0.24	0.02
15/199	0.002	0.002
15/275	<u>0.11</u>	(NEW) <u>0.025</u>
	<u>2.15</u>	<u>1.85</u>

( T= Trent Catchment)

### SUMMARY

#### Resource Balance



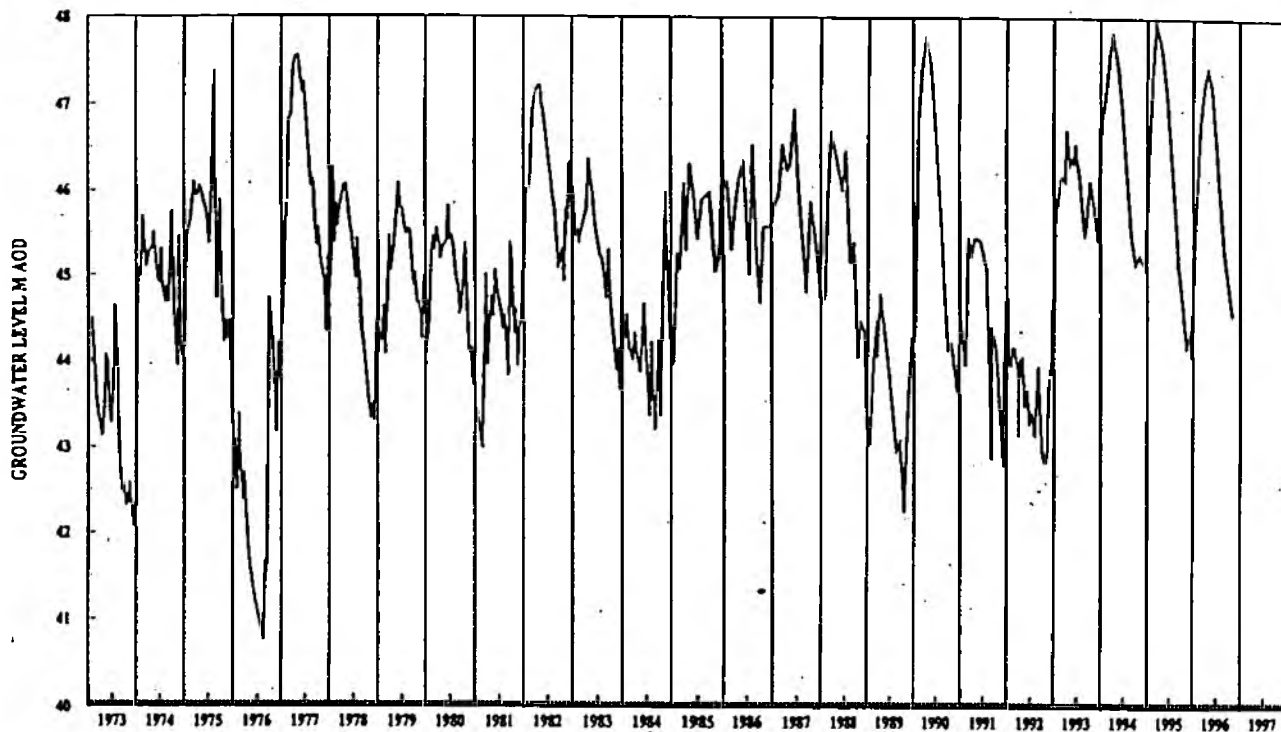
#### Unit Classification: D

There are no objections in principle to new licence applications. Little information is available on borehole yield and groundwater quality.

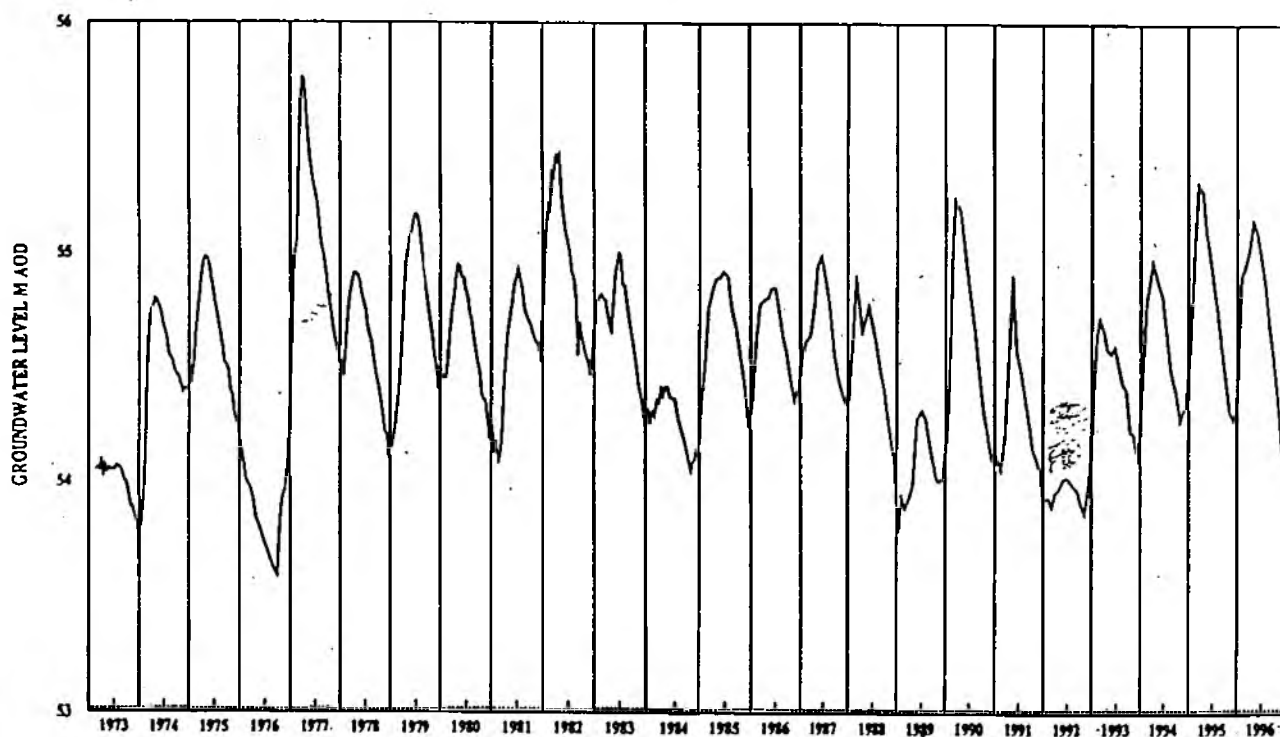
#### Classification History

1/10/83 - 30/9/91	E*
1/10/91 -	D

# GROUNDWATER UNIT: OXENHALL (F9.1) [Fig 10]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		ANTHONY'S CROSS	S07192291	0004



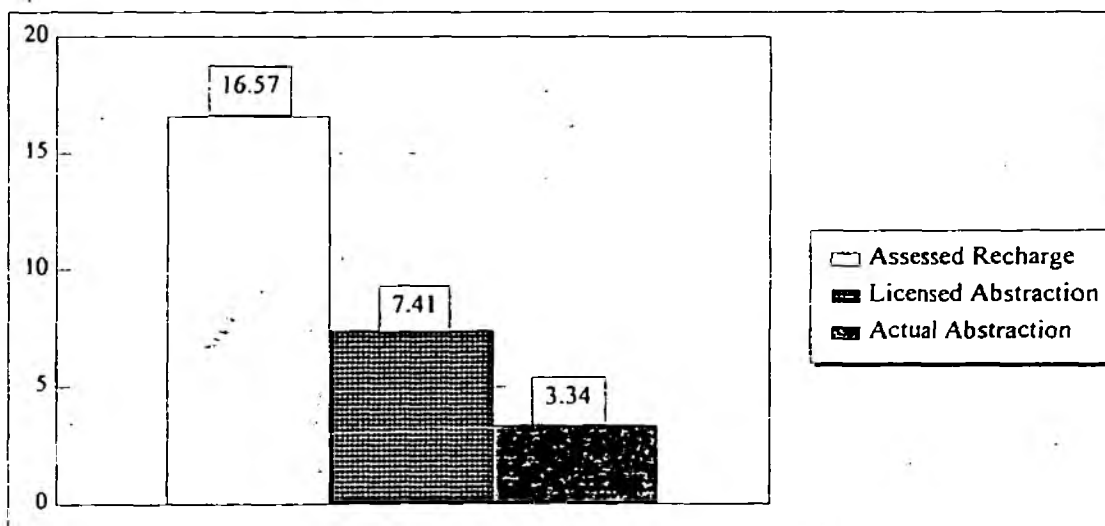
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		RAYES FARM BOTLOES GREEN	S072652913	0162

## GROUNDWATER UNIT: OXENHALL (F9.1) [Fig 10]

Licence No	Licensed Abstraction	Actual Abstraction
21/26 (Ketford) (ST)	3.24	0.42
21/27 (Newent) (ST)	2.49	2.34
21/99	0.011	0.011
21/120	0.002	0.002
21/123	0.25	0.22
21/125	0.0005	0.0005
21/147	0.31	0.08
21/153	0.09	0.06
21/172	0.12	0.07
21/180	0.07	0.00
21/191	0.04	0.02
21/192	0.05	0.03
21/194	0.01	0.00
21/195	0.07	0.07
21/196	<u>0.03</u>	<u>0.01</u>
	<u>7.41</u>	<u>3.34</u>
Public Water Supply	5.73	2.76
Private Water Supply	1.68	0.58

### SUMMARY

#### Resource Balance



#### Unit Classification: D

Some development can be considered provided that baseflow is adequately protected. Severn Trent Water have drilled an additional borehole at Ketford with a view to increasing the licence, with a corresponding reduction at Bromsberrow. Further details on their proposals are still awaited.

#### Classification History

1/10/83 - 30/9/91	E*
30/9/91 -	D

**GROUNDWATER UNIT : BROMSBERROW (F 9.2) [Fig 10]**

There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: BROMSBERROW (F9.2) [Fig 10]

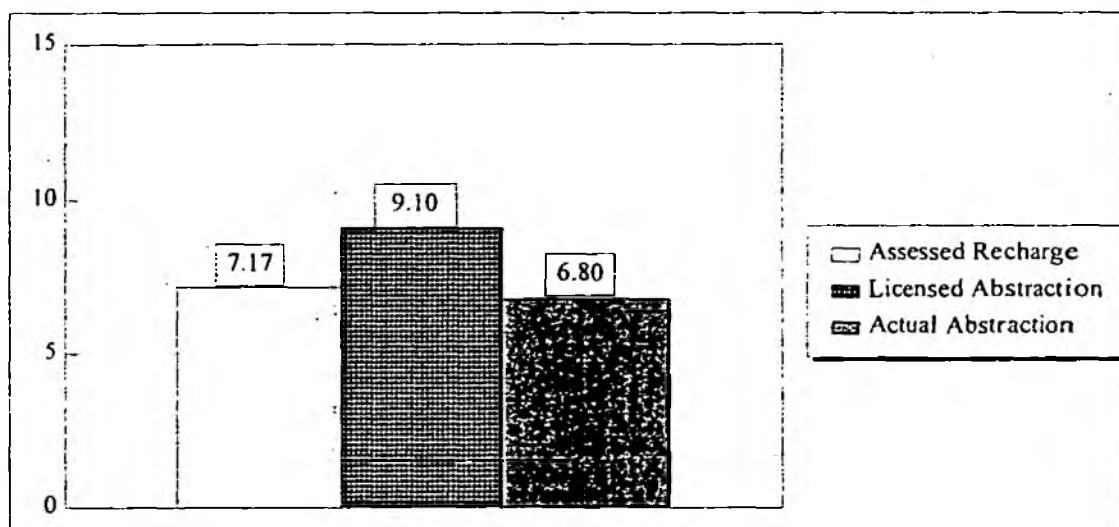
Licence No		Licensed Abstraction	Actual Abstraction
21/18		0.013	0.013
21/116* (Lintridge) (ST)	)	(3.41)	2.50
21/116* (Bromsberrow) (ST)	)	(9.09)	4.29
		<u>9.10</u>	<u>6.80</u>

\*Group licence, covering two sources, is 9.09; individual licences given in brackets.

Public Water Supply	9.09	6.79
Private Water Supply	0.01	0.01

### SUMMARY

#### Resource Balance



#### Unit Classification: A

This unit is both overlicensed and overabstracted. There is clear evidence of unacceptable low flows and also dry watercourses in some parts of the unit, especially the Glynn Brook. Proposals to add a new borehole (which has now been constructed) to the Bromsberrow licence are still awaited from STW and will have to be looked at critically in the light of the affects already recorded; a compensation flow clause will be included in any revised licence for Bromsberrow, even if the licence is reduced, to restore some of the flow lost due to historical overabstraction.

#### Classification History

1/10/83 - 30/9/91	A*
1/9/91 -	A



**GROUNDWATER UNIT : WARWICK (F 9.3) [Fig 11]**

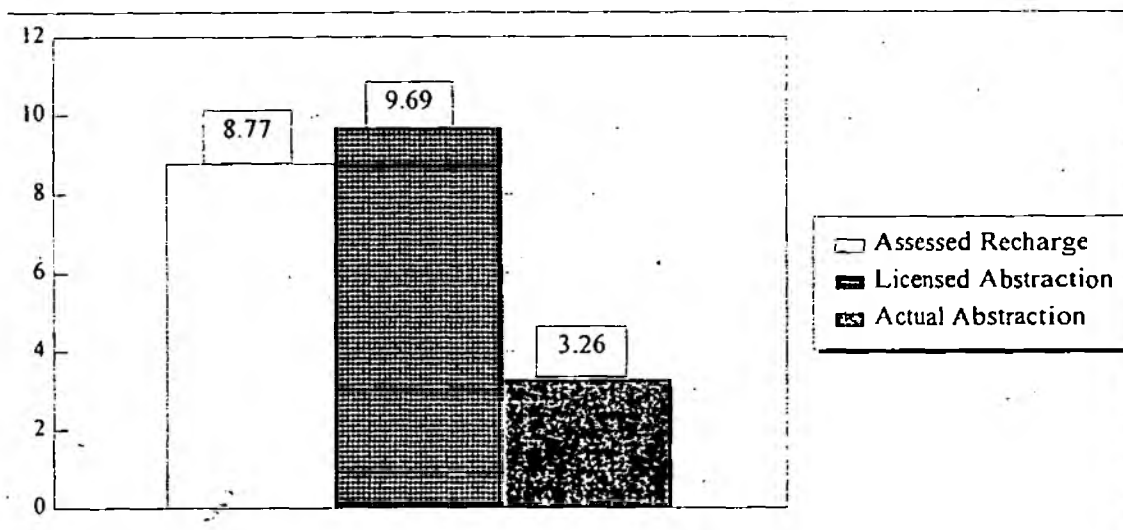
There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: WARWICK (F9.3) [Fig 11]

Licence No	Licensed Abstraction	Actual Abstraction
10/133	0.016	0.016
10/187	0.10	(NEW) 0.10
12/5	0.002	0.002
12/24 (Campion Terrace) (ST)	( 6.23)	2.08
12/48	0.012	0.012
12/49	0.002	0.002
13/39 (Lillington) (ST)	1.74	0.98
13/42 (Leek Wooton) (ST)	0.29	0.00
13/44 (Whitnash) (ST)	0.55	0.00
13/252	<u>0.75</u>	<u>0.17</u>
	<u>9.69</u>	<u>3.37</u>
Public Water Supply	8.81	3.06
Private Water Supply	0.88	0.30

### SUMMARY

#### Resource Balance



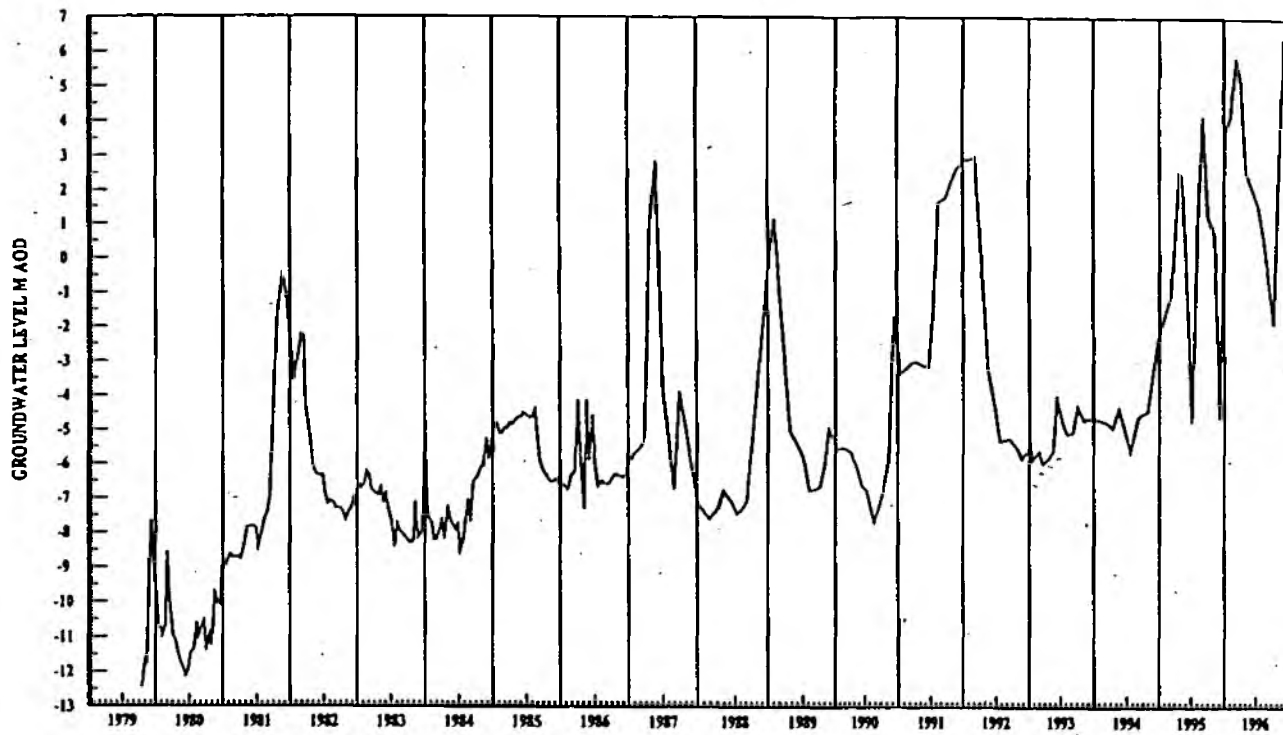
#### Unit Classification: B (TL)

This unit represents a new southern sub-division of the former Coventry (F 9.3) unit. The outcrop area of the unit is small and borehole yields are generally poor, reflecting the limited thickness of the aquifer. Groundwater quality is extremely variable. Although the resource balance indicates that the unit is overlicensed, but underabstracted, there are no observation boreholes to provide evidence of long term groundwater level trends. For the time being, only small licences can be considered and these must be time limited to allow for any future increase in actual abstractions by existing licence holders.

#### Classification History

1/12/95 -	B(TL)
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# **GROUNDWATER UNIT: AVON CONFINED (F9.4)**



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		TIDDINGTON	SP22583592	0393

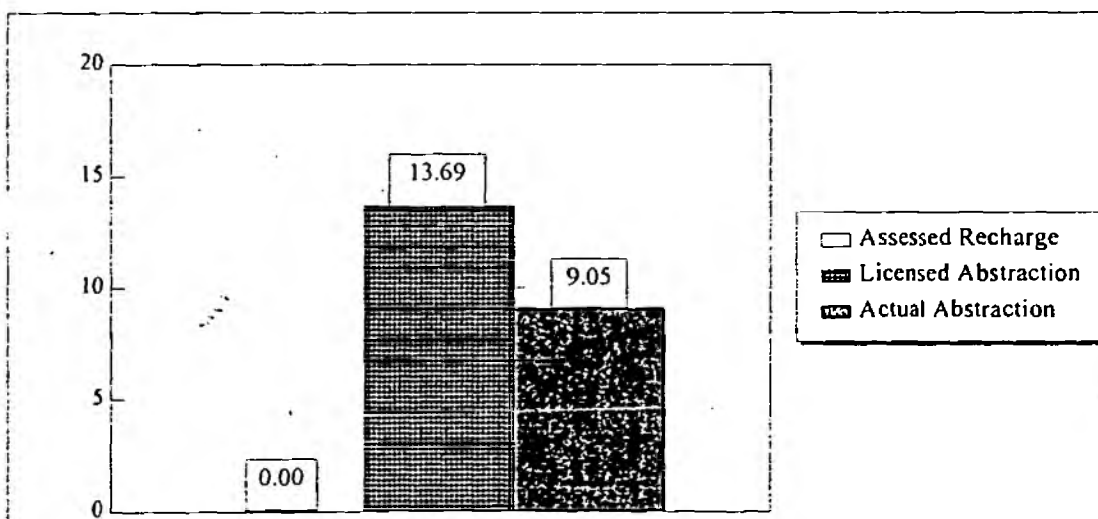
FB

## GROUNDWATER UNIT: AVON CONFINED (F9.4)

<u>Licence No</u>		<u>Licensed Abstraction</u>		<u>Actual Abstraction</u>
13/27 (Warwick Road) (ST)	)		)	
13/27 (Welcombe Fields) (ST)	)		)	
13/27 (August Hill) (ST)	)		)	
13/27 (Ryon Hill) (ST)	)	4.43	)	3.18
13/27 (Alveston Hill) (ST)	)		)	
13/27 (Tiddington) (ST)	)		)	
13/27 (Alcester Road) (ST)	)		)	
13/29 (Budbrooke) (ST)		0.85		0.69
13/41 (Heath End) (ST)		2.18		0.70
13/98		0.15		0.08
13/105		0.012		0.012
13/283 (Thelsford) (ST)	)	1.60	)	1.16
13/283 (Wellesbourne) (ST)	)	1.60	)	1.12
13/335		0.37		0.13
15/34 ( Little Shrewley)	)			
15/34 (Rowington) (ST)	)	2.49		1.99
		<u>13.69</u>		<u>9.05</u>
Public Water Supply		13.15		8.83
Private Water Supply		0.54		0.22

### SUMMARY

#### Resource Balance



#### Unit Classification: A

This unit is grossly overlicensed and overabstracted. Due to the appreciable thickness of overlying Mercia Mudstones, actual recharge is assessed as being negligible. STW are constructing a new borehole at Hatton Reservoir as a replacement for Little Shrewley within the existing licence constraints.

#### Classification History

1/10/83 - 30/9/85	C*
1/10/85 - 30/9/91	A*
1/10/91 -	A

**GROUNDWATER UNIT : WHITLEY (F 9.6) [Fig 11]**

There are currently no groundwater observation boreholes in this unit.

## GROUNDWATER UNIT: WHITLEY (F9.6) [Fig 11]

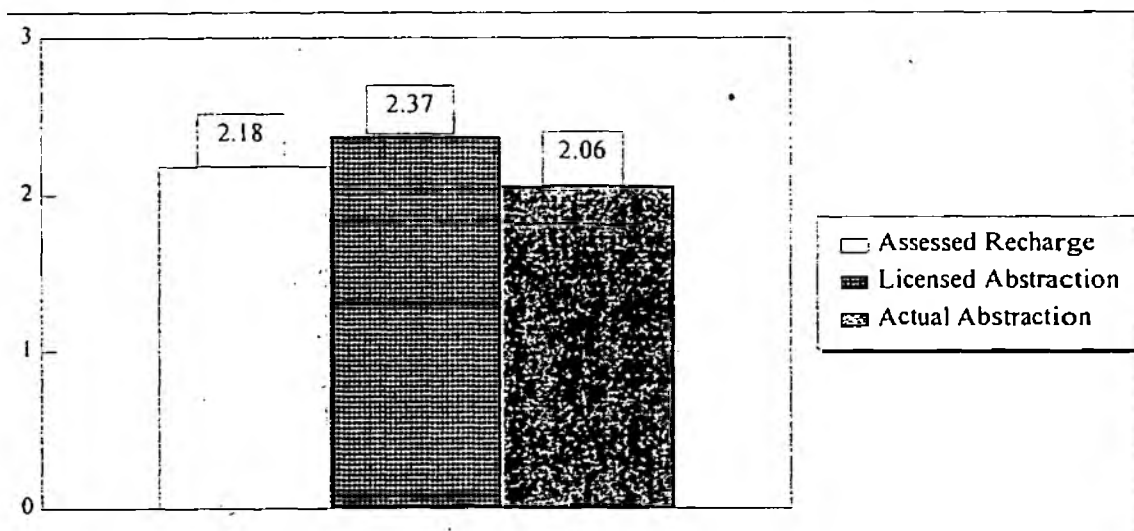
Licence No	Licensed Abstraction	Actual Abstraction
10/44	0.004	0.004
11/129* Whitley (ST)	( 2.29)	1.97
11/141	<u>0.08</u>	(NEW) <u>0.08</u>
	<u>2.37</u>	<u>2.06</u>

\* Whitley draws on both the Sherwood Sandstones and Permo-Carboniferous aquifers; 2.29 represents that part of the licence attributed to the Sherwood Sandstones (60%).

Public Water Supply	2.29	1.97
Private Water Supply	0.08	0.09

### SUMMARY

#### Resource Balance



#### Unit Classification: B (TL)

This unit represents a new northern sub-division of the former Coventry (F9.3) unit. The outcrop area of the unit is long and narrow, and consequently the assessed recharge is low. Although the unit is marginally overlicensed, but underabstracted, there are no observation boreholes to provide evidence of long term groundwater level trends. For the time being, only small licences can be considered and these must be time limited to allow for any future increase in actual abstraction from the Whitley PWS source.

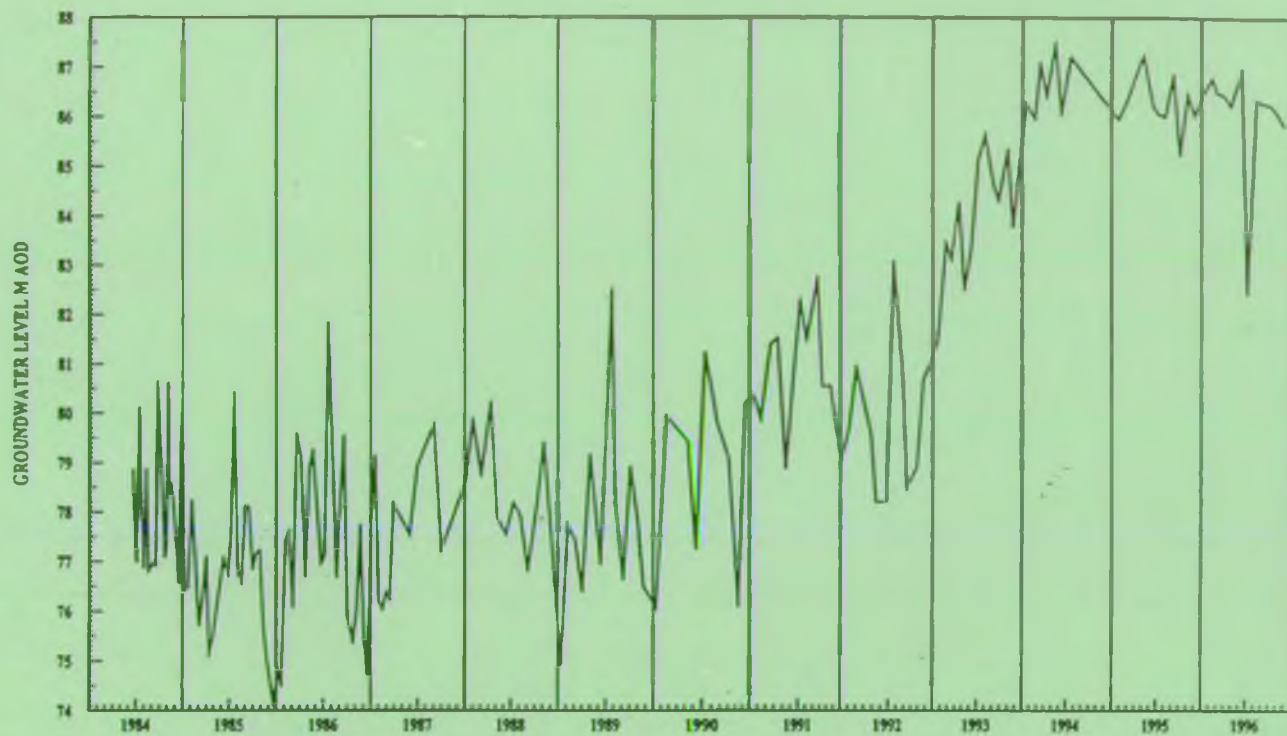
#### Classification History

1/12/95 -	B(TL)
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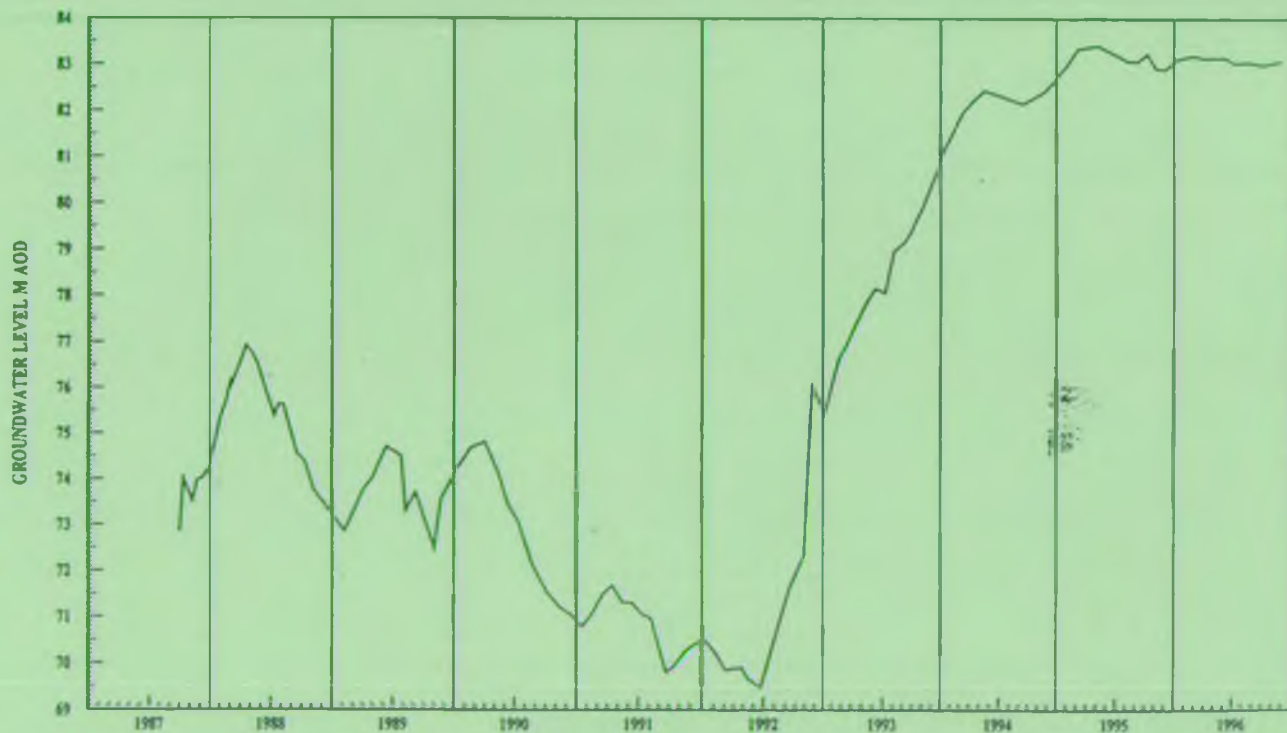
## **SECTION B**

### **3. Permo- Carboniferous Strata - Coventry Area**

# GROUNDWATER UNIT: COVENTRY (D9.3) [Fig 11]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		JAGUAR (RADFORD)	SP33288088	0513



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		COVENTRY DAIRY	SP34928014	0520



## GROUNDWATER UNIT: COVENTRY (D9.3) [Fig 11]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
11/2	0.50	0.00
11/6	5.35	1.95
11/20	0.72	0.10
11/28	1.45	0.38
11/29	0.83	0.16
11/34	3.25	0.38
11/37 # (Meriden) (ST)	7.20	4.77
11/41+	1.88	0.00
11/61	0.55	0.04
11/65	0.0009	0.0009
11/69	0.009	0.009
11/126	0.21	0.00
11/128* (Waveley Road) (ST)	( 8.48)	6.22
11/129* (Whitley) (ST)^	( 1.52)	1.31
11/130* (Watery Lane) (ST)	( 6.00)	2.55
11/136 (Brownhill Green) (ST)	2.25	1.76
11/137~ (Mount Nod) (ST)	3.32	2.90
11/140	<u>1.50</u>	<u>0.36</u>
	<u>45.02</u>	<u>22.90</u>
Public Water Supply	28.77	19.53
Private Water Supply	16.25	3.38

\* Group licence, covering 3 sources, is 16.00; individual licences given in brackets.

^ Whitley: 40 % of individual licence (and abstraction) is from this unit with the remainder from the Whitley Unit (F 9.6).

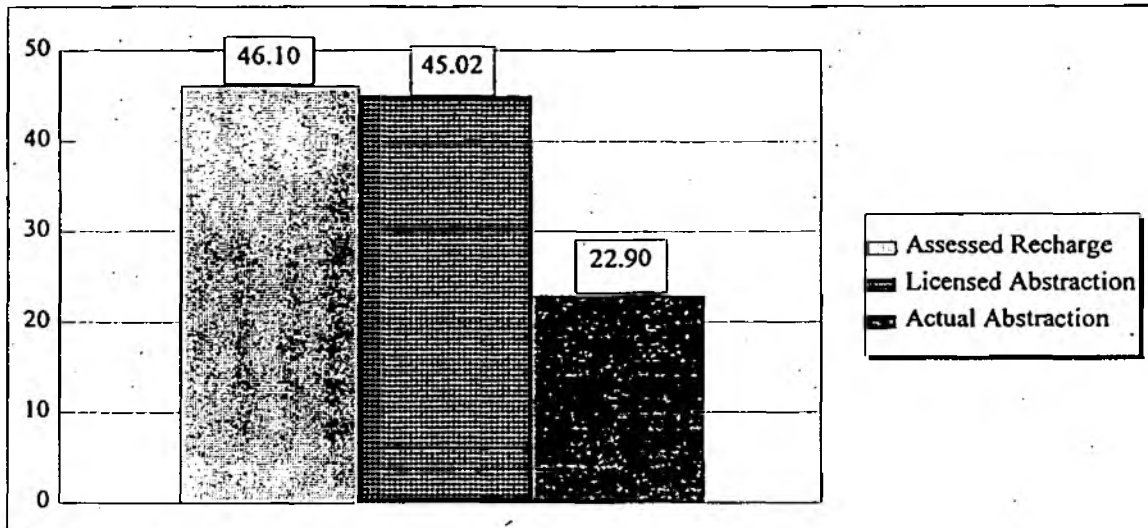
+Rover: 90 % of licence (and abstraction) is from this unit with the remainder from the Kenilworth Unit (D 9.5).

~ Mount Nod: 83% of the licence (and abstraction) is from this unit with the remainder from the Kenilworth Unit (D 9.5).

#Meriden: 60% of individual licence (and abstraction) is from this unit with the remainder from the Meriden Unit (D 9.4).

## GROUNDWATER UNIT: COVENTRY (D9.3) [Fig 11]

### SUMMARY



### Unit Classification: A

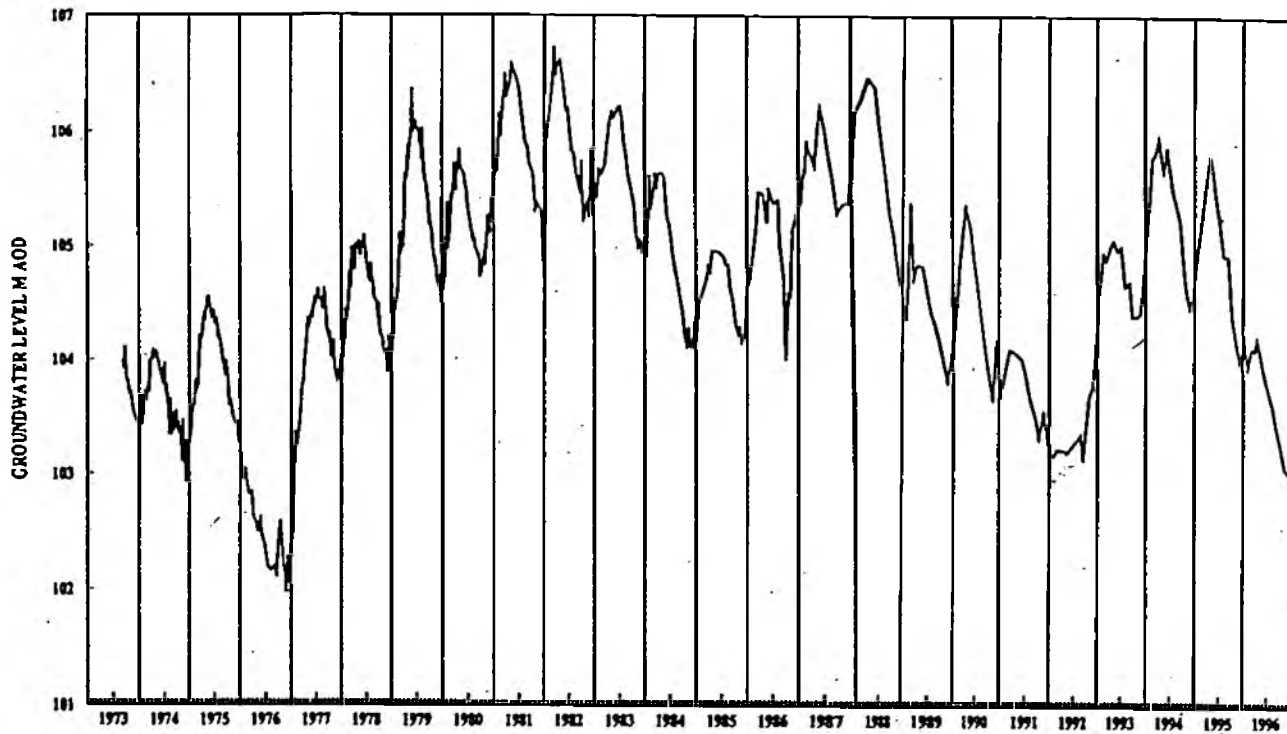
A detailed study has led to a re-defining of the Coventry and Meriden units, with the intervening boundary now following the surface water catchment divide. Licensed abstractions in the Coventry unit equate closely to the revised resource estimate, which includes a significant component (36%) of mains leakage. Reductions in leakage and further utilisation of existing licences would have a significant impact on baseflows to the Rivers Sowe and Sherbourne, which have already been adversely affected by groundwater abstraction. No further licences can be considered, and every opportunity should be taken to reduce existing levels of abstraction.

Rising groundwater levels in Coventry city centre, resulting from a decline in historic industrial abstractions, do not indicate a major increase in available groundwater resources, due to low storage in the semi-confined aquifer.

### Classification History

1/10/86 - 30/9/87	A*
1/10/87 - 30/9/89	D*
1/10/89 - 30/9/91	A*
1/09/91 -	A

# GROUNDWATER UNIT: MERIDEN (D9.4) [Fig 4]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		RAM HALL	SP24677827	1219

## GROUNDWATER UNIT: MERIDEN (D9.4) [Fig 4]

Licence No	Licensed Abstraction	Actual Abstraction
11/37 (Meriden) (ST)	4.80	3.18
11/10 (T)	0.002	0.002
11/33 (T)	0.002	0.002
11/40 (T)	0.007	0.007
11/134 (T)	0.15	0.05
11/139 (T)	0.17	0.06
15/8 (T)	0.004	0.004
15/21 (T)	0.25	0.06
15/29 (T)	0.37	0.47
15/30 (T)	<u>0.03</u>	<u>0.002</u>
	<u>5.79</u>	<u>5.36</u>

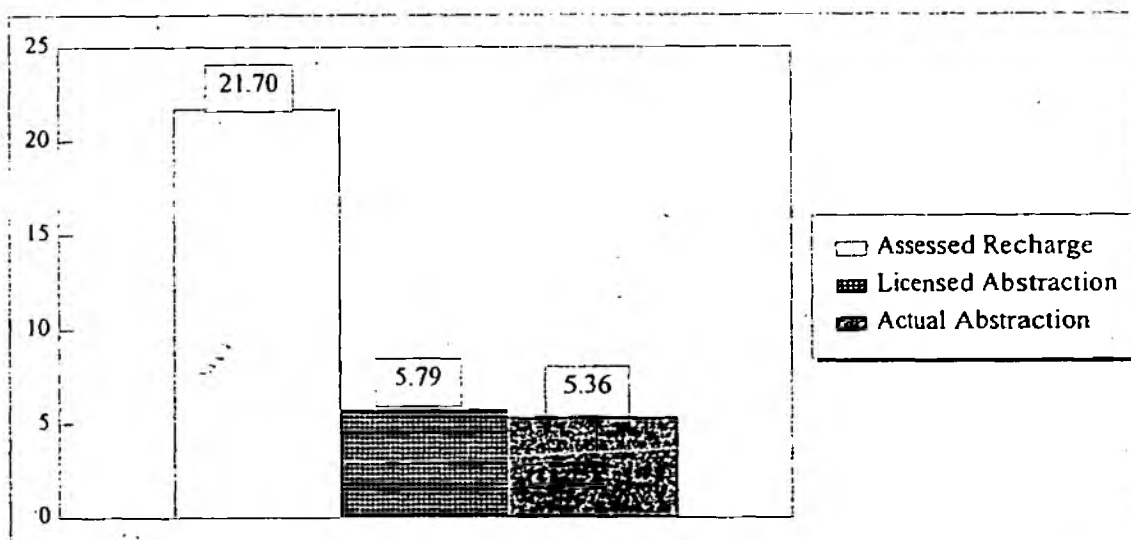
(T = Trent Catchment)

# Meriden : 40% of individual licence (and abstraction) is from this unit with the remainder from the Coventry Unit (D 9.3).

Public Water Supply	4.80	4.77
Private Water Supply	0.99	0.58

### SUMMARY

#### Resource Balance



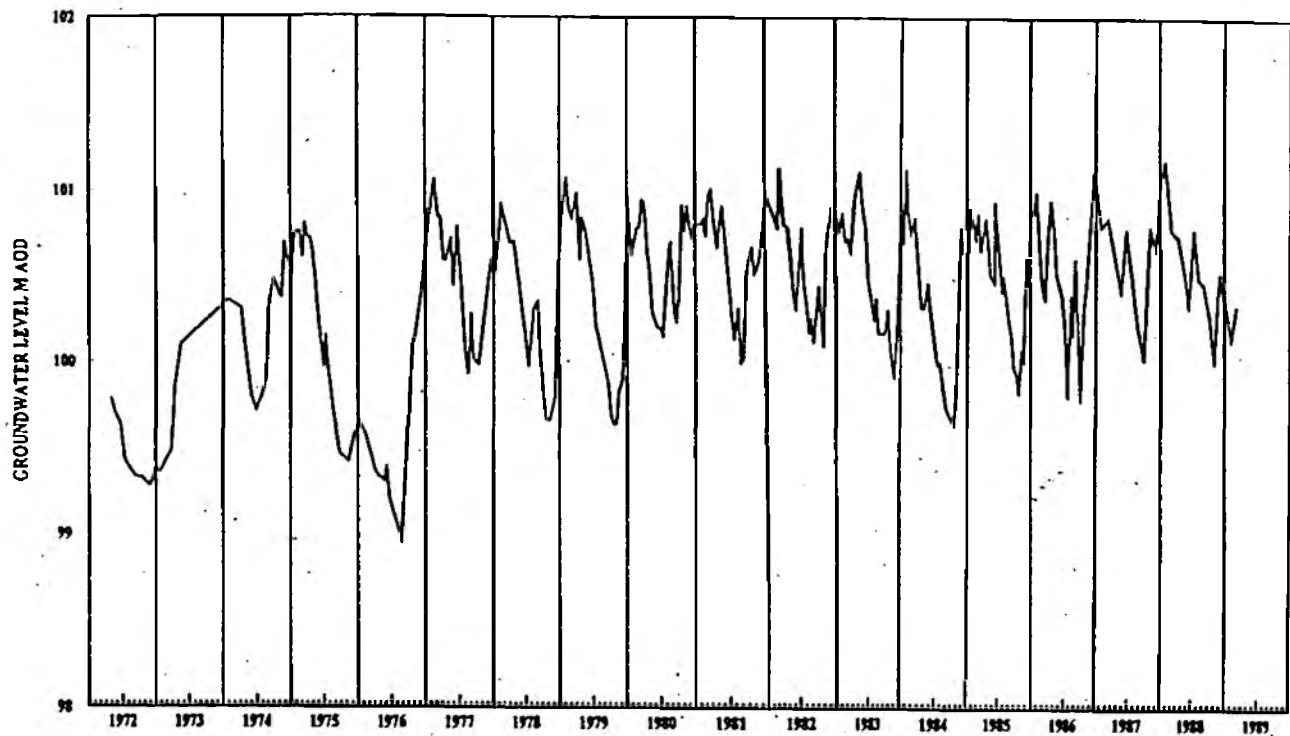
#### Unit Classification: C

There is scope for some small-scale development of groundwater. However, any large new or varied licence must be carefully considered with respect to protection of baseflow, particularly in the headwaters of river catchments. Borehole yields in the unit are typically moderate.

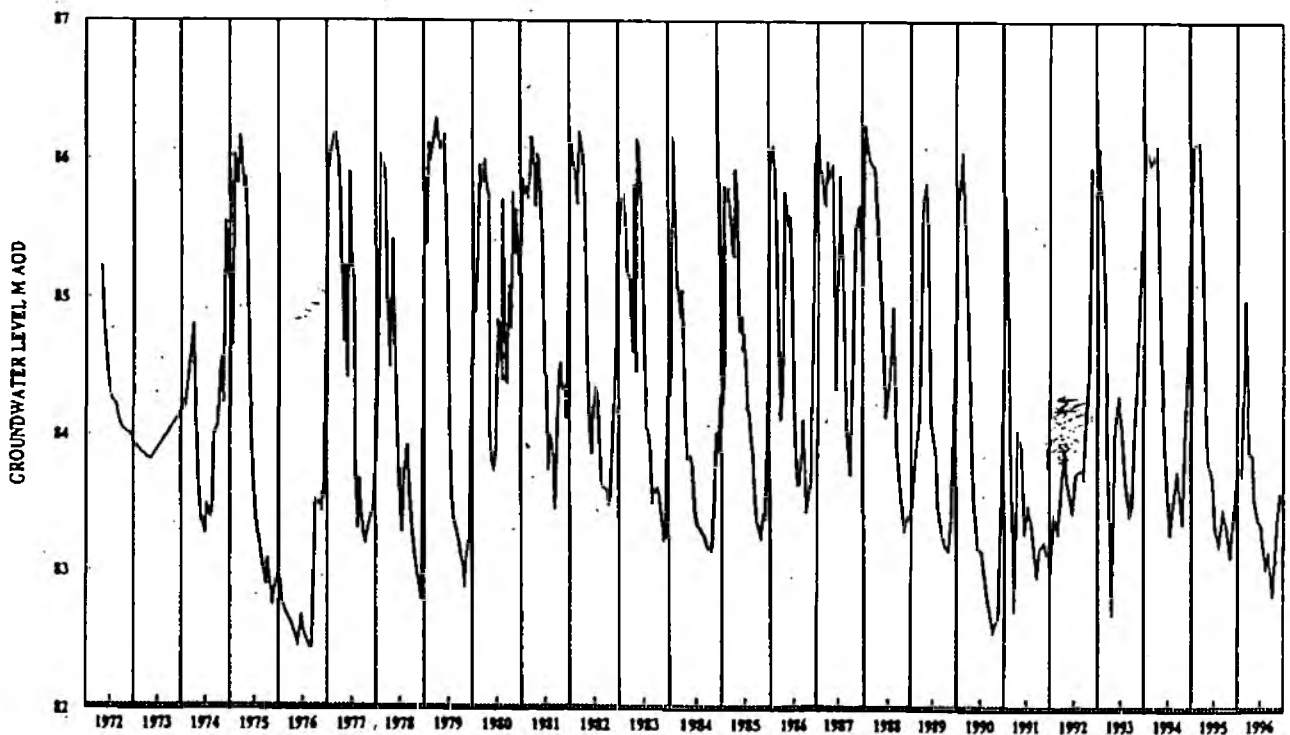
#### Classification History

1/10/86 - 30/9/91	D*
1/10/91 -	C

# GROUNDWATER UNIT: KENILWORTH (D9.5) [Fig 11]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BROAD LANE	SP30627870	0049



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		IVY FARM	SP30537672	0202

## GROUNDWATER UNIT: KENILWORTH (D9.5) [Fig 11]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
11/9	0.002	0.002
11/11 (Birmingham Road) (ST)	0.45	0.37
11/22 (Mill End) (ST)	3.47	2.16
11/41+	0.21	0.00
11/42	0.004	0.004
11/50	0.0008	0.0008
11/98	0.019	0.019
11/102	0.002	0.002
11/131	0.019	0.019
11/135 (Green Lane) (ST)	2.15	2.10
11/137~ (Mount Nod) (ST)	0.68	0.59
11/138	0.02	(NEW) 0.016
13/162	0.011	0.011
13/213	0.002	0.002
13/341	<u>0.25</u>	<u>0.23</u>
	<u>7.29</u>	<u>5.54</u>

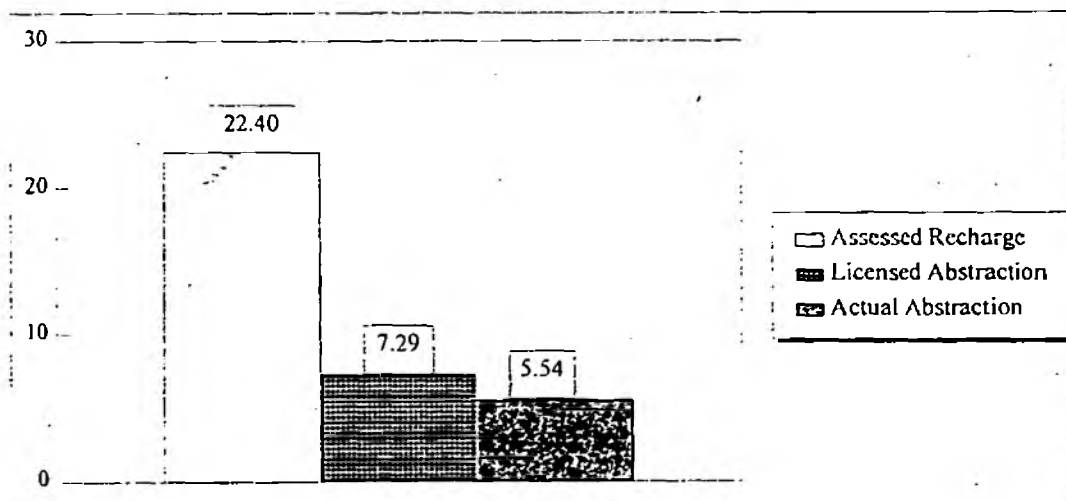
+Rover: 10% of the licence (and abstraction) is from this unit with the remainder from the Coventry Unit (D9.3).

~ Mount Nod: 17 % of the licence ( and abstraction) is from this unit with the remainder from the Meriden Unit (D 9.4)

Public Water Supply	3.92	2.53
Private Water Supply	3.37	3.01

### SUMMARY

#### Resource Balance



#### Unit Classification: C

Yields are variable but tend to be poor. New licence applications can be considered provided that baseflow is protected.

#### Classification History

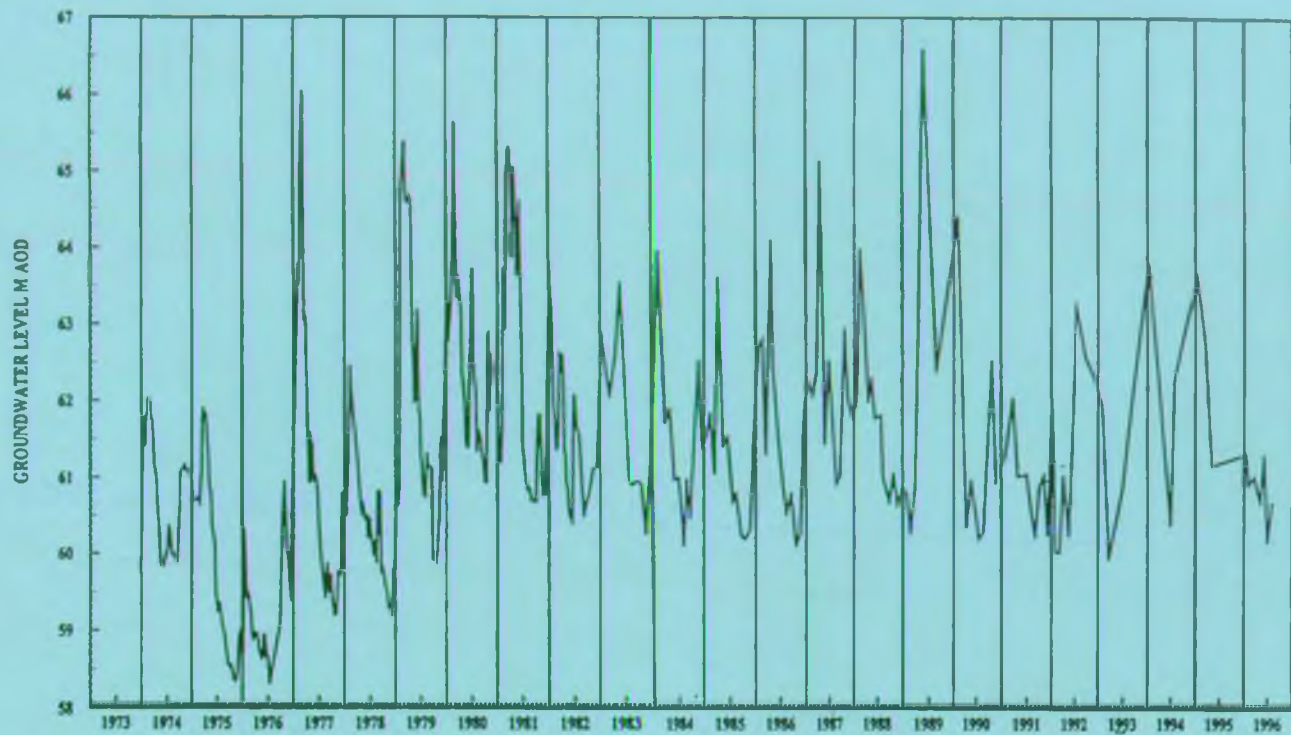
1/10/86 - 30/9/91	E*
1/10/91	C

## **SECTION B**

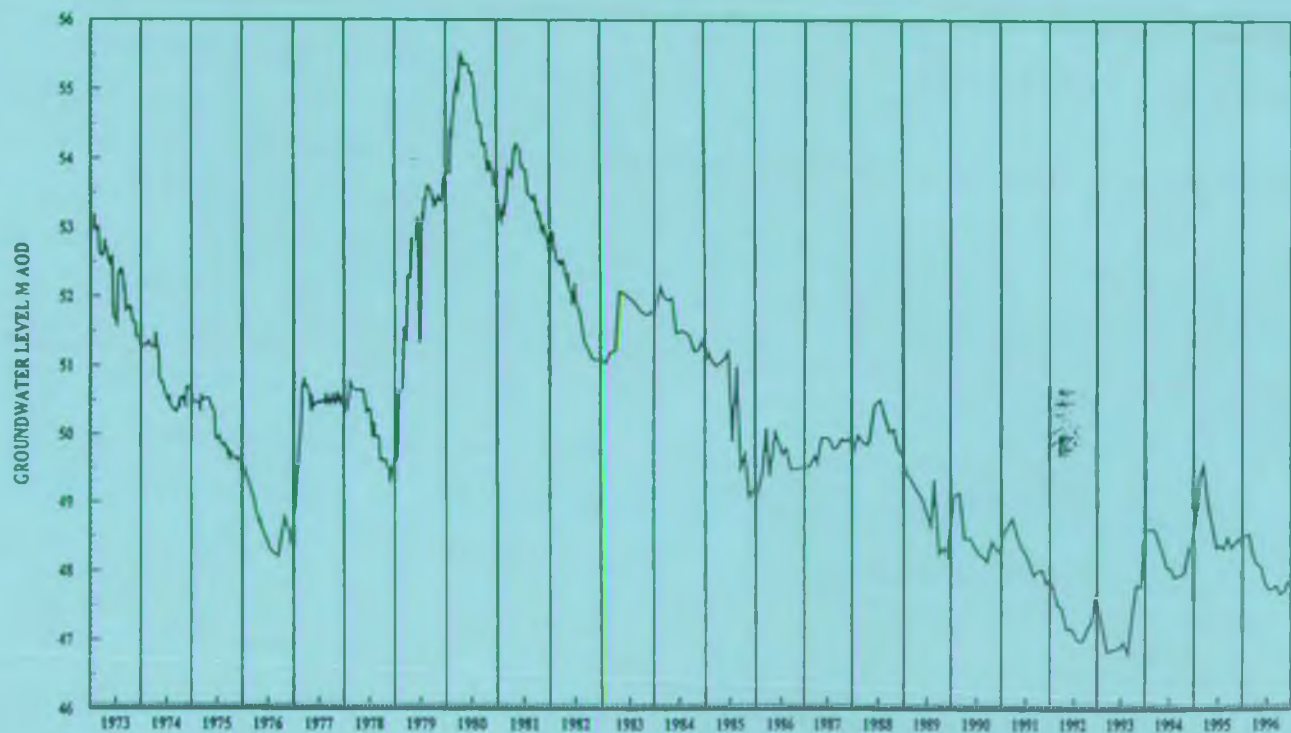
### **4. Lower Magnesian Limestone - Notts and South Yorkshire**



## GROUNDWATER UNIT: MALTBY (E1.2) [Fig 1]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		GILDINGWELLS	SK55818502	1759



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		STANTON LITTLEWOOD	SK55479429	1767

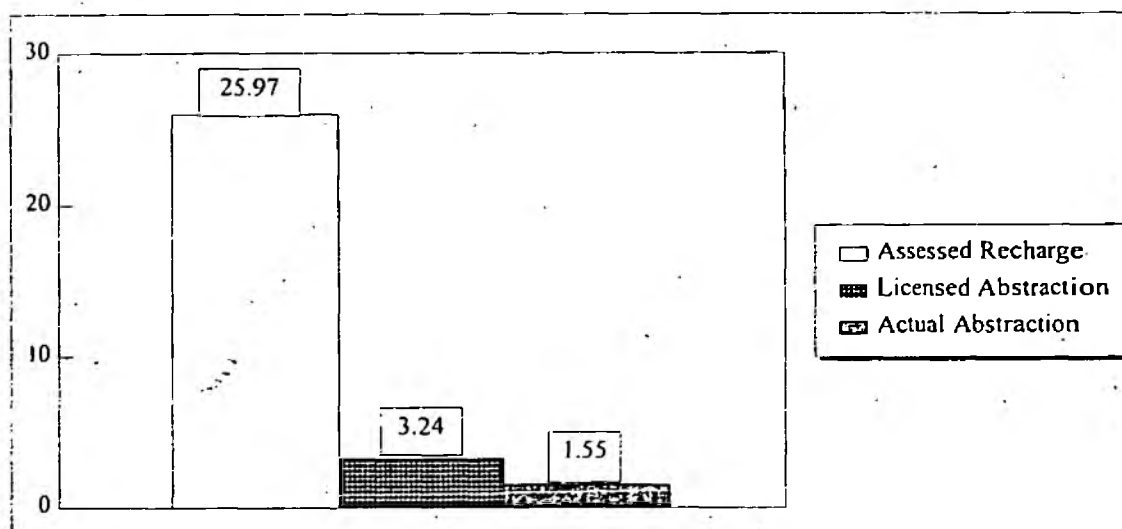


## GROUNDWATER UNIT: MALTBY (E1.2) [Fig 1]

Licence No	Licensed Abstraction	Actual Abstraction
75/23	0.02	0.01
76/6	0.007	0.007
76/23	0.56	0.14
76/32	0.05	0.00
76/33	0.06	(NEW) 0.06
76/34	0.21	(NEW) 0.21
76/35	0.27	(NEW) 0.27
77/21	0.006	0.006
77/26	0.06	0.06
83/20	1.15	0.38
83/124	0.06	0.02
83/164	0.006	0.007
83/170	0.27	0.03
83/176	0.27	0.15
83/199	0.01	(NEW) 0.01
83/218	0.05	0.002
83/219	<u>0.17</u>	(NR) <u>0.17</u>
	<u>3.24</u>	<u>1.55</u>

### SUMMARY

#### Resource Balance



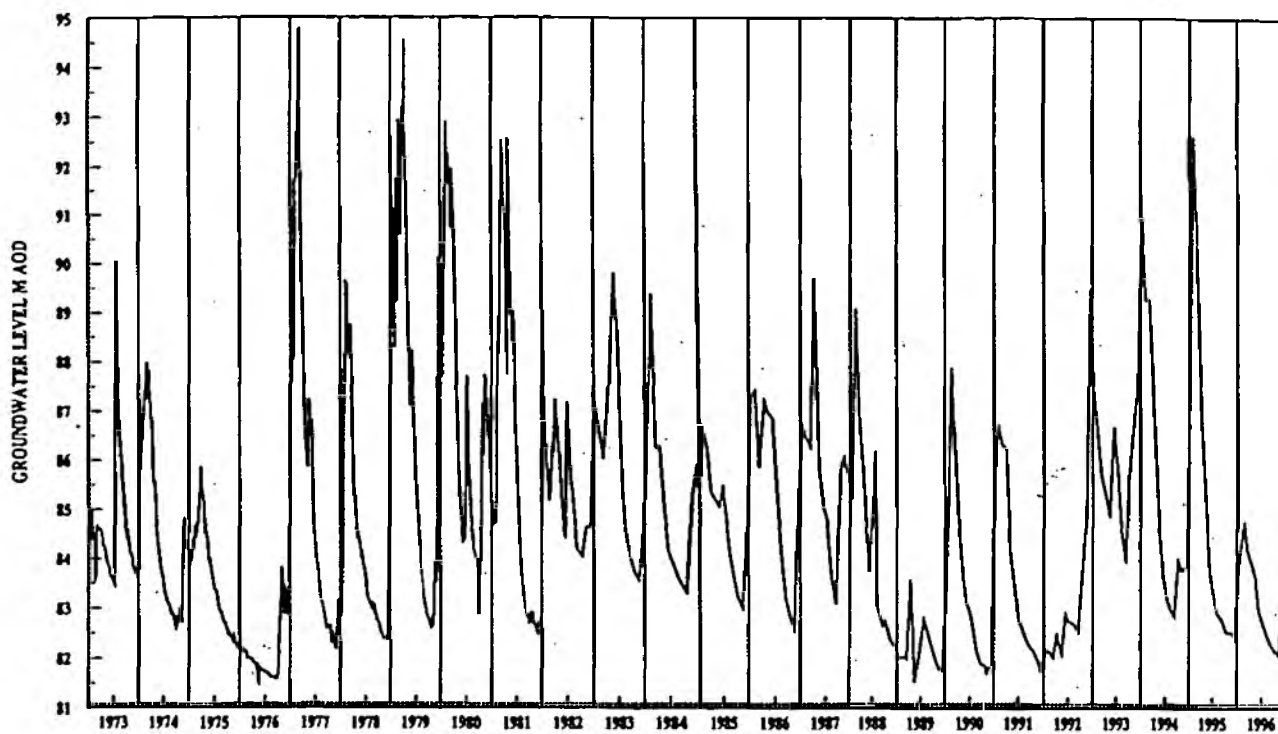
#### Unit Classification: B

There is some potential for further development but borehole yields and groundwater quality are variable with yields especially tending to be poor. Baseflow discharges from the unit assist in ameliorating problems associated with low flows and quality in watercourses, on the Sherwood Sandstones, to the east, and must be protected.

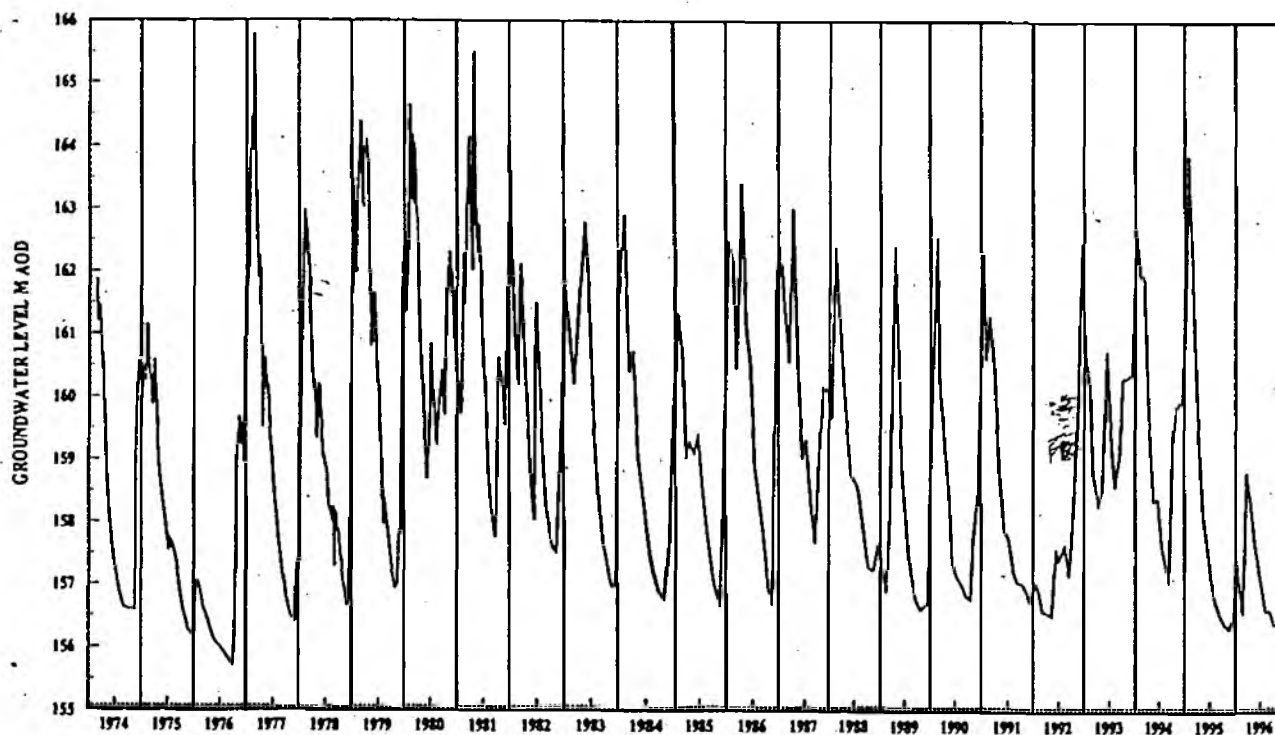
#### Classification History

1/10/86 - 30/9/91	E*
1/10/91 - 30/4/97	D
1/5/97 -	B

# GROUNDWATER UNIT: BOLSOVER (E1.3) [Fig 1]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		SOUTHARDS LANE	SK52548021	1760



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		MARLPIT LANE (BOLSOVER)	SK48307092	1762

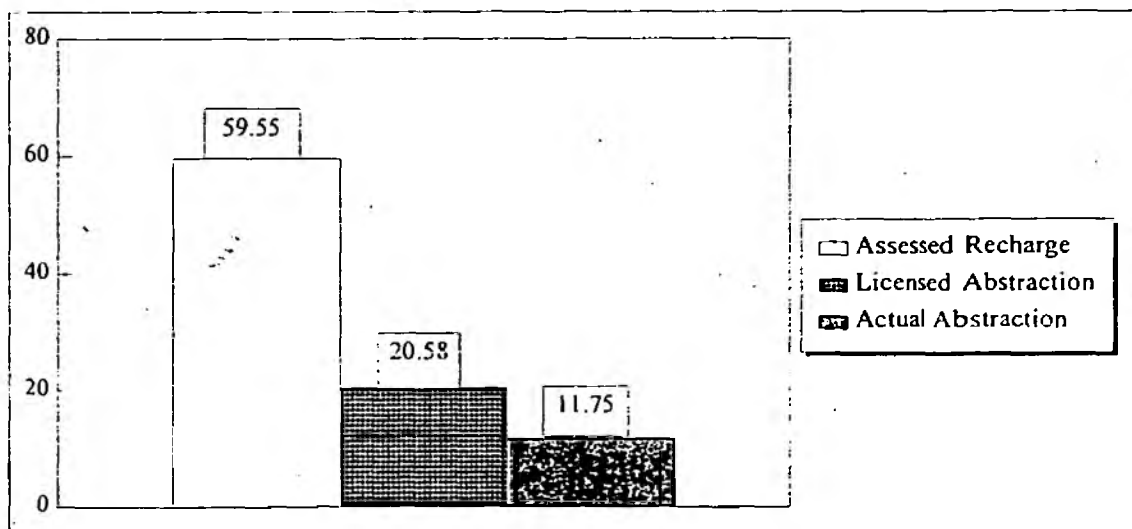
## GROUNDWATER UNIT: BOLSOVER (E1.3) [Fig 1]

Licence No	Licensed Abstraction	Actual Abstraction
71/10	0.01	(NEW) 0.01
71/32	0.08	(NEW) 0.00
71/36	1.30	0.48
71/40	0.11	(NEW) 0.13
73/11	1.25	0.00
73/48	0.55	(NEW) 0.55
75/20	0.001	0.001
75/28	0.14	0.08
75/65	1.27	0.78
75/84 (Sunnyside) (ST)	3.50	1.57
75/86	0.006	0.006
75/88	1.08	0.49
75/93+ (Manton) (ST)	11.16	7.63
75/94	<u>0.12</u>	<u>0.02</u>
	<b>20.58</b>	<b>11.75</b>

+ Manton: This licence (time limited until 31.3.99) is for 18.6 Ml/d, and includes a provision for compensation discharge to the River Ryton. 11.16 is equivalent to 60 % of the licensed volume which is allocated to the Lower Magnesian Limestone; the remaining 40 % is allocated to the Sherwood Sandstones of the Blyth Unit (F10.2).

Public Water Supply	14.66	9.21
Private Water Supply	5.92	2.54

### SUMMARY



## **GROUNDWATER UNIT: BOLSOVER (E1.3) [Fig 1]**

### **Unit Classification: B**

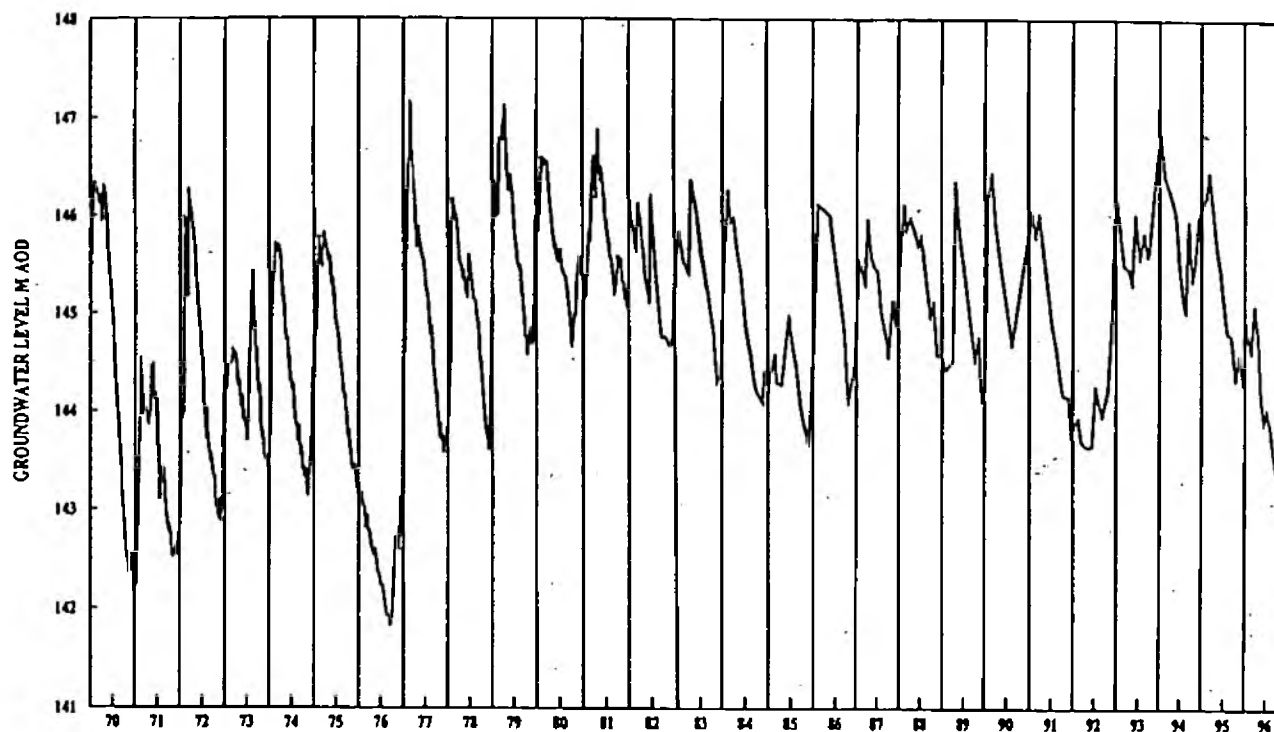
The resource balance indicates that there is scope for substantial groundwater development. However borehole yields and groundwater quality are very variable with yields tending to be poor. Baseflow from the unit assists in ameliorating problems associated with low flows and quality in watercourses, on the Sherwood Sandstones, to the east, and must be protected.

### **Classification History**

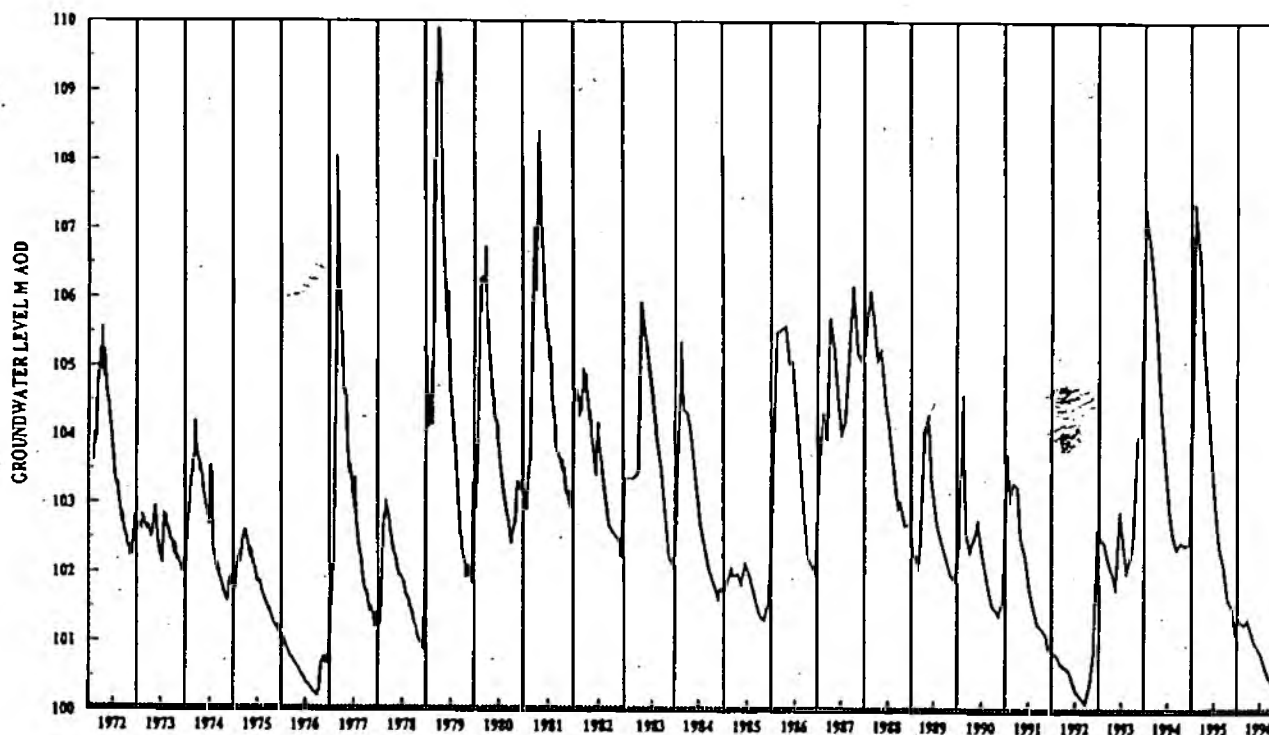
1/10/89 - 30/9/91	E*
1/10/91 - 30/4/97	D
1/5/97 -	B



# GROUNDWATER UNIT: MANSFIELD (E1.4) [Fig 1]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		PENNIMENT FARM	SK50826201	1764



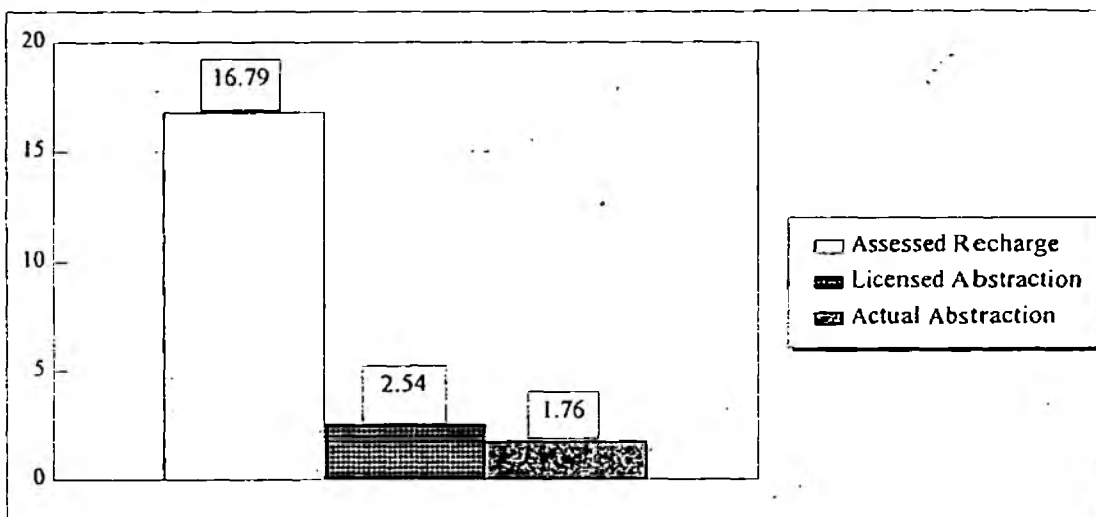
ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		BODHILL FARM	SK52096634	1766

## GROUNDWATER UNIT: MANSFIELD (E1.4) [Fig 1]

Licence No	Licensed Abstraction	Actual Abstraction
63/104 (replacement for 63/34)	1.25	1.25
70/14	0.93	0.27
71/10	0.01	0.01
71/32	0.08	0.08
71/37	0.27	0.15
	<u>2.54</u>	<u>1.76</u>

### SUMMARY

#### Resource Balance



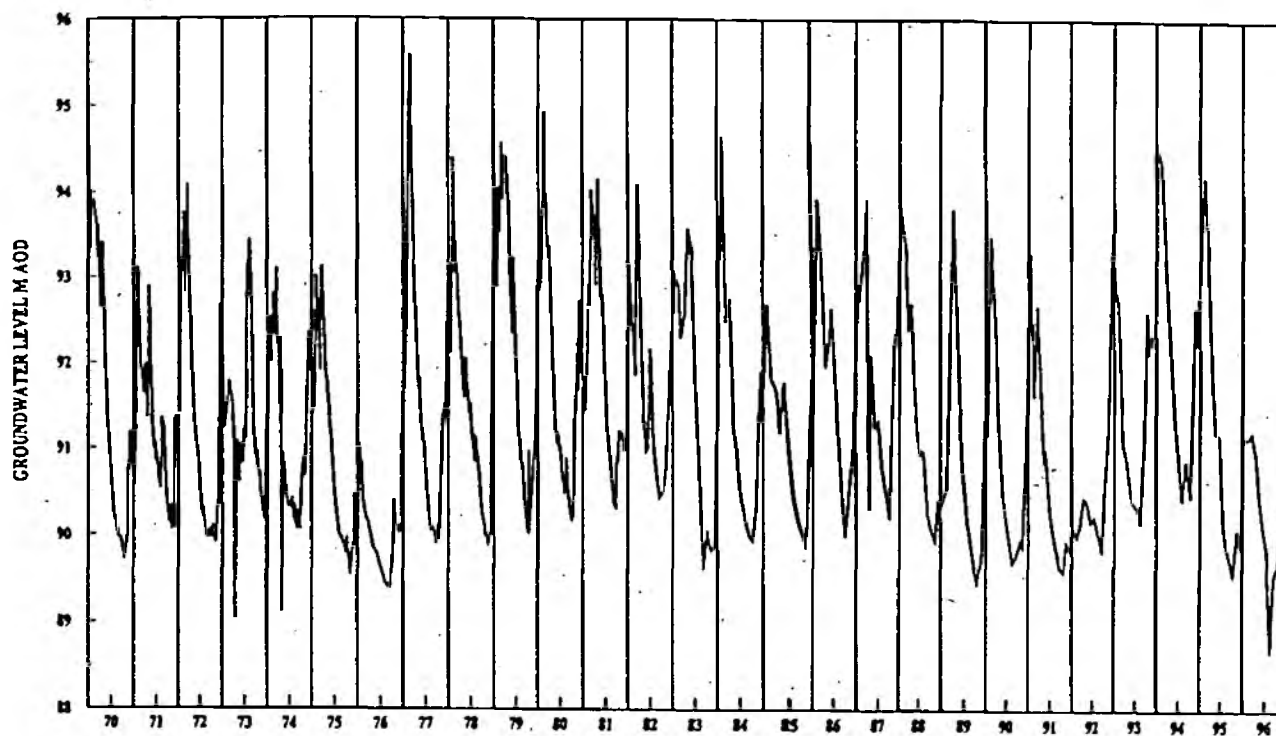
#### Unit Classification: B

Borehole yields and groundwater quality are very variable with yields tending to be poor. Baseflow from the unit is very important in ameliorating problems associated with low flows and quality in watercourses, on the Sherwood Sandstones, to the east, and must be protected.

#### Classification History

1/10/89 - 30/9/91	E*
1/10/91 - 30/4/97	D
1/5/97 -	B

# GROUNDWATER UNIT: HUCKNALL (E1.5) [Fig 2]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		END COTTAGE (STRELLEY)	SKS1284185	1769

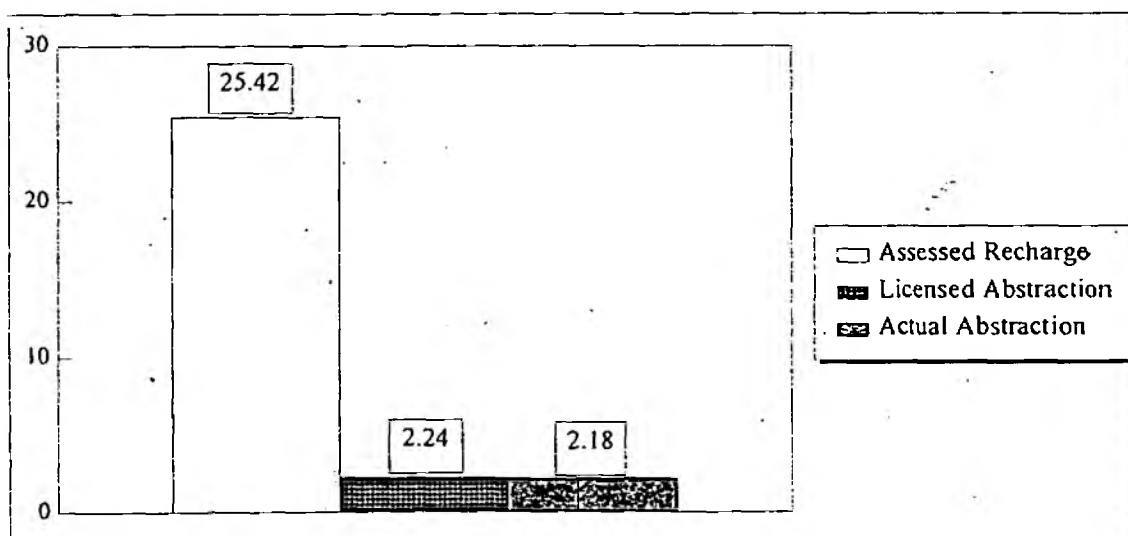


## GROUNDWATER UNIT: HUCKNALL (E1.5) [Fig 2]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
63/65	2.24	2.18
	2.24	2.18

### SUMMARY

#### Resource Balance



#### Unit Classification: B

The resource balance indicates that there is potential for some development but borehole yields are generally poor and groundwater quality variable. Baseflow protection is required for the headwaters of the River Leen, hence there is a presumption against large licences.

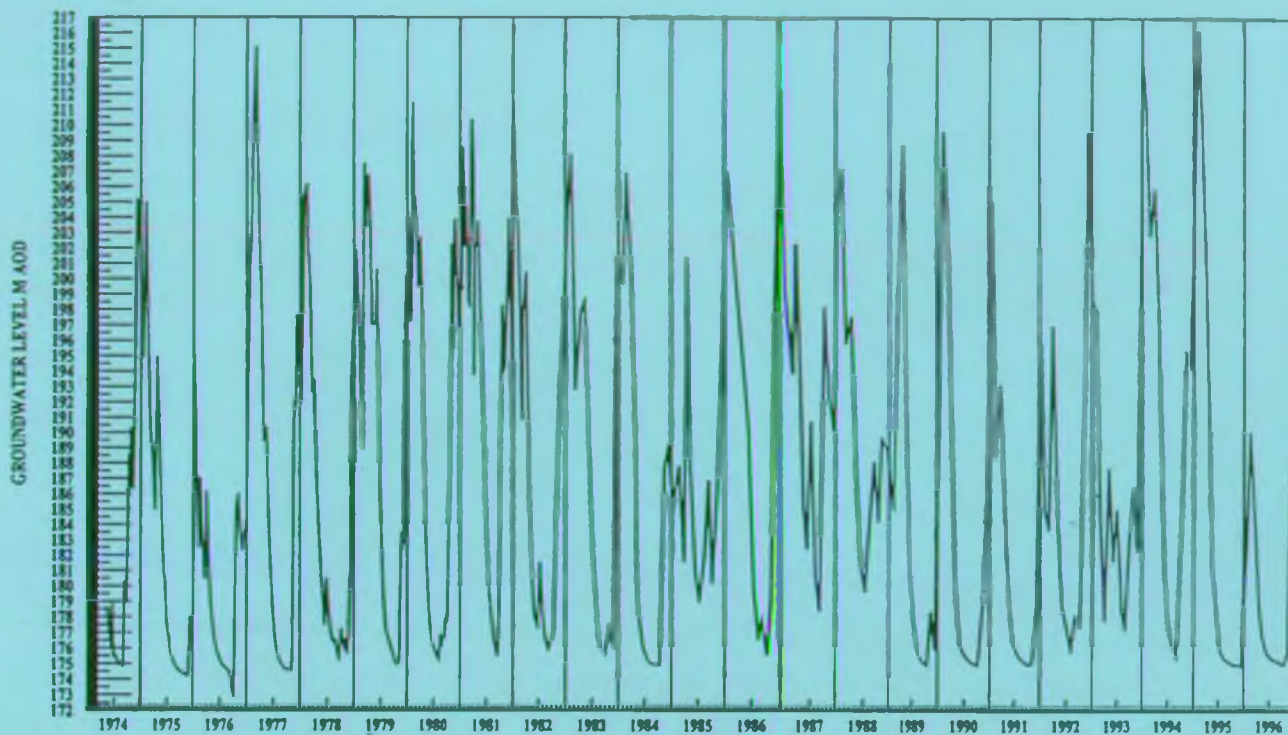
#### Classification History

1/10/89 - 30/9/91	E*
1/10/91 - 30/4/97	D
1/5/97 -	B

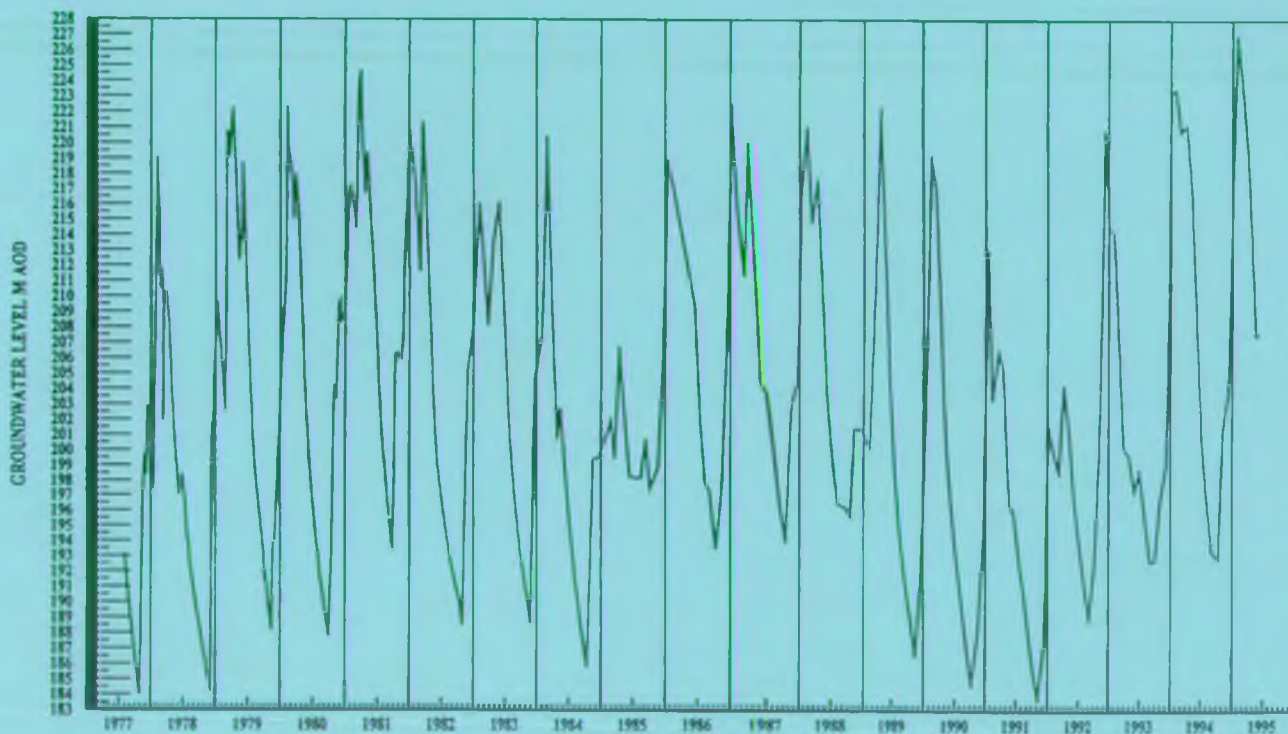
## **SECTION B**

### **5. Peak District - Carboniferous Limestone**

# GROUNDWATER UNIT: ALSTONEFIELD (D3.3) [Fig 5]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		ALSTONEFIELD	SK12925546	1420



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		TWO DALE BARN	SK19385585	1437

## GROUNDWATER UNIT: ALSTONEFIELD (D3.3) [Fig 5]

<u>Licence No</u>	<u>Licensed Abstraction</u>	<u>Actual Abstraction</u>
25/1	0.0004	0.0004
25/7	0.005	0.005
25/10	0.01	0.01
26/8	0.003	0.003
26/10	0.0005	0.0005
26/15	0.0002	0.0002
27/2	0.004	0.004
27/9	0.005	0.005
27/10	0.009	0.009
27/13	0.031	(NR) 0.031
27/15	0.005	0.005
27/16	0.02	0.02
29/8	0.006	0.006
29/10	0.0005	0.0005
29/26	0.0004	0.0004
29/55	0.001	0.001
29/70	0.02	0.018
39/92	<u>0.02</u>	<u>0.016</u>
	<u>0.14</u>	<u>0.13</u>

### SUMMARY

Assessed Recharge:

Licensed Abstraction: 0.14

Actual Abstraction: 0.13

### Unit Classification: C

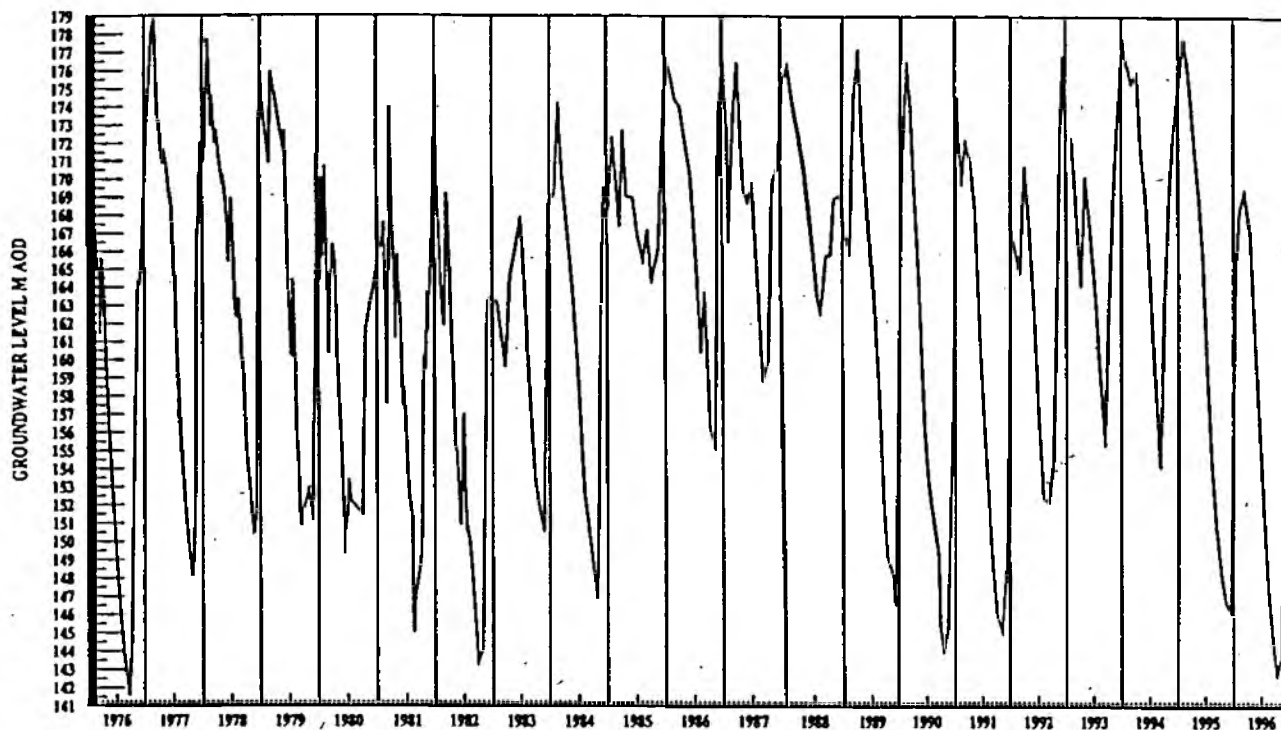
Baseflow discharges from the limestone form a major component of the overall flow in rivers draining the area, particularly during periods of dry weather. These rivers support major Public Water Supply abstractions, and restrictions are applied to existing surface water licences. Protection of baseflow is therefore of paramount importance. There are no objections in principle to small, new groundwater abstractions (up to 20 Ml/a). However, for larger proposals, an Environmental Report will be required in support of any licence application, and licences in excess of 100 Ml/a will be time limited in order to assess any long term impact on baseflows.

Borehole yields within the unit tend to be poor and only when a good fissure system is intercepted can satisfactory yields be obtained.

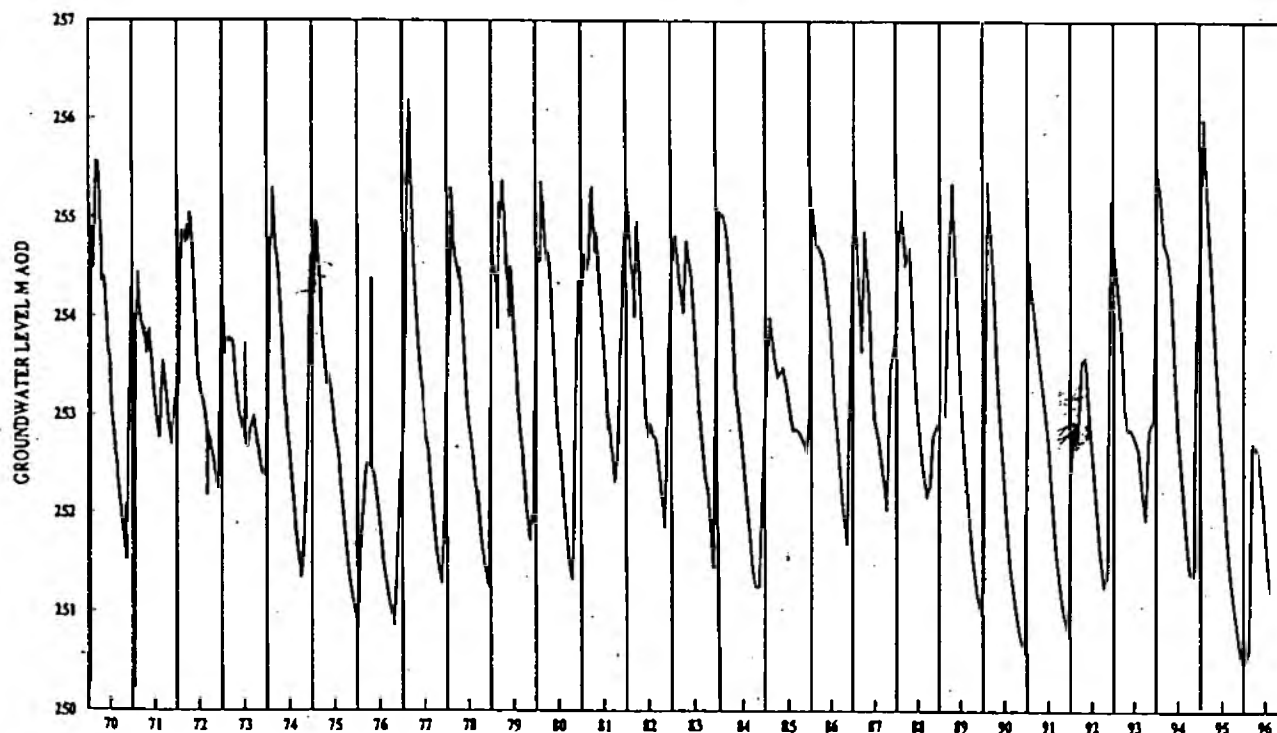
### Classification History

01/10/89 - 30/09/91	E*
01/10/91 - 30/04/97	D
01/05/97 -	C

# GROUNDWATER UNIT: MATLOCK (D3.4) [Fig 3]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		RIDER POINT (VIA GELLIA)	SK26155641	1419



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		ODDO HOUSE	SK21816072	1431

### GROUNDWATER UNIT: MATLOCK (D3.4) [Fig 3]

Licence No	Licensed Abstraction	Actual Abstraction
39/3	0.07	0.04
39/4	0.009	0.009
39/44	0.00004	0.00004
39/57	0.005	0.005
39/65	0.007	0.007
39/71	0.02	0.02
39/91	0.02	0.018
40/34	0.0009	0.0009
40/46	0.45	0.10
40/45 (Meerbrook Sough) (ST)	54.79	51.72
40/66	0.0015	0.002
40/70	0.005	0.005
40/77	0.12	0.12
40/80	0.001	0.001
40/85	0.009	0.009
40/97	0.37	0.37
40/98	0.68	0.68
40/103	0.019	0.019
40/123	0.12	0.125
40/127	0.022	0.022
40/130	0.004	(NEW) 0.004
41/56	0.0004	0.0004
43/3	0.002	0.002
43/9 (Lady Flatte)	<u>2.74</u>	<u>2.52</u>
	<u>59.47</u>	<u>55.81</u>

#### **SUMMARY**

Assessed Recharge:

Licensed Abstraction: 59.47

Actual Abstraction: 55.81



## GROUNDWATER UNIT: MATLOCK (D3.4) [Fig 3]

### Unit Classification: C

Baseflow discharges from the limestone form a major component of the overall flow in rivers draining the area, particularly during periods of dry weather. These rivers support major Public Water Supply abstractions, and restrictions are applied to existing surface water licences. Protection of baseflow is therefore of paramount importance. There are no objections in principle to small, new groundwater abstractions (up to 20 Ml/a). However, for larger proposals, an Environmental Report will be required in support of any licence application, and licences in excess of 100 Ml/a will be time limited in order to assess any long term impact on baseflows.

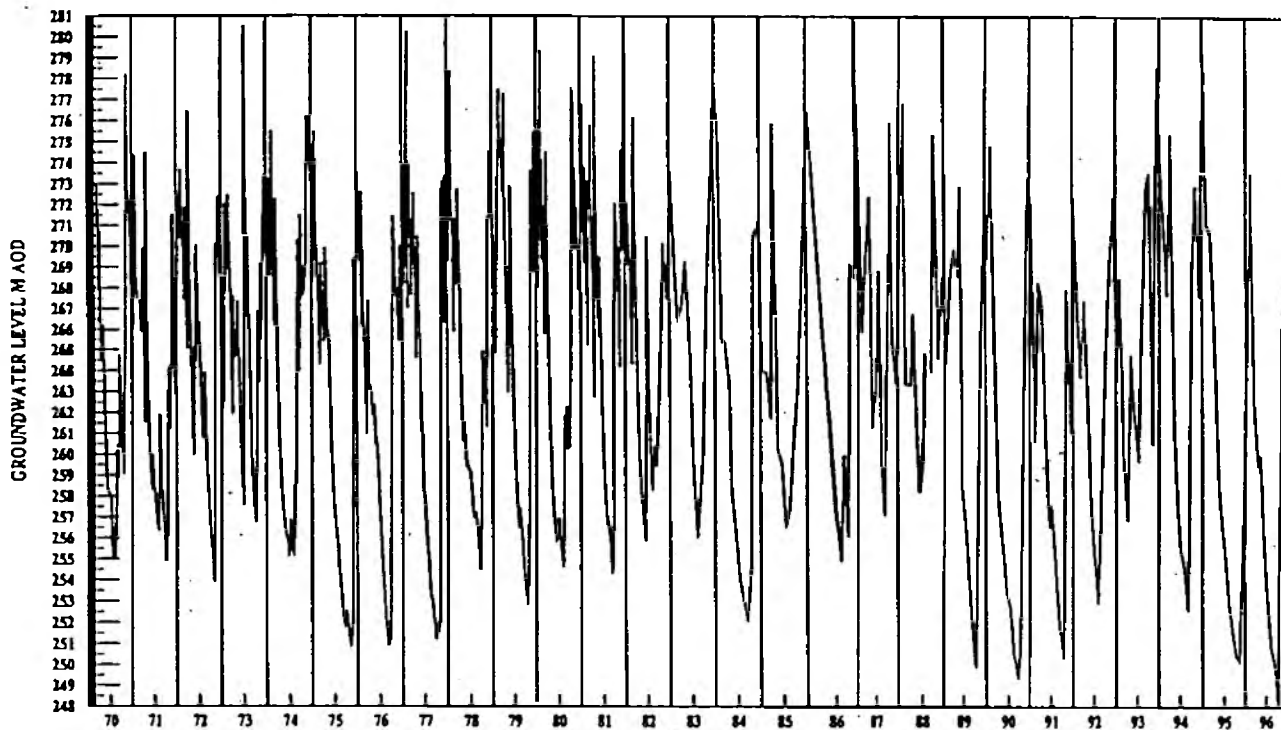
Borehole yields within the unit tend to be very poor and only when a good fissure system is intercepted can satisfactory yields be attained.

Meerbrook Sough is not a borehole but a system of drainage adits into the limestone; Lady Flatte is a mineshaft with adits.

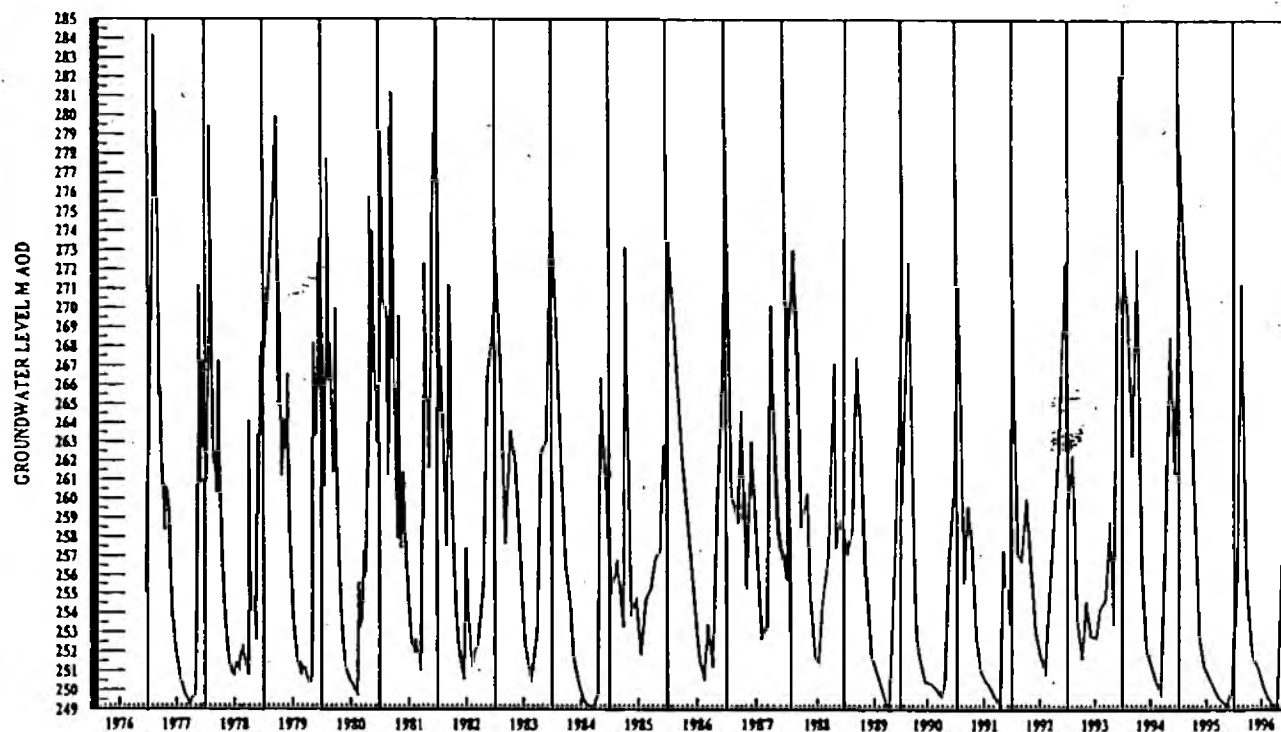
### Classification History

01/10/89 - 30/09/91	E*
01/10/91 - 30/04/97	D
01/05/97 -	C

# GROUNDWATER UNIT: BUXTON (D3.5) [Fig 3]



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		HUCKLOW SOUTH	SK1777762	1424



ENVIRONMENT AGENCY	MIDLANDS REGION	GROUNDWATER HYDROGRAPH		
		HIGGLOVE FARM	SK08197135	1442



# **GROUNDWATER UNIT: BUXTON (D3.5) [Fig 3]**

<b>Licence No</b>	<b>Licensed Abstraction</b>	<b>Actual Abstraction</b>
38/2	1.87	0.521
38/43	0.002	0.002
38/68 (Brightside Sough)	0.02	0.02
38/79	0.02	0.02
38/40	0.013	(NEW) 0.013
39/2	0.60	0.16
39/12 (Stanley Moor) (ST)	1.12	0.00
39/36	0.019	0.002
39/42	0.016	0.016
39/44	0.0001	0.0001
39/47	0.0002	0.0002
39/51	0.014	0.014
39/52	0.003	0.003
39/55	0.09	0.09
39/56	3.23	2.75
39/59	0.022	0.022
39/75	0.11	0.009
39/76	0.005	0.005
39/78 (Monksdale) (ST)	1.51	0.00
39/79	0.48	0.088
39/84	0.01	0.01
39/86	4.36	2.40
39/87	0.016	0.016
39/90	0.02	0.02
39/93	0.02	0.002
39/94	<u>0.02</u>	<u>0.008</u>
	<u>13.59</u>	<u>6.19</u>
Public Water Supply	2.63	0.00
Private Water Supply	10.96	6.19

## **SUMMARY**

Assessed Recharge:	
Licensed Abstraction:	13.59
Actual Abstraction:	6.19

## **GROUNDWATER UNIT: BUXTON (D3.5) [Fig 3]**

### **Unit Classification: D**

Baseflow discharges from the limestone form a major component of the overall flow in rivers draining the area, particularly during periods of dry weather. These rivers support major Public Water Supply abstractions, and restrictions are applied to existing surface water licences. Protection of baseflow is therefore of paramount importance. There are no objections in principle to small, new groundwater abstractions (up to 20 Ml/a). However, for larger proposals, an Environmental Report will be required in support of any licence application, and licences in excess of 100 Ml/a will be time limited in order to assess any long term impact on baseflows.

Borehole yields within the unit tend to be poor and only when a good fissure system is intercepted can satisfactory yields be obtained.

### **Classification History**

01/10/89 - 30/09/91	E*
01/10/91 - 30/04/97	D
01/05/97 -	C

## SECTION C

# **REVIEW OF GROUNDWATER ABSTRACTION FOR LICENSING PURPOSES**

## **Section C : Other Units**

Groundwater Unit Index	Groundwater Unit Name	Assessed Recharge	Licensed Abstractions	Actual Abstraction	Unit Classification
<b>Permo-Carboniferous Strata</b>					
D.0.1	Arley (fig 4)	-	0.40	0.34	D
D.0.2	Swadlincote (fig 4)	-	0.05	0.05	D
D.0.3	Melbourne (fig 4)	-	5.29	1.34	D
D.1.1	Kiveton Park (fig 1)	-	0.24	0.18	D
D.1.2	Eastwood (fig 2)	-	0.15	0.12	D
D.2.1	Alfreton (fig 1)	-	0.07	0.05	D
D.2.2	Belper (fig 3)	-	6.37	3.31	D
D.2.3	Hathersage (fig 3)	-	0.07	0.07	D
D.2.4	Barbrook	-	0.19	0.15	D
D.3.1	Longsdon (fig 5)	-	2.15	0.34	D
D.3.2	Hollinsclough (fig 3 & 5)	-	3.24	1.50	D
D.4.1	Stoke (fig 5 & 6)	-	3.11	1.15	D
D.4.2	Cannock (fig 4 & 6)	-	5.92	3.44	D
D.5.1	West Bromwich (fig 4)	-	2.25	0.49	D
D.6.1	Oswestry (fig 7 & 8)	-	3.58	3.27	D
D.6.2	Hanwood (fig 7 & 8)	-	0.28	0.20	D
D.6.3	Dorington (fig 8)	-	0.41	0.40	D
D.7.1	Chipnal (fig 8)	-	0.11	0.11	D
D.7.2	Cluddley (fig 8)	-	0.01	0.01	D
D.7.3	Coalport (fig 8)	-	4.90	0.69	D
D.8.1	Six Ashes (fig 8 & 9)	-	0.13	0.05	D
D.8.2	Highley (fig 8)	-	0.04	0.04	D
D.8.3	Lem Hill (fig 8 & 9)	-	0.09	0.08	D
D.8.4	Clee Hill (fig 8)	-	0.02	0.02	D
D.8.5	West Midlands (fig 9)	-	0.03	0.03	D
D.9.2	Forest Of Dean (fig 10)	-	7.69	4.40	D
<b>Upper Magnesian Limestone</b>					
E1.1	Tickhill (fig 1)*	-	0.006	0.006	D
<b>Jurassic limestone</b>					
G.9.1	Cotswolds (fig 10 & 11)	-	0.16	0.12	D
G.9.2	Scunthorpe (fig 1)	-	0.00	0.00	D

\* Draws on both the Upper & Lower Magnesian Limestone aquifers, see Maltby (E1.2).

No partition of the licence quantities has been made.

## **SECTION D**

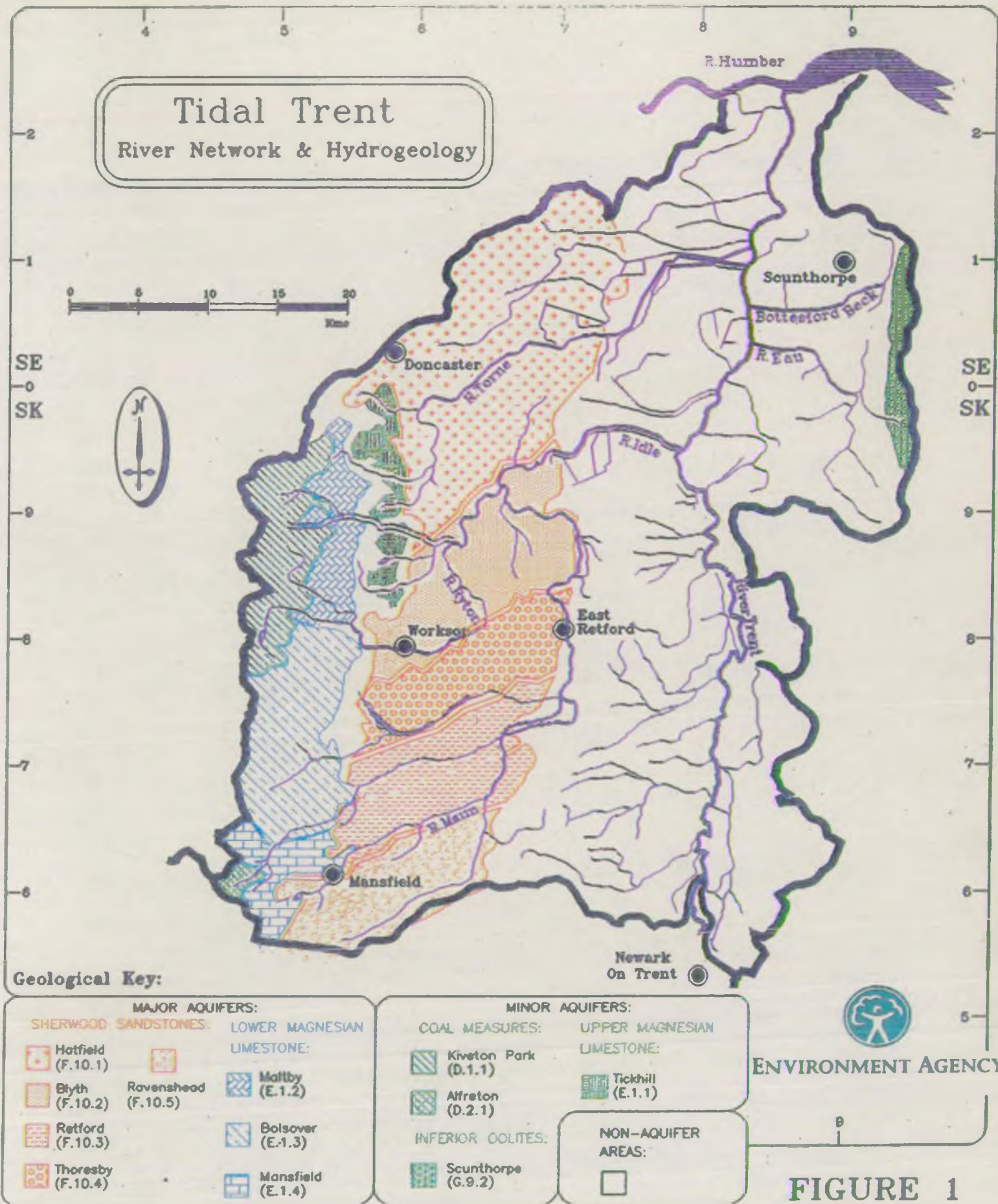
### **Location of Groundwater Management Units.**

1. Tidal Trent
2. Soar/ Nottinghamshire Trent
3. Derwent
4. Tame and Mid Trent
5. Dove
6. Upper Trent
7. Welsh Uplands
8. Mid Severn ( Upper Section)
9. Mid Severn ( Lower Section)
10. Tidal Severn
11. Avon



# Tidal Trent

## River Network & Hydrogeology





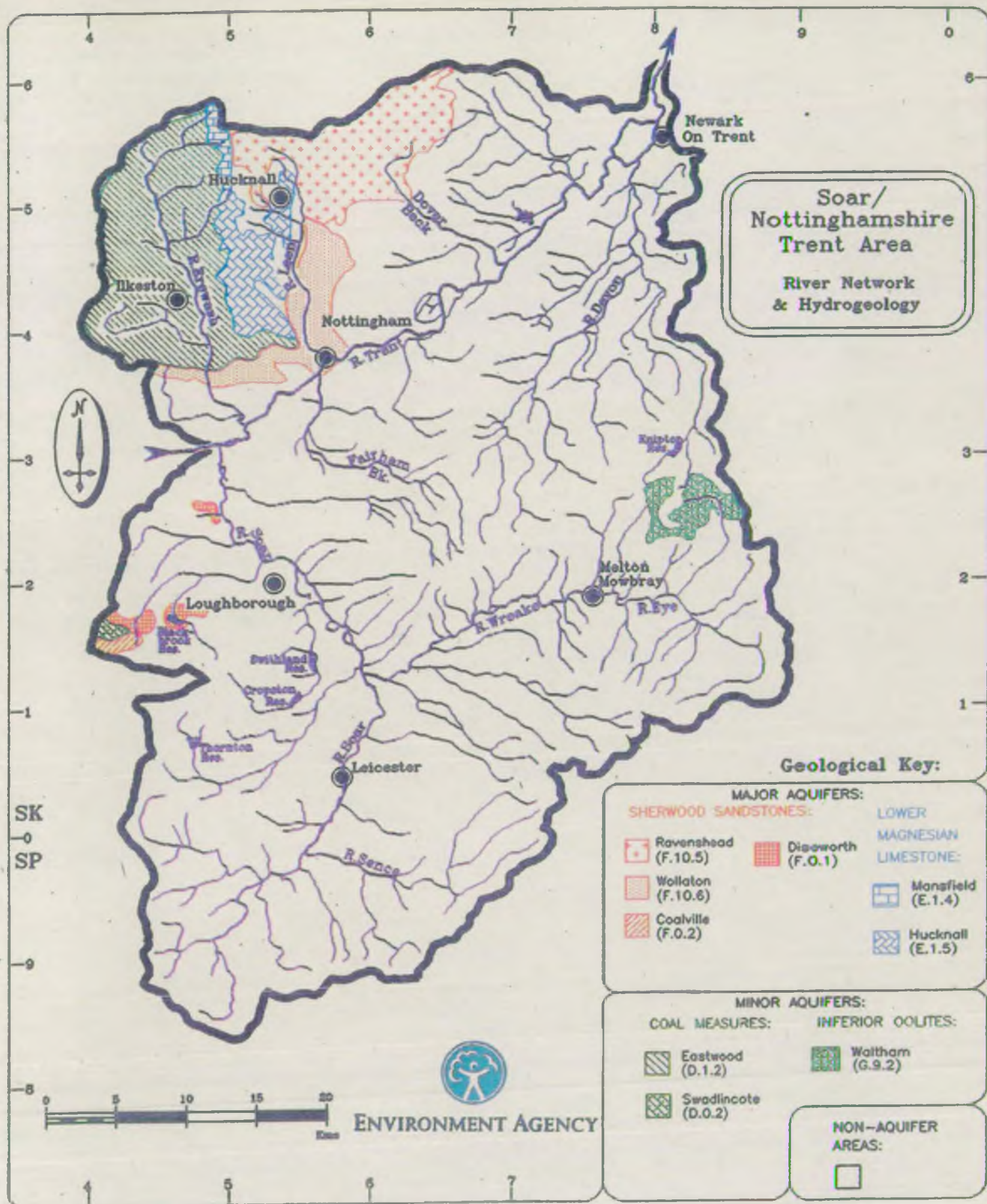


FIGURE 2



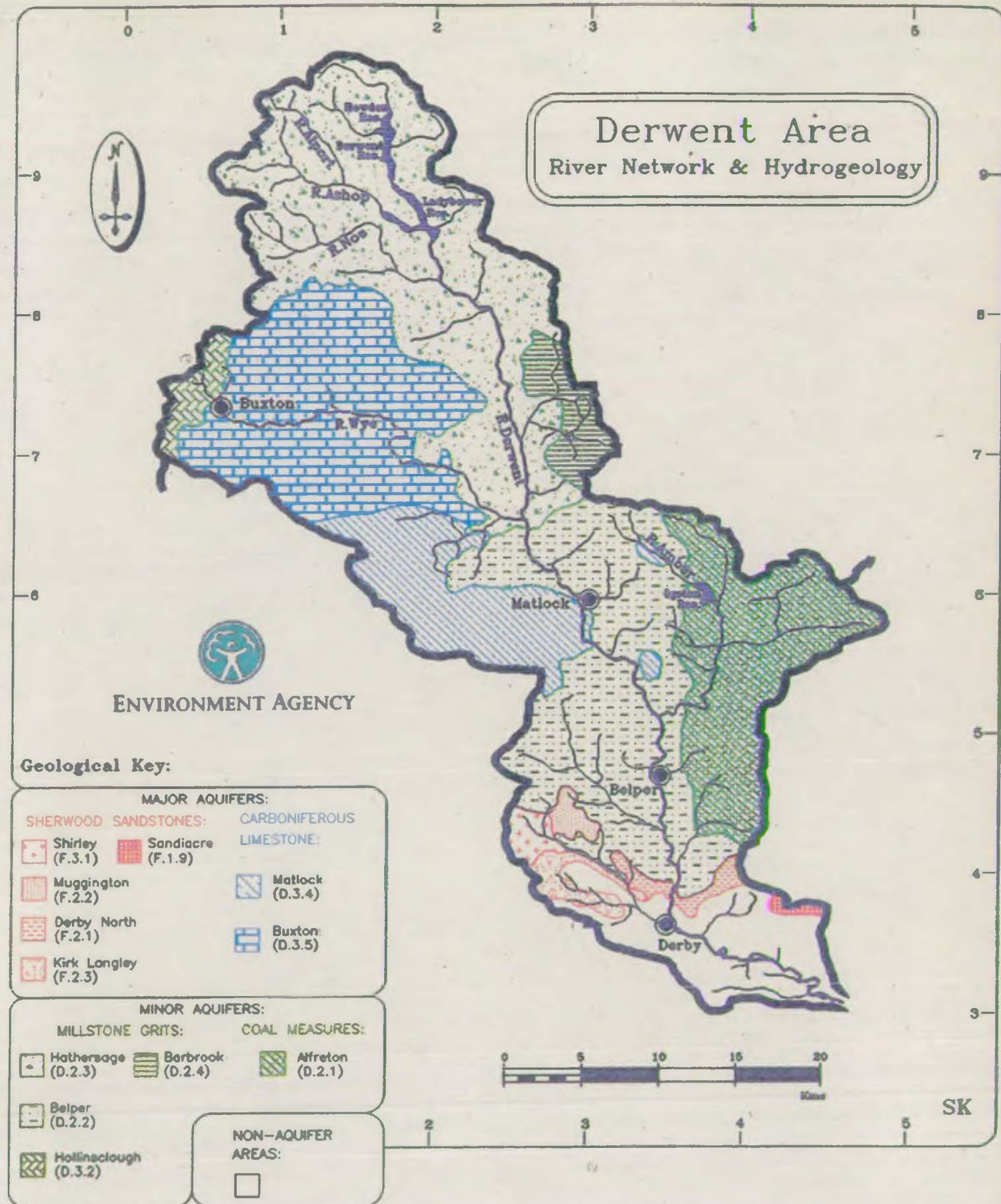
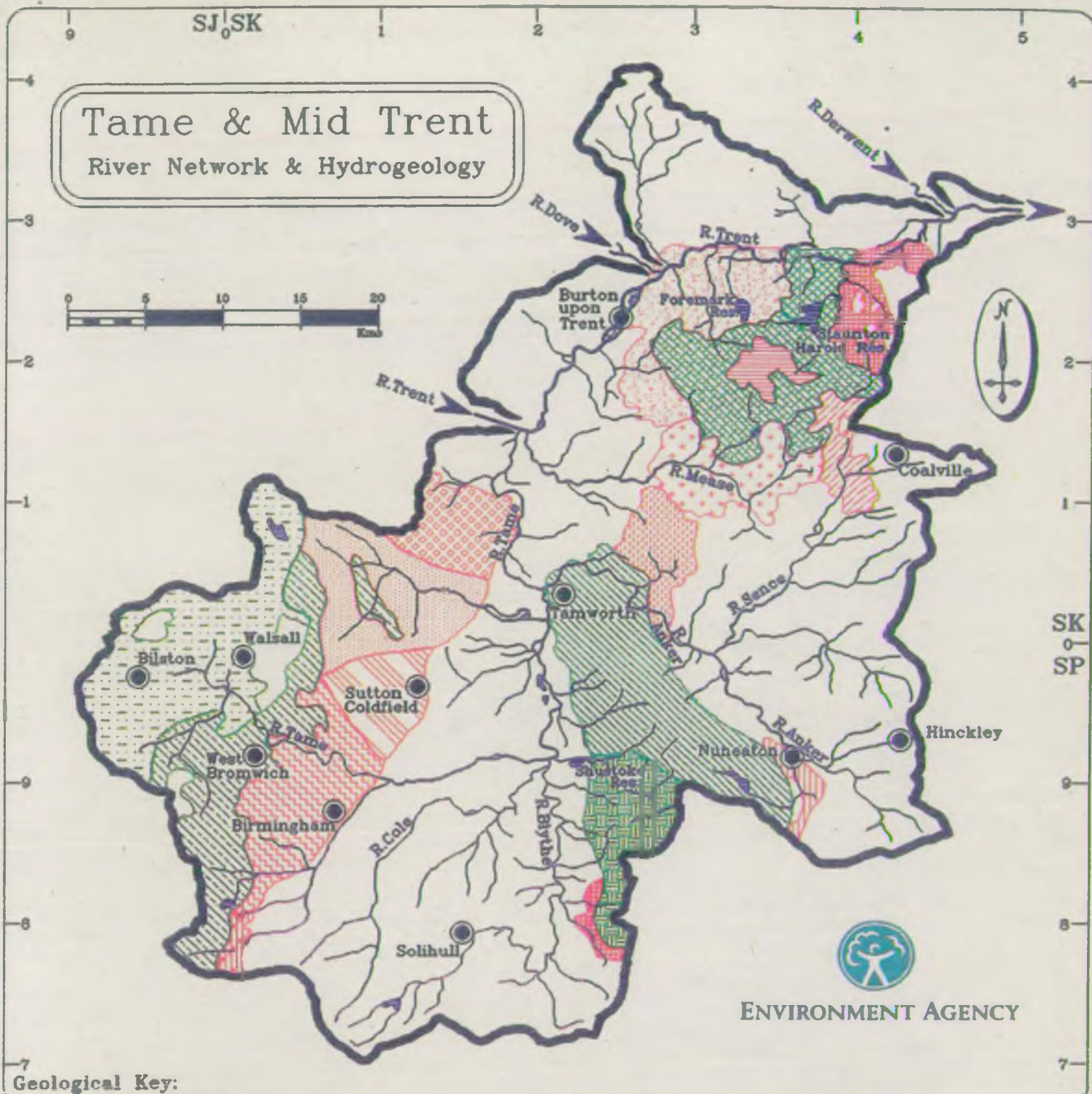


FIGURE 3





### Geological Key:

#### MAJOR AQUIFERS: SHERWOOD SANDSTONES:

Diseworth (F.0.1)	Measham (F.0.5)	Lichfield (F.5.1)	Meriden (F.5.5)
Coalville (F.0.2)	Warton (F.0.6)	Shenstone (F.5.2)	
Ashby (F.0.3)	Nuneaton (F.0.7)	Sutton (F.5.3)	Longbridge (F.8.8)
Burton (F.0.4)		Birmingham (F.5.4)	

#### MINOR AQUIFERS: CARBONIFEROUS STRATA

Arley (D.0.1)	Cannock (D.4.2)	West Bromwich (D.5.1)
Swadincote (D.0.2)	Meriden (D.9.4)	
Melbourne (D.0.3)		

#### NON-AQUIFER AREAS:



FIGURE 4



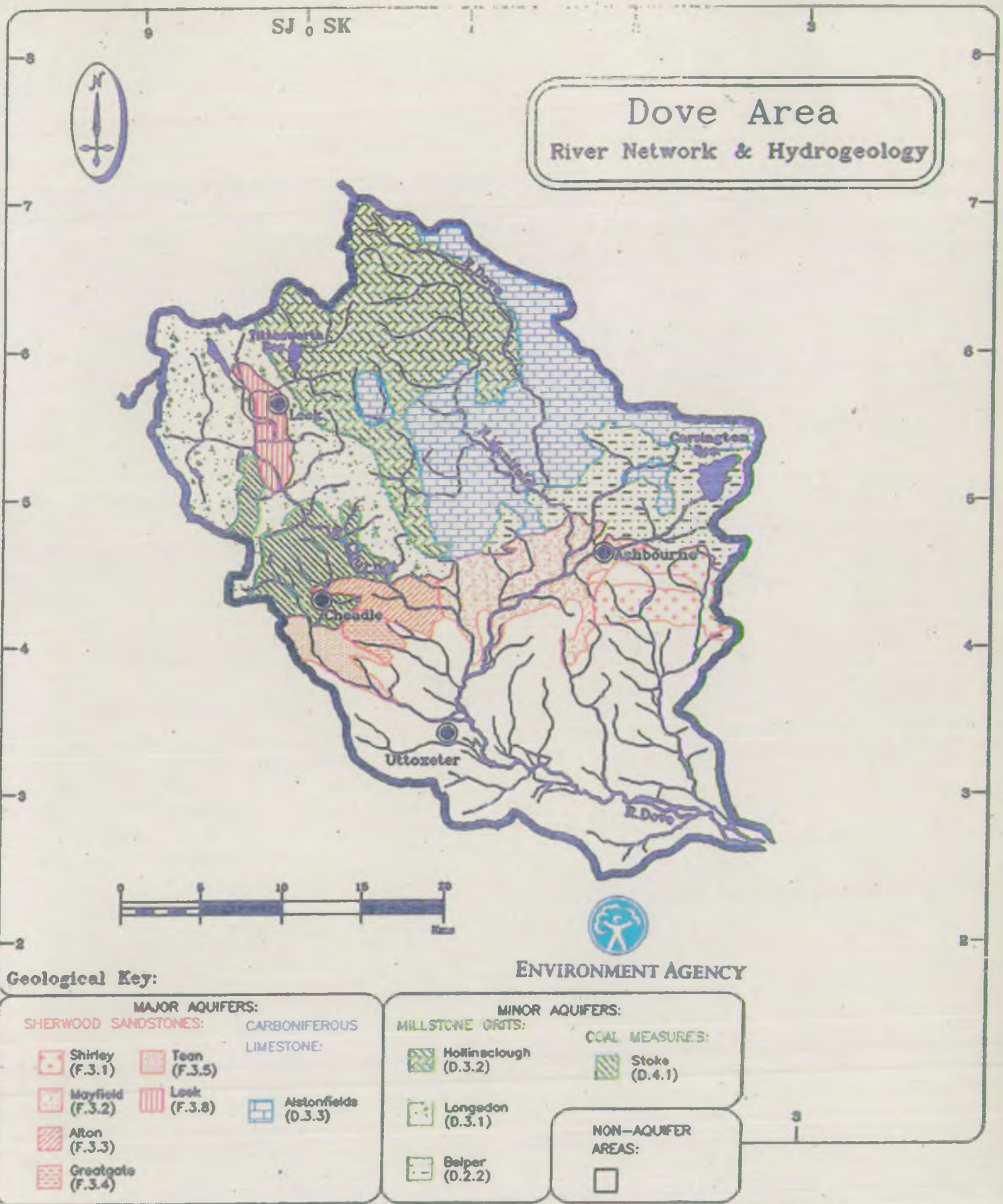
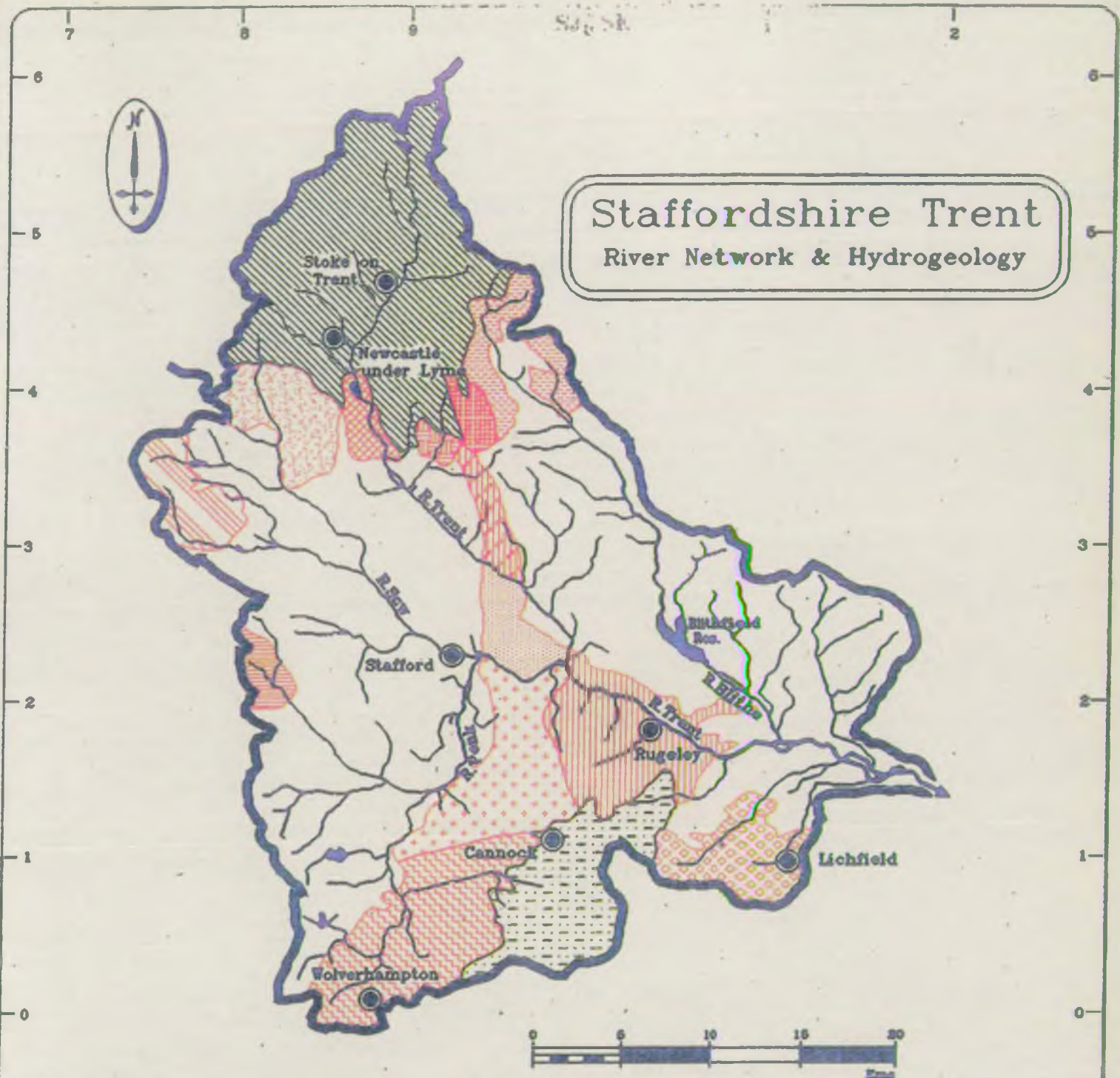


FIGURE 5





**Geological Key:**

**MAJOR AQUIFERS:**  
**SHERWOOD SANDSTONES:**

Bishop's Wood (F.4.1)	Hardwick (F.4.5)	Coven (F.4.9)	Forebrook (F.3.6)
Hatton (F.4.2)	Hopton (F.4.6)	Spot (F.3.7)	Lichfield (F.5.1)
Tittensor (F.4.3)	Rugeley (F.4.7)	Aqualate (F.7.5)	
Dulton (F.4.4)	Teddesley (F.4.8)		

**MINOR AQUIFERS:**  
**COAL MEASURES:**

Stoke (D.4.1)
Cannock (D.4.2)

**NON-AQUIFER AREAS:**

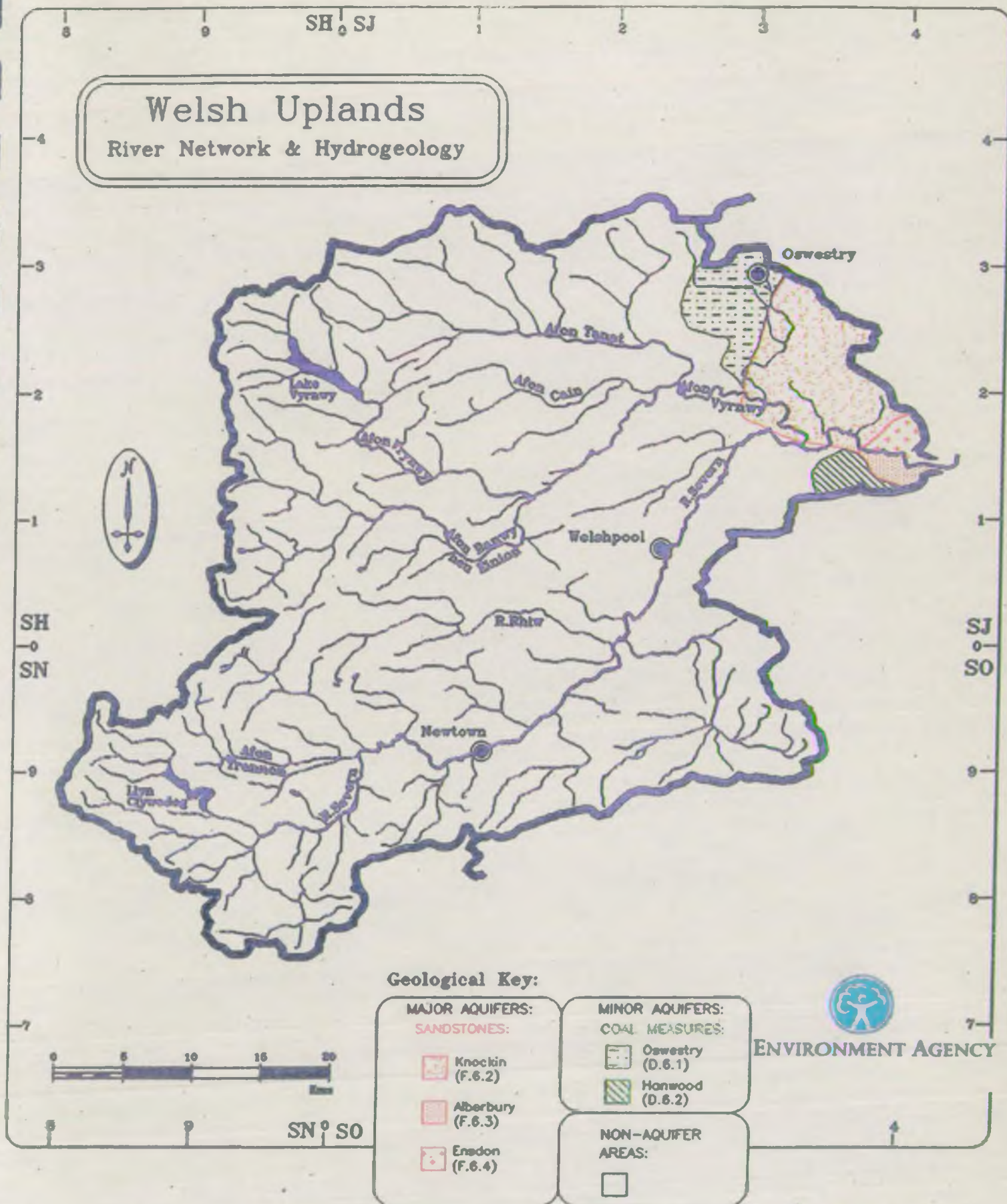


ENVIRONMENT AGENCY

2

**FIGURE 6**



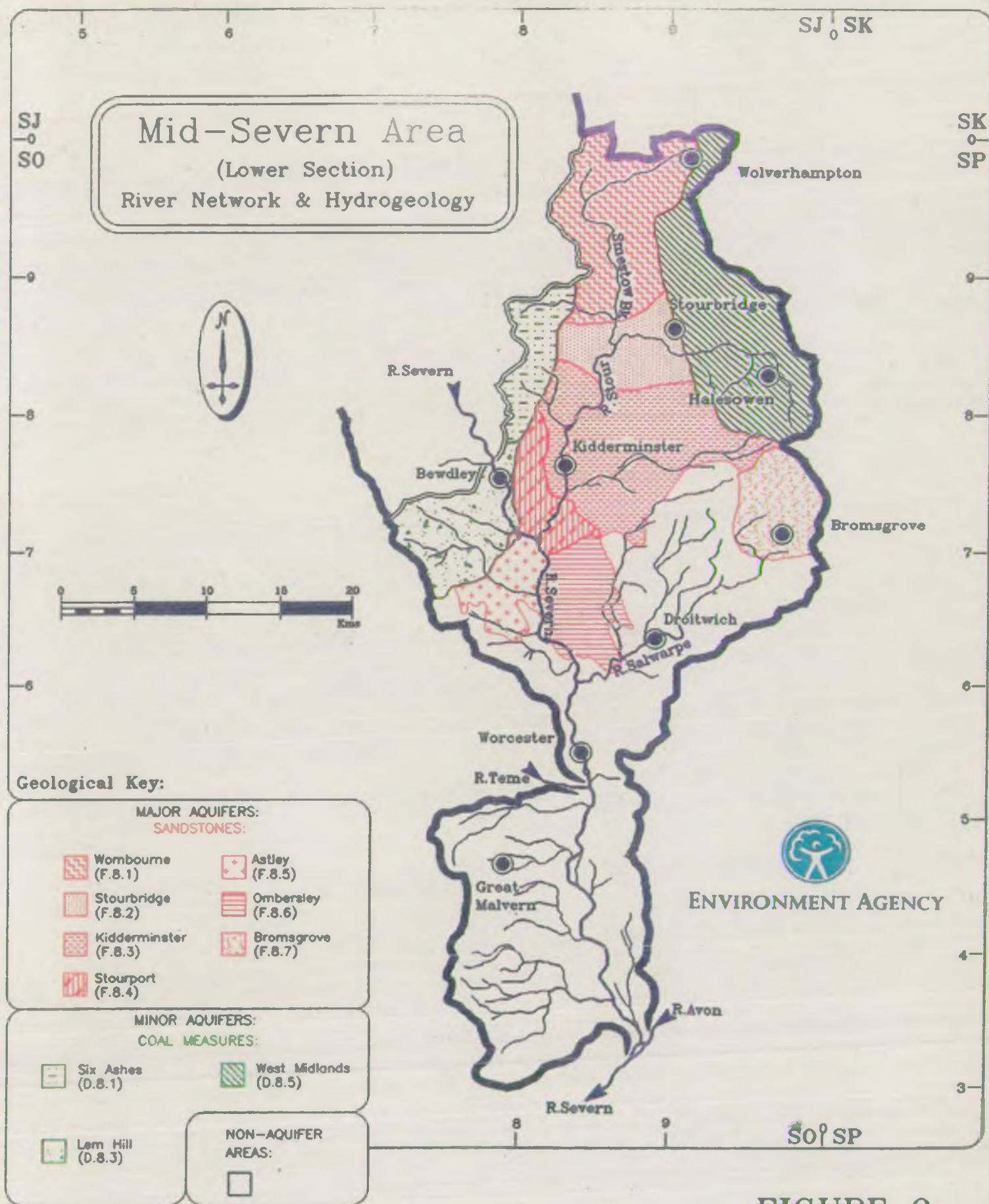


**FIGURE 7**









**FIGURE 9**



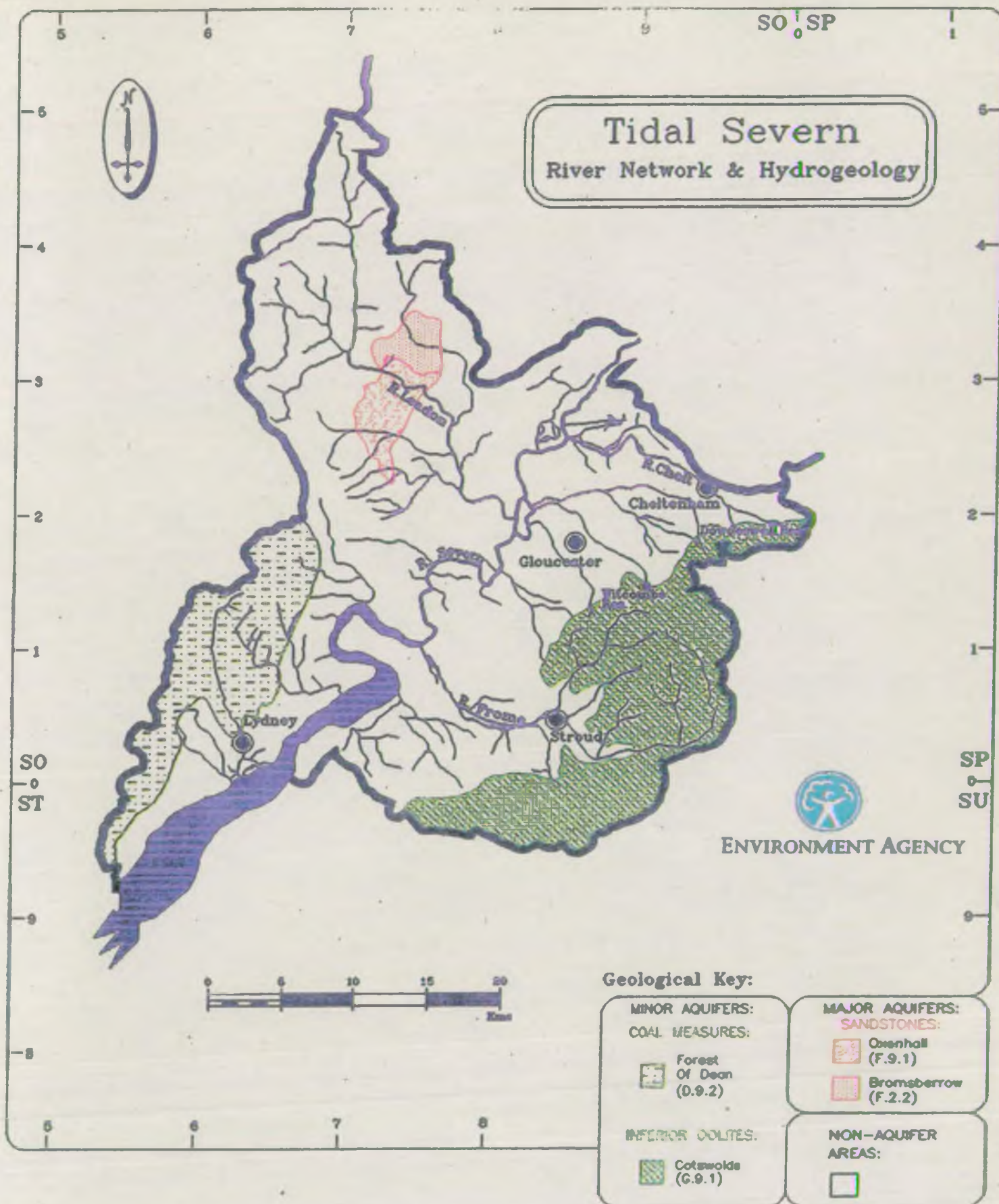


FIGURE 10



FIGURE 11

