

NRA-WATER RESOURCES 374 73

# Water NATURE'S PRECIOUS RESOURCE

*An Environmentally  
Sustainable Water Resources  
Development Strategy for  
England and Wales*

## SUPPLEMENTARY REPORT



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National Rivers Authority

RESPLAN MODELLING  
Supplementary Report No 7  
March 1994

NATIONAL RIVERS AUTHORITY

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**WATER RESOURCES DEVELOPMENT STRATEGY  
THE RESPLAN MODELL**

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Supplementary Report No.7

March 1994 Version 1

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## PREFACE

This report is the Seventh in a series of nine supplementary reports which provide supporting information for the National Rivers Authority Water Resources Development Strategy document:

"An Environmentally Sustainable Water Resources Strategy for England and Wales".

The other reports in the series are as follows:

1. Methodology and Assumptions for Public Water Supply Demand Scenarios
2. Review of Public Water Supply Yields
3. Marginal Demands
4. Other Options
5. Hydrological Modelling
6. Resource Scheme Costings
8. Environmental Assessment of Strategic Options
9. National Strategic Overview

# NATIONAL WATER RESOURCES DEVELOPMENT STRATEGY

## The RESPLAN Model

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# NATIONAL WATER RESOURCES DEVELOPMENT STRATEGY

## The RESPLAN Model

### 1 INTRODUCTION

RESPLAN is a computer model which is used to analyse the costs of development plans to meet future demands for water. It is essentially concerned with the choice and timing of long term strategic capital investments, and does not include hydrological or water quality aspects, which are considered in other types of model.

The main reasons for using a model such as RESPLAN are:

- the amount of work involved in manually costing a plan;
- the large number of options to be considered;
- the interlinked nature of water resource systems, in which apparently local decisions may influence opportunities for the rest of the system;
- the ease with which sensitivity analyses can be carried out; and
- the ease with which plans can be updated as data are changed.

Following the development of two similar models<sup>(1)(2)</sup> by the Water Resources Board in the early seventies, the RESPLAN model was developed by Page, Warn and Brew of Anglian Water Authority<sup>(3)(4)</sup> in 1975 to overcome deficiencies in the earlier models, and has been used regularly since then. In 1989 the original version, written in Fortran for a mainframe computer, was updated to run on a PC and a graphics interface was added to improve the input and output of results.

When the NRA started work on its National Strategy, RESPLAN was considered to be the most suitable tool for analysing strategic water resource development options, and has been used extensively during the project.

The purpose of this report is to explain the main features of RESPLAN used during the National Strategy work, and to document the data used and the results obtained. More detailed documentation of RESPLAN is available in references 3,4 and 5.

### 2 STRUCTURE OF RESPLAN

#### 2.1 Network components

RESPLAN idealises a water resources system as a network comprising:

<b>Sources:</b>	These can be reservoirs, groundwater schemes, or any other scheme which will provide additional yield. They can be new sources or existing sources which can be redeployed.
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**Demand centres:** These are water supply areas which are sufficiently integrated that any potential source can meet demands throughout the area.

**Link elements:** These are the means of transporting water from sources to demand centres, and in the present study comprise mainly pipelines and associated pumping equipment.

The network used for the National Strategy is illustrated in Figure 1.

## 2.2 Other basic concepts

Feasible routes by which sources can meet demands are called **links**, each link is defined by one source, one demand centre and a series of link elements. These link elements may each feature in a number of links. There can be only one link between a given source and demand centre. (To overcome this restriction when it is necessary to represent two routes between a source and a demand, an additional dummy source, known as a **twin source**, has to be used.)

The last year of the time span over which the plan is required is called the **planning horizon**. The span is divided up into **periods** of one or more years, each of which is identified by a **base year**.

The model considers both capital and operating costs. The only operating costs being considered in the present study are those for power and pumping. Costs are all discounted back to the first base year using a **discount factor**. This enables all the costs of a plan to be summed to a **total discounted cost** (alternatively known as **net present value**).

When the yield of a source is allocated to meet a demand, the amount of demand met is referred to as a **demand flow**, or throughout this report as a **flow**.

Flows do not necessarily correspond to actual flows in link components because of the use of various factors. The **load factor** is a factor applied to the flow to determine the average flow in a link element. The **yield factor** is applied to the flow to determine the amount of source yield used; eg if a source yield is specified as a direct supply yield, the amount of direct supply yield used when a flow is allocated to a link using river regulation will be less than the flow, the difference being represented by the yield factor. The **capacity factor** is a similar factor applied to the flow which determines the amount of link element capacity used.

The concept of **discounted unit cost** is used throughout RESPLAN. This is the total discounted cost divided by the total discounted flow, and can be applied to any individual component. It is a measure of the relative cost attractiveness of different components, and reflects the time which the component takes to be fully utilised.

A **plan** is a costed allocation providing details of the flow allocated from each source to each demand for each period, the timing of introduction of each source and link element, and the associated discounted capital and operating costs.

## 2.3 Allocation and costing modes

The model can be used in two different ways. When it is used in the **allocation** mode, a series of plans is produced for a predefined number of iterations, the allocation for each iteration being derived from discounted unit costs obtained from the previous allocation. Although the objective of this procedure is to find the least cost allocation, the algorithm used does not converge to a least cost solution; however the plan with the least discounted cost is usually a good approximation to the optimal allocation. Descriptions of the algorithms used for allocating flows to links within an iteration and for updating unit costs between iterations are given in Chapter 4 of the user manual<sup>(5)</sup>.

To determine the cost of a particular allocation, the **costing** mode is used. In such cases the allocation is usually based on a plan produced by the allocation mode and amended manually. The costing mode is normally used to answer "what if" questions, eg to determine the sensitivity of the plan costs to, say, a particular source being excluded, or the costs of a link element being increased.

## 2.4 Input data

The principal data requirements for RESPLAN, as used in the National Strategy, are given below. The descriptions are not intended to match the input formats used by the model, and for more detailed information on the overall data requirements and format, reference should be made to the user manual<sup>(5)</sup>.

- General data:**      number of periods;  
                         base years;  
                         discount rate;  
                         number of iterations (for allocation mode);  
                         control parameters determining level of detail in output and  
   how costs are updated between iterations.
- Demand centres:**   name of demand centre;  
                         forecast marginal demand for each base year.
- Sources:**            name of source;  
                         yield    (Where the yield varies according to how the source is  
   used eg direct supply v. river regulation, one yield  
   value is entered here, and yield factors based on links  
   are used to provide the alternative values.);  
                         capital cost in £M (This can be the total cost of an indivisible  
   scheme, or the unit cost in £M/Mld for sources such as  
   groundwater schemes which can be developed  
   incrementally.); operating cost in £M/Mld/annum.
- Link elements:**    link element reference number (a unique number used in  
   defining which link elements are used by each link);  
                         link element name;  
                         maximum capacity;  
                         capital cost in £;



operating cost (This can be either a unit cost in £/Mld/annum, or a total cost in £/annum where the cost is independent of the flow.);  
load factor;  
capacity factor.

**Links:** link name (eg *Sourcenname* to *Demandname*);  
yield factor;  
link element reference number of each link element used in the link.

## 2.5 Output

The results from the model are produced partly in graphical and partly in tabular form. Examples of both are given in Appendix 4.

The graphical output takes the form of a network diagram with the flows in each link element for four selected base years shown against the element. This provides a quick visual summary of the allocation.

The text output takes the form of a series of tables:

**Source development**, showing for each source, year of introduction, yield, capital cost, discounted capital and operating costs;

**Unused yields of developed sources**, showing the unallocated yield for each source for each period;

**Demand flows through link elements** for all selected links for all periods;

**Link element development**, showing for each link element, year of introduction, capital cost, discounted capital and operating costs, discounted unit cost;

**Unit Costs of Links**, showing for each demand centre, the discounted total cost, total flow and unit cost of the supply from each source;

**Development of Links**, showing the flows through each link for each period;

**Cost summaries**, showing the capital and operating costs for each period and the total discounted capital and operating costs of the plan.

**Validity checks**, indicating whether all demands have been exactly met and whether source outputs are within their yields.

## 3 APPLICATION OF RESPLAN TO THE NATIONAL STRATEGY

### 3.1 Data acquisition

The accumulation of data for the application of RESPLAN to the National Strategy

was carried out over an 18 month period between May 1992 and November 1993. It involved considerable input from NRA regional and head office staff and consultants, including:

- selecting the demand centres to be used for each Region;
- production of consistent demand forecasts across all demand centres;
- identification of potential sources and transfer schemes (link elements) and their classification as 'strategic' or 'local' to determine whether they should be included in the RESPLAN analysis;
- studies to determine the feasibility and costs of potential strategic developments;
- extraction of data from reports and interpretation for use in RESPLAN;
- hydrological modelling studies to determine yields, yield factors and load factors;
- vetting of all cost data to ensure the use of a consistent cost base for all options.

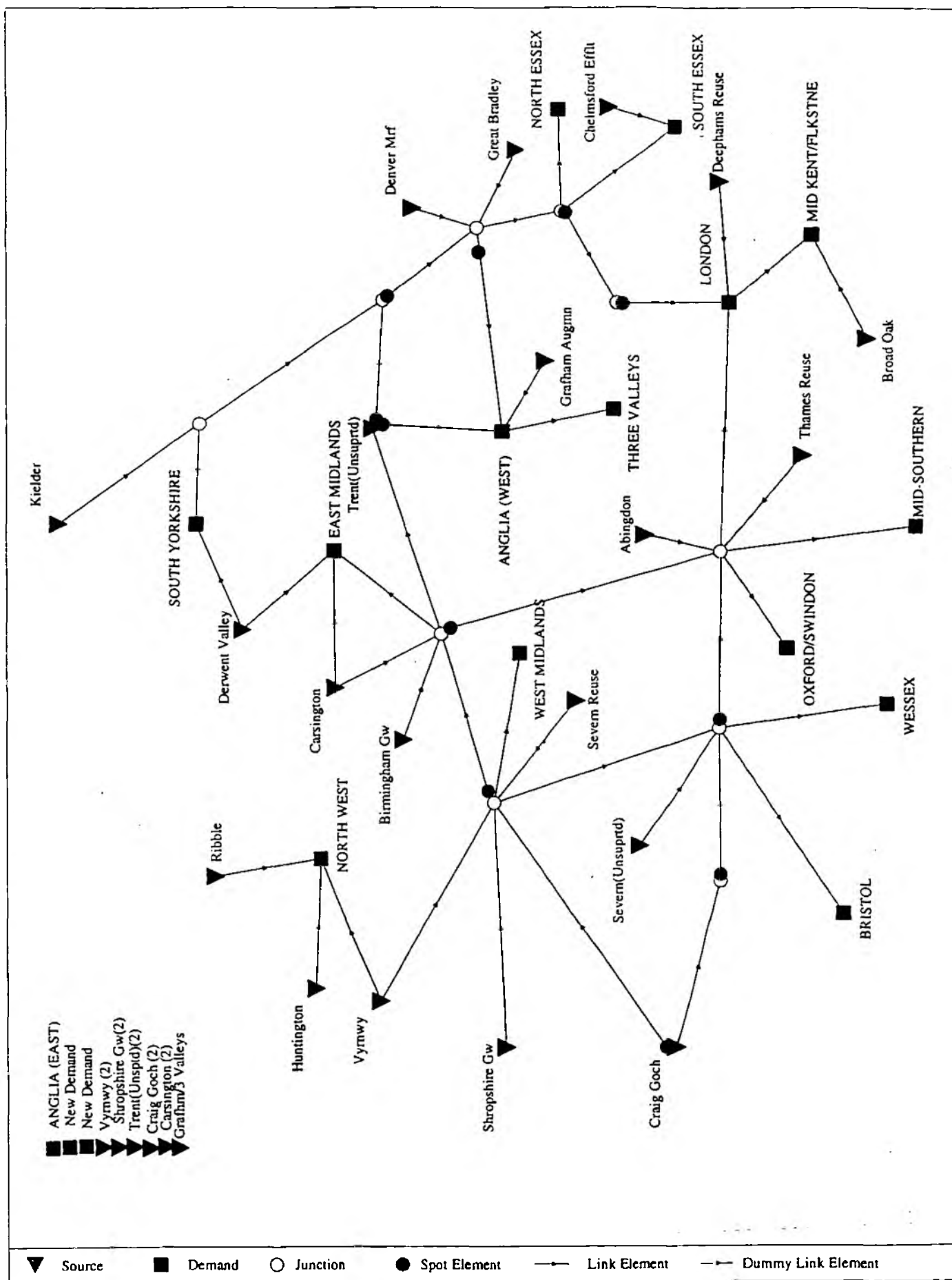
### 3.2 Network diagram

The RESPLAN network diagram used for the model runs is shown in Figure 1. Sources are shown as triangles, demand centres as squares and link elements as lines. The empty circles are merely junctions joining two link elements and have no significance in RESPLAN. The solid black circles, called spot elements, are dummy link elements. The unconnected squares and triangles in the top left corner of the diagram are either sources and demand centres which were not used or twin sources. The use of dummy link elements and twin sources is described in Section 3.3 below.

Most of the components of the network are described in other National Strategy reports<sup>(6)(7)</sup>, or can be recognised from the input data. Other features are further described below.

The demand centres Anglia (West), Anglia (East), Three Valleys and Mid-Southern were all included when the model data was set up, but were then found to have zero marginal demands for the high and medium demand scenarios modelled and do not feature in the results. The North West and South Yorkshire demand centres, although they also have zero marginal demands, were included so that the possible redeployment of their existing sources (Vyrnwy and Derwent Valley) could be modelled.

Figure 1: RESPLAN network diagram



The source Denver MRF was included in the original model data, but was later excluded because its feasibility was not proven. Deephams Reuse was similarly excluded, except for one model run to test the sensitivity of programme costs to its inclusion. Severn Reuse and Thames Reuse reflect the additional yield available through the return of effluent to the Severn and the Thames from the West Midlands and Oxford/Swindon demand centres respectively. Shropshire GW, although originally included, was subsequently reclassified as a local source and assumed to have zero capital and operating costs.

The link elements Craig Goch - R.Wye and R.Wye - R.Severn, although shown on Figure 1, were not included, and all transfers from Craig Goch were assumed to be direct to R.Severn.

### 3.3 Input data used for model runs

A schedule of the data values and the data source documents is given in Appendix 1. The input data files used for the baseline model cases in the high and medium scenarios are listed in Appendix 3.

The information in Appendix 1 together with Figure 1 and the outline description of RESPLAN in Section 2 above provides an explanation of the input data files listed in Appendix 3.

However, there are three further features of the input data files which require further explanation:

**Twin Sources:** A number of sources in the input data are duplicated, the second instance of each name being followed by '(2)'. As described in Section 2.2, this is to allow two links between the same source and demand centre. In each case, the reference number of the twinned source is shown in the input data for that source. (This feature has been used for Shropshire GW, Vyrnwy and Craig Goch, where links to the Thames demand centres can be either via a Severn-Thames transfer, or by a combined Severn-Trent and Canal transfer, and for Trent (Unsupported) and Carsington, where links to Anglian demand centres can be either via a Trent-Witham-Nene-Ouse transfer or a Trent-Rutland transfer.)

**Maximum link element capacity:** RESPLAN was designed to operate with cost functions for link element components (pipelines, pumps, bankside storage etc). The model then selects as big a link element as is required to meet demands. In the present study, cost functions have not been used (although they still have to be included in the input data) as consultants' studies have been used to determine fixed costs for fixed capacities. To prevent the model from attempting to develop capacity in excess of the fixed capacity, a dummy link element was introduced in series with each fixed capacity element. The dummy element has an 'existing' capacity equal to the fixed capacity and an excessively high dummy cost. This cost prevents the dummy element from being replicated, and hence the original element can also not be extended beyond the fixed capacity. Where a dummy element is used, the names of the dummy element and the real element in the input data are followed by '(1)' and '(2)' respectively.

**Effluent Reuse Sources:** The yields of two sources, Severn Reuse and Thames Reuse, are expressed as the percentage of the demands of different demand centres. These are coded in the input data as negative decimal numbers, of which the integer part is the demand centre number and the decimal part is the percentage.

### 3.4 Model runs

Over the period of the study, a vast number of model runs were carried out as new options were considered or as data were updated. In Appendix 2 a table is given of the model runs which were used to provide information used in the final report of the National Strategy, together with the principal features of the results for each case.

For each of the runs listed in the table, Appendix 4 shows the tabular and graphical output of the results. The graphical outputs show the flows in each link element for the four base years 1991, 2001, 2011 and 2021. The flow for 1991 is shown nearest the 'downstream' end of the element. The flow for 2021 is shown in bold nearest the 'upstream' end of the element.

## 4 REFERENCES

- 1 'Water resource planning in South East England' Armstrong R B and Clarke K F 1972 JIWE Vol 26 p11
- 2 'A mathematical programming model for planning a regional water resource system' O'Neill P G 1972 JIWE Vol 26 p47
- 3 'Economic planning model of water resources' Page C Internal Anglian Water report 1984
- 4 'Water Resource Planning Model - Technical Report and User Manual' Warn A E Internal Anglian Water report 1986
- 5 'RESPLAN user manual' Anglian Water Services 1993
- 6 'An environmentally sustainable water resources development strategy for England and Wales' National Rivers Authority 1994
- 7 'Water Resources Development Strategy: Marginal Demands' National Rivers Authority 1994

## **Appendix 1: Schedule of RESPLAN data source documents and assumptions**

## SOURCES

DATA ITEM	VALUE	REFERENCE	COMMENTS
DENVER MRF	Yield=18 CC = £2M OC=0	1: Table A.2.2 2:	Case 18 - Case 1. MRF=114 (MRF=50 assumed not feasible.) CC assumed to include capitalised OCs
GREAT BRADLEY	Yield=174 CC = £69.4M OC=0	28: Table A1.3 29: Table 3	Capacity assumed to be 46mcn. Kennet pump capacity assumed as 681. OC assumed to be included in Ely Ouse-Essex link element.
CHELMSFORD EFFLUENT	Yield=30	3: p34	Note: Ref 1 Table A2.2 gives yield as 40. Costs included on link element Chelmsford Effluent - South Essex
DEEPHAMS REUSE	Yield=100	25: Table 1	Costs included on link element Deephams Reuse - London
GRAFHAM AUGMENTATION	Yield=100	3: Table 11-2	(Brownshill Intake) Costs included on link element Gratham Augmentation
TRENT (UNSUPPORTED)	Yield=210 (105)  CC=0 OC=0	43:  28: Table A1.3	Case 2 - Case 1. (699-489) Assumes Trent transfer capacity=400. Kennett capacity=681; Gt Bradley developed first and Trent MRF = 2500. Figure in brackets is yield with Kennett=681 but no Gt Bradley ie Case 3 - Case 0 (503-398). Costs all attributed to link elements.
ABINGDON	Yield=350 CC = £400M OC = £0.023M/Mld	30 & 27: Thl 7  35:	Note: yield reduced to 262 (350+337-425) when introduced after supported Severn-Thames transfer.
CARSINGTON	Yield=140  CC=0 OC=0	9: p3	Yield is 200, of which 60 is already committed and used. Increased yield through conjunctive use with Trent specified through yield factors on links. Costs all attributed to link elements.
DERWENT VALLEY	Yield=40  CC=0 OC=0	10:	Amount currently used by Yorkshire Water which could be reallocated to Severn Trent Water. Costs all attributed to link elements.

KIELDER	Yield=525 CC=0 OC=0	17:	Note: Ref 5 p10-1 gives 325. Costs all attributed to link elements.
SEVERN (UNSUPPORTED)	Yield=146 (100) CC=0 OC=0	27: Table 5	Figures for 400 Mld transfer (200 Mld transfer in brackets) Costs all attributed to link elements.
VYRNWY	Yield=147 CC=0 OC=0	37: 5:	Yield for direct supply is 212. As it is an existing source this is reduced by 2.5% to 207. Of this 60 must be used for direct supply and is not reallocable. Hence 147 (=207-60). Yields for Severn Regulation and Thames transfers are calculated using YFs on links. CC taken as 0, as per Option 1 in Ref 5.
HUNTINGTON	Yield=74 CC=£36.9M OC=£0.0259M/Mld	37: 40:	Costs produced using TR61 Atkins/Halcrow method Treatment costs included as alternative TW for Vyrnwy already exists.
RIBBLE	Yield=40 CC=£27.9M OC=£0.0404M/Mld	37: 40:	Costs produced using TR61 Atkins/Halcrow method Treatment costs included as alternative TW for Vyrnwy already exists.
CRAIG GOCH	Yield=629 CC=£60.5M OC=0	5: Table 8-4 35:	775-146 (146 = yield of Severn (Unsupported)).
SHROPSHIRE GW	Yield=155 CC=£0.0845M/Mld OC=£0.0059M/Mld	29:	
THAMES REUSE	Yield= 90% of Oxford / Swindon demand		Assumes 90% of water supplied to Oxford/Swindon from Thames Regulation options can be reused for London.
SEVERN REUSE	Yield= 44% of West Midlands demand	10:	Assumes 63% of West Midlands demand occurs in Severn catchment, of which 70% is returned and can be reused eg for transfer to Thames.
BROAD OAK	Yield=40	30:	Costs included on link element Broad Oak - Mid Kent/Folkestone



BIRMINGHAM GW	Yield = 50 Mld CC = £0.088M/Mld OC = £0.0059M/Mld	35:	
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## LINK ELEMENTS

DATA ITEM	VALUE	REFERENCE	COMMENTS
TRENT-RUTLAND	Capacity = 100 (200) CF = 104 CC = £32M (£46M) OC = £0.0208M/Mld LF = 47(51)	13: p.32 28: Table A1.3  13: Table 6.2 28: (Supp)	Route 2.1a. 104 = 100/96: 96 is additional Rutland yield from 100 Mld transfer.  £1.3M*2/1.25/100.
TRENT-WITHAM	Capacity = 400 (200) CC = £18M (£8M) OC = £0.0010M/Mld LF = 31	3: Table 12  29: 28: Table A1.3	Case 4 - Case 1: (103-31)/(791-558)
WITHAM-ELY OUSE	Capacity = 400 (200) CC = £149M (£100M) OC = £0.0104M/Mld (£0.0144M/Mld) LF = 33	3: Table 12  21: 29: 28: Table A1.3	Includes increases to Kennett and Wixoe capacities. £134M (£85M) plus £13.3M for Kennett and £1.3M for Wixoe.  Case 4 - Case 1: 78/(791-558)
ELY OUSE-ESSEX	CC = 0 OC = £0.0112M/Mld LF = 79	29: 28: Table A1.3	CC = 0 - existing transfer 50% of water assumed to transfer to Stour and not to Pant. Case 3 - Case 1: (224.9-98.7)/(558-398)
CHELMSFORD EFFLT - SOUTH ESSEX	CC = £13.5M OC = £0.280M	3: Table 11-4 34: p.56	CC is £8.98 in WH report; increased to £13.5 for additional Langford intake capacity.
DEEPHAMS REUSE - LONDON	CC = £37M OC = £1.05M	35:	

SEVERN-TRENT	Capacity = 300 (100) CC = £70M (£26M) OC = £0.0202M/Mld (£0.0163M/Mld)	29:	
WITHAM- GRAFHAM/RUTLAND	Capacity = 150 CF = 104 LF = 33 CC = £37M OC = £0.0196M/Mld	28: 29:	Case 6 - Case 1: Additional Rutland/Grafham yield = 159 (= 150*1.04) LF assumed to be same as Witham-Ely Ouse.
SEVERN-THAMES	Capacity = 400 (200) CF = 94 (80) CC = £92M (£57M) OC = £0.0315M/Mld LF = 12(8)	27: Table 7 29: 42: Table 1	Max demand which can be met is 425 = 400/0.94 (249 = 200/0.80)  Same OC and LF used for unregulated as for regulated Severn, as model can use only one OC and LF per element. (Additional costs of a Severn-London transfer are £120M (£60M). )
WYE-SEVERN	Capacity = 400 CC = £47.5M OC = 0.015M/Mld LF = 12	29:	LF assumed to be same as for Severn-Thames transfer.
CRAIG GOCH-SEVERN	Capacity = ? CC = £44.5M OC = 0	35:	
CRAIG GOCH-WYE	CC = £11.5M OC = 0	35:	
R. TRENT-EAST MIDLANDS	Capacity = 300 CC = £50M OC = £0.0016M/Mld	22: & 33:	Temporary assumption that all Carsington supply to E. Midlands is via 'conjunctive use' link, as cost data is only available for this option
DERWENT VALLEY- EAST MIDLANDS	CC = £13.3M OC = £0.025M/Mld	30:	
YORKSHIRE OUSE - SHEFFIELD	Capacity = 40 CC = £23.5M OC = £0.037M/Mld LF = 100	36:	LF taken to be 100, as OC has built-in assumption that transfer will be used 250 days/yr.

KJELDER-SWALE	Capacity=325 (40) CC = £48M (£8.2M) OC = £0.0305M/Mld (£0.034M/Mld) LF = 100	36:	Figures in brackets relate to supply required from Kielder if Derwent Valley redeployed to Severn Trent.  LF taken to be 100, as OC has built in assumption that Kielder-Tees used 31 days/yr and Tees-Swale used 100 days/yr.
YORKSHIRE OUSE-WITHAM	Capacity=325 CC = £107M OC = £0.0165M/Mld LF = 100	36:	LF taken to be 100, as OC has built in assumption that Ouse-Witham is used 100 days/yr.
LONDON-MID KENT / FOLKESTONE	Capacity=50 CC = £67.2M OC = £0.0216M/Mld LF=25	29:	(London-Canterbury costs)  LF assumed to be same as for Broad Oak-Mid Kent/Folkestone.
PANT-CHELMER-RODING	Capacity = 100(200) CC = £24M (£39M) OC = £0.0103M/Mld CF = 123(113) LF = 11	29:  27: Table 1	Sum of Pant-Chelmer and Chelmer-Roding; ie 13 + 11 (21 + 18).  Transfer capacity of 100(200) gives yield of 81(176)
RODING-STORT	Capacity = 100(200) CC = £11M (£16M) OC = £0.0029M/Mld CF = 123(113) LF = 12	29:  27: Table 1	Transfer capacity of 100(200) gives yield of 81(176)
CANAL TRANSFER	Capacity = 100 CC = £23.1M OC = £0.02M/Mld LF = 12	30:	LF assumed to be same as Severn-Thames transfer
BROAD OAK - MID KENT/FOLKESTONE	CC = £47.5M OC = £0.025M/Mld LF = 25	30:	

GRAFHAM AUGMENTATION	CC = £35M OC = £0.0091M/Mld LF = 33	3: Table 11-2 31:	(Brownhill Intake)  LF assumed to be the same as Witham-Grafham/Rutland
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LINKS (with yield factors different from 1)

DATA ITEM	VALUE	REFERENCE	COMMENTS
CARSINGTON to all demands involving conjunctive use with Trent.	YF = 80	10: 33:	Yield of Carsington = 140, when used as at present, but increased by 35 to 175 (=140/0.80) when used conjunctively with Trent.
VYRNWY to all demands using Severn-Thames transfer	YF = 83 (53)	12: Table 4 & 27: Table 7 37: J. Oldman 15/11	Yield = 229 when 69 of Vyrnwy is redeployed. Of this, 146 (100) is available from Unsupported Severn. YF = 69/(229-146) for 400 transfer, or 69/(229-100) for 200 transfer.
VYRNWY to demands on Severn not using Severn-Thames transfer	YF = 56	12: Table 4	Using NW Case 9, 154 of yield is available when minimum Vyrnwy supply to NWW is 120, ie when 87 = 207-120 is available for redeployment. YF = 87/154.
SHROPSHIRE GW, CRAIG GOCH and SEVERN REUSE to all demands using Severn Thames transfer.	YF = 100		Used in the absence of better information! Yield is limited by the capacity of Severn-Thames pipeline.
DERWENT VALLEY - EAST MIDLANDS	YF = 57	10:	Current yield of Derwent Valley to South Yorkshire is 40, but could be increased to 70 (40/0.57) if used for river regulation to meet East Midlands demand.
TRENT (UNSUPPORTED) - ANGLIA (WEST)	YF = 38	28: Table A1.3	= 61/159: additional yield of 159 (90 Rutland + 69 Grafham) at expense of 61 (791-730) Ely Ouse - Essex yield. Same YF assumed to apply to Trent-Rutland direct route.

GREAT BRADLEY - LONDON & MID KENT / FOLKESTONE	YF=64 (67)	28: Table A1.3 27: Table 1	= 52/81 (118/176): additional yield of 81 (176) for London at expense of 52 (118) yield to Essex - for transfer capacity of 100 (200).
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**DEMANDS** - These are taken from Ref 38, except as detailed below.

DATA ITEM	VALUE	REFERENCE	COMMENTS
NORTH WEST (SCZ)	81 - 191	37:	Vyrnwy, Ribble, Huntington taken as allocable sources. Existing sources taken as Dee, Rivington, Boreholes ie $0.975 * (390 + 43 + 171) = 589$ . Vyrnwy yield is 207 ( $= 0.975 * 212$ ), of which 60 must go to NWW (not reallocable). Therefore existing sources increased to 649 ( $= 589 + 60$ ). Marginal demands for high scenario become: 81, 70, 94, 118, 141, 166, 191.
NORTH WEST (RR)	0	37:	Demand of up to 102 assumed to be met by other means than sources available for NW (SCZ).
UPPER TRENT	0		Demand of up to 12 assumed to be met from local sources.
SOUTHERN - S. EAST	0		Demand of 2 assumed to be met from local sources.
SLOUGH / WYCOMBE / AYLESBURY	0	39:	Demand of up to 22 assumed to be met from local sources.
LONDON /SUTTON	94 - 567 (HIGH) 46 in 2021 (MED)	39:	Sutton demands incorporated in London figures, except that for MEDIUM case it is assumed that Sutton demands will not trigger a strategic demand before London, and Sutton demands to 2016 have been assumed to be met from local sources.
SOUTH WEST	0		Demand of 17 assumed to be met from local sources.
SOUTH YORKSHIRE	40 (1991-2021)		Included to allow modelling of Derwent Valley redeployment option.

#### Key

CC Capital cost

OC

Operating cost / annum (power cost only)

YF Yield factor

CF

Capacity factor

#### References

1. 'Preliminary modelling of water storage and transfers in Anglian Region' NRA Anglian May 1993
2. Verbal communication David Evans Anglian Region
3. 'Water Resource Strategy - Consultation Draft' NRA Anglian April 1993
4. 'National Water Resources Development Strategy - Water Company Consultation Paper' NRA HIO June 1993
5. 'Water Resources Strategy - Other Options Report - Draft Report' Halcrow Apr 1993
6. 'Water Resources Development Options - Final Report' NRA Thames/Humphrey Apr 1992
7. Memo from NRA Thames (Brian Arkell) 15/12/92 (Superseded by Ref 25)
8. Memo from NRA Thames (Brian Arkell) 28/05/93
9. 'Calculation of Marginal Demands for PWS' NRA Severn Trent May 1993 (Incorporated in Ref 26)
10. Telephone conversation CP / Gordon Davies (NRA Severn Trent) 24/5/93
11. Report on modelling of transfers by NRA Thames May 1993
12. 'Lake Vyrnwy Redeployment Study - Phase 2 Report' NRA Severn Trent May 1993
13. 'Regional Strategic Options Study - Final Report - Component 7 R.Trent to Rutland Water Transfer' Atkins Apr 1993
14. 'Regulation of the R.Trent for transfer to Anglian Region' NRA Severn Trent May 1993
15. 'Proforma for reporting of modelling associated with inter-regional transfers' NRA North West May 1993
16. 'Vyrnwy Redeployment Options - Potential Impact on Water Supplies in North West England' NRA North West Mar 1993
17. Memo from NRA Northumbria (Dave Archer) 13/05/93 (Incorporated in Ref 26)
18. Memo from NRA Thames (Alison Brook) 26/05/93 (Incorporated in Ref 26)
19. Memo from NRA Southern (Rachel Skidmore) 14/05/93 (Incorporated in Ref 26)
20. Memo from NRA Wessex (Richard Symonds) 14/05/93 (Incorporated in Ref 26)
21. Memo from NRA Anglian (Bob Hillier) 15/06/93
22. Notes of meeting at Solihull 23/06/93 - Gordon Davies, Paul Crockett, Chris Page
23. 'Severn-Trent Transfer Options - Feasibility and Outline Engineering Appraisal Study' NRA Severn Trent / Atkins Apr 1993
24. Memo from NRA Wessex (Richard Symonds) 24/06/93 and telephone conversation 29/06/93.
25. 'Water Resources Strategic Scheme Development Options - Technical Overview' NRA Thames June 1993
26. 'Derivation of Marginal Demands - Audit Review' NRA Head Office June 1993
27. 'National Water Resources Strategy Inter-Regional Transfers Modelling Report' NRA Thames July 1993

## Appendix 1 - RESPLAN data source documents and assumptions

28. 'Stage 2 Modelling of Water Storage and Transfers in the Anglian Region' NRA Anglian Aug 1993
29. 'NRA Water Resources Strategy Technical Note - Costings' Halcrow Aug 1993
30. 'Water Resources Project Management Costings' Memos from Halcrow (Tim Turner) 25/08/93, 01/09/93, 16/09/93
31. Memo from NRA Anglian (Bob Hillier) 21/07/93
32. 'NRA National Water Resources Strategy Broad Oak Reservoir Costs' Memo from NRA Southern to Halcrow 27/08/93
33. Memo from NRA Severn Trent (Paul Crockett) 22/09/93
34. Report on Chelmsford-Witham Effluents: Essex Water / Watson Hawksley 1992
35. Letter from Halcrow (Jill Rankin) 03/11/93
36. Letter from Halcrow (Jill Rankin) 17/11/93
37. 'Notes on NW Region Marginal Demands and Vymwy Redeployment' NRA Head Office 08/11/93
38. 'Marginal Demands Calculations' NRA Head Office (Mark Sifton) 11/11/93
39. Memo from NRA Thames (Brian Arkell) 13/09/93
40. Fax from Halcrow to MS (Ref: WE/RPMA/62/331; 07/12/93). (Costs in letter WE/RPM/25/329 to CP on 02/12/93 are incorrect.)
41. Memo from Graham Wilson to MS (Ref: GMW/JJ/654/16; 15/12/93 alternative size Bradley.
42. Letter from Jill Rankin to MS (Ref: WE/RPM/62/332; 13/12/93) changes to Severn-Thames costings.
43. Memo from NRA Anglian Region (Steve Cook) 16/02/94

## **Appendix 2: Summary of results from RESPLAN runs**



# Appendix 2 - Summary of results from RESPLAN model runs

CASE	DISC COST	ADJ <sup>1</sup> DISC COST	DATE NEW SOURCES INTRODUCED						DATE NEW TRANSFERS INTRODUCED					COMMENTS <sup>2</sup>
			GREAT BRDLY	SHROP GW	VRNWX RDPMT	CRAIG GOCH	ABGDN	DPHMS REUSE	SEV-THMS	SEV-TRENT	G BRD LNDN	TRNT-ANGLN	CANAL	
HIGH SCENARIO														
HIGH1	415	353	2006	2001	2006	2011	2021	-	1996	2016	2006	-	-	Baseline case: Involves uses of Vyrnwy Redeployment (until Vyrnwy full required by NWM), use of Great Bradley in London from 2006.
HIGH2	677	637	2006	2001	-	2016	1996	-	2011	2016	-	-	-	Abingdon first for London with no use of Vyrnwy and Shropshire GW from 2001.
HIGH3	519	417	2006	2001	2006	2011	2021	-	1996 <sup>3</sup>	2016	2006	-	-	As case HIGH1 but with Severn-Thames replaced by Severn-London at an additional cost of £120M.
HIGH4	349	330	2006	2001	-	2011	-	1996	2011	2016	2006	-	-	Least cost allocation when Deephams is included as an option.
HIGH5	490	398	-	2001	2006	2006	2016	-	1996	2016	-	2006	-	As case HIGH1 but with Great Bradley replaced by Trent (Unsupported).
MEDIUM SCENARIO														
MED1	115	65	2011	-	2001	-	-	-	2016	-	-	-	-	Baseline Case: Involves use of Vyrnwy Redeployment for Bristol and W.Midlands in preference to Shropshire GW.
MED2	150	59	-	-	2001	-	-	-	2016	-	-	2011	-	As case MED1 but with Great Bradley replaced by Trent (Unsupported) (Assumes Trent-Witham-Ouse capacity of 237.)
MED3	206	129	2011	-	2001	-	2016	-	-	-	-	-	-	Least cost allocation with forced selection of Abingdon first for London.
MED4	132	72	2011	-	2001	-	-	-	2016 <sup>3</sup>	-	-	-	-	As case MED1 but with Severn-Thames transfer replaced by Severn-London pipeline at additional cost of £60M (200 Mld capacity).
MED5	113	63	2011	2001	-	-	-	-	2016	-	-	-	-	As case MED1 but with Vyrnwy replaced by Shropshire GW with zero CC and QC.

## Appendix 2 - Summary of results from RESPLAN model runs

- Notes:
- 1 Adjusted Discounted Cost calculated from Total Discounted Cost less an allowance for developed, but unused, capacity in major sources and transfers. (Allowance calculated by subtracting (proportion of capacity unused) \* (capital cost) \* (discount factor for 2021) for sources, and (proportion of unused capacity) \* (capital cost) \* (discount factor for year of introduction) for transfers.
  - 2 Features common to all the high forecast runs are:  
Use made of Broad Oak, conjunctive use of Carsington/Trent.  
Use not made of Kielder, transfers from London to Mid Kent/Folkestone, reallocation of Derwent Valley.
  - 3 Costs are for Severn-London transfer rather than Severn-Thames transfer.
  - 4 All runs assume the use of Shropshire GW as a local option with CC and OC set to zero and automatic first selection.

### **Appendix 3: Input data for the National Strategy**

# Appendix 3 - Input Data File for High Scenario Case HIGH1

```

0 NUMBER LINES HEADING
*****ABOVE DATA ARE USED AS HEADINGS IN THE OUTPUT. GENERAL DATA FOLLOW***
7 1991 NUMBER PERIODS & FIRST BASE YEAR
1996 2001 2006 2011 2016 2021 BASE YEARS AFTER FIRST BASE YEAR
1991 DISCOUNT YEAR
1991 FIRST YEAR IN PLAN
0 DATA TESTING(0 = FOR NORMAL RUN,1 = NO ALLOCATION,2 = NULL ALLOCATION
0 NO COSTING BUT ALLOCATION CHECKED (1 = NO COSTING, ZERO OTHERWISE)
1 (1 = CONDENSED OUTPUT,0 = FULL OUTPUT)
1 (1 = NO TABLE OF PEAK FACTORS,0 = FULL OUTPUT)
1 (1 = NO TABLES OF INPUT DATA IN OUTPUT, ZERO OTHERWISE)
1 (1 = NO EXPLANATORY NOTES IN OUTPUT, ZERO OTHERWISE)
0 (1 = TABULATED MONITORING OUTPUT FOR ALLOCATION, ZERO OTHERWISE)
0 (1 = STEPWISE MONITORING OUTPUT FOR ALLOCATION, ZERO OTHERWISE)
1 30 PIPE STAGING VARIABLES
0.83 PROGRAM CONTROL PARAMETER RHO
0.17 PROGRAM CONTROL PARAMETER RHO2
0.06 DISCOUNT RATE
0.06 INTEREST RATE
1.000 INFLATION INDEX FOR NON-STANDARD CAPITAL ITEMS
1.000 INFLATION INDEX FOR NON-STANDARD COSTS OF OPN
100 NUMBER OF ITERATIONS REQUIRED
0 SELECT PARTICULAR GROUPS OF DEMAND CENTRES
1 ) GROUPS TO BE SELECTED-
1 ) WHEN DEMAND SELECT VARIABLE=11
1 SELECT PARTICULAR TYPES OF DEMAND CENTRES
1.00 SCALING FACTOR FOR SELECTED DEMAND CENTRE TYPES
#####END OF GENERAL DATA: DEMAND DATA FOLLOW#####
17 NUMBER DEMAND CENTRES
DEMAND CENTRE NAME
DEMAND CENTRE REFERENCE NO
DEMAND CENTRE REORDER NO
REGION REF NO
TYPE REF NO
YIELD OF EXISTING RESOURCES
DEMANDS FOR YEARS SHOWN
1985 1990 1995 2000 2005 2010
'ANGLIA (EAST) ' 2 0 0 0 0 0 0 0 0 0 0 0
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'NORTH ESSEX ' 3 0 0 0 0 0 0 0 0 11 21 28
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'SOUTH ESSEX ' 4 0 0 0 0 0 0 16 39 62 80 90
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'ANGLIA (WEST) ' 5 0 0 0 0 0 0 0 0 0 0 0
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'LONDON ' 6 0 0 0 0 0 96 193 307 423 501 567
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'THREE VALLEYS ' 7 0 0 0 0 0 0 0 0 0 0 0
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'MID-SOUTHERN ' 9 0 0 0 0 0 0 0 0 0 0 0
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'OXFORD/SWINDON ' 10 0 0 0 0 0 0 0 2 20 31 40
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'WESSEX ' 11 0 0 0 0 0 0 0 0 0 7 38 71
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'WEST MIDLANDS ' 12 0 0 0 0 0 0 12 72 139 195 258
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'EAST MIDLANDS ' 13 0 0 0 0 0 44 112 158 206 258 310
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'SOUTH YORKSHIRE ' 14 0 0 0 0 40 40 40 40 40 40 40
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'MID KENT/FLKSTNE' 16 0 0 0 0 2 5 8 12 16 24 31
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'BRISTOL ' 17 0 0 0 0 0 0 17 34 49 58 67
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'New Demand ' 18 0 0 0 0 0 0 0 0 0 0 0
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'New Demand ' 19 0 0 0 0 0 0 0 0 0 0 0
1.00 1.00 1.00 1.00 1.00 1.00 1.00
'NORTH WEST ' 20 0 0 0 0 81 70 94 118 141 166 191
1.00 1.00 1.00 1.00 1.00 1.00 1.00
****SOURCE DATA FOLLOW*****
26 NUMBER SOURCES
SOURCE NAME
SOURCE REF NO

```

### Appendix 3 - Input Data File for High Scenario Case HIGH1

[illegible]

\*\*\*\*LINK DATA FOLLOW\*\*\*\*\*

93 NUMBER LINKS

93 NUMBER  
LINK NAME

SOURCE REF NO				
DEMAND REF NO				
YIELD FACTOR				
SOURCE OPERATION COST FACTOR				

LINK ELEMENT REFERENCE NUMBERS (SECOND LINE)

[illegible]

# Appendix 3 - Input Data File for High Scenario Case HIGH1

56	55	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'GRAFH/3 VALLEYS To SOUTH ESSEX										68	4	100	100	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Great Bradley To NORTH ESSEX										22	3	100	100	0	0	0	0	0	0	0
55	57	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Denver Mrf To NORTH ESSEX										21	3	100	100	0	0	0	0	0	0	0
56	55	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To NORTH ESSEX										28	3	100	100	0	0	0	0	0	0	0
53	103	54	110	55	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Grafham Augmn To ANGLIA (WEST)										26	5	100	100	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To ANGLIA (WEST)										28	5	38	100	0	0	0	0	0	0	0
53	103	54	110	66	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Carsington To ANGLIA (WEST)										30	5	80	100	0	0	0	0	0	0	0
99	97	53	103	54	110	66	51	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsptrd)(2) To ANGLIA (WEST)										44	5	38	100	0	0	0	0	0	0	0
15	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Grafham Augmn To THREE VALLEYS										26	7	100	100	0	0	0	0	0	0	0
67	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To THREE VALLEYS										28	7	38	100	0	0	0	0	0	0	0
53	103	54	110	66	51	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Carsington To THREE VALLEYS										30	7	80	100	0	0	0	0	0	0	0
99	97	53	103	54	110	66	51	27	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsptrd)(2) To THREE VALLEYS										44	7	38	100	0	0	0	0	0	0	0
15	41	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Deephams Reuse To LONDON										25	6	100	100	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Abingdon To LONDON										29	6	100	100	0	0	0	0	0	0	0
74	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Great Bradley To LONDON										22	6	64	100	0	0	0	0	0	0	0
55	57	111	112	113	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To LONDON										28	6	100	100	0	0	0	0	0	0	0
53	103	54	110	55	111	112	113	114	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Kielder To LONDON										32	6	100	100	0	0	0	0	0	0	0
105	106	54	110	55	111	112	113	114	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Thames Reuse To LONDON										46	6	100	100	0	0	0	0	0	0	0
59	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Severn(Unsuprtd) To LONDON										33	6	100	100	0	0	0	0	0	0	0
79	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Craig Goch To LONDON										37	6	100	100	0	0	0	0	0	0	0
116	117	86	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Shropshire Gw To LONDON										39	6	100	100	0	0	0	0	0	0	0
88	86	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy To LONDON										35	6	83	100	0	0	0	0	0	0	0
90	86	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Craig Goch (2) To LONDON										38	6	100	100	0	0	0	0	0	0	0
116	117	60	93	64	65	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Shropshire Gw (2) To LONDON										40	6	100	100	0	0	0	0	0	0	0
88	60	93	64	65	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy (2) To LONDON										36	6	83	100	0	0	0	0	0	0	0
90	60	93	64	65	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### Appendix 3 - Input Data File for High Scenario Case HIGH1

[illegible]

### Appendix 3 - Input Data File for High Scenario Case HIGH1

[illegible]



### Appendix 3 - Input Data File for High Scenario Case HIGH1

0	116	117	86	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy To WESSEX	90	86	80	0	0	0	0	0	0	35	11	53	100	0	0	0	0	0
'Severn Reuse To BRISTOL	8	86	52	0	0	0	0	0	0	47	17	100	100	0	0	0	0	0
'Shropshire Gw To BRISTOL	88	86	52	0	0	0	0	0	0	39	17	100	100	0	0	0	0	0
'Craig Goch To BRISTOL	116	117	86	52	0	0	0	0	0	37	17	100	100	0	0	0	0	0
'Vyrnwy To BRISTOL	90	86	52	0	0	0	0	0	0	35	17	53	100	0	0	0	0	0
'Ribble To NORTH WEST	89	0	0	0	0	0	0	0	0	71	20	100	100	0	0	0	0	0
'Huntington To NORTH WEST	91	0	0	0	0	0	0	0	0	43	20	100	100	0	0	0	0	0
'Vyrnwy To NORTH WEST	92	0	0	0	0	0	0	0	0	35	20	100	100	0	0	0	0	0

\*\*\*\*\*END OF LINK DATA: LINK ELEMENT DATA FOLLOW\*\*\*\*\*

61 NUMBER LINK ELEMENTS

LINK ELEMENT REFERENCE NO

LINK ELEMENT NAME

DIAMETER EXISTING PIPELINE

EXISTING CAPACITY

• • **EXISTING USE**

CONSTRUCTION PERIOD

• • • • • **STATIC HEAD**

PIPELINE LENGTH

• • • • • FRICTION LENGTH

### CAPITAL COST

**OPERATING COST**

LOAD FACTOR

CAPACITY FACTOR

LINK ELEMENT DEFINITION

[illegible]

### Appendix 3 - Input Data File for High Scenario Case HIGH1

[illegible]

# Appendix 3 - Input Data File for High Scenario Case HIGH1

```

110 'R.WITHAM - R.ELY CUSE (2)      ' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
149000 -10400      33 100      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
111 'R.PANT - R.CHELMER - R.RODING (1) ' 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1000000      0      100 123      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
112 'R.PANT - R.CHELMER - R.RODING (2) ' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
24000 -10300      11 100      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
113 'R.RODING - R.STORT (1)      ' 0 100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1000000      0      100 123      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
114 'R.RODING - R.STORT (2)      ' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
11000 -2900      12 100      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
116 'CRAIG GOCH - R.SEVERN (1)      ' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0      0      100 100      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
117 'CRAIG GOCH - R.SEVERN (2)      ' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
44500      0      100 100      0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

```

\*\*\*\*\*END OF LINK ELEMENT DATA: COST FUNCTION DATA FOLLOWS\*\*\*\*\*

14 NUMBER COST FUNCTIONS

12 NUMBER COST FUNCTION COEFFICIENTS

GENERAL FORM (CONF ARE 80% CONFIDENCE LIMIT MULTIPLIERS) :

COST FUNCTION	f	g	h	a	r	b	s	c	t	d	u	e
'1-INTAKE	1.0	1.0	1.000	.0176	0.79	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'2-GAC/OZONE	1.0	1.0	1.000	0.1036	1.0	0.0	1.362	1.0	1.0	0.0	0.0	0.0
-0.0000737	1.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
'3-BANKSIDE STORAGE	1.0	1.0	1.000	0.021036	1.0	0.0	3.967	1.0	1.0	0.0	0.0	0.0
-0.0000124	1.0	2.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
'4-WATER TREATMENT	1.0	1.0	1.000	1.246	0.64	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'5-PUMPS	1.0	1.0	1.000	.0026	.81	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.43	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'6-PUMPHOUSE	1.0	1.0	1.000	.012	.79	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'7-PIPELINE	1.0	1.0	1.000	.00027	1.04	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'8-TUNNEL	1.0	1.0	1.000	3.000000	1.0	0.0	0.000000	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'9-TERMINAL STORAGE	1.0	1.0	1.000	0.0676131	1.0	0.0	-0.1281	1.0	1.0	1.0	0.0	0.0
-0.0000727	1.0	2.0	1.0	1.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'10-POWER (ELECTRICITY)	1.0	1.0	1.000	.00081	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'11A-WATER TREATMENT CHEMS'	1.0	1.0	2.234	0.00169	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'11B-WATER TREATMENT POWER'	1.0	1.0	2.940	0.0001751	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'13-RAW WATER CHLORINATION'	1.0	1.0	2.234	0.000533	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
'13-EXTRA SOFTENING	1.0	1.0	2.234	0.000934	1.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0
1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	0.0

\*\*\*\*\*END OF COST FUNCTION DATA: END OF

DATAFILE\*\*\*\*\*

# Appendix 3 - Input Data File for Medium Scenario Case MED1

## 0 NUMBER LINES HEADING

\*\*\*\*\*ABOVE DATA ARE USED AS HEADINGS IN THE OUTPUT. GENERAL DATA FOLLOW\*\*\*

7 1991 NUMBER PERIODS & FIRST BASE YEAR

1996 2001 2006 2011 2016 2021 BASE YEARS AFTER FIRST BASE YEAR

1991 DISCOUNT YEAR

1991 FIRST YEAR IN PLAN

0 DATA TESTING(0 = FOR NORMAL RUN,1 = NO ALLOCATION,2 = NULL ALLOCATION

0 NO COSTING BUT ALLOCATION CHECKED (1 = NO COSTING, ZERO OTHERWISE)

1 (1 = CONDENSED OUTPUT,0 = FULL OUTPUT)

1 (1 = NO TABLE OF PEAK FACTORS,0 = FULL OUTPUT)

1 (1 = NO TABLES OF INPUT DATA IN OUTPUT, ZERO OTHERWISE)

1 (1 = NO EXPLANATORY NOTES IN OUTPUT, ZERO OTHERWISE)

0 (1 = TABULATED MONITORING OUTPUT FOR ALLOCATION, ZERO OTHERWISE)

0 (1 = STEPWISE MONITORING OUTPUT FOR ALLOCATION, ZERO OTHERWISE)

1 30 PIPE STAGING VARIABLES

0.85 PROGRAM CONTROL PARAMETER RHO

0.15 PROGRAM CONTROL PARAMETER RHO2

0.06 DISCOUNT RATE

0.06 INTEREST RATE

1.000 INFLATION INDEX FOR NON-STANDARD CAPITAL ITEMS

1.000 INFLATION INDEX FOR NON-STANDARD COSTS OF OPN

100 NUMBER OF ITERATIONS REQUIRED

0 SELECT PARTICULAR GROUPS OF DEMAND CENTRES

1 ) GROUPS TO BE SELECTED-

1 ) WHEN DEMAND SELECT VARIABLE=11

1 SELECT PARTICULAR TYPES OF DEMAND CENTRES

1.00 SCALING FACTOR FOR SELECTED DEMAND CENTRE TYPES

\*\*\*\*\*END OF GENERAL DATA: DEMAND DATA FOLLOW\*\*\*\*\*

17 NUMBER DEMAND CENTRES

DEMAND CENTRE NAME

DEMAND CENTRE REFERENCE NO

DEMAND CENTRE REORDER NO

REGION REF NO

TYPE REF NO

YIELD OF EXISTING RESOURCES

DEMANDS FOR YEARS SHOWN

1985 1990 1995 2000 2005 2010

'ANGLIA (EAST)	2	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'NORTH ESSEX	3	0 0 0	0	0	0	0	0	0	0	4	14
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'SOUTH ESSEX	4	0 0 0	0	0	0	2	17	32	48	58	
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'ANGLIA (WEST)	5	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'LONDON	6	0 0 0	0	0	0	0	0	0	0	0	46
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'THREE VALLEYS	7	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'MID-SOUTHERN	9	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'OXFORD/SWINDON	10	0 0 0	0	0	0	0	0	0	0	13	20
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'WESSEX	11	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'WEST MIDLANDS	12	0 0 0	0	0	0	0	0	11	25	58	
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'EAST MIDLANDS	13	0 0 0	0	0	0	40	72	104	141	178	
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'SOUTH YORKSHIRE	14	0 0 0	0	40	40	40	40	40	40	40	40
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'MID KENT/FLKSTNE'	16	0 0 0	0	0	0	0	0	1	4	6	
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'BRISTOL	17	0 0 0	0	0	0	7	18	30	37	43	
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'New Demand	18	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'New Demand	19	0 0 0	0	0	0	0	0	0	0	0	0
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
'NORTH WEST	20	0 0 0	0	81	55	28	34	48	64	80	
			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

\*\*\*\*\*SOURCE DATA FOLLOW\*\*\*\*\*

26 NUMBER SOURCES

SOURCE NAME

SOURCE REF NO

### Appendix 3 - Input Data File for Medium Scenario Case MED1

[illegible]

\*\*\*\*\*LINK DATA FOLLOW\*\*\*\*\*

93 NUMBER LINKS

73 NUMBER  
LINK NAME

SOURCE REF NO
- DEMAND REF NO
- " YIELD FACTOR
- " SOURCE OPERATION COST FACTOR
- " "
- " "
- " "

LINK ELEMENT REFERENCE NUMBERS (SECOND LINE)

[illegible]

# Appendix 3 - Input Data File for Medium Scenario Case MED1

56	55	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'GRAFH/3 VALLEYS To SOUTH ESSEX										'	68	4	100	100	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Great Bradley To NORTH ESSEX										'	22	3	100	100	0	0	0	0	0	0
55	57	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Denver Mrf To NORTH ESSEX										'	21	3	100	100	0	0	0	0	0	0
56	55	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To NORTH ESSEX										'	28	3	100	100	0	0	0	0	0	0
53	103	54	110	55	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Grafham Augmn To ANGLIA (WEST)										'	26	5	100	100	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To ANGLIA (WEST)										'	28	5	38	100	0	0	0	0	0	0
53	103	54	110	66	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Carsington To ANGLIA (WEST)										'	30	5	80	100	0	0	0	0	0	0
99	97	53	103	54	110	66	51	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsptrd)(2) To ANGLIA (WEST)										'	44	5	38	100	0	0	0	0	0	0
15	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Grafham Augmn To THREE VALLEYS										'	26	7	100	100	0	0	0	0	0	0
67	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To THREE VALLEYS										'	28	7	38	100	0	0	0	0	0	0
53	103	54	110	66	51	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Carsington To THREE VALLEYS										'	30	7	80	100	0	0	0	0	0	0
99	97	53	103	54	110	66	51	27	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsptrd)(2) To THREE VALLEYS										'	44	7	38	100	0	0	0	0	0	0
15	41	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Deephams Reuse To LONDON										'	25	6	100	100	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Abingdon To LONDON										'	29	6	100	100	0	0	0	0	0	0
74	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Great Bradley To LONDON										'	22	6	64	100	0	0	0	0	0	0
55	57	111	112	113	114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Trent(Unsuprtd) To LONDON										'	28	6	100	100	0	0	0	0	0	0
53	103	54	110	55	111	112	113	114	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Kielder To LONDON										'	32	6	100	100	0	0	0	0	0	0
105	106	54	110	55	111	112	113	114	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Thames Reuse To LONDON										'	46	6	100	100	0	0	0	0	0	0
59	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Severn(Unsuprtd) To LONDON										'	33	6	100	100	0	0	0	0	0	0
79	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Craig Goch To LONDON										'	37	6	100	100	0	0	0	0	0	0
116	117	86	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Shropshire Gw To LONDON										'	39	6	100	100	0	0	0	0	0	0
88	86	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy To LONDON										'	35	6	83	100	0	0	0	0	0	0
90	86	77	78	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Craig Goch (2) To LONDON										'	38	6	100	100	0	0	0	0	0	0
116	117	60	93	64	65	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Shropshire Gw (2) To LONDON										'	40	6	100	100	0	0	0	0	0	0
88	60	93	64	65	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy (2) To LONDON										'	36	6	83	100	0	0	0	0	0	0
90	60	93	64	65	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### Appendix 3 - Input Data File for Medium Scenario Case MED1

[illegible]

### Appendix 3 - Input Data File for Medium Scenario Case MED1

'Severn(Unsuprtd) To MID KENT/FLKSTNE											33	16	100	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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# Appendix 3 - Input Data File for Medium Scenario Case MED1

116	117	86	80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy To WESSEX																				
90	86	80	0	0	0	0	0	0	0	35	11	53	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Severn Reuse To BRISTOL																				
8	86	52	0	0	0	0	0	0	0	47	17	100	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Shropshire Gw To BRISTOL																				
88	86	52	0	0	0	0	0	0	0	39	17	100	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Craig Goch To BRISTOL																				
116	117	86	52	0	0	0	0	0	0	37	17	100	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy To BRISTOL																				
90	86	52	0	0	0	0	0	0	0	35	17	53	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Ribble To NORTH WEST																				
89	0	0	0	0	0	0	0	0	0	71	20	100	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Huntington To NORTH WEST																				
91	0	0	0	0	0	0	0	0	0	43	20	100	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
'Vyrnwy To NORTH WEST																				
92	0	0	0	0	0	0	0	0	0	35	20	100	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

\*\*\*\*\*END OF LINK DATA: LINK ELEMENT DATA FOLLOW\*\*\*\*\*

61 NUMBER LINK ELEMENTS

LINK ELEMENT REFERENCE NO

LINK ELEMENT NAME

DIAMETER EXISTING PIPELINE

EXISTING CAPACITY

EXISTING USE

CONSTRUCTION PERIOD

STATIC HEAD

PIPELINE LENGTH

FRICTION LENGTH

CAPITAL COST

OPERATING COST

LOAD FACTOR

CAPACITY FACTOR

LINK ELEMENT DEFINITION

1	'BIRMINGHAM GW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	'SEVERN REUSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	'R.TRENT - RUTLAND (1)	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000000	0	100	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	'R.THAMES - OXFORD/SWINDON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	'GRAFHAM - THREE VALLEYS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	'R.TRENT - RUTLAND (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32000	-20800	47	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	'DENVER - GRAFHAM (1)	0	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000000	0	100	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	'R.SEVERN - BRISTOL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	'R.TRENT - R.WITHAM (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	'R.WITHAM - R.ELY OUSE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	'ELY OUSE - ESSEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	-11200	79	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	'DENVER MRF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	'GREAT BRADLEY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	'ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	'THAMES REUSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	'R.SEVERN - R.TRENT (1)	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1000000	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### Appendix 3 - Input Data File for Medium Scenario Case MED1

[illegible]

### Appendix 3 - Input Data File for Medium Scenario Case MED1

[illegible]

\*\*\*END OF LINK ELEMENT DATA: COST FUNCTION DATA FOLLOWS\*\*\*\*\*

## 14 NUMBER COST FUNCTIONS

12 NUMBER COST FUNCTION COEFFICIENTS

GENERAL FORM (CONF ARE 80% CONFIDENCE LIMIT MULTIPLIERS) :

(aY + c(Y+d) + f(gY)) * rZ (SEEMANUAL)		b	e	s	a	c	d	e
COST FUNCTION	f	g	CONF INFL	r	t	u		
'1-INTAKE 1	1.0	1.0	1.000 .0176	0.79	0.0	1.0	1	0
'2-GAC/OZONE -0.0000737    1.0	2.0	1.0	1.000 0.1036	1.0	1.362	1.0	0.0	
'3-BANKSIDE STORAGE -0.0000124    1.0	2.0	1.0	1.000 0.021036	1.0	3.967	1.0	0.0	
'4-WATER TREATMENT 1.0	1.0	1.0	1.000 1.246	0.64	0.0	1.0	1.0	0.0
'5-PUMPS 1	1	1	1.000 .0026	.81	0.0	1.0	1	0
'6-PUMPHOUSE 1.0	1	1	1.000 .012	.79	0.0	1.0	1	0.0
'7-PIPELINE 1.0	1	1	1.000 .00027	1.04	0	1.0	1	0.0
'8-TUNNEL 1.0	1.0	1.0	1.000 3.000000	1.0	0.00000	1.0	1	0.0
'9-TERMINAL STORAGE -0.0000727    1.0	2.0	1.0	1.000 0.0676131	1.0	-0.1281	1.0	0.0	
'10-POWER (ELECTRICITY) 1.0	1.0	1.0	1.000 .00081	1.0	0.0	1.0	1.0	0.0
'11A-WATER TREATMENT CHEMS' 1.0	1.0	1.0	1.0 2.234 0.00169	1.0	0.0	1.0	1.0	0.0
'11B-WATER TREATMENT POWER' 1.0	1.0	1.0	1.0 2.940 0.0001751	1.0	0.0	1.0	1.0	0.0
'13-RAW WATER CHLORINATION' 1.0	1.0	1.0	1.0 2.234 0.000533	1.0	0.0	1.0	1.0	0.0
'13-EXTRA SOFTENING 1.0	1.0	1.0	1.0 2.234 0.000934	1.0	0.0	1.0	1.0	0.0

\*\*\*\*\*END OF COST FUNCTION DATA: END OF

DATAFILE\*\*\*\*\*

**Appendix 4: Results for the National Strategy**

# Appendix 4 - Results for High Scenario Case HIGH1

## WATER RESOURCE PLANNING MODEL.

\*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:10:35.90

\*\*\*\*\*

## RESULTS

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## (CONDENSED OUTPUT)

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\*\*\*\*\*

## SOURCE DEVELOPMENT

\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021	CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED OPERATING COST TO 2021	DISCOUNTED OPERATING COST BEYOND 2021	TOTAL DISCOUNTED COST
	(TCMD)	(£M)	(£M)	(£M)	(£M)	(£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
1991 Broad Oak	40	.000	.000	.000	.000	.000
1996 Carsington	140	.000	.000	.000	.000	.000
1996 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Shropshire Gw	155	.000	.000	.000	.000	.000
2001 Severn Reuse	114	.000	.000	.000	.000	.000
2006 Great Bradley	174	69.400	34.504	.000	.000	34.504
2006 Thames Reuse	36	.000	.000	.000	.000	.000
2011 Birmingham Gw	50	4.400	1.478	.769	.856	3.103
2011 Craig Goch	629	60.500	22.477	.000	.000	22.477
2016 Huntington	74	36.900	10.244	1.109	3.307	14.661
2021 Abingdon	262	400.000	82.982	.701	4.338	88.021
TOTALS FOR SOURCES		571.200	151.686	2.579	8.501	162.766

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## UNUSED YIELDS OF DEVELOPED SOURCES

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SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	113	79	51	34
Chelmsford Efflt	30	30	14	0	0	0	0
Abingdon	262	262	262	262	262	262	197
Carsington	140	105	50	14	0	0	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	50	0	0	0	0	0
Birmingham Gw	50	50	50	50	19	0	0
Vyrnwy	66	77	53	0	0	0	0
Craig Goch	629	629	629	629	459	269	138
Shropshire Gw	155	155	84	47	0	0	0
Broad Oak	38	35	32	28	24	16	9
Huntington	74	74	74	74	74	55	30
Thames Reuse	0	0	0	0	0	0	0
Severn Reuse	0	0	0	0	0	0	0

\*\*\*\*\*

# Appendix 4 - Results for High Scenario Case HIGH1

## DEMAND FLOWS THROUGH LINK ELEMENTS \*\*\*\*\*

LINK ELEMENT NAME	FLOWS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
ELY OUSE - ESSEX	0	0	0	90	124	152	169
GREAT BRADLEY	0	0	0	90	124	152	169
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	11	21	28
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	9	32	50	60
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	16	30	30	30	30
CARSINGTON - R.TRENT	0	44	112	158	175	175	175
VYRNWY - R.SEVERN	0	0	0	46	7	0	0
R.SEVERN - R.TRENT (1)	0	0	0	0	0	33	85
R.SEVERN - R.TRENT (2)	0	0	0	0	0	33	85
CRAIG GOCH - R.SEVERN (1)	0	0	0	0	170	360	491
CRAIG GOCH - R.SEVERN (2)	0	0	0	0	170	360	491
SHROPSHIRE GW - R.SEVERN	0	0	71	108	155	155	155
R.PANT - R.CHELMER - R.RODING (1)	0	0	0	81	81	81	81
R.PANT - R.CHELMER - R.RODING (2)	0	0	0	81	81	81	81
R.RODING - R.STORT (1)	0	0	0	81	81	81	81
R.RODING - R.STORT (2)	0	0	0	81	81	81	81
ABINGDON - R.THAMES	0	0	0	0	0	0	65
R.THAMES	0	96	193	226	342	420	486
R.SEVERN (UNSUPRTD)	0	96	146	146	146	146	146
R.SEVERN - R.THAMES (1)	0	96	193	226	344	423	425
R.SEVERN - R.THAMES (2)	0	96	193	226	344	423	425
BIRMINGHAM GW	0	0	0	0	31	50	50
R.SEVERN	0	0	64	114	254	373	417
THAMES REUSE	0	0	0	2	18	28	36
SEVERN REUSE	0	0	5	32	61	86	114
R.THAMES - OXFORD/SWINDON	0	0	0	2	20	31	40
R.SEVERN - WESSEX	0	0	0	0	7	38	71
R.SEVERN - W.MIDLANDS	0	0	12	72	139	195	258
R.TRENT - E.MIDLANDS	0	44	112	158	206	258	310
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	2	5	8	12	16	24	31
R.SEVERN - BRISTOL	0	0	17	34	49	58	67
VYRNWY - NORTH WEST	81	70	94	118	141	147	147
HUNTINGTON - NORTH WEST	0	0	0	0	0	19	44

## \*\*\*\*\* LINK ELEMENT DEVELOPMENT \*\*\*\*\*

YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED COST OF OPERATION		UNIT COST OF OPERATION	TOTAL DISCOUNTED COST	BASE YEARS FOR REPLICATION	
		(£M)	(£M)	TO 2021 (£M)	BEYOND 2021 (£M)	(P/M3)	(£M)	AVG PEAK (TCMD)	
2006	ELY OUSE - ESSEX	.000	.000					2006	169 169
	ELY OUSE - ESSEX	.000	.000	5.657	4.339	(2.42)	9.996	( ELEMENT TOTALS )	
2006	GREAT BRADLEY	.000	.000					2006	169 169
	GREAT BRADLEY	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	
2011	ELY OUSE ESSEX - NORTH ESSEX	.000	.000					2011	28 28
	ELY OUSE ESSEX - NORTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	
2006	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000					2006	60 60
	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	
2001	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720					2001	30 30
	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720	.227	.081	(.29)	9.028	( ELEMENT TOTALS )	
1996	CARSINGTON - R.TRENT	.000	.000					1996	175 175
	CARSINGTON - R.TRENT	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	

# Appendix 4 - Results for High Scenario Case HIGH1

2006	VYRNWY - R.SEVERN	.000	.000					2006 46 46
	VYRNWY - R.SEVERN	.000	.000	.651	.000	(1.66)	.651	( ELEMENT TOTALS )
2016	R.SEVERN - R.TRENT (1)	.000	.000					2016 100 100
	R.SEVERN - R.TRENT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2016	R.SEVERN - R.TRENT (2)	26.000	7.008					2016 85 85
	R.SEVERN - R.TRENT (2)	26.000	7.008	.422	1.327	(1.47)	8.756	( ELEMENT TOTALS )
2011	CRAIG GOCH - R.SEVERN (1)	.000	.000					2011 491 491
	CRAIG GOCH - R.SEVERN (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2011	CRAIG GOCH - R.SEVERN (2)	44.500	16.051					2011 491 491
	CRAIG GOCH - R.SEVERN (2)	44.500	16.051	.000	.000	(.00)	16.051	( ELEMENT TOTALS )
2001	SHROPSHIRE GW - R.SEVERN	.000	.000					2001 155 155
	SHROPSHIRE GW - R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2006	R.PANT - R.CHELMER - R.RODING (1)	.000	.000					2006 81 100
	R.PANT - R.CHELMER - R.RODING (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2006	R.PANT - R.CHELMER - R.RODING (2)	24.000	11.585					2006 81 81
	R.PANT - R.CHELMER - R.RODING (2)	24.000	11.585	.486	.266	(.31)	12.337	( ELEMENT TOTALS )
2006	R.RODING - R.STORT (1)	.000	.000					2006 81 100
	R.RODING - R.STORT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2006	R.RODING - R.STORT (2)	11.000	5.310					2006 81 81
	R.RODING - R.STORT (2)	11.000	5.310	.149	.082	(.10)	5.541	( ELEMENT TOTALS )
2021	ABINGDON - R.THAMES	.000	.000					2021 65 65
	ABINGDON - R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	R.THAMES	.000	.000					1996 486 486
	R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	R.SEVERN (UNSUPRTD)	.000	.000					1996 146 146
	R.SEVERN (UNSUPRTD)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	R.SEVERN - R.THAMES (1)	.000	.000					1996 425 400
	R.SEVERN - R.THAMES (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	R.SEVERN - R.THAMES (2)	92.000	79.529					1996 425 425
	R.SEVERN - R.THAMES (2)	92.000	79.529	9.850	4.662	(1.04)	94.040	( ELEMENT TOTALS )
2011	BIRMINGHAM GW	.000	.000					2011 50 50
	BIRMINGHAM GW	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2001	R.SEVERN	.000	.000					2001 417 417
	R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2006	THAMES REUSE	.000	.000					2006 36 36
	THAMES REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2001	SEVERN REUSE	.000	.000					2001 114 114
	SEVERN REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )

# Appendix 4 - Results for High Scenario Case HIGH1

2006	R.THAMES - OXFORD/SWINDON	.000	.000					2006	40	40
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	R.SEVERN - WESSEX	.000	.000					2011	71	71
	R.SEVERN - WESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN - W.MIDLANDS	.000	.000					2001	258	258
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.TRENT - E.MIDLANDS	50.000	43.222					1996	310	310
	R.TRENT - E.MIDLANDS	50.000	43.222	2.526	1.439	(.44)	47.187	( ELEMENT TOTALS )		
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991	40	40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500					1991	31	31
	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500	.866	.562	(1.71)	48.928	( ELEMENT TOTALS )		
2001	R.SEVERN - BRISTOL	.000	.000					2001	67	67
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	147	147
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	HUNTINGTON - NORTH WEST	.000	.000					2016	44	44
	HUNTINGTON - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		308.500	218.925	20.834	12.759		252.517			

## UNIT COSTS OF LINKS

	DISCOUNTED (£M/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.04753	13.02	6.47	136.13
TOTAL:	.04753	13.02	6.47	136.13
2. SOUTH ESSEX				
Great Bradley	.04753	13.02	15.67	329.59
Chelmsford Efflt	.03105	8.51	9.03	290.76
TOTAL:	.03981	10.91	24.69	620.35
3. LONDON				
Great Bradley	.06060	16.60	40.24	664.02
Abingdon	.40178	110.08	36.56	91.00
Severn(Unsuprtd)	.02450	6.71	48.16	1965.90
Vyrnwy	.03057	8.37	1.29	42.36
Craig Goch	.04095	11.22	38.45	938.87
Shropshire Gw	.02450	6.71	4.47	182.58
Thames Reuse	.00000	.00	.00	186.42
Severn Reuse	.02450	6.71	15.45	630.88
TOTAL:	.03927	10.76	184.63	4702.03
4. OXFORD/SWINDON				
Abingdon	.40178	110.08	51.46	128.08
Craig Goch	.04095	11.22	2.77	67.53
Shropshire Gw	.02450	6.71	.10	4.19
Severn Reuse	.02450	6.71	.17	6.74
TOTAL:	.26383	72.28	54.49	206.54



# Appendix 4 - Results for High Scenario Case HIGH1

5. WESSEX				
Shropshire Gw	.00000	.00	.00	271.08
Severn Reuse	.00000	.00	.00	23.59
TOTAL:	.00000	.00	.00	294.68
6. WEST MIDLANDS				
Vyrnwy	.00607	1.66	.39	64.91
Craig Goch	.01645	4.51	16.62	1010.26
Shropshire Gw	.00000	.00	.00	424.22
TOTAL:	.01135	3.11	17.02	1499.38
7. EAST MIDLANDS				
Carsington	.01904	5.22	35.75	1877.81
Birmingham Gw	.03030	8.30	8.35	275.48
Craig Goch	.06243	17.10	20.29	325.07
TOTAL:	.02598	7.12	64.40	2478.35
8. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
9. MID KENT/FLKSTNE				
Broad Oak	.21411	58.66	48.93	228.51
TOTAL:	.21411	58.66	48.93	228.51
10. BRISTOL				
Shropshire Gw	.00000	.00	.00	489.11
TOTAL:	.00000	.00	.00	489.11
11. NORTH WEST				
Vyrnwy	.00000	.00	.00	1849.25
Huntington	.08598	23.56	14.66	170.51
TOTAL:	.00726	1.99	14.66	2019.76
TOTAL			415.28	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	11	21	28
Great Bradley	SOUTH ESSEX	0	0	0	9	32	50	60
Chelmsford Efflt	SOUTH ESSEX	0	0	16	30	30	30	30
Great Bradley	LONDON	0	0	0	81	81	81	81
Abingdon	LONDON	0	0	0	0	0	0	27
Severn(Unsuprtd)	LONDON	0	96	146	146	146	146	146
Vyrnwy	LONDON	0	0	0	15	7	0	0
Craig Goch	LONDON	0	0	0	0	110	160	172
Shropshire Gw	LONDON	0	0	42	31	0	0	0
Thames Reuse	LONDON	0	0	0	2	18	28	36
Severn Reuse	LONDON	0	0	5	32	61	86	105
Abingdon	OXFORD/SWINDON	0	0	0	0	0	0	38
Craig Goch	OXFORD/SWINDON	0	0	0	0	20	31	0
Shropshire Gw	OXFORD/SWINDON	0	0	0	2	0	0	0
Severn Reuse	OXFORD/SWINDON	0	0	0	0	0	0	2
Shropshire Gw	WESSEX	0	0	0	0	7	38	64
Severn Reuse	WESSEX	0	0	0	0	0	0	7
Vyrnwy	WEST MIDLANDS	0	0	0	31	0	0	0
Craig Goch	WEST MIDLANDS	0	0	0	0	40	136	234
Shropshire Gw	WEST MIDLANDS	0	0	12	41	99	59	24
Carsington	EAST MIDLANDS	0	44	112	158	175	175	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	31	50	50
Craig Goch	EAST MIDLANDS	0	0	0	0	0	33	85
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	2	5	8	12	16	24	31
Shropshire Gw	BRISTOL	0	0	17	34	49	58	67
Vyrnwy	NORTH WEST	81	70	94	118	141	147	147
Huntington	NORTH WEST	0	0	0	0	0	19	44
TOTALS		123	255	492	782	1114	1412	1693

\*\*\*\*\*  
SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	69.4	63.2	38.6	400.0
LINK ELEMENTS	47.5	142.0	13.5	35.0	44.5	26.0	.0
TOTALS	47.5	142.0	13.5	104.4	107.7	64.6	400.0

\*\*\*\*\*  
SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.9	3.9	14.6
LINK ELEMENTS	.0	2.3	4.9	11.5	15.8	19.2	22.0
TOTALS	.0	2.3	4.9	11.5	16.7	23.1	36.6

\*\*\*\*\*  
COST SUMMARY  
\*\*\*\*\*

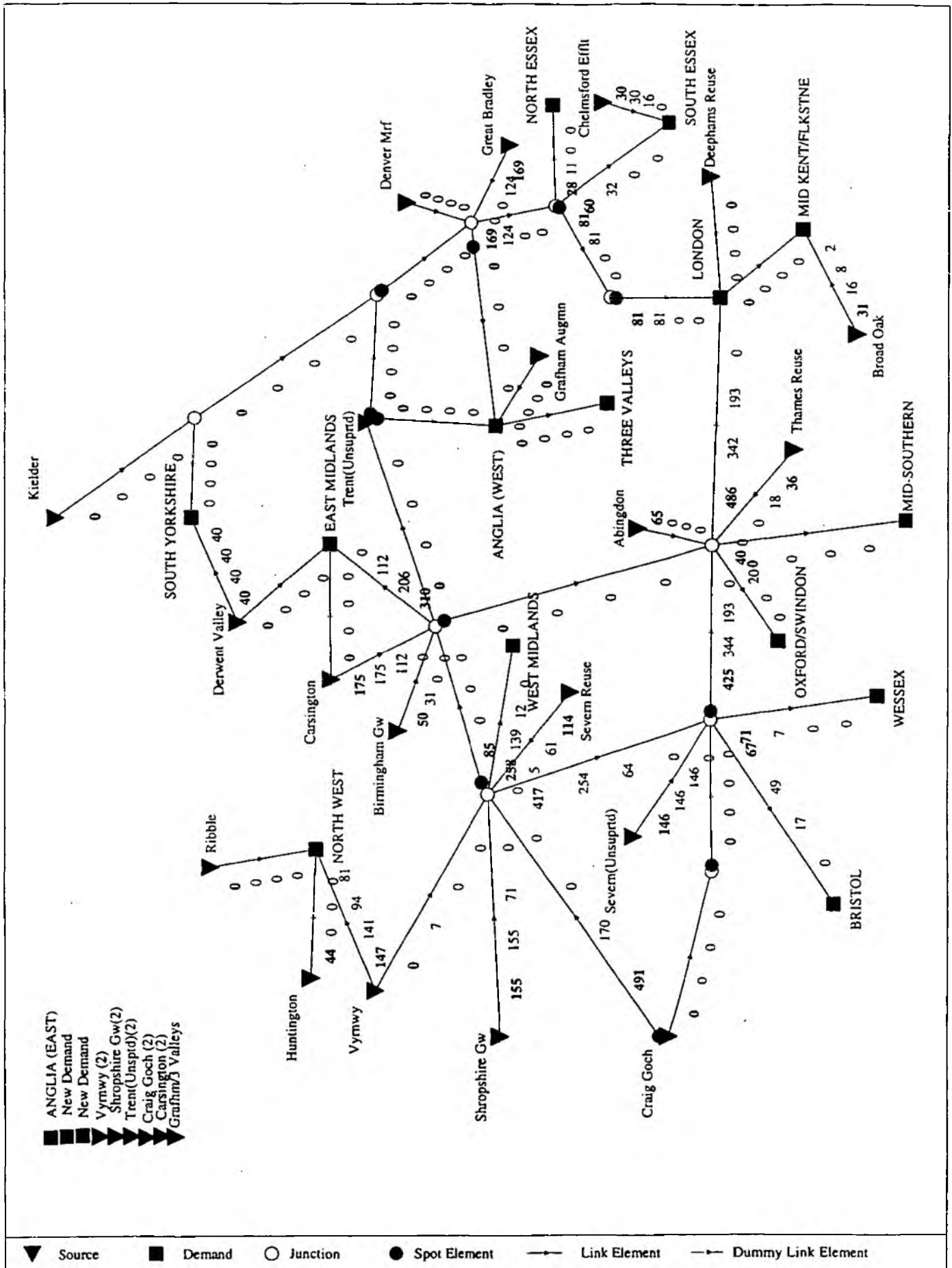
TOTAL DISCOUNTED COST FOR PLAN	= £M 415.283
TOTAL DISCOUNTED CAPITAL COST	= £M 370.611
TOTAL DISCOUNTED COSTS OF OPERATION	= £M 44.673 (ALLOWANCE INCLUDED FOR BEYOND 2021 = £M 21.260)
TOTAL CAPITAL OUTLAY TO 2021	= £M 879.700
TOTAL COSTS OF OPERATION TO 2021	= £M 95.217

TOTAL DISCOUNTED DEMANDS = 13357.870 TCMO

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## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.  
 B. NO DEMAND CENTRES OVER SUPPLIED.  
 C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.
- \*\*\*\*\*



## WATER RESOURCE PLANNING MODEL.

\*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:12:12.96

## RESULTS

\*\*\*\*\*

(CONDENSED OUTPUT)

\*\*\*\*\*

## SOURCE DEVELOPMENT

\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021 (TCMD)	CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED OPERATING COST TO 2021 (£M)	DISCOUNTED OPERATING COST BEYOND 2021 (£M)	TOTAL DISCOUNTED COST (£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
1991 Broad Oak	40	.000	.000	.000	.000	.000
1996 Abingdon	350	400.000	356.150	61.278	23.360	440.788
1996 Carsington	140	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Shropshire Gw	155	.000	.000	.000	.000	.000
2001 Severn Reuse	114	.000	.000	.000	.000	.000
2006 Great Bradley	174	69.400	34.504	.000	.000	34.504
2006 Thames Reuse	36	.000	.000	.000	.000	.000
2011 Severn(Unsuprtd)	176	.000	.000	.000	.000	.000
2011 Birmingham Gw	50	4.400	1.478	.769	.856	3.103
2016 Craig Goch	629	60.500	16.796	.000	.000	16.796
2016 Huntington	74	36.900	10.244	1.109	3.307	14.661
TOTALS FOR SOURCES		571.200	419.172	63.157	27.523	509.852

## UNUSED YIELDS OF DEVELOPED SOURCES

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SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	165	131	103	86
Chelmsford Efflt	30	30	14	0	0	0	0
Abingdon	350	254	157	43	0	0	0
Carsington	140	105	50	14	0	0	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	176	176	176	176	101	22	0
Birmingham Gw	50	50	50	50	19	0	0
Vyrnwy	66	77	53	29	6	0	0
Craig Goch	629	629	629	629	629	546	372
Shropshire Gw	155	155	131	81	16	0	0
Broad Oak	38	35	32	28	24	16	9
Huntington	74	74	74	74	74	55	30
Thames Reuse	0	0	0	0	0	0	0
Severn Reuse	0	0	0	0	5	0	0

# Appendix 4 - Results for High Scenario Case HIGH2

## DEMAND FLOWS THROUGH LINK ELEMENTS

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### LINK ELEMENT NAME

### FLOWS THROUGH TIME(TCMD)

1991 1996 2001 2006 2011 2016 2021

ELY OUSE - ESSEX	0	0	0	9	43	71	88
GREAT BRADLEY	0	0	0	9	43	71	88
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	11	21	28
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	9	32	50	60
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	16	30	30	30	30
CARSINGTON - R.TRENT	0	44	112	158	175	175	175
R.SEVERN - R.TRENT (1)	0	0	0	0	0	33	85
R.SEVERN - R.TRENT (2)	0	0	0	0	0	33	85
CRAIG GOCH - R.SEVERN (1)	0	0	0	0	0	83	257
CRAIG GOCH - R.SEVERN (2)	0	0	0	0	0	83	257
SHROPSHIRE GW - R.SEVERN	0	0	24	74	139	155	155
ABINGDON - R.THAMES	0	96	193	307	350	350	350
R.THAMES	0	96	193	307	423	501	567
R.SEVERN (UNSUPRTD)	0	0	0	0	75	154	176
R.SEVERN - R.THAMES (1)	0	0	0	0	75	154	221
R.SEVERN - R.THAMES (2)	0	0	0	0	75	154	221
BIRMINGHAM GW	0	0	0	0	31	50	50
R.SEVERN	0	0	17	34	56	96	183
THAMES REUSE	0	0	0	2	18	28	36
SEVERN REUSE	0	0	5	32	56	86	114
R.THAMES - OXFORD/SWINDON	0	0	0	2	20	31	40
R.SEVERN - WESSEX	0	0	0	0	7	38	71
R.SEVERN - W.MIDLANDS	0	0	12	72	139	195	258
R.TRENT - E.MIDLANDS	0	44	112	158	206	258	310
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	2	5	8	12	16	24	31
R.SEVERN - BRISTOL	0	0	17	34	49	58	67
VYRNWY - NORTH WEST	81	70	94	118	141	147	147
HUNTINGTON - NORTH WEST	0	0	0	0	0	19	44

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### LINK ELEMENT DEVELOPMENT

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YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION TO 2021 BEYOND 2021 (£M)	UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)
2006	ELY OUSE - ESSEX ELY OUSE - ESSEX	.000 .000	.000 .000	1.861 2.259	(2.42)	4.121	2006 88 88 ( ELEMENT TOTALS )
2006	GREAT BRADLEY GREAT BRADLEY	.000 .000	.000 .000	.000 .000	( .00)	.000	2006 88 88 ( ELEMENT TOTALS )
2011	ELY OUSE ESSEX - NORTH ESSEX ELY OUSE ESSEX - NORTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 28 28 ( ELEMENT TOTALS )
2006	ELY OUSE ESSEX - SOUTH ESSEX ELY OUSE ESSEX - SOUTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2006 60 60 ( ELEMENT TOTALS )
2001	CHELMSFORD EFFLT - SOUTH ESSEX CHELMSFORD EFFLT - SOUTH ESSEX	13.500 13.500	8.720 8.720	.227 .081	( .29)	9.028	2001 30 30 ( ELEMENT TOTALS )
1996	CARSINGTON - R.TRENT CARSINGTON - R.TRENT	.000 .000	.000 .000	.000 .000	( .00)	.000	1996 175 175 ( ELEMENT TOTALS )
2016	R.SEVERN - R.TRENT (1) R.SEVERN - R.TRENT (1)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 100 100 ( ELEMENT TOTALS )

# Appendix 4 - Results for High Scenario Case HIGH2

2016	R.SEVERN - R.TRENT (2)	26.000	7.008					2016 85 85
	R.SEVERN - R.TRENT (2)	26.000	7.008	.422	1.327	(1.47)	8.756	( ELEMENT TOTALS )
2016	CRAIG GOCH - R.SEVERN (1)	.000	.000					2016 257 257
	CRAIG GOCH - R.SEVERN (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2016	CRAIG GOCH - R.SEVERN (2)	44.500	11.994					2016 257 257
	CRAIG GOCH - R.SEVERN (2)	44.500	11.994	.000	.000	(.00)	11.994	( ELEMENT TOTALS )
2001	SHROPSHIRE GW - R.SEVERN	.000	.000					2001 155 155
	SHROPSHIRE GW - R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	ABINGDON - R.THAMES	.000	.000					1996 350 350
	ABINGDON - R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	R.THAMES	.000	.000					1996 567 567
	R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2011	R.SEVERN (UNSUPRTD)	.000	.000					2011 176 176
	R.SEVERN (UNSUPRTD)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2011	R.SEVERN - R.THAMES (1)	.000	.000					2011 425 400
	R.SEVERN - R.THAMES (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2011	R.SEVERN - R.THAMES (2)	92.000	33.184					2011 221 221
	R.SEVERN - R.THAMES (2)	92.000	33.184	1.516	2.424	(1.04)	37.124	( ELEMENT TOTALS )
2011	BIRMINGHAM GW	.000	.000					2011 50 50
	BIRMINGHAM GW	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2001	R.SEVERN	.000	.000					2001 183 183
	R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2006	THAMES REUSE	.000	.000					2006 36 36
	THAMES REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2001	SEVERN REUSE	.000	.000					2001 114 114
	SEVERN REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2006	R.THAMES - OXFORD/SWINDON	.000	.000					2006 40 40
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2011	R.SEVERN - WESSEX	.000	.000					2011 71 71
	R.SEVERN - WESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
2001	R.SEVERN - W.MIDLANDS	.000	.000					2001 258 258
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1996	R.TRENT - E.MIDLANDS	50.000	43.222					1996 310 310
	R.TRENT - E.MIDLANDS	50.000	43.222	2.526	1.439	(.44)	47.187	( ELEMENT TOTALS )
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991 40 40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )
1991	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500					1991 31 31
	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500	.866	.562	(1.71)	48.928	( ELEMENT TOTALS )

# Appendix 4 - Results for High Scenario Case HIGH2

2001	R.SEVERN - BRISTOL	.000	.000					2001	67	67
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	147	147
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	HUNTINGTON - NORTH WEST	.000	.000					2016	44	44
	HUNTINGTON - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		273.500	151.629	7.417	8.093		167.140			

## UNIT COSTS OF LINKS

	DISCOUNTED (£M/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.08294	22.72	11.29	136.13
TOTAL:	.08294	22.72	11.29	136.13
2. SOUTH ESSEX				
Great Bradley	.08294	22.72	27.33	329.59
Chelmsford Efflt	.03105	8.51	9.03	290.76
TOTAL:	.05862	16.06	36.36	620.35
3. LONDON				
Abingdon	.11978	32.82	440.29	3675.72
Severn(Unsuprtd)	.03562	9.76	24.51	688.23
Craig Goch	.06551	17.95	9.94	151.67
Thames Reuse	.00000	.00	.00	186.42
TOTAL:	.10096	27.66	474.74	4702.03
4. OXFORD/SWINDON				
Abingdon	.11978	32.82	.50	4.19
Severn(Unsuprtd)	.03562	9.76	7.21	202.35
TOTAL:	.03733	10.23	7.71	206.54
5. WESSEX				
Craig Goch	.02989	8.19	.10	3.51
Severn Reuse	.00000	.00	.00	291.17
TOTAL:	.00036	.10	.10	294.68
6. WEST MIDLANDS				
Craig Goch	.02989	8.19	11.77	393.92
Shropshire Gw	.00000	.00	.00	1105.47
TOTAL:	.00785	2.15	11.77	1499.38
7. EAST MIDLANDS				
Carsington	.01904	5.22	35.75	1877.81
Birmingham Gw	.03030	8.30	8.35	275.48
Craig Goch	.07587	20.79	24.66	325.07
TOTAL:	.02775	7.60	68.76	2478.35
8. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
9. MID KENT/FLKSTNE				
Broad Oak	.21411	58.66	48.93	228.51
TOTAL:	.21411	58.66	48.93	228.51
10. BRISTOL				
Craig Goch	.02989	8.19	2.66	89.07
Shropshire Gw	.00000	.00	.00	37.81
Severn Reuse	.00000	.00	.00	362.22
TOTAL:	.00544	1.49	2.66	489.11

# Appendix 4 - Results for High Scenario Case HIGH2

11. NORTH WEST				
Vyrnwy	.00000	.00	.00	1849.25
Huntington	.08598	23.56	14.66	170.51
TOTAL:	.00726	1.99	14.66	2019.76
TOTAL			676.99	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	11	21	28
Great Bradley	SOUTH ESSEX	0	0	0	9	32	50	60
Chelmsford Efflt	SOUTH ESSEX	0	0	16	30	30	30	30
Abingdon	LONDON	0	96	193	305	350	350	350
Severn(Unsuprtd)	LONDON	0	0	0	0	55	123	136
Craig Goch	LONDON	0	0	0	0	0	0	45
Thames Reuse	LONDON	0	0	0	2	18	28	36
Abingdon	OXFORD/SWINDON	0	0	0	2	0	0	0
Severn(Unsuprtd)	OXFORD/SWINDON	0	0	0	0	20	31	40
Craig Goch	WESSEX	0	0	0	0	0	3	0
Severn Reuse	WESSEX	0	0	0	0	7	35	71
Craig Goch	WEST MIDLANDS	0	0	0	0	0	40	103
Shropshire Gw	WEST MIDLANDS	0	0	12	72	139	155	155
Carsington	EAST MIDLANDS	0	44	112	158	175	175	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	31	50	50
Craig Goch	EAST MIDLANDS	0	0	0	0	0	33	85
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	2	5	8	12	16	24	31
Craig Goch	BRISTOL	0	0	0	0	0	7	24
Shropshire Gw	BRISTOL	0	0	12	2	0	0	0
Severn Reuse	BRISTOL	0	0	5	32	49	51	43
Vyrnwy	NORTH WEST	81	70	94	118	141	147	147
Huntington	NORTH WEST	0	0	0	0	0	19	44
TOTALS		123	255	492	782	1114	1412	1693

## SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	400.0	.0	69.4	2.7	99.1	.0
LINK ELEMENTS	47.5	50.0	13.5	.0	92.0	70.5	.0
TOTALS	47.5	450.0	13.5	69.4	94.7	169.6	.0

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	11.0	22.2	35.3	41.2	44.2	47.4
LINK ELEMENTS	.0	.5	1.3	2.2	5.6	9.9	13.9
TOTALS	.0	11.5	23.5	37.5	46.8	54.1	61.4

## COST SUMMARY



## Appendix 4 - Results for High Scenario Case HIGH2

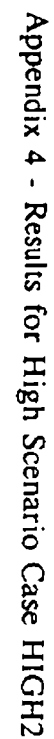
TOTAL DISCOUNTED COST FOR PLAN	=	EM 676.991
TOTAL DISCOUNTED CAPITAL COST	=	EM 570.802
TOTAL DISCOUNTED COSTS OF OPERATION	=	EM 106.190 (ALLOWANCE INCLUDED FOR BEYOND 2021 = EM 35.616)
TOTAL CAPITAL OUTLAY TO 2021	=	EM 844.700
TOTAL COSTS OF OPERATION TO 2021	=	EM 234.762

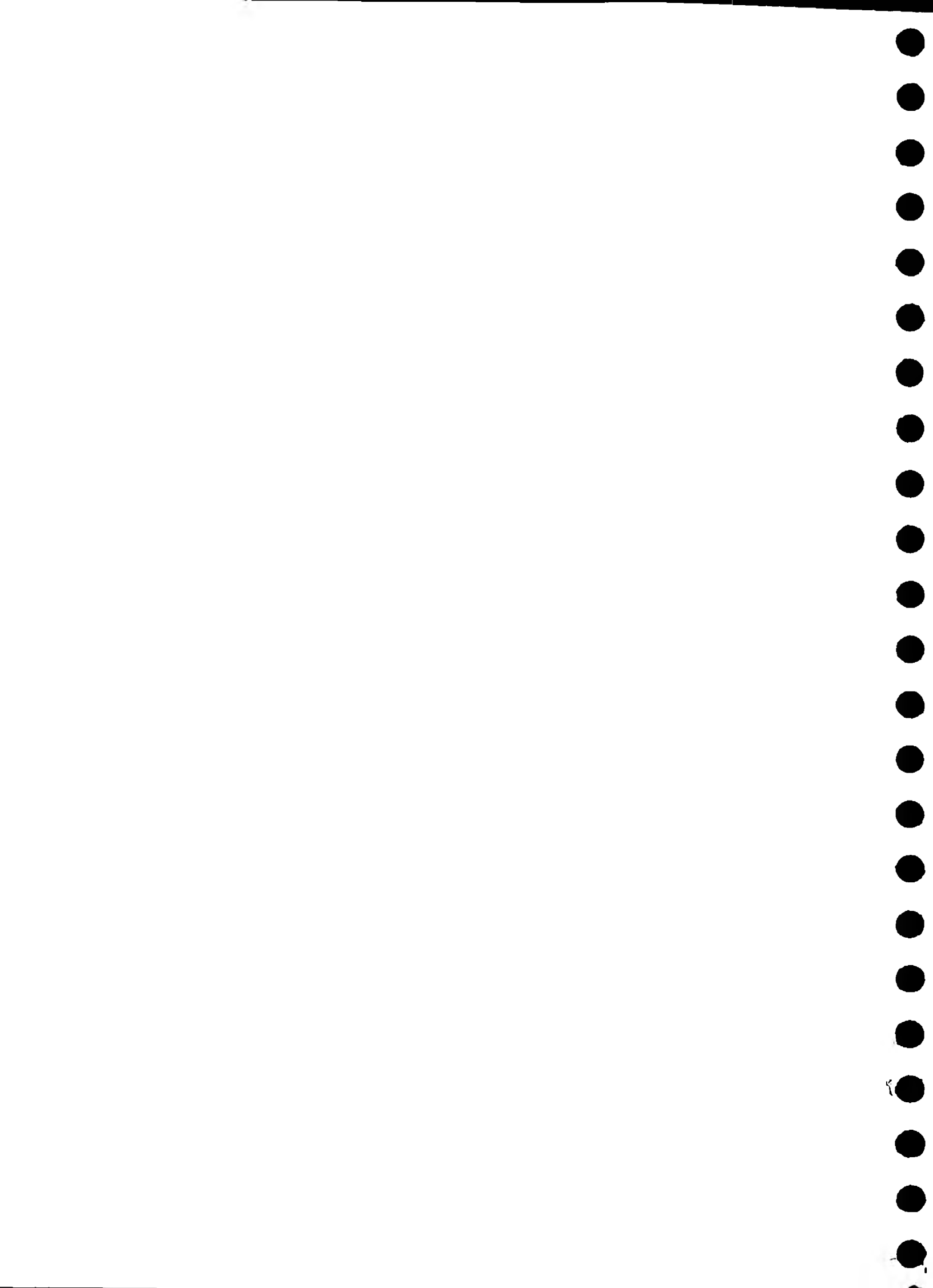
TOTAL DISCOUNTED DEMANDS = 13357.870 TCMD

### \*\*\*\*\*

#### RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
  - B. NO DEMAND CENTRES OVER SUPPLIED.
  - C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.
- \*\*\*\*\*





# Appendix 4 - Results for High Scenario Case HIGH3

## WATER RESOURCE PLANNING MODEL.

\*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:13:22.93

\*\*\*\*\*

## RESULTS

\*\*\*\*\*

(CONDENSED OUTPUT)

\*\*\*\*\*

\*\*\*\*\*

## SOURCE DEVELOPMENT

\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021	CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED OPERATING COST TO 2021	DISCOUNTED OPERATING COST BEYOND 2021	TOTAL DISCOUNTED COST
	(TCMD)	(£M)	(£M)	(£M)	(£M)	(£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
1991 Broad Oak	40	.000	.000	.000	.000	.000
1996 Carsington	140	.000	.000	.000	.000	.000
1996 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Shropshire Gw	155	.000	.000	.000	.000	.000
2001 Severn Reuse	114	.000	.000	.000	.000	.000
2006 Great Bradley	174	69.400	34.504	.000	.000	34.504
2006 Thames Reuse	36	.000	.000	.000	.000	.000
2011 Birmingham Gw	50	4.400	1.478	.769	.856	3.103
2011 Craig Goch	629	60.500	22.477	.000	.000	22.477
2016 Huntington	74	36.900	10.244	1.109	3.307	14.661
2021 Abingdon	262	400.000	82.982	.701	4.338	88.021
TOTALS FOR SOURCES		571.200	151.686	2.579	8.501	162.766

\*\*\*\*\*

## UNUSED YIELDS OF DEVELOPED SOURCES

\*\*\*\*\*

SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	113	79	51	34
Chelmsford Efflt	30	30	14	0	0	0	0
Abingdon	262	262	262	262	262	262	197
Carsington	140	105	50	14	0	0	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	50	0	0	0	0	0
Birmingham Gw	50	50	50	50	19	0	0
Vyrnwy	66	77	53	0	0	0	0
Craig Goch	629	629	629	629	459	269	138
Shropshire Gw	155	155	84	47	0	0	0
Broad Oak	38	35	32	28	24	16	9
Huntington	74	74	74	74	74	55	30
Thames Reuse	0	0	0	0	0	0	0
Severn Reuse	0	0	0	0	0	0	0

\*\*\*\*\*

# Appendix 4 - Results for High Scenario Case HIGH3

## DEMAND FLOWS THROUGH LINK ELEMENTS \*\*\*\*\*

LINK ELEMENT NAME	FLOWS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
ELY OUSE - ESSEX	0	0	0	90	124	152	169
GREAT BRADLEY	0	0	0	90	124	152	169
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	11	21	28
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	9	32	50	60
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	16	30	30	30	30
CARSINGTON - R.TRENT	0	44	112	158	175	175	175
VYRNWY - R.SEVERN	0	0	0	46	7	0	0
R.SEVERN - R.TRENT (1)	0	0	0	0	0	33	85
R.SEVERN - R.TRENT (2)	0	0	0	0	0	33	85
CRAIG GOCH - R.SEVERN (1)	0	0	0	0	170	360	491
CRAIG GOCH - R.SEVERN (2)	0	0	0	0	170	360	491
SHROPSHIRE GW - R.SEVERN	0	0	71	108	155	155	155
R.PANT - R.CHELMER - R.RODING (1)	0	0	0	81	81	81	81
R.PANT - R.CHELMER - R.RODING (2)	0	0	0	81	81	81	81
R.RODING - R.STORT (1)	0	0	0	81	81	81	81
R.RODING - R.STORT (2)	0	0	0	81	81	81	81
ABINGDON - R.THAMES	0	0	0	0	0	0	65
R.THAMES	0	96	193	226	342	420	486
R.SEVERN (UNSUPRTD)	0	96	146	146	146	146	146
R.SEVERN - R.THAMES (1)	0	96	193	226	344	423	425
R.SEVERN - R.THAMES (2)	0	96	193	226	344	423	425
BIRMINGHAM GW	0	0	0	0	31	50	50
R.SEVERN	0	0	64	114	254	373	417
THAMES REUSE	0	0	0	2	18	28	36
SEVERN REUSE	0	0	5	32	61	86	114
R.THAMES - OXFORD/SWINDON	0	0	0	2	20	31	40
R.SEVERN - WESSEX	0	0	0	0	7	38	71
R.SEVERN - W.MIDLANDS	0	0	12	72	139	195	258
R.TRENT - E.MIDLANDS	0	44	112	158	206	258	310
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	2	5	8	12	16	24	31
R.SEVERN - BRISTOL	0	0	17	34	49	58	67
VYRNWY - NORTH WEST	81	70	94	118	141	147	147
HUNTINGTON - NORTH WEST	0	0	0	0	0	19	44

## \*\*\*\*\* LINK ELEMENT DEVELOPMENT \*\*\*\*\*

YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION		UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)	
				TO 2021	BEYOND 2021				
2006	ELY OUSE - ESSEX	.000	.000					2006	169 169
	ELY OUSE - ESSEX	.000	.000	5.657	4.339	(2.42)	9.996	( ELEMENT TOTALS )	
2006	GREAT BRADLEY	.000	.000					2006	169 169
	GREAT BRADLEY	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	
2011	ELY OUSE ESSEX - NORTH ESSEX	.000	.000					2011	28 28
	ELY OUSE ESSEX - NORTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	
2006	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000					2006	60 60
	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	
2001	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720					2001	30 30
	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720	.227	.081	(.29)	9.028	( ELEMENT TOTALS )	
1996	CARSINGTON - R.TRENT	.000	.000					1996	175 175
	CARSINGTON - R.TRENT	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )	

# Appendix 4 - Results for High Scenario Case HIGH3

2006	VYRNWY - R.SEVERN	.000	.000					2006	46	46
	VYRNWY - R.SEVERN	.000	.000	.651	.000	(1.66)	.651	( ELEMENT TOTALS )		
2016	R.SEVERN - R.TRENT (1)	.000	.000					2016	100	100
	R.SEVERN - R.TRENT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	R.SEVERN - R.TRENT (2)	26.000	7.008					2016	85	85
	R.SEVERN - R.TRENT (2)	26.000	7.008	.422	1.327	(1.47)	8.756	( ELEMENT TOTALS )		
2011	CRAIG GOCH - R.SEVERN (1)	.000	.000					2011	491	491
	CRAIG GOCH - R.SEVERN (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	CRAIG GOCH - R.SEVERN (2)	44.500	16.051					2011	491	491
	CRAIG GOCH - R.SEVERN (2)	44.500	16.051	.000	.000	(.00)	16.051	( ELEMENT TOTALS )		
2001	SHROPSHIRE GW - R.SEVERN	.000	.000					2001	155	155
	SHROPSHIRE GW - R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.PANT - R.CHELMER - R.RODING (1)	.000	.000					2006	81	100
	R.PANT - R.CHELMER - R.RODING (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.PANT - R.CHELMER - R.RODING (2)	24.000	11.585					2006	81	81
	R.PANT - R.CHELMER - R.RODING (2)	24.000	11.585	.486	.266	(.31)	12.337	( ELEMENT TOTALS )		
2006	R.RODING - R.STORT (1)	.000	.000					2006	81	100
	R.RODING - R.STORT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.RODING - R.STORT (2)	11.000	5.310					2006	81	81
	R.RODING - R.STORT (2)	11.000	5.310	.149	.082	(.10)	5.541	( ELEMENT TOTALS )		
2021	ABINGDON - R.THAMES	.000	.000					2021	65	65
	ABINGDON - R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.THAMES	.000	.000					1996	486	486
	R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.SEVERN (UNSUPRTD)	.000	.000					1996	146	146
	R.SEVERN (UNSUPRTD)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.SEVERN - R.THAMES (1)	.000	.000					1996	425	400
	R.SEVERN - R.THAMES (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.SEVERN - R.THAMES (2)	212.000	183.262					1996	425	425
	R.SEVERN - R.THAMES (2)	212.000	183.262	9.850	4.662	(1.04)	197.773	( ELEMENT TOTALS )		
2011	BIRMINGHAM GW	.000	.000					2011	50	50
	BIRMINGHAM GW	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN	.000	.000					2001	417	417
	R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	THAMES REUSE	.000	.000					2006	36	36
	THAMES REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	SEVERN REUSE	.000	.000					2001	114	114
	SEVERN REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		

# Appendix 4 - Results for High Scenario Case HIGH3

2006	R.THAMES - OXFORD/SWINDON	.000	.000					2006	40	40
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	R.SEVERN - WESSEX	.000	.000					2011	71	71
	R.SEVERN - WESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN - W.MIDLANDS	.000	.000					2001	258	258
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.TRENT - E.MIDLANDS	50.000	43.222					1996	310	310
	R.TRENT - E.MIDLANDS	50.000	43.222	2.526	1.439	(.44)	47.187	( ELEMENT TOTALS )		
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991	40	40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500					1991	31	31
	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500	.866	.562	(1.71)	48.928	( ELEMENT TOTALS )		
2001	R.SEVERN - BRISTOL	.000	.000					2001	67	67
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	147	147
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	HUNTINGTON - NORTH WEST	.000	.000					2016	44	44
	HUNTINGTON - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		428.500	322.658	20.834	12.759		356.250			

## UNIT COSTS OF LINKS

	DISCOUNTED UNIT COSTS (£M/TCMD)	(P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.04753	13.02	6.47	136.13
TOTAL:	.04753	13.02	6.47	136.13
2. SOUTH ESSEX				
Great Bradley	.04753	13.02	15.67	329.59
Chelmsford Efflt	.03105	8.51	9.03	290.76
TOTAL:	.03981	10.91	24.69	620.35
3. LONDON				
Great Bradley	.06060	16.60	40.24	664.02
Abingdon	.40178	110.08	36.56	91.00
Severn(Unsuprtd)	.05152	14.11	101.28	1965.90
Vyrnwy	.05759	15.78	2.44	42.36
Craig Goch	.06797	18.62	63.81	938.87
Shropshire Gw	.05152	14.11	9.41	182.58
Thames Reuse	.00000	.00	.00	186.42
Severn Reuse	.05152	14.11	32.50	630.88
TOTAL:	.06088	16.68	286.24	4702.03
4. OXFORD/SWINDON				
Abingdon	.40178	110.08	51.46	128.08
Craig Goch	.06797	18.62	4.59	67.53
Shropshire Gw	.05152	14.11	.22	4.19
Severn Reuse	.05152	14.11	.35	6.74
TOTAL:	.27410	75.10	56.61	206.54

# Appendix 4 - Results for High Scenario Case HIGH3

5. WESSEX				
Shropshire Gw	.00000	.00	.00	271.08
Severn Reuse	.00000	.00	.00	23.59
TOTAL:	.00000	.00	.00	294.68
6. WEST MIDLANDS				
Vyrnwy	.00607	1.66	.39	64.91
Craig Goch	.01645	4.51	16.62	1010.26
Shropshire Gw	.00000	.00	.00	424.22
TOTAL:	.01135	3.11	17.02	1499.38
7. EAST MIDLANDS				
Carsington	.01904	5.22	35.75	1877.81
Birmingham Gw	.03030	8.30	8.35	275.48
Craig Goch	.06243	17.10	20.29	325.07
TOTAL:	.02598	7.12	64.40	2478.35
8. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
9. MID KENT/FLKSTNE				
Broad Oak	.21411	58.66	48.93	228.51
TOTAL:	.21411	58.66	48.93	228.51
10. BRISTOL				
Shropshire Gw	.00000	.00	.00	489.11
TOTAL:	.00000	.00	.00	489.11
11. NORTH WEST				
Vyrnwy	.00000	.00	.00	1849.25
Huntington	.08598	23.56	14.66	170.51
TOTAL:	.00726	1.99	14.66	2019.76
TOTAL			519.02	

## DEVELOPMENT OF LINKS

\*\*\*\*\*

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	11	21	28
Great Bradley	SOUTH ESSEX	0	0	0	9	32	50	60
Chelmsford Efflt	SOUTH ESSEX	0	0	16	30	30	30	30
Great Bradley	LONDON	0	0	0	81	81	81	81
Abingdon	LONDON	0	0	0	0	0	0	27
Severn(Unsuprtd)	LONDON	0	96	146	146	146	146	146
Vyrnwy	LONDON	0	0	0	15	7	0	0
Craig Goch	LONDON	0	0	0	0	110	160	172
Shropshire Gw	LONDON	0	0	42	31	0	0	0
Thames Reuse	LONDON	0	0	0	2	18	28	36
Severn Reuse	LONDON	0	0	5	32	61	86	105
Abingdon	OXFORD/SWINDON	0	0	0	0	0	0	38
Craig Goch	OXFORD/SWINDON	0	0	0	0	20	31	0
Shropshire Gw	OXFORD/SWINDON	0	0	0	2	0	0	0
Severn Reuse	OXFORD/SWINDON	0	0	0	0	0	0	2
Shropshire Gw	WESSEX	0	0	0	0	7	38	64
Severn Reuse	WESSEX	0	0	0	0	0	0	7
Vyrnwy	WEST MIDLANDS	0	0	0	31	0	0	0
Craig Goch	WEST MIDLANDS	0	0	0	0	40	136	234
Shropshire Gw	WEST MIDLANDS	0	0	12	41	99	59	24
Carsington	EAST MIDLANDS	0	44	112	158	175	175	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	31	50	50
Craig Goch	EAST MIDLANDS	0	0	0	0	0	33	85
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	2	5	8	12	16	24	31
Shropshire Gw	BRISTOL	0	0	17	34	49	58	67
Vyrnwy	NORTH WEST	81	70	94	118	141	147	147
Huntington	NORTH WEST	0	0	0	0	0	19	44
TOTALS		123	255	492	782	1114	1412	1693



\*\*\*\*\*  
SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (€M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	69.4	63.2	38.6	400.0
LINK ELEMENTS	47.5	262.0	13.5	35.0	44.5	26.0	.0
TOTALS	47.5	262.0	13.5	104.4	107.7	64.6	400.0

\*\*\*\*\*  
SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (€M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.9	3.9	14.6
LINK ELEMENTS	.0	2.3	4.9	11.5	15.8	19.2	22.0
TOTALS	.0	2.3	4.9	11.5	16.7	23.1	36.6

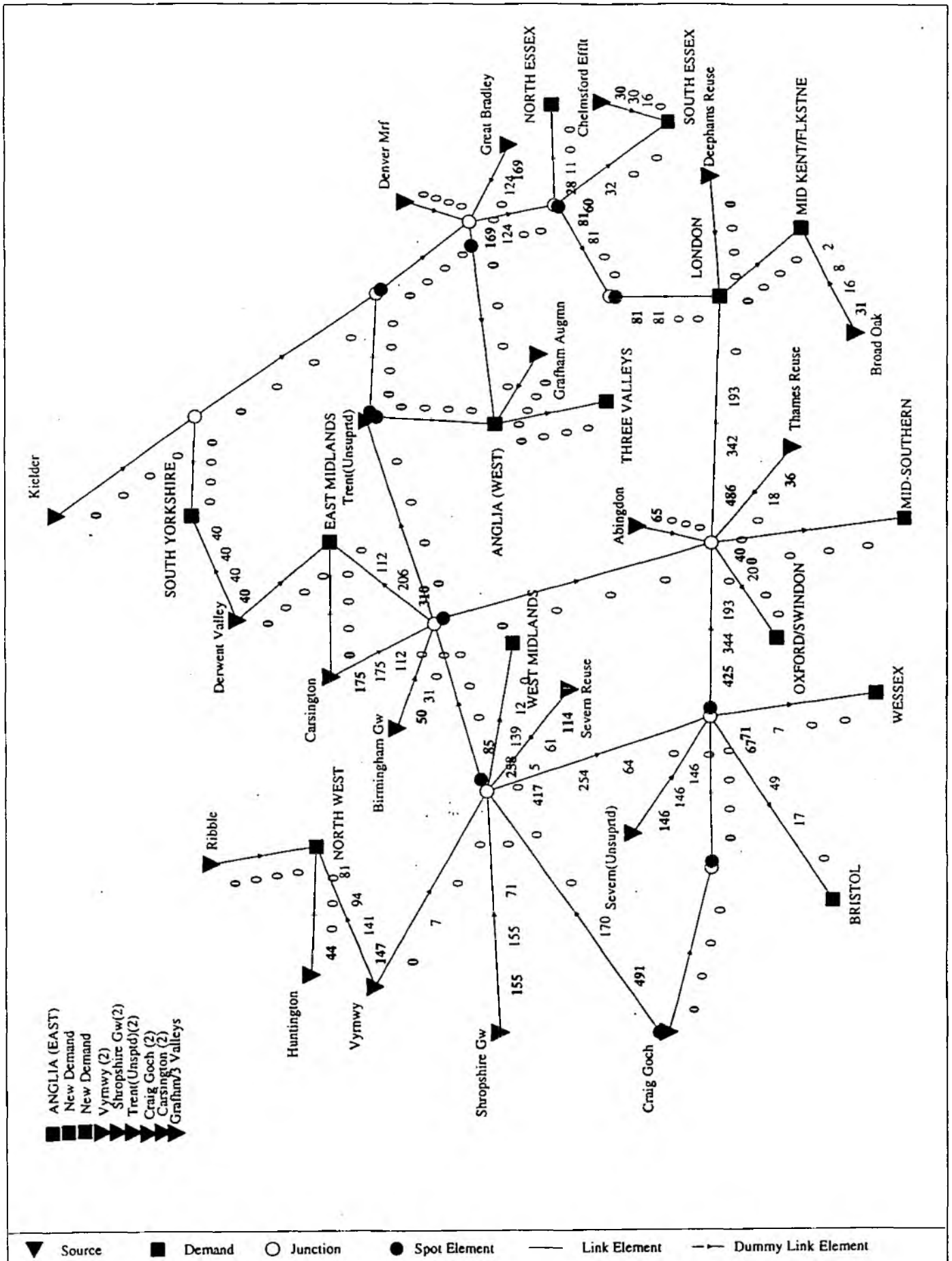
\*\*\*\*\*  
COST SUMMARY

TOTAL DISCOUNTED COST FOR PLAN	= €M 519.016
TOTAL DISCOUNTED CAPITAL COST	= €M 474.343
TOTAL DISCOUNTED COSTS OF OPERATION	= €M 44.673 (ALLOWANCE INCLUDED FOR BEYOND 2021 = €M 21.260)
TOTAL CAPITAL OUTLAY TO 2021	= €M 999.700
TOTAL COSTS OF OPERATION TO 2021	= €M 95.217

TOTAL DISCOUNTED DEMANDS = 13357.870 TCMO  
\*\*\*\*\*

## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.  
B. NO DEMAND CENTRES OVER SUPPLIED.  
C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.
- \*\*\*\*\*



WATER RESOURCE PLANNING MODEL.  
\*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:14:58.34

\*\*\*\*\*  
RESULTS  
\*\*\*\*\*

(CONDENSED OUTPUT)  
\*\*\*\*\*

\*\*\*\*\*  
SOURCE DEVELOPMENT  
\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021 (TCMD)	CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED OPERATING COST TO 2021 (£M)	DISCOUNTED OPERATING COST BEYOND 2021 (£M)	TOTAL DISCOUNTED COST (£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
1991 Broad Oak	40	.000	.000	.000	.000	.000
1996 Deephams Reuse	100	.000	.000	.000	.000	.000
1996 Carsington	140	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2001 Shropshire Gw	155	.000	.000	.000	.000	.000
2001 Severn Reuse	114	.000	.000	.000	.000	.000
2006 Great Bradley	174	69.400	34.504	.000	.000	34.504
2006 Thames Reuse	36	.000	.000	.000	.000	.000
2011 Birmingham Gw	50	4.400	1.478	.769	.856	3.103
2011 Craig Goch	629	60.500	22.477	.000	.000	22.477
2016 Huntington	74	36.900	10.244	1.109	3.307	14.661
TOTALS FOR SOURCES		171.200	68.703	1.879	4.163	74.745

\*\*\*\*\*  
UNUSED YIELDS OF DEVELOPED SOURCES  
\*\*\*\*\*

SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	127	79	51	34
Chelmsford Efflt	30	30	14	0	0	0	0
Deephams Reuse	100	4	0	0	0	0	0
Carsington	140	105	50	14	0	0	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	146	53	0	0	0	0
Birmingham Gw	50	50	50	50	19	0	0
Vyrnwy	66	77	53	29	6	0	0
Craig Goch	629	629	629	629	552	369	173
Shropshire Gw	155	155	131	79	0	0	0
Broad Oak	38	35	32	28	24	16	9
Huntington	74	74	74	74	74	55	30
Thames Reuse	0	0	0	0	0	0	0
Severn Reuse	0	0	0	0	0	0	0

# Appendix 4 - Results for High Scenario Case HIGH4

## DEMAND FLOWS THROUGH LINK ELEMENTS \*\*\*\*\*

LINK ELEMENT NAME	FLOWS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
ELY OUSE - ESSEX	0	0	0	68	124	152	169
GREAT BRADLEY	0	0	0	68	124	152	169
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	11	21	28
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	9	32	50	60
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	16	30	30	30	30
CARSINGTON - R.TRENT	0	44	112	158	175	175	175
R.SEVERN - R.TRENT (1)	0	0	0	0	0	33	85
R.SEVERN - R.TRENT (2)	0	0	0	0	0	33	85
CRAIG GOCH - R.SEVERN (1)	0	0	0	0	77	260	456
CRAIG GOCH - R.SEVERN (2)	0	0	0	0	77	260	456
SHROPSHIRE GW - R.SEVERN	0	0	24	76	155	155	155
R.PANT - R.CHELMER - R.RODING (1)	0	0	0	59	81	81	81
R.PANT - R.CHELMER - R.RODING (2)	0	0	0	59	81	81	81
R.RODING - R.STORT (1)	0	0	0	59	81	81	81
R.RODING - R.STORT (2)	0	0	0	59	81	81	81
DEEPHAMS REUSE - LONDON	0	96	100	100	100	100	100
R.THAMES	0	0	93	148	242	320	386
R.SEVERN (UNSUPRTD)	0	0	93	146	146	146	146
R.SEVERN - R.THAMES (1)	0	0	93	148	244	323	390
R.SEVERN - R.THAMES (2)	0	0	93	148	244	323	390
BIRMINGHAM GW	0	0	0	0	31	50	50
R.SEVERN	0	0	17	36	154	273	382
THAMES REUSE	0	0	0	2	18	28	36
SEVERN REUSE	0	0	5	32	61	86	114
R.THAMES - OXFORD/SWINDON	0	0	0	2	20	31	40
R.SEVERN - WESSEX	0	0	0	0	7	38	71
R.SEVERN - W.MIDLANDS	0	0	12	72	139	195	258
R.TRENT - E.MIDLANDS	0	44	112	158	206	258	310
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	2	5	8	12	16	24	31
R.SEVERN - BRISTOL	0	0	17	34	49	58	67
VYRNWY - NORTH WEST	81	70	94	118	141	147	147
HUNTINGTON - NORTH WEST	0	0	0	0	0	19	44

## \*\*\*\*\* LINK ELEMENT DEVELOPMENT \*\*\*\*\*

YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION		UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)		
				TO 2021	BEYOND 2021					
2006	ELY OUSE - ESSEX	.000	.000					2006	169	169
	ELY OUSE - ESSEX	.000	.000	5.249	4.339	(2.42)	9.588	( ELEMENT TOTALS )		
2006	GREAT BRADLEY	.000	.000					2006	169	169
	GREAT BRADLEY	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	ELY OUSE ESSEX - NORTH ESSEX	.000	.000					2011	28	28
	ELY OUSE ESSEX - NORTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000					2006	60	60
	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720					2001	30	30
	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720	.227	.081	(.29)	9.028	( ELEMENT TOTALS )		
1996	CARSINGTON - R.TRENT	.000	.000					1996	175	175
	CARSINGTON - R.TRENT	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		

# Appendix 4 - Results for High Scenario Case HIGH4

2016	R.SEVERN - R.TRENT (1)	.000	.000					2016	100	100
	R.SEVERN - R.TRENT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	R.SEVERN - R.TRENT (2)	26.000	7.008					2016	85	85
	R.SEVERN - R.TRENT (2)	26.000	7.008	.422	1.327	(1.47)	8.756	( ELEMENT TOTALS )		
2011	CRAIG GOCH - R.SEVERN (1)	.000	.000					2011	456	456
	CRAIG GOCH - R.SEVERN (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	CRAIG GOCH - R.SEVERN (2)	44.500	16.051					2011	456	456
	CRAIG GOCH - R.SEVERN (2)	44.500	16.051	.000	.000	(.00)	16.051	( ELEMENT TOTALS )		
2001	SHROPSHIRE GW - R.SEVERN	.000	.000					2001	155	155
	SHROPSHIRE GW - R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.PANT - R.CHELMER - R.RODING (1)	.000	.000					2006	81	100
	R.PANT - R.CHELMER - R.RODING (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.PANT - R.CHELMER - R.RODING (2)	24.000	11.585					2006	81	81
	R.PANT - R.CHELMER - R.RODING (2)	24.000	11.585	.434	.266	(.31)	12.285	( ELEMENT TOTALS )		
2006	R.RODING - R.STORT (1)	.000	.000					2006	81	100
	R.RODING - R.STORT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.RODING - R.STORT (2)	11.000	5.310					2006	81	81
	R.RODING - R.STORT (2)	11.000	5.310	.133	.082	(.10)	5.525	( ELEMENT TOTALS )		
1996	DEEPHAMS REUSE - LONDON	37.000	31.984					1996	100	100
	DEEPHAMS REUSE - LONDON	37.000	31.984	12.440	3.047	(2.91)	47.471	( ELEMENT TOTALS )		
2001	R.THAMES	.000	.000					2001	386	386
	R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN (UNSUPRTD)	.000	.000					2001	146	146
	R.SEVERN (UNSUPRTD)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN - R.THAMES (1)	.000	.000					2001	425	400
	R.SEVERN - R.THAMES (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN - R.THAMES (2)	92.000	59.428					2001	390	390
	R.SEVERN - R.THAMES (2)	92.000	59.428	5.717	4.278	(1.04)	69.424	( ELEMENT TOTALS )		
2011	BIRMINGHAM GW	.000	.000					2011	50	50
	BIRMINGHAM GW	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN	.000	.000					2001	382	382
	R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	THAMES REUSE	.000	.000					2006	36	36
	THAMES REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	SEVERN REUSE	.000	.000					2001	114	114
	SEVERN REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.THAMES - OXFORD/SWINDON	.000	.000					2006	40	40
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		

# Appendix 4 - Results for High Scenario Case HIGH4

2011	R.SEVERN - WESSEX	.000	.000					2011	71	71
	R.SEVERN - WESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN - W.MIDLANDS	.000	.000					2001	258	258
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.TRENT - E.MIDLANDS	50.000	43.222					1996	310	310
	R.TRENT - E.MIDLANDS	50.000	43.222	2.526	1.439	(.44)	47.187	( ELEMENT TOTALS )		
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991	40	40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500					1991	31	31
	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500	.866	.562	(1.71)	48.928	( ELEMENT TOTALS )		
2001	R.SEVERN - BRISTOL	.000	.000					2001	67	67
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	147	147
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	HUNTINGTON - NORTH WEST	.000	.000					2016	44	44
	HUNTINGTON - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		345.500	230.809	28.014	15.422		274.245			

## UNIT COSTS OF LINKS

\*\*\*\*\*

	DISCOUNTED (£M/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.04884	13.38	6.65	136.13
TOTAL:	.04884	13.38	6.65	136.13
2. SOUTH ESSEX				
Great Bradley	.04884	13.38	16.10	329.59
Chelmsford Efflt	.03105	8.51	9.03	290.76
TOTAL:	.04050	11.10	25.13	620.35
3. LONDON				
Great Bradley	.06336	17.36	39.15	617.96
Deephams Reuse	.03252	8.91	47.47	1459.92
Severn(Unsuprtd)	.02625	7.19	38.26	1457.45
Craig Goch	.04590	12.57	19.76	430.41
Thames Reuse	.00000	.00	.00	186.42
Severn Reuse	.02625	7.19	14.44	549.87
TOTAL:	.03383	9.27	159.08	4702.03
4. OXFORD/SWINDON				
Craig Goch	.04590	12.57	7.90	172.02
Shropshire Gw	.02625	7.19	.11	4.19
Severn Reuse	.02625	7.19	.80	30.33
TOTAL:	.04261	11.68	8.80	206.54
5. WESSEX				
Shropshire Gw	.00000	.00	.00	294.68
TOTAL:	.00000	.00	.00	294.68
6. WEST MIDLANDS				
Craig Goch	.01964	5.38	20.31	1033.85

# Appendix 4 - Results for High Scenario Case HIGH4

Shropshire Gw	.00000	.00	.00	465.53
TOTAL:	.01354	3.71	20.31	1499.38
7. EAST MIDLANDS				
Carsington	.01904	5.22	35.75	1877.81
Birmingham Gw	.03030	8.30	8.35	275.48
Craig Goch	.06562	17.98	21.33	325.07
TOTAL:	.02640	7.23	65.43	2478.35
8. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
9. MID KENT/FLKSTNE				
Broad Oak	.21411	58.66	48.93	228.51
TOTAL:	.21411	58.66	48.93	228.51
10. BRISTOL				
Shropshire Gw	.00000	.00	.00	408.10
Severn Reuse	.00000	.00	.00	81.01
TOTAL:	.00000	.00	.00	489.11
11. NORTH WEST				
Vyrnwy	.00000	.00	.00	1849.25
Huntington	.08598	23.56	14.66	170.51
TOTAL:	.00726	1.99	14.66	2019.76
TOTAL			348.99	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	11	21	28
Great Bradley	SOUTH ESSEX	0	0	0	9	32	50	60
Chelmsford Efflt	SOUTH ESSEX	0	0	16	30	30	30	30
Great Bradley	LONDON	0	0	0	59	81	81	81
Deephams Reuse	LONDON	0	96	100	100	100	100	100
Severn(Unsuprtd)	LONDON	0	0	93	146	146	146	146
Craig Goch	LONDON	0	0	0	0	17	60	99
Thames Reuse	LONDON	0	0	0	2	18	28	36
Severn Reuse	LONDON	0	0	0	0	61	86	105
Craig Goch	OXFORD/SWINDON	0	0	0	0	20	31	31
Shropshire Gw	OXFORD/SWINDON	0	0	0	2	0	0	0
Severn Reuse	OXFORD/SWINDON	0	0	0	0	0	0	9
Shropshire Gw	WESSEX	0	0	0	0	7	38	71
Craig Goch	WEST MIDLANDS	0	0	0	0	40	136	241
Shropshire Gw	WEST MIDLANDS	0	0	12	72	99	59	17
Carsington	EAST MIDLANDS	0	44	112	158	175	175	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	31	50	50
Craig Goch	EAST MIDLANDS	0	0	0	0	0	33	85
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	2	5	8	12	16	24	31
Shropshire Gw	BRISTOL	0	0	12	2	49	58	67
Severn Reuse	BRISTOL	0	0	5	32	0	0	0
Vyrnwy	NORTH WEST	81	70	94	118	141	147	147
Huntington	NORTH WEST	0	0	0	0	0	19	44
TOTALS		123	255	492	782	1114	1412	1693

## SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	69.4	63.2	38.6	.0

# Appendix 4 - Results for High Scenario Case HIGH4

LINK ELEMENTS	47.5	87.0	105.5	35.0	44.5	26.0	.0
TOTALS	47.5	87.0	105.5	104.4	107.7	64.6	.0

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (EM/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.9	3.9	7.2
LINK ELEMENTS	.0	5.8	8.3	13.3	18.2	22.5	26.6
TOTALS	.0	5.8	8.3	13.3	19.1	26.5	33.7

## COST SUMMARY

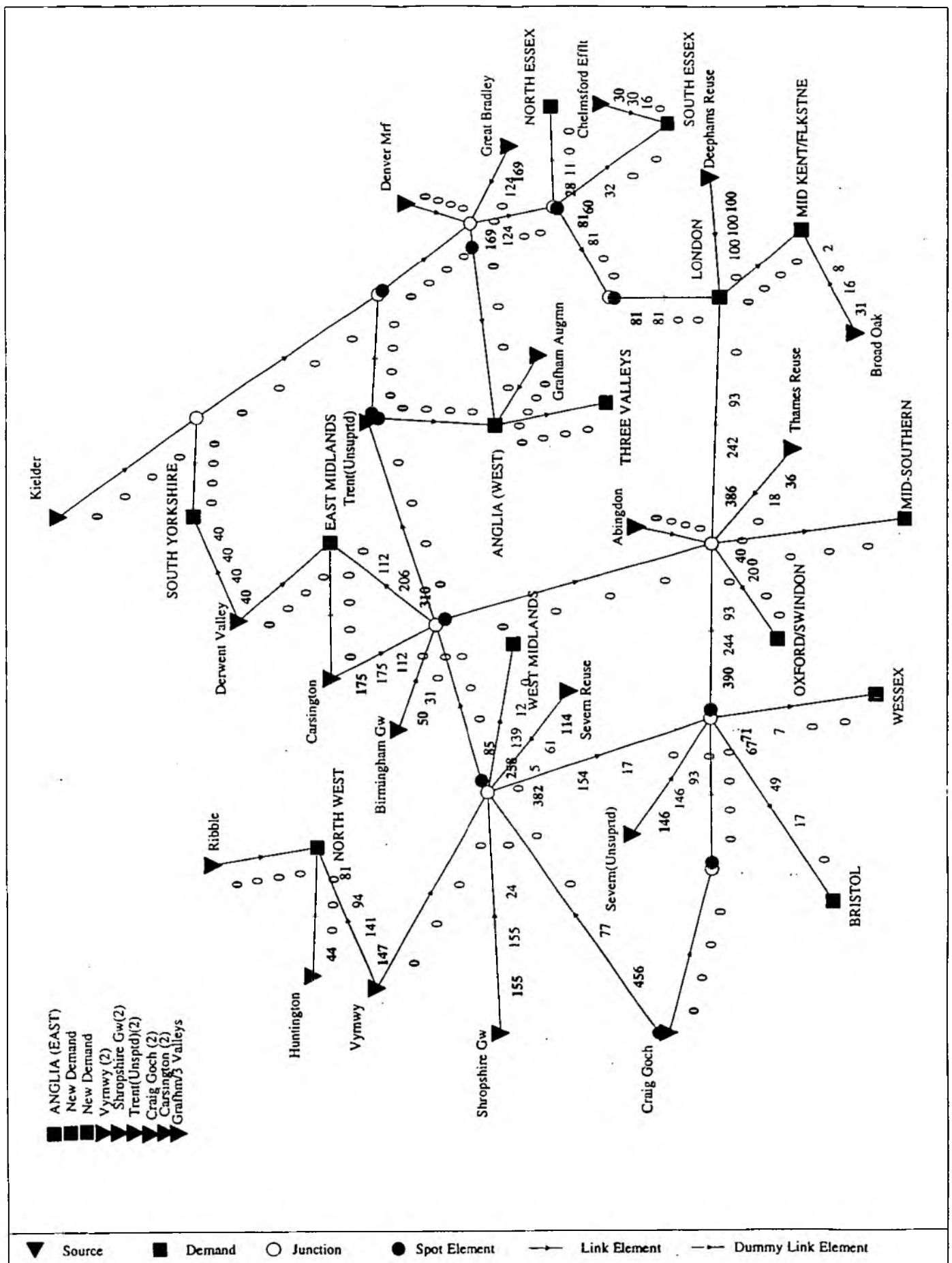
TOTAL DISCOUNTED COST FOR PLAN	=	EM 348.990
TOTAL DISCOUNTED CAPITAL COST	=	EM 299.512
TOTAL DISCOUNTED COSTS OF OPERATION	=	EM 49.477 (ALLOWANCE INCLUDED FOR BEYOND 2021 = EM 19.585)
TOTAL CAPITAL OUTLAY TO 2021	=	EM 516.700
TOTAL COSTS OF OPERATION TO 2021	=	EM 106.705

TOTAL DISCOUNTED DEMANDS = 13357.870 TCMD

## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
- B. NO DEMAND CENTRES OVER SUPPLIED.
- C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.





# Appendix 4 - Results for High Scenario Case HIGH5

## WATER RESOURCE PLANNING MODEL. \*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:33:57.66

## \*\*\*\*\* RESULTS \*\*\*\*\* (CONDENSED OUTPUT) \*\*\*\*\*

## \*\*\*\*\* SOURCE DEVELOPMENT \*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021	CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED OPERATING COST TO 2021	DISCOUNTED OPERATING COST BEYOND 2021	TOTAL DISCOUNTED COST
	(TCMD)	(£M)	(£M)	(£M)	(£M)	(£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
1991 Broad Oak	40	.000	.000	.000	.000	.000
1996 Carsington	140	.000	.000	.000	.000	.000
1996 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Shropshire Gw	155	.000	.000	.000	.000	.000
2001 Severn Reuse	114	.000	.000	.000	.000	.000
2006 Trent(Unsuprtd)	105	.000	.000	.000	.000	.000
2006 Craig Goch	629	60.500	30.079	.000	.000	30.079
2006 Thames Reuse	36	.000	.000	.000	.000	.000
2011 Birmingham Gw	50	4.400	1.478	.769	.856	3.103
2016 Abingdon	262	400.000	111.049	3.752	9.744	124.545
2016 Huntingdon	74	36.900	10.244	1.109	3.307	14.661
TOTALS FOR SOURCES		501.800	152.851	5.630	13.907	172.388

## \*\*\*\*\* UNUSED YIELDS OF DEVELOPED SOURCES \*\*\*\*\*

SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Chelmsford Efflt	30	30	14	0	0	0	0
Trent(Unsuprtd)	105	105	105	96	62	34	17
Abingdon	262	262	262	262	262	181	116
Carsington	140	105	50	14	0	0	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	50	0	0	0	0	0
Birmingham Gw	50	50	50	50	19	0	0
Vyrnwy	66	77	53	0	0	0	0
Craig Goch	629	629	629	548	378	269	138
Shropshire Gw	155	155	84	47	0	0	0
Broad Oak	38	35	32	28	24	16	9
Huntingdon	74	74	74	74	74	55	30
Thames Reuse	0	0	0	0	0	0	0
Severn Reuse	0	0	0	0	0	0	0

# Appendix 4 - Results for High Scenario Case HIGH5

## DEMAND FLOWS THROUGH LINK ELEMENTS

\*\*\*\*\*

### LINK ELEMENT NAME

### FLOWS THROUGH TIME(TCMD)

1991 1996 2001 2006 2011 2016 2021

ELY OUSE - ESSEX	0	0	0	9	43	71	88
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	11	21	28
R.TRENT - R.WITHAM (1)	0	0	0	9	43	71	88
R.TRENT - R.WITHAM (2)	0	0	0	9	43	71	88
R.WITHAM - R.ELY OUSE (1)	0	0	0	9	43	71	88
R.WITHAM - R.ELY OUSE (2)	0	0	0	9	43	71	88
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	9	32	50	60
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	16	30	30	30	30
CARSINGTON - R.TRENT	0	44	112	158	175	175	175
VYRNWY - R.SEVERN	0	0	0	46	7	0	0
R.SEVERN - R.TRENT (1)	0	0	0	0	0	33	85
R.SEVERN - R.TRENT (2)	0	0	0	0	0	33	85
CRAIG GOCH - R.SEVERN (1)	0	0	0	81	251	360	491
CRAIG GOCH - R.SEVERN (2)	0	0	0	81	251	360	491
SHROPSHIRE GW - R.SEVERN	0	0	71	108	155	155	155
ABINGDON - R.THAMES	0	0	0	0	0	81	146
R.THAMES	0	96	193	307	423	501	567
R.SEVERN (UNSUPRTD)	0	96	146	146	146	146	146
R.SEVERN - R.THAMES (1)	0	96	193	307	425	423	425
R.SEVERN - R.THAMES (2)	0	96	193	307	425	423	425
BIRMINGHAM GW	0	0	0	0	31	50	50
R.SEVERN	0	0	64	195	335	373	417
THAMES REUSE	0	0	0	2	18	28	36
SEVERN REUSE	0	0	5	32	61	86	114
R.THAMES - OXFORD/SWINDON	0	0	0	2	20	31	40
R.SEVERN - WESSEX	0	0	0	0	7	38	71
R.SEVERN - W.MIDLANDS	0	0	12	72	139	195	258
R.TRENT - E.MIDLANDS	0	44	112	158	206	258	310
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	2	5	8	12	16	24	31
R.SEVERN - BRISTOL	0	0	17	34	49	58	67
VYRNWY - NORTH WEST	81	70	94	118	141	147	147
HUNTINGTON - NORTH WEST	0	0	0	0	0	19	44

\*\*\*\*\*

### LINK ELEMENT DEVELOPMENT

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YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED COST OF OPERATION	UNIT COST OF OPERATION	TOTAL DISCOUNTED COST	BASE YEARS FOR REPLICATION	AVG PEAK
		(£M)	(£M)	TO 2021 BEYOND 2021	(P/M3)	(£M)		(TCMD)
2006	ELY OUSE - ESSEX	.000	.000				2006 88 88	
	ELY OUSE - ESSEX	.000	.000	1.861 2.259	(2.42)	4.121	( ELEMENT TOTALS )	
2011	ELY OUSE ESSEX - NORTH ESSEX	.000	.000				2011 28 28	
	ELY OUSE ESSEX - NORTH ESSEX	.000	.000	.000 .000	( .00)	.000	( ELEMENT TOTALS )	
2006	R.TRENT - R.WITHAM (1)	.000	.000				2006 88 88	
	R.TRENT - R.WITHAM (1)	.000	.000	.000 .000	( .00)	.000	( ELEMENT TOTALS )	
2006	R.TRENT - R.WITHAM (2)	18.000	8.689				2006 88 88	
	R.TRENT - R.WITHAM (2)	18.000	8.689	.065 .079	( .08)	8.833	( ELEMENT TOTALS )	
2006	R.WITHAM - R.ELY OUSE (1)	.000	.000				2006 88 88	
	R.WITHAM - R.ELY OUSE (1)	.000	.000	.000 .000	( .00)	.000	( ELEMENT TOTALS )	
2006	R.WITHAM - R.ELY OUSE (2)	149.000	71.922				2006 88 88	
	R.WITHAM - R.ELY OUSE (2)	149.000	71.922	.722 .876	( .94)	73.521	( ELEMENT TOTALS )	

# Appendix 4 - Results for High Scenario Case HIGH5

2006	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000					2006	60	60
	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720					2001	30	30
	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720	.227	.081	(.29)	9.028	( ELEMENT TOTALS )		
1996	CARSINGTON - R.TRENT	.000	.000					1996	175	175
	CARSINGTON - R.TRENT	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	VYRNWY - R.SEVERN	.000	.000					2006	46	46
	VYRNWY - R.SEVERN	.000	.000	.651	.000	(1.66)	.651	( ELEMENT TOTALS )		
2016	R.SEVERN - R.TRENT (1)	.000	.000					2016	100	100
	R.SEVERN - R.TRENT (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	R.SEVERN - R.TRENT (2)	26.000	7.008					2016	85	85
	R.SEVERN - R.TRENT (2)	26.000	7.008	.422	1.327	(1.47)	8.756	( ELEMENT TOTALS )		
2006	CRAIG GOCH - R.SEVERN (1)	.000	.000					2006	491	491
	CRAIG GOCH - R.SEVERN (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	CRAIG GOCH - R.SEVERN (2)	44.500	21.480					2006	491	491
	CRAIG GOCH - R.SEVERN (2)	44.500	21.480	.000	.000	(.00)	21.480	( ELEMENT TOTALS )		
2001	SHROPSHIRE GW - R.SEVERN	.000	.000					2001	155	155
	SHROPSHIRE GW - R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	ABINGDON - R.THAMES	.000	.000					2016	146	146
	ABINGDON - R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.THAMES	.000	.000					1996	567	567
	R.THAMES	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.SEVERN (UNSUPRTD)	.000	.000					1996	146	146
	R.SEVERN (UNSUPRTD)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.SEVERN - R.THAMES (1)	.000	.000					1996	425	400
	R.SEVERN - R.THAMES (1)	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.SEVERN - R.THAMES (2)	92.000	79.529					1996	425	425
	R.SEVERN - R.THAMES (2)	92.000	79.529	10.970	4.662	(1.04)	95.160	( ELEMENT TOTALS )		
2011	BIRMINGHAM GW	.000	.000					2011	50	50
	BIRMINGHAM GW	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN	.000	.000					2001	417	417
	R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	THAMES REUSE	.000	.000					2006	36	36
	THAMES REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	SEVERN REUSE	.000	.000					2001	114	114
	SEVERN REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2006	R.THAMES - OXFORD/SWINDON	.000	.000					2006	40	40
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		

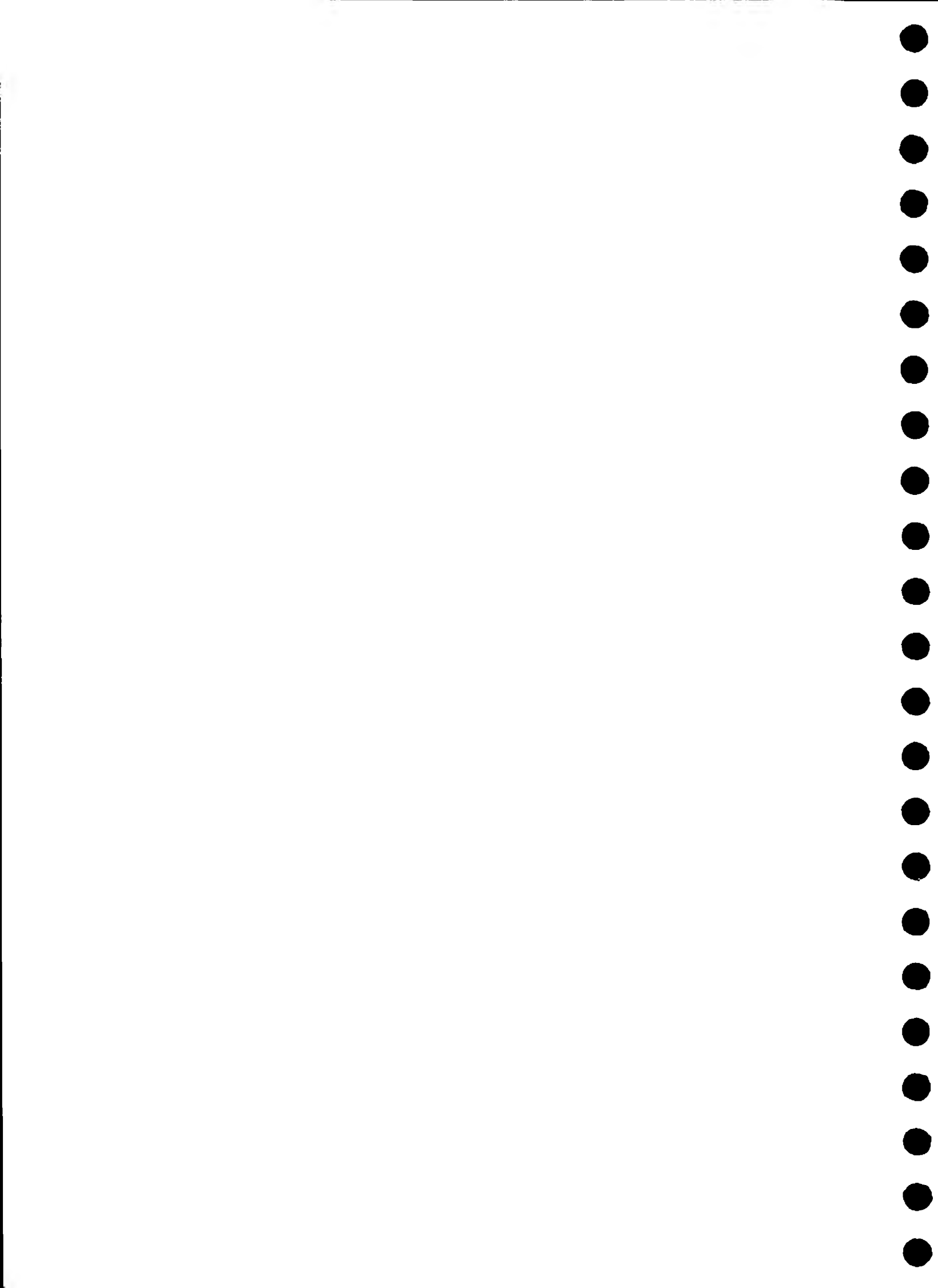
# Appendix 4 - Results for High Scenario Case HIGH5

2011	R.SEVERN - WESSEX	.000	.000					2011	71	71
	R.SEVERN - WESSEX	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN - W.MIDLANDS	.000	.000					2001	258	258
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1996	R.TRENT - E.MIDLANDS	50.000	43.222					1996	310	310
	R.TRENT - E.MIDLANDS	50.000	43.222	2.526	1.439	(.44)	47.187	( ELEMENT TOTALS )		
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991	40	40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500					1991	31	31
	BROAD OAK - MID KENT/FLKSTNE	47.500	47.500	.866	.562	(1.71)	48.928	( ELEMENT TOTALS )		
2001	R.SEVERN - BRISTOL	.000	.000					2001	67	67
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	147	147
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	HUNTINGTON - NORTH WEST	.000	.000					2016	44	44
	HUNTINGTON - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		440.500	288.070	18.310	11.286		317.666			

## UNIT COSTS OF LINKS

\*\*\*\*\*

	DISCOUNTED (£M/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Trent(Unsuprtd)	.18568	50.87	25.28	136.13
TOTAL:	.18568	50.87	25.28	136.13
2. SOUTH ESSEX				
Chelmsford Efflt	.03105	8.51	9.03	290.76
Trent(Unsuprtd)	.18568	50.87	61.20	329.59
TOTAL:	.11320	31.01	70.23	620.35
3. LONDON				
Abingdon	.21225	58.15	97.36	458.70
Severn(Unsuprtd)	.02301	6.30	45.24	1965.90
Vyrnwy	.02908	7.97	1.23	42.36
Craig Goch	.04256	11.66	52.56	1235.19
Shropshire Gw	.02301	6.30	4.20	182.58
Thames Reuse	.00000	.00	.00	186.42
Severn Reuse	.02301	6.30	14.52	630.88
TOTAL:	.04575	12.53	215.11	4702.03
4. OXFORD/SWINDON				
Abingdon	.21225	58.15	27.18	128.08
Craig Goch	.04256	11.66	2.87	67.53
Shropshire Gw	.02301	6.30	.10	4.19
Severn Reuse	.02301	6.30	.16	6.74
TOTAL:	.14675	40.21	30.31	206.54
5. WESSEX				
Shropshire Gw	.00000	.00	.00	271.08
Severn Reuse	.00000	.00	.00	23.59
TOTAL:	.00000	.00	.00	294.68



# Appendix 4 - Results for High Scenario Case HIGH5

6. WEST MIDLANDS				
Vyrnwy	.00607	1.66	.39	64.91
Craig Goch	.01954	5.35	19.75	1010.26
Shropshire Gw	.00000	.00	.00	424.22
TOTAL:	.01343	3.68	20.14	1499.38
7. EAST MIDLANDS				
Carsington	.01904	5.22	35.75	1877.81
Birmingham Gw	.03030	8.30	8.35	275.48
Craig Goch	.06552	17.95	21.30	325.07
TOTAL:	.02639	7.23	65.40	2478.35
8. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
9. MID KENT/FLKSTNE				
Broad Oak	.21411	58.66	48.93	228.51
TOTAL:	.21411	58.66	48.93	228.51
10. BRISTOL				
Shropshire Gw	.00000	.00	.00	489.11
TOTAL:	.00000	.00	.00	489.11
11. NORTH WEST				
Vyrnwy	.00000	.00	.00	1849.25
Huntington	.08598	23.56	14.66	170.51
TOTAL:	.00726	1.99	14.66	2019.76
TOTAL			490.05	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Trent(Unsuprtd)	NORTH ESSEX	0	0	0	0	11	21	28
Chelmsford Efflt	SOUTH ESSEX	0	0	16	30	30	30	30
Trent(Unsuprtd)	SOUTH ESSEX	0	0	0	9	32	50	60
Abingdon	LONDON	0	0	0	0	0	81	108
Severn(Unsuprtd)	LONDON	0	96	146	146	146	146	146
Vyrnwy	LONDON	0	0	0	15	7	0	0
Craig Goch	LONDON	0	0	0	81	191	160	172
Shropshire Gw	LONDON	0	0	42	31	0	0	0
Thames Reuse	LONDON	0	0	0	2	18	28	36
Severn Reuse	LONDON	0	0	5	32	61	86	105
Abingdon	OXFORD/SWINDON	0	0	0	0	0	0	38
Craig Goch	OXFORD/SWINDON	0	0	0	0	20	31	0
Shropshire Gw	OXFORD/SWINDON	0	0	0	2	0	0	0
Severn Reuse	OXFORD/SWINDON	0	0	0	0	0	0	2
Shropshire Gw	WESSEX	0	0	0	0	7	38	64
Severn Reuse	WESSEX	0	0	0	0	0	0	7
Vyrnwy	WEST MIDLANDS	0	0	0	31	0	0	0
Craig Goch	WEST MIDLANDS	0	0	0	0	40	136	234
Shropshire Gw	WEST MIDLANDS	0	0	12	41	99	59	24
Carsington	EAST MIDLANDS	0	44	112	158	175	175	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	31	50	50
Craig Goch	EAST MIDLANDS	0	0	0	0	0	33	85
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	2	5	8	12	16	24	31
Shropshire Gw	BRISTOL	0	0	17	34	49	58	67
Vyrnwy	NORTH WEST	81	70	94	118	141	147	147
Huntington	NORTH WEST	0	0	0	0	0	19	44
TOTALS		123	255	492	782	1114	1412	1693

## SUMMARY OF CAPITAL COSTS;

# Appendix 4 - Results for High Scenario Case HIGH5

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	60.5	2.7	438.6	.0
LINK ELEMENTS	47.5	142.0	13.5	211.5	.0	26.0	.0
TOTALS	47.5	142.0	13.5	272.0	2.7	464.6	.0

\*\*\*\*\*

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.9	13.3	24.0
LINK ELEMENTS	.0	2.3	4.9	9.0	13.9	16.3	19.4
TOTALS	.0	2.3	4.9	9.0	14.8	29.6	43.4

\*\*\*\*\*

## COST SUMMARY

\*\*\*\*\*

TOTAL DISCOUNTED COST FOR PLAN	= £M 490.054
TOTAL DISCOUNTED CAPITAL COST	= £M 440.921
TOTAL DISCOUNTED COSTS OF OPERATION	= £M 49.134 (ALLOWANCE INCLUDED FOR BEYOND 2021 = £M 25.194)
TOTAL CAPITAL OUTLAY TO 2021	= £M 942.300
TOTAL COSTS OF OPERATION TO 2021	= £M 104.123

TOTAL DISCOUNTED DEMANDS = 13357.870 TCMO

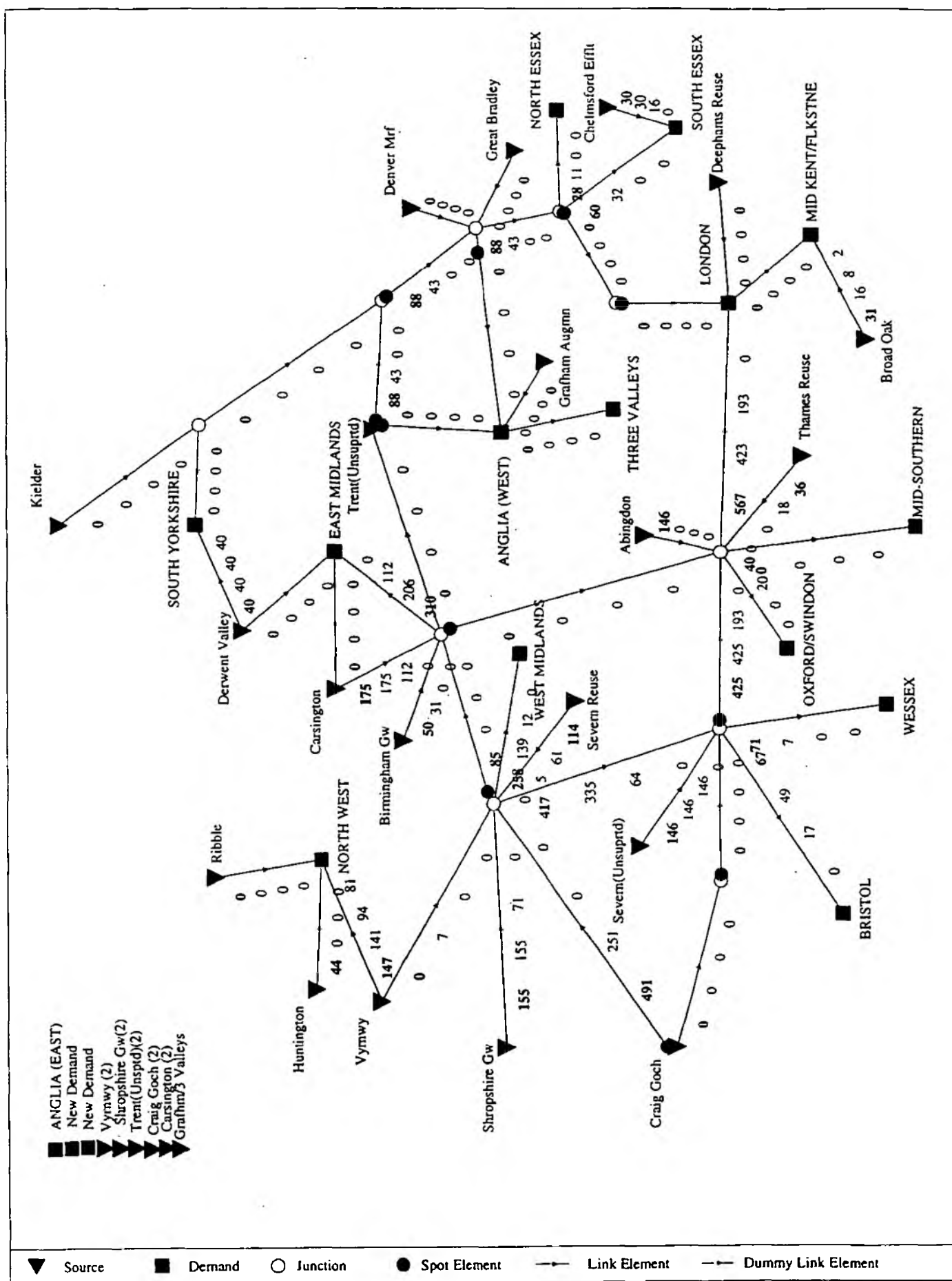
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## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
- B. NO DEMAND CENTRES OVER SUPPLIED.
- C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.

\*\*\*\*\*





# Appendix 4 - Results for Medium Scenario Case MED1

## WATER RESOURCE PLANNING MODEL.

\*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:24:41.15

## RESULTS

\*\*\*\*\*

(CONDENSED OUTPUT)

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## SOURCE DEVELOPMENT

\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021 (TCMD)	CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED OPERATING COST TO 2021 (£M)	DISCOUNTED OPERATING COST BEYOND 2021 (£M)	TOTAL DISCOUNTED COST (£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Carsington	140	.000	.000	.000	.000	.000
2011 Great Bradley	174	69.400	25.784	.000	.000	25.784
2011 Broad Oak	40	.000	.000	.000	.000	.000
2011 Severn Reuse	26	.000	.000	.000	.000	.000
2016 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2021 Birmingham Gw	3	.264	.055	.008	.051	.114
2021 Thames Reuse	18	.000	.000	.000	.000	.000
TOTALS FOR SOURCES		69.664	25.838	.008	.051	25.898

## UNUSED YIELDS OF DEVELOPED SOURCES

\*\*\*\*\*

## SOURCE NAME

## SPARE YIELDS THROUGH TIME(TCMD)

1991 1996 2001 2006 2011 2016 2021

Great Bradley	174	174	174	174	172	152	132
Chelmsford Efflt	30	30	28	13	0	0	0
Carsington	140	140	108	82	57	27	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	146	146	146	146	133	98
Birmingham Gw	50	50	50	50	50	50	47
Vyrnwy	66	92	115	103	80	56	27
Broad Oak	40	40	40	40	39	36	34
Thames Reuse	0	0	0	0	0	12	0
Severn Reuse	0	0	0	0	0	0	0

## DEMAND FLOWS THROUGH LINK ELEMENTS

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## LINK ELEMENT NAME

## FLOWS THROUGH TIME(TCMD)

1991 1996 2001 2006 2011 2016 2021

# Appendix 4 - Results for Medium Scenario Case MED1

ELY OUSE - ESSEX	0	0	0	0	2	22	42
GREAT BRADLEY	0	0	0	0	2	22	42
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	0	4	14
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	0	2	18	28
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	2	17	30	30	30
CARSINGTON - R.TRENT	0	0	40	72	104	141	175
VYRNWY - R.SEVERN	0	0	7	18	36	51	75
R.THAMES	0	0	0	0	0	0	46
R.SEVERN (UNSUPRTD)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (1)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (2)	0	0	0	0	0	13	48
BIRMINGHAM GW	0	0	0	0	0	0	3
R.SEVERN	0	0	7	18	30	37	43
THAMES REUSE	0	0	0	0	0	0	18
SEVERN REUSE	0	0	0	0	5	11	26
R.THAMES - OXFORD/SWINDON	0	0	0	0	0	13	20
R.SEVERN - W.MIDLANDS	0	0	0	0	11	25	58
R.TRENT - E.MIDLANDS	0	0	40	72	104	141	178
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	0	0	0	0	1	4	6
R.SEVERN - BRISTOL	0	0	7	18	30	37	43
VYRNWY - NORTH WEST	81	55	28	34	48	64	80

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## LINK ELEMENT DEVELOPMENT

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YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION TO 2021 BEYOND 2021 (£M)	UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)
2011	ELY OUSE - ESSEX ELY OUSE - ESSEX	.000 .000	.000 .000	.429 1.078	(2.42)	1.508	2011 42 42 ( ELEMENT TOTALS )
2011	GREAT BRADLEY GREAT BRADLEY	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 42 42 ( ELEMENT TOTALS )
2016	ELY OUSE ESSEX - NORTH ESSEX ELY OUSE ESSEX - NORTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 14 14 ( ELEMENT TOTALS )
2011	ELY OUSE ESSEX - SOUTH ESSEX ELY OUSE ESSEX - SOUTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 28 28 ( ELEMENT TOTALS )
2001	CHELMSFORD EFFLT - SOUTH ESSEX CHELMSFORD EFFLT - SOUTH ESSEX	13.500 13.500	8.720 8.720	.227 .081	( .38)	9.028	2001 30 30 ( ELEMENT TOTALS )
2001	CARSINGTON - R.TRENT CARSINGTON - R.TRENT	.000 .000	.000 .000	.000 .000	( .00)	.000	2001 175 175 ( ELEMENT TOTALS )
2001	VYRNWY - R.SEVERN VYRNWY - R.SEVERN	.000 .000	.000 .000	1.441 .517	(1.26)	1.958	2001 75 75 ( ELEMENT TOTALS )
2021	R.THAMES R.THAMES	.000 .000	.000 .000	.000 .000	( .00)	.000	2021 46 46 ( ELEMENT TOTALS )
2016	R.SEVERN (UNSUPRTD) R.SEVERN (UNSUPRTD)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 48 48 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (1) R.SEVERN - R.THAMES (1)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 425 400 ( ELEMENT TOTALS )

# Appendix 4 - Results for Medium Scenario Case MED1

2016	R.SEVERN - R.THAMES (2)	92.000	24.797					2016	48	48
	R.SEVERN - R.THAMES (2)	92.000	24.797	.142	.527	(1.04)	25.466	( ELEMENT TOTALS )		
2021	BIRMINGHAM GW	.000	.000					2021	3	3
	BIRMINGHAM GW	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.SEVERN	.000	.000					2001	43	43
	R.SEVERN	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2021	THAMES REUSE	.000	.000					2021	18	18
	THAMES REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	SEVERN REUSE	.000	.000					2011	26	26
	SEVERN REUSE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2016	R.THAMES - OXFORD/SWINDON	.000	.000					2016	20	20
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	R.SEVERN - W.MIDLANDS	.000	.000					2011	58	58
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.TRENT - E.MIDLANDS	50.000	32.298					2001	178	178
	R.TRENT - E.MIDLANDS	50.000	32.298	1.078	.826	(.44)	34.203	( ELEMENT TOTALS )		
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991	40	40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	BROAD OAK - MID KENT/FLKSTNE	47.500	17.133					2011	6	6
	BROAD OAK - MID KENT/FLKSTNE	47.500	17.133	.057	.109	(1.71)	17.299	( ELEMENT TOTALS )		
2001	R.SEVERN - BRISTOL	.000	.000					2001	43	43
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	81	81
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		203.000	82.949	3.375	3.138		89.462			

## UNIT COSTS OF LINKS

	DISCOUNTED (£M/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.16015	43.88	8.31	51.86
TOTAL:	.16015	43.88	8.31	51.86
2. SOUTH ESSEX				
Great Bradley	.16015	43.88	18.99	118.54
Chelmsford Efflt	.04025	11.03	9.03	224.32
TOTAL:	.08171	22.39	28.01	342.86
3. LONDON				
Severn(Unsuprtd)	.14390	39.42	13.58	94.37
Thames Reuse	.00000	.00	.00	60.67
TOTAL:	.08759	24.00	13.58	155.04

# Appendix 4 - Results for Medium Scenario Case MED1

4. OXFORD/SWINDON				
Severn(Unsuprtd)	.14390	39.42	11.89	82.61
TOTAL:	.14390	39.42	11.89	82.61
5. WEST MIDLANDS				
Vyrnwy	.00460	1.26	1.11	241.92
TOTAL:	.00460	1.26	1.11	241.92
6. EAST MIDLANDS				
Carsington	.02873	7.87	33.91	1180.20
Birmingham Gw	.04005	10.97	.40	10.11
TOTAL:	.02883	7.90	34.32	1190.31
7. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
8. MID KENT/FLKSTNE				
Broad Oak	.65368	179.09	17.30	26.46
TOTAL:	.65368	179.09	17.30	26.46
9. BRISTOL				
Vyrnwy	.00460	1.26	.85	184.11
Severn Reuse	.00000	.00	.00	108.31
TOTAL:	.00289	.79	.85	292.42
10. NORTH WEST				
Vyrnwy	.00000	.00	.00	963.86
TOTAL:	.00000	.00	.00	963.86
TOTAL			115.36	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	0	4	14
Great Bradley	SOUTH ESSEX	0	0	0	0	2	18	28
Chelmsford Efflt	SOUTH ESSEX	0	0	2	17	30	30	30
Severn(Unsuprtd)	LONDON	0	0	0	0	0	0	28
Thames Reuse	LONDON	0	0	0	0	0	0	18
Severn(Unsuprtd)	OXFORD/SWINDON	0	0	0	0	0	13	20
Vyrnwy	WEST MIDLANDS	0	0	0	0	11	25	58
Carsington	EAST MIDLANDS	0	0	40	72	104	141	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	0	0	3
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	0	0	0	0	1	4	6
Vyrnwy	BRISTOL	0	0	7	18	25	26	17
Severn Reuse	BRISTOL	0	0	0	0	5	11	26
Vyrnwy	NORTH WEST	81	55	28	34	48	64	80
TOTALS		121	95	117	181	266	376	543

## SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (EM)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	69.4	.0	.3
LINK ELEMENTS	.0	.0	63.5	.0	47.5	92.0	.0
TOTALS	.0	.0	63.5	.0	116.9	92.0	.3

# Appendix 4 - Results for Medium Scenario Case MED1

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.0	.0	.1
LINK ELEMENTS	.0	.0	1.4	1.6	2.0	3.5	5.4
TOTALS	.0	.0	1.4	1.6	2.0	3.5	5.5

## COST SUMMARY

TOTAL DISCOUNTED COST FOR PLAN	= £M 115.360
TOTAL DISCOUNTED CAPITAL COST	= £M 108.788
TOTAL DISCOUNTED COSTS OF OPERATION	= £M 6.572 (ALLOWANCE INCLUDED FOR BEYOND 2021 = £M 3.189)
TOTAL CAPITAL OUTLAY TO 2021	= £M 272.664
TOTAL COSTS OF OPERATION TO 2021	= £M 13.935

TOTAL DISCOUNTED DEMANDS = 4030.372 TCMD

## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
- B. NO DEMAND CENTRES OVER SUPPLIED.
- C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.



# Appendix 4 - Results for Medium Scenario Case MED2

## WATER RESOURCE PLANNING MODEL.

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DATE : 28- 2-1994  
TIME : 10:26:17.33

## RESULTS

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(CONDENSED OUTPUT)

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## SOURCE DEVELOPMENT

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FIRST SOURCE NAME BASE YEAR	YIELD IN 2021	CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED OPERATING COST TO 2021	DISCOUNTED OPERATING COST BEYOND 2021	TOTAL DISCOUNTED COST
	(TCMD)	(£M)	(£M)	(£M)	(£M)	(£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Carsington	140	.000	.000	.000	.000	.000
2011 Trent(Unsuprtd)	105	.000	.000	.000	.000	.000
2011 Broad Oak	40	.000	.000	.000	.000	.000
2011 Severn Reuse	26	.000	.000	.000	.000	.000
2016 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2021 Birmingham Gw	3	.264	.055	.008	.051	.114
2021 Thames Reuse	18	.000	.000	.000	.000	.000
TOTALS FOR SOURCES		.264	.055	.008	.051	.114

## UNUSED YIELDS OF DEVELOPED SOURCES

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SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Chelmsford Efflt	30	30	28	13	0	0	0
Trent(Unsuprtd)	105	105	105	105	103	83	63
Carsington	140	140	108	82	57	27	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	146	146	146	146	133	98
Birmingham Gw	50	50	50	50	50	50	47
Vyrnwy	66	92	115	103	80	56	27
Broad Oak	40	40	40	40	39	36	34
Thames Reuse	0	0	0	0	0	12	0
Severn Reuse	0	0	0	0	0	0	0

## DEMAND FLOWS THROUGH LINK ELEMENTS

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LINK ELEMENT NAME	FLOWS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
ELY OUSE - ESSEX	0	0	0	0	2	22	42



# Appendix 4 - Results for Medium Scenario Case MED2

ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	0	4	14
R.TRENT - R.WITHAM (1)	0	0	0	0	2	22	42
R.TRENT - R.WITHAM (2)	0	0	0	0	2	22	42
R.WITHAM - R.ELY OUSE (1)	0	0	0	0	2	22	42
R.WITHAM - R.ELY OUSE (2)	0	0	0	0	2	22	42
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	0	2	18	28
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	2	17	30	30	30
CARSINGTON - R.TRENT	0	0	40	72	104	141	175
VYRNWY - R.SEVERN	0	0	7	18	36	51	75
R.THAMES	0	0	0	0	0	0	46
R.SEVERN (UNSUPRTD)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (1)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (2)	0	0	0	0	0	13	48
BIRMINGHAM GW	0	0	0	0	0	0	3
R.SEVERN	0	0	7	18	30	37	43
THAMES REUSE	0	0	0	0	0	0	18
SEVERN REUSE	0	0	0	0	5	11	26
R.THAMES - OXFORD/SWINDON	0	0	0	0	0	13	20
R.SEVERN - W.MIDLANDS	0	0	0	0	11	25	58
R.TRENT - E.MIDLANDS	0	0	40	72	104	141	178
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	0	0	0	0	1	4	6
R.SEVERN - BRISTOL	0	0	7	18	30	37	43
VYRNWY - NORTH WEST	81	55	28	34	48	64	80

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## LINK ELEMENT DEVELOPMENT

YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION TO 2021 (£M)	DISCOUNTED COST BEYOND 2021 (£M)	UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION	AVG PEAK (TCMD)
2011	ELY OUSE - ESSEX	.000	.000					2011	42
	ELY OUSE - ESSEX	.000	.000	.429	1.078	(2.42)	1.508	( ELEMENT TOTALS )	42
2016	ELY OUSE ESSEX - NORTH ESSEX	.000	.000	.000	.000	( .00)	.000	2016	14
	ELY OUSE ESSEX - NORTH ESSEX	.000	.000					( ELEMENT TOTALS )	14
2011	R.TRENT - R.WITHAM (1)	.000	.000					2011	42
	R.TRENT - R.WITHAM (1)	.000	.000	.000	.000	( .00)	.000	( ELEMENT TOTALS )	42
2011	R.TRENT - R.WITHAM (2)	18.000	6.493					2011	42
	R.TRENT - R.WITHAM (2)	18.000	6.493	.015	.038	( .08)	6.545	( ELEMENT TOTALS )	42
2011	R.WITHAM - R.ELY OUSE (1)	.000	.000					2011	42
	R.WITHAM - R.ELY OUSE (1)	.000	.000	.000	.000	( .00)	.000	( ELEMENT TOTALS )	42
2011	R.WITHAM - R.ELY OUSE (2)	149.000	53.744					2011	42
	R.WITHAM - R.ELY OUSE (2)	149.000	53.744	.167	.418	( .94)	54.329	( ELEMENT TOTALS )	42
2011	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000					2011	28
	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000	.000	.000	( .00)	.000	( ELEMENT TOTALS )	28
2001	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720					2001	30
	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720	.227	.081	( .38)	9.028	( ELEMENT TOTALS )	30
2001	CARSINGTON - R.TRENT	.000	.000					2001	175
	CARSINGTON - R.TRENT	.000	.000	.000	.000	( .00)	.000	( ELEMENT TOTALS )	175
2001	VYRNWY - R.SEVERN	.000	.000					2001	75
	VYRNWY - R.SEVERN	.000	.000	1.441	.517	(1.26)	1.958	( ELEMENT TOTALS )	75

# Appendix 4 - Results for Medium Scenario Case MED2

2021	R.THAMES R.THAMES	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2021 46 46 ( ELEMENT TOTALS )
2016	R.SEVERN (UNSUPRTD) R.SEVERN (UNSUPRTD)	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2016 48 48 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (1) R.SEVERN - R.THAMES (1)	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2016 425 400 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (2) R.SEVERN - R.THAMES (2)	92.000 92.000	24.797 24.797	.142 .142	.527 .527	(1.04) (1.04)	25.466 25.466	2016 48 48 ( ELEMENT TOTALS )
2021	BIRMINGHAM GW BIRMINGHAM GW	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2021 3 3 ( ELEMENT TOTALS )
2001	R.SEVERN R.SEVERN	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2001 43 43 ( ELEMENT TOTALS )
2021	THAMES REUSE THAMES REUSE	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2021 18 18 ( ELEMENT TOTALS )
2011	SEVERN REUSE SEVERN REUSE	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2011 26 26 ( ELEMENT TOTALS )
2016	R.THAMES - OXFORD/SWINDON R.THAMES - OXFORD/SWINDON	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2016 20 20 ( ELEMENT TOTALS )
2011	R.SEVERN - W.MIDLANDS R.SEVERN - W.MIDLANDS	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2011 58 58 ( ELEMENT TOTALS )
2001	R.TRENT - E.MIDLANDS R.TRENT - E.MIDLANDS	50.000 50.000	32.298 32.298	1.078 1.078	.826 .826	(.44) (.44)	34.203 34.203	2001 178 178 ( ELEMENT TOTALS )
1991	DERWENT VALLEY - SOUTH YORKSHIRE DERWENT VALLEY - SOUTH YORKSHIRE	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	1991 40 40 ( ELEMENT TOTALS )
2011	BROAD OAK - MID KENT/FLKSTNE BROAD OAK - MID KENT/FLKSTNE	47.500 47.500	17.133 17.133	.057 .057	.109 .109	(1.71) (1.71)	17.299 17.299	2011 6 6 ( ELEMENT TOTALS )
2001	R.SEVERN - BRISTOL R.SEVERN - BRISTOL	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2001 43 43 ( ELEMENT TOTALS )
1991	VYRNWY - NORTH WEST VYRNWY - NORTH WEST	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	1991 81 81 ( ELEMENT TOTALS )
TOTALS FOR LINK ELEMENTS		370.000	143.186	3.556	3.594		150.336	

## UNIT COSTS OF LINKS

DISCOUNTED UNIT COSTS (£M/TCMD)	(P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
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1. NORTH ESSEX Trent(Unsuprtd)	.36608	100.30	18.99	51.86
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# Appendix 4 - Results for Medium Scenario Case MED2

TOTAL:	.36608	100.30	18.99	51.86
2. SOUTH ESSEX				
Chelmsford Efflt	.04025	11.03	9.03	224.32
Trent(Unsuprtd)	.36608	100.30	43.40	118.54
TOTAL:	.15290	41.89	52.43	342.86
3. LONDON				
Severn(Unsuprtd)	.14390	39.42	13.58	94.37
Thames Reuse	.00000	.00	.00	60.67
TOTAL:	.08759	24.00	13.58	155.04
4. OXFORD/SWINDON				
Severn(Unsuprtd)	.14390	39.42	11.89	82.61
TOTAL:	.14390	39.42	11.89	82.61
5. WEST MIDLANDS				
Vyrnwy	.00460	1.26	1.11	241.92
TOTAL:	.00460	1.26	1.11	241.92
6. EAST MIDLANDS				
Carsington	.02873	7.87	33.91	1180.20
Birmingham Gw	.04005	10.97	.40	10.11
TOTAL:	.02883	7.90	34.32	1190.31
7. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
8. MID KENT/FLKSTNE				
Broad Oak	.65368	179.09	17.30	26.46
TOTAL:	.65368	179.09	17.30	26.46
9. BRISTOL				
Vyrnwy	.00460	1.26	.85	184.11
Severn Reuse	.00000	.00	.00	108.31
TOTAL:	.00289	.79	.85	292.42
10. NORTH WEST				
Vyrnwy	.00000	.00	.00	963.86
TOTAL:	.00000	.00	.00	963.86
TOTAL			150.45	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Trent(Unsuprtd)	NORTH ESSEX	0	0	0	0	0	4	14
Chelmsford Efflt	SOUTH ESSEX	0	0	2	17	30	30	30
Trent(Unsuprtd)	SOUTH ESSEX	0	0	0	0	2	18	28
Severn(Unsuprtd)	LONDON	0	0	0	0	0	0	28
Thames Reuse	LONDON	0	0	0	0	0	0	18
Severn(Unsuprtd)	OXFORD/SWINDON	0	0	0	0	0	13	20
Vyrnwy	WEST MIDLANDS	0	0	0	0	11	25	58
Carsington	EAST MIDLANDS	0	0	40	72	104	141	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	0	0	3
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	0	0	0	0	1	4	6
Vyrnwy	BRISTOL	0	0	7	18	25	26	17
Severn Reuse	BRISTOL	0	0	0	0	5	11	26
Vyrnwy	NORTH WEST	81	55	28	34	48	64	80
TOTALS		121	95	117	181	266	376	543

## SUMMARY OF CAPITAL COSTS;

# Appendix 4 - Results for Medium Scenario Case MED2

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (€M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.0	.0	.3
LINK ELEMENTS	.0	.0	63.5	.0	214.5	92.0	.0
TOTALS	.0	.0	63.5	.0	214.5	92.0	.3

\*\*\*\*\*

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (€M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.0	.0	.1
LINK ELEMENTS	.0	.0	1.4	1.6	2.0	3.9	6.2
TOTALS	.0	.0	1.4	1.6	2.0	3.9	6.3

\*\*\*\*\*

## COST SUMMARY

TOTAL DISCOUNTED COST FOR PLAN	= €M 150.451
TOTAL DISCOUNTED CAPITAL COST	= €M 143.241
TOTAL DISCOUNTED COSTS OF OPERATION	= €M 7.210 (ALLOWANCE INCLUDED FOR BEYOND 2021 = €M 3.645)
TOTAL CAPITAL OUTLAY TO 2021	= €M 370.264
TOTAL COSTS OF OPERATION TO 2021	= €M 15.170

TOTAL DISCOUNTED DEMANDS = 4030.372 TCMO

\*\*\*\*\*

## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
- B. NO DEMAND CENTRES OVER SUPPLIED.
- C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.

\*\*\*\*\*



# Appendix 4 - Results for Medium Scenario Case MED3

## WATER RESOURCE PLANNING MODEL.

\*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:28:12.12

## RESULTS

\*\*\*\*\*

(CONDENSED OUTPUT)

\*\*\*\*\*

## SOURCE DEVELOPMENT

\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021 (TCMD)	CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED OPERATING COST TO 2021 (£M)	DISCOUNTED OPERATING COST BEYOND 2021 (£M)	TOTAL DISCOUNTED COST (£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Carsington	140	.000	.000	.000	.000	.000
2011 Great Bradley	174	69.400	25.784	.000	.000	25.784
2011 Broad Oak	40	.000	.000	.000	.000	.000
2011 Severn Reuse	26	.000	.000	.000	.000	.000
2016 Abingdon	262	400.000	111.049	1.061	4.405	116.515
2021 Birmingham Gw	3	.264	.055	.008	.051	.114
TOTALS FOR SOURCES		469.664	136.888	1.069	4.456	142.413

## UNUSED YIELDS OF DEVELOPED SOURCES

\*\*\*\*\*

SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	174	172	152	132
Chelmsford Efflt	30	30	28	13	0	0	0
Abingdon	262	262	262	262	262	249	196
Carsington	140	140	108	82	57	27	0
Derwent Valley	0	0	0	0	0	0	0
Birmingham Gw	50	50	50	50	50	50	47
Vyrnwy	66	92	115	103	80	56	27
Broad Oak	40	40	40	40	39	36	34
Severn Reuse	0	0	0	0	0	0	0

## DEMAND FLOWS THROUGH LINK ELEMENTS

\*\*\*\*\*

LINK ELEMENT NAME	FLOWS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
ELY OUSE - ESSEX	0	0	0	0	2	22	42
GREAT BRADLEY	0	0	0	0	2	22	42
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	0	4	14

# Appendix 4 - Results for Medium Scenario Case MED3

ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	0	2	18	28
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	2	17	30	30	30
CARSINGTON - R.TRENT	0	0	40	72	104	141	175
VYRNWY - R.SEVERN	0	0	7	18	36	51	75
ABINGDON - R.THAMES	0	0	0	0	0	13	66
R.THAMES	0	0	0	0	0	0	46
BIRMINGHAM GW	0	0	0	0	0	0	3
R.SEVERN	0	0	7	18	30	37	43
SEVERN REUSE	0	0	0	0	5	11	26
R.THAMES - OXFORD/SWINDON	0	0	0	0	0	13	20
R.SEVERN - W.MIDLANDS	0	0	0	0	11	25	58
R.TRENT - E.MIDLANDS	0	0	40	72	104	141	178
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	0	0	0	0	1	4	6
R.SEVERN - BRISTOL	0	0	7	18	30	37	43
VYRNWY - NORTH WEST	81	55	28	34	48	64	80

## \*\*\*\*\* LINK ELEMENT DEVELOPMENT \*\*\*\*\*

YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION TO 2021 BEYOND 2021 (£M)	UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)
2011	ELY OUSE - ESSEX	.000	.000				2011 42 42
	ELY OUSE - ESSEX	.000	.000	.429	1.078	(2.42)	( ELEMENT TOTALS )
2011	GREAT BRADLEY	.000	.000				2011 42 42
	GREAT BRADLEY	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2016	ELY OUSE ESSEX - NORTH ESSEX	.000	.000				2016 14 14
	ELY OUSE ESSEX - NORTH ESSEX	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2011	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000				2011 28 28
	ELY OUSE ESSEX - SOUTH ESSEX	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2001	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720				2001 30 30
	CHELMSFORD EFFLT - SOUTH ESSEX	13.500	8.720	.227	.081	( .38)	( ELEMENT TOTALS )
2001	CARSINGTON - R.TRENT	.000	.000				2001 175 175
	CARSINGTON - R.TRENT	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2001	VYRNWY - R.SEVERN	.000	.000				2001 75 75
	VYRNWY - R.SEVERN	.000	.000	1.441	.517	(1.26)	( ELEMENT TOTALS )
2016	ABINGDON - R.THAMES	.000	.000				2016 66 66
	ABINGDON - R.THAMES	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2021	R.THAMES	.000	.000				2021 46 46
	R.THAMES	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2021	BIRMINGHAM GW	.000	.000				2021 3 3
	BIRMINGHAM GW	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2001	R.SEVERN	.000	.000				2001 43 43
	R.SEVERN	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )
2011	SEVERN REUSE	.000	.000				2011 26 26
	SEVERN REUSE	.000	.000	.000	.000	( .00)	( ELEMENT TOTALS )

# Appendix 4 - Results for Medium Scenario Case MED3

2016	R.THAMES - OXFORD/SWINDON	.000	.000					2016	20	20
	R.THAMES - OXFORD/SWINDON	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	R.SEVERN - W.MIDLANDS	.000	.000					2011	58	58
	R.SEVERN - W.MIDLANDS	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2001	R.TRENT - E.MIDLANDS	50.000	32.298					2001	178	178
	R.TRENT - E.MIDLANDS	50.000	32.298	1.078	.826	(.44)	34.203	( ELEMENT TOTALS )		
1991	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000					1991	40	40
	DERWENT VALLEY - SOUTH YORKSHIRE	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
2011	BROAD OAK - MID KENT/FLKSTNE	47.500	17.133					2011	6	6
	BROAD OAK - MID KENT/FLKSTNE	47.500	17.133	.057	.109	(1.71)	17.299	( ELEMENT TOTALS )		
2001	R.SEVERN - BRISTOL	.000	.000					2001	43	43
	R.SEVERN - BRISTOL	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
1991	VYRNWY - NORTH WEST	.000	.000					1991	81	81
	VYRNWY - NORTH WEST	.000	.000	.000	.000	(.00)	.000	( ELEMENT TOTALS )		
TOTALS FOR LINK ELEMENTS		111.000	58.152	3.232	2.611		63.995			

## UNIT COSTS OF LINKS

	DISCOUNTED (£M/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.16015	43.88	8.31	51.86
TOTAL:	.16015	43.88	8.31	51.86
2. SOUTH ESSEX				
Great Bradley	.16015	43.88	18.99	118.54
Chelmsford Efflt	.04025	11.03	9.03	224.32
TOTAL:	.08171	22.39	28.01	342.86
3. LONDON				
Abingdon	.49029	134.33	76.01	155.04
TOTAL:	.49029	134.33	76.01	155.04
4. OXFORD/SWINDON				
Abingdon	.49029	134.33	40.50	82.61
TOTAL:	.49029	134.33	40.50	82.61
5. WEST MIDLANDS				
Vyrnwy	.00460	1.26	1.11	241.92
TOTAL:	.00460	1.26	1.11	241.92
6. EAST MIDLANDS				
Carsington	.02873	7.87	33.91	1180.20
Birmingham Gw	.04005	10.97	.40	10.11
TOTAL:	.02883	7.90	34.32	1190.31
7. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
8. MID KENT/FLKSTNE				
Broad Oak	.65368	179.09	17.30	26.46
TOTAL:	.65368	179.09	17.30	26.46



# Appendix 4 - Results for Medium Scenario Case MED3

9. BRISTOL				
Vyrnwy	.00460	1.26	.85	184.11
Severn Reuse	.00000	.00	.00	108.31
TOTAL:	.00289	.79	.85	292.42
10. NORTH WEST				
Vyrnwy	.00000	.00	.00	963.86
TOTAL:	.00000	.00	.00	963.86
TOTAL			206.41	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	0	4	14
Great Bradley	SOUTH ESSEX	0	0	0	0	2	18	28
Chelmsford Efflt	SOUTH ESSEX	0	0	2	17	30	30	30
Abingdon	LONDON	0	0	0	0	0	0	46
Abingdon	OXFORD/SWINDON	0	0	0	0	0	13	20
Vyrnwy	WEST MIDLANDS	0	0	0	0	11	25	58
Carsington	EAST MIDLANDS	0	0	40	72	104	141	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	0	0	3
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	0	0	0	0	1	4	6
Vyrnwy	BRISTOL	0	0	7	18	25	26	17
Severn Reuse	BRISTOL	0	0	0	0	5	11	26
Vyrnwy	NORTH WEST	81	55	28	34	48	64	80
TOTALS		121	95	117	181	266	376	543

## SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	69.4	400.0	.3
LINK ELEMENTS	.0	.0	63.5	.0	47.5	.0	.0
TOTALS	.0	.0	63.5	.0	116.9	400.0	.3

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.0	1.5	7.7
LINK ELEMENTS	.0	.0	1.4	1.6	2.0	3.3	4.5
TOTALS	.0	.0	1.4	1.6	2.0	4.8	12.2

## COST SUMMARY

TOTAL DISCOUNTED COST FOR PLAN	= £M 206.408
TOTAL DISCOUNTED CAPITAL COST	= £M 195.039
TOTAL DISCOUNTED COSTS OF OPERATION	= £M 11.369 (ALLOWANCE INCLUDED FOR BEYOND 2021 = £M 7.068)
TOTAL CAPITAL OUTLAY TO 2021	= £M 580.664
TOTAL COSTS OF OPERATION TO 2021	= £M 21.867

## Appendix 4 - Results for Medium Scenario Case MED3

TOTAL DISCOUNTED DEMANDS = 4030.372 TCMD

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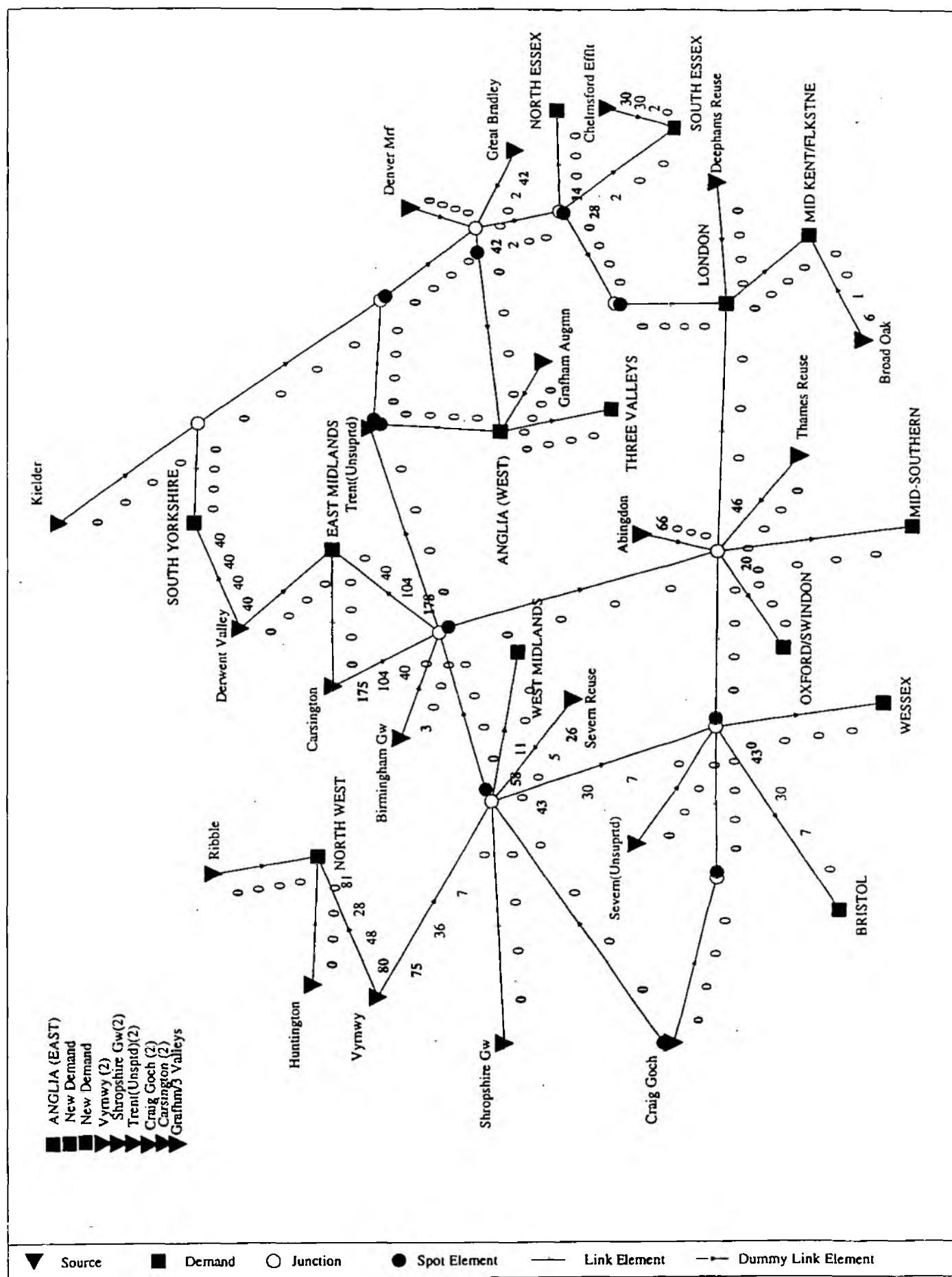
RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

A. ALL SUPPLY DEFICIENCIES MET IN FULL.

B. NO DEMAND CENTRES OVER SUPPLIED.

C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.

\*\*\*\*\*



# Appendix 4 - Results for Medium Scenario Case MED4

## WATER RESOURCE PLANNING MODEL. \*\*\*\*\*

DATE : 28- 2-1994  
TIME : 10:29:40.50

## RESULTS

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(CONDENSED OUTPUT)

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## SOURCE DEVELOPMENT

\*\*\*\*\*

FIRST SOURCE NAME BASE YEAR	YIELD IN 2021	CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED OPERATING COST TO 2021	DISCOUNTED OPERATING COST BEYOND 2021	TOTAL DISCOUNTED COST
	(TCMD)	(£M)	(£M)	(£M)	(£M)	(£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Carsington	140	.000	.000	.000	.000	.000
2011 Great Bradley	174	69.400	25.784	.000	.000	25.784
2011 Broad Oak	40	.000	.000	.000	.000	.000
2011 Severn Reuse	26	.000	.000	.000	.000	.000
2016 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2021 Birmingham Gw	3	.264	.055	.008	.051	.114
2021 Thames Reuse	18	.000	.000	.000	.000	.000
TOTALS FOR SOURCES		69.664	25.838	.008	.051	25.898

## UNUSED YIELDS OF DEVELOPED SOURCES

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SOURCE NAME	SPARE YIELDS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	174	172	152	132
Chelmsford Efflt	30	30	28	13	0	0	0
Carsington	140	140	108	82	57	27	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	146	146	146	146	133	98
Birmingham Gw	50	50	50	50	50	50	47
Vyrnwy	66	92	115	103	80	56	27
Broad Oak	40	40	40	40	39	36	34
Thames Reuse	0	0	0	0	0	12	0
Severn Reuse	0	0	0	0	0	0	0

## DEMAND FLOWS THROUGH LINK ELEMENTS

\*\*\*\*\*

LINK ELEMENT NAME	FLOWS THROUGH TIME(TCMD)						
	1991	1996	2001	2006	2011	2016	2021
ELY OUSE - ESSEX	0	0	0	0	2	22	42

# Appendix 4 - Results for Medium Scenario Case MED4

GREAT BRADLEY	0	0	0	0	2	22	42
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	0	4	14
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	0	2	18	28
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	2	17	30	30	30
CARSINGTON - R.TRENT	0	0	40	72	104	141	175
VYRNWY - R.SEVERN	0	0	7	18	36	51	75
R.THAMES	0	0	0	0	0	0	46
R.SEVERN (UNSUPRTD)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (1)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (2)	0	0	0	0	0	13	48
BIRMINGHAM GW	0	0	0	0	0	0	3
R.SEVERN	0	0	7	18	30	37	43
THAMES REUSE	0	0	0	0	0	0	18
SEVERN REUSE	0	0	0	0	5	11	26
R.THAMES - OXFORD/SWINDON	0	0	0	0	0	13	20
R.SEVERN - W.MIDLANDS	0	0	0	0	11	25	58
R.TRENT - E.MIDLANDS	0	0	40	72	104	141	178
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	0	0	0	0	1	4	6
R.SEVERN - BRISTOL	0	0	7	18	30	37	43
VYRNWY - NORTH WEST	81	55	28	34	48	64	80

## LINK ELEMENT DEVELOPMENT

YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION TO 2021 BEYOND 2021 (£M)	UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)
2011	ELY OUSE - ESSEX ELY OUSE - ESSEX	.000 .000	.000 .000	.429 1.078	(2.42)	1.508	2011 42 42 ( ELEMENT TOTALS )
2011	GREAT BRADLEY GREAT BRADLEY	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 42 42 ( ELEMENT TOTALS )
2016	ELY OUSE ESSEX - NORTH ESSEX ELY OUSE ESSEX - NORTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 14 14 ( ELEMENT TOTALS )
2011	ELY OUSE ESSEX - SOUTH ESSEX ELY OUSE ESSEX - SOUTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 28 28 ( ELEMENT TOTALS )
2001	CHELMSFORD EFFLT - SOUTH ESSEX CHELMSFORD EFFLT - SOUTH ESSEX	13.500 13.500	8.720 8.720	.227 .081	( .38)	9.028	2001 30 30 ( ELEMENT TOTALS )
2001	CARSINGTON - R.TRENT CARSINGTON - R.TRENT	.000 .000	.000 .000	.000 .000	( .00)	.000	2001 175 175 ( ELEMENT TOTALS )
2001	VYRNWY - R.SEVERN VYRNWY - R.SEVERN	.000 .000	.000 .000	1.441 .517	(1.26)	1.958	2001 75 75 ( ELEMENT TOTALS )
2021	R.THAMES R.THAMES	.000 .000	.000 .000	.000 .000	( .00)	.000	2021 46 46 ( ELEMENT TOTALS )
2016	R.SEVERN (UNSUPRTD) R.SEVERN (UNSUPRTD)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 48 48 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (1) R.SEVERN - R.THAMES (1)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 425 400 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (2) R.SEVERN - R.THAMES (2)	152.000 152.000	40.970 40.970	.142 .527	(1.04)	41.639	2016 48 48 ( ELEMENT TOTALS )

# Appendix 4 - Results for Medium Scenario Case MED4

2021	BIRMINGHAM GW BIRMINGHAM GW	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2021 3 3 ( ELEMENT TOTALS )
2001	R.SEVERN R.SEVERN	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2001 43 43 ( ELEMENT TOTALS )
2021	THAMES REUSE THAMES REUSE	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2021 18 18 ( ELEMENT TOTALS )
2011	SEVERN REUSE SEVERN REUSE	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2011 26 26 ( ELEMENT TOTALS )
2016	R.THAMES - OXFORD/SWINDON R.THAMES - OXFORD/SWINDON	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2016 20 20 ( ELEMENT TOTALS )
2011	R.SEVERN - W.MIDLANDS R.SEVERN - W.MIDLANDS	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2011 58 58 ( ELEMENT TOTALS )
2001	R.TRENT - E.MIDLANDS R.TRENT - E.MIDLANDS	50.000 50.000	32.298 32.298	1.078 1.078	.826 .826	(.44) (.44)	34.203 34.203	2001 178 178 ( ELEMENT TOTALS )
1991	DERWENT VALLEY - SOUTH YORKSHIRE DERWENT VALLEY - SOUTH YORKSHIRE	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	1991 40 40 ( ELEMENT TOTALS )
2011	BROAD OAK - MID KENT/FLKSTNE BROAD OAK - MID KENT/FLKSTNE	47.500 47.500	17.133 17.133	.057 .057	.109 .109	(1.71) (1.71)	17.299 17.299	2011 6 6 ( ELEMENT TOTALS )
2001	R.SEVERN - BRISTOL R.SEVERN - BRISTOL	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	2001 43 43 ( ELEMENT TOTALS )
1991	VYRNWY - NORTH WEST VYRNWY - NORTH WEST	.000 .000	.000 .000	.000 .000	.000 .000	(.00) (.00)	.000 .000	1991 81 81 ( ELEMENT TOTALS )
TOTALS FOR LINK ELEMENTS		263.000	99.121	3.375	3.138		105.634	

## UNIT COSTS OF LINKS

	DISCOUNTED UNIT COSTS (£M/TCMD)	(P/M3)	DISCOUNTED TOTAL COST (£M)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX Great Bradley TOTAL:	.16015 .16015	43.88 43.88	8.31 8.31	51.86 51.86
2. SOUTH ESSEX Great Bradley Chelmsford Efflt TOTAL:	.16015 .04025 .08171	43.88 11.03 22.39	18.99 9.03 28.01	118.54 224.32 342.86
3. LONDON Severn(Unsuprtd) Thames Reuse TOTAL:	.23528 .00000 .14321	64.46 .00 39.24	22.20 .00 22.20	94.37 60.67 155.04
4. OXFORD/SWINDON Severn(Unsuprtd) TOTAL:	.23528 .23528	64.46 64.46	19.44 19.44	82.61 82.61

# Appendix 4 - Results for Medium Scenario Case MED4

5. WEST MIDLANDS				
Vyrnwy	.00460	1.26	1.11	241.92
TOTAL:	.00460	1.26	1.11	241.92
6. EAST MIDLANDS				
Carsington	.02873	7.87	33.91	1180.20
Birmingham Gw	.04005	10.97	.40	10.11
TOTAL:	.02883	7.90	34.32	1190.31
7. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
8. MID KENT/FLKSTNE				
Broad Oak	.65368	179.09	17.30	26.46
TOTAL:	.65368	179.09	17.30	26.46
9. BRISTOL				
Vyrnwy	.00460	1.26	.85	184.11
Severn Reuse	.00000	.00	.00	108.31
TOTAL:	.00289	.79	.85	292.42
10. NORTH WEST				
Vyrnwy	.00000	.00	.00	963.86
TOTAL:	.00000	.00	.00	963.86
TOTAL			131.53	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	0	4	14
Great Bradley	SOUTH ESSEX	0	0	0	0	2	18	28
Chelmsford Efflt	SOUTH ESSEX	0	0	2	17	30	30	30
Severn(Unsuprtd)	LONDON	0	0	0	0	0	0	28
Thames Reuse	LONDON	0	0	0	0	0	0	18
Severn(Unsuprtd)	OXFORD/SWINDON	0	0	0	0	0	13	20
Vyrnwy	WEST MIDLANDS	0	0	0	0	11	25	58
Carsington	EAST MIDLANDS	0	0	40	72	104	141	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	0	0	3
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	0	0	0	0	1	4	6
Vyrnwy	BRISTOL	0	0	7	18	25	26	17
Severn Reuse	BRISTOL	0	0	0	0	5	11	26
Vyrnwy	NORTH WEST	81	55	28	34	48	64	80
TOTALS		121	95	117	181	266	376	543

## SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	69.4	.0	.3
LINK ELEMENTS	.0	.0	63.5	.0	47.5	152.0	.0
TOTALS	.0	.0	63.5	.0	116.9	152.0	.3

## SUMMARY OF TOTAL COSTS OF OPERATION;

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021

## Appendix 4 - Results for Medium Scenario Case MED4

SOURCES	.0	.0	.0	.0	.0	.0	.1
LINK ELEMENTS	.0	.0	1.4	1.6	2.0	3.5	5.4
TOTALS	.0	.0	1.4	1.6	2.0	3.5	5.5

### COST SUMMARY

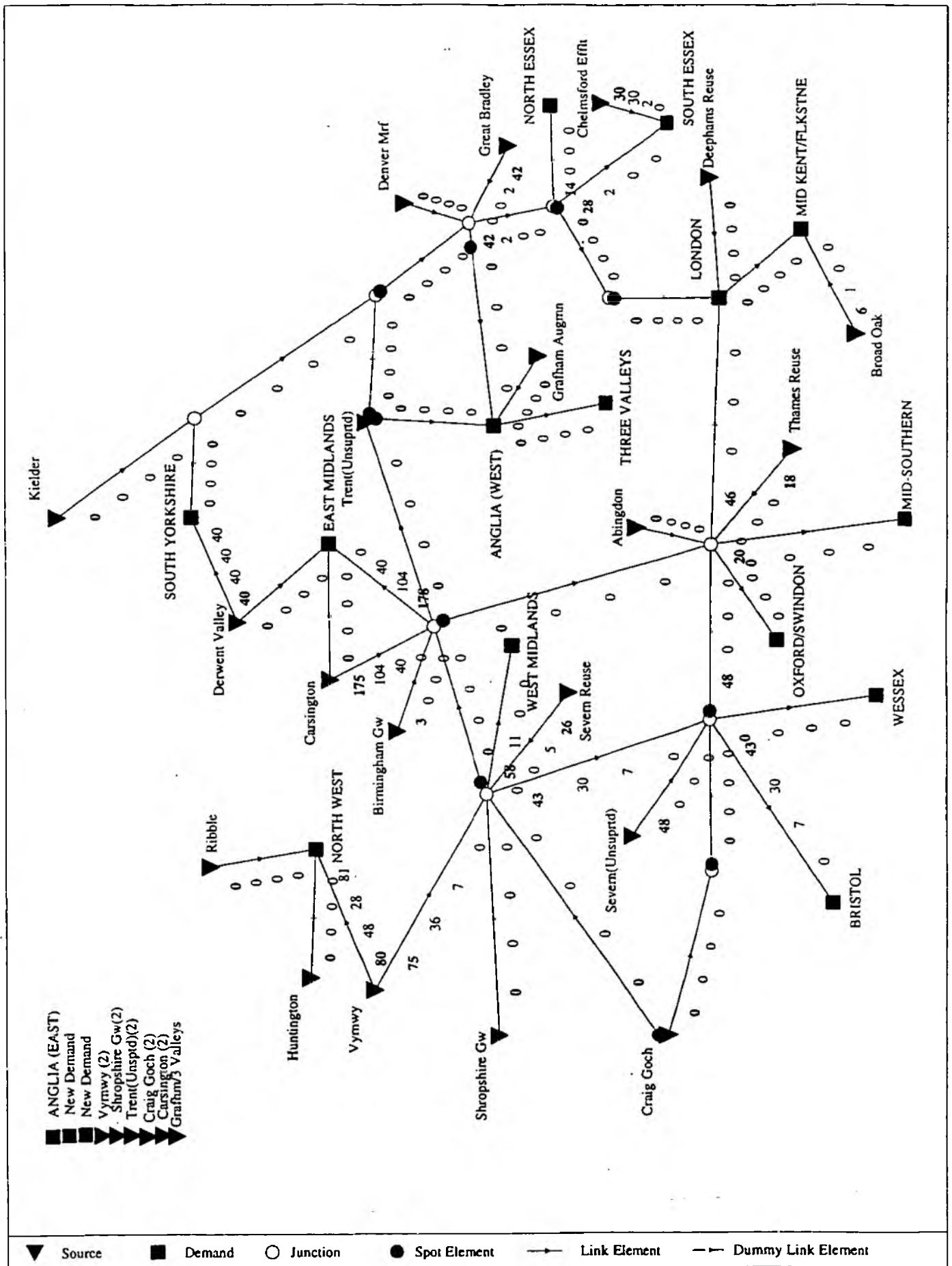
TOTAL DISCOUNTED COST FOR PLAN = £M 131.532  
 TOTAL DISCOUNTED CAPITAL COST = £M 124.960  
 TOTAL DISCOUNTED COSTS OF OPERATION = £M 6.572 (ALLOWANCE INCLUDED FOR BEYOND 2021 = £M 3.189)  
 TOTAL CAPITAL OUTLAY TO 2021 = £M 332.664  
 TOTAL COSTS OF OPERATION TO 2021 = £M 13.935

TOTAL DISCOUNTED DEMANDS = 4030.372 TCMD

### RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
- B. NO DEMAND CENTRES OVER SUPPLIED.
- C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.





# Appendix 4 - Results for Medium Scenario Case MED5

## WATER RESOURCE PLANNING MODEL.

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DATE : 1- 3-1994  
TIME : 17:18:24.78

## RESULTS

\*\*\*\*\*

(CONDENSED OUTPUT)

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## SOURCE DEVELOPMENT

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FIRST SOURCE NAME BASE YEAR	YIELD IN 2021	CAPITAL COST	DISCOUNTED CAPITAL COST	DISCOUNTED OPERATING COST TO 2021	DISCOUNTED OPERATING COST BEYOND 2021	TOTAL DISCOUNTED COST
	(TCMD)	(£M)	(£M)	(£M)	(£M)	(£M)
1991 Derwent Valley	40	.000	.000	.000	.000	.000
1991 Vyrnwy	147	.000	.000	.000	.000	.000
2001 Chelmsford Efflt	30	.000	.000	.000	.000	.000
2001 Carsington	140	.000	.000	.000	.000	.000
2001 Shropshire Gw	155	.000	.000	.000	.000	.000
2011 Great Bradley	174	69.400	25.784	.000	.000	25.784
2011 Broad Oak	40	.000	.000	.000	.000	.000
2011 Severn Reuse	26	.000	.000	.000	.000	.000
2016 Severn(Unsuprtd)	146	.000	.000	.000	.000	.000
2021 Birmingham Gw	3	.264	.055	.008	.051	.114
2021 Thames Reuse	18	.000	.000	.000	.000	.000
TOTALS FOR SOURCES		69.664	25.838	.008	.051	25.898

## UNUSED YIELDS OF DEVELOPED SOURCES

\*\*\*\*\*

## SOURCE NAME

## SPARE YIELDS THROUGH TIME(TCMD)

	1991	1996	2001	2006	2011	2016	2021
Great Bradley	174	174	174	174	172	152	132
Chelmsford Efflt	30	30	28	13	0	0	0
Carsington	140	140	108	82	57	27	0
Derwent Valley	0	0	0	0	0	0	0
Severn(Unsuprtd)	146	146	146	146	146	133	98
Birmingham Gw	50	50	50	50	50	50	47
Vyrnwy	66	92	119	113	99	83	67
Shropshire Gw	155	155	148	137	119	104	80
Broad Oak	40	40	40	40	39	36	34
Thames Reuse	0	0	0	0	0	12	0
Severn Reuse	0	0	0	0	0	0	0

## DEMAND FLOWS THROUGH LINK ELEMENTS

\*\*\*\*\*

## LINK ELEMENT NAME

## FLOWS THROUGH TIME(TCMD)

	1991	1996	2001	2006	2011	2016	2021
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# Appendix 4 - Results for Medium Scenario Case MED5

ELY OUSE - ESSEX	0	0	0	0	2	22	42
GREAT BRADLEY	0	0	0	0	2	22	42
ELY OUSE ESSEX - NORTH ESSEX	0	0	0	0	0	4	14
ELY OUSE ESSEX - SOUTH ESSEX	0	0	0	0	2	18	28
CHELMSFORD EFFLT - SOUTH ESSEX	0	0	2	17	30	30	30
CARSINGTON - R.TRENT	0	0	40	72	104	141	175
SHROPSHIRE GW - R.SEVERN	0	0	7	18	36	51	75
R.THAMES	0	0	0	0	0	0	46
R.SEVERN (UNSUPRTD)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (1)	0	0	0	0	0	13	48
R.SEVERN - R.THAMES (2)	0	0	0	0	0	13	48
BIRMINGHAM GW	0	0	0	0	0	0	3
R.SEVERN	0	0	7	18	30	37	43
THAMES REUSE	0	0	0	0	0	0	18
SEVERN REUSE	0	0	0	0	5	11	26
R.THAMES - OXFORD/SWINDON	0	0	0	0	0	13	20
R.SEVERN - W.MIDLANDS	0	0	0	0	11	25	58
R.TRENT - E.MIDLANDS	0	0	40	72	104	141	178
DERWENT VALLEY - SOUTH YORKSHIRE	40	40	40	40	40	40	40
BROAD OAK - MID KENT/FLKSTNE	0	0	0	0	1	4	6
R.SEVERN - BRISTOL	0	0	7	18	30	37	43
VYRNWY - NORTH WEST	81	55	28	34	48	64	80

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## LINK ELEMENT DEVELOPMENT

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YEAR FIRST USED	ELEMENT NAME	TOTAL CAPITAL COST (£M)	DISCOUNTED CAPITAL COST (£M)	DISCOUNTED COST OF OPERATION TO 2021 BEYOND 2021 (£M)	UNIT COST OF OPERATION (P/M3)	TOTAL DISCOUNTED COST (£M)	BASE YEARS FOR REPLICATION AVG PEAK (TCMD)
2011	ELY OUSE - ESSEX ELY OUSE - ESSEX	.000 .000	.000 .000	.429 1.078	(2.42)	1.508	2011 42 42 ( ELEMENT TOTALS )
2011	GREAT BRADLEY GREAT BRADLEY	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 42 42 ( ELEMENT TOTALS )
2016	ELY OUSE ESSEX - NORTH ESSEX ELY OUSE ESSEX - NORTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 14 14 ( ELEMENT TOTALS )
2011	ELY OUSE ESSEX - SOUTH ESSEX ELY OUSE ESSEX - SOUTH ESSEX	.000 .000	.000 .000	.000 .000	( .00)	.000	2011 28 28 ( ELEMENT TOTALS )
2001	CHELMSFORD EFFLT - SOUTH ESSEX CHELMSFORD EFFLT - SOUTH ESSEX	13.500 13.500	8.720 8.720	.227 .081	( .38)	9.028	2001 30 30 ( ELEMENT TOTALS )
2001	CARSINGTON - R.TRENT CARSINGTON - R.TRENT	.000 .000	.000 .000	.000 .000	( .00)	.000	2001 175 175 ( ELEMENT TOTALS )
2001	SHROPSHIRE GW - R.SEVERN SHROPSHIRE GW - R.SEVERN	.000 .000	.000 .000	.000 .000	( .00)	.000	2001 75 75 ( ELEMENT TOTALS )
2021	R.THAMES R.THAMES	.000 .000	.000 .000	.000 .000	( .00)	.000	2021 46 46 ( ELEMENT TOTALS )
2016	R.SEVERN (UNSUPRTD) R.SEVERN (UNSUPRTD)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 48 48 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (1) R.SEVERN - R.THAMES (1)	.000 .000	.000 .000	.000 .000	( .00)	.000	2016 425 400 ( ELEMENT TOTALS )
2016	R.SEVERN - R.THAMES (2)	92.000	24.797				2016 48 48

# Appendix 4 - Results for Medium Scenario Case MED5

	R.SEVERN - R.THAMES (2)	92.000	24.797	.142	.527	(1.04)	25.466	( ELEMENT TOTALS )
2021	BIRMINGHAM GW BIRMINGHAM GW	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2021 3 3 ( ELEMENT TOTALS )
2001	R.SEVERN R.SEVERN	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2001 43 43 ( ELEMENT TOTALS )
2021	THAMES REUSE THAMES REUSE	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2021 18 18 ( ELEMENT TOTALS )
2011	SEVERN REUSE SEVERN REUSE	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2011 26 26 ( ELEMENT TOTALS )
2016	R.THAMES - OXFORD/SWINDON R.THAMES - OXFORD/SWINDON	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2016 20 20 ( ELEMENT TOTALS )
2011	R.SEVERN - W.MIDLANDS R.SEVERN - W.MIDLANDS	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2011 58 58 ( ELEMENT TOTALS )
2001	R.TRENT - E.MIDLANDS R.TRENT - E.MIDLANDS	50.000 50.000	32.298 32.298	1.078 1.078	.826 .826	(.44)	34.203	2001 178 178 ( ELEMENT TOTALS )
1991	DERWENT VALLEY - SOUTH YORKSHIRE DERWENT VALLEY - SOUTH YORKSHIRE	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	1991 40 40 ( ELEMENT TOTALS )
2011	BROAD OAK - MID KENT/FLKSTNE BROAD OAK - MID KENT/FLKSTNE	47.500 47.500	17.133 17.133	.057 .057	.109 .109	(1.71)	17.299	2011 6 6 ( ELEMENT TOTALS )
2001	R.SEVERN - BRISTOL R.SEVERN - BRISTOL	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	2001 43 43 ( ELEMENT TOTALS )
1991	VYRNWY - NORTH WEST VYRNWY - NORTH WEST	.000 .000	.000 .000	.000 .000	.000 .000	(.00)	.000	1991 81 81 ( ELEMENT TOTALS )
TOTALS FOR LINK ELEMENTS		203.000	82.949	1.933	2.621		87.504	

## UNIT COSTS OF LINKS

	DISCOUNTED (EM/TCMD)	UNIT COSTS (P/M3)	DISCOUNTED TOTAL COST (EM)	DISCOUNTED TOTAL FLOW (TCMD)
1. NORTH ESSEX				
Great Bradley	.16015	43.88	8.31	51.86
TOTAL:	.16015	43.88	8.31	51.86
2. SOUTH ESSEX				
Great Bradley	.16015	43.88	18.99	118.54
Chelmsford Efflt	.04025	11.03	9.03	224.32
TOTAL:	.08171	22.39	28.01	342.86
3. LONDON				
Severn(Unsuprtd)	.14390	39.42	13.58	94.37
Thames Reuse	.00000	.00	.00	60.67
TOTAL:	.08759	24.00	13.58	155.04
4. OXFORD/SWINDON				

# Appendix 4 - Results for Medium Scenario Case MED5

Severn(Unsuprtd)	.14390	39.42	11.89	82.61
TOTAL:	.14390	39.42	11.89	82.61
5. WEST MIDLANDS				
Shropshire Gw	.00000	.00	.00	241.92
TOTAL:	.00000	.00	.00	241.92
6. EAST MIDLANDS				
Carsington	.02873	7.87	33.91	1180.20
Birmingham Gw	.04005	10.97	.40	10.11
TOTAL:	.02883	7.90	34.32	1190.31
7. SOUTH YORKSHIRE				
Derwent Valley	.00000	.00	.00	683.02
TOTAL:	.00000	.00	.00	683.02
8. MID KENT/FLKSTNE				
Broad Oak	.65368	179.09	17.30	26.46
TOTAL:	.65368	179.09	17.30	26.46
9. BRISTOL				
Shropshire Gw	.00000	.00	.00	184.11
Severn Reuse	.00000	.00	.00	108.31
TOTAL:	.00000	.00	.00	292.42
10. NORTH WEST				
Vyrnwy	.00000	.00	.00	963.86
TOTAL:	.00000	.00	.00	963.86
TOTAL			113.40	

## DEVELOPMENT OF LINKS

SOURCE NAME	DEMAND NAME	FLOWS THROUGH TIME(TCMD)						
		1991	1996	2001	2006	2011	2016	2021
Great Bradley	NORTH ESSEX	0	0	0	0	0	4	14
Great Bradley	SOUTH ESSEX	0	0	0	0	2	18	28
Chelmsford Efflt	SOUTH ESSEX	0	0	2	17	30	30	30
Severn(Unsuprtd)	LONDON	0	0	0	0	0	0	28
Thames Reuse	LONDON	0	0	0	0	0	0	18
Severn(Unsuprtd)	OXFORD/SWINDON	0	0	0	0	0	13	20
Shropshire Gw	WEST MIDLANDS	0	0	0	0	11	25	58
Carsington	EAST MIDLANDS	0	0	40	72	104	141	175
Birmingham Gw	EAST MIDLANDS	0	0	0	0	0	0	3
Derwent Valley	SOUTH YORKSHIRE	40	40	40	40	40	40	40
Broad Oak	MID KENT/FLKSTNE	0	0	0	0	1	4	6
Shropshire Gw	BRISTOL	0	0	7	18	25	26	17
Severn Reuse	BRISTOL	0	0	0	0	5	11	26
Vyrnwy	NORTH WEST	81	55	28	34	48	64	80
TOTALS		121	95	117	181	266	376	543

## SUMMARY OF CAPITAL COSTS;

CATEGORY	TOTAL CAPITAL COST INCURRED IN PERIODS (£M)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	69.4	.0	.3
LINK ELEMENTS	.0	.0	63.5	.0	47.5	92.0	.0
TOTALS	.0	.0	63.5	.0	116.9	92.0	.3

## SUMMARY OF TOTAL COSTS OF OPERATION;

# Appendix 4 - Results for Medium Scenario Case MED5

CATEGORY	TOTAL COSTS OF OPERATION THROUGH TIME (£M/PERIOD)						
	1991	1996	2001	2006	2011	2016	2021
SOURCES	.0	.0	.0	.0	.0	.0	.1
LINK ELEMENTS	.0	.0	.5	.7	1.1	2.6	4.5
TOTALS	.0	.0	.5	.7	1.1	2.6	4.6

## COST SUMMARY

TOTAL DISCOUNTED COST FOR PLAN = £M 113.402  
 TOTAL DISCOUNTED CAPITAL COST = £M 108.788  
 TOTAL DISCOUNTED COSTS OF OPERATION = £M 4.614 (ALLOWANCE INCLUDED FOR BEYOND 2021 = £M 2.673)  
 TOTAL CAPITAL OUTLAY TO 2021 = £M 272.664  
 TOTAL COSTS OF OPERATION TO 2021 = £M 9.485

TOTAL DISCOUNTED DEMANDS = 4030.372 TCMD

## RESULTS OF CHECKS ON VALIDITY OF ALLOCATION;

- A. ALL SUPPLY DEFICIENCIES MET IN FULL.
- B. NO DEMAND CENTRES OVER SUPPLIED.
- C. TAKE FROM SOURCES NEVER EXCEEDS DEVELOPED YIELD.

