

WS Atkins Water

a division of WS Atkins Consultants Limited
Curzon House
Southernhay West
Exeter EX1 1JG

DOCUMENT CONTROL SHEET

Client: **National Rivers Authority**

Project: **Environmental Consultancy Support
Exe/Axe Water Resources**

Title: **Review of Environmental Statement
River Axe Option -
Implications for Water Quality**

Date: **June 1993**

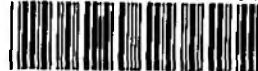
COPY NO: **08**

COPY HOLDER

00 Original
01 Master Copy - file
02 Distribution - **WSA**
03 Distribution - **NRA**
04 Distribution - **NRA**
05 **NRA**
06 **NRA**
07 **NRA**
08 **NRA**

Issue	Purpose	Originated	Checked	Reviewed	Authorised	Date
1	Final Draft	SR Crewe	HL Westbrook	RI Collinson	<i>SR Crewe</i>	21/6/93
1-D1	Preliminary Draft	SR Crewe	HL Westbrook	<i>/</i>	<i>/</i>	10/3/93

ENVIRONMENT AGENCY



105010

CONTENTS

	Page No
0. SUMMARY	1
1.0 INTRODUCTION	2
1.1 Background	2
1.2 Terms of Reference	2
1.3 The Environmental Statement	2
1.4 Information Sources	3
2.0 ENVIRONMENTAL STATEMENT PART B - RIVER ABSTRACTION AND TREATMENT	5
2.1 Section 3.0 Existing Situations	5
2.2 Section 4.0 Scheme Description and Mode of Operation	7
2.3 Section 5.0 Effects of Scheme Operation	7
2.4 Section 6.0 Scheme Construction	9
2.5 Section 7.0 Effects of Scheme Construction	9
2.6 Section 8.0 Monitoring	9
3.0 ENVIRONMENTAL STATEMENT PART D - PUMPED STORAGE RESERVOIR	10
3.1 Section 12.0 Location	10
3.2 Section 13.0 Existing Situation	10
3.3 Section 14.0 Scheme Description	10
3.4 Section 15.0 Reservoir Operation	11
3.5 Section 16.0 and 17.0 Construction Phase	11
3.6 Section 18.0 Monitoring	12
4.0 ENVIRONMENTAL STATEMENT ANNEXE B - WATER QUALITY	13
4.1 Section 3.0 Existing River Quality Objectives and Compliance	13
4.2 Section 4.0 Water Quality Studies	13
5.0 OVERVIEW OF THE ENVIRONMENTAL STATEMENT	19
5.1 Format of the Environmental Statement	19
5.2 Issues Omitted from the Environmental Statement	19
5.3 Water Quality	20
5.4 Ecology	20
5.5 Fisheries	21
5.6 Landscape, History and Archaeology, Recreation and Amenity	21
6.0 CONCLUSIONS	22

0. SUMMARY

This report constitutes primarily a review of the water quality and biology sections of the Environmental Statement and Annexe B - Water Quality submitted by South West Water Services Ltd (SWWS) to the NRA as part of the application for licences to abstract additional water from the River Axe. The Environmental Statement constitutes a number of additions and rewritten sections to the previously submitted draft report. However, the main conclusions drawn are much the same.

There are a number of issues in the Environmental Statement with which WS Atkins holds different views. The main issues relate to the conclusions that can be drawn, from what constitutes, a limited data set. Where the Environmental Statement draws a number of firm conclusions WS Atkins is of the opinion that additional long term data is required before these conclusions can be drawn.

The Environmental Statement has placed emphasis on the use of mass-balance calculations and the extrapolated impact on water quality when compared to a standard of 10% decline in water quality. The data used in this mass balance approach is from a limited number of years, including some years of low flow, used to define a baseline against which the effect of abstraction can be assessed. It is the contention of WS Atkins that the use of a small number of years to define the baseline, and the inclusion of low flow years, does not provide a meaningful basis to assess the impact of abstraction.

A number of other issues are discussed within the document where WS Atkins differs on the views expressed in the Environmental Statement. In overview, WS Atkins considers that the Environmental Statement in its present form does not provide sufficient evidence to allow an assessment of the proposed abstraction.

1. INTRODUCTION

1.1 BACKGROUND

South West Water Services Ltd (SWWS) has made applications to the National Rivers Authority - South West Region (NRA) for licences in connection with proposals to abstract additional quantities of water from the River Axe and to construct and operate a pumped storage reservoir. The proposed abstraction would be made near Whitford Bridge and the reservoir would be located at Higher Bruckland. The latter lies to the east of the river and in the same catchment area. SWWS has submitted an Environmental Statement to the NRA in support of their applications. This Statement has been prepared by MRM Partnership.

1.2 TERMS OF REFERENCE

The NRA has commissioned WS Atkins to review this Statement with particular reference to water quality issues with a view to :

- a) Identifying any fundamental changes between the draft Statement previously submitted in 1992 and the present version.
- b) Identifying any issues which conflict with conclusions drawn by WS Atkins.
- c) Justifying the use by the NRA of the WS Atkins study at public inquiry.
- d) Determining if there is sufficient information to make an assessment of the proposed abstraction.

1.3 THE ENVIRONMENTAL STATEMENT

The document "East Devon Water Resources - Axe Valley Water Resources - Environmental Statement (ref RP-PLA-1328A)-054(01))" as provided to WS Atkins for review comprises four main parts:

Part A Overview of Scheme
Part B River Abstraction and Treatment
Part C Pipeline
Part D Pumped Storage Reservoir

and is supported by a series of Annexes:

Annexe A	Hydrology
Annexe B	Water Quality
Annexe C	Fisheries
Annexe D	Ecology
Annexe E	Landscape
Annexe F	History and Archaeology
Annexe G	Recreation
Annexe H	Consultation Report

In line with the terms of reference this review is confined primarily to the water quality aspects of Parts B and D of the main document and Annexe B.

General comments have been provided on a section by section basis through Parts B and D of the main report whilst Annexe B has been examined in greater detail.

Comments by WSA on the earlier draft Statement (The Axe Valley Water Resources Scheme - Higher Bruckland Reservoir - Environmental Statement) previously submitted by SWWS to NRA in April 1992, were provided in WSA Interim Report : Exe/Axe Water Resources - Review of Documentation and Modelling Approach, November 1992, ref K1248.PD1/002.

1.4 INFORMATION SOURCES

Part of the terms of reference for this review require a comparison of issues and conclusions drawn from each of the Environmental Statement and the WS Atkins report "Environmental Consultancy Support - Exe/Axe Water Resources. River Axe Low Flow Study, February 1993 (K1248.PD1/003, Issue 2). It should be noted that a number of data sources used in the production of the two reports were not made available to both report writers. So that the following reports are discussed in the Environmental Statement but not in the WS Atkins report:

- Axe Resource Study Stage 1. Volumes 1, 2 and 3
MRM Partnership, 1987
- Axe Resource Study Stage 2. Volumes 1, 2, 3 and 4
MRM Partnership, 1989
- Basic Information Requirements for Axe Water Resource
Proposal, Dr J E Cochrane, NRA. December, 1990
- Survey of the Benthic and Planktonic Algae of the
River Axe System, Dr N T H Holmes, 1986
- 'Farming Practises and Potential Pollution Sources'
Roberston Gould Consultants, 1990.
(Not clearly referenced in the Environmental Statement)
- Weekly (?) Tidal Monitoring Survey Data, NRA

Those reports discussed in the WS Atkins report, but not in the Environmental Statement include the following:

- River Axe Water Resources Scheme. Biological Study.
NRA (SW) Environmental Protection Field Control Section
Summer and Autumn 1992
- Parkinson, M. (1985). The Axe Estuary and its Marshes.
Rep. Trans. Devon. Ass. Advmt. Sci 117, 19-62
- Wimpey Environmental,(1992). River Axe Abstraction: Implications
for Estuarine Water Quality. March 1992

Contract no RPEZ 5191. Commissioned by National Rivers Authority,
South West Region.

2. ENVIRONMENTAL STATEMENT PART B - RIVER ABSTRACTION AND TREATMENT

2.1 SECTION 3.0 EXISTING SITUATION

- 2.1.1 Subsection 3.1 of the Statement presents flow information. With regard to the river the information presented is similar to that previously presented although there has been some recalculation of flow figures given in Table 3.1. An additional series of paragraphs (3.1.4 - 3.1.6) has been added to cover the tidal regime.

The information presented in Subsection 3.1 is adequate and not disputed.

- 2.1.2 Subsection 3.2 of the Statement describes current abstraction licences. This section is substantially rewritten but contains similar information to the previous draft. No mention is made of the temporary licence conditions currently in force at Whitford Bridge as a drought measure.

Again the information presented in Subsection 3.2 is adequate and not disputed.

- 2.1.3 Subsection 3.3 of the Statement is concerned with discharge consents. The information presented is largely as before except that the Axminster discharge volume has been reduced from 2.5 Ml/d to 2.3 Ml/d and no mention is made of Colyton Sewage Treatment works. This is probably an oversight since the works outfall is clearly marked on Figure 3.2.

Except as mentioned above the information presented is not disputed.

- 2.1.4 Subsection 3.4 of the Statement is concerned with water quality. The information presented is largely as before except that reference is now also made to the NRA's intensive data collection programme in 1992 (paragraph 3.4.1). In paragraph 3.4.3 the annual river quality classification is discussed at Whitford and Axe Bridge (Axe Bridge is denoted wrongly as Axebridge in the table) between 1985 and 1991.

The information displayed in Table 3.3, which is not disputed, does not however, support the view put forward in paragraph 3.4.3 that whilst the RQO of 1B is now met at Whitford, quality is slightly poorer at Axe Bridge. A classification of 1B was achieved at both locations in 1991 whilst both locations only achieved class 2 in the previous year.

- 2.1.5 In paragraph 3.4.4 there is a suggestion that quality in the river improves downstream of the confluence with the "relatively clean" River Coly. It is not made clear however, that this tributary in fact discharges as a separate inflow to the estuary.

- 2.1.6 In paragraph 3.4.5 the Axe is compared in terms of quality to the Thames and Great Ouze both of which are used for water supply. Reference is presumably made to these rivers because of their eutrophic status, though this is not made clear here. The statements in the same paragraph: "since the river is eutrophic there will be some potential for algal growth during storage", and "However, it is not expected that insuperable problems of reservoir management will arise." are gross understatements of the likely situation. Managing eutrophic water supply reservoirs can be a very expensive business as Grafham Water (supplied from the Great Ouze) has shown.

- 2.1.7 Paragraph 3.4.6 quite rightly refers to a rising trend in nitrate concentrations in the River Axe although similar trends in ammonia and orthophosphate are not as apparent. The observation that the Axe water quality "deteriorates with rising flow rate" is somewhat unsubstantiated in the Statement in that only ammonia is put forward as an example. In fact an examination of data reveals that the reverse is true in the case of phosphate concentration.

WS Atkins holds the view that insufficient evidence is currently available to draw the conclusion with any certainty that water quality deteriorates with increased flow rate.

- 2.1.8 Paragraphs 3.4.7 and 3.4.8, which refer to tidal waters, are new additions to the Statement. Paragraph 3.4.7 describes the available data whilst 3.4.8 discusses the findings.

The observation in paragraph 3.4.8: "very little spatial variation (in water quality) between the four sampling points" is not entirely supported by data. Whilst there may be similarity in mean values of DO and BOD concentrations, those for total ammonia, phosphate and faecal coliforms show distinct variation (Figure 1 - Appendix B6 Annexe B of the Statement). In any event it is considered inappropriate to view data distributions globally when looking at an estuary. The diurnal changes at each of the sites due to tidal action are important, particularly if there are times of the day when conditions may become hostile. For example on at least one occasion in mid estuary an unionised ammonia level exceeding 0.021 mg/l was observed.

The final sentence which states that "quality (in the estuary) appears to be independent of freshwater flow at Whitford between 0.9 m³/s and 1.6 m³/s, but deteriorates markedly at higher river flows" is unsubstantiated by data.

- 2.1.9 Subsection 3.5 covers Fisheries and the text is essentially similar to the previous draft.

This area falls outside of WS Atkins' Brief.

- 2.1.10 Subsection 3.6 covers Ecology and Nature Conservation.

Much of this section is as previously stated, there are some additions however:

- 2.1.11 Paragraph 3.6.2 refers to previously mentioned catchment wide invertebrate surveys undertaken by Freshwater Biological Association and SWWS. It is mentioned that the river is generally of high interest based upon the BMWP system particularly in the middle and lower Axe. There are also references to new work carried out in 1992 by Dr Patrick Armitage of Institute of Freshwater Ecology (IFE) which, it is claimed, confirmed original conclusions.

These comments concur with those of WS Atkins. A high BMWP score is also indicative of a 'clean river'.

- 2.1.12 Paragraph 3.6.4 refers to more recent surveys (1992) covering "detailed invertebrate, river corridor and macrophyte recording in the vicinity of the abstraction site". It is claimed that these surveys, details of which are contained in Annexe D, "provide a better basis for impact assessment as well as to serve as the baseline for monitoring changes resulting from construction and operation of the intake".

It is agreed that this additional information contributes to the baseline data and as such provides an improved basis for impact assessment.

- 2.1.13 Paragraph 3.6.6 contains amended information concerning nationally and regionally rare species found in the Axe. The Statement now clearly refers to the presence of such species downstream of Whitford Bridge.

This is important in that the conservation value of the stretch of river to be impacted by the abstraction is now perhaps more fully recognised.

- 2.1.14 Paragraph 3.6.7 contains an additional reference to areas of exposed stones and cobbles at low flows – particularly above Whitford.

- 2.1.15 Paragraph 3.6.8 which refers to invertebrate records at Nunford Dairy contains a further reference to 1992 NRA and SWWS invertebrate surveys. The Statement states that "these new data have not necessitated Dr Patrick Armitage of the IFE amending his original conclusions regarding the community and its potential vulnerability to change".

Whilst it is not clear what these conclusions were, it would appear that Dr Armitage is of the same view as WS Atkins ie, that there is potential risk to the existing community but that at present the risk cannot be quantified.

- 2.1.16 Paragraphs 3.6.12, 3.6.13 and 3.6.14 are concerned with estuarial biology. Previously it was stated that "little data was available on the ecological interest of the estuary". Further information now appears to have come to hand. NRA biological surveys carried out in 1990 are mentioned, although no conclusions are drawn, and reference is made to "baseline surveys" carried out by the University of Plymouth in 1992 "on which future monitoring will be based".

WS Atkins has reviewed these reports and considers that based on the limited data available there is little evidence of risk to the estuary.

- 2.1.17 Subsections 3.7 Landscape, 3.8 History and Archaeology and 3.9 Recreation and Amenity fall outside of the WS Atkins Brief.

2.2 SECTION 4.0 SCHEME DESCRIPTION AND MODE OF OPERATION

WS Atkins has no comments to make on this Section.

2.3 SECTION 5.0 EFFECTS OF SCHEME OPERATION

- 2.3.1 Subsection 5.1 is concerned with flows and as such is outside of the WS Atkins Brief.

- 2.3.2 Subsection 5.2 discusses effects on water quality.

- 2.3.3** Paragraphs 5.2.2 and 5.2.3 set out the main water quality concerns to be addressed. This is a little more explicit than the previous version and includes solids deposition and resuspension.

The content of these two paragraphs is adequate.

- 2.3.4** Paragraphs 5.2.4 and 5.2.5 deal with river water quality. The content is similar to the draft version except that more attention is paid to the possible impact of increased retention time on algal growth and solids deposition.

As previously the submission is based on simulations and theoretical calculations. Comments on river water quality are still confined to the sanitary parameters and no mention is made here of nutrients. The fact that ammonia levels are predicted to exceed the NRA's 10% rule is quickly dismissed as trivial. The comments concerning algal growth and solids deposition are too theoretical to be of much practical value.

- 2.3.5** Paragraph 5.2.6 covers bacterial concentrations. Again these predictions are based on theoretical calculations. Implications for the beach which currently achieves the EC bathing water standard are probably insignificant. However, levels in the estuary exceed the EC Bathing Water limit (which may form the basis of a watersports standard) and are predicted to increase further. Whilst agricultural run-off probably adds significantly to the bacterial load carried by the river, the bold statement which claims that this is the major source is unsubstantiated.

- 2.3.6** Paragraph 5.2.7 is concerned with estuary water quality and contains no new information.

- 2.3.7** Paragraph 5.2.8 looks specifically at the implications for STW consent standards of a reduced 95% of time exceeded flow in the river. Again the conclusions reached are based on theory and the predicted 10% exceedance for ammonia is dismissed.

- 2.3.8** Subsection 5.3 is concerned with Fisheries and is outside of WS Atkins' Brief.

- 2.3.9** Subsection 5.4 is concerned with the effects on ecology of the river works and treatment works.

This section is largely outside of WS Atkins Brief however some issues are relevant:

- 2.3.10** Paragraph 5.4.7 discusses the impact of lower flows on the riverine habitats. The point is made that desiccation due to exposure is the most obvious example. The comment which follows however: "the reverse often happens in thickly vegetated rivers" implies that the author expects low flow to lead to enhanced plant growth. This is already a problem in the river and no reference is made to increased risk of flooding. In addition the final sentence "increases in temperature and siltation could occur resulting in super-saturation of oxygen followed by its rapid depletion at night" ignores the real cause of this phenomenon – increased plant activity.

- 2.3.11** Paragraph 5.4.11 contains the statement "there are no aquatic plants present which are vulnerable to the likely effects of low flows". *Ranunculus*, a fast flow species is currently found in the stretch of river below Whitford. Such a species may well suffer under reduced flow velocities.

- 2.3.12 In paragraph 5.4.13 it is claimed that the effects of reduced flows will be "slight reductions in flow velocity", "slight increases in temperature" and "minimal changes in water chemistry". These statements are speculative and unsubstantiated.
- 2.3.13 Whilst the observation in paragraph 5.4.14 concerning susceptibility of the known invertebrate community to the above mentioned physical parameters may be a true reflection of the situation, insufficient comment is made concerning the risk to these organisms of increased pollutant concentrations as a direct result of reduced dilution of effluents entering the river downstream of the abstraction. The risk to these organisms is not just confined to upstream agricultural pollution as is suggested.
- 2.3.14 The statements contained in paragraph 5.4.17 referring the 'unknown' and the need for a monitoring programme (paragraph 5.4.18) are fully supported and reiterate the findings of WS Atkins.
- 2.3.15 Paragraph 5.4.19 also underlines the conclusion drawn by WS Atkins that insufficient data concerning the estuary is currently available to enable predictions to be made. The reference to the Coly providing "additional flow" is misleading in that it implies that this in some way compensates for the abstraction.
- 2.3.16 Subsections 5.5 Effects on Landscape, 5.6 Effects on History and Archaeology and 5.7 Effects on Recreation, are outside the WS Atkins Brief.

2.4 SECTION 6.0 SCHEME CONSTRUCTION

WS Atkins has no comments to make on this section.

2.5 SECTION 7.0 EFFECTS OF SCHEME CONSTRUCTION

WS Atkins has no comments to make on this section.

2.6 SECTION 8.0 MONITORING

Details of the monitoring programme are absent from the Statement. It is stated in paragraph 8.1.3 that a proposed monitoring programme is currently under discussion. WS Atkins has put forward recommendations regarding monitoring in its River Axe Low Flow Report.

3. ENVIRONMENTAL STATEMENT – PART D – PUMPED STORAGE RESERVOIR

3.1 SECTION 12.0 LOCATION

This section is concerned with the location of the proposed pumped storage reservoir and is largely unchanged from the original draft.

WS Atkins has no comment to make on this Section.

3.2 SECTION 13.0 EXISTING SITUATION

This section provides information on the existing situation with respect to the proposed reservoir site. Again much of the information is as previously reported, however, there are some additions:

3.2.1 In paragraph 13.4.2 which is concerned with groundwater quality reference is now made to groundwater samples having been taken indicating hard, slightly alkaline water.

3.2.2 In paragraph 13.5.4, which is concerned with Higher Bruckland Stream water quality, reference is now made to further surveys in "later autumn/early winter of 1992" although the results are not included with earlier data in Table 13.1 on page 79.

The general conclusion here that the stream is class 2 is not supported by data which in fact indicates 1B.

3.2.3 In paragraph 13.6.3, which is concerned with ecological surveys, reference is made to further data collection in 1992 at four sites. However, the results are not specifically discussed here.

3.2.4 In paragraph 13.6.5, which again is concerned with biological interest in the stream, reference is now made to "further surveys by both NRA and SWWS biologists" which "indicate a typical, but not special, stream invertebrate fauna". This information has been appraised by Dr Armitage of IFE.

3.2.5 Subsection 13.7 is concerned with terrestrial ecology and is largely as per the previous draft except for additional information in paragraphs 3.7.1 and 3.7.5.

3.2.6 Subsections 13.8, 13.9, 13.10, 13.11 and 13.12 cover landscape character/site visibility, history/archaeology, land use/pollution sources, existing water use and recreation/amenity respectively.

These are new subsections which attempt to provide baseline information, albeit limited in some cases, against which changes can be assessed. WS Atkins has no comment to make on these sub sections.

3.3 SECTION 14.0 – SCHEME DESCRIPTION

This section describes the proposed pumped storage reservoir scheme and has been substantially rewritten.

3.3.1 Items of water quality interest are the proposals for rapid drawdown and scour release (paragraphs 14.2.18 and 14.2.19) and the proposal to provide public toilets and tea shop at the visitor centre (paragraph 14.5.2). Whilst pollution prevention measures are outlined in the case of the scour release, no reference is made to the provision of treatment facilities for the visitor centre.

3.3.2 Subsection 14.8 is concerned with control of reservoir quality and is unchanged from the previous draft.

3.4 SECTION 15.0 - RESERVOIR OPERATION

This section is concerned with the effects of reservoir operation.

3.4.1 Subsections 15.1, 15.2 and 15.3 are concerned with climate, drawdown, slope stability and ground water and are similar to the previous draft except for additional information on reservoir drawdown (paragraphs 15.1.3 and 15.1.4).

3.4.2 Subsection 15.4 is concerned with surface water and is essentially similar to the previous draft.

3.4.3 Subsection 15.5 is concerned with stream and corridor ecology and again is essentially similar to the previous draft except that some consideration has been given to the likely effects of drainage water from access roads and visitor facilities and dam construction (paragraph 15.5.6). It is noted that insufficient information is available to quantify the last of these issues.

3.4.5 Subsection 15.6 is concerned with terrestrial ecology and habitats in the upper Bruckland Valley and is outside of the WS Atkins' Brief.

3.4.6 Subsections 15.7, 15.8, 15.9, 15.10, 15.11 are concerned with planning, landscape, history/archaeology and land use and are also outside of WS Atkins' Brief.

3.4.7 Subsection 15.12 is concerned with effects on existing water use, however, this is primarily concerned with quantity rather than quality and as such is outside of WS Atkins' Brief.

3.4.8 Subsection 15.13 is concerned with effects on recreation and again is outside of WS Atkins' Brief.

3.5 SECTIONS 16.0 AND 17.0 - CONSTRUCTION PHASE

The Statement clearly recognises that there is potential for damage to water quality and ecology during the construction phase of the reservoir. It is admitted in paragraph 17.1.2 that it is not possible at this stage to foresee all possible impacts that may arise as the result of construction.

Whilst WS Atkins would concur with this view it is important that a worst case scenario of possible effects be drawn up so that no "surprises" occur once construction has commenced.

3.6 SECTION 18.0 – MONITORING

The Statement recognises the need for a monitoring programme to assess impacts and confirm predictions. It is stated in paragraph 18.1.3 that a proposed monitoring programme is currently under discussion.

4. ENVIRONMENTAL STATEMENT - ANNEXE B - WATER QUALITY

4.1 SECTION 3.0 - EXISTING RIVER QUALITY OBJECTIVES AND COMPLIANCE

4.1.1 Subsection 3.1 sets out the criteria used by the NRA to judge the impact of the proposed scheme on water quality. This subsection is essentially similar to the previous draft except that the reference to non prejudice of low flows figures used in consent calculations has been omitted.

4.1.2 Subsection 3.2 covers environmental quality objectives as applied to the river.

4.1.3 Paragraph 3.2.3 expresses the view that non-compliance with NWC class objective in the past has been largely due to infringement of the BOD standard as a result of agricultural run-off.

Whilst this may be the case there is no direct evidence that this is the only cause. The Axe at Axe Bridge has failed more consistently than the Axe at Whitford Bridge. There are two STW's outfalls between these points.

4.1.4 In Paragraph 3.2.5 it is stated that the 1991 quality assessment indicated that the Axe complied with the EC Freshwater Fish Directive requirements.

Whilst this is probably true, data collected over the three years 1990 - 1991 suggests that dissolved oxygen concentration may occasionally fall below 7.0 mg/l.

4.1.5 Subsection 3.5 covers bathing water quality and in paragraph 3.5.1 it is stated that the bathing water at Seaton Beach failed to comply with mandatory bacteriological standards in 1986 and 1987.

No reference is made to the fact that the bathing water has complied in subsequent years.

4.1.6 Subsection 3.7 discusses effluent discharges and, in paragraph 3.7.2, it is stated that Colyton STW effluent has recently indicated individual determinand exceedances but in general has complied with consent conditions during 1991 and 1992.

Colyton STW failed to comply with consent in respect of both BOD and SS during 1992.

4.2 SECTION 4.0 - WATER QUALITY STUDIES

4.2.1 Subsection 4.1 discusses implications of the '10 Percent Rule'.

The arguments put forward in paragraph 4.1.1 are not entirely valid:

A 10% deterioration in quality would be demonstrated by a 95 percentile value (or statistical mean) for a determinand (5 percentile in the case of dissolved oxygen or lower pH value) at a given point being shown to have worsened by 10%. Such effect can only be shown by establishing baseline 95 percentile values (or means) over a number of years, and comparing future data distributions with this value. Natural variations in river flow are of no direct concern since these are taken into account in establishing the baseline distribution of data.

Where a rising (or falling) trend in a particular determinand has been demonstrated it may be more difficult to show a change.

It is true that application of the '10% rule' may have economic implications particularly in respect of ammonia concentration which does appear to be critical. We would also concur with the view that a deterioration marginally in excess of 10% in the case of ammonia at the concentrations currently found would not be detrimental to water quality.

4.2.2 Subsection 4.2 looks at simulations of the effect of the abstraction.

4.2.3 In paragraph 4.2.1 it is not clear why a simulation involving the abstraction of maximum volume from a drought flow of 0.8 m³/s has been put forward when this situation has been specifically excluded in the licence application.

4.2.4 Also in paragraph 4.2.1 the reference to impact on treatability of the water is out of place.

4.2.5 The simulations put forward in paragraph 4.2.3 supported by Appendix B3 are new to the Statement and would appear to present a valid case to indicate that breach of the 10% rule with regard to ammonia would be marginal. However, the comment concerning the 'net improvement' achieved above a river flow of 1.3 m³/s is misleading in that the actual concentrations of ammonia in the river would still be up to 15% higher than would be the case without the abstraction.

The graphs in Figure 2 indicate that a continuation of the simulations for river flows above 1.320 m³/s would in fact show a fall in the level of breach of the '10% rule' back toward compliance. However, the rule would again be breached when the second stage of the abstraction comes into play.

4.2.6 Subsection 4.3 looks at the effects of reduced flows.

4.2.7 An attempt is made in paragraphs 4.3.1, 4.3.2 and 4.3.3 to predict the likely effects of abstraction on algal growth. The retention time calculations described in Appendix B4, which supports these sections, were not revealed in the previous draft of the Environmental Statement. The comments made regarding the impact of reduced velocities and depths on growth of planktonic and benthic algae are quite valid. However the reference to a 'trade off' between increased algal productivity and reduced wetted bed area (in paragraph 4.3.3) is a little misplaced.

No mention is made of the likely impact on macrophytes which may increase in density under conditions of reduced velocity and depth. Prolific growth of macrophytes can lead to choking of the river and smothering of other life forms.

4.2.8 Subsection 4.3.4 continues in the vein of the impact of reduced velocity but with respect to sediments. No evidence is presented to confirm the assumption that the sedimentation process is exponential with a half life of 6 hours in moving water corresponding to a rate coefficient of 2.8 per day. Insufficient data is available to predict the impact on sediment movements within the river and to suggest that the abstraction may even result in an improvement, without evidence, is considered to be rather misleading.

Furthermore there is no reference to the likely impact of reduced river flows on the estuary sediments.

4.2.9 Subsection 4.4 considers water quality in the estuary.

4.2.10 It is claimed in paragraph 4.4.1 that the '10 percent rule' is largely satisfied in the estuary below Seaton STW outfall the only exception being a marginal infringement in the concentration of ammonia within the flow range 1.3 to 1.42 m³/s at Whitford. This statement is based on theoretical mass balance equations (Appendix B3 to Annexe B) and assumes that Seaton STW effluent meets an ammoniacal nitrogen standard of 10 mg/l. No real data is presented. Again, as in paragraph 4.2.3, a misleading reference to an apparent net improvement at the above flows is made.

Appendix B3 is a new addition to the Statement. It was prepared in November 1992 by Brooker and Garland, no doubt in an attempt to quantify the position regarding ammonia and the '10 percent rule'. The approach adopted is perfectly logical, but can only serve as an indication of the likely situation.

4.2.11 Paragraphs 4.4.2 and 4.4.3 discuss bacterial quality in the estuary based on a preliminary assessment by Brooker and Garland undertaken in 1991 and previously reported (Appendix B5 to Annexe B). Whilst the calculations are reworked to take account of the scheme now proposed, no new evidence is presented. Appendix B5 concludes that the impact of the abstraction on bacterial numbers at Seaton Beach will be negligible. The approach adopted is rather simplistic however and can only be taken as an indication.

4.2.12 Paragraph 4.4.4 refers to another recent report by Brooker and Garland (Appendix B6 to Annexe B) which looks at estuarine surveys carried out by the NRA between May 1990 and February 1991. The report concludes that whilst the estuary is stratified, there is no significant variation in pollutant concentration along its length. This observation is not entirely supported by data and, being based only on the surface layers, is an over simplistic view of estuarial water quality. This point has already been covered in paragraph 2.1.8 of this Review.

4.2.13 Paragraph 4.4.5 refers particularly to dissolved oxygen and unionised ammonia levels in the estuary and the relationship between the condition of the estuary and river flow. Again the findings of Brooker and Garland's report (Appendix B6) are quoted. It is concluded that even under the lowest river flows the above determinands are at satisfactory levels and that the condition of the estuary is not materially influenced by flows up to 1.6 m³/s. At higher flows however a deterioration in condition occurs.

These observations are based on eleven estuary surveys over a ten month period during which time only one survey coincided with a flow exceeding 1.6 m³/s. This one event, a flow of 19.6 m³/s, which clearly impacted upon the estuary is the basis upon which it is concluded that estuary quality deteriorates with higher river flows.

It is well known that sudden increases in river flow due to high rainfall events coincide with a deterioration in water quality. This is due to many sources including urban surface water run-off and foul storm water overflows as well as agricultural run off. These are particularly pronounced after a long dry spell. The deterioration which occurred at a flow of 19.6 m³/s is therefore perhaps not surprising. To use this event to infer that quality generally decreased with increased river flow is not valid.

WS Atkins is of the view that currently insufficient data exists to demonstrate any correlation between river flow and tidal water quality.

Equally there is insufficient evidence to demonstrate that tidal water quality would not have deteriorated below that observed under the 0.9 - 1.6 m³/s natural flow range which occurred during the study period if this flow had been further depleted by abstraction (i.e. due to increased impact of pollution sources downstream of Whitford).

WS Atkins accepts however that the seawater provides an overwhelming source of clean water for dilution of river water and Seaton STW effluent during naturally low flow periods.

- 4.2.14 Paragraph 4.4.6 claims to present new evidence that the condition of the estuary declines at flows in excess of 1.6 m³/s. This is based on a continuous monitoring exercise carried out in summer 1992 by the NRA and is discussed by Brooker and Garland in Appendix B7 to Annexe B.

The graphs presented in Figure 7 of Appendix B7 would appear to indicate that higher oxygen values occur at lower flows. This is more noticeable at Gin Bottle Hole suggesting that the river is having a major influence.

These oxygen values were obtained during summer 1992 hence they are biased toward lower flows and will reflect the large diurnal changes found in eutrophic rivers at that time of the year. It might equally be concluded therefore that the oxygen pattern obtained is due entirely to natural causes. The observed indication that oxygen levels fall as river flow rises might merely be a reflection of meteorological changes (cloud cover, rainfall etc).

There are insufficient data at flows in excess of 3 m³/s and seasonally to establish a firm correlation between river flow and oxygen content in the estuary. Equally there is insufficient information to confirm that an artificially lowered river flow will have the same effect as naturally occurring low flows.

4.2.15 Subsection 4.5 discusses predicted reservoir quality.

In this subsection predictions are made concerning reservoir water quality and reference is made to two reports: Appendix B8 (Brooker and Garland on simulations of nutrient concentrations in three hypothetical reservoirs in the Axe system, 1990) and Appendix B10 (Wessex Water Environmental on algal studies and treatment problems associated with the same three reservoirs, 1990).

The work undertaken by Brooker and Garland (Appendix B8) was aimed at problem minimisation through site selection rather than problem quantification. The work by Wessex Water Environmental was aimed at treatability. Whilst both of these pieces of work are important from a water supply management point of view, neither addresses the environmental issues. Indeed Brooker and Garland raise the issue of the rising trend in nitrate values in the river and the possible need for selective abstraction. This is not mentioned in the main text however.

4.2.16 It is assumed that the reservoir will stratify (paragraph 4.5.2) and concluded that the Higher Bruckland site offers the best opportunity for overcoming some of the problems associated with this phenomenon. It is also stated that "no attempt was made or is deemed necessary to model the ecology of the system since adequate experience exists to manage eutrophic reservoirs".

Quite apart from this being a rather over-confident statement, management of eutrophic reservoirs has its price in daily monitoring, operation and treatment costs. Also the NRA should be aware of the possible implications for control of nitrate and phosphate levels in the Axe under the Urban Waste Water Treatment and Nitrate Directives.

4.2.17 In paragraph 4.5.3 the report usefully compares the proposed Axe/Higher Bruckland system with the Great Ouze/Grafham and Thames/Farmoor systems. Details are given in Appendix B9.

The text fails to mention however that Grafham Water has been the subject of extensive algal blooms (including Blue-Greens) to the extent that treatment filters have been blocked and dosing of the reservoir with ferric sulphate has been necessary.

4.2.18 Subsection 4.6 discusses the effect of the reservoir on Bruckland Stream.

The ES states that impact on the Bruckland Stream will be limited to that caused by seepage, scour releases, overtopping and car park drainage.

4.2.19 In paragraphs 4.6.1 and 4.6.2 the implications for water quality of seepage are clearly stated together with mitigating measures.

4.2.20 In paragraph 4.6.3 the question of scour releases is discussed.

There is always a risk of stream bed discolouration from this activity and this should not be underestimated in the design. It is stated that the discharge will be carefully monitored but does not say how.

4.2.21 Paragraph 4.6.4 deals with overtopping and states that no deleterious effect on Bruckland Stream from this source is foreseen.

Whilst this is probably a reasonable assumption, no evidence is presented in support.

4.2.22 Paragraph 4.6.5 discusses drainage from the access road and visitor area. Mitigating measures to prevent stream pollution are planned, but no details are given. It is not stated as to whether toilet facilities are to be provided, although this is referred to in the main report.

5. OVERVIEW OF THE ENVIRONMENTAL STATEMENT

This section of the report provides an overview of the Environmental Statement and considers its appropriateness for assessing the impact of the proposed abstraction.

5.1 FORMAT OF THE ENVIRONMENTAL STATEMENT

The Environmental Statement has been prepared as supporting information for the licence application made by SWWS to the NRA. The format of the Environmental Statement is intended to conform to a number of relevant documents¹²³. The Environmental Statement notes however that a number of issues normally addressed in environmental statements have been omitted including : planning framework and policies; land ownership; public rights of way; traffic impacts and socio-effects.

In addition the Environmental Statement makes no mention of noise and odour impacts. These issues are not necessarily of concern to the NRA. However, their omission seems unjustified given that issues of landscape and heritage are discussed extensively in the document. A more fundamental omission from the Environmental Statement is to the Non-Technical Summary which is entirely absent.

The format of the present Environmental Statement is such that there is a need for extensive reference to the several annexes. The report is divided into four parts referring to: overview of the scheme; river abstraction and treatment; pipeline and pumped storage reservoir. Within each of these sections the following are variously described: existing situation; scheme description; scheme operation; scheme construction; effects of construction and monitoring.

5.2 ISSUES OMITTED FROM THE ENVIRONMENTAL STATEMENT

Irrespective of the issues defined as being omitted from the Environmental Statement by the authors, there are a number of issues that appear to have been overlooked: sediment dynamics in the estuary; detailed monitoring programme; assessment of emissions, noise and odour.

5.2.1 Sediment Dynamics

The impact of abstraction on sediment distribution in the estuary is ignored. The abstraction may impact on sediment distribution in a number of ways : relocation of the maximum turbidity zone; reduction in total load of sediments to the estuary and possible alteration in the action of spates on sediment distribution. This potential impact should be included in the Environmental Statement.

¹ Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 (IS No 1199).

² Environmental Assessment, A Guide to the Procedures. DoE and Welsh Office.

³ Environmental Assessment, The Treatment of Landscape and Countryside Recreation Issues. Countryside Commission.

5.2.2 Monitoring

Recommendations for monitoring are not included in the Environmental Statement, rather they are being prepared as a separate statement (Section 8.1.3 of the Environmental Statement). This lack of detail does not allow comment to be made.

5.2.3 Emissions, Noise and Odour

Insufficient attention has been paid to discharges from the water treatment works, visitor centre and any washouts. Noise and odour implications are not addressed.

5.3 WATER QUALITY

The details of the water quality sections of the Environmental Statement have been discussed in detail elsewhere. In outline the arguments used in the discussion of water quality are generally unsubstantiated and supporting information is not always clearly expressed. The Environmental Statement makes a number of statements inferring accurate determination of the likely impact of the abstraction. The WS Atkins view is that the data available are insufficient for these predictions to be considered as any more than an indication.

The Environmental Statement therefore does not adequately support the proposed abstraction according to the criteria stated in the Environmental Statement:

- i) 'The extent to which increases in concentrations could be expected to occur bearing in mind that these should not be greater than 10 percent'.
- ii) 'The extent to which retention time might be lengthened and its possible effects on algal growth and the deposition of particulate matter'.
- iii) 'The extent to which increases in concentrations of bacteria might occur in the river, its estuary and the bathing beach at Seaton'.
- iv) 'The effects of a downward shift in the 95 percentile exceedance flow on consent conditions'.

In summary it is considered that there are insufficient water quality data to allow proper assessment of the impact of the proposed abstraction. In particular there are insufficient data to isolate the effects of natural variation in river flow from the likely effect of an abstraction.

5.4 ECOLOGY

The details of the ecology sections of the Environmental Statement are discussed elsewhere. Statements are made indicating that reduced flow as a result of abstraction should not cause the macro-invertebrate community of the river to suffer (5.4.14) and that no adverse impacts are expected on the macrophyte community (5.4.13). WS Atkins takes the view that such predictions can only be speculative given the lack of available data.

The Environmental Statement presents a large but incomplete data set relating to the ecology of the system and the conclusions drawn are open to debate. Therefore it is considered that there is insufficient information to properly assess the impact of the proposed abstraction. In particular there are insufficient data to allow the isolation of natural variation from the likely impact of the proposed abstraction.

5.5 FISHERIES

WS Atkins has not been involved in the fisheries studies undertaken in connection with this project and therefore cannot provide comments on the adequacy of this Section.

5.6 LANDSCAPE, HISTORY AND ARCHAEOLOGY, RECREATION AND AMENITY

This area of the Statement provides information relevant to other NRA functions and again does not fall within WS Atkins brief.

6. CONCLUSIONS

- The Environmental Statement contains a number of additions to the draft document.
- These additions do not constitute fundamental changes to the issues and conclusions drawn in the draft document. However an attempt is made to provide answers to some of the questions that have been raised since the first draft was produced.
- The views expressed by the Environmental Statement and the WS Atkins Report are based to some extent on different data sources.
- WS Atkins holds different views to those stated in the Environmental Statement on a number of issues.
- There are insufficient data to support the view that water quality in the River Axe deteriorates with rising flow rate.
- The reliance placed on simulations and theoretical calculations in the Environmental Statement due to the lack of data is considered to be excessive.
- The theoretical calculations employed in the Environmental Statement are not adequately validated.
- The theory used to justify the simulations and theoretical calculations is not always clearly expressed; in particular the calculations addressing 10% deterioration in water quality.
- The risks to both aquatic plants and invertebrates due to the proposed abstraction regime are considered to be understated.
- The risk of enhanced macrophyte growth in the river and the potential for choking the river are also understated.
- The approach used to estimate bacterial concentrations and possible failure at Seaton Bridge is too simplistic.
- There are insufficient data to support the view that estuarial water quality decreases with increased river flows.
- The Environmental Statement under estimates the potential costs associated with the management of a eutrophic reservoir.
- The Environmental Statement is characterised by a number of omissions, both acknowledged and unacknowledged. Included in the latter are the Non-Technical Summary, discussions of sediments, discussions of monitoring and sections on emissions, noise and odour.
- In overview it is considered that the Environmental Statement does not present a clearly substantiated case for the acceptance by the NRA of the proposed licence.

- The WS Atkins report in contradiction to the Environmental Statement, indicates a number of areas where data are considered insufficient for a clear view to be drawn on the impact of the proposed abstraction.

- The recommendations contained in the WS Atkins River Axe Low Flow Report are therefore commended to the Authority as the best way forward.

