
Part B – Key Components

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B4 Quality Enhancements

B4.1 Overview of the Quality Enhancement Programme

This section sets out our proposed investment for 2010-2015 to meet statutory and other quality enhancement drivers. The proposals are designed to ensure, as a minimum, compliance with statutory obligations and are thus consistent with general company strategy as set out in our Strategic Direction Statement (SDS). The programme has been developed on the basis of information and guidance received from Defra, the Environment Agency (EA), Natural England (NE) and the Drinking Water Inspectorate (DWI). Our proposals are consistent with Defra guidance as set out in their 'Statement of Obligations, December 2007, and the 'Social and Environmental Guidance to Ofwat, February 2008'. We have maintained close liaison with the regulators during the development of our proposals, and have amended our Business Plan to accommodate recent changes in policy, as well to reflect feedback on our draft plan.

All of our drinking water schemes have been submitted to the Drinking Water Inspectorate for review, assessment and approval. The drinking water quality programme includes several schemes that were not included in the draft plan and other schemes, particularly our lead strategy, have been modified significantly. DWI has given written support for all of the schemes we are including in our final Business Plan. In addition, our environmental programme is supported by both the EA and NE, whilst our programme to meet the requirements of Security and Emergency Measures Direction has Defra support.

The Environment Agency has prepared the National Environment Programme (NEP, last updated January 2009) and schemes to meet these obligations form the basis of our quality programme.

For parts of the wastewater programme, there are strong links to proposals in supply demand waste (Section B5), in particular for sewage works upgrades where there is a growth driver e.g. the Thames Tideway sewage works and with our proposals for investment in sludge treatment. Quality enhancements are largely driven by statutory obligations and therefore, in general, must be included in our plan. However the proposed investment has been through the same process as the remainder of the programme with respect to customer willingness to pay, cost benefit assessment, optimisation etc.

B4.1.1 Summary of AMP5 Proposals

Our customers believe that maintaining the quality of drinking water and the environment in general should be a key priority for our future investment programme. This was apparent both from the responses to the consultation on our Strategic Direction Statement and the detailed 'Willingness to Pay' research carried out as part of the development of our investment proposals for 2010–2015. Our quality enhancement programme is designed largely to meet statutory obligations although there is some investment to meet local priority drivers. Our cost benefit analysis (CBA) on the programme has found that of the 87 schemes that could be assessed, only 11 are not cost beneficial. These 11 are all

within the sewerage service programme, are supported by the Environment Agency and we are confident that, like the rest of our submission, represent the most cost-effective solution. In addition, six of the 11 are either direct or indirect statutory obligations.

Our **drinking water quality programme** comprises 15 schemes, which all have DWI support, covering a range of parameters. These include the removal or reduction of pesticides, nitrates and *Cryptosporidium* from drinking water where there has been significant deterioration in raw water quality. In order to meet the forthcoming lead standard of $10\mu\text{g l}^{-1}$ we plan the installation of treatment at 5 works in order to reduce plumbosolvency and have developed an integrated lead strategy that involves the replacement of lead pipes in areas that are at greatest risk of exceeding the standard. Our drinking water quality programme has been developed in conjunction with, and informed by, the preparation of our . ✕ [Redacted]. All of the drinking water quality schemes have been identified as the appropriate mechanism for managing an unacceptable risk of supplying water that is non-compliant with regulatory standards or presents a danger to human health. The preparation of our . ✕ [Redacted]. has also identified other risks to drinking water quality that are more appropriately dealt with by capital maintenance and feature elsewhere in the Business Plan.

The **environmental programme** is based on the Thames EA NEP received in November 2008, updated in January 2009. The programme includes a number of schemes required to address cases where abstractions have been demonstrated to have an adverse impact on the environment, as well as the requirement for investigations and options appraisals at sites where the Environment Agency feel that there is the potential for our abstractions to have an adverse impact on the environment. We have also included schemes to investigate water treatment works sludge processing and the occurrence and impact of the pesticide metaldehyde in this section as they are both part of the agreed NEP programme. We have removed our references to fish screen installation following advice from EA head office, although we note the implications of the Defra consultation (Jan-April 2009) which suggest that fish screens may still become a regulatory requirement. We therefore note this as an uncertainty, as recorded below.

The wastewater investment programme for 2010-2015 is dominated, in financial terms, by the delivery of improvements related to the Thames Tideway; the sewage treatment works (STW) flow to full treatment and quality upgrades that were initiated in AMP4, completion of the River Lee Tunnel (and associated increased treatment capacity at Beckton STW) to alleviate storm discharges from Abbey Mills and starting work on the main River Thames Tideway Tunnel. This period also sees the commencement of a major rebuild of the Deephams STW, which is not expected to complete until 2017 at the earliest. This scheme was omitted from the draft plan, although the need for subsequent inclusion was clearly identified. It is a confirmed requirement from the Environment Agency and two interim outputs are required, one under UWWTR and another under Water Framework Directive. There are two other schemes proposed under the Water Framework Directive where the Environment Agency are confident of their contribution to non-compliance, and a further 28 STW improvement schemes related to the 'flow' driver which, by ensuring 'no deterioration', is seen as a prerequisite for WFD compliance. It is also recognised that much will remain to be done to fully comply with WFD, and that better data will be needed to support the expected additional investment required in the second cycle with sufficient confidence of

outcome. Hence we have included a significant tranche of investigations, in accordance with Environment Agency requirements.

Other investment drivers We have included investment that relates to the requirements of the security element of the Security and Emergency Measures Direction (SEMD) in this section. This is principally covered in the water section of B4. The proposals have been based on Defra ‘Advice Notes’ with interpretation informed by meetings with Defra. We have also engaged independent advice to confirm that we have interpreted the Advice Notes appropriately. It should be noted that, as described in the detailed text, there is a discrepancy between our latest view of costs and our financial tables. Our Plan includes the following outputs:

Our Plan includes the following outputs:

Table 1: Summary of Outputs for the Quality Enhancement Programme 2010 to 2015

Quality Enhancement	FBP		
	Output No	Capex £m	Opex £m
Water Service			
Deteriorating raw water quality (pesticides and Nitrates)	6	⌘ [Redacted]	⌘ [Redacted]
Reducing the risk from <i>Cryptosporidium</i>	3		
Installing treatment to meet the new standard for lead in water	5		
Replacement of lead communication pipes and customer supply pipes	(Note 1)		
NEP Water treatment sludge processing	1		
NEP Metaldehyde environmental investigation (Note 10)	1		
Low flow investigations and baseline drought monitoring	7		
⌘ [Redacted]	⌘ [Redacted]		
Sewerage Service			
Thames Tideway STW upgrades (UWWTD and Local Priority drivers)	5 (Note 3)		
Tideway (River Lee) Tunnel	1		
Urban Wastewater Treatment Directive, nutrient reduction	4		
Intermittent Discharge improvements	20 (Note 4)		

Water Framework Directive	3		
Implementation of CRoW Act	1		
Compliance with Freshwater Fish Directive	1		
Commencement of Deephams STW rebuild (Note 6)	-		
Local priority schemes	1 (Note 5)		
Consent changes to meet revised flow conditions	27 (Note 7)		
Compliance with the Groundwater Directive	12		
Compliance with NVZ Regulations	9 (Note 8)		
East London sludge improvements and capacity (quality and growth)	2		
First Time Rural Sewerage Schemes (S101a)	4		
Investigation into effluent effects on SSSIs	2		
Monitoring of priority substances	3 (Note 9)		
Investigation of impact of IPPC and Environmental Permitting Regulations (Note 10)	4		
✂ [Redacted]	✂ [Redacted]		

All financial figures are in £millions
All numbers quoted to 1 decimal point and therefore rounded.

Note 1: The number of lead pipes replaced has been agreed with DWI. This is 34930 lead communication pipes and 29620 customer side pipes. The number of customer side pipes assumes a 80% take-up by customers. The costs reflect the total lead strategy in addition to the outputs specified. The capex figure quoted reflects our final BP proposal. ✂ [Redacted]

Note 2: ✂ [Redacted]

Note 3: All five have a local priority driver; 3 are also UWWTD

Note 4: This output comprises a number of outfalls on the River Lee requiring resolution due to the change in receiving water quality and issues around the impoundment of the River Lee. In the NEP it appears as 2 outputs under the Local Priority driver.

Note 5: This is a 'local priority' scheme not otherwise included under Tideway or an intermittent discharge

Note 6: This expenditure at Deephams STW completes post 2015 and does not deliver an output in this period

Note 7: We have identified 25 capital schemes to address this driver; the NEP includes 29, although two are combined with other drivers. We expect to achieve two outputs without capital spend allocated to quality

Note 8: Nine improvements will be made to ensure NVZ compliance, but due to an allocation error only 8 are identified in the quality programme. The remaining project is allocated under supply/demand

Note 9: The Draft NEP included 3 separate outputs for monitoring priority substances however the latest versions list the STWs individually. (41 STWs) We continue to record under three outputs.

Note 10: This line consists of 3 outputs for investigations grouped under Environmental permitting Regulations (EPR, 13 STWs) and 1 output for anticipating revised obligations under IPPC (37 STWs)

Note 11: The NEP scheme is included in outputs but not in financial modelling. (see B 4.2.2 for further detail).

We have carried out a detailed cost benefit assessment on all our quality enhancement programme with the exceptions of: investigations (benefit depends on outcome of investigation), groundwater STW sites (no suitable valuation tool available), licensing requirements (no suitable valuation tool available), SEMD (very low probability combined with very large consequence generates unsupportable benefits) and NVZ sites (no suitable valuation tool available). We have assessed the benefits primarily using the results of our willingness to pay survey (undertaken by ✂ [Redacted]) which determined monetary valuations for changes to ten key service attributes. The results of the CBA indicate that 76 out of the 87 schemes assessed are cost beneficial. Since our draft submission, further analysis has been undertaken including a more thorough assessment of the impacts of carbon emissions and embodied carbon, associated social and environmental costs and the incorporation of revised river length improvements from the EA. In addition we have challenged the Environment Agency on the requirement for the non cost-beneficial schemes and have the support of Drinking Water Inspectorate for all the drinking water quality schemes. Where the benefits only exceed costs marginally or

where positive net benefits cannot be demonstrated, the most cost-effective solution has been selected.

B4.1.2 Summary of Changes from Draft Business Plan

✂ [Redacted]

Water Service

With respect to the water quality programme the principal changes from our draft submission are the inclusion of:

- Confirmation that all drinking water quality schemes are supported by DWI
- A scheme at Playhatch WTW to reduce the risk from *Cryptosporidium*
- A revised and more detailed lead strategy for meeting the new lead standard
- ✂ [Redacted]

- Two schemes to reduce nitrate concentrations at Wantage and Westerham groundwater sources
- A catchment management scheme for metaldehyde to reduce the risk of pesticide failures at all of our surface water treatment works.

With respect to the environmental programme the principal changes from our draft submission are:

- The realignment from wastewater quality (B4.3.4.), of NEP WTW sludge processing investigations
- The removal of the requirement for the installation of fish screens at the lower Thames intakes and at Farmoor following consultation with the Environment Agency. These were not included in the January 2009 NEP.
- The removal of the requirement for a low flow investigation into the Lower Rib as this was not included in the January 2009 NEP
- We have re-scheduled the investigation into the lower Thames abstractions for completion in 2012/13 and all other investigations in 2014/15. The drought permit baseline monitoring is scheduled for delivery in 2014/15.
- We have updated the costs of the low flow investigations and the drought permit baseline monitoring following more detailed scoping and costing of the requirements.
- The inclusion of the NEP metaldehyde investigations
- ✂ [Redacted]
-
- ✂ [Redacted]
- ✂ [Redacted]

Wastewater Service

With respect to wastewater obligations our programme is based on the National Environment Programme (NEP) from the Environment Agency, which was last updated on 21st January 2009. The principal changes from our draft submission are outlined below;

- **Tideway STW Upgrades** – We recognised that the costs included in the draft were very early estimates and had not been fully updated, that for Mogden in particular being a substantial underestimate. For Mogden, Crossness, and Riverside STWs, we have now adopted firm costs based on contractors' tenders, which, aside from leaving little scope for the application of efficiency assumptions, will be different to earlier costs based on our internal estimating process. The delays to delivery resulting from planning issues have necessitated a review of our anticipated spend in AMP4, with a concomitant increase in the 2010-15 period. Additionally, we have reviewed the proportional allocation of these schemes, and although this does not impact on total cost, it overstates the impact when comparing quality spend between draft and final. The disparity is a combination of allocation and recosting;
- ☒ [Redacted]
- **Tideway tunnel ('Thames' tunnel)** – As captured in correspondence and our ☒ [Redacted] tables, we have agreed our proposed expenditure in the remainder of this period. Similarly, our Business Plan now includes only our proposed development costs and some land purchase costs, as early construction expenditure has been removed.
- **Lee Tunnel** - We have continued to refine our cost estimates, and planning delays have caused a shift of expenditure from this period (2005-10) to the next. ☒ [Redacted]

Wick Lane CSO - This was included previously as one of a number of CSOs contributing to a larger local priority scheme, tackling intermittent discharges to the River Lee. We have now identified this as an individual line and properly allocated the UID1 driver, ☒ [Redacted] It is not addressed by either the Thames or Lee tunnel projects and requires an independent solution

Deephams STW upgrade - At the time of our draft, our proposals were so uncertain that we did not include this item, although the scale and importance of it was highlighted. We have challenged the Environment Agency in terms of the stringency of the proposed standards and engaged independent consultants to review options and alternatives, and we are convinced that our proposal represents the least-cost solution to achieve the required outputs, and is a robust estimate. ☒ [Redacted] we do not anticipate full completion with the next period, although intermediate outputs can be delivered. Expenditure on this scheme is predominantly in addition to that in the draft, the exception being a substantial scheme to replace part of the inlet works.

Flow related schemes – The new effluent quality standards required for these sites had not been received from the Agency in time to inform costs for the draft plan. Consequently, we had been unable to complete individual costing for these sites, and the cost for this part of the programme was derived by extrapolation from a few sites where costings were complete, as a bulk solution. With the information now confirmed from the Agency, we have been able to calculate the individual site-specific costs on a robust basis. These individual costs have proved to give a larger total than in the draft.

Groundwater schemes - At the time of the draft there was no Agency driver to include groundwater schemes although we were convinced that there would be a requirement for improvement. By agreement with our Environment Agency Region we included four schemes. However, the Environment Agency nationally has since provided an appropriate driver, methodology and guidance for the region to assess better our groundwater discharges. Hence we have now included 12 schemes.

River Lee intermittents (formerly ‘Olympic CSO’s) – The Environment Agency have confirmed the obligation to improve the intermittent discharges to the River Lee, and this is no longer associated with the Olympic games, but a river quality improvement that has been overlooked for many years. Compared to the draft, we have a better understanding of the intermittent discharges contributing to the river quality problems in the Lee and have been able to develop sound proposals for each site. These costs replace earlier ‘bulked’ solutions. The Wick Lane CSO scheme is now identified separately, and new information, following installation of monitoring equipment, has caused us to include the Auckland Road and Low Hall Farm storm tank installations as being considered ‘unsatisfactory’.

Environmental permitting regulations (EPR) – The impact of the revised Integrated Pollution Prevention and Control (IPPC) (now called the Industrial Emissions Directive) was included in the original NEP guidance. This was then removed by the EA from ‘their’ NEP, apparently on the basis that it was for companies to identify sites under this driver. However, via our work with WaterUK and directly with Europe it is clear that the revised Directive will have an impact on our operations, and it remains as an Ofwat driver code. Therefore we have identified under this driver an investigation to scope our future cost liability. This is essential to enable preparation for AMP6 and ensure we are able to provide robust and accurate estimates of investment to meet future regulatory obligations. In this context it is comparable to investigations for WFD.

- ✂ [Redacted]

Sewage Sludge Management – Nitrate Vulnerable Zones (NVZ) - Since submission of the Draft Business Plan we have modified our programme ✂ [Redacted]

Oxford was included in the draft submission in error. A possible scheme for Beddington was costed for the draft submission; however, the management of Beddington sludge will instead continue to be dealt with via an existing contract with ✂ [Redacted], which continues until 2018. This removal of the Beddington scheme is the major driver in the reduction in costs associated with NVZ compliance. Woking, Camberley and Basingstoke were omitted from the Draft Business Plan in error.

As these schemes are identified by companies, and not the Agency, the sites do not appear on the latest NEP, although the Agency support their inclusion.

Sewage Sludge Management – East London strategy - Since the draft Business Plan, an independent East London ✂ [Redacted] has been completed - this investigated site-specific options most suitable for dealing with the shortfall in required sludge capacity across our East London STWs. The ✂ [Redacted] determined that the preferred option for both Beckton and Crossness is to retain the existing SPG and provide additional treatment capacity using enhanced digestion, with the resulting digested cake recycled to agriculture. The review determined that a thermal hydrolysis solution had a significantly lower capex and whole life cost and was more positive with regard to the environmental objectives.

Flooding resilience and carbon mitigation

In addition we have removed flooding resilience from this section (B4) to Customer Service Strategy and Changes in Service (B6), and carbon mitigation to Maintaining Service and Serviceability (B3) as requested in the baseline analysis.

B4.1.3 Response to Ofwat Research and our Own Consultation

Our research into customer and stakeholder views has been extensive and is explained in detail in C1 Consumer Views. The relevant elements of that research to this section are:

Drinking Water Quality: Our customers and stakeholders support our drinking water quality improvements, by confirming that maintaining and improving drinking water quality is seen as a high priority. Some expressed concerns about the safety of drinking water such as 'unseen contaminants' e.g. lead, hormones and pesticides as well as local issues such as discolouration, and taste and odour of drinking water. Our plans address these issues via this section B4 (drinking water quality enhancements) and section B3 Maintaining Service and Serviceability.

Environmental Investigations: Our environmental investigations programme is driven by the EA NEP, and consists of: investigations to assess the potential impact of our

abstractions on the water environment; the fate and behaviour of the pesticide Metaldehyde; and, the environmental impacts of our water treatment works sludge processing plants. This programme falls within the scope of sustainability and environmental protection, which our consumer research indicated had widespread support.

Security and Emergency Measures Direction (SEMD): No public consultation was undertaken on these proposals due to the sensitive nature of the content. However our consultation on drinking water did indicate that customers value safe drinking water and our SEMD programme contains a 90% focus on water service infrastructure to protect drinking water from potential threats.

Wastewater: Our customers and stakeholders show broad support for environmental improvements and the protection of habitats. Proper care for the aquatic environment, meeting all existing standards, reducing energy usage and protecting wildlife on our sites, seemed a self-evident requirement for almost everyone.

Whilst some stakeholders would like us to do more, this is not consistent with more widespread concerns among customers that prices should not rise unduly. This was particularly evident in relation to the Tideway Tunnel where the question of 'who pays' and 'who benefits' arose more frequently. Overall, there were neither general nor specific points that have prompted a review of our programme.

B4.1.4 Response to Ofwat Feedback

Responses to feedback on our draft Plan

Drinking Water, environmental and SEMD: We have noted the various points made and believe them now to be fully addressed. These included:

- We can confirm that we have considered other options, and that we have answered DWI Caveats to our pesticide and *Cryptosporidium* treatment schemes and catchment protection schemes (B4.2.2(a))
- The three further catchment protection schemes that were to be nominated have been replaced with one scheme to reduce the risk from the pesticide metaldehyde at all our surface water treatment works (B4.2.2(a)).
- Our adherence to the ✕ [Redacted] was questioned and we now believe we are fully compliant and DWI have confirmed their inclusion in the drinking water quality programme (B4.2.2(a)).
- Our lead strategy at draft plan did not have DWI support. This has now been secured (B4.2.2(a)).
- The comments regarding fish screens are no longer relevant as these have been removed from our FBP (B4.2.2(b))
- We have addressed concerns regarding the costs for low flow schemes and these have EA support (B4.2.2(b)).
- Our SEMD proposals have been substantially revised in light of the comments made. (B4.2.2(c) and B4.3.1)
- Our flooding resilience programme has been transferred to service enhancements

Wastewater: We have noted the various points made and believe them now to be fully addressed. These included:

- Excessive focus on Tideway schemes, full justification for all investment areas is required and a better report structure. Response: Acknowledged, now as described in following sections. (B4.3.1 and B4.3.4)
- Allocation between sections B4 and B10. Response: We have reluctantly included the Tideway STWs in section B4
- Deephams – not included in draft. Response: Correct, but we have a cost-effective solution proposed, which is described below. (B4.3.4)
- PR09 projects database – limited detail. Response: Acknowledged, final database is more comprehensive (Projects Database)
- Chemicals investigation not allocated to correct driver. Response: Acknowledged, now allocated to the three appropriate drivers (B4.3.4)
- Sludge (various) Response: Requirements are now better set out, mainly in section B5 as principal driver is supply demand (B5 and B4.3.2)

- Olympic schemes – If required by Olympics then TW customers should not pay. Response: These are schemes to improve long-standing water quality issues and are not specifically Olympics-related. The Environment Agency has since described them differently (B4.3.4)
- First time sewerage schemes – better support needed for costs proposed (Reporter). Response: We have set out more clearly the basis for costs and confirmed alignment with Ofwat guidance
- SEMD – lack of clarity. Response: We will separate out the wastewater components from the main body of text (previously in water service) and provide a concise summary (B4.3.1)
- Costs, reconciliation and driver allocation – incorrect or not transparent. Response: we have facilitated cross-checking and consistency checks in this final plan.

B4.1.4.2 – Responses to baseline challenges

We have reviewed the changes and challenges presented in Ofwat’s Capital Expenditure for 2010-2015: Capital Incentive Scheme (CIS) Report – draft baseline, and make the following responses and modifications as a result.

Table 2: Baseline – Challenges and Responses

Baseline	Ofwat Challenge	Anticipated Ofwat response
Lead pipe replacement	No DWI support	DWI support now obtained, and we anticipate that Ofwat will now be able to support our proposals
Fish screens	Not part of NEP and no clear cost driver	Fish screens no longer included in plan, with EA agreement
East Grafton and Wilton STWs	Not EA requirements	Accepted, have been removed from NEP
Bulk solution for DWF sites	Pro-rata reduction based on change from previous NEP to current	We now have provided individual scheme costs for the 25 capital schemes. Anticipate support for all sites
Beckton TTQI and tunnel	Transfer to B4 and apply pre-efficiency reduction	Costs moved to B4, but slippage due to planning issues has meant a larger sum in AMP5. Anticipate support as this site has had detailed independent audit. Our proposal includes an efficiency challenge.
First time sewerage schemes	15% cost reduction as no apparent justification for outputs	We have clarified the basis for our estimates, which align with Ofwat instruction to base on extrapolation from current schemes. Anticipate support
Sludge enhancements	25% cost reduction	We have revised our scope and propose a smaller sum which is better supported by a coherent sludge strategy. We anticipate that Ofwat will now be able to support our proposals
'Olympic' CSOs	Excluded as Thames customers should not fund these	The Agency have re-confirmed the need for these schemes which help address long-standing water quality issues in the river Lee. They are not linked to the Olympics but relate to an overall water quality improvement plan for the Lee. We anticipate support.
SEMD programmes	15% reduction based on lack of robust support	Programme scrutiny and revision has reduced costs by 29% whilst retaining the same overall output. We anticipate that Ofwat will now be able to support our proposals
Cost Benefit analysis	Review non cost beneficial schemes	All our CBA has been reviewed and robustly challenged. All negative NPV schemes in the DMP have been reviewed and are now cost beneficial. We anticipate that Ofwat will now be able to support our proposals.

B4.1.5 Reporter Challenges

Drinking Water

Following audit of our draft business programme there were four areas identified for further work (a fifth related to flooding resilience which is now covered in enhanced service level). The relevant four were:

- verifying the cost estimates for customer side lead pipe replacements by surveying two further hot spot areas
- refining the scope, scheme definitions, costing and delivery profile for the SEMD programme
- refining and concluding the cost benefit analysis programme of work
- formal agreement between the business and relevant quality regulators is required regarding the outputs and timing of deliverables.

All of these areas have been addressed in the final Business Plan, and all elements of our plan have support from regulators (DWI – drinking water, Defra – SEMD, and EA – environmental investigations).

Wastewater

Following audit of our draft Business Plan, four principal areas were identified, either as being of concern or to be revisited for the final Plan, recognising that work was in hand to improve the robustness of our estimates.

These were:

- review and refinement of cost estimates for Thames and Lee tunnels
- confirmation of the scope of work and estimated cost for Deephams STW improvements
- refinement of costs for flow driver schemes (i.e. to be completed and made robust on a site basis)
- refinement of costs to address intermittent discharges to the river Lee (i.e. to be made robust on an individual site basis)

All of these topics have been addressed in the final plan, as follows:

- Thames Tunnel – Development and land costs only are now included
- Deephams STW – a robust, least-cost option has been identified
- Flow schemes now costed on an individual basis
- Intermittent discharges now costed on an individual basis

B4.1.6 Treatment of Uncertain Obligations

Drinking Water

The most significant uncertainty within the Drinking Water programme lies with the lead pipe replacement programme, which is part of the company lead strategy. The pipe replacement programme relies on two variables. These are an 80% uptake for customer supply pipe replacement (an increase from 50%) and the dependency of our opportunistic lead pipe replacement which is reliant upon the overlap of our mains replacement programme with identified category 2 lead 'hot spots'. During the development of our plan the location and priorities of our mains replacement programme in London have been modified and refined. These changes have affected the degree of overlap with our 'Category 2' lead hotspots and altered the number of lead supply pipe replacements that we plan to replace on an opportunistic basis. Based on our current programme we estimate that 4550 lead supply pipes will be replaced on an opportunistic basis in Category 2 hotspots but this number could increase or decrease driven by the changing priorities and location of our mains replacement programme.

We have included plans for a catchment management approach to the control of concentrations of the pesticide metaldehyde. However the presence and future concentrations of metaldehyde in treated drinking water remains an emerging issue. It is uncertain how the regulatory position will emerge between final submission and determination.

Environment Programme (impact of company abstractions)

There continues to be uncertainty regarding the provision of fish screens at our abstraction points. These are not in the latest (21 January 2009) version of the NEP, but we note the current consultation being carried out by Defra that may require installation of screens in the future. Also AMP4 scheme completion could lead to activities in AMP5, which are not costed or included.

Wastewater Programme

The European Commission is pursuing infraction proceedings against the UK Government for the alleged failure to fully implement the requirements of the Urban Wastewater Treatment Directive as regards nutrient-sensitive waters. The case is now with the European Court of Justice, and the oral hearing took place on 5 March this year. If the UK loses (the case addresses six locations across the UK) we would be obliged, at minimum, to reduce the concentrations of nitrogen (nitrate) currently discharged from our sewage treatment works serving the 'London Agglomeration' (10 in number) and, potentially, all qualifying works in the catchment. The risk that phosphorus reduction could also be required cannot be completely discounted, although the Environment Agency consider this unlikely. Due to the uncertainty we have not included any of these costs in our Business Plan. We have estimated the investment required to achieve nitrate removal at

the 5 main Tideway works at around £500m. A 'worst case' scenario is that all qualifying STWs in the catchment (that is, all those >10,000 population equivalent (pe) and contributing to the eutrophic conditions) could require N-reduction, which could raise the cost to nearer £900m. We are proposing that this should be recognised as a Relevant Change of Circumstance for AMP5, as agreed with Ofwat. Note that this would also involve a major opex uplift and that the carbon footprint consequences are substantial.

Due to the mismatch on delivery timetables between the draft Business Plan and the Water Framework Directive River Basin Management Plans (RBMP), which will not be available until December 2009, the overall 'level of ambition' and hence scale and scope of our contribution to the WFD remains unclear. We have included a small number of schemes where there is a greater certainty of obligation. We should also recognise that there may be pressure to increase the extent of ambition after the RBMP has been submitted to Brussels, resulting in additional obligations being identified post Final Determination. We are proposing that additional WFD obligations are recognised as a Relevant Change of Circumstance for AMP5.

We agreed a series of schemes with the Thames Environment Agency to prevent or limit contamination of groundwater arising from the discharge of sewage treatment works effluent. The current scope of these schemes reflects the agreed (Defra, Environment Agency and water industry) interpretation of the anticipated Groundwater Regulations which transpose the 'new' Groundwater Daughter Directive. It was believed that the new Regulations would be laid in mid-January, but these have been delayed. We have been assured that this delay should not have any bearing on the scope of our schemes, although, as the current interpretation is favourable, any changes to the expected Regulations will most likely drive increased costs. We propose that any additional obligations arising from the final version of the Regulations be recognised as a Relevant Change of Circumstance for AMP5. A related, but more speculative topic concerns action to remediate groundwater pollution attributed to escapes from sewers.

The Government has made a commitment that the responsibility for private sewers will be transferred to the appropriate sewerage undertaker, and the proposed date for this transfer is 2011. In our draft plan we had developed costs based on a UKWIR model, as adapted to meet the differing network needs of our region. Nonetheless, the scope and timing of the transfer is as yet uncertain and consequently we have not included the anticipated costs in this Business Plan. Should the transfer take place, we proposed that this be recognised as a Relevant Change of Circumstance.

B4.2 Water Service

B4.2.1 Quality Enhancement Obligations

Drinking Water

DWI's original advice on the drinking water quality elements of the Business Plan was set out in ~~§~~ [Redacted]. Drivers included:

- predicted failures to meet drinking water quality standard for pesticides and nitrates due to deterioration of the quality of the raw water;
- reducing the risk of contamination of drinking water with *Cryptosporidium*;
- targeted replacement of lead communication pipes where treatment is insufficient to meet the final lead standard of 10µg/l; and
- Drinking Water Safety Plans (DWSP) developed for all water supplies.

In developing our Business Plan we have reviewed these drivers and taken account of further guidance from the DWI and Ministers especially in the area of lead pipe replacement.

The drinking water quality programme in our final Business Plan is more extensive than was included in the draft.

Two nitrate schemes have been included. These have been supported by DWI following the submission of more recent water quality data that has demonstrated a significant risk of concentrations exceeding the nitrate standard in the AMP5 period.

Two plumbosolvency schemes have been added following further analysis of recent lead results in the Henley area. The addition of phosphate at these two treatment works will be considerably more cost-effective in achieving the forthcoming standard of 10 µg/l⁻¹ than the replacement of lead pipes.

A new scheme for *Cryptosporidium* treatment at Playhatch WTW has been developed following the unexpected detection of elevated numbers of oocysts in November 2008.

There has also been a significant change in our plumbosolvency strategy following the detailed specification set out in ~~§~~ [Redacted]. This recommended the need for companies to develop an integrated approach to reducing the risk from lead including the targeted replacement of lead pipes in consultation with local authorities and the opportunistic replacement of lead pipes in conjunction with more general activities on the mains distribution system.

Following the detection of significant concentrations of the pesticide metaldehyde at all our surface water treatment works (including failures of the $0.1 \mu\text{g l}^{-1}$ standard). and the emergence of the compound as an industry-wide water quality issue, we have modified our proposals for catchment protection activities and set out a programme specifically designed to reduce the concentrations of this pesticide without the need to install expensive and energy intensive drinking water treatment.

Environment Programme (impact of company abstractions)

There are a number of quality drivers that lead to the requirement for sustainability reductions (SRs) and these can be divided into two categories within the Environment Agency's Restoring Sustainable Abstractions Programme (RSAP)

- Statutory Drivers (European Habitats Directive (HD) status) or (SSSI Status)
- Non-Statutory Drivers (e.g. Biodiversity Action Plan or local driver)

Sites designated under the HD are subject to 'Appropriate Assessments' by the Environment Agency with completion dates dependent on the priority afforded to the site by Natural England. The Agency is obliged to adopt a precautionary approach in determining the need for sustainability reductions.

✕ [Redacted]. SSSI driven schemes are also statutory and therefore investigations at those sites that identify an environmental impact caused by a company abstraction are given high priority by the EA. Drivers other than HD or SSSI have lower regulatory status than the HD and are therefore normally regarded as lower priority by the Agency.

From guidance received from the Agency to date, only abstractions where a completed investigation has shown that a company abstraction is having an impact on a receptor site should be included in the Business Plan. EA guidance indicates that all TWUL sources that are being considered within the AMP4 investigations (both statutory (HD/SSSI) and non-statutory) are at risk of potential reduction during AMP5, following the completion of investigations. However, because the AMP4 investigations are not yet completed we have not included any schemes for these sites within the plan.

Security and Emergency Measures Directions (SEMD)

Our SEMD proposals are based upon security advice note developments and modifications issued to us by Defra since 2005 and the requirements of the Water UK Security Standard. Our proposals are to meet the statutory obligations conveyed upon us by the Security and Emergence Measures Directions.

B4.2.2 Proposals to Meet Water Quality, Environmental and Security / Emergency Provisions Obligations

Table 5 summarises our proposed enhancements over the period 2010 to 2015.

Table 3: Outputs for the Water Quality Programme 2010 to 2015

Driver	Outputs 2010-2015
Reducing the risk from <i>Cryptosporidium</i>	Treatment to reduce the risk from <i>Cryptosporidium</i> at 3 works
Deteriorating raw water quality (nitrates)	Treatment to reduce nitrate concentrations at 2 works
Deteriorating raw water quality (pesticides)	Treatment to reduce pesticide concentrations at 1 works; 3 Catchment control projects covering 2 ground water works and all surface water treatment works
Reducing lead concentrations	Plumbosolvency control installed at 5 sites
Replacement of lead communication pipes	Approx. 34930 lead communication pipes.
Replacement of customer service lead pipes	Approx. 29620 pipes replaced (Note 1)
NEP Water treatment sludge processing	Investigation of environmental impacts, permitting requirements and environmental monitoring
NEP metaldehyde environmental investigation	Environmental monitoring programme to determine load and impact of metaldehyde on aquatic environment prior to abstraction
Low flow investigations/options appraisals	6 investigations (including the Lower Thames Operating Agreement investigation) with associated options appraisals included in our S/D Water submission. (3 further options appraisals are included in our S/D Water submission for sites where investigations have been completed).
Drought permit baseline monitoring	Environmental monitoring programme to establish baseline for potential drought permit applications
Sustainability Reduction Implementations (Note 3).	2 sustainability reduction implementations are included in the S/D water submission. 1 other environmental solution is also included in our S/D Water submission consisting of an augmentation scheme rather than sustainability reduction
⌘ [Redacted]	

Note 1: 29,620 is based on the assumption of an 80% take up of the offer to replace customer service pipe

⌘ [Redacted]

Note 3: These are included for completeness although funded through the SD element of our Business Plan. The schemes referenced are Speen and Axford and the West Berkshire Groundwater Scheme (WBGWS) augmentation.

a) Drinking Water Quality

Our approach to identifying the need for investment is driven by our constant vigilance in reviewing water quality data collected via both our operational and statutory sampling programmes. This provides an overview of the key issues facing the business in terms of drinking water compliance. With the introduction of drinking water safety planning into drinking water legislation at the end of 2007 and the submission of \times [Redacted] risk assessments in September 2008, our own internal view was combined with one that has a regulatory structure. All our submissions are consistent with our DWSPs and supported by the DWI. Our technical submissions that received support from DWI were more detailed than the base level DWSP and reviewed in detail incident data and water quality trend data over the last 20 years.

For each investment need, a three-stage approach is conducted. The first is to review all the possible options to achieve the desired outcome (optioneering review), the second stage is to discount the options that are not practicable (practicality review) and finally for the remaining options a cost benefit analysis is conducted to identify the solution with the highest net benefit. If two schemes have the same benefit then the cheapest scheme is selected.

The following quality drivers described by \times [Redacted] are relevant to Thames Water's AMP5 proposals:

Reducing the Risk from *Cryptosporidium*

At two water treatment works (Fairford and Marlborough) continuous monitoring results and an assessment of the risks of contamination indicate a significant risk of elevated oocysts being present in the treated water. At both works it has been determined that a treatment barrier is necessary to ensure that the presence of these pathogenic parasites does not pose a risk to human health. Since the submission of the draft plan significant numbers of oocysts have been detected at Playhatch water treatment works, which appears to be related to a recent deterioration in the raw water quality. All three *Cryptosporidium* removal schemes have been approved and supported by DWI.

Pesticides

At one water treatment works (Woods Farm) exceedances of the $0.1\mu\text{g l}^{-1}$ standard were recorded in 2007 and 2008. Operational monitoring of raw waters indicates that failures are likely to recur. To comply with the Drinking Water Regulations it is proposed that granular activated carbon treatment is installed. Catchment control is not appropriate for this source as this contamination must be historic, as the pesticides detected are no longer approved for use. In addition, where pesticide concentrations in raw water pose a significant threat to compliance with the drinking water standard, we plan to implement a catchment management approach to control levels. In our draft submission we specified two catchments (Harpsden and Sheafhouse) where we will adopt this approach. Since this submission we have seen the emergence of a new pesticide challenge, metaldehyde, which has developed into a widespread problem throughout the Thames region. Exceedances of the drinking water pesticide standard have now occurred at most of our surface water treatment works. A catchment management scheme has been developed to

control metaldehyde levels as traditional treatment processes are ineffective at removing this pesticide.

Nitrate

Two schemes (at Westerham and Wantage) were included in our draft submission for nitrate removal. Further monitoring since this submission, confirms the trend in nitrate concentrations at these works which continue to rise significantly with several exceedances of the drinking water standard

Lead

Whilst lead is probably the most challenging and complex drinking water quality issue that Thames Water is facing, we have developed an appropriate response strategy that manages this risk and compliance in the most cost beneficial way which has DWI support.

For the calendar year 2008 DWI's headline measure of overall drinking water quality compliance (mean zonal compliance percentage - MZCP) will be 99.99%. The equivalent figure for lead is only 99.84% making it the worst of all the 40 parameters that make up MZCP.

At the end of 2013 the standard for lead in drinking water will reduce from 25 to 10µg/l⁻¹ and, without further action, compliance with the new standard is expected to fall to around 98.2%. As the standards for lead are health-based and designed to protect pregnant mothers and children this level of compliance is unacceptable.

Guaranteeing 100% compliance with the 10ugl⁻¹ lead standard would require the replacement of all lead pipes belonging to both Thames Water and property owners. ✂
[Redacted] Thames has sought to develop an integrated, risk-based and measured approach to reduce lead concentrations that takes full account of the guidance on lead included in DWI's Information Letter 11/2008.

The 10µg/l standard was first identified as a driver for investment in our Business Plan for the Periodic Review 1999. At that stage the focus was on the installation of phosphate dosing plant in order to reduce the tendency of water to 'pick up' lead from pipework belonging to both the company and customers. Phosphate dosing is currently carried out at 49 treatment works that produce over 90% of the total volume of water entering supply.

The addition of phosphate at these works has significantly reduced the number of lead samples that fail the forthcoming 10µg/l⁻¹ standard. In 2001, the year before dosing commenced, the percentage of samples exceeding 10µg/l⁻¹ across all of our water supply zones was 10.3%. During 2008 this number had fallen to 1.7%.

The benefits of dosing phosphate are very clear and as part of our Business Plan we have identified two more areas, East Aylesbury and Henley, where failures of the 10µg/l⁻¹ can be largely eliminated by the addition of phosphate at five more treatment works. The inclusion of the two works that supply the Henley area is a change from our draft Business Plan and arises from an analysis of lead data carried out during the summer of 2008. The DWI has supported our plans to extend phosphate dosing to these five works.

The improvement in lead concentrations due to phosphate dosing has been far better than expected but it is evident that the improvement has not been uniform across the supply

area. In many water supply zones the addition of phosphate produced a rapid improvement with the number of failures reducing to <1% within two to three years. In the areas supplied by our surface water treatment works in London and Oxford, the improvement has been slower and in some areas more than 5% of samples continue to be above 10ugl⁻¹. Mapping of individual lead results and property ages show that many of the results greater than 10µg/l are clustered in discrete areas e.g. housing estates, within water supply zones. As the water supplied in these 'lead hotspots' is identical to that supplied to adjacent areas it appears that some feature of the properties within these developments is reducing the effectiveness of the phosphate dosing. Although we do not understand the precise mechanism it appears that within the hotspots the type of lead pipe or the way it has been used is causing continued failure of the 10 µg/l⁻¹ standard.

Whatever the cause the only way to make significant reductions in the number of lead failures within these hotspots is to remove a significant proportion of the lead pipework supplying these properties.

✂ [Redacted]

DWI did not support the proposals in our draft plan on the grounds that there was insufficient evidence of a risk-based approach to assess the need for investment. Furthermore DWI was looking to promote 'multitrack solutions' and closer working with other stakeholders to encourage lead pipe replacement. Without DWI's support Ofwat was unable to include the costs for lead pipe replacement within our Baseline.

✂ [Redacted]

Our plan for lead in the AMP5 period represents a comprehensive, cost-effective, affordable and risk-based strategy for reducing lead concentrations in drinking water and improving compliance with the 10µg/l⁻¹ standard. The strategy draws together work under different drivers for expenditure specifically, quality enhancement, supply demand and capital maintenance. Our strategy has DWI support, and we anticipate that Ofwat will now be able to support our FBP proposal.

The strategy has five key but integrated elements which can be summarised as follows:

Phosphate dosing/plumbosolvency control

- Maintaining optimised phosphate dosing at 49 treatment works that supply areas that were at significant risk from lead prior to the installation of plumbosolvency control.
- Extension of phosphate dosing to 5 additional treatment works supplying areas newly identified to be at risk.
- Improved consistency and reliability of phosphate dosing by upgrading dosing equipment (included within our capital maintenance programme).

Enhanced random and targeted monitoring

Continuing to undertake extensive monitoring for lead at customers taps in order to understand and communicate the risks from lead at a local level, to refine the location and boundaries of lead hotspots, assess the benefits of remedial actions, and to inform future investment programmes.

Replacement of lead communication and external customer service pipes

From 2011 this will, in general, be undertaken where random daytime samples exceed 10µg/l. This timescale allows for some continued improvement in lead concentrations over the next two years. Removing lead pipework at properties that exceed the 10µg/l standard is, in principal, the same as our risk based approach to lead hotspots but applied to individual properties.

Working with local and health authorities to identify areas at risk from lead and to find appropriate solutions

DWI's guidance document on the drinking water quality regulations and Information Letter 11/2008 (both published in October 2008) recommend that water companies work with local and health authorities and other stakeholders to develop and implement measures to identify areas at risk from lead and find appropriate solutions. Until the final determination is confirmed it is not possible to engage stakeholders in detailed discussions about activities and priorities on reducing the risk from lead. However, general discussions about scenarios and approaches to risk management have been held with local and health authorities. These discussions have informed the development of this part of our strategy which can be broken down into four discrete components:

- Replacement of lead communication and customer lead pipes in category 1 'hot spot' areas where $\geq 20\%$ of random daytime samples for lead exceed $10 \mu\text{g l}^{-1}$.
- Opportunistic replacement of lead supply pipes where our Victorian Mains Replacement Programme overlaps with category 2 'hot spot' areas i.e. where between 15% and 20% of samples fail the $10 \mu\text{g l}^{-1}$ standard.
- Investigating the risk from lead pipe in social housing, identifying investment priorities for 2015 – 2020 and replacing lead communication pipes where appropriate.
- Continuing to replace lead communication pipes in all areas in conjunction with Victorian mains replacement activity (funded through supply demand growth and capital maintenance drivers).

A communication and education programme

Our proposed programme will target customers and other stakeholders, explaining the actions they can take to reduce the risks from lead in drinking water. As this will increase the number of customers replacing their lead supply pipes provision is made for replacement of lead communication pipes serving these properties.

✂ [Redacted] A significant reduction in the scale of mains replacement in the AMP5 period means there will be less opportunity for synergistic replacement of lead pipework. The strategy we submitted to DWI did identify the potential for a change in the scope of this opportunistic activity and this was reinforced when we submitted a summary of our cost benefit analysis to the quality regulator. We have recently written to DWI to confirm how this change will affect our final Business Plan.

Challenges by our Reporter

In discussing our proposals on lead with our Reporter a number of challenges were made, many relating to the replacement of lead supply pipes that belong to the consumer/property owner.

The first challenge was why we had chosen a failure rate of 20% as our criterion for defining 'Category 1 lead hotspots' and proposing a total of seventeen areas for the replacement of lead communication and supply pipes. DWI has given no guidance on a target or acceptable level of compliance with the $10\mu\text{g l}^{-1}$ lead standard. Ideally there would be no failures but experience suggests that prolonged stagnation times before samples are taken, disturbance of pipework or the use of inappropriate materials or fittings will, inevitably, give rise to occasional failures. At a low level it seems reasonable to address these on a retrospective basis as these arise. However, in areas where a significant percentage of lead samples fail the $10\mu\text{g l}^{-1}$ limit it is appropriate to address these on a proactive basis, tackling the areas at greatest risk first. The 20% criterion is, to a large extent, arbitrary but it is felt that saying that more than 1 in 5 samples is likely to exceed the lead standard is likely to persuade customers (and local authorities) of the need for action. We also stressed that our approach is not rigid and in discussion with local authorities and others we may decide to modify the 20% criterion in the light of local circumstances. Clearly this flexibility will be constrained by financial considerations and the need to give priority to areas at greatest risk.

Although no formal cost benefit analysis has been undertaken it is evident that the benefit of replacing lead pipes in areas with lower failure rates will diminish progressively. Moreover in areas with lower failure rates it is likely that other changes eg replacement of lead communication pipes through VMR projects and the accumulated benefits of continued phosphate dosing reduce lead concentrations to the point that a proactive approach is inappropriate. Another consideration is the size of the programme that it is considered manageable. Using a lower compliance criterion would not only increase the costs for pipe replacement it would increase the number of local authorities and other stakeholders that would need to be engaged to deliver the programme.

It is envisaged that the experience derived from the AMP5 programme will determine whether it is appropriate or feasible to use different criteria for action in future AMP periods.

The second challenge was why we were proposing to replace lead pipes that we do not own. The amount of lead in drinking water will be dependent on the amount of time that water spends in contact with lead pipework. Reducing the amount of lead pipework will reduce this contact time. As most of the lead pipework is on the customer's side of the property boundary, DWI has advised that there is little benefit in simply replacing the company's lead communication pipes. Industry experience and DWI guidance suggests that property owners show little interest in replacing lead pipework at their own expense. Therefore DWI has advised that Companies work closely with local authorities, housing associations and property owners to encourage the replacement of customer's lead pipework. In order to facilitate this process we are proposing to meet the cost of replacing external lead pipework but only in areas at significant risk of exceeding the lead standard. The new pipework and its maintenance will remain the responsibility of the property owner and on that basis we are treating the expenditure as Opex. This is consistent with advice received from Ofwat.

The third challenge relates to the proportion of property owners that will be prepared to have their lead supply pipes replaced. Our final Business Plan assumes that where we replace our lead communication pipes in category 1 and category 2 hotspots, 80% of customers will be prepared to have their lead supply pipes replaced. This compares with an assumed 50% take up in our draft plan.

We accept that the 80% figure represents a challenging target but we consider that it is a reasonable assumption given the following:

- Our strategy for replacing lead pipework is focussed on discrete lead hotspots (rather than DMA's or water supply zones) where we can clearly demonstrate a significant proportion of samples failing a health based standard even after several years of phosphate dosing to reduce the risk to a minimum.
- We shall be working closely with local and health authorities to help consumers better understand the risks to health from lead in drinking water and the benefits of removing lead pipework.
- DWI guidance says that replacement of lead communication pipes should only proceed when a significant number of property owners are prepared to have their lead supply pipes replaced. The definition of significant is to be decided jointly by the water company and local authority. It is this explicit requirement for collaboration and decision making with the local authorities that justifies the increase in customer take up from 50 to 80%.
- We are only proposing to replace external lead supply pipes, up to the front wall of the building. This recognises that many customers are likely to reject proposals to replace any lead pipework that would involve taking up floors and causing disturbance to fixtures and fittings.

Our reporter asked what our contingency was if the 80% target for customer pipe replacement is not achieved. In response we explained that our strategy is sufficiently flexible and broadly based to accommodate changes. For example if it was evident that a significant number of property owners in a category 1 lead hotspot were unwilling to have their lead pipework replaced we could transfer the proposed level of activity to a category 2 hotspot where lead failure rates are between 15 and 20%. Another option would be to

offer to subsidise the replacement of lead supply pipes in social housing where there is a lead risk but it does not, by itself, create a lead hotspot.

✂ [Redacted]

Project on the Feasibility of Softening Water in Certain Water Supply Zones

In our draft submission we proposed undertaking a project to evaluate the feasibility of providing softened water to our customers, subject to discussion with the DWI, although no financial provision for such activity was made at that time. In light of the discussions with the DWI we have now excluded this item from our final Business Plan.

General uncertainties and key assumptions for drinking water quality proposals

We have assumed that regulatory requirements on drinking water quality are not revised significantly before 2015, and that any investment requirements associated with the revision of the EU Drinking Water Directive will be incorporated into planning for AMP6. Nevertheless due to the current uncertainties in terms of scope, timescales and potential costs, which could have implications before AMP6, we propose that it is recognised as a Relevant Change of Circumstances in AMP5.

The lead pipe replacement programme, which is part of the company lead strategy, relies on two variables. These are an 80% uptake for customer supply pipe replacement (an increase from 50%) and the dependency of our opportunistic lead pipe replacement which is reliant upon the overlap of our mains replacement programme with identified lead 'hot spots'. During the development of our final plan the location and priorities for our mains replacement programme in London have been modified and refined. These changes have affected the degree of overlap with our 'Category 2' lead hot spots and altered the number of lead supply pipe replacements that we plan to replace on an opportunistic basis. Based on our current programme we estimate that 4550 lead supply pipes will be replaced on an opportunistic basis in Category 2 hot spots but this number could increase or decrease driven by the changing priorities and location of our mains replacement programme.

We have included plans for a catchment management approach to the control of concentrations of the pesticide metaldehyde. However the presence and future concentrations of metaldehyde in treated drinking water remains an emerging issue. It is uncertain how the regulatory position will develop over the AMP5 period.

- It is assumed that research relevant to drinking water quality and health does not identify a major new water quality issue that requires immediate remedial action e.g. from endocrine disruptors, pharmaceuticals, N-nitrosodimethylamine (NDMA) etc.
- All additional costs that might arise from the implementation of new schemes to fluoridate water supplies will be recovered from the relevant health authorities.

✂ [Redacted]

b) Environmental Impact of Water Company Abstractions

Requirement

Environmental Schemes: Our Business Plan assumes 4MI/d (average) and 5MI/d (peak) loss of deployable output arising from the Habitats Directive following EA guidance on the reduction of licence at Speen near Newbury. Our Plan also assumes loss of deployable output of 3MI/d (average) and 3.6 MI/d (peak) at Axford following guidance from the EA on the licence reduction required to protect the River Kennet SSSI. These two schemes have been included in our Supply Demand Water submission. A further scheme identified by the EA in relation to the West Berkshire Groundwater Scheme (WBGWS) has been included. This scheme does not require any reduction to abstraction licences and so does not have an impact on deployable output. The scheme identified by the Agency is the provision for flow augmentation to the Thatcham Reedbeds SSSI, which also has Habitats Directive designation.

Environmental Investigations: Under the AMP5 quality programme, six sites have been identified on the NEP for low flow investigations to assess whether significant adverse impacts are occurring to any of the receptor sites/watercourses as a result of Thames Water abstractions. The results from the studies will dictate which schemes will need to have detailed options appraisal and allowance for these options appraisals has been included in our Final Business Plan in line with guidance from the Environment Agency.

Current AMP4 investigations to determine the extent of abstraction impacts are still to be completed, thus there is uncertainty over the need for, and scale of, sustainability reductions that may be required as a result of these studies. The Environment Agency has therefore issued water resource planning guidance indicating that the Business Plan should only include sustainability reductions based on completed investigations that have established a significant impact on the environment.

Following receipt of comments from the Environment Agency on our draft Drought Plan we have undertaken production of environmental reports to support potential drought permit requirements. The Agency has also required that we undertake baseline monitoring at a number of sites.

Approach

We have included in our draft Plan the requirement for investigation of the impact of abstraction from the lower Thames on river flows in the lower freshwater Thames and Thames Tideway. We have recognised, together with the Environment Agency, that this will be a major investigation and so will entail significantly greater cost compared with other investigations. We have therefore completed a specific detailed scoping and costing exercise for delivering this investigation and have included the appropriate cost in our draft Plan following guidance from the Environment Agency.

We have also undertaken a detailed review of the scope provided by the Environment Agency for the remaining proposed AMP5 investigations. We have used the scope to assess the requirements for each of the investigations and used this as the basis for the

costing. We have assessed the hydrological, hydrogeological, hydraulic and ecological requirements of each investigation to enable detailed costs to be compiled for each one.

We have reviewed the requirement for drought permit baseline monitoring based on the likelihood of the drought permit options being required and the potential environmental impact of each option. We have then assessed in detail for each option the hydrometric and ecological monitoring requirements taking into account the existing data availability. We have used this detailed monitoring assessment to identify the costs associated with each option in order to arrive at a final cost for the full programme of monitoring. We have included an output for this monitoring and included the costs following confirmation from the Agency of the scope of the monitoring required. ✂ [Redacted].

Our strategy is set out in more detail in our Water Resources Plan and has been discussed with the Thames Region EA. Our final Business Plan includes:

- Investigations into the impact of TW licensed abstractions on RSAP sites and options appraisals following completion of the investigations.
- Sustainability Reductions; a DO loss of 4MI/d average and 5MI/d peak at Speen and a DO loss of 3MI/d average and 3.6MI/d peak at Axford. An environmental scheme is also included for the WBGWS consisting of implementation of an augmentation capability at Thatcham Reedbeds SSSI. These schemes are included in our Supply Demand Water submission.
- Two options appraisals at sites where investigations have been completed and one at a site where investigation will be completed in AMP4. These options appraisals are included in our Supply Demand Water submission.
- Baseline monitoring at environmentally sensitive drought permit sites identified in our Drought Management Plan.

The Quality programme therefore includes six investigations and options appraisals, baseline monitoring for the drought plan and three further options appraisals at sites where the investigations have been completed in AMP4. As noted above, following the guidance provided by Ofwat, the costs for the sustainability reduction schemes at Speen and Axford, and the WBGWS augmentation scheme and the nine options appraisals have been included in Supply Demand Water.

✂ [Redacted]

Speen and Thatcham Reed Bed schemes: These two schemes are proposed to protect the habitat of the rare Desmoulin's Whorl Snail populations in the Kennet and Lambourn Floodplain SSSI and at the Thatcham Reedbeds SSSI (both part of the Kennet and Lambourn Floodplain SAC).

It is not possible to value these two schemes using our customers' Willingness To Pay as none of the measures or metrics valued in the survey can be applied or translated to them. Consequently we have undertaken a substantial literature review of prior benefit assessment studies with a view to finding a more suitable metric. While the search did not uncover any prior study on the value of snails, Garrod and Willis considered the environmental impact of water abstraction for public supply on a SSSI wetland in the South of England (*Hardham Artificial Recharge Environmental Valuation*, 2000. Garrod, G., N. Powe and K. Willis). This found that households would be willing to pay £1.52 per

year (2000 prices) to avoid a one percent decrease in the number of birds and plant diversity.

On consultation with Natural England, it was jointly concluded that while the valuation would be directly transferable for a scheme to protect birds and plant diversity, snails may not elicit as high a willingness to pay value, even if they are designated as 'rare' in the GB Red List.

✂ [Redacted]

To calculate the actual annual benefits for each scheme, we also forecast the future operating regime and therefore benefit to be derived. It is currently considered that the West Berkshire Groundwater Scheme (WBGWS), which could impact on the Thatcham Reed Beds, would be required once every twenty years while the Speen abstraction is in continuous use and the abstraction licence volume is considered unsustainable in the context of the Kennet and Lambourn Floodplain SSSI. It is therefore appropriate that the maximum annual benefits should be divided by twenty for the scheme at the Thatcham Reed Beds and maintained at 100% for the permanent reduction in abstraction at Speen.

We then applied these annual benefit values each year from the scheme's completion until the end of the planning horizon and discounted them to 2007/08 prices in line with the rest of our Business Plan. These values were then compared to the 'whole life costs' to assess their net benefit, as in Table 7 below. This shows the Speen scheme to have a very positive benefit.

The augmentation scheme for the Thatcham Reedbeds is cost beneficial, although Whole Life costs and Whole Life benefits are similar for the scheme, as shown in Table 7 below. The scheme represents a significantly more cost-effective solution than the alternative option, which consists of resource development for London to offset the DO loss if abstraction were to be reduced. ✂ [Redacted]

Axford scheme: The Restoration of Sustainable Abstraction scheme at Axford to alleviate the impact of low flows in the River Kennet SSSI is expected to result in a direct benefit to the quality of the river. Quantity of flow is a key factor influencing river quality, and it is therefore appropriate to apply our customers' Willingness To Pay value for meeting Environment Agency standards for river quality, to assess the benefits.

To calculate the annual benefit, we established what percentage of the Thames river catchment length the predicted improved stretch represents, before multiplying our customers' Willingness To Pay by the total number of our clean water bill payers. This annual benefit was then applied from after the scheme's completion to the end of the 40-year planning horizon and discounted to 2007/08 prices.

✂ [Redacted]

d) Maintaining Drinking Water Quality and Plentiful Supply of Water Through Asset Maintenance

Maintaining a safe good quality drinking water as our customers have expressed (Section B4.1.3) is not delivered solely by the investment for meeting new obligations. Our overall asset maintenance strategy for AMP5 has an equally important role to play with respect to maintaining drinking water quality and maintaining a plentiful supply of water to our customers. This strategy includes as follows:

Non-infrastructure

- Undertake a programme of major refurbishment at our large surface water treatment works where the risks to serviceability and resilience have been identified as significant and under-investment will impact on service levels to customers. The planned investments include a rolling maintenance programme on our slow sand filters and rapid gravity filters and first-time refurbishment of our ozone treatment plant.
- Increase the level of maintenance at service reservoirs as our risk-based approach has identified value for money investments that maintain the current levels of resilience and water quality performance in our network.
- Undertake a programme of refurbishment at several of our highest risk high lift pumping stations that are critical in terms of supplying water to thousands of our customers. The pumps at several of our critical sites are beyond their design life.
- Continue to develop our risk-based Drinking Water Safety Plan Approach in line with best practice

Infrastructure

- Similar levels of distribution mains replacement activity and expenditure as in AMP4 to maintain stable serviceability but with an increased allocation of expenditure to capital maintenance in order to maintain leakage and serviceability levels.
- A significant expansion of our AMP4 trunk mains programme, which combines asset maintenance with enhanced monitoring and control at our highest risk sections. Some of this expenditure is allocated to service enhancement as it provides benefits to interruptions to supply and manages down the risk to third parties of flooding from burst mains. Similarly, an uplift in expenditure to enable us to manage down the risks associated with our storage reservoirs and tunnels.
- Improved DG3 serviceability performance through our trunk mains and SCADA programme.
- Reduce localised customer complaints through targeted maintenance of our network focussing in particular on discolouration issues (see Section B3 for more details).
- Continuation of our ongoing Flow Monitoring Zone plans and Distribution and Operation Maintenance Strategy (DOMS) programmes, which are key components of our drinking water safety plans

e) NEP Environmental Permitting of Water Treatment Sludge Plant

- Thames Water as a member of Water UK has worked with the EA since 2003 to understand how changes in environmental regulation would apply to water treatment works sludge processes. This triggered the EA to publish a 'no-enforcement notice' if such plants were not licensed, until clarity was obtained from the Department of Environment and Rural Affairs (DEFRA). DEFRA responded in early 2007 confirming that permits were required under the Environmental Permitting Regulations 2007.
- Thames Water has included in its plan funding to investigate the environmental impact of these processes and to obtain and maintain the relevant environmental permits as a single programme. This is planned to deliver compliance by the end of March 2011.

f) NEP Environmental Impact of Metaldehyde

- As part of the response to the emerging metaldehyde issue (section B4.2.2 (a)) the EA included in the NEP an environmental investigation and monitoring programme to determine metaldehyde's occurrence in and impact upon the aquatic environment. This programme of work has emerged since the draft Business Plan submission. This work is beyond the statutory remit of DWI but is however complimentary to the catchment management proposal which is aimed at reducing the risk of failing drinking water standards. It is envisaged that this investigation will enhance the understanding of the occurrence and movement of metaldehyde through the aquatic environment, thereby enabling a more effective and targeted approach to be adopted in our catchment management proposal. The costs

associated with implementation of this investigation are ~~£~~ [Redacted]. Although this has been included as an identified output in Tables 1 and 5, costs associated with it have not been included in the financial modelling.

B4.2.3 Expenditure Implications of the Proposed Programme

The investment required and resulting changes in operating cost are detailed in Table 9:

Table 4: Expenditure Implications of the Proposed AMP5 Programme (Note 1)

Quality Enhancement	Capex (£m)	Opex (£m)
Reducing the risk from <i>Cryptosporidium</i> at 3 works	⌘ [Redacted]	⌘ [Redacted]
Reducing nitrate concentrations at 2 works		
Reducing pesticide concentrations at 1 works (Note 3)		
Reducing pesticide concentrations through catchment management (3 projects)		
Installation of plumbosolvency control at 5 works		
Replacement of lead communication pipes (Note 2)		
Replacement of customer service pipes (Note 2)		
NEP Water treatment sludge processing		
NEP Metaldehyde investigation (Note 4)		
Low flow investigations		
Investigation of Lower Thames Operating Agreement		
Drought Permit baseline monitoring		
Security and Emergency Measures Direction (Note 5)		
Adjustment for fixed overhead (Note 6)		
Total		

⌘ [Redacted]

B4.2.4 Delivering the Plan

The delivery of the programme will accord with our overall capital delivery strategy. This covers issues relating to programme level procurement and how we engage with the supply chain to ensure that such items as, appropriate transfer of risk, commercial terms and implementation timescales are in place.

We have proposed indicative delivery dates to DWI for the drinking water quality programme and profiles for lead pipe replacement.

The Investigations and drought permit baseline monitoring will be delivered through the Asset Management function within Thames Water, with the use of consultants where appropriate. The lower Thames investigation will be delivered by 2012/13 and the remaining investigations by 2013/14. The drought permit baseline monitoring will be delivered by 2014/15. All delivery dates have been agreed with the EA.

✂ [Redacted]

B4.3 Sewerage Service

B4.3.1 Quality Enhancement Obligations

We have set out below a brief summary of the environmental obligations confirmed in guidance from the Environment Agency and Defra. Most of our programme is to deliver statutory schemes to achieve EU Directive compliance (e.g. the Urban Wastewater Treatment Regulations), however there are also significant, related components to achieve local river quality improvements.

With a few exceptions, there is insufficient clarity on the likely requirements arising from the Water Framework Directive (WFD) for there to be many WFD-specific obligations. However, compliance with existing Directives is a basic requirement of WFD, as is the prevention of deterioration from existing quality. Lastly, local improvements will also contribute to compliance with WFD.

In almost all major investment cases (the exceptions being sludge quality, 'Section 101a' schemes and investigations, such as to inform Environmental Permitting Regulations (EPR) and IPPC requirements) the obligation described below has been interpreted by the Environment Agency as a site-specific consent requirement, usually derived through water quality modelling. The closeness of our liaison depended on the complexity of the issue and the extent of our contribution to the modelling (such as agreed STW discharge 'flow' figures for the redefinition of 'dry weather flow' (dwf) exercise), and we have continued to challenge consent standards that appeared unnecessarily stringent or otherwise seemed to drive excessive costs.

Compliance with general provisions of the Urban Waste Water Treatment Directive (Regulations) A statutory requirement that will enhance river quality through protecting the water environment from the adverse effects of insufficiently-treated discharges of urban wastewater. As such it encompasses a range of possible obligations, in our case most significantly in relation to the collecting systems and treatment provision for London. (See below, intermittent discharges) It is also the major driver for reductions in the quantity of nutrients, in particular phosphorus, discharged from STWs.

Existing Intermittent Discharges (EA codes UID0 and UID1) A requirement (derived from the UWWTD) to address only **existing** unsatisfactory intermittent discharges (primarily, in terms of our plan, those to the Thames Tideway, an exception being Wick Lane CSO), with the purpose of ensuring improved water quality and reduced aesthetic pollution. Where these drivers apply to STWs, improvements may be secured by either an increase in treatment capacity, or improved storm flow handling, or a combination of both. There is no equivalent obligation driver code regarding discharges that are newly-identified as unsatisfactory.

Local Priority Schemes. Schemes that are significant and locally important, and that help deliver (or move towards) good ecological or chemical status, required by the Water Framework Directive, over and above improvements required by other drivers. In the absence of an alternative suitable driver, the Environment Agency has, as one output in

the NEP, a tranche of newly-identified intermittent discharges which require attention under this driver. We have shown these as intermittent discharges in all relevant Tables (1,2,19,20).

Compliance with the Groundwater Directive (Regulations). A statutory requirement for improvements to sewage treatment works which discharge effluent indirectly into groundwater. New Regulations were expected to be laid by mid-January but have been delayed. Our schemes address the anticipated requirements of the new Regulations as interpreted by the Environment Agency.

Compliance with Freshwater Fish Directive. A statutory requirement that will lead to river quality improvements and improved protection for freshwater fish. This generally involves reducing ammonia or Biochemical Oxygen Demand at specified sewage treatment works to standards set by the Environment Agency.

'Flow' schemes. The Agency is seeking to revise the definition of 'dry weather flow' it uses for compliance assessment, and this exercise has identified a tranche of STWs where, for historic reasons, the flow figure in the consent does not align with that currently measured or proposed. Further investment is proposed at a range of sites to prevent river quality deterioration. This ('no deterioration') is seen as a prerequisite for WFD compliance.

Water Framework Directive. This is a wide-ranging obligation that is expected to drive the majority of our quality enhancement investment in the future. To date, however, the evidence base for action and cost benefit assessment is not often robust enough to justify improvements, and we only have a limited number of schemes under this driver.

Priority Substances. The Priority Substances Directive (Directive 2008/105/EC) has now been adopted but is not yet transposed into UK legislation. Nonetheless, both the Government and the EA support widespread monitoring of plant effectiveness and an evaluation of possible sewage treatment options for the reduction of priority and priority hazardous substances (and other chemical contaminants) to inform the next periodic review and WFD investment cycle. The Environment Agency has provided a list of sites and specification for three types of investigation, totalling 41 STWs.

First time (rural) sewerage schemes (S101a). A statutory requirement to provide sewerage where environmental or amenity problems are best resolved by mains drainage. The Environment Agency does not promote these schemes, which arise from third-party requests to us. We will have delivered four such schemes in this period and expect a similar extent of obligation in 2010-15.

Countryside and Rights of Way Act (CRoW). Actions necessary to ensure compliance with the requirements of the CRoW Act to protect designated sites. This might require nutrient reduction to more stringent standards, or applied to smaller sites, than other legislation such as the UWWT Regulations.

Compliance with Nitrate Pollution Prevention Regulations (Nitrate Directive). The impact of extending designations of Nitrate Vulnerable Zones, requiring additional treatment of sewage sludge and/or alternative disposal routes. The most cost-effective approach to compliance with these requirements is an integral part of our sludge strategy, as set out below in B4.3.2.

Integrated Pollution Prevention and Control (IPPC Directive). The initial NEP did not contain any measures related to the introduction of the Environmental Permitting regulations or the proposed revision to the IPPC Directive. However we have included a provision for investigations in the 2010-2015 period in order to understand the potential nature and scope of any changes that may be required in AMP6. These consider four areas – licensing for smaller thermal installations (0.4 – 3MW), which tackles existing and new separately, larger installations (>3MW) and lastly other IPPC-driven changes.

✂ [Redacted]

B4.3.2 Company Proposals to Meet Sewage Sludge Management Obligations

Our sludge investment programme is divided between Quality Enhancements, Capital Maintenance and Supply Demand Waste. The bulk of the investment is allocated to Supply Demand Waste since the principal driver is increasing sludge production in the catchment. The main investment case is therefore presented in Section B5 Supply/Demand Balance Sewerage Service (Sludge) and this section covers only those sites where there is also a Quality driver.

Planning Methodology

Thames Water has sought to adopt sustainable, beneficial and cost-effective solutions to sludge management, however the quantities of sludge produced have risen in recent years, arising mainly as a result of population increases and from more stringent levels of wastewater treatment. We recognised the need for a strategic approach to the management of sewage sludge and our corporate Sludge Strategy was finalised during December 2008. Prior to this, an independent Strategic Environmental Assessment (SEA) of our draft Sludge Strategy was undertaken to ensure that potential environmental, economic and social impacts were properly accounted for in all stages of our strategy development. The subsequent SEA post adoption statement was completed in December 2008 and this document explains how the findings of the earlier SEA Environmental Report have been taken into account and includes our responses to comments submitted during the public consultation & [Redacted] Notably, in response to our draft Sludge Strategy, the EA confirmed that lime treatment should not be considered as an acceptable longer-term treatment option for sewage sludge.

In summary, we have broad support for our Sludge Strategy and our Business Plan aims to provide a sustainable outlet for our sludge, which reduces the quantities of sludge for recycling, maximises the energy recovery, reduces our dependency on lime treatment and responds to regulatory requirements.

The immediate issues that have influenced our AMP5 proposals are:

Nitrate Pollution Prevention Regulations: In September 2008, the new Nitrate Pollution Prevention Regulations were introduced and the Action Programme measures established by these Regulations came into force on 1st January 2009.

In the previous Action Programme for Nitrate Vulnerable Zones (England and Wales) Regulations, the closed periods for liquid digested sludge on sandy or shallow soils were 2 months for grassland and 3 months for arable land. In the revised Nitrate Pollution Prevention Regulations 2008, the closed periods for organic manures with high available nitrogen (including liquid digested sludge) are now as follows:

Table 5: Closed Periods for Organic Manures

Soil Type	Grassland	Arable Land
Sandy or shallow soils	1 st September – 31 st December	1 st August – 31 st December
All other soils	15 th October – 15 th January	1 st October – 15 th January

Therefore, with the introduction of the Nitrate Pollution Prevention Regulations 2008, additional storage capacity is required by 1st January 2012 so that treated sludge can be held onsite or on-farm during these extended 'closed periods'. This additional capacity is only an issue at sites that currently have 'liquid' sludge operations (approx 2-4% dry solids).

These regulations require the provision of adequate storage for such liquid manures, but the enforcement of this is deferred for up to two years, to allow for storage to be installed. Our farmers do not currently have adequate facilities for the required storage of liquid sludges over these extended closed periods, nor can we provide this storage at our sludge treatment centres at this current time. Hence by 1st January 2012, additional storage will be required to hold treated liquid digested sludge on-site or on farm. Consequently, with support from the Environment Agency, we have regarded these regulations as an AMP5 Quality driver for sludge.

Effluent quality standards: Increasingly stringent effluent quality standards have a knock-on effect on the mass of sludge produced. Much of the additional sludge produced is secondary activated sludge, which is more difficult to treat, handle and dispose of than primary sludge. Additional capacity is required to treat the sludge arising as a result of enhanced effluent quality obligations. This is particularly pertinent for our 5 Tideway sewage treatment works (see section B4.3.3) where the upgrades of flow to full treatment and the introduction of suspended solids consents will result in the production of more sludge that requires treatment and disposal.

The majority of our current sludge production is recycled to agricultural land in the form of conventionally treated sludge cake or liquid, thus an assessment of the availability of suitable land was an essential component of our strategy. Therefore, in 2007, ~~XXXX~~ [Redacted] and ~~XXXX~~ [Redacted] were approached to carry out a detailed assessment of landbank availability over the next 25 years. ~~XXXX~~ [Redacted]

Since the Draft Business Plan, our consultants have built upon and enhanced the November 2007 report through considering the impact of the extractable phosphorus status of agricultural soils, the quantities of other organic materials recycled to agricultural land and Thames Water experience of farmer acceptance on the available agricultural landbank.

This updated report has estimated that the total capacity for accepting biosolids in the Thames Water region, after accounting for existing land use/physical constraints, land in direct proximity to housing, the area occupied by animal manures and other organic materials (e.g. green compost, paper crumble etc.) and land not suitable for biosolids application due to soil phosphate levels is 220,000 hectares (47%) less than that estimated in the 2007 report (460,000 ha). This suggests that we have only some 240,000

ha. available for recycling. As we already utilise approximately 10-15% of this land area, the main issue for Thames Water is having the right type of land available at the right time of year. This can and does cause difficulties.

In 2007/08 the land bank utilisation, in terms of sludge application was to arable (87.7%), silage and fodder (10.7%), industrial crops (1.2%) and grassland (0.3%). With the implementation of the Nitrate Pollution Prevention Regulations and the cessation of liquid sludge recycling operations by 1st January 2012, this will result in the current proportion of sludge recycled to grassland being accommodated by arable land. Other changes to land use are expected to be marginal although the risk remains that we may lose more landbank due to food supply chain perception issues and this may also have an effect on utilisation.

Table 6: Expected Changes in Land Bank Utilisation

Land bank utilisation (%)	2007/08	2014/15
Arable	87.7	88.0
Grassland	0.3	0
Silage and Fodder	10.7	10.7
Fruit, salad, vegetable, horticultural	0	0
Industrial crop	1.2	1.2

Our strategic approach of installing enhanced digestion (thermal hydrolysis, or THP) will enable us to maintain the landbank currently available by producing a better quality, more acceptable product and reduce the landbank dependency. Increasing our treatment to thermal hydrolysis reduces the nitrogen content of the final product, reduces fresh weight quantities recycled to land, improves 'stackability' characteristics, reduces odour nuisance (which is a major issue in terms of public perception) and increases acceptability of treated sludge to stakeholders.

Proposed Enhancements and costs: The costs for delivering the planned programme of work have been derived primarily from historic investment via our engineering cost models and then validated by site-specific, bottom-up costings and the resulting solutions represent a cost effective and sustainable approach to providing sludge treatment capacity (more detail can be found in Section B5 < [Redacted]). The sludge investment programme has been divided between Quality Enhancements, Capital Maintenance and Supply Demand Waste.

Nitrate Vulnerable Zones: The 9 sludge centres affected are Ascot, Basingstoke, Bracknell, Camberley, Chertsey, Cranleigh, Crawley, Haslemere and Woking. At most of the sites in question, there is inadequate space available for the development of the additional storage capacity required and in addition, there is a significant cost associated with additional storage requirements for liquid sludge.

Rather than install additional liquid sludge tank capacity and continue this type of operation, we propose to install sludge dewatering and storage/recycling of the product as sludge cake (20-25% dry solids). Not only are the storage requirements simpler (consisting of a concrete pad rather than a bunded rectangular storage tank), but also the resulting cake product is not classed as containing high available nitrogen and is therefore not affected by the closed periods. There will also be benefits from a reduction in haulage

costs by transporting a reduced volume of sludge i.e. requiring fewer vehicle movements and a reduced carbon footprint.

The proposed solution for the sites that are currently liquid sludge operations requiring either extended liquid storage or dewatering (with the exception of Ascot) are below. In calculating the costs it was assumed that 6 months liquid storage would be required to provide the level of operational contingency needed to manage the closed periods including weather restrictions. The costs for dewatering have assumed 2 months covered storage for the mesophilic anaerobic digested sludge cake, as this product can be stockpiled on farm and spread later. The comparative whole life cost for the two options is shown below. In all cases the dewatering option is more cost effective.

✂ [Redacted]

The tankering of liquid sludge from Ascot to Reading STW will be achieved through operational expenditure. This option is only feasible for the Ascot to Reading import scenario because, upon closure of the local brewery, Reading STW will have spare capacity available to receive imports. Ascot is ideally placed to export liquid sludge to Reading due to its close proximity and in addition, Reading STW can only receive liquid sludge imports due to the lack of re-slurrying facilities on-site. It is proposed that Cranleigh, Haslemere and Woking sludge will be transported as raw sludge cake to Guildford, which has spare treatment capacity available and is also the only Thames Water site currently with cake reception facilities.

Dewatering sludge generates a liquor with a very high ammoniacal-nitrogen content, which then has to be treated by the biological process plant. This can impose a very large additional load on the existing plant and would put effluent compliance at risk, so, Bracknell, Camberley, Chertsey and Crawley solutions include liquor treatment as these sites are either biological filter works or have tight ammonia consents.

At the time of the Draft Business Plan, we presented our strategy to meet the Nitrate Pollution Prevention Regulations to the Environment Agency and they endorsed our proposed programme and included these sites on their Initial NEP. Although the SL1 driver schemes are no longer mentioned in the NEP, the Environment Agency still supports our proposals.

✂ [Redacted]

Beckton: In addition to the population growth detailed in Section B5, sludge disposal capacity at Beckton is further challenged by the need to accommodate enhanced wastewater treatment. When the planned extension to the effluent stream is commissioned at Beckton to meet the new flow and quality consent, the shortfall in sludge disposal capacity rises sharply. A further increase in sludge will occur following the commissioning of, respectively, both the Lee and Thames Tunnels that will capture additional sewage from the catchment and discharge to Beckton STW. The by-products of treating this additional flow will add to the sludge treatment requirement at the works.

In the short-term, we have installed temporary lime stabilisation at Beckton to provide additional capacity, however, this is not a sustainable option at the quantities required to meet the needs of Beckton in the medium to long-term. Instead, the medium term need for

both the Riverside and Beckton catchments will be met by the proposed enhanced digestion scheme at Riverside STW with the interim pumping of a proportion of Beckton's sludge to Riverside for treatment (detailed in Section B5 and logging-up case in Section C5.2).

In the short term, the Riverside digestion plant and lime treatment will provide sufficient additional sludge treatment capacity at Beckton until 2014. However, in the longer-term more, and sustainable, sludge treatment capacity is needed at Beckton to treat the increasing sludge produced as a result of Lee and Thames Tideway Tunnels, the future increase in population and to allow the phased major refurbishment of the existing Sludge Powered Generators (incinerators) in AMP6.

Changes from DBP: Since the draft Business Plan, an independent East London ✂ [Redacted] has been completed - this investigated site-specific options most suitable for dealing with the shortfall in required sludge capacity across our East London STWs. The ✂ [Redacted] determined that the preferred option for Beckton is to retain the existing Sludge Powered Generator (SPG) – which incinerates the sludge - and provide additional treatment capacity using enhanced digestion, with the resulting digested cake recycled to agriculture. The review determined that a thermal hydrolysis solution had a significantly lower capex and whole life cost and was more positive with regard to the environmental objectives. The final report can be found in ✂ [Redacted] and a comparison of the costs of the selected treatment options are shown in Section B5.

✂ [Redacted]

Crossness: Sludge enhancements at Crossness were omitted from the Draft Business Plan, as it was anticipated that additional thermal destruction capacity would be required and we had assumed that we could provide additional sludge treatment capacity and refurbishment of the Crossness Sludge Powered Generator (SPG) during AMP6. However, when the current STW upgrade is completed, there will be a shortfall in sludge treatment capacity and no spare treatment capacity to allow the SPG to be taken out of service for its major refurbishment.

A number of treatment options have been investigated and, as at Beckton, the ✂ [Redacted] has determined thermal hydrolysis and digestion with the continued use of the existing SPG to be most appropriate technology and process configuration, to deliver this long-term sludge treatment capacity. Comparisons of the costs of the selected treatment options are shown in Section B5.

We are confident, following our experience with the limed product, there are sufficient outlets to recycle the new digested sludge cake from Crossness to land, which is a more preferable product to lime treated sludge. The use of thermally hydrolysed digested cake to agriculture should be a robust route that may be augmented with possible modification of the SPG in the future in order to provide an alternative outlet (as a fuel) for the sludge product.

✂ [Redacted]

Proposed Enhancements and Costs

The obligations listed in section B4.3.1 above give no indication of the scale of importance or relative expenditure which attaches to each obligation. (The cost of the quality allocation is identified in Table 20 below).

We have set out below, in six sections, more detailed descriptions of the content of the programme. The sections are:

- Tideway STWs, Tunnels and CSOs
- Deephams STW
- Flow-related schemes
- Groundwater schemes
- River Lee Intermittents
- Other (the remainder of the programme)
- Thames Tideway STW Upgrades, Tideway Tunnels and CSOs

STW upgrades

The improvements requiring investment at the Tideway works (Beckton, Crossness, Mogden, Long Reach and Riverside) are necessary under two drivers. The first is a Local Priority driver specifically for a revised (tighter) consent. This applies to all the Tideway works. The second driver is an obligation arising from the Urban Wastewater Treatment Directive and applies to Beckton, Crossness and Mogden only. This requirement is represented by the UID1 driver (unsatisfactory intermittent discharge) and confirms the need to increase treatment capacity (Maximum Flow to Full Treatment), to reduce the frequency of intermittent discharges (eg from storm tanks) to the Thames. As we have developed solutions which address both drivers (as appropriate), we have used UID1 as the primary driver for Beckton, Crossness and Mogden, and Local Priority (L1) for Riverside and Long Reach

These improvements require major engineering works involving detailed preparation, the need to obtain planning permission and undertake Environmental Impact Assessments. For these reasons the projects were originally scheduled to be delivered over an 8-year period with completion predicted by 2012 for all but one site (Crossness) due in 2014. The objective of the improvements was twofold; first, to provide additional capacity at the STWs so that storm discharges occur less frequently, thus reducing the impact on water quality in the Tideway during and after such events; and secondly, to improve the background quality of the river under dry weather conditions.

However the programme of work agreed at the final determination in 2004 has been severely delayed for several reasons. The first was a review of the whole 'package' of improvements to Tideway STWs, initially as a result of the decision to implement the Tideway Tunnel in 2006. One of our refined assumptions in the 2006 review was that the tunnel discharge had to be fully (secondary) treated. Coupled with other planning considerations, and development of the optimum solution to deliver objectives, this required the tunnel to terminate at Beckton instead of Crossness. There is a balance to be established between the storage volume of the tunnel, the treated pump-out during filling and the subsequent emptying to ensure that it is ready for the next rainfall event. This iteration led to a substantial treatment capacity need at Beckton; this is a 'new' cost in addition to the expected upgrades endorsed at PR04.

Additionally, this review resulted in a change of scope for Long Reach and Riverside requiring much more substantial investment and a step change from what were assumed (in 2004) to be 'no' or 'low' cost sites. Tentative delivery dates for all these sites were provided to Defra in ✂ [Redacted]. The assumption and agreed basis was that this 'basket' of improvements was within the same cost envelope as the PR04 Final Determination, subject to the 'extra' investment required for Beckton (to treat the tunnel pump out) being an additional cost.

However, the assumption that we could proceed on the basis of these agreed standards was overturned early in 2007 when the Agency notified us of their intention to impose, at all five sites, additional consent parameters (suspended solids limits) and revised the principal control mechanism from median, composite sample values in the summer, to a year-round look-up table value derived from spot samples. This prompted detailed discussions to identify what standards were neutral in terms of both cost and risk, which took approximately a year to resolve. We have now reached an agreement acceptable to both parties and we are now implementing schemes to deliver the latest effluent quality specifications sent to us by the EA, and we have only recently (March 09) received the full set of draft consent documents confirming our required outputs. These discussions have led to slippage in the programme and further delays to planning submissions. ✂ [Redacted]

We have also reconsidered the expected catchment growth on a longer design horizon, in keeping with the Minister's request to develop further the Tideway tunnel. This has also lead to an increase in costs, as has a new obligation regarding renewable energy generation (a planning policy decision by the Greater London Authority, GLA) and some early 'facilitating' work to permit subsequent fitment of nitrogen-reduction plant. These changes are examined in Table 16 below, which considers the total scheme cost and so includes spend in this period. This table demonstrates that the majority of cost change between the 2004 determination (post-efficiency costs) and our final plan can be attributed to revised obligations in the intervening period.

✂ [Redacted]

Lastly, planning permission has been sought for Beckton, Crossness and Mogden STWs, and it is clear that, with the exception of Crossness STW, there will be delays to obtaining planning approval and/or planning conditions attached that may cause delay or incur additional expense. There is a particular issue as regards odour management at Beckton which has led to delay in the planning process, and it is not clear how this will be resolved without a substantial commitment to additional odour reduction investment (for which the funding is uncertain). Should this result in a planning appeal, then further delays to delivery must be expected. Our scheme costs, profiling and delivery dates all assume that planning permission is granted within reasonable timescales. Although these are our best estimate, they should be viewed as indicative, as they are to a large extent outside our control. We continue to advise the Environment Agency of these delays, as we do Defra, given the commitments made to the European Commission.

The quality enhancement element of the costs for the Tideway STW upgrades have been included in Table B4.4 and, by implication, will be subject to the same efficiency assumptions as for the remainder of the programme. We believe this is wholly

inappropriate as these upgrades are now largely at the stage of project delivery and hence have been subject to much more rigorous costing than other components of the Business Plan. This was demonstrated by an independent assessment of Beckton costs by ~~3~~ [Redacted]. We would welcome Ofwat's confirmation that anything beyond minor efficiency assumptions will not be applied.

Tideway Tunnel ('Thames Tunnel'): The current assumption is for an approximately 32km long, 7.2m diameter storage and transfer tunnel, running from the vicinity of Hammersmith and terminating at Beckton STW where the contents will be pumped out for full treatment under most normal circumstances. The tunnel will collect the 34 intermittent discharges identified as unsatisfactory and is assumed to largely follow the path of the river.

However, the route, capacity and number of overflows collected by the Thames tunnel continue to be discussed and refined. The funding of the construction of Thames Tunnel remains, for the moment, outside of the province of this Business Plan, as agreed. Accordingly, we have included our development costs and an allowance for land purchase costs only. It is proposed that planning permission is sought in 2010, with construction beginning in 2012 and completion by 2020. As with the Tideway STW upgrades, it is clear that obtaining planning permission will be a major hurdle that will dictate the rate of progress.

Lee Tunnel: The Lee tunnel is a 7km long, 7.2m diameter storage and transfer tunnel which will collect the existing overflows from the Abbey Mills pumping station and convey them to Beckton STW for full treatment, other than on occasions of heavy or prolonged rainfall when an overflow will be made at Beckton direct to the Thames. (This will change again on completion of the Thames tunnel, after which the frequency will decrease) This will mean that under all normal circumstances there will no longer be any storm sewage discharges from the Abbey Mills site to the River Lee or tributaries. Tackling the storm discharges from Abbey Mills – which contribute some 50% of the annual volume of storm overflows from the Beckton and Crossness catchments – early is seen as a significant contributor to demonstrating UWWTD compliance. The Lee tunnel is promoted and to be constructed as a separate entity and has far fewer planning issues than the Thames tunnel, although the Beckton extensions are a pre-requisite to receive the storm flows from Abbey Mills. However, as the Lee tunnel and Beckton STW extensions are so closely linked, and therefore have to be promoted under a single planning application, it follows that the planning delays at Beckton have consequences for the delivery of Lee tunnel. Earlier assumptions of delivery by March 2014 now appear unrealistic, and the planning delays to date have eroded any float in the project. Even with future planning decisions assumed to be favourable, we do not expect completion before December 2014.

Wick Lane CSO: The Wick lane CSO is not remediated by either the Thames or Lee Tunnels. ✂ [Redacted] The solution proposed requires a substantial new pumping station and an associated discharge main.

Deephams STW Upgrade: The Environment Agency has identified the need for a significant improvement in the quality of the discharge from Deephams sewage works (a) to meet requirements under the Urban Waste Water, and Freshwater Fish, Directives (b) as a result of the change in the nature of the receiving water following impoundment of the River Lee and (c) the major campaign in the area to improve the quality of the River Lee catchment. This is reflected in the multiple driver codes allocated in the NEP: U1, F1a, Flow1, WFD 1, WFD 3 and WFD 4. In addition there is investment required at the site to meet growth and maintenance drivers.

The consent proposed for Deephams by the Environment Agency represents the most stringent combination anywhere in our area, and is at the limits of conventional treatment

technology – 10mg/l Suspended Solids, 5 mg/l Biochemical Oxygen Demand, 1mg/l Ammoniacal Nitrogen, and 1mg/l total Phosphorus. ✂ [Redacted]

Having assessed these alternatives, the most cost-effective option at present is a partial relocation of the treatment process to an adjoining site in our ownership. In broad terms, the inlet works, preliminary treatment, storm tanks and transfer pumping stations will remain on the existing site, together with the sludge treatment stream, whilst the entire primary, secondary and tertiary treatment plant will be built on the new site. It was suggested at audit that some of the existing primary and secondary plant could be retained, allied to a smaller proportion of the treatment stream as new build. This was an option that we considered qualitatively but discounted at an early stage, and hence it was not developed to any degree of detail. We remain convinced that when the longer term issues of structure, reliability and performance risk are properly accounted for, then the complete treatment stream rebuild will be the most cost-effective option. We will develop this partial replacement option more fully and report in good time for the draft determination, but even in the event that an alternative option is practicable at marginally lower total cost, the required investment in the 2010-15 period is unlikely to be less as it represents only some 35% of total expenditure.

Our best estimate for completion of the full treatment relocation scheme is March 2017, which assumes three preparatory years (2010-13) to obtain planning permission and site clearance. This then assumes at least three years of major construction which delivers both the F1a and Flow 1 obligations of stringent ammonia, BOD and suspended solids standards. A longer timeframe would be necessary for more limited relocation since the necessary enhancements to the existing plant could only commence once the new plant is commissioned.

We recognise that there may well be significant planning issues raised in connection with the relocation proposal – the new site is both green belt and in the Lee Valley Regional Park – and we have started discussions with the local authority. We have also commissioned and received a report from external consultants considering alternative locations, of which there appears only one other, which is both far less practicable and not in our ownership.

There are further phasing and plant considerations relating to the achievement and maintenance of a tighter ammonia standard as of March 2010, a peroxide dosing facility by March 2011 (WFD 4) and the delivery by March 2012 of nutrient (Phosphorus) reduction. (U1) Where these outputs are clear and specific they are identified individually in Table 19 below.

The adoption of iron-dosing to reduce the effluent Phosphorus concentration, allied to improved solids capture from the tertiary treatment plant, will significantly increase the sludge quantities to be handled at the site. These consequences are fully described in section B5.

Lastly, we wish to highlight that the delivery of the obligation in March 2017 will mean that a major contract will need to be let in advance of any guarantee of funding for the subsequent period. We would welcome some certainty of how this may be suitably addressed and propose that a specific agreement with Ofwat should be reached before significant contract commitment is made.

Flow Related Schemes

In accordance with Environment Agency policy to review the basis for consent-setting, we have provided flow data for a large proportion of our STWs. Whilst for most, the new definition of 'dry weather flow' can be substituted in the consent and matched with the current flow received without any consequences for effluent quality, the Environment Agency have identified that new quality standards are required for some. These new standards, as modelled by the Environment Agency, are required to maintain existing river quality and are considered essential to comply with the no-deterioration requirement of the WFD.

This driver relates to 29 sites on the NEP, but for two sites we propose a combined solution under a different lead driver, and for a further two we propose a solution without capital spend allocated to quality. For the remaining 25 sites we have, as with the rest of our programme, assessed on an individual basis the capability of the existing plant and what additions are necessary to meet the new standards, developing alternatives where such are practicable. For some sites we have been able to take a view on likely growth and the standards proposed reflect the expected flow in 2021 – for these sites, the costs have been proportionately allocated as appropriate between quality, growth and base.

Groundwater Schemes

Thames has over 40 discharges of effluent made into or onto land, and hence indirectly into groundwater. There was a concern that some discharges were direct into groundwater, a practice forbidden under the Water Framework Directive, but further investigation has shown that these discharges are indirect, rather than direct. A new Groundwater Daughter Directive was adopted, although the old Directive is not repealed until 2013, and although transposition should have been completed by January 2009, this has yet to happen. The Water Industry has been working with Defra and the Environment Agency to understand the likely contents of the awaited Regulations, and the Environment Agency has derived new effluent quality standards for the 12 sites included based on the anticipated contents.

In the main, the process upgrades reflect improvements to ammonia standards, although some also have the introduction of suspended solids and biochemical oxygen demand parameters. At one site there has been a specific requirement on the disposal method, and at another, a specific treatment provision.

River Lee Intermittents

The Environment Agency has identified some 19 intermittent discharges ✂ [Redacted] (These are in addition to the Wick Lane CSO) This has come about due to an improved understanding of the Lee and in recognition of the likely water quality changes following its impoundment (the re-establishment of the Prescott Lock and weir) in 2008. ✂ [Redacted] It is further complicated by a lack of data or modelling to show the effect of individual intermittent discharges, although the collective impact can be assessed. In the NEP, the Environment Agency has included two lines; one for screening, and one for capacity. This latter recognises that the substantial upgrades implied will take longer to deliver. We have identified each intermittent discharge individually and have a range of

responses – those identified late, such as Lordship Recreation Ground, where we propose only a detailed survey and thorough investigation of the problem in this period – to those where major structures will be required, such as additional capacity for the Auckland Road Storm Tanks. The majority of schemes assume provision of a screen to prevent the discharge of litter.

‘Other’ Improvement Schemes

The Environment Agency has identified in the NEP a number of schemes which do not, individually or collectively, attract large investment sums. We have also identified schemes, where the sums involved are relatively modest, which may not feature in the current NEP although they have Environment Agency endorsement and we believe are likely to be listed in the eventual list of obligations.

These include:

- **Urban Waste Water Treatment Directive** Schemes (beyond Tideway STWs and Deephams, as above) to achieve more stringent quality requirements, having crossed a size threshold due to growth. These are either new Phosphorus limits where the STW exceeds 10,000 pe for the first time, or, where an STW is expected to exceed 100,000 pe, a more stringent limit.
- **Water Framework Directive** Aside from Deephams STW, two STWs (Byfield and Fiddlers Hamlet) require improvements to Ammonia and Biochemical Oxygen Demand under this driver. The Suspended Solids limit at Byfield also needs to be reduced to meet the requirements of this Directive.
- **Local Priority** One scheme, Woodstock STW which discharges to a world heritage site lake.
- **Freshwater Fish Directive** Aside from Deephams STW, one STW (Berkhamsted) where improved effluent quality is required to ensure compliance with the Directive.
- **CRoW Act** We have one construction project, providing phosphorus reduction at Great Bedwyn STW (which also delivers a Flow 1 obligation). Additionally, two investigations are proposed, one to understand the impact of Tring STW on the nearby SSSI, and another to assess the implications for the Kennet and Avon Canal of further nutrient reductions at minor but contributing STWs.
- **Priority Substances** Investigations to a list of works and specification provided by the Environment Agency. The Environment Agency have latterly listed STWs individually – we have identified costs according to the type of investigation and show these under three lines, being C1, C2 and C3. The costs shown on these lines map across to the STWs included on the latest version of the Environment Agency specification and the detail is provided in the underpinning database. A total of 41 STWs are included, being 40 C1, 8 C2 and 2 C3 (some STW have more than 1 investigation).
- **Section 101a sewerage schemes** The costs shown against this driver represent our best estimate of the obligation likely to arise in the period, based on numbers of schemes and costs during this period.

- **EPR and IPPC** These include four investigations to assess the impact of the recent changes to the Environmental Permitting Regulations and to comply with the revised IPPC Directive
- **Implementation of Operator Self-Monitoring (OSM)** This represents the additional sampling, analysis and reporting burden anticipated as a result of the addition of new parameters to consents, such as caused by implementation of the Environment Agency 'dangerous substances' policy. We have reviewed the likely scale of risk since the draft and have reduced the operational cost, but this reflects a higher risk to us.

✂ [Redacted]

Outputs for the Wastewater Quality Programme 2010 to 2015

Table 20 summarises the components and principal outputs of the Business Plan. Based on the Environment Agency NEP we have consolidated options to a single output for each site, if they are delivered by the same scheme. The consequence of this is that schemes may deliver several obligations and that the link between obligation and expenditure may not be immediately apparent.

Table 7: Outputs for the Wastewater Quality Programme

Quality Enhancement Effluent and Investigations	Outputs
Thames Tideway STW upgrades (Urban Wastewater Treatment Directive, Local Priority drivers)	5
Lee Tunnel and Wick Lane CSO (Urban Wastewater Treatment Directive)	2
Urban Wastewater Treatment Directive (P reduction)	4
CRoW act (P reduction)	1
Water Framework Directive	3
Compliance with new flow conditions at sewage works (Note 1)	29 (25)
Compliance with the Freshwater Fish Directive	1
Intermittent Discharge improvements to the River Lee	19
Local priority schemes	1
Investigation into effluent effects on SSSIs	2
Compliance with Groundwater Directive	12
Monitoring and investigation of priority hazardous substances (Note 2)	3
First Time (Rural) Sewerage Schemes (S101a)	4
Investigation of changes at Sewage Treatment Works to meet new regulations on IPPC and Environmental Permitting (Note 3)	4
⌘< [Redacted]	⌘< [Redacted]
Sludge treatment to meet NVZ regulations (Note 4)	8
Sludge treatment (Beckton and Crossness Enhancement)	2

Note 1: There are 29 STWs on the Environment Agency NEP with this driver, two of which have combined solutions with other drivers. We have identified capital schemes (quality) at only 25 of the remainder.

Note 2: We have included 3 separate outputs for monitoring priority substances. This is not presentationally consistent with the NEP which lists all STWs individually, although the sites and investigations are the same.

Note 3: This line consists of 3 outputs for investigations grouped under Environmental permitting Regulations (EPR, 13 STWs) and 1 output for anticipating revised obligations under IPPC (37 STWs).

Note 4: This output reflects the 8 schemes listed in the quality programme; a further site has been incorrectly allocated to supply/demand.

Exclusions from the Plan - General Uncertainties and Key Assumptions

UK Infraction Proceedings from failure to implement the UWWTD: The Urban Wastewater Treatment Directive requires, where waters are at risk of eutrophication and there are qualifying STWs upstream, that they should be identified as a Sensitive Area (Eutrophic) and nutrient reduction installed at contributing STWs. As a generality, it is a UK assumption that phosphorus is the principal nutrient for control in freshwaters, whilst nitrogen is addressed in estuarial or coastal waters, although UWWTD does not make this distinction and presumes both N and P reduction.

The European Commission is pursuing infraction proceedings against the UK Government by virtue of the alleged failure to designate the outer Thames Estuary as a Sensitive Area (Eutrophic). The case is now with the European Court of Justice (ECJ), and an oral hearing took place on 5 March 2009. If the UK loses the action, we would be obliged to install nutrient reduction at all of our sewage treatment works serving the London Agglomeration (the large five, Beckton, Crossness, Mogden, Long Reach and Riverside, plus five others – Deephams, Hogsmill, Beddington, Esher and Brentwood) as a minimum and, potentially, all qualifying works in the catchment. In keeping with UK assumptions, and supported by recent modelling carried out for the Environment Agency, we have assumed that this would be nitrogen reduction only, although a decision that it should be both nitrogen and phosphorus cannot be discounted. However, since the UK Government is currently challenging this case, we have not included any of these costs in our Business Plan. ✕ [Redacted]

Water Framework Directive: There is a mismatch in delivery timetables between the draft Business Plan and the Water Framework Directive River Basin Management Plans (RBMP), which will not be available until December 2009. Very little specific investment has been included in our draft Plan to meet statutory obligations under the WFD due to the uncertainty involved. We have included a small number of schemes where there is clarity of obligation. We should also recognise that there may be pressure to increase the extent of ambition after the RBMP has been submitted to Brussels, resulting in additional obligations being identified post Business Plan submission. We are proposing that additional WFD obligations are recognised as a Relevant Change of Circumstance for AMP5.

Private Sewers: It is proposed that the responsibility for private sewers is passed to sewerage undertakers. This requires enabling legislation, and the timetable for this to be laid and passed is not clear. Hence it is not certain when the transfer will take place, nor is the scope and pace of the transfer clear. Although we have not included any cost assumptions in our plan, this transfer remains a Government commitment and when, or if, this becomes a specific obligation, we assume that it will be recognised as a Relevant Change of Circumstance.

Groundwater Directive (2006) Regulations: The transposing Regulations for the ‘new’ Groundwater Directive should have been laid by mid-January 2009, but have been delayed. We have based our programme on information supplied by the Environment Agency that reflects a joint ‘working’ position adopted as regards the expected content of the new Regulations. If the Regulations when laid are different then our programme will, or at least may, need to be modified, and we believe this would represent a Relevant Change of Circumstance. As the Regulations should be laid by the summer, we anticipate the opportunity to make representations in the light of the Regulations and/or draft determination. Equally, we have not attempted to predict any policy changes that may subsequently emerge in terms of implementation, such as tackling the alleged pollution of groundwater due to exfiltration from leaking sewers.

Environmental Permitting Regulations and the application of IPPC to sewage treatment works: The NEP does not include any measures in relation to the introduction of the Environmental Permitting Regulations or the consequences of revisions of the IPPC Directive (now the Industrial Emissions Directive). We have therefore omitted from our plan any major investment that will ultimately be required to meet these new obligations but we have included the costs for investigations to determine the nature and scale of any impact. There remains a risk that we may need to make significant expenditure to meet these new requirements during the 2010-15 period

✂ [Redacted]

Other Quality Obligations: Other quality obligations are likely to impact on our business during the AMP5 period. Many of these are as yet unclear and we have therefore not attempted to cost them for our Business Plan. We are therefore continuing to bear the risk of expenditure to meet new or revised UK policies

These include:

- Revised Sludge use in Agriculture Directive
- Consequences of Pitt review
- Changes to Environmental Permitting Regulations
- Environment Agency charging protocol - the Unified Charging Framework, which is moving to a ‘risk-based’ charge
- Additional discharge or environmental sampling requirements stemming from WFD
- Application of BTKNEEC by Environment Agency when determining applications for Combined Sewer Overflows

B4.3.4 Expenditure Implications of the Proposed Programme

Table 21 details the investment required and resulting changes in operating costs for the proposed programme:

Table 8: Expenditure Implications of the Proposed AMP5 Programme

Quality Enhancement (Note 1)	Capex (£m)	Opex (£m)
Thames Tideway STW upgrades	⌘ [Redacted]	⌘ [Redacted]
Delivery of Lee Tunnel		
Development of Thames Tunnel		
Commencement of Deephams rebuild (not completed in AMP5 period)		
Implementation of UWWTD (nutrient reduction)		
CroW Act		
Implementation of Water Framework Directive (3 sites)		
Compliance with Freshwater Fish Directive (1 site)		
Compliance with new flow consents (27 sites)		
Provide new S101A rural sewerage schemes (4 sites)		
Compliance with Groundwater Directive (12 sites)		
Local priority scheme		
Improving intermittent discharges to the River Lee		
Investigation into the effluent effect on SSSIs (2 sites)		
Investigation and monitoring of priority substances		
Sludge treatment to meet NVZ regulations		
Sludge treatment to treat Crossness and Beckton STW upgrades and Lee tunnel discharge.		
Impact of operator self monitoring (OSM)		
Investigation of impact of IPPC and Environmental Permitting.		
Security and Emergency Measures Direction		
Total (Note 2)		

Note 1: Costs are prior to the application of efficiency factors
⌘ [Redacted]

✂ [Redacted]

B4.4 Concluding Statement

The quality component of our Business Plan has been designed to meet all statutory and other quality enhancement obligations. ✂ [Redacted]

All of the components have been agreed and supported by one or more of our quality regulators, the Drinking Water Inspectorate, Environment Agency and Natural England. In the case of measures to meet the requirements of the Security and Emergency Measures Direction, our SEMD certifier and Defra have supported our proposals.

Cost benefit analysis has been undertaken wherever a valid methodology and means of expressing benefits are available and appropriate. All of our proposed water service investment is cost-beneficial and most of our wastewater investment. As explained in the text, it is not considered appropriate to try and undertake CBA for SEMD measures.

We have responded positively to all of the comments received on our draft plan, whether arising from Ofwat's and our own consultation, our reporter or as part of Ofwat's report on the CIS baseline.

Our proposed programme is now significantly more robust than that presented in the draft plan. In addition to responding to external comments we have also subjected high cost items to severe internal challenge, undertaken a more comprehensive CBA to facilitate full understanding of the benefits that our proposals will bring to customers and provided a more complete and comprehensive response to some of the quality drivers, for example, a more comprehensive strategy for approaching the new standard for lead in drinking water, inclusion of a fully argued case for the redevelopment of Deephams STW and consideration of the 'flow' schemes on a site by site basis.

As a result, we are now presenting a more soundly based and cost-effective response to the quality drivers, with clearly defined benefits for customers from proposed investment.

We have identified a number of uncertainties in the requirements or the outcomes that cannot be resolved at this time. Where appropriate eg lead and catchment management for pesticides, we have used our judgement to determine the requirement, and the outcome based on a central estimate of the investment required. In some cases it is not clear whether new or more demanding drivers will materialise. Should they do so some may have a significant impact and if so it will be necessary to revisit the plan to address these new obligations. In some areas eg the environmental regulatory framework, we anticipate changes, which are almost certain to result in additional cost for us within the AMP5 period, but these are not certain enough for inclusion in the plan at this stage. We therefore consider that our approach to dealing with uncertainty within the plan represents an appropriate balance of risk between the company and our customers.