

Part B5.3 – Maintaining the Supply / Demand Balance (Sludge)**Summary Report by REPORTER****Summary of Audit Findings & Reporter Opinion**

We note that the Company is proposing a major change in sludge treatment technology with a consequential step increase in the proposed level of investment, compared to AMP4. Its proposals for the FBP are a significant development after the DBP resulting in an integrated strategy dealing with growth, quality and capital maintenance requirements and provides an overall reduction in planned cost.

Thames propose complying with new Nitrate Pollution Prevention Regulations by installing sludge dewatering and storage/recycling facilities to overcome the extended 'closed period' imposed by the regulations. We feel this solution has been shown to be valid.

In addition, Thames intends to install thermal hydrolysis as a pre-treatment at 5 digestion sites within the region to address current under capacity and future increased sludge production. Additional conventional digestion capacity is also proposed at 2 sites.

(TEXT REDACTED)

During audit, we looked particularly closely at the calculation of future sludge production. After detailed review, we are content with procedures for estimating sludge production but hold some residual uncertainty over the likely sludge production levels at 2 sites due to uncertainty relating to growth after 2016 and following completion of the Tideway and other improvements.

(TEXT REDACTED)

Thames has conducted a strategic review to develop the proposals within its Sludge Strategy in line with its Strategic Direction Statement (SDS). This has been undertaken in a pragmatic manner by identifying preferred technology and sites that are suitable for development in locations that are readily accessible for sludge imports and disposal of treated sludge to land. We consider that the strategy that comprises the construction of five thermal hydrolysis plants and the extension of two conventional digestion plants represents a sound and cost effective solution to meeting the Company's sludge treatment and disposal needs. We are satisfied that the treatment option chosen at each of the sites is cost effective in the range of treatment options considered and against the 'do-nothing' scenario. Whilst the Company has undertaken an evaluation of a series of options incorporating a review of varying treatment options at a selection and range of locations, we cannot confirm that the Company's proposals represent a least whole life cost optimal plan for the whole region. In

the absence of a clear alternative however, we consider the company has used a sensible approach and we support the Company's plans which we are satisfied is consistent with its Sludge Strategy and SDS.

We consider that the Company's proposed programme is necessary as the consequences of not investing would be:

- Not being able to treat the additional amounts of sludge that will be generated in East London by the Tideway STW Upgrade programme and the Thames and Lee tunnels
- Continued reliance on lime treatment, which is not considered to be a viable long term treatment method of disposal
- Greater risk of loss of disposal route as access to land for recycling becomes more restricted.

Thames is confident that their investment plans are deliverable. We accept Thames view on this issue.

(TEXT REDACTED)

Reporter Engagement & Scope of Audit

We have tracked the Company's work supporting its Part B5 submission for the sludge investment. The sludge audit commenced with a preliminary meeting on 7th July. Further meetings and detailed audits were also conducted on the 17th and 18th July after which a commentary was prepared detailing areas requiring further discussion. A final meeting was carried out on 1st August. Audit reporting on the DBP completed in August 2008.

Audit of the Final Business Plan (FBP) started with a preliminary meeting on 5th December 2008 followed by an audit of the NVZ proposals and the methodology for the calculation of sludge production figures on 10th February 2009. Further audit meetings were carried out relating to East London and Thames Valley sites on the 10th and 12th March. Feedback was prepared and Thames provided their responses. A site visit was carried out on 13th March to review the performance of the Thermal Hydrolysis process at one of Thames' site at Chertsey, the process being prominent in Thames FBP proposals. A final clarification meeting was carried out on 1st April 2009 to review any points of concern. Further clarifications of the FBP were conducted through telephone conversations and e-mail communications.

The audits consisted of interviews with the Thames team responsible for the preparation of the Part B5 - sludge submission. This included a review of the assumptions and methodology that underpin the submission, a review of the analyses that were undertaken and examination of a sample of scheme solutions. We trailed a sample of data and costs from their sources into the FBP tables.

We confirm that we have reviewed all of the Company's submission, are satisfied that it is complete and consider that it conforms to the Reporting Requirements.

We have followed the Reporter Guidance and have addressed the points set out in our audit plan.

We have seen evidence that the Company's submission has been subject to a good level of internal checking and challenge and are satisfied that there has been appropriate input and oversight from the Company's Senior Managers and Directors. We have noted that the submission for sludge treatment has been signed-off by the responsible Senior Manager and Director.

- We can confirm that a complete review was carried out of Thames's submission in respect of proposed sludge investment. A number of documents were reviewed. (TEXT REDACTED)

The processes used to develop the submission are already embedded in the business.

Summary of Thames Water's Proposals

The Company is proposing a significant increased level of investment in non-infrastructure Sludge compared with AMP4 levels.

Thames proposes complying with new Nitrate Pollution Prevention Regulations by installing sludge dewatering and storage/recycling facilities to overcome the extended 'closed periods' imposed by the regulations. Plans also include the provision of additional liquor treatment facilities to treat the high ammonia liquors that arise from the dewatering process. (TEXT REDACTED) Thames proposes to invest in a number of sites to comply with the Nitrate Pollution Prevention Regulations all of which has been allocated 100% to Quality.

Thames intends to install thermal hydrolysis as pre-treatment at 5 digestion sites within the region as a result of current under capacity and future increases in sludge production. It intends investing (TEXT REDACTED) at 2 sludge centres in the Thames Valley during AMP5. (TEXT REDACTED)

Further additional sludge treatment capacity is also proposed at 3 sites. (TEXT REDACTED)

Additional treatment capacity is also proposed at 2 other sites. (TEXT REDACTED)

(TEXT REDACTED)

AMP 5 Audit & Review

(TEXT REDACTED)

Changes since the DBP

Thames plans have altered considerably since the Draft Business Plan.
(TEXT REDACTED)

Overall since the draft proposals, the number of supply/demand schemes included in the business plan has stayed the same, but the number of THP schemes in the Thames Valley has been reduced from five sites to two whilst those for East London has increased from one site (TEXT REDACTED) to three.

FBP Audit & Review

Thames has carried out a high level strategic sludge assessment in preparing proposals for the next ten year period. The main conclusions are to favour processes that (a) maximise energy recovery and (b) minimise sludge volumes whilst continue to recycle to land. (TEXT REDACTED)

In their FBP, Thames cites a number of investment drivers, principally;

- ◆ Meeting Nitrate Pollution Prevention Regulations
- ◆ Accounting for increased sludge production due to population growth
- ◆ Stringent effluent quality standards
- ◆ Securing sustainable outlets for sludge; and
- ◆ Maximising renewable energy opportunities and tackling climate change

Their priorities are consistent with the Sludge Strategy and SDS, which include additional sludge treatment capacity and securing sustainable and long-term recycling routes. Accounting for population growth and the introduction of more stringent effluent quality standards, particularly with regard to phosphorus consent and tightening of effluent standards for the Tideway Works, increases sludge production and thus requires additional sludge treatment capacity which has a direct effect on costs. Meeting the Nitrate Pollution Prevention Regulations, securing sustainable outlets for sludge, maximising renewable energy opportunities and tackling climate change have no effect on sludge production but has an effect on costs because of influencing the type of treatment strategy proposed. Increased sludge production from existing customers has been included in the list of drivers and is accounted for in the

FBP by the proportion of the expenditure allocated to quality at 2 sites. (TEXT REDACTED)

After review, we are satisfied that the drivers as proposed represent an appropriate basis for the FBP.

During audit, we looked particularly closely at the calculation of future sludge production and the basis on which current treatment capacity was estimated.
TEXT REDACTED

The build up of grit and screenings in a digester represents a significant loss of capacity especially at those sites where digestion capacity is due to be doubled by the addition of thermal hydrolysis pre-treatment. Thames has advised that a programme of digester cleaning will be carried out where THP is to be installed and a design EDV of 90% was used in these instances. This is considered satisfactory.

After detailed review, we are content with procedures for estimating sludge production for the regional sites but hold some residual uncertainty over the likely sludge production levels following completion of the Tideway and other improvements at Beckton. (TEXT REDACTED)

(TEXT REDACTED)

Following Tideway improvements we also remain unsure of future sludge production up to 2031 which is shown in the FBP as declining (albeit very slightly) between 2014 and 2019 but thereafter growing at a rate greater than estimated by population alone. We were advised that this was an over estimate due to recent changes in future population growth which was unable to be corrected for the FBP. We understand the explanation but nevertheless sludge production at Beckton and Riverside currently shows an over estimate of possibly 20 - 30 tds/d, which equates to less than 10% of the total Beckton and Riverside sludge make and is considered within reasonable forecasting accuracy by Thames.

(TEXT REDACTED)

Having reviewed Thames proposals as a whole for expansion at the East London and regional sites, we recognise that they have been based on detailed consideration by TW and supported by considerable internal and external reporting.

Thames has conducted a strategic review to develop the proposals within its Sludge Strategy in line with its Strategic Direction Statement (SDS). This has been undertaken in a pragmatic manner by identifying preferred technology and sites that are suitable for development in locations that are readily accessible for sludge imports and disposal of treated sludge to land.

We consider that the strategy that comprises the construction of five thermal hydrolysis plants and the extension of two conventional digestion plants represents a sound and cost effective solution to meeting the Company's sludge treatment and disposal needs. We are satisfied that the treatment option chosen at each of the sites is cost effective in the range of treatment options considered which were lime, thermal hydrolysis, conventional digestion, and for the import strategy proposed. We have seen the operating cost data for each option which take into account the change in manpower, chemical costs, transport costs and energy consumption and production.

(TEXT REDACTED)

The Company has undertaken an evaluation of a series of options incorporating a review of varying treatment options at a selection and range of locations. We cannot confirm that the Company's proposals represent a least whole life cost optimal plan, however, in the absence of a clear alternative we consider the Company has used a sensible approach.

We consider that the Company's proposed programme is necessary as the consequences of not investing would be:

- Not being able to treat the additional amounts of sludge that will be generated in East London by the Tideway STW Upgrade programme and the Thames and Lee tunnels
- Continued reliance on lime treatment, which is not considered to be a viable long term treatment method of disposal
- Greater risk of loss of disposal route as access to land for recycling becomes more restricted.

We support the Company's plans which we are satisfied are consistent with its Sludge Strategy and SDS.

Thermal Hydrolysis Process

(TEXT REDACTED)

Our views on this particular technology, its potential benefits, reported problems, and current status, may be summarised as follows:

- a) Our understanding is that the first commercial-scale sludge processing plant employing this particular technology began operating in about 1995. This particular plant, at Hamar in Norway, has reportedly continued to perform satisfactorily since then (i.e. for well over ten years), although it should also be mentioned that the capacity/throughput of the plant, at 3,600 tds/year, is relatively small.

- b) A number of larger capacity developments followed between 1998 and 2002, which included plants to the west of London, Sarpsborg, Fredericia, Aberdeen and Dublin. However, the various technical problems that were then encountered on some of these sites probably undermined client/customer confidence and caused the supplier's sales to falter in the years immediately following, but it has since been reported that all of the problems were successfully resolved, and expected levels of utilisation and performance subsequently achieved.
- c) In this context, TW's reporting of their own experience with the plant installed at its works to the west of London corroborates the information reported in technical literature, i.e. that the remedial measures implemented by the supplier in 2005 (which apparently involved some re-engineering of the work done by the original contractor) successfully resolved the operational problems that had beset the plant since its original start-up in 1998, and that the plant has operated successfully since then. We saw evidence that the plant is achieving high levels of performance and availability.
- d) By 2006, with all of the aforementioned reference plants achieving satisfactory levels of performance (i.e. in line with design expectations) and customer confidence presumably restored, the supplier had received further orders for three more large-capacity thermal hydrolysis plants (for Brisbane, Brussels, and Bydgoszcz in Poland), and all of these have now been in operation for 12 months or more.
- e) Thus, with a total of at least 10 full-scale plants now operating successfully in Europe and elsewhere, we consider the supplier's technology to be sufficiently well-established and proven at the commercial scale for it to merit inclusion in any evaluation of available treatment options for the processing of sewage sludge at site level.
- f) Technically, we think the supplier's thermal hydrolysis process, now is sufficiently proven to feel reasonably confident that the process will operate satisfactorily and achieve the benefits that have been claimed

Thames has issued a European public procurement form for the supply of the thermal hydrolysis plants. Responses to this notice were received in early March from a number of suppliers. These responses are being evaluated before Thames place firm orders for the plants. Thames are confident that their investment plans are deliverable especially the installation of thermal hydrolysis at 5 sites which has been subject to considerable debate during the development of the DBP and the FBP. We accept Thames' view on this issue

NVZ Regulations

The Nitrate Pollution Prevention Regulations 2008 came into force on 1st January 2009 and extend the closed periods when sludge with high readily available nitrogen concentrations can be applied to land during specific periods of the year. These regulations require the provision of adequate storage, but the enforcement of this is deferred until the 1st January 2012, to allow for storage to be installed. Thames is proposing to install dewatering of liquid digested sludge with storage/recycling of the resulting sludge cake (20-25% dry solids) and thereby overcome new restrictions on the application of liquid sludge to land contained within the Regulations. The 9 sludge centres are affected. (TEXT REDACTED)

We support the Company's proposals and being the correct option to comply with the revised Regulations.

Further commentary can be found in Section B4.

(TEXT REDACTED)

Summary of Audit and Review

We are satisfied that the Company has fully disclosed its assumptions, methodology and data sources used for the preparation of its B5 submission for sludge service.

We are satisfied that subject to a review of cost estimates that the proposed schemes are required and should proceed. We have reviewed each of scheme solutions in detail and are satisfied that the needs have been correctly assessed and the solutions are fit for purpose.

We confirm that Thames submission, tables and supporting documents are complete and consistent with the SDS.

Date: 20 April 2009
Prepared By: HMS
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