Jersey's Wastewater Strategy Peer Review

Prepared by: .....
Dylan Morris
Senior Engineer

Checked by: .....
Andy Palmer
Chief Engineer - Water

Approved by: .....
Richard Verity
Project Manager

Jersey's Wastewater Strategy Peer Review

Rev No	Comments	Checked by	Approved by	Date
1	Issued for Review	A.Palmer	R.Verity	4/4/2014

AECOM House, 63-77 Victoria Street, St Albans, Hertfordshire, AL1 3ER
Telephone: 01727 535000 Website: http://www.aecom.com

Job No 60319137 Reference 0001 Date Created 4 April 2014

Table of Contents

Executive Summary **1**

1. Introduction **6**

2. Legislation **7**

3. Existing Systems **10**

4. Population Projection **13**

5. Sewerage Network Options Review **15**

6. Wastewater Treatment Options Review **17**

7. Sustainability **26**

8. Conclusion **29**

9. Recommendations **31**

Appendix 1 Response to Comments from Minister for Planning and Environment

Capabilities on project:
Water

Executive Summary

AECOM has been commissioned by the States of Jersey Environment Panel to undertake a peer review of the draft Wastewater Strategy prepared by the Transport and Technical Services Department (TTS) for the island of Jersey. The panel requires an objective, expert report on the proposals contained in the TTS Minister's draft Strategy, together with an informed assessment of possible alternative technologies. The aims of this report are as follows:

- Ensure that States members have been fully informed before any decisions are made
- Confirm that all practical alternative technologies have been given due consideration
- Highlight any needs for further studies.

In addition to the Wastewater Strategy document, the review will also consider the supporting information provided. The full list of documents and other information considered during the review are as follows:

- Jersey's Waste Water Strategy (Version 10, dated 29/07/13)
- Minister for Transport's Technical Services' Report and Proposition to the States
- Bellozanne Sewage Treatment Works Best Available Technology Report (dated May 2012)
- Technical Note on Deep Shaft ASP Reactors (dated April 2010)
- Comments from the Minister for Planning and Environment

This review should be read in conjunction with the documentation listed above.

Legislation

AECOM have undertaken an independent review of the relevant legislation related to the development of the Strategy. Whilst Jersey, as a crown dependency, does not come under European Union (EU) jurisdiction, the States have made a commitment that Jersey law requires standards of at least the equivalent of the EU (as set out in the Strategic Plan 2009 – 2014 document). Therefore, the review has considered all relevant United Kingdom (UK) and EU laws, and concluded that all relevant legislation and amendments has been considered in the Wastewater Strategy.

Existing Sewers and Treatment Condition

The condition of the existing systems is described in the Wastewater Strategy. This is the only information source available to AECOM, and therefore a detailed, independent review of the existing systems is not feasible. However, a review of the information provided in the Strategy was undertaken.

In order to develop a suitable long term strategy, the sewers have been categorised based on consequence of sewer failure, and inspected by CCTV. At this stage, approximately 39 percent of the foul and surface water sewers have been inspected, with 15 percent of the surveyed sewers graded as 4 or 5 based on performance categories identified by OFWAT. It has been assumed that the un-surveyed sewers have the same mix of conditions, resulting in an estimated 76km of sewer at grade 4 or 5. Whilst this is a substantial proportion of the total asset stock, it is uncertain whether it is representative of the entire asset conditions. Unless a structured approach has been adopted, then surveys often tend to be targeted at known problem areas which may skew the assumptions on overall asset condition. The Strategy recommends completion of the remaining category A and B sewers, plus a representative sample of the non-critical assets. We would concur with this approach but would also suggest further analysis is undertaken to assess whether any trends can be established for different asset cohorts, based on physical, environmental and performance data e.g. age, material, traffic loadings, collapse records, etc., to enable more detailed assessment of future investment needs.

Capabilities on project:
Water

There are 110 pumping stations on the island, with capacity ranging from 1 l/s to 1,100 l/s. An assessment of the pumping stations has been undertaken, which considered civil, mechanical and electrical aspects. The pumping stations are generally in poor condition (grades 1 and 2); the large pumping stations in particular are in poor condition. Hydrogen sulphide (H_2S) is also a problem at certain pumping stations, which causes odour problems in their vicinity and can cause corrosion of assets. Whilst this is recognised as a problem, it should be noted that this may pose a serious health and safety issue with regards to access into the wet well (confined space). If not known, the concentrations of H_2S should be determined as soon as possible to allow for mitigation as required.

Based on the issues listed in the Wastewater Strategy (section 5.1.4), it is clear to AECOM that the Bellozanne STW is struggling hydraulically, due to an outdated process design and due to its age. As the population of the island increases, it is highly unlikely that simple upgrades will result in an efficient plant. Significant capital expenditure will be required to comply with the more stringent EU Bathing Water Framework Directive and especially if a total nitrogen consent of 10 or 15 mg/l is to be met.

Population

AECOM have undertaken a review of the population projection to test the validity of the design population for Bellozanne STW. It should be noted that the review was limited as the information available for assessment was also limited. The review was undertaken based on the Jersey Population Projections 2013 Release issued by the States of Jersey Statistics Unit in September 2013, and can be considered a sensitivity analysis for the population data provided. The population values determined were similar to those developed within the Strategy (± 1%), and therefore they are deemed acceptable.

A population of 118,000 in 2035 has been selected as the design horizon for the proposed new Bellozanne STW. However, the Strategy does state that it is advisable to provide flexibility in the design such that 118,000 is not an absolute limit but can be expanded with minimal cost in the future. AECOM fully support this view, and it is crucial that the design considers suitable flexibility in the technology, sizing and site layout.

Sewer Network Options

The capital expenditure is focussed on ensuring that the current condition of the assets does not deteriorate over the 20 year period of this Strategy. The initial focus is on upgrading sewers with a grade 4 or 5 condition. As only 39 percent of the foul and surface water sewers have been inspected, the condition data is currently incomplete. Additional data is therefore required, but in the absence of this data, AECOM agree that basing capital investment estimates on UK sewer renewal rates is a suitable approach. The missing data should be gathered as soon as practical and further analysis undertaken to understand condition trends and the potential that this may have on future investment needs.

From the information provided, the main factor contributing to the sewer capacity issues and underperformance of Bellozanne STW during wet weather periods is the high levels of infiltration and inflow into the sewers. Where the infiltration is sea water, in addition to capacity issues, dissolved oxygen levels will be reduced at the treatment works, and therefore greater aeration levels are required for secondary treatment. Mitigation measures should be implemented as soon as possible. This could include replacement or repair of the affected sewers and manholes.

Policy LWM 3 - Surface water drainage facilities identifies measures for incorporation of Sustainable Drainage Systems (SuDS) into new development and redevelopment, which are intended to minimise the impact of future development. It is also noted that schemes to separate surface water and reduce infiltration have been completed or are being progressed and these will help to relieve pressure on the wastewater system. Without further details, it is not clear what these schemes involve, but if not already part of the strategy, consideration should also be given to retrofitting SuDS measures in established areas. This approach will reduce the load on the wastewater system and also help to mitigate the effects of climate change. There are numerous schemes currently being implemented to measure the effects of retrofitting SuDS, such as flow reduction, cost and public engagement and acceptability, and would provide a basis for evaluating their applicability to Jersey.

Capabilities on project:
Water

The current pumping stations maintenance plan includes the replacement of approximately forty control panels and the replacement of pumps at the majority of the large pumping stations. This, along with repairs of pipework, covers, valves and civil infrastructure, will significantly increase the proportion of sewage pumping stations classified as good condition (grades 1 and 2). This is considered a suitable priority given the current condition of the assets.

As this is a desktop study, and suitable information regarding the calculation of the network capital expenditure has not been provided, AECOM have not undertaken a review of the values summarised in section 7.4 of the Wastewater Strategy. However, based on the details of the proposed maintenance and upgrades, it is agreed that significant funding is required to improve the current service levels and environmental status. A more detailed analysis of the sewerage network is required to prioritise future work and determine the associated costs. This analysis should be undertaken as soon as practical to ensure that the funding can be more accurately calculated, as this represents a risk to the Strategy.

Treatment Options

It is highly unlikely, given the site constraints and the stated current condition of the assets, that refurbishment and upgrade of the plant will provide a cost effective solution to the issues. It should be noted that, at this stage, AECOM have not visited the site and this assessment it based purely on the information provided in the Wastewater Strategy and supporting documents. Replacement of the treatment plant is considered a reasonable, and likely the most financially beneficial solution.

AECOM agree that conventional activated sludge technology would be suitable for use at Bellozanne STW and should be strongly considered, primarily due to operator familiarity with the technology and the capacity for expansion. As this technology is in widespread use, the associated design and operation risks are far lower than for other technologies.

AECOM believe that Sequence Batch Reactor (SBR) technology should be considered as a secondary option. The processes in an SBR all occur in a single tank and therefore final settlement tanks are not required. This results in a smaller footprint than conventional activated sludge, which is a key consideration in the technology selection for the Wastewater Strategy. No return sludge facility is required as both aeration and settling occur in the same tank. Other advantages of SBR technology include good operational flexibility and allowance for remote operation. Disadvantages of this technology include higher energy consumption and the potential requirement for an equalisation tank. Operators would require some training as this is a new technology for Jersey, although the processes are similar. A higher level of maintenance is also required due to the more sophisticated controls. Nitrification can be achieved through addition of an anoxic cycle, if there are any concerns with the design, a separate anoxic zone can and / or recycling can be provided.

Deep shaft aeration was also considered in detail, as this had the potential to offer significant space savings. Despite its many advantages, this was eliminated as an option. This technology represents significant operational risks and the benefits would not be realised due to the low strength of the effluent (no industrial waste). The construction costs are likely to be very high due to the depth of the system and low availability of construction equipment. Use of this technology could only be considered if it could be demonstrated that the cost of construction is not prohibitively high.

Sustainability

Sustainability should be further considered in the Strategy as it is developed. There are several opportunities to provide sustainable solutions to minimise water use and wastewater production. These include sustainable drainage systems, water minimisation and effluent reuse. Climate change should also be further considered prior to detailed design of the infrastructure. Refer to section 7 of this report for further details.

Capabilities on project:
Water

Strategy

The options provided for delivery and funding of the Strategy are considered to be suitable, and following the direction of the English and Welsh water industries is a sensible approach. Further consideration of the correct procurement, business and funding strategies will be required as the programme develops. AECOM cannot comment further on delivery at present, as not enough information is available to fully assess the options available. It should be noted that the Strategy refers to PAS 55 *Asset Management*, this has now been superseded by ISO 55001 *Asset Management.*

Risks

There are a number of risks associated with the Strategy, with details as follows. Further studies are required to eliminate these risks; these should be undertaken as soon as is practical.

- The classification of St Aubin's Bay as a sensitive area would have a significant impact on the level of treatment and associated capital costs. The classification process should be undertaken as soon as possible.
- At this stage, only approximately 39% of the sewers have been inspected by CCTV. The Strategy has been developed on the assumption that the remaining sewers have the same mix of condition as those surveyed. If this assumption is not accurate, the capital and maintenance costs could be much higher than anticipated. The trend in condition of these assets is also not known at this stage and could significantly influence future investment needs.
- The Strategy states that a more detailed analysis of the sewerage network is required to prioritise future work and determine the associated costs. This analysis has the potential to uncover further problems, increasing the associated costs.
- A concept layout has been developed for a new conventional activated sludge system at the existing Bellozanne STW site. It has been demonstrated that the required land area appears to be available. However, should the design be sufficiently modified or increased in size, this solution may not be viable. A second technology may have to be considered, and the Strategy would therefore have to be modified.
- Climate change has not been fully considered in the Strategy. An allowance of 5% of the maintenance costs has been allocated to allow for upsizing of the sewers as they are maintained. However, the actual costs of climate change effects could be significantly greater. These risks include sewer flooding, inundation of treatment works and changes to discharge consents.
- As there is a variation planned to the current discharge consent, further discussions are required and agreement must be reached with the Department of Environment. This is critical to the design of the works, as the need to meet more stringent consents could significantly impact the Strategy, e.g. greater land areas required to construct the treatment plant.
- The length of the outfall into St Aubin's Bay is referred to as 500m from the sea wall (section 2.3.2 of the Strategy). The diameter is not quoted and may need to be increased for higher final effluent flows, as well as for effects from increasing flows from the Bellozanne Valley stream.

Capabilities on project:
Water

Recommendations

Based on the conclusions of our review, the following are AECOM's recommendations for inclusion in the Strategy.

- The classification of St Aubin's Bay should be completed as soon as possible to understand whether nitrification and denitrification are required to meet nitrogen and ammonia consents.
- Discussions regarding the proposed discharge consent for the new Bellozanne STW should be held to ensure that the treatment options proposed are reasonable.
- The sewer surveys should be completed as soon as possible. These would highlight whether the allowances made in the costs for sewer maintenance and upgrades are reasonable. Additional analysis should also be undertaken to assess likely future condition trends and their impact on investment needs.
- The network analysis should also be completed as soon as possible, to gain a better understanding of the issues.
- The Strategy should clarify whether modifications will be made to the overflows at the Weighbridge CSO (installation of a screen) and upstream of the Fauvic SPS.
- The H_2S issues at certain pumping stations around the island should be investigated, with the gas eliminated or minimised to lowest possible levels.
- Discussions regarding the proposed discharge consent for the new Bellozanne STW should be held to ensure that the treatment options proposed are reasonable.
- It should be established whether sustainable options such as SuDS and water minimisation should be considered within the Strategy, or whether these should be considered separately.
- The effects of climate change should be more fully considered. Understanding of these effects is now covered by legislation in the UK, and consistent with other aspects of the strategy, it would be appropriate to follow this approach.

Capabilities on project:
Water

1. Introduction

AECOM has been commissioned by the States of Jersey Environment Panel to undertake a peer review of the draft Wastewater Strategy prepared by the Transport and Technical Services Department (TTS) for the island of Jersey. The panel requires an objective, expert report on the proposals contained in the TTS Minister's draft Strategy, together with an informed assessment of possible alternative technologies. The aims of this report are as follows:

- Ensure that States members have been fully informed before any decisions are made
- Confirm that all practical alternative technologies have been given due consideration
- Highlight any needs for further studies

The Strategy is a high level description of the vision for ensuring that the wastewater infrastructure for collection, treatment and disposal is in line with legislative requirements and the future needs for the island. The Strategy document was first drafted in 2009, and has been continually developed over the last four years.

In addition to the Wastewater Strategy document, the review will also consider supporting information. The full list of documents and other information considered during the review are as follows:

- Jersey's Waste Water Strategy (Version 10, dated 29/07/13)
- Minister for Transport's Technical Services' Report and Proposition to the States
- Bellozanne Sewage Treatment Works Best Available Technology Report (dated May 2012)
- Technical Note on Deep Shaft ASP Reactors (dated April 2010)
- Comments from the Minister for Planning and Environment

This review should be read in conjunction with the documentation listed above. The Minister for Planning and Environment's comments have been included in Appendix 1, along with our response.

The review has focussed on the following items:

- Relevant legislation
- Existing systems
- Population projections
- Sewerage network options review
- Wastewater treatment options review
- Sustainability

2. Legislation

AECOM have undertaken an independent review of the relevant legislation related to the development of the Strategy. Whilst Jersey, as a crown dependency, does not come under European Union (EU) jurisdiction, the States have made a commitment that Jersey law requires standards of at least the equivalent of the EU (as set out in the Strategic Plan 2009 – 2014 document). Therefore, the review has considered all relevant United Kingdom (UK) and EU laws, and concluded that all relevant legislation and amendments has been considered in the Wastewater Strategy, i.e.

- Bathing Waters Directive (76/160/EEC)
- Urban Wastewater Treatment Directive (91/271/EEC)
- EU Shellfish Directive (2006/113/EC)
- EU Freshwater Fish Directive (2006/44/EC)
- Water Framework Directive (2000/60/EC)
- EU Directive on the Use of Sewage Sludge in Agriculture (86/278/EEC)
- UK Sludge (Use in Agriculture) Regulations 1989
- UK DEFRA Code of Practice for Agriculture Use of Sewage Sludge 1996
- EU Strategic Environmental Assessment Directive (2001/42/EC)

AECOM have also noted that the Strategy also considers the OSPAR Convention, Basel Convention and the UK ADAS Sludge Matrix.

Whilst we are satisfied that all relevant legislation has been considered in the Strategy, the following points are noted.

2.1 Bathing Waters Directive (76/160/EEC)

At present, all sixteen monitored bathing waters have passed the European Imperative Standard, with twelve of the sixteen further passing the more stringent European Guide Standard. As stated in the strategy, classification of further microbiological parameters is required by 2015, as follows:

Table 1. Classification of new parameters for revised Bathing Waters Directive

Parameter	Excellent Quality	Good Quality	Sufficient	Reference Method of Analysis
Intestinal enterococci (cfu/100 ml)	100 (*)	200 (*)	185 (**)	ISO 7899-1 or ISO 7899-2
Escherichia coli (cfu/100 ml)	250 (*)	500 (*)	500 (**)	ISO 9803-3 or ISO 9803-1

* based on a 95%ile evaluation

** based on a 90%ile evaluation

From the Strategy, it is unclear whether these parameters have been analysed for Jersey's bathing waters. Classification should be undertaken before 2015, and the proposed design of Bellazonne STW should consider the new parameters.

2.2 Urban Wastewater Treatment Directive (91/271/EEC)

Article 4 of the Urban Wastewater Treatment Directive states that Member States shall ensure that urban waste water entering collecting systems shall, before discharge, be subject to secondary treatment or an equivalent treatment. However, article 6 allows for discharges from agglomerations of between 10,000 and 150,000 population equivalents, to coastal waters, to be subjected to less stringent treatment. This is providing that such discharges receive at least primary treatment and that comprehensive studies indicate that such discharges will not adversely affect the environment. From the information provided in section 3.5.1 of the Strategy, this is the approach that has been adopted by the States of Guernsey. However, based on the overall information presented in the Wastewater Strategy for Jersey, this is not a suitable approach for Bellozanne STW.

It should be noted that article 12 states that treated wastewater shall be reused whenever appropriate and disposal routes shall minimise the effect on the environment. At this stage, no provision has been made for reusing the effluent from Bellazonne STW. Further consideration should be given to the financial viability of effluent reuse and the required levels of treatment; this is discussed in section 7.1 of this report.

Article 14 states that sludge arising from waste water treatment shall be reused whenever appropriate. Disposal routes shall minimise the adverse effects on the environment. The intention of the Wastewater Strategy is to dispose sludge to land, which is consistent with this.

The critical issue with regards to the requirements of the Urban Wastewater Treatment Directive is to confirm whether St Aubin's Bay should be designated as sensitive. AECOM understand that further studies are underway, but the designation is critical for the design of the proposed new STW at Bellozanne.

2.3 EU Shellfish Directive (2006/113/EC)

The mandatory and guideline levels for physical, chemical and microbiological water quality standards are set out in Annex 1, and include pH, total suspended solids, faecal coliforms and metal concentrations. These are factors that may be affected by the discharge from Bellozanne STW, and should be considered in the proposed design of the new treatment facility.

As stated in the Strategy, although this directive is to be repealed, there is a requirement in the Water Framework Directive that the same level of protection must be maintained. Therefore, the Strategy must consider the requirements of the EU Shellfish Directive.

2.4 EU Freshwater Fish Directive (2006/44/EC)

From section 2.3.4 of the Wastewater Strategy, the majority of wastewater discharges are to coastal waters, and these have minimal impact on freshwater quality. This implies that there are wastewater discharges to freshwater areas, and the impact of these should be assessed against the requirements of the directive.

As for the EU Shellfish Directive, the requirements of the Freshwater Fish Directive must be considered in the Strategy, even though it is to be repealed.

2.5 Water Framework Directive (2000/60/EC)

As set out in article 4, subsection 1(ii), member states shall protect, enhance and restore all bodies of surface water with the aim of achieving good surface water status at the latest 15 years after the date of entry into force of this directive. Therefore, this should be achieved by 2015.

The requirements of the high, good and moderate statuses for coastal waters are listed in subsection 1.2.4 of Annex V of the directive. This includes biological, hydromorphological and physiochemical quality elements. It is stated in the Strategy (section 2.3.5) that the discharges from the sewerage network, including the STW, do not affect water quality apart from the quality standards in St Aubin's Bay, and so incorporation of this directive will not impact the Wastewater Strategy. At this stage, AECOM does not have suitable information to confirm this statement.

It should be noted that article 6 subsection 1 requires the establishment of a register or registers of all areas lying within each river basin district which have been designated as requiring special protection. The register shall include amongst others (relevant to the Wastewater Strategy):

- Bodies of water designated as recreational waters, including areas designated as bathing water under directive 76/160/EEC.
- Nutrient sensitive areas, including areas designated as sensitive areas under directive 91/211/EEC.

If a register is not currently kept, a suitable register should be assembled as soon as practical.

2.6 Sludge Legislation

At present, the sludge from Bellozanne STW is disposed of to land whenever permitted by seasons and weather conditions. This disposal method will continue when the new works is constructed. The Strategy suitably considers the legislation at this stage of its development. However, it should be highlighted that the testing requirements should be further considered as the Strategy is developed.

In general, across all legislation, sludge should be analysed every six months. Where changes occur in the wastewater being treated, the frequency of analysis must be increased. The parameters to be analysed are:

- pH
- Percentage content of dry matter, organic matter, nitrogen and phosphorus
- Concentration of cadmium, copper, nickel, lead, zinc, mercury and chromium

Suitable treatment should be designed to meet the criteria set out by the UK and EU sludge legislation.

3. Existing Systems

The condition of the existing systems is described in the Wastewater Strategy. This is the only information source available to AECOM, and therefore a detailed, independent review of the existing systems was not feasible. However, a review of the information provided in the Strategy was undertaken.

3.1 Existing Sewerage Catchment

It is understood that the island's sewerage system works well during dry weather, but comes under pressure and fails in certain parts of the island during wet weather.

3.1.1 Condition of the Sewerage Network Assets

In order to develop a suitable long term strategy, the sewers have been categorised based on consequence of sewer failure, and inspected by CCTV. At this stage, approximately 39 percent of the foul and surface water sewers have been inspected. Based on this survey, the sewers have been graded using the scale aligning with performance categories identified by the Water Services Regulation Authority (OFWAT). It has been determined that 15 percent of the surveyed sewers are grade 4 or 5 (requiring preventative or immediate capital maintenance). It has been assumed that the un-surveyed sewers have the same mix of conditions, resulting in an estimated 76km of sewer at grade 4 or 5.

Whilst this is a substantial proportion of the total asset stock, it is uncertain whether it is representative of the entire asset conditions. Unless a structured approach has been adopted, then surveys often tend to be targeted at known problem areas which may skew the assumptions on overall asset condition. The Strategy recommends completion of the remaining category A and B, plus a representative sample of the non-critical assets. We would concur with this approach but would also suggest further analysis is undertaken to assess whether any trends can be established for different asset cohorts, based on physical, environmental and performance data e.g. age, material, traffic loadings, collapse records, etc., to enable more detailed assessment of future investment needs.

3.1.2 Current Sewerage Network Position and Issues

The Strategy highlights the issues currently identified within the sewer network as follows:

- *There are nineteen locations where flooding is predicted to occur. These tie up with known flooding locations, which flood in both 1 in 10 year and 1 in 30 year rainfall events.* This is potentially a significant issue if any properties are affected by these floods. If this is the case, then immediate capital maintenance is required. For surface water / combined systems, designs standards (e.g. Sewers for Adoption WRc 7th Edition) state that systems should be designed not to flood in a 1 in 30 year design storm.
- *There are known areas of significant network infiltration and seawater intrusion increasing the flows to be collected, pumped and treated. This results in increased levels of flooding and overflow discharges, corrosion damage, excessive maintenance and odour.* It is understood that a programme of works is underway to reduce the amount of surface water infiltration. A similar program to reduce seawater intrusion should be undertaken as soon as practical.
- *Accumulation of sediment in sewers is an issue, especially in sewers that have been laid flat (mainly in St Helier). In approximately 39km of foul sewers, self-cleansing velocities are not reached in a 1 in 3 month design event*. This can only be mitigated through regular maintenance, e.g. flushing and rodding the pipelines, as redesign and replacement of the sewers will likely be prohibitively expensive.

3.1.3 Combined Sewer Overflows

AECOM have the following comments regarding the issues identified with the combined sewer overflows (CSOs).

It is unclear how often, and during what rainfall events, the Weighbridge CSO discharges. The Strategy states that consideration will be given to providing a screen at this location. If this CSO discharges during 1 in 5 year events, it is recommended that a screen should be installed in line with UK design standards. Suitable access will need to be provided to the screen for maintenance and replacement / removal.

The Strategy states that the overflow upstream of Fauvic SPS discharges an average of fourteen times a year. As this is non-compliant, action is required at this location. The Strategy does not identify any capital maintenance or investment at this location (section 7), this should be revisited.

3.1.3 The Cavern

AECOM understand that the civil, mechanical and electrical components of the cavern storage facility are in good condition, and have no issues to note.

3.1.4 Surface Water System

The recent sewage network model identified that there are three areas at risk of surface water flooding at St Saviour. There is also flooding at St Aubin / St Brelade, caused by high tides when there is no outlet for the surface water system and minor flooding associated with the watercourses at Millbrook and St Peter's Valley during heavy rainfall. Further investigations are required to determine whether the issues will be solved by the current Strategy, or whether further measures are required.

3.1.5 Pumping Stations

There are 110 pumping stations on the island, with capacity ranging from 1 l/s to 1,100 l/s. An assessment of the pumping stations has been undertaken, which considered civil, mechanical and electrical aspects. The pumping stations are generally in poor condition (grades 1 and 2), the large pumping stations in particular are in poor condition.

Although the pumping stations cope well during dry weather conditions, all suffer surface water ingress to some extent and there are a number of stations that are unable to deal with increased inflows and infiltration during wet weather. Therefore, as discussed in 3.1.2, reducing infiltration, together with the campaign of surface water separation, is critical in minimising overloading.

Thirty nine pumping stations do not meet UK design standards in terms of passing forward Formula A flows or providing 24 hours storage capacity at 3 times dry weather flow. Providing extra storage and replacing pumps to increase flows may be possible, although this may be prohibitively expensive for some pumping stations. AECOM do not have enough information to asses suitable solutions; further investigations at each pumping station site are required.

Hydrogen sulphide (H_2S) is a problem at certain pumping stations, which causes odour problems in their vicinity. Whilst this is recognised as a problem, it should be noted that this may pose a serious health and safety issue with regards to access into the wet well (confined space). H_2S levels above 100 parts per million are immediately dangerous to life and health. In addition, H_2S is extremely flammable, and electrical equipment may provide an ignition source. High H_2S levels are also corrosive to the fabric and plant of pumping stations. If not known, the concentrations of H_2S should be determined as soon as possible to allow for mitigation as required.

3.2 Existing Wastewater Treatment and Disposal Review

There are two wastewater treatment works on the island, i.e. Bellozanne STW and Bonne Nuit STW. In addition, numerous properties on the island are served by tight tanks, as well as some septic tanks and package treatment plants.

3.2.1 Bellozanne STW

It is understood that Bellozanne STW is struggling to meet its consent conditions due to outdated design, poor performance of the installed hybrid technology and variability of loading. Approximately 42 percent of the assets are in poor condition, particularly the activated sludge plant and sludge treatment plant.

Based on the issues listed in the Wastewater Strategy (section 5.1.4), it is clear that the plant is struggling hydraulically, due to an outdated process design and due to its age. As the population of the island increases, it is highly unlikely that simple upgrades will result in an efficient plant. Significant capital expenditure will be required to comply with the more stringent EU Bathing Water Framework Directive and especially if a total nitrogen consent of 10 or 15 mg/l is to be met.

The sludge treatment plant also requires replacement, though it is understood that this is currently being constructed. At present, the majority of the sludge disposal is as sludge cake to land. AECOM has no issue with the continuance of this disposal method. Sludges from the Bonne Nuit STW, septic tanks, tight tanks and private treatment plant facilities are transported to Bellozanne STW for further treatment and ultimate disposal.

Final effluent is discharged via the outfall into St Aubin's Bay near the first tower area. This effluent is discharged to mean high water level with the outfall being exposed for long periods. The diameter of the outfall is not stated in the Strategy.

3.2.2 Bonne Nuit STW

Based on the information provided in section 5.2 of the Strategy, the issues associated with Bonne Nuit STW are minor. AECOM has no comment on these issues.

3.2.3 Septic Tanks and Tight Tanks

It is understood that the contents of tight tanks are tankered to Bellozanne STW; this is subsidised by the States. Collection from tight tanks may been impeded by extreme weather conditions, i.e. floods. It is unknown whether this has been an issue in Jersey.

4. Population Projection

An accurate population projection is a key aspect in delivering a successful wastewater strategy. The proposed wastewater infrastructure should be based on up to date population data, consideration of suitable design horizons and an allowance for flexibility within the Strategy.

The Strategy population projection was originally based on a population model developed in 2009, but has been updated as further population information became available in 2010 to 2013. The original design population for the proposed new treatment works at Bellozanne was 118,000 in 2035. This value continues to sit in the middle of all the various population projection models. This remains the selected forecast design connected population for Bellozanne STW in 2035.

AECOM have undertaken a review of the population projection to test the validity of the design population for Bellozanne STW. It should be noted that the review was limited as the information available for assessment was also limited. The review was undertaken based on the Jersey Population Projections 2013 Release issued by the States of Jersey Statistics Unit in September 2013, and can be considered a sensitivity analysis for the population data provided. The projected populations given in this document are as follows:

Table 2: Population Projections from the September 2013 Statistics Unit Release

Population Growth	2010	2015	2020	2035	2065
Net + 200	97,100	100,400	102,600	107,200	108,500
Net + 350		100,900	103,900	111,300	119,400
Net + 500		101,300	105,100	115,500	130,400
Net + 700		102,000	106,800	121,000	144,900

It is assumed that these numbers do not contain visitor population. Therefore, as the visitor numbers are considered constant every year (14,900 tourist population and 4,249 seasonal workers, from section 6.4 of the Strategy), if 19,149 visitors are added to each of the population projections, the revised populations are as follows:

Table 3: September 2013 Population Projections Including Visitors

Population Growth	2010	2015	2020	2035	2065
Net + 200	116,249	119,549	121,749	126,349	127,649
Net + 350		120,049	123,049	130,449	138,549
Net + 500		120,449	124,249	134,649	149,549
Net + 700		121,149	125,949	140,149	164,049

In order to account for the connected resident population, the methodology used in the Strategy will be adopted to reflect 87 percent connectivity to the sewer network and 160 head per year will be allowed for as new connections over twenty years. The resulting populations from this methodology are summarised in the following table.

Capabilities on project:
Water

Table 4: September 2013 Population Projections Including Visitors

Population Growth	2010	2015	2020	2035	2065
Net + 200	101,137	104,808	107,522	113,124	114,255
Net + 350		105,243	108,653	116,691	123,738
Net + 500		105,591	109,697	120,345	133,308
Net + 700		106,200	111,176	125,130	145,923

The population values determined are similar to those developed within the Strategy (± 1%), and therefore they are deemed acceptable.

A population of 118,000 in 2035 has been selected as the design horizon for the proposed new Bellozanne STW. However, the Strategy does state that it is advisable to provide flexibility in the design such that 118,000 is not an absolute limit but can be expanded with minimal cost in the future. AECOM fully support this view, and it is crucial that the design considers suitable flexibility in the technology, sizing and site layout. It is stated in the Strategy that the Bellozanne site appears to have the space required to accommodate a 20% increase from the 118,000 design population, and that the design is to be completed using conservative parameters. This represents a suitable approach.

5. Sewerage Network Options Review

The Wastewater Strategy provides details of proposed capital maintenance and investment for the sewerage network, which includes the sewers, pumping stations and combined sewer overflows. This investment is required to comply with all the relevant Jersey, UK and EU policies and legislation.

5.1 Sewer Networks

The capital expenditure is focussed on ensuring that the current condition of the assets does not deteriorate over the 20 year period of this Strategy. The initial focus is on upgrading sewers with a grade 4 or 5 condition.

As only 39 percent of the foul and surface water sewers have been inspected, the condition data is currently incomplete. Additional data is therefore required, but in the absence of this data, AECOM agree that basing capital investment estimates on UK sewer renewal rates is a suitable approach. The missing data should be gathered as soon as practical to minimise risk.

It is stated that the proposed sewer network upgrade programme will include the following:

- Construction of the Philip Street Shaft (currently under construction), completing the St Helier flood alleviation strategy
- Further surface water separation in St Helier to provide capacity for future development, to reduce flows to treatment and to further reduce the risk of CSO spills.
- Upgrade sub-standard rising mains to reduce risk of bursts and subsequent pollution incidents.
- Repair or replace sewers known to be in poor condition to reduce infiltration and improve capacity at the STW.

It is unclear whether the construction of the Philip Street Shaft forms park of the capital expenditure for the Strategy, or whether it is regarded as a separate project, as it is currently being constructed.

From the information provided, the main factor contributing to the sewer capacity issues and underperformance of Bellozanne STW during wet weather periods is the high levels of infiltration and inflow into the sewers. Where the infiltration is sea water, in addition to capacity issues, dissolved oxygen levels will be reduced at the treatment works, and therefore greater aeration levels are required. It is understood that a systematic investigation is currently being undertaken to identify the locations and severity of the problems. Mitigation measures should be implemented as soon as possible. This could include replacement or repair of the affected sewers and manholes. Installing a lining within a defective sewer can reduce infiltration, although this has resulted in varying success rates. The most commonly used renovation technique within the UK is lining with cured-in-place pipes (CIPP) which can be used for full lengths (i.e. manhole-to-manhole) or localised patch repairs (typically 600mm to 1m long). Other methods include flood grouting and joint sealing. Repair / lining will likely be sufficiently less expensive than replacement; therefore replacement should be considered a last resort and only used in areas of significant infiltration.

It is considered best practice to provide separate foul and surface water systems for new developments, as defined in documentation such as Sewers for Adoption (WRc 7th Edition). Whilst there is no legal requirement to replace existing combined systems with separate foul and surface water systems, AECOM consider this a suitable part of the Strategy.

No details of surface water specific mitigation measures are provided, e.g. for the issues highlighted in section 3.1.4 of this report, other than the surface water separation. It is unclear whether this will mitigate the surface water flooding described in section 3.1.4 of this report.

At present, there is an ongoing programme to replace the existing unplasticized polyvinylchloride (uPVC) rising mains, with focus on the class B pipes. It is not stated which pipe material is being used as a replacement. High density polyethylene (HDPE) is widely adopted and has the following advantages:

- Long life (50 year design life and life expectancy in access of 100 years)
- Ease of installation and minimal maintenance requirements
- Flexible and lightweight, with a tolerance to ground movement
- Completely resistant to corrosion, this is a key consideration due to the high levels of seawater inflow currently in the sewer system
- When welded connections are used, the pipeline is fully load bearing, without any need for anchor blocks

5.2 Pumping Stations

The current pumping stations maintenance plan includes the replacement of approximately forty control panels and the replacement of pumps at the majority of the large pumping stations. This, along with repairs of pipework, covers, valves and civil infrastructure, will significantly increase the proportion of sewage pumping stations classified as good condition (grades 1 and 2). This is considered a suitable priority given the current condition of the assets, especially the larger pumping stations (all 14 are classified as grade 4 or 5, section 4.1.5.2 of the Wastewater Strategy). Where an increase in pumping station capacity is required, it is assumed that the network has been analysed hydraulically to confirm that the rising mains have sufficient flow and pressure capacity.

Additional pumping stations will also be required as part of the sewer extensions programme in order to connect to the existing network. New pumping stations should be designed using suitable design standards and supplier guidelines. For low flow pumping stations, package pumping stations provide a cost effective solution that generally comply with all required standards.

5.3 Combined Sewer Overflows

The Strategy states that only minor capital investment is envisaged for the CSOs in St Helier, which will include modification of the overflow settings for a number of existing overflows once the Philip Street Shaft is completed. It is unclear whether the addition of a screen at the Weighbridge CSO or any modifications to the overflow upstream of Fauvic SPS are included in the Strategy and associated capital expenditure summary. From the information provided, AECOM believes that action is required at both these locations, and therefore capital spend should be included in the programme.

5.4 Summary of Sewer Network Capital Expenditure

As this is a desktop study, and suitable information regarding the calculation of the network capital expenditure has not been provided, AECOM have not undertaken a review of the values summarised in section 7.4 of the Wastewater Strategy. However, based on the details of the proposed maintenance and upgrades, it is agreed that significant funding is required to improve the current service levels and environmental status.

It is stated that a more detailed analysis of the sewerage network is required to prioritise future work and determine the associated costs. This analysis should be undertaken as soon as practical to ensure that the funding can be more accurately calculated, as this represents a risk to the Strategy.

6. Wastewater Treatment Options Review

The Wastewater Strategy's key focus with regards to wastewater treatment is to identify options to address the issues at Bellozanne STW. For the package plant at Bonne Nuit, only continual routine maintenance will be required, which does not cause any concern. The existing Bellozanne STW is undersized and at the end of its original design life. It regularly fails to meet its effluent consent for total nitrogen and suffers from excessive biological foaming. It is clear that the situation poses a significant problem that will only worsen with any increase in population. Therefore AECOM agrees that action is required.

It is highly unlikely, given the site constraints and the stated current condition of the assets, that refurbishment and upgrade of the plant will provide a cost effective solution to the issues. It should be noted that, at this stage, AECOM have not visited the site and this assessment it based purely on the information provided in the Wastewater Strategy and supporting documents. Replacement of the treatment plant is considered a reasonable, and likely the most financially beneficial solution.

The proposed investments as listed by the Strategy are as follows:

- A new STW will be constructed using conventional activated sludge plant with carbonaceous Biological Oxygen Demand (BOD) removal, followed by monitoring of key water quality parameters in St Aubin's Bay for up to 5 years to confirm no deterioration or improvement to the current level of water quality as a result of the STW replacement.
- Provision will be made in the new STW design for potential population increases of up to 20% beyond the design horizon and to meet a tighter consent for effluent quality to avoid any deterioration of water quality in St Aubin's Bay.
- Ultraviolet disinfection tertiary treatment will be provided to all STW effluent discharges.
- Odour control will be provided to the treatment units that generate significant odour such as inlet works, sludge tanks and other units that are at risk of causing statutory nuisance.
- The flow to full treatment at Bellozanne STW is assumed to increase from 600 l/s to 830 l/s with additional storm overflow storage facilities on site, which will eliminate the storm overflow events at the STW.

It should be noted that a sensitivity analysis of the population projection and design horizon was undertaken in section 5 of this report; the population numbers used in the Strategy are appropriate.

6.1 Proposed Sewage Treatment Works Location

As the existing Bellozanne STW is severely constrained by the valley sides, research was conducted by TTS to address potential locations for constructing a new treatment works. A report, i.e. STW Configuration and Locations Options Report (April 2010), was produced detailing the findings, which discounted several location options on the basis of cost, specifically the cost in revising the sewerage network.

This options report was not part of AECOM's scope, and therefore only the Bellozanne and La Collette options have been considered, as per the Wastewater Strategy. From the information provided, it is clear that locating the new treatment plant at Bellozanne is the best option. It should be noted that AECOM do not have enough information to verify the capital and energy costs, and the environmental information. However, the approach used seems to be a reasonable method of determining the most feasible location.

6.2 Process Options (Best Available Technology Report – May 2012)

The purpose of the Best Available Technology Report was to review the available secondary treatment technologies along with the economic and environmental considerations to determine the most suitable for the proposed new treatment works. A significant constraint to be considered is the limited land available at the site. It is also understood that operator familiarity with the technology is a key factor.

AECOM have reviewed the information provided in the Best Available Technology Report, as well as its conclusions. The review also considered whether any other technologies that were not considered are suitable for consideration in the Strategy. The review focusses on assessing each technology against its required size, suitability for the proposed flows, energy demand, whether it can achieve the required treatment standards, operational complexity and maintenance requirements.

The technologies discussed within the Best Available Technology Report are as follows:

- Conventional Activated Sludge
- Extended Aeration
- Sequencing Batch Reactors (SBR)
- Membrane Bioreactors (MBR)
- Deep Shaft Activated Sludge
- Moving Bed Bioreactor (MBBR)
- Trickling Filters
- Biological Aerated Filters

As this review is to be read in conjunction with the Strategy, descriptions of these technologies will not be provided. Refer to the Best Available Technology Report for process descriptions.

6.2.1 Conventional Activated Sludge

Conventional Activated Sludge is the most common treatment technology used for large and small works. Its widespread use means that the capabilities of the plant are well known and effective designs can be readily produced. As stated in the Best Available Technology Report, the process is reliable in terms of robustness and flexibility. The initial design will vary depending on the consent, and this technology allows for easier expansion and modification for varying consents than most of the other technologies discussed. The system is suitable for the population projections, and has been used on numerous works of similar size. However, it should be noted that this technology is not suitable for shock loading, and therefore storm flow entering the works should be minimised or stored to ensure that the discharge consents are met.

Another key advantage for the use of conventional activated sludge is operational familiarity. As this system is currently used at Bellozanne STW, the training required for the operators will be less than for other technologies, although continual monitoring of the sludge and oxygen levels in the tanks are required. Energy use can be high for this technology, especially if the process is not running at optimal parameters.

It should be noted that conventional activated sludge tanks generally have a large footprint, as final settlement tanks are also required, as well as a return activated sludge pumping station. Maintenance requirements can be onerous, and the inflow must be monitored to ensure that the living conditions are suitable for the required bacteria.

AECOM agree that this technology would be suitable for use at Bellozanne STW and should be strongly considered, primarily due to operator familiarity with the technology and the capacity for expansion. As this technology is in widespread use, the associated design and operation risks are far lower than for other technologies.

6.2.2 Extended Aeration

The main disadvantage to extended aeration treatment processes is the size of the facility required to provide the longer hydraulic and solids retention times for larger populations. As one of the primary considerations for the technology's suitability to be used is the overall footprint, AECOM do not think that extended aeration should be considered for Jersey.

The sludge digesters currently in construction have been designed to treat both primary and secondary (activated) sludge. Sludge from Bonne Nuit STW, septic tanks and tight tanks are also taken for treatment at Bellozanne STW. As primary settlement tanks are not required if extended aeration is used, no primary sludge will be produced. The remaining sludge (secondary and important sludge from Bonne Nuit STW, septic and tight tanks) will require significant thickening before it can be digested and incinerated in the energy from waste plant (as required). It should be noted that the primary sludge also provides sufficient quantities of consistent thickness to offset any variance in the sludge received from septic and tight tanks. Therefore, the primary sludge is an important factor in providing for consistent and stable operation of the sludge treatment facility.

When the need for primary sludge to stabilise the anaerobic digestion plant, and the higher running costs are also considered, it is clear that this is not a viable option.

6.2.3 Sequencing Batch Reactors (SBR)

This is a similar technology to the conventional activated sludge process, with the processes in an SBR all occuring in a single tank. Therefore final settlement tanks are not required. This results in a smaller footprint than conventional activated sludge, which is a key consideration in the technology selection for the Wastewater Strategy. The footprint can be further reduced through use of a two deck arrangement; this solution has been used for other works where land availability was limited. The type of SBR operation used would depend on the wastewater characteristics, with normally four or five phases in each operating cycle, i.e. fill, react, clarify, decant and possibly an idle phase. No return sludge facility is required as both aeration and settling occur in the same tank.

Other advantages of SBR technology include good operational flexibility and allowance for remote operation. Disadvantages of this technology include higher energy consumption and the potential requirement for an equalisation tank. Operators would require some training as this is a new technology for Jersey, although the processes are similar. A higher level of maintenance is also required due to the more sophisticated controls.

Nitrification can be achieved through addition of an anoxic cycle, if there are any concerns with the design, a separate anoxic zone and / or recycling can be provided. At this stage, from the information provided, AECOM believe that the use of SBR technology should be considered as a viable alternative to conventional activated sludge and a second option for Bellozanne STW.

6.2.4 Membrane Bioreactors

AECOM agree that membrane bioreactor technology is not suitable for use at Bellozanne STW. These are primarily used for smaller flows and are generally not suitable for larger works. Although the effluent quality achieved by use of membrane technology would likely negate the need for tertiary treatment, the capital and operational costs associated with membrane bioreactors will almost certainly be prohibitively high for the flows encountered.

High maintenance costs are also required to keep membranes clean, and significant operator input is also required.

6.2.5 Deep Shaft Process

This process has been strongly considered for use, with a Technical Note prepared by Grontmij on the subject, as well as consideration in the Best Available Technology Report. AECOM agrees with the findings of both in that this technology is not suitable for consideration in the Wastewater Strategy. This will be discussed in detail in this section. It is understood that the rejection of this system has been queried by the Minister for Planning and Environment; his comments will also be addressed in this section.

The advantages have been summarised in the technical note as follows:

- No primary settlement stage is required.
- Higher energy efficiency with removal rates of 1 to 4 kg/BOD kW hr
- Higher efficiency of oxygen transfer requiring less aeration for the same function.
- The process is unaffected by temperature changes.
- The footprint is much smaller than for conventional activated sludge.
- The process is resistant to hydraulic or loading variations.
- There is less potential for filamentous growth.
- The seeding period is typically reduced.
- The initial start-up of the activated sludge process is reduced to 3 to 4 days in comparison to approximately 18 to 20 days for conventional processes.

AECOM agree that all advantages listed are beneficial. In particular, the smaller footprint, both from elimination of the primary stage and smaller aeration tank plan area, and lower energy costs provide savings in land use and operational costs. However the following disadvantages, listed in the Technical Note, raise serious concerns about the use of the technology at Bellozanne. AECOM's comments on each are also included.

- *There is a high capital cost associated with drilling and lining the deep shaft, dependent on the underlying geotechnical conditions.* AECOM have no geotechnical information for the Bellozanne area, but the costs associated with installing a 40 to 100m deep tank are likely to be very significant, especially if the ground consists of large quantities of rock as suggested in the Best Available Technology Review (Table 2.1). It is unlikely that the plant required to drill the shaft as suggested is readily available in Jersey, and therefore there will be costs associated with import of this plant. It is difficult to estimate the costs associated with constructing a deep shaft treatment facility, as the required depth and diameter of the system are not known. Finding a comparable site will be difficult, as the technology is not widely used (there are currently only 200 facilities constructed worldwide). It is likely that at least 2 No. aerators will be required to allow one to be maintained, which will also add to the cost.
- *Due to the subsurface nature of the deep shaft, it is not possible to observe the mixed liquor and thus more difficult to operate or diagnose problems.* Whilst the new plant would be designed to operate to the correct inflow and achieve the required consents, it is inevitable that issues will occur. Significant supplier support will likely be required for operation. This will come at a cost, likely to be more as the suppliers will be remote from the plant. Significant operator training will also be required. Any tank entry requirements for maintenance will pose significant health and safety issues due to the depth and the fact that it will be a confined space.
- *The efficiencies and cost savings of the system are only realised where the influent BOD strength is greater than approximately 500 mg/l.* It should be noted that the deep shaft technology will treat the sewage to a high standard due to a much higher mixed liquor rate. However, this level of efficiency is not required, because there are little to no industrial flows contained within the influent. Influents of this strength will likely never be seen at Bellozanne STW.
- *No nitrification or denitrification is provided.* This is a common problem with most of the technologies discussed, as both nitrification and denitrification has to be considered within the design. A separate treatment stream could be added to the deep shaft aerators, however, this adds to the cost and increases the footprint, resulting in less space saving. Both nitirification and denitrification are far easily incorporated into conventional activated sludge and SBR technology.

- *The effluent normally requires de-gassing. High quantities of carbon dioxide and nitrogen can be released out of solution with the rapid reduction in pressure as the mixed liquor rises to the top of the shaft.* De-gassing would likely be required at Bellozanne, which will again increase the overall cost and operational complexity.
- *Maintenance of the high pressure blowers is more onerous than a conventional system.* This is not considered a major disadvantage, as the blowers will be at ground level. However, operator training for maintenance of the high pressure blowers will be required.

It is understood that there are significant possible environmental disadvantages due to the location of the treatment works i.e. it is close to residential areas, e.g. odour, aeration spray mist. Whereas this technology may be able to solve any issues through eliminating spray mist due to its smaller footprint, it will have no impact on odour as activated sludge plants are not a major odour source. Inlet works and sludge treatment will still be required, which are the major odour sources on sewage treatment works.

Tertiary treatment is a requirement under the Island Plan 2011 policy LWM 4 – Sewage Treatment Works and Sewerage Outfall, i.e. "*For the avoidance of doubt, ultra-violet disinfection or an equivalent system will be required at all sewage treatment works so as to safeguard bacteriological quality for bathing and fisheries."* Whilst installing a deep shaft aeration system may negate the need for tertiary treatment, it may have to be included for any periods when the activated sludge system is not available due to maintenance or breakdown. This would have to be agreed between the States departments.

As for extended aeration, primary tanks will not be provided for this solution, and therefore, no primary sludge will be produced. This is required for stable operation of the sludge treatment plant currently being constructed.

This technology will represent significant operational risks and the benefits would not be realised due to the low strength of the effluent (no industrial waste). Due to its likely high capital installation cost, and the available space for other technologies, AECOM do not consider this a suitable technology for Bellozanne STW. However, as land use is a key consideration in Jersey, it may be prudent to develop a high level cost estimate to determine whether there is any potential benefit in considering deep shaft aeration.

6.2.6 Moving Bed Bioreactor (MBBR)

MBBRs use both activated sludge and fixed film technology, and has both their advantages.

The main advantage of using this system is its small footprint due to a larger biomass volume. MBBR's are stable under varying volumes of wastewater and can easily be expanded by increasing the media fill percentage.

Although the system is generally simple to operate, training would be required as this is a new technology. The capital costs would also be much higher than for conventional activated sludge, and therefore this technology is not suitable for consideration.

6.2.7 Trickling Filters

Although trickling filters represent a simple, reliable biological process with relatively low energy costs, AECOM do not believe that this technology should be considered. In addition to the reasons provided in the Best Available Technology Report, further disadvantages include:

- Additional treatment may need to be provided to meet stringent design standards
- Potential odour problems
- Available space
- Filter clogging may occur for high organic loads
- No real possibilities exist for operational control

6.2.8 Biological Aerated Filters (BAF)

Biological Aerated Filters are not recommended for consideration due to the associated high capital and operational costs. Generally, BAF technology produces effluents with very low suspended solid concentrations. However, after backwash cycles, this can deteriorate resulting in poorer quality effluent, which will reduce the effectiveness of the UV disinfection plant.

6.2.9 Proposed Secondary Treatment Alternatives

In addition to the treatment processes discussed in the Best Available Technology Report, the other technologies considered for inclusion in the strategy are as follows:

6.2.9.1Rotating Biological Contactor (RBC)

RBCs are aerobic attached growth bioreactors containing circular shaped media mounted on a rotating shaft. The media is partially submerged in the wastewater and is rotated at a speed of approximately one to two revolutions per minute to provide alternate exposure to the wastewater and to the atmosphere. Micro-organisms grow on the media and metabolise the biodegradable organic material and the nitrogen containing compounds in the wastewater. Excess biomass shears off at a steady rate and is then carried through the RBC system for removal in a clarifier.

Figure 1. Rotating Biological Contactors

Treatment systems using RBCs can be designed to provide secondary or advanced levels of treatment. Effluent BOD characteristics for secondary treatment use are comparable to well-operated activated sludge processes. For nitrification, RBCs can be used to provide combined treatment for BOD and ammoniacal nitrogen, or to provide this separately. A modified RBC process has been previously used for denitrification, where the disc support shaft is totally submerged.

Covers are generally required for RBCs to protect against cold weather and to prevent odours and allow for odour control measures.

RBCs have many advantages as follows:

- Short contact periods only are required because of the large active surface, resulting in shorter retention times.
- They are capable of handling a large range of flows, which is useful during storm conditions. The process remains stable for larger flows.
- Biomass generally has good settling characteristics and can easily be separated from the effluent.
- Low operation costs and energy requirements (RBCs use approximately half the energy required for conventional activated sludge).
- Low sludge production and excellent process control.

However, there are disadvantages to this technology that make it unsuitable for consideration at Bellozanne STW. Frequent maintenance is required, in particular for the shaft bearings and mechanical drive units. This is because there is a higher likelihood of mechanical breakdown than for other technologies. As covers are provided, hazardous atmospheres can be developed which also poses a problem for maintenance.

The main concern with regards to using RBCs in this instance is the lack of suitability for large population equivalent works. Whilst RBCs have been used for larger works (primarily in the United States), this is uncommon. A significant number of RBC units would be required, which will require high capital investment. Operator training will also be required, as this will be a new technology for the island of Jersey. Therefore, RBCs are not considered a suitable treatment solution for the Wastewater Strategy, unless it can be demonstrated that the capital costs are comparable to conventional activated sludge.

6.2.9.2Oxidation Ditch

An oxidation ditch is a modified activated sludge treatment process that utilises long solid retention times to remove biodegradable organics. This process is similar to extended aeration. Typically, oxidation ditch treatment systems consist of a single or multichannel configuration within an oval or similar shape basin. Horizontal mounted aerators provide circulation, oxygen transfer and aeration in the ditch.

Oxygen is entrained into the mixed liquor which encourages microbial growth. Dissolved oxygen concentration is high immediately downstream of the aerators, but this decreases as the biomass uses the oxygen as the mixed liquor travels through the ditch. The system can be designed to achieve a high degree of nitrification. Oxidation ditches can also achieve partial denitrification, or can be modified to achieve a higher level through introduction of an anoxic tank and recirculation of mixed liquor.

Figure 2. Oxidation Ditch

Preliminary treatment, i.e. screens and grit removal, are normally provided, primary settlement tanks are provided in some cases. Final settlement tanks are required to allow for activated sludge to be returned to the oxidation ditch.

The advantages of this technology are as follows:

- Low operational requirements and costs.
- An added measure of reliability and performance over other biological processes owing to a constant water level and continuous discharge.
- Long hydraulic retention time and complete mixing minimise the impact of a shock load or hydraulic surge.
- Production of less sludge compared to other processes, due to extended biological activity during the activated sludge process.
- Lower energy costs compared to conventional activated sludge.

The disadvantages of using this system are that larger land areas are generally required than for other activated sludge options. This is an important consideration for the Wastewater Strategy due to the constraints at the proposed site. In addition, effluent suspended solids concentrations are relatively high compared to other variations of activated sludge technology. This could lead to poor UV transmissivity and therefore poor disinfection. If no primary tank is required, this could impact on the operation of the sludge treatment, as was the case for extended aeration.

This technology should only be considered if it could be demonstrated that sufficient land area was available.

6.2.10 Appropriate Technologies

Based on the review of the information provided in the Best Available Technology Report, AECOM agree that conventional activated sludge would be a suitable technology. The land required for this technology has been considered, and it has been demonstrated, as far as possible at this stage, that the site can accommodate a treatment plant utilising this technology. The operator knowledge of this technology is also a key factor in its selection as suitable.

AECOM believe that SBRs provide a viable alternative to conventional activated sludge, and could be considered as a second option for the proposed treatment plant. This technology has a smaller footprint, and therefore could be used should any major land availability issues arise with the conventional activated sludge solution.

RBCs and oxidation ditches should only be considered if it can be demonstrated that their prohibitive factors (cost and land availability respectively) are not an issue at Bellozanne STW.

AECOM also agree that a process suitable for both nitrification and denitrification can be designed for Bellozanne STW. This could be based on conventional activated sludge or SBR technology. As AECOM has not visited the site at this stage, we cannot comment on the land available for the new works, but drawings are provided within the Wastewater Strategy and the Best Available Technology Report that demonstrate that suitable land appears to be available.

6.3 Preferred Treatment Solution

The preferred secondary treatment method to be used at Bellozanne STW is a conventional activated sludge plant with phased implementation of the sewage treatment facilities. It is understood that the plan for the works is detailed in the "Bellozanne STW Feasibility Report (03/2013)," which is not part of AECOM's review scope. It should be noted that the report was provided to AECOM for information.

The proposed works layout demonstrates that suitable land is available for constructing the works in phases whilst the existing plant remains operational. Future expansion and allowance for tighter consents has also been considered, through identification of areas for future upgrades. It should be noted that there is a risk that the required area may increase due to unforeseen circumstances. It is unclear how much further land is available for expansion should this occur.

The proposed treatment plant construction has been split into two phases as follows:

Phase 1

- Inlet works, including screening and grit / fats, oil, grease (FOG) removal
- Storm tanks
- Primary settlement tanks
- Sludge storage tanks (replacement of existing)
- Administration building

Sections of the existing plant (including the existing inlet works, sludge storage tanks and primary settlement tanks) will then be demolished to make way for the phase 2 assets.

Phase 2

- Activated sludge plant
- Final settlement tanks (if not constructed under stage 1)
- UV disinfection plant (if not constructed under stage 1)

Careful consideration will need to be given to the construction methodology to ensure that the works remain operational at all times.

Tertiary treatment is to be provided, in the form of UV disinfection. This is a requirement under policy LWM4 – Sewage Treatment Works and Sewerage Outfall, which states that *"for the avoidance of doubt, ultra-violet disinfection or an equivalent system will be required at all sewage treatment works so as to safeguard bacteriological quality for bathing and fisheries."* The requirement for tertiary treatment should be confirmed in the design, but this is a sensible approach to ensuring that discharge consents are met.

6.4 Sludge Treatment and Disposal

The existing anaerobic sludge digesters at Bellozanne STW are currently being replaced by a new sludge treatment facility. Completion is expected by the end of 2014. Sludge will continue to be digested, thickened and enhanced, with as much as possible being disposed to land. AECOM agree that this is suitable, it is assumed that the new facility design complies with all regulations and legislation.

6.5 Effluent Outfall

At this stage, the Bellozanne STW Feasibilty Report assumes that the extension of the outfall will not be required on the basis of assimilative capacity of the receiving waters, resulting from evidence based policy to be agreed with the environmental regulator. AECOM cannot comment on this, as suitable information is not available. Further data collection and water quality monitoring will be needed to demonstrate that the location of the outfall is suitable for long term needs. Hydraulic checks will be required to ensure that the outfall length and capacity is adequate for increased effluent flows and climate change effects.

As there is a variation planned to the current discharge consent, further discussions are required and agreement must be reached with the Department of Environment. This is critical to the design of the works, as the need to meet more stringent consents could significantly impact the Strategy, e.g. greater land areas required to construct the treatment plants. This represents a significant risk.

7. Sustainability

Several sustainability issues are raised in the Wastewater Strategy, but are not discussed in detail. Further consideration should be given to these issues, as they can offer significant opportunities to minimise costs and reduce the overall demand on the wastewater network (e.g. water minimisation), or can pose risks to the overall Strategy (e.g. climate change). Relevant sustainable topics for further consideration are discussed in this section.

7.1 Effluent Reuse

As previously discussed in section 3.2, article 12 of the Urban Wastewater Treatment Directive states that treated wastewater shall be reused whenever appropriate. Whilst this is not always suitable, reuse of effluent can significantly reduce overall potable water usage. This has been considered in the Strategy, as stated in the recommendations (section 12.1), i.e.

Consideration will be given to adopting an integrated water resource management strategy such as grey water and water recycling schemes. This type of approach requires public engagement and support and is likely to be phased in as the drive for better environmental and sustainable solutions accelerates.

The key factors to consider in developing effluent reuse are as follows:

- **Overall cost.** Suitable infrastructure will be required to deliver the treated effluent to its end use point. This will represent further costs.
- **Is the water required?** An end use for the water is required. Whilst a proportion of the water can be used on site for washwater purposes, in order to justify the costs, a significant effluent user / users are required.
- **Regulatory approvals.** The water may have to be treated to a higher standard depending on its end use.
- **Demand variations.** Demands will fluctuate throughout the year, and therefore for certain months, the discharge to the outfall will be greater than others. This may impact on consents, particularly nitrogen and ammonia.

Further studies would be required to determine whether an effluent reuse scheme is suitable for the island of Jersey.

7.2 Sustainable Drainage Solutions (SuDS)

The Island Plan 2011 commits to including sustainable drainage systems in new developments in policy LWM 3 – Surface Water Drainage Facilities, i.e. *Minister for Planning and Environment will expect proposals for new development and redevelopment to incorporate Sustainable Drainage Systems(SUDs) into the overall design wherever practicable*. The intention to implement these systems on new schemes is confirmed in the Strategy's recommendations (section 12.1) as follows:

Alternative sustainable techniques for reducing flows entering the STW at Bellozanne, such as Sustainable Urban Drainage Systems (SUDS), will be promoted for use on all new developments and as part of any programme to connect existing properties to the sewerage network. These store or attenuate flows and can provide a certain level of treatment for surface water before discharge. Through the planning process these advances in sustainable techniques will become accepted practice.

It is noted that schemes to separate surface water and reduce infiltration have been completed or are being progressed and these will help to relieve pressure on the wastewater system. Without further details, it is not clear what these schemes involve, but if not already part of the strategy, consideration should also be given to retrofitting SuDS measures in established areas. This approach will reduce the load on the wastewater system and also help to mitigate the effects of climate change. There are numerous schemes currently being implemented to measure the effects of retrofitting SuDS, which consider factors such as flow reduction, cost , public engagement and acceptability, these would provide a basis for evaluating their applicability to Jersey.

Examples of systems that could be implemented include:

- Water butts
- Tree pits
- Rain gardens
- Permeable paving
- Green roofs

7.3 Water Minimisation Initiatives

Water is becoming an increasingly expensive resource with mains, sewerage and trade effluent charges rising. However, introducing water minimisation measures is one of the easiest and most inexpensive ways to achieve cost savings for end users, water supply and wastewater treatment.

In the UK, Waterwise, founded in 2005, is the leading authority on water efficiency. They have developed a strategy for 2010 to 2020, based on the following principles:

- Ensuring that water efficiency becomes a standard element of water providers' planning and management processes
- Securing political and regulatory commitment to water efficiency to adapt to and mitigate the effects of climate change
- Providing knowledge and support for driving water efficient behaviour
- Strengthening the ability of society to deliver water efficiency
- Influencing consumers and business towards resource efficiency

Based on policy LWM 1 of the Island Plan 2011, Jersey is committed to implementing water efficiency in new developments. Following a similar approach to Waterwise would extend this commitment to effective water management.

7.4 Climate Change

Climate change has the potential to impact on all areas of the water industry, including effects to the quality and availability of water sources, the infrastructure vital to services and the further treatment that will be required to meet quality standards.

In the UK, The Climate Change Act 2008 gave Government the power to direct statutory undertakers, including water and wastewater companies, to report on how their operations are affected by the impacts of climate change both now and in the future, and present an action plan to mitigate against these risks. A similar approach should be adopted in Jersey to ensure that the potential effects are accounted for in the long term strategies.

Climate change is discussed briefly in the Wastewater Strategy (section 7.2.4) as follows:

The potential for climate change impacts on the Jersey sewerage network has not been fully assessed. It has been assumed that in common with the southern part of England climate change will lead to increases in the magnitude of storm events within the strategy period. This will increase the wastewater flows to be handled by the network, the pumping stations, the overflows and the STW. In the absence of detailed modelling of the assets, a simple general allowance for upsizing the assets as they are maintained / renewed has been made of 5% of the projected maintenance cost.

Whilst an allowance has been made for the effects of climate change, this should be further developed before the Strategy is fully implemented. At this stage, the capital cost risks associated with climate change are not fully known, but scenarios should be modelled to determine whether this assumption for capital costs is appropriate. There are also risks to supply and potential failure of assets to consider.

Risks associated with climate change include the following:

- **Increased sewer flooding.** The increase in winter precipitation and intense summer storms could result in overloaded sewers. Blocked road drains could cause severe surface water flooding.
- **Inundation of sewage treatment works and pumping stations.** This could be from higher flows entering the works producing shock loads or flooding of treatment plant sites from rising river / tidal levels or flash floods.
- **Change in sea conditions which could result in revised sewage treatment plant discharge consents.** Lower summer precipitation and higher summer temperatures may lead to higher water temperatures. These effects will make the receiving water ecology more sensitive to polluting discharges, which will in turn increase demand to treat sewage to a higher standard. Higher sea levels could also affect the hydraulics of the final effluent outfall.
- **Impacts on sewage / sludge transfer routes.** Sewage is tankered from several locations around the island to Bellozanne STW. Flooding, including flash floods could impact the collection of this sewage.

There are several mitigation measures available, including maintenance, such as upsizing when replacement of a sewer is required, or through design, e.g. locating all electrical equipment above flood levels, designing all treatment plants to operate during 1 in 100 year events. Further research should be undertaken to understand the effects of climate change and suitable mitigation measures.

8. Conclusion

Based on the review undertaken, AECOM are satisfied that the Wastewater Strategy represents a suitable approach for the island of Jersey. The options developed, for both the sewer networks and wastewater treatments, are considered to be reasonable solutions for the issues encountered. However, it should be noted that there are risks associated with the Strategy, further details are provided in section 8.1. All relevant legislation has been considered in the development of the Strategy.

The review of the existing system has highlighted a number of issues, the majority of which have been considered in the Strategy. However, it is unclear whether mitigation of the following existing issues has been allowed for.

- It is not confirmed whether a screen is to be provided at the Weighbridge CSO.
- The Strategy does not seem to identify any capital maintenance or investment at the overflow upstream of Fauvic SPS.
- There may be H_2S issues at certain pumping stations. The Strategy discusses the provision of odour control, but no measures for elimination of the gas are discussed. As this could pose health and safety and corrosion issues, this should be considered a priority.

A sensitivity analysis was undertaken for the population projections used in the Wastewater Strategy. The population values determined are similar to those developed within the Strategy (± 1%), and therefore they are deemed acceptable. AECOM agree that the design should include flexibility through use of conservative parameters. This will allow for population variances.

Based on the information available, AECOM agree that the existing Bellozanne STW site is the most suitable location for the new works. AECOM also agree that conventional activated sludge technology is a suitable preferred technology for the new works. An alternative system that is worthy for consideration is SBRs. This technology has a smaller footprint, and therefore could be used should any major land availability issues arise with the conventional activated sludge solution. A two deck arrangement could be considered to provide additional space savings.

Deep shaft aeration was also considered in detail, as this had the potential to offer significant space savings. Despite its many advantages, this was eliminated as an option. This technology will represent significant design and operational risks, as it is relatively new and the benefits would not be realised due to the low strength of the effluent (no industrial waste). The construction costs are likely to be very high due to the depth of the system and low availability of construction equipment. Use of this technology could only be considered if it could be demonstrated that the cost of construction is not prohibitively high.

Sustainability should be further considered in the Strategy as it is further developed. There are several opportunities to provide sustainable solutions to minimise water use and wastewater production. These include sustainable drainage systems, water minimisation and effluent reuse. The effects of climate change should also be considered.

The options provided for delivery and funding of the Strategy are considered to be suitable, and following the direction of the English and Welsh water industries is a sensible approach. Further consideration of the correct procurement, business and funding strategies will be required as the programme develops. AECOM cannot comment further on delivery at present, as not enough information is available to fully assess the options available. It should be noted that the Strategy refers to PAS 55 *Asset Management*, this has now been superseded by ISO 55001 *Asset Management.*

Capabilities on project:
Water

8.1 Risks

There are a number of risks associated with the Strategy, with details as follows. Further studies are required to eliminate these risks; these should be undertaken as soon as is practical.

- The classification of St Aubin's Bay as a sensitive area would have a significant impact on the level of treatment and associated capital costs. The classification process should be undertaken as soon as possible.
- At this stage, only approximately 39% of the sewers have been inspected by CCTV. The Strategy has been developed on the assumption that the remaining sewers have the same mix of condition as those surveyed. If this assumption is not accurate, the capital and maintenance costs could be much higher than anticipated. The trend in condition of these assets is also not known at this stage and could significantly influence future investment needs.
- The Strategy states that a more detailed analysis of the sewerage network is required to prioritise future work and determine the associated costs. This analysis has the potential to uncover further problems, increasing the associated costs.
- A concept layout has been developed for a new conventional activated sludge system at the existing Bellozanne STW site. It has been demonstrated that the required land area appears to be available. However, should the design be sufficiently modified or increased in size, this solution may not be viable. A second technology may have to be considered, and the Strategy would therefore have to be modified.
- Climate change has not been fully considered in the Strategy. An allowance of 5% of the maintenance costs has been allocated to allow for upsizing of the sewers as they are maintained. However, the actual costs of climate change effects could be significantly greater. These risks include sewer flooding, inundation of treatment works and changes to discharge consents.
- As there is a variation planned to the current discharge consent, further discussions are required and agreement must be reached with the Department of Environment. This is critical to the design of the works, as the need to meet more stringent consents could significantly impact the Strategy, e.g. greater land areas required to construct the treatment plant.
- The length of the outfall into St Aubin's Bay is referred to as 500m from the sea wall (section 2.3.2 of the Strategy). The diameter is not quoted and may need to be increased for higher final effluent flows, as well as for effects from increasing flows from the Bellozanne Valley stream.

9. Recommendations

Based on the conclusions of our review, the following are AECOM's recommendations for inclusion in the Strategy.

- The classification of St Aubin's Bay should be completed as soon as possible to understand whether nitrification and denitrification are required to meet nitrogen and ammonia consents.
- Discussions regarding the proposed discharge consent for the new Bellozanne STW should be held to ensure that the treatment options proposed are reasonable.
- The sewer surveys should be completed as soon as possible. These would highlight whether the allowances made in the costs for sewer maintenance and upgrades are reasonable. Additional analysis should also be undertaken to assess likely future condition trends and their impact on investment needs.
- The network analysis should also be completed as soon as possible, to gain a better understanding of the issues.
- The Strategy should clarify whether modifications will be made to the overflows at the Weighbridge CSO (installation of a screen) and upstream of the Fauvic SPS.
- The H_2S issues at certain pumping stations around the island should be investigated, with the gas eliminated or minimised to lowest possible levels.
- Discussions regarding the proposed discharge consent for the new Bellozanne STW should be held to ensure that the treatment options proposed are reasonable.
- It should be established whether sustainable options such as SuDS and water minimisation should be considered within the Strategy, or whether these should be considered separately.
- The effects of climate change should be more fully considered. Understanding of these effects is now covered by legislation in the UK, and consistent with other aspects of the strategy, it would be appropriate to follow this approach.

Appendix 1

Response to Comments form Minister for Planning and Environment

The comments received from the Minister for Planning and Environment were considered in the review. AECOM's responses to the comments are as follows.

Comment	**AECOM's Response**
The rejection by the consultants of the DeepShaft system is somewhat perfunctory. A cost benefit analysis should be undertaken to properly take into account the noted advantages of such a system. Land is in short supply in Jersey and should not be squandered.	AECOM have no geotechnical information for the Bellozanne area, but the costs associated with installing a 40 to 100m deep tank are likely to be very significant, especially if the ground consists of large quantities of rock as suggested in the Best Available Technology Report. It is unlikely that the plant required to drill the shaft as suggested is readily available in Jersey, and therefore there will be costs associated with import of this plant. It is difficult to estimate the costs associated with constructing a deep shaft treatment facility, as the required depth and diameter of the system are not known. Finding a comparable site will be difficult, as the technology is not widely used (there are currently only approximately 200 facilities constructed worldwide). It is likely that at least 2 No. aerators will be required to allow one to be maintained, which will increase the costs.
The placement of the STW close to residential areas poses many environmental negatives. The DeepShaft system has the potential to overcome these. The footprint of the DeepShaft system is significantly smaller than the conventional plant and would allow for cheaper and more practical odour control.	It is understood that there are significant environmental and social disadvantages in that the location of the treatment works is close to residential areas, e.g. odour, aeration spray mist. Whereas this technology may be able to solve any issues through eliminating spray mist due to its smaller footprint, it will have no impact on odour as activated sludge plants are not a major odour source. Inlet works and sludge treatment will still be required, which are the major odour sources on sewage treatment plants.
The process itself is more efficient albeit with stronger influent which will arise as SuDS and water saving schemes develop.	Whilst the process is more efficient, the influent will never reach the strength for which the DeepShaft system has been designed for, i.e. industrial effluent. Therefore, the efficiencies achievable from this system will never be realised.
The process could also be coupled with ethanol production to provide a revenue stream to offset costs and to substitute fuel imports.	The costs and associated benefits in developing an ethanol production facility are unknown. This could be investigated if it could be demonstrated that the construction costs of the DeepShaft system are not prohibitive.

Comment	**AECOM's Response**
The addition of tertiary treatment might also be required for conventional plant.	Tertiary treatment is a requirement under the Island Plan 2011 policy LWM 4 – Sewage Treatment Works and Sewerage Outfall, i.e. "*For the avoidance of doubt, ultra-violet disinfection or an equivalent system will be required at all sewage treatment works so as to safeguard bacteriological quality for bathing and fisheries."* Whilst installing a deep shaft aeration system may negate the need for tertiary treatment, it may have to be included for any periods when the activated sludge system is not available due to maintenance or breakdown. This would have to be agreed between the States departments.
It is suggested that the cost of drilling a vertical shaft is high but no cost estimates / examples are given.	As no geotechnical information is available, AECOM cannot estimate the associated high level costs with constructing the DeepShaft system. A cost estimate could be undertaken, this would be at the discretion of the States departments.
Over 80 units are quoted as existing but only Southport UK is considered.	The Best Available Technology Report considered the plants constructed in the UK. Of these, only Southport was comparable to the situation at Bellozanne STW. Further consideration could be given to sites abroad. This is at the discretion of the States departments.
Extra holding units for overflow storm waters could also be constructed using this method at other sites.	The capital costs associated would likely be prohibitively high. As the tanks would be deeper, pumps would be required to return the flow to the storm system. The hydraulic head required for pumping would be higher due to the increased depth, which would increase operational costs. There may be issues associated with pump removal, as this would certainly be a confined space.
Overall the draft report and poposition does not make enough mention in 8.0 Future waste water minimisation initiatives of the potential flow reduction arguments and the timescale acceleration that could easily be encouraged to deliver this.	Water minimisation should be considered either in or alongside the Strategy. Details of AECOM's position are included in section 7.3.
Is this a 20 year strategy or a longer period? In either case the sustainability issues must be better defined as a proper part of the strategy and not just an afterthought.	Sustainability issues should be considered in the Strategy, with consideration given to the effects of climate change. Refer to section 7 of this report for further details.
It is not clear just how much sewage is produced / delivered to the STW / sea and the environmental sense of adding sewage to less soiled water to bulk up flows for central treatment or disposal.	The strategy is based on the influent to the works (830 l/s), the effluent volume is not given (to be confirmed). Discharging to other waters would require significant investment in further infrastructure, the cost of which would likely outweigh the benefits.

Capabilities on project:
Water

Comment	AECOM's Response
Assumptions for DWF are based on 150 litres / capita and future weather usage estimates could be much lower as "wise use of resources" sets in.	This is the current industry standard, and represents a sensible approach to quantification of wastewater. It is noted that usage estimates could be lower, but it is difficult to quantify this saving at present.
No green paper has been provided.	This is a States matter, AECOM cannot comment on this.
Climate effects must be better assessed, sedimentation, erratic weather, new seasonality etc.	Climate change should certainly be considered in the Strategy. Refer to section 7.4 of this report for further details.
The LWS represents a challenge to the strategic planning framework initiative in that from work undertaken so far there doesn't appear to have been much joined up ministerial activity to ensure that the decision making takes place in the sustainable development intersection of the three main sectors of government.	This is a States matter, AECOM cannot comment on this.