Ocean outlet for treated wastewater, Bunbury wastewater treatment plant

Water Corporation

Report and recommendations of the Environmental Protection Authority

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Summary and recommendations

Water Corporation of Western Australia, proposes to construct an ocean outlet at the Bunbury wastewater treatment plant to replace the existing disposal via lagoons and to allow disposal of up to 6000 ML/annum (forecasted for the year 2040) of treated wastewater to the ocean. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) Wastewater; and

(b) Marine environment, including water and sediment quality and marine flora and fauna.

The following factor, while relevant to the proposal, can be managed through the implementation of the proponent's commitments to meet the EPA's objectives:

(c) Coastal system, including dunes and foreshore, terrestrial flora and fauna, Aboriginal heritage and public health and safety.

Conclusion

The EPA has considered the proposal by the Water Corporation to construct an ocean outlet at the Bunbury wastewater treatment plant to dispose of up to 6000 ML/annum of treated wastewater to the ocean.

The EPA notes that apart from a 100 m mixing zone around the diffuser, a high level of protection will be maintained for the marine ecosystem in the region. A primary contact exclusion zone extending 100 m from the diffuser and a shellfish harvesting exclusion zone extending 500 m from the diffuser will be required. However the discharge of treated wastewater approximately 1.7 km offshore through the ocean outlet will lead to the improvement of water quality in the nearshore area near the wastewater treatment plant.

The EPA further notes that it is the intention of the Water Corporation to dispose of treated wastewater by a combination of reuse and disposal to the ocean, where the amount reused would be maximised at every viable opportunity. One potential reuse option, summer irrigation of Hay Park, has been identified so far.

The EPA notes the proponent's commitments to prepare and implement construction and operational Environmental Management Plans.

The EPA commends Water Corporation on the extensive community consultation that has been carried out and on Water Corporation's commitment to continue the process of public consultation in future decision-making.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

As separate advice to this proposal, the EPA encourages further investigations to assess the impact on marine ecosystem health of the cumulative load of nutrients it receives, and the development and implementation of strategies to reduce nutrient input to the Bunbury area from diffuse sources.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment and Heritage:

1. That the Minister notes that the project being assessed is for the construction and operation of an ocean outlet for treated wastewater from the Bunbury wastewater treatment plant.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3.
3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 6 and summarised in Section 4, including the proponent's commitments.
4. That the Minister imposes the conditions and procedures recommended in Appendix 6 of this report.
5. That the Minister notes the EPA's other advice presented in Section 5 in relation to cumulative impacts of nutrients on the marine waters in the Bunbury area.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by the Water Corporation to construct and operate an ocean outlet for treated wastewater from the Bunbury wastewater treatment plant, is approved for implementation. These conditions are presented in Appendix 6. Matters addressed in the conditions include the following:

(a) that the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 6;

(b) that the proponent shall manage the discharge of effluent from the outlet to achieve agreed ecosystem health objectives, fishing and aquaculture objectives and recreational and aesthetic objectives consistent with the EPA's framework for protection of coastal waters and marine ecosystems set out in the Authority's document "Perth's Coastal Waters, Environmental Values and Objectives." However the zones and the criteria applying to them may be varied on review by the EPA, as the procedures for the implementation of environmental quality objective zones are currently being developed;

(c) that the proponent be required to prepare a written prescription for contractor work practices covering pipeline installation and support vessel operation, to ensure that work practices are carried out in accordance with best practice in environmental management; and

(d) that the proponent be required to evaluate their environmental performance with regard to options for reuse of the treated wastewater every six years as part of the required Performance Review (Condition 10).

Contents

1 Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal by Water Corporation of Western Australia, to dispose of up to 6000 million litres per annum (ML/a) of treated wastewater to the ocean.

The Bunbury wastewater treatment plant (WWTP) is located approximately 7 kilometres (km) south of Bunbury and is situated on the coast behind the foredunes, approximately 300 metres (m) inland of the beach (Figure 1). Currently the wastewater treatment plant treats up to 6.6ML/day of predominantly domestic wastewater from the Bunbury city wastewater catchment. It is estimated that flows to the Bunbury WWTP will increase to an anticipated 16 ML/d by the year 2040.

The current treatment system at the plant is a combination of a trickling filter system with a capacity of up to 3.8 ML/d, and an intermittently decanted extended aeration (IDEA) plant which can treat up to 5.4 ML/d.

Following treatment, the wastewater is discharged to seven lagoons constructed in the coastal dunes. The wastewater infiltrates into the sand and then joins the groundwater flow to the ocean at the shoreline. Recent modelling indicates that the lagoons are operating at, or near to, capacity. The ocean outlet, with a diffuser between 1.58 km and 1.7 km out to sea, has been proposed for the disposal of wastewater to replace the infiltration system.

The proposal was set a formal level of assessment due to the potential impacts of contaminants in the wastewater on marine water quality, sediments, flora and fauna.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses environmental factors relevant to the proposal. The Conditions and commitments to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides Other Advice by the EPA, Section 6 presents the EPA's Conclusions and Section 7, the EPA's Recommendations.

Appendix 7 contains matters raised in submissions and the proponent's response to these matters. It is included for information only and does not form part of the EPA's report and recommendations. Issues arising from this process and which have been taken into account by the EPA appear in the report itself.

2. The proposal

The Bunbury wastewater treatment plant is located approximately 7 km south of Bunbury and is situated on the coast behind the foredunes, approximately 300 m inland of the beach (Figure 1). Currently the wastewater treatment plant treats an average daily flow of 6.6ML/d of wastewater from the Bunbury city wastewater catchment. It is estimated that flows to the Bunbury WWTP will increase to an anticipated 16 ML/d by the year 2040 due to population increases and the sewage in-fill programme.

The current treatment system at the plant is a combination of a trickling filter system with capacity up to 3.8 ML/d, producing treated wastewater containing on average 35 milligrams per litre (mg/L) total nitrogen (TN) and 10 mg/L total phosphorus (TP) and an IDEA plant which can treat up to 5.4 ML/d producing treated wastewater with an average 10 mg/L TN and 10 mg/L TP. The wastewater contains 100 000 colony forming units per 100 millilitres (cfu/100ml) of faecal coliform bacteria. It is proposed to limit the capacity of the trickling filter system to 3.0ML/d and expand the IDEA plant to 6.2 ML/d when necessary, to maintain the existing treatment total capacity of 9.2 ML/d. When the existing capacity is approached, another IDEA plant module would be built to replace the trickling filter plant. This is expected to occur in about 2005 – 2006, depending on growth rates in the region.

The plant produces 350 tpa of biosolids, which are trucked offsite and used by agricultural and horticultural enterprises as soil conditioner.

Fig 1

Currently treated wastewater is disposed of by pumping to seven permeable lagoons located near the shoreline. The wastewater infiltrates into the sand and into the groundwater and then joins the groundwater flowing to the ocean. The infiltration through the sand acts to reduce coliform bacterial concentrations. Recent measurements show faecal coliform levels along the shore in this area of the order of 10–20 cfu/100 mL. These levels are well within the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992) for primary contact recreation (e.g. swimming). The nitrogen and phosphorus (nutrient) levels in the treated wastewater are higher than those found in the natural environment and the current disposal practice has resulted in elevated nutrient levels in the nearshore adjacent to the wastewater treatment plant. In addition recent modelling indicates that increases in discharges above the average of 6.6 ML/d currently being discharged to the lagoons may cause surface ponding in winter and spring on the beach in front of the wastewater treatment plant. It is concluded that the lagoons are operating at, or near to, capacity.

It is proposed to dispose of treated wastewater via an ocean outlet, instead of via the current infiltration lagoons. Wastewater treatment plant Lagoons 1 and 2 will be drained, scraped and lined so that they are impervious. Secondary treated wastewater from the plant will be discharged to the lined lagoons to allow further polishing and reduction in bacterial levels. A weir manhole will be constructed adjacent to Lagoon 1 to allow tertiary treated wastewater to flow by gravity from the two lagoons to the ocean outlet pipeline through a 900 mm outside diameter (OD) pipe.

The other unlined lagoons will be retained to maintain groundwater levels if necessary for the protection of vegetation on the wastewater treatment plant site. They may also be used to store treated wastewater in event of an extended process breakdown or power failure. However the lagoons will not be used for the infiltration of treated wastewater under normal operating conditions.

An ocean outlet will be constructed, consisting of a 610 mm OD pipeline, heading offshore at a bearing of 290º from the dune blowout north of the WWTP. This will lead to a diffuser section 120 m long fitted with 30 ports which will have an 80 mm inside diameter. The diffuser will be located in approximately 11 m of water and end 1.7 km offshore.

The pipeline will be constructed through the blow-out foredune area and buried to a depth of at least 2 m across the beach and surf breaker zone. Beyond the surf breaker zone, the pipeline will be laid on top of the seabed within ±20 m of the proposed alignment inshore and within ±50 m at the offshore end.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Section 3 of the PER (Water Corporation 2000).

The proposal does not include:

- the replacement of the trickling filter plant with a second module of the IDEA plant; and
- any reuse options, including the proposed summer irrigation of Hay Park.

These aspects will be referred as separate projects to the EPA and the DEP at the appropriate time for consideration on environmental approval process requirements.

Since release of the PER, a number of modifications to the proposal have been made by the proponent. These include:

- change to the proposed zones of ecosystem protection (EQO 1) around the outlet. The PER set the level of protection for the ecosystem at moderate protection (E3), for a 500 m zone around the diffuser and a high level of protection (E2) beyond this zone. The proposal has been amended to a 100 m zone around the diffuser with a low level of protection (E4) and an E2 level beyond this zone;
- an additional commitment to undertake a stable nitrogen/isotopic ratio study in order to differentiate between nitrogen from anthropogenic and natural sources;

- the addition of a reference site for monitoring of marine ecosystem impacts to commitments;

Table 1: Key Proposal Characteristics

ELEMENT	PARAMETER	DESCRIPTION	
Proposal	Location	Reserve 37116, Lot 5262, Minninup Road, Bunbury WA 6230	
Treated wastewater	Treated wastewater quantity and quality to pipeline	**PARAMETER**	**MEAN CONCENTRATION OR VALUE**
		Volume: current 2040 estimated	Average 6.6 ML/d Average 16 ML/d
		Suspended solids (SS)	<20 mg/L
		Biological oxygen demand (BOD_5)	<20 mg/L
		Total Nitrogen (TN)	15 mg/L
		Total Phosphorus (TP)	10 mg/L
		Faecal coliform bacteria counts	<10,000 cfu/100 mL
		Discharge of TN to ocean	Maximum 60 tpa
Tertiary treatment lagoons	Description	Two lined lagoons designed to reduce bacterial levels in wastewater and also to reduce suspended solids concentrations. Existing Lagoons 1 and 2 will be modified to provide this treatment.	
	Area	10,000 m^2 and 9,600 m^2 respectively	
	Volume	16,000 m^3 and 14,000 m^3 respectively	
	Retention time	1.9 days @ 16ML/d	
Connecting pipeline	Description	Wastewater from the lagoons will enter a 900 mm diameter pipeline which leads to the outlet pipeline. This pipeline will pass through the dunes between Lagoon 1 and the dune blowout area.	
	Length	Approximately 180 m	
	Diameter	Approximately 900 mm	
Outlet pipeline	Description	Buried under the foredune, beach and surfzone and then sitting on the seabed leading to the diffuser.	
	Length	Onshore: ~100 m; Offshore including diffuser: 1.7 km	
	Diameter	610 mm outside diameter and 530 mm inside diameter.	
Outlet diffuser	Length	120 m	
	Diameter	610 mm outside diameter and 530 mm inside diameter	
	Number of ports	30 ports	
	Port diameter	80 mm	
	Initial dilution	At peak flow (24 ML/d): 1:90 to 1:150	
Marine habitat loss	Due to construction of pipeline	Approximately 0.1 ha of marine habitat	

- modification of the remediation proposal for the dune blow-out area to retain the natural features of the area;
- an additional commitment to address weed introduction and spread in the Construction Environmental Management Plan; and
- an additional commitment to prepare an Aboriginal heritage management plan which addresses the issues of consultation with local Aboriginal groups and obtaining advice from the Department of Aboriginal Affairs prior to construction.

The potential impacts of the proposal initially predicted by the proponent in the PER document (Water Corporation, 2000) and their proposed management are summarised in Table 3 (Appendix 3).

3. Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal and the

conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the relevant factors is summarised in Appendix 4. The reader is referred to Appendix 4 for evaluation of preliminary factors not discussed in detail in the main body of this report, including the reasons why these were not considered to be relevant factors.

It is the EPA's opinion that the following are the key environmental factors relevant to the proposal which require detailed evaluation in this report:

(a) Wastewater;

(b) Marine environment, including water and sediment quality and marine flora and fauna;

The following factor, while relevant to the proposal, can be managed through the implementation of the proponent's commitments to meet the EPA's objectives and the main issues are mentioned briefly in the following section:

(c) Coastal system, including dunes and foreshore, terrestrial flora and fauna, Aboriginal heritage and public health and safety.

Details on the relevant environmental factors and their assessment are contained in Sections 3.1 – 3.3 and also in Table 5 in Appendix 5. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

3.1 Wastewater

Description

Treatment of raw wastewater

The upgrade of the wastewater treatment plant is not part of this proposal. However the quality of treated wastewater disposed of through the ocean outlet is related to the environmental impact that this proposal will have. Therefore the treatment of the raw wastewater is relevant to this proposal and cannot be excluded from consideration of the proposal.

The current wastewater treatment system consists of a trickling filter system and intermittently decanted extended aeration (IDEA) system. The IDEA plant is capable of attaining substantially more reduction of nitrogen in the treated wastewater (approximately 10 mg/L) than the trickling filter plant (approximately 35 mg/L).

Neither treatment system attains removal of pathogens in the treated wastewater, although the concentration is reduced. The addition of polishing ponds in the proposal will reduce the pathogen concentration further, but not fully disinfect the treated wastewater. The pathogen concentration in the treated wastewater has led to the proposed creation of 100 m exclusion zone for primary contact and a 500 m exclusion zone for seafood harvesting around the diffuser.

No commitment to a timeframe for the upgrading of the wastewater treatment plant has been given, although this is expected to be necessary by 2005/2006 because of increased flow volumes.

Management of treated wastewater

The treatment of raw wastewater produces large volumes of treated wastewater. This treated wastewater must be utilized or disposed of in an environmentally acceptable manner.

Water Corporation undertook extensive community consultation regarding wastewater treatment and disposal in the 1990's and in 1995 released the document *Wastewater 2040: Strategy for the South West Region.* One of the major conclusions from the community involvement programme was that "marine disposal of treated wastewater effluent was considered by the

community to be unsatisfactory and the reuse of treated wastewater in industry, parks and gardens was preferred."

Following this report, Water Corporation investigated land disposal options for treated wastewater from the Bunbury area. It concluded that "land disposal solutions on the coastal plain hinterland around Bunbury were limited due to the generally high water table, high winter rainfall, and sensitivity of many possible sites with respect to run-off of treated wastewater containing nutrients" (PER, 2000).

In 1998 Water Corporation held a public workshop in Bunbury to discuss strategies for the disposal of treated wastewater. The three most favoured options were:

- ocean disposal;
- reuse on public parks and gardens with the balance to the ocean; and
- irrigation of the Binningup tree farm.

Water Corporation has recommended the option of reuse on public parks and gardens with the balance to ocean. To date only one reuse opportunity has been identified, namely, 3ML/day of irrigation in summer to Hay Park.

Submissions

Treatment of raw wastewater

Several submissions mentioned the level of treatment for wastewater. Comments included:

- Wastewater treatment and disposal in WA should meet international best practice standards.
- Water Corporation should allocate further funding towards the process of attaining drinking quality standard of the treated wastewater, and further recycling opportunities.
- It is recommended that the upgrade of the wastewater treatment plant be set as a condition on the proposal's approval.

Management of treated wastewater

Submissions supported the community's preference for land disposal of treated wastewater and the desire to be consulted in wastewater decisions. Some comments were:

- The long-term option for wastewater disposal should remain as land disposal. The projects outlined in the report *Wastewater 2040: Strategy for the South West Region* should be finalised.
- The ocean outlet should be considered as a temporary wastewater disposal solution only, as it will reach its capacity quickly. Water Corporation should actively seek ongoing land-use recycling options in the Bunbury area.
- It is suggested that a committee be formed to explore possibilities and opportunities for the increased use of treated wastewater, especially in new developments taking place in the Bunbury area.
- Wastewater should be treated and used for agricultural purposes and a valuable resource should not be wasted.

Assessment

The area considered for assessment of this factor is the marine environment impacted by the disposal of wastewater.

The EPA's environmental objective for this factor is to ensure that the waste minimisation hierarchy has been considered and to minimize the environmental impact of the treated wastewater disposal to the marine environment consistent with best practice and adoption of all reasonable and practicable measures for contaminant management.

Treatment of raw wastewater

Where wastewater is discharged to the environment, higher level treatment will minimise waste discharge and reduce potential environmental impacts through the reduction of contaminants in the wastewater. It is the EPA's preference that for ocean disposal, as much contaminant removal as reasonably achievable, is attained before discharge.

For some irrigation reuse, a lower level of treatment and a higher level of nutrient concentration may be acceptable if the crop to be irrigated can take up the nutrients.

Although the Water Corporation has not committed to a timeframe in which to achieve the upgrade of the treatment system and hence the reduction of nutrient discharge, it has committed to ensure that the maximum annual average nitrogen load to the ocean from the outlet is less than 60 tonnes per annum (commitment 3.6, Schedule 2, Appendix 6). Water Corporation has also committed to discontinue the current practice of discharging treated wastewater to unlined lagoons, except where maintenance of flows is required to avoid stress on nearby trees (commitment 3.6, Schedule 2, Appendix 6). In order to cater for the expected volumes of treated wastewater in the future and meet the commitments, treatment must be improved beyond the current average level of approximately 15 mg/L of total nitrogen, or alternative disposal options for the treated wastewater found.

Water Corporation has also committed to bringing forward the upgrade of the treatment system if monitoring shows unacceptable marine environmental impacts (commitment 3.6, Schedule 2, Appendix 6).

Although it would be preferable for the wastewater treatment plant to be upgraded and the quality of the treated wastewater improved prior to ocean discharge, the EPA accepts that this is currently not essential to prevent unacceptable adverse impact on the environment. The commitments made by Water Corporation are considered sufficient to safeguard the environment from significant environmental impacts, although best practice may not be attained. The EPA encourages the proponent to continue to minimise waste discharge to the environment by continual improvement of wastewater treatment methods.

Management of treated wastewater

It is the EPA's preference for reduction, reuse or recycling of waste (WAste, 2000). However investigation by the Water Corporation has shown that there are currently limited alternative disposal options available.

The proponent has made a commitment to continue to investigate reuse options and to report triennially on investigation and implementation of reuse to the DEP and the community (commitment 1 of Schedule 2, Appendix 6). The proponent is also committed to on-going community consultation (commitment 4 of Schedule 2, Appendix 6).

In addition the EPA has included the reuse of treated wastewater for review in the six yearly environmental performance review required by condition 10 (Appendix 6).

Summary

Having particular regard to:

(a) the proponent's commitment to limit discharge of total nitrogen to 60 tpa ;

(b) the proponent's commitment to bring forward the upgrade of the wastewater treatment plant if unacceptable environmental impacts are found;

(c) the proponent's commitment to continue to investigate reuse opportunities; and

(d) the current limitations on the practicability of reuse in the immediate area,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that environmental performance in relation to treated wastewater use is reviewed six yearly.

Specific reuse options should be referred to the EPA for consideration of level of assessment.

3.2 Marine environment

Description

The marine environment will be impacted temporarily by the construction of the outlet and in the long term by the discharge of treated wastewater from the outlet.

Construction impacts

The location of the pipeline route and diffuser was selected by the proponent following assessment of the following factors:

- proximity to degraded dune blowout area north of the WWTP;
- diffuser to be located at a minimum water depth of 10 m to achieve a necessary level of initial dilution;
- requirement for diffuser to be well beyond the surf zone and in an area of predominantly longshore (parallel to the coast) currents;
- suitable bathymetry to place pipe and diffuser; and
- location of benthic habitat least likely to be impacted by any local increase in nitrogen concentrations.

The construction of the outlet will cause some damage to the existing marine flora and habitat along the pipeline route. No declared rare or priority marine flora were listed for the survey area (PER, 2000). There are a number of low reefs along the route which will require levelling for the laying of the pipeline. Mechanical removal of rock or reef will be the preferred option. However it may be necessary to blast in places. A total of approximately 0.1 ha of marine habitat will be affected.

Impacts due to discharge of treated wastewater

The marine environment may be impacted by the long-term discharge of toxicants, nutrients and pathogens in the treated wastewater.

Over the last few years the EPA has been developing a management framework based on defining Environmental Values and Objectives to protect coastal waters and marine environment systems. The EPA is also developing quantitative Environmental Quality Criteria (EQCs) to correspond with each level of EQO. The ANZECC (2000) guidelines provide an authoritative and comprehensive basis for developing and applying EQC to support the management framework.

The ANZECC water quality guidelines promote a more holistic approach to aquatic ecosystem management (ANZECC, (2000)). There is a greater focus on issue based management of water quality rather than individual parameters.

The EPA document *Perth's Coastal Waters, Environmental Values and Objectives*, (EPA 2000) proposes six environmental quality objectives (EQOs) which can be used to define the management goals for designated areas of the marine environment. These EQOs are for the maintenance of:

1. ecosystem integrity;
2. aquatic life for human consumption;
3. primary contact recreation values;
4. secondary contact recreation values;
5. aesthetic values; and
6. industrial water supplies.

The EQO for the maintenance of ecosystem integrity is divided into four levels of protection, namely, total (E1), high (E2), moderate (E3) and low (E4). The qualitative limits of acceptable change for these levels are indicated in the table below.

Table 2: Levels of protection for EQO 1.

EQO 1 Level of protection (code)	Relative protection	Limit of acceptable change
Level 1 (E1)	total protection	no detectable changes from natural variation
Level 2 (E2)	high protection	some small changes from natural variation
Level 3 (E3)	moderate protection	moderate changes from natural variation
Level 4 (E4)	low protection	large changes from natural variation

The levels can be defined in terms of changes from natural conditions for a range of elements, namely, ecosystem processes, biodiversity, abundance and biomass of marine life and quality of water, biota and sediment. Preliminary qualitative limits of acceptable change for these elements are presented in Appendix B of EPA, 2000.

The proponent has defined by means of designated zones, the EQOs and level of protection that it aims to meet in the vicinity of the outlet (Figure 2 and Water Corporation 2000 (b)). These EQOs have been modified from those in the PER during the assessment. The EQOs and associated EQCs are to be met with a 95% level of confidence (Water Corporation 2000 (a)). These EQOs are:

- within 100m of the diffuser a low (E4) level of protection for ecosystem integrity (EQO 1);
- outside of the 100m zone a high (E2) level of protection for ecosystem integrity will be met;
- within 500m of the diffuser a seafood harvesting (EQO 2) exclusion zone (S2) will apply;
- within 100m of the diffuser a primary contact recreation (EQO 3) exclusion zone (S3) will apply; and
- EQOs 4, 5 and 6 will not be affected by the presence of the outlet.

Toxicants

Treated wastewater contains toxicants such as heavy metals, organochlorines and hydrocarbons. ANZECC (2000) recommends guideline trigger values (hereafter referred to as "guideline values") for these contaminants in marine waters that will protect certain percentages of species found in the marine environment. If concentrations of a toxicant are below these guideline values, the percentage of species to which the value applies will be protected. However if the concentration of the toxicant is above the guideline value, it does not necessarily mean that species will be affected. It is intended that exceedence of the guideline value will trigger further investigation and risk-based assessment protocols to define at what point ("standard" criteria) there is an unacceptable risk that the intended species protection target will not be met. These "standard" criteria may be generic or site specific but are proposed to be a composite of a variety of indicators providing "multiple lines of evidence" that a concerted and co-operative management is required to ensure the EQOs are met and maintained. A third set of criteria will be established above which pollution is considered to have occurred. At the present time neither the "standard" nor the "pollution" criteria have been established.

The ANZECC (2000) guidelines propose guideline values for 99%, 95%, 90% and 80% levels of species protection. The DEP considers that the 99% level can be equated to the high (E2) level of protection and the 90% to the moderate (E3) level for ecosystems. The designated ecological protection zones for this proposal have been calculated on the basis that the

concentrations of toxicants will be below the guideline values given in ANZECC (2000), or other recognised standards where ANZECC does not supply a value.

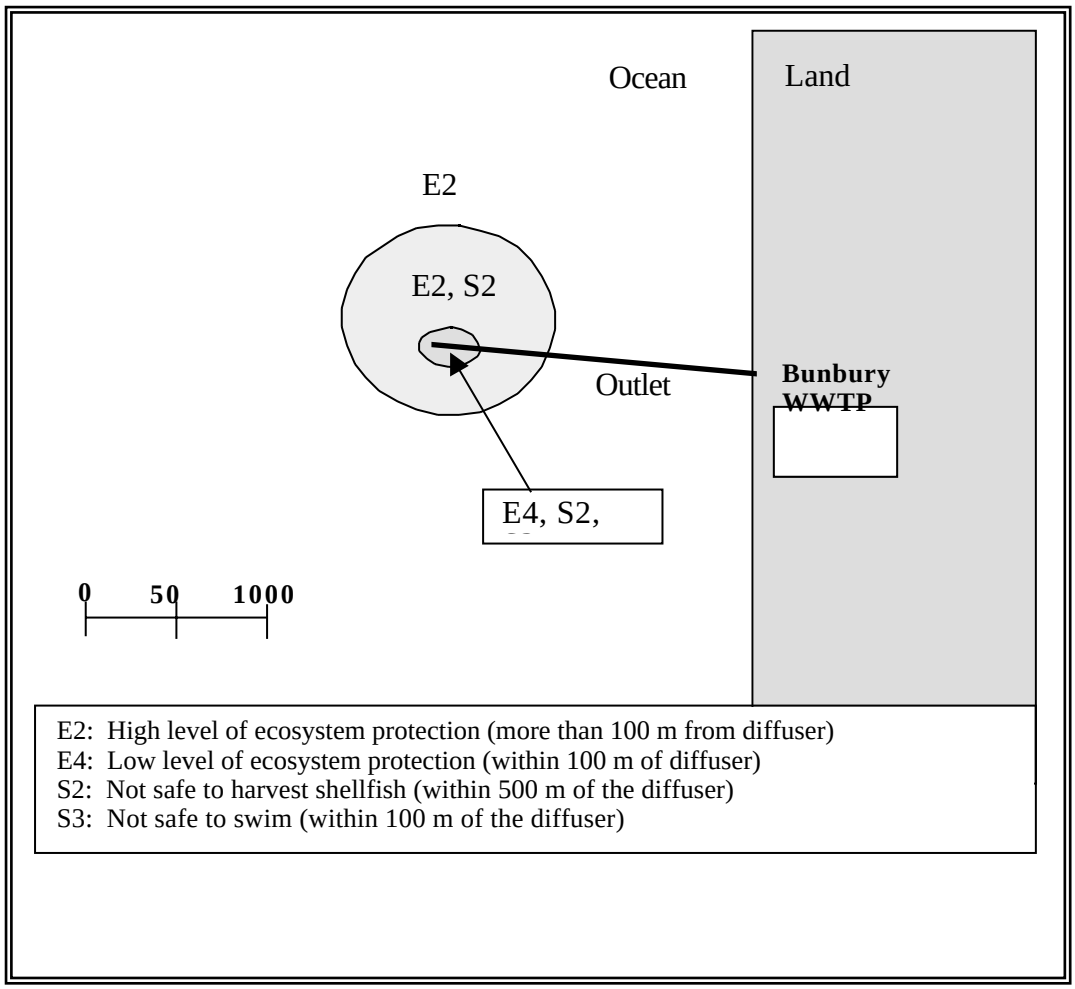

FIGURE 2 BUNBURY OCEAN OUTLET

Schematic diagram showing levels of protection based on the EPA working document "Perth's Coastal Waters, Environmental Values and Objectives", Environmental Protection Authority, February 2000.

In this proposal it was found that copper was the toxicant of highest concern and that based on total copper concentrations, the E2 criteria may not be met at the predicted 100m distance from the diffuser. Further analysis of the copper in the treated wastewater, showed that the bio-available fraction of copper would meet the E2 criteria at 100m from the diffuser, and therefore the environmental quality objective could be met (Water Corporation 2000 (a)).

Concentrations of dieldrin and chlorpyrifos were initially thought to be present in the treated wastewater. Further investigation and analysis has shown that it is unlikely that significant concentrations of dieldrin are present (Water Corporation 2000 (c)). Some chlorpyrifos is present in the treated wastewater. However current indications are that the concentration of chlorpyrifos is such that after initial dilution and 100m from the diffuser, it will be below the E2 guideline value for marine water.

ANZECC (2000) provides interim sediment quality guideline values for metal and organic contaminants as guideline trigger values (ISQG – low) and high values (ISQG – high). A background survey of sediment and water quality in the area of the proposed ocean outlet using sediment and mussel analysis, has found that "the metal and pesticide levels observed in the

sediments and in the tissues of deployed mussels indicate that the sediments and waters in the vicinity of the proposed ocean outlet are clean on a regional and national scale and the sediments are clean" (PER, 2000). One site approximately 1 km north of the proposed outlet showed concentrations of arsenic in sediment above ANZECC guideline trigger values, but no reason was found for the presence of arsenic. Sediment quality is consistent with an E2 level of ecosystem protection which allows small detectable changes in the quality of water, biota and sediment, but no resultant effect on biota.

The primary contact and seafood harvesting zones are not based on toxicant concentrations as the marine ecosystem is the more sensitive receptor, with respect to toxicant concentrations. Primary contact and seafood harvesting exclusion zones (S2, S3) are based on predicted exceedence of bacteriological criteria.

Nutrients

The treated wastewater contains concentrations of nitrogen and phosphorus. Studies have shown (eg DEP, 1996) that, in Perth coastal waters, inorganic nitrogen is the nutrient primarily limiting algal growth. Increased nitrogen concentrations can cause increases in phytoplankton and periphyton biomass, changes in species composition and impact other marine flora through shading and smothering.

ANZECC (2000) provides recommended guideline values for chlorophyll a, total phosphorus, filterable reactive phosphorus, total nitrogen, oxides of nitrogen, ammonium ion, dissolved oxygen and pH for marine waters which are applicable to Geographe Bay. Background studies have found that the marine environment in the vicinity of the proposed outlet is very productive and that the guideline values for chlorophyll a, total phosphorus and ammonium are already exceeded. Other nutrients are approaching the guideline values. This increased productivity may be due to impacts of the discharge of nutrients from other sources, such as agricultural drains, rivers and the Leschenault Inlet. Further investigation is needed to assess if marine ecosystem health is being impacted by cumulative loads of nutrients.

The proponent has predicted that there will be slight increases in nitrogen concentration attributable to the treated wastewater plume within approximately 500 m of the Bunbury Ocean outlet (PER 2000). Even if a small increase in chlorophyll a is detectable, it is unlikely that this increase will be sufficient to result in an adverse impact to the marine ecosystem. For the purpose of monitoring, chlorophyll a is treated as a "water quality" parameter, for which small changes from natural variation are acceptable in an E2 zone. Any detected biomass increase will indicate the need to monitor against the "standard" criteria to ensure that the E2 level of protection is maintained outside the E4 zone. To exceed "standard' criteria would require multiple lines of evidence of impact to marine ecosystem health. Therefore, with respect to nutrients, the high (E2) level of protection for marine ecosystems which allows some small change from natural variation, but no resultant effects on key ecological attributes (e.g. seagrass meadows, algal dominated reefs), is likely to be met outside the 100 m E4 zone.

Bacteriological contaminants

The treated wastewater will contain approximately 10 000 colony forming units per 100 millilitres (cfu/100mL). The main effect of the bacteriological contaminants is on primary contact recreation and the suitability of shellfish for human consumption.

Modelling of the expected maximum discharge was used as a worst case scenario to predict the dilution of the treated wastewater and the maximum likely extent of bacterial contamination. Criteria for shellfish harvesting of 14 most probable number (MPN)/100mL for the median faecal coliform concentration with no more than 10% of samples exceeding 43 MPN/100ml and of 150 cfu/100mL median bacterial content for primary contact have been applied (ANZECC, (2000)).

Results of the modelling under different conditions has led to the conclusion that a 100 m radius zone around the diffuser should be designated as unsuitable for primary contact and a 500 m radius zone as unsuitable for shellfish harvesting.

The location of the exclusion zones will be publicised to warn the public of the possible health risk associated with them.

Submissions

Submissions concerning construction impacts referred to the fact that the pipeline alignment had not been surveyed and asked how underwater digging was to be carried out. The opinion was expressed that the construction of the pipeline should give high priority to avoiding or minimising impacts on seagrasses. The basis for statements that turbidity would not have a sustained impact was requested. Another submission asked how rapidly the habitat would recover.

Several submitters were concerned about the ecological impacts of the treated wastewater disposal regarding long term impacts, nitrogen and phosphorus concentrations, toxicant concentrations, phytoplankton, fauna and cumulative impacts. Several questions regarding the modelling study and use of predicted concentrations and volumes, the size of predicted zones and the situation of the diffuser were also raised. The origin of the already elevated nutrient concentrations was questioned. Information on current sediment quality survey was requested by the DEP for recording as existing background conditions.

Submissions also addressed the issue of advising the public of the areas unsuitable for primary recreation and shellfish harvesting.

A copy of the proponent's response to submissions can be found in Appendix 7.

Assessment

The area considered for assessment of this factor is the pipeline route and the marine environment in the area of influence of the treated wastewater discharge.

The EPA's environmental objective for this factor is to maintain or improve the quality of marine water and sediment consistent with agreed EQOs, and corresponding ANZECC (2000) or other acceptable criteria. In principle the ecosystem integrity consistent with EQO 1 at a total or high level of protection (E1 or E2) should be aimed for wherever practicable. Where the high level of protection cannot be met, areas of lower levels of protection for ecosystem integrity should be minimised. With respect to other EQOs, the EPA's objective, as a starting point, is to protect all social values.

Construction impacts

The proponent investigated alternative sites for the ocean outlet, both in terms of location along the shore and distance of the diffuser from the shore. The location of the diffuser was chosen on the basis of maximising the amount of sand and reef habitat and minimising the seagrass habitat in the vicinity of the diffuser location (PER, 2000). The Water Corporation considered that there was no environmental benefit to locating the diffuser an additional 200m out further from the reef area as the diffuser is designed with risers that direct the discharge upwards. Treated wastewater will only reach the benthic habitat after initial dilution and mixing back through the water column. The EPA accepts the proponent's argument that a 200 m extension will cause more damage to the seabed during construction and that the cost of the extension would not justify the possible small environmental benefit.

The EPA notes that a full description of construction techniques has not been supplied as these will not be decided until the contract is awarded. Therefore the Environmental Management Plans (EMPs) for marine construction and blasting (if required) are an important requirement, and the proponent has made commitments to prepare and implement these plans (commitments 2.7, 2.8, 2.9 and 2.10. Schedule 2, Appendix 6).

The pipeline will cross the beach and will be buried to the 5 m depth contour. This will require a temporary construction groyne to be built across the beach offshore to the 3 m depth contour. Construction of this groyne and potential impacts also need to be addressed in the EMP.

A transect of the pipeline route shows it to be well vegetated with few areas of bare sand and the construction of the pipeline will cause some damage to marine flora and fauna habitat. Management to minimise the impact of construction will be required. It is anticipated that within weeks of pipeline construction, algae, bacteria and sessile organisms will have colonised

the pipeline and disturbed reef. Within a year these hard substrates should be virtually indistinguishable from undisturbed reefs in terms of species.

There are a number of low reefs that will require levelling for the laying of the pipeline. If blasting is required the management plan should address the protection of marine mammals, especially migratory and threatened whale species that are found in the area. Should there be any significant impact on these species, referral to Environment Australia will be required. At present it is envisaged that only small charges will be necessary for blasting, if at all, and appropriate measures will be implemented to ensure no impact on marine fauna from blasting. This activity can also be scheduled to avoid the whale migration season.

Condition 9 contained in Appendix 6, requires that the proponent prepares a written prescription for contractor work practices covering pipeline installation and support vessel operation to ensure that work practices are carried out at the level of international best practice.

Impacts due to discharge of treated wastewater

The proponent's modelling and dilution predictions were reviewed and appear to be reasonable and attainable. The results show a zone of low level of ecosystem protection and a primary contact exclusion zone extending 100 m from the diffuser, together with a shellfish harvesting exclusion zone of 500 m from the diffuser. While the EPA would prefer to maintain a high level of ecosystem protection and all social environmental values throughout the marine environment, in the immediate vicinity of the outlet this is not practicable with the quality of effluent from the proposal. The level of environmental impact in the immediate vicinity of the outlet is considered minimal on a regional scale, given that a high level of ecosystem protection is being maintained outside the 100 m zone around the diffuser.

The EPA notes that for this proposal the ANZECC (2000) Water Quality Guidelines have been applied within the context of the marine environmental quality management framework being developed by the EPA (see EPA 2000). The framework is currently well developed but as yet incomplete. Work is currently underway to develop "standard" and "pollution" criteria and to identify indicators for establishing and measuring ecosystem health. For this reason, the designated zones and associated levels of protection and the "guideline" values and "standard" criteria applying to them, may need to be reviewed by the EPA as the process is developed.

The environmental quality guideline values and "standard" and "pollution" criteria will also be reflected in the emission concentration limits and monitoring requirements to be set under the operating licence required by the DEP. Emission limits will need to ensure that the levels of protection for the ecosystem are achieved in the zones as defined, taking into account the design and operating conditions of the outlet. Emission limits will also be based on waste minimisation and best practice principles and the need for all reasonable and practicable measures to be taken to minimise total loads of contaminants to the environment. Monitoring requirements will be based on the guideline values and the standard criteria to be established.

The construction and commissioning of the outlet will improve the quality of the near-shore marine environment in the vicinity of the wastewater treatment plant. The impact of nutrients and toxicants will be removed from this environment and transported off-shore where more predictable dilution will be obtained and impacts will be more predictable and manageable.

Toxicants

The concentration of the major toxicants in the treated wastewater has been established and it is predicted that after 100 fold dilution and at 100 m from the diffuser the bio-available concentration of toxicants will meet the trigger guideline values (ANZECC (2000)) for 99% species protection (E2). The one possible exception to this, is chlorpyrifos, the concentration of which has been difficult to establish. Further investigation is continuing. Should it be found that the concentration of chlorpyrifos does exceed the E2 guideline value at 100 m from the diffuser, it will be necessary for the proponent to take steps to reduce the concentration in the treated wastewater, for example by reducing the source of the contaminant or treating the wastewater further, or demonstrate on a site specific basis that the concentration is not causing an adverse impact on the ecosystem.

The proponent has committed to prepare and implement an Operations EMP that will include:

- operating the wastewater treatment plant such that national guidelines for toxicant concentrations in marine waters are met;
- operating the wastewater treatment plant such that agreed EQOs and EQC are met to 95% confidence limits;
- monitoring of contaminant levels in treated wastewater at Bunbury WWTP;
- designing of water quality monitoring programs which have the ability to measure long-term changes in water quality, including changes in productivity, biodiversity and ecosystem processes. A reference site will be included for comparison;
- contingency planning to improve water quality or reduce loads of contaminants and nutrients discharged if monitoring shows that agreed criteria are not met;
- designing monitoring programs for the sediments in the vicinity of the outlet; and
- contingency plans for non-standard operation of the WWTP.

Nutrients

The annual average nutrient levels in offshore waters at Bunbury were found to be slightly higher than those for Perth's offshore waters (PER, 2000). The higher level of nutrients present in the marine environment has been attributed to the productivity of the seafloor at Bunbury. Further investigation of this is considered necessary in order to determine the source of the nutrients (i.e. to determine if the marine ecosystem is already impacted by human activity) and distinguish future changes due to the outlet. The proponent has made a commitment to design an appropriate study to differentiate between natural and anthropogenic sources of nitrogen currently existing and due to future discharge from the outlet (Water Corporation 2000 (b)).

As the nutrient concentration levels offshore at Bunbury currently approach or exceed the guideline trigger values recommended in ANZECC (2000), it will be necessary to develop site specific nutrient impact indicators and "standard" criteria to establish if the nutrient load is affecting the ecosystem at unacceptable levels. The EPA recognises that some small increase in phytoplankton and periphyton biomass may be detectable outside the 100 m zone. This does not necessarily mean that the E2 level of protection has not been met. The "standard" criteria should comprise of multiple lines of evidence so as to establish that there has been measurable and adverse change in marine ecosystem health. For example, guideline values may be set for light attenuation, phytoplankton and algal growth stimulation potential (e.g. measured as periphyton biomass), which if exceeded, lead to monitoring against appropriate "standard criteria" such as light received by the seagrass leaves and measurable reduction in seagrass growth rate or density. These latter criteria are set as precursors to loss or serious damage to the key environmental attribute needing protection. The proponent should consult with the DEP with regard to the work currently underway for Perth Coastal Waters to determine which nutrient related indicators are appropriate to the Bunbury site. If the "standard" criteria are exceeded, management of nutrient load must be initiated.

The limitation of total nitrogen discharge to the marine environment of 60 tonnes per annum (tpa) is a key commitment. For comparison, the discharge of total nitrogen from Perth metropolitan outlets in 1998/1999 was 662 tpa from Swanbourne, 891 tpa from Ocean Reef and 2292 tpa to the Sepia Depression (PER, 2000). Monitoring at Perth outlets has shown some impact in terms of an increase in phytoplankton and periphyton growth. However the nutrient discharge from the Bunbury outlet is an order of magnitude less than that of the Perth outlets.

The proposal to dispose of treated wastewater from the Bunbury wastewater treatment plant via an ocean outlet will not add substantially to the load of nutrients already reaching the marine environment due to the infiltration of wastewater via the existing lagoons. In terms of overall load to Geographe Bay from rivers, drains and groundwater, the amount of nutrients from the outlet is approximately 4 % of the load for total nitrogen and 36 % of the load for total phosphorus, based on 1992/1993 data (PER, 2000).

In addition to the commitments detailed under toxicant management the proponent has committed to including in the Operations EMP the following measures:

- deriving site specific trigger levels for waters in the vicinity of the outlet for indicators other than toxicants, where appropriate (ANZECC, (2000));
- bringing forward the upgrade of the wastewater treatment system if monitoring shows unacceptable environmental impacts;
- discontinuing the current practice of discharging treated wastewater to unlined lagoons, except where flows are required to avoid stress on nearby trees; and
- ensuring maximum annual average nitrogen load to the ocean from the outlet is less than 60 tpa.

Bacteriological contaminants

The EPA considers that the proposed exclusion zones for primary contact recreation and shellfish harvesting based on the discharge plume modelling are attainable and reasonable.

However, it is recommended that the standard of 35 enterococci organisms/100 ml is applied to the primary contact recreation zone. Fish caught outside of the 500 m zone should also comply with the Food Standards Code (ANZFA, 2000). A revision of health standards is being undertaken and it is likely that some changes will be made.

No submissions were received from the public on these exclusion zones. The EPA considers that the loss of social value in these two zones is acceptable given their location off-shore and their relatively small size.

The EPA notes the proponent's reasons for not wanting to mark restricted marine areas with buoys, which are that:

- no Perth outlets are marked with buoys and there has been no need to mark them;
- buoys are likely to be lost due to theft or storms, and may attract people to the area; and
- the location of the diffuser will be advertised in the local press and marked on navigation charts.

The proponent has undertaken to continue public consultation and distribute information about the monitoring of the plume to Local Government, Government Departments, Community Interest Groups and the general public to ensure that public health is protected (Response to Submissions, Appendix 7).

The proponent has committed as part of the Operations EMP to prepare a recreational water quality management plan that addresses the following issues:

- designing a bacterial monitoring program which will establish whether primary contact criteria are met at 100 m from the diffuser and whether shellfish harvesting criteria are met at 500 m from the diffuser; and
- contingency planning to improve water quality if monitoring shows that agreed criteria are not met.

Should monitoring show that standards outside of agreed exclusion zones are being exceeded, further treatment of the wastewater is possible and will be necessary to meet the proponent's commitments.

Summary

Having particular regard to the:

(a) additional information provided through assessment;

(b) predicted impacts relating to environmental quality objectives;

(c) commitment to limiting ocean discharge of total nitrogen to 60 tonnes per annum;

(d) commitment to undertaking a study to establish anthropogenic and natural sources of nitrogen in the marine environment;

(e) proponent's operational management commitments; and

(f) requirement for an operational licence from the DEP,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that recommended conditions 7 and 9 are implemented.

3.3 Coastal system

Description

Dunes and foreshore

It was proposed that following construction of the pipeline, the degraded foredunes and dune blowout area would be stabilised and rehabilitated.

Other areas of the beach and dunes impacted by the construction of the pipeline will be fully restored to their original form.

Terrestrial flora and fauna

During the construction of the pipeline and connecting pipe work there will be a small amount of disturbance to terrestrial flora.

The vegetation on the eastern section of the wastewater treatment plant contains Tuart trees. The vegetation, habitats and communities represented by the Tuart Woodlands and forests in the wastewater treatment plant area are given a high conservation value because of their good condition and because of the general scarcity of this vegetation unit in healthy condition, particularly in conservation reserves (PER, 2000). When the lagoons at the wastewater treatment plant are no longer used for infiltration of treated wastewater, it is expected that the groundwater levels at the site will decline. As the Tuart trees may have adjusted to the current elevated groundwater level at the site, a sudden drop in level may stress the trees.

Construction work may introduce or spread weeds on the wastewater treatment plant site.

Since most of the construction activity will take place at the dune blow out, any impact on terrestrial fauna should be limited and temporary in nature.

Aboriginal heritage

Aboriginal burial sites are commonly found in Holocene coastal dunes along the Western Australian coast.

The proponent has undertaken to consult the local Aboriginal population prior to commencement of construction with regard to the significance of the site and take appropriate action as required following the consultation (PER, 2000).

Public health and safety

The area of beach and ocean impacted by the construction of the pipeline is used for a variety of recreational pursuits. The dune blow out is used by trail bike riders and four wheel drivers, however this is not a use approved by the Water Corporation or the City of Bunbury. The beach is used by four wheel drivers for access to other points and areas off-shore are used for recreational fishing and crayfishing.

It will be necessary to close a 150 m section of the beach from the dunes to the surf zone during the construction of the pipeline for approximately nine months.

Submissions

Dunes and foreshore

Two submissions raised the issue that the dune blow out is a natural feature and not man made; to revegetate it would therefore not be rehabilitation.

Terrestrial flora and fauna

Submissions mentioned that the PER did not address introduced weed species and their impact on conservation values. Methods to prevent accidental introduction of weeds into the area during the construction and other disturbance works, as well as control methods during this phase of the project should be described.

Another submission requested that the community be consulted on the effects of reduced groundwater levels on the Tuart trees.

Aboriginal heritage

The Department of Aboriginal Affairs advised that it should be consulted regarding cultural and archaeological sites and how work should proceed.

Public health and safety

No submissions relating to public safety during construction of the pipeline were received.

Assessment

The area considered for assessment of this factor is the dune and beach area and other areas of the wastewater treatment plant site impacted by the pipeline construction.

The EPA's environmental objective for this factor is to maintain or improve the integrity, function and environmental values of the dune and foreshore area, to protect threatened ecological communities and critical habitats, and to protect Declared Rare and Priority Flora consistent with the provisions of the *Wildlife Conservation Act 1950.*

For Aboriginal Heritage the EPA's objective is to ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972.

For public health and safety the EPA's objective is to maintain public safety during construction.

Dunes and foreshore

In response to submissions, the proponent has modified the proposal and now proposes to revegetate the low foredune at the western extent of the dune blow-out and leave the sandbowl as it is.

Terrestrial flora and fauna

In response to submissions the proponent has added addressing the introduction and spread of weeds to the commitment for the preparation and implementation of a Construction Environmental Management Plan (commitment 2.5, Appendix 6).

The proponent has also undertaken to keep the community reference group informed of the status of the Tuart trees and the proposed management of the decommissioning of lagoons (Response to Submissions, Appendix 7). Provision has been made to retain treated wastewater in the lagoon system if it is necessary for the health of the trees.

The Construction Environmental Management Plan will also contain management measures to ensure minimal impact on dune vegetation.

Aboriginal heritage

The proponent has committed that the excavation of the beach and dune blowout area will be excavated in accordance with a plan prepared as part of the Construction EMP and this has been added to the commitments table. This plan will include a strategy for responding to any

discoveries of items of heritage significance to ensure that the work is undertaken in accordance the *Aboriginal Heritage Act 1972* and will be on the advice of the Department of Aboriginal Affairs.

Public health and safety

To manage construction impacts on public safety, the proponent has committed to include in the Construction Environmental Management Plan:

- restriction of public access to the construction site;
- marine equipment complies with Department of Transport regulations; and
- public notification of any restrictions.

Summary

Having particular regard to the:

(a) modification to the proposal;

(b) additions to commitments; and

(c) the proponent's commitment to a Construction Environmental Management Plan, that will address dune and beach rehabilitation, terrestrial flora management, Aboriginal heritage issues and public safety,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor

4 Conditions and commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal and, following discussion with the proponent, the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure enforceability, then form part of the conditions to which the proposal should be subject, if it is to be implemented.

4.1 Proponent's commitments

The proponent's commitments as set out in the PER, and subsequently modified as shown in Appendix 6, should be made enforceable.

4.2 Recommended conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by the Water Corporation to construct and operate an ocean outlet for treated wastewater from

the Bunbury wastewater treatment plant, is approved for implementation. These conditions are presented in Appendix 6. Matters addressed in the conditions include the following:

(a) that the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 6;

(b) that the proponent shall manage the discharge of effluent from the outlet to achieve agreed ecosystem health objectives, fishing and aquaculture objectives and recreational and aesthetic objectives consistent with the EPA's framework for protection of coastal waters and marine ecosystems set out in the Authority's document "Perth's Coastal Waters, Environmental Values and Objectives." However the zones and the criteria applying to them may be varied on review by the EPA, as the procedures for the implementation of environmental quality objective zones are currently being developed;

(c) that the proponent be required to prepare a written prescription for contractor work practices covering pipeline installation and support vessel operation, to ensure that work practices are carried out in accordance with best practice in environmental management; and

(d) that the proponent be required to evaluate their environmental performance with regard to options for reuse of the treated wastewater every six years as part of the required Performance Review (Condition 10).

It should be noted that other regulatory mechanisms relevant to the proposal are works approval and operating licence from the DEP.

5. Other Advice

Cumulative impacts of nutrients on the marine environment

The amount of nutrients discharged by the wastewater treatment plant to the marine environment is likely to be a relatively small portion of the total nutrient load being received by the wider waters of Geographe Bay. The nitrogen isotopic study to be undertaken by the Water Corporation will assist in establishing how much nitrogen in the marine environment in the Bunbury area is from anthropogenic sources. It is generally accepted that the coastal waters of Geographe Bay have elevated levels of nutrients originating from land-use practices in the catchment (eg agricultural fertilizer application), which are transported from the land catchment via surface and groundwater to the ocean. The EPA encourages further investigations to assess the impact on marine ecosystem health of the cumulative load of nutrients it receives, and the development and implementation of strategies to reduce nutrient input to the Bunbury area from diffuse sources.

6. Conclusions

The EPA has considered the proposal by the Water Corporation to construct an ocean outlet at the Bunbury wastewater treatment plant to dispose of up to 6000 ML/annum of treated wastewater to the ocean.

The EPA notes that apart from a 100 m mixing zone around the diffuser, a high level of protection will be maintained for the marine ecosystem in the region. A primary contact exclusion zone extending 100 m from the diffuser and a shellfish harvesting exclusion zone extending 500 m from the diffuser will be required. However the discharge of treated wastewater approximately 1.7 km offshore through the ocean outlet will lead to the improvement of water quality in the nearshore area near the wastewater treatment plant.

The EPA further notes that it is the intention of the Water Corporation to dispose of treated wastewater by a combination of reuse and disposal to the ocean, where the amount reused would be maximised at every viable opportunity. One potential reuse option, summer irrigation of Hay Park, has been identified so far.

The EPA notes the proponent's commitments to prepare and implement construction and operational Environmental Management Plans.

The EPA commends Water Corporation on the extensive community consultation that has been carried out and on Water Corporation's commitment to continue the process of public consultation in future decision-making.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

As separate advice to this proposal, the EPA encourages further investigations to assess the impact on marine ecosystem health of the cumulative load of nutrients it receives, and the development and implementation of strategies to reduce nutrient input to the Bunbury area from diffuse sources.

7. Recommendations

The EPA submits the following recommendations to the Minister for the Environment and Heritage:

1. That the Minister notes that the project being assessed is for the construction and operation of an ocean outlet for treated wastewater from the Bunbury wastewater treatment plant.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3.
3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 6 and summarised in Section 4, including the proponent's commitments.
4. That the Minister imposes the conditions and procedures recommended in Appendix 6 of this report.
5. That the Minister notes the EPA's other advice presented in Section 5 in relation to cumulative impacts of nutrients on marine waters in the Bunbury area.

Appendix 1

List of submitters

Organisations:

Conservation Council
Health Department of WA
South West Environment Centre
Shire of Capel
Department of Environmental Protection

Individual:

Mr B Bischoff
Dr G H Thompson

Appendix 2

References

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Appendix 3

Potential impacts of the proposal predicted by the proponent

Table 3. Potential impacts of the proposal predicted by the proponent

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Recreation	Not to compromise recreational uses of the area, as developed by planning agencies. Protect the recreational value of the area consistent with EQOs 2, 3, 4, 5: Fishing and Aquaculture and Recreation and Aesthetics as defined in the Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000).	The dune blowout area is currently used for recreation by four wheel drive enthusiasts and trail bike riders. The beach is traversed by four wheel drive enthusiasts moving between Bunbury and Dalyellup several kilometres south. The beach adjacent to the WWTP is occasionally used for swimming and recreational activities. The beach is not a surfing beach. The reefs offshore are targeted for fish and crayfish by recreational fishers.	Access to the dune blowout area for recreational vehicle use will be restricted. The operation of the outlet will result in an area within 500 m of the diffuser which will may not meet national criteria for shellfish harvesting. The operation of the outlet will generally result in primary contact criteria being met in surface waters above the diffuser. However, Water Corporation suggest that an area within 100 m of the diffuser is unsuitable for primary contact recreation.	The beach and dune system will be fully rehabilitated after construction in accordance with the construction of a EMP. The area is not used for shellfish harvesting, however, the Water Corporation will advertise the location of the affected zone in the local press. The location of the outlet will be marked in future editions of local navigation charts. The operations EMP will include a program of bacteriological monitoring around the diffuser designed to confirm the extent of the plume. The Water Corporation will operate the Bunbury WWTP plant such that designated Environmental Quality Objectives are met.
Public safety during construction	Maintain public safety during construction.	Combination of Water Corporation owned land (dune blowout), crown land (beach) and offshore waters.	Access to the dune blowout area for recreational vehicle use will be restricted during construction. Temporary restrictions will be placed on access to a small section of beach during construction.	The management of construction activities will be detailed in the Construction EMP submitted to the DEP for approval. Public access to the construction site will be prohibited for the duration of construction and rehabilitation. Marine equipment associated with the laying of the pipeline will be in full compliance with Department of Transport regulations.

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Amenity	Ensure that the amenity of the area adjacent to the project should not be unduly affected by the proposal. Protect the aesthetical value of the area consistent with EQO 5: Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000).	Coastal dune system bordering developing residential areas.	The project will not have any impact on the odour associated with the WWTP. The project will not affect the visual aesthetics of the area after commissioning is complete. The rehabilitation of the dune blowout area will improve visual amenity.	No management required for odour or visual amenity.
Road transport	Ensure that noise levels meet acceptable standards and that an adequate level of service, safety and public amenity is maintained. Ensure that the noise levels generated by the project meet acceptable standards. Ensure that noise and vibration levels meet statutory requirements and acceptable standards.	WWTP is accessed via sub-arterial road and unsealed track.	No significant impact on the local community arising from transport during construction. The construction and operation of the project will not result in noise levels above those currently experienced in adjacent residential areas.	The management of construction activities will be detailed in the Construction EMP submitted to the DEP for approval.
Marine Flora (general)	Maintain the ecological function, abundance, species diversity and geographic distribution of marine flora locally and regionally.	Waters offshore support a diverse assemblage of algae and seagrass species on the seabed. The coverage is extensive and far ranging. The water column supports a population of phytoplankton, dominated by diatom species, considered typical of healthy marine waters.	The construction of the outlet will result in direct loss of approximately 0.1 ha of marine habitat. Operation of the outlet may result in slightly elevated productivity in the water column within 500 m of the diffuser under calm conditions.	Construction EMP submitted to the DEP for approval prior to construction. Management of construction activities will include implementing procedures to minimise disturbance of marine habitat. The quality of the water surrounding the diffuser will be monitored as will potential for epiphyte growth. The program for these activities will be detailed in the Operations EMP submitted to the DEP for approval prior to commissioning.

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Marine Flora: Declared Rare and Priority Flora (specific)	Protect Declared Rare and Priority Flora, consistent with the provisions of the Wildlife Conservation Act 1950.	Intensive mapping of the area has been undertaken. No declared rare or priority marine flora are listed for the area.	There are no declared rare species.	No management required.
Marine Flora: Seagrass and its habitat (specific)	Maintain the ecological function, abundance, species diversity and geographic distribution of seagrasses locally and regionally. Encourage the development and implementation of practical technical solutions for the rehabilitation of the environment. Refer to EPA Guidance Notes 22 and 29.	Waters offshore support significant quantities of seagrasses which are generally found on sandy substrate. There are seagrasses in the vicinity of the outlet, however, the outlet has been located to minimise disturbance to seagrass.	The construction of the outlet will result in direct loss of approximately 0.1 ha of marine habitat, which will include some seagrass. Operation of the outlet may result in slightly elevated productivity in the water column within 500 m of the diffuser under calm conditions.	Construction EMP submitted to the DEP for approval prior to construction. Management of construction activities will include implementing procedures to minimise disturbance of marine habitat. The quality of the water surrounding the diffuser will be monitored as will potential for epiphyte growth. The program for these activities will be detailed in the Operations EMP submitted to the DEP for approval prior to commissioning.
Marine Flora: Algae and its habitat (specific)	Minimise interference with the process of nutrient and carbon cycling from algae. Maintain the ecological function, abundance, species diversity, productivity and geographic distribution of algae.	Waters offshore support an extensive and diverse assemblage of algae, this is generally found on limestone reef substrate.	The construction of the outlet will result in direct loss of approximately 0.1 ha of marine habitat which will include some algae. Operation of the outlet will result in slightly elevated productivity in the water column within 500 m of the diffuser under calm conditions.	Initially, no management required as monitoring of epiphyte growth and water quality adjacent to the diffuser will provide an indication as to whether changes in the benthic macroalgae community may occur. If monitoring suggests impacts are greater than expected, macroalgal monitoring may be undertaken following consultation with the DEP.

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Marine Fauna (general)	Maintain the abundance, species diversity and geographic distribution of marine fauna.	The region contains a diverse community of marine fauna. The ocean conditions and the habitat type in the vicinity of the outlet are common throughout the region.	In the event that localised blasting of sections of limestone reef is required, there will be loss on fauna within approximately 20 m of each blast. The operational phase of the project is unlikely to have any impact on marine fauna in the area.	Blasting is not the preferred construction technique and the contractor will be discouraged from using blasting, which will be used only as a last resort. If blasting is necessary, an underwater blasting procedure will be developed to the requirements of DEP and CALM such that any impacts on marine fauna are minimised. Blasting activities would be monitored by CALM. The Water Corporation will monitor the sediments in the region for toxicants. The Water Corporation will monitor the treated wastewater for toxicants. The operations of the WWTP will be conducted such that designated EQOs are met at the diffuser. The water and sediment monitoring program will be detailed in the Operations EMP.
Marine Fauna Specifically Protected (Threatened Fauna) (specific)	Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the Wildlife Conservation Act 1950. Maintain or improve the ecology consistent with EQO 1: Maintenance of Ecosystem Integrity (level 2-high protection) defined in the Southern Metropolitan Coastal Waters Study (SMCWS, 1996) and Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000).	The waters host a number of protected marine species, including bottlenose dolphins and humpback whales.	The operation of the outlet will not have any impact on protected marine fauna in the area. In the event that blasting is required strict procedures will be followed to ensure that no protected species are harmed.	Blasting is not the preferred construction technique and the contractor will be discouraged from using blasting, which will be used only as a last resort. If blasting is necessary, an underwater blasting procedure will be developed to the requirements of DEP and CALM such that any impacts on marine fauna are minimised. Blasting activities would be monitored by CALM. The Water Corporation will monitor the sediments in the region for toxicants. The Water Corporation will monitor the treated wastewater for toxicants. The operations of the WWTP will be conducted such that designated EQOs are met at the diffuser. The water and sediment monitoring program will be detailed in the Operations EMP.

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Marine Flora and Fauna: Benthic community (specific)	Maintain the biodiversity of the seafloor within the relevant geographical area and to ensure that impacts upon locally significant marine flora and fauna communities are avoided.	Waters offshore support a diverse assemblage of algae and seagrass species. The coverage is extensive and far ranging.	In the event that blasting is necessary, there may be adverse impacts on attached benthic fauna within approximately 20 m of each blast. The operation of the outlet will not have an impact on the diversity of the marine flora and fauna in the area.	Blasting is not the preferred construction technique and the contractor will be discouraged from using blasting, which will be used only as a last resort. If blasting is necessary, an underwater blasting procedure will be developed to the requirements of DEP and CALM such that any impacts on marine fauna are minimised. The Water Corporation will monitor the sediments in the region for toxicants. The Water Corporation will monitor the treated wastewater for toxicants. The operations of the WWTP will be conducted such that designated EQOs are met at the diffuser. The water and sediment monitoring program will be detailed in the Operations EMP. The Water Corporation will monitor the phytoplankton community in the vicinity of the diffuser for changes in species assemblage arising from increased nutrient loads.

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Marine water and sediment quality	Maintain or improve the quality of marine water consistent with the draft Western Australia Guidelines for Fresh and Marine Waters (EPA, 1993). Maintain or improve marine water and sediment quality consistent with EQO 1 and Environmental Quality Criteria (EQCs) defined in the SMCWS (1996) and Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000).	The water quality of the region is typical for south-west Western Australian waters, characterised by low nutrients and with anthropogenic impacts generally confined to localised areas affected by flows of drains, creeks and rivers containing elevated nutrients due to agricultural practises.	There is no dredging associated with this project. An excavator or similar machine will be used in burying the outlet across the surfzone. The impacts on water clarity will be highly localised and short-term. The project will not have an impact on nutrient concentrations at distances greater than 500 m from the diffuser and there will be no effect on the wider marine area (Geographe Bay). Operation of the outlet will result in slightly elevated productivity in the water column within 500 m of the diffuser under calm conditions. The operation of the outlet will result in an area within 500 m of the diffuser which will may not meet National criteria for shellfish harvesting. The operation of the outlet will generally result in primary contact criteria being met at the water surface above the diffuser. However, Water Corporation suggest that an area within 100 m of the diffuser is unsuitable for direct contact recreation. The wastewater will be tertiary treated wastewater. Following initial dilution, the turbidity will be similar to naturally occurring turbidity in seawater.	Turbidity generated by construction activities will be managed in accordance with the Construction EMP prepared for approval prior to construction. The Water Corporation will monitor the sediments in the region for toxicants. The Water Corporation will monitor the treated wastewater for toxicants. The Water Corporation will monitor the phytoplankton community in the vicinity of the diffuser for changes in species assemblage arising from increased nutrient loads. The area is not used for shellfish harvesting, however, the Water Corporation will advertise the location of the affected zone in the local press. The location of the outlet will be marked in future editions of local navigation charts. The Operations EMP will include a program of bacteriological monitoring around the diffuser designed to confirm the extent of the plume. The operations of the WWTP will be conducted such that designated EQOs are met at the diffuser.

EPA FACTOR	EPA OBJECTIVE	EXISTING ENVIRONMENT	POTENTIAL IMPACT	ENVIRONMENTAL MANAGEMENT
Management of treated wastewater	Ensure that the management of treated wastewater during construction and operation is environmentally acceptable.	The Bunbury WWTP current treats approximately 6.6 ML/d of wastewater from the Bunbury area and it is forecast that this will increase to 16 ML/d by 2040. Existing disposal is to infiltration ponds surrounding the WWTP. This system is close to its maximum capacity.	The primary potential impacts of the proposal are: • Elevated nutrient levels 1.7 km offshore; • Increased bacterial levels 1.7 km offshore; and • Loss of habitat due to installation of the outlet.	The decision to construct an ocean outlet has arisen through a lengthy and detailed investigation of options based on a hierarchical approach which had reuse as the preferred option. The most manageable and environmentally responsible solution is to treat the wastewater to a tertiary level and dispose of it to the ocean. The impacts of the project will be managed through the implementation of Construction and Operations EMPs prepared to the approval of the DEP.

Appendix 4

Summary of identification of relevant environmental factors

Table 4: Summary of Identification of Relevant Environmental Factors

Preliminary Environmental Factors	**Proposal Characteristics**	**Government Agency and Public Comments**	**Identification of Relevant Environmental Factors**
BIOPHYSICAL			
Coastal formations Dune, foreshore and nearshore areas	Construction and burial of pipeline and infrastructure	**Public comment** •The Sand Bowl is not a man-made feature but a natural landform. Motorbike and four-wheel drive access should be discouraged to protect the sand bowl from further erosion. A full re-vegetation programme, however, would not be rehabilitation but another type of misuse. Has the progress of the dunes ever been properly monitored or surveyed?	Impact of construction of pipeline on coastal formations considered to be a relevant, but not key, factor
Terrestrial flora and fauna	Construction and burial of pipeline and infrastructure	**Gov't comments** •Section 5.4.2 Declared Rare and Priority Flora needs to take into account more recent listings than Atkins (1996). •The PER does not address introduced weed species and their impact on conservation values. Methods to prevent accidental introduction of weeds into the area during the construction and other disturbance works, as well as control methods during this phase of the project should be described. Monitoring and control methods for weed species after the completion of construction and during rehabilitation should be addressed. These commitments should be indicated for listing in the yet to be prepared EMPs. •Section 5.5.1 and Appendix 2 is inadequate and does not take into account recent studies of vertebrate fauna. Appendix 2 (species expected to occur) includes a number of species that are unlikely to occur based on known habitat preferences or known distributions. •The bird list in Table 2 is incomplete – it is likely that as much as another 50% of bird species occur in the area. •Section 5.5.2 dealing with Rare and Endangered Fauna needs to be reassessed to take into account more recent listings than the 1996 listing. **Public comments** •The terminology of a vegetation community in Fig 5.3 and page 43 as "Disturbed coastal complex" is questioned and a justification for it and comparison with the Tingay and Hart & Simpson surveys is requested •As the short and long term effects of reduced groundwater levels on the Tuart trees is unknown, the community should be consulted on this issue.	Impact of construction of pipeline on terrestrial vegetation considered to be a relevant, but not key, factor. .
Marine flora	Construction of pipeline across seabed. Change of marine water and sediment	**Govt comments** •The effects of the pipeline alignment on benthic communities cannot be evaluated, as a pipeline route survey has not been conducted. The route should be surveyed before construction commences and the pipe laid to minimise direct impacts as far as practicable.	Impact of pipeline construction and wastewater disposal on marine flora considered to be a relevant

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	quality due to wastewater disposal. Possible impact on declared rare and priority flora, seagrass, algae and benthic flora.	•How is digging or ripping of limestone at 10m depths carried out? •According to Fig. 6.7, the diffuser has been sited in an area that is predominantly reef. It would appear that if the pipeline was extended by approximately 200 m, the diffuser could be located in an area that is predominantly sand. The Water Corporation should review the outlet location and assess the feasibility of locating the diffuser 200 m further offshore. •At what TN level in water would damage to seagrass and benthic vegetation be expected? •Explain why the proposal will not result in change to phytoplankton species and why it will have no impacts in the wider marine environment. •The monitoring strategy should be related to management options so that adverse trends can be identified with sufficient lead time to implement an appropriate management response. Commitments should include management and amelioration of any impacts. **Public comments** •The Environmental Management Plan (EMP) for the design and construction of the pipeline should have as one of its high priorities avoiding or minimising the disturbance of seagrass areas. •There are significant uncertainties about the long-term ecological impacts of wastewater ocean disposal. It is harder to identify long-term impacts in marine than in terrestrial environments and these may go unnoticed and not be halted or ameliorated. •Regular monitoring and reporting of treatment plant operations and receiving environment should be undertaken. Ecological indicators should be established and monitored to assess the long-term impacts of the wastewater disposal on the receiving environment and surrounding coastal waters.	environmental factor.
Marine fauna	Construction of pipeline across seabed Change of marine water and sediment quality due to wastewater disposal. Possible impact on fauna, specifically protected and benthic fauna.	**Govt comments** •Habitat impacted by construction activities will recover rapidly – define rapidly and what evidence there is for this? •What impact will there be on marine fauna due to habitat change?	Impact of pipeline construction and wastewater disposal on marine fuana considered to be a relevant environmental factor.

POLLUTION			
Marine water and sediment quality	Wastewater disposal causing change to marine water and sediment quality. Possible impact in immediate area and wider surrounds, for lifetime of disposal.	**Govt comments** •Support the statement that turbidity plumes caused by construction settle quickly and will not last more than a few hours. •Explain why construction will not create a continuous plume of suspended sediment •Provide monitoring information for contaminants other than nutrient and bacteriological in the wastewater and consideration of the impact these may have on the marine environment, including sediments. Data and an assessment of impacts should be supplied to complete the requirements of the guidelines. •The modelling described in the document has been based on nutrient and volume figures for 2040 which are based on the assumption that the WWTP has been upgraded. However the upgrade is not a 'key commitment' The current concentrations with the 2040 predicted flow rates would give "results characteristic of worst case episodes" unless the upgrade becomes a 'key commitment'. •Provide substantiation of the validity of using 2040 flows and concentrations in the modelling (i.e. that this is the worst case scenario) rather than the pre-upgrade data. •Provide predicted worse case impacts under emergency conditions or abnormal operating conditions. •Modelling results seem to show little difference between the spring "worst case" and summer results •Provide expected cumulative impacts of nutrients on the marine environment from all sources to the year 2040. •For Fig. 7.9 there is approximately a 500 m radius E3 zone around the outlet which is about the same size as Swanbourne and Ocean Reef which receive up to 1000 tonnes N/yr. The E3 zone is large relative to the amount of nitrogen being discharged. The need for such a large E3 area should be reviewed. •The rationale attributing elevated offshore nutrient concentrations at depth (compared to surface samples) to nutrient recycling by primary producers rather than groundwater discharge appears speculative. Better insight into the processes causing these observed patterns could occur through well planned monitoring programs looking at the outlet and the shoreline. •Assessment of impacts should be carried out on peak flows and peak loads rather than average flows and loads. Peak nutrient loads, rather than average, should be specified. •Could Water Corporation of WA supply the information on background levels of contaminants in sediments? •Is there supporting evidence that shoreline water impact will e zero and near-shore water impact reduced after implementation of the proposal? What reduction in total nutrient load to near-shore zone is anticipated? •According to Fig 6.1, the area within which marine study sampling sites will be located is	Impact of pipeline construction and wastewater disposal on marine water quality and sediment considered to be a relevant environmental factor.

		approx. 6 x 3 km, with monitoring occurring up to 3 km from the proposed outlet. With the Beenyup outlet, effects can be detected at least 4 km from the outlet. Although the expected loads are far lower, it is recommended that at least one more site is included at a greater distance, downstream of the outlet as a check. This could be reviewed as data becomes available. **Public comments** •A nitrogen concentration limit, based on ecological criteria, at the edge of the mixing zone should be specified in addition to an annual total nitrogen load to provide timely data. If concentrations at the outflow pipe are used, these should be matched with flow volumes, but concentrations in the environment are considered most important •Total load and concentration limitations should be placed on phosphorus too. •Emission limits for heavy metals and organic chemicals should be considered •There are concerns about the effect of the wastewater discharge on the quality of seawater around Dalyellup. Can Water Corporation give an assurance that in the event of an uncontrolled discharge to ocean, raw effluent will not contaminate the beach at Dalyellup and the waters of Geographe Bay?	
Management of wastewater effluent	Consideration of alternative disposal options for the wastewater. Treatment and quality of wastewater to be disposed.	**Govt comments** •Is there a "lack of agricultural activities" in the Bunbury area? Has increased winter storage been considered? •The ocean outlet will be an improvement on the existing situation of 7 permeable lagoons if there is a commitment to upgrading the wastewater treatment plant. •The planned upgrade of the trickling filter plant is not included in the proposal. However modelling is based on an improvement of water quality. Therefore some commitment to the upgrade or alternative method of meeting wastewater quality should be made. •The trickling filter plant does not meet the criteria of "best practice" or "as low as reasonably practical" and should be upgraded as soon as possible. • What commitment does Water Corporation of WA have to developing better nutrient removal technologies? •Was chlorination of the wastewater considered (as at Beenyup and Subiaco) and why were retention lagoons chosen? • Groundwater monitoring results for existing bores show levels of TN as high as 23 mg/L for existing operations. Is the predicted mean concentration value of 15 mg/L for existing operations achievable and sustainable? •Which lagoons (other than lined lagoons 1 & 2) will be retained and for what purpose, besides gradual lowering of the groundwater level to protect the Tuart trees? **Public comments** •The long-term option for wastewater disposal should remain as land disposal. The projects outlined in the report *Wastewater 2040: Strategy for the South West Region* should be finalised •The ocean outlet should be considered as a temporary wastewater disposal solution only as it	Alternative disposal options and treatment of wastewater considered to be a relevant environmental factor.

		will reach its capacity quickly. Water Corporation should actively seek ongoing land-use recycling options in the Bunbury area. •Water circulation in the ocean off Bunbury is not good and the marine environment will eventually suffer as a result of the ocean outlet. What long-term wastewater disposal plans have been prepared or could be prepared? •Wastewater treatment and disposal in WA should meet international best practice standards. . •When wastewater is disposed of through reuse, the standards for treating the water are generally higher and this is the direction our wastewater treatment and disposal should be heading. •Water Corporation's commitment to investigate options for viable wastewater reuse at Bunbury is welcomed. Clear criteria for meeting this commitment need to be set •Water Corporation should allocate further funding towards the process of attaining drinking quality standard of the treated wastewater, and further recycling opportunities. •It is suggested that a committee be formed to explore possibilities and opportunities for the increased use of treated wastewater, especially in new developments taking place in the Bunbury area. •Wastewater should be treated and used for agricultural purposes and a valuable resource should not be wasted. •It is recommended that the upgrade of the wastewater treatment plant be set as a condition on the proposal's approval •Many details of environmental management have been left for EMPs (for example contingency measures for power failures or other WWTP process failures). If the proposal is approved, the approval should contain clear criteria for specific issues that must be addressed in the EMP and any standards of compliance that can be specified.	
SOCIAL SURROUNDINGS			
Recreation	Construction of pipeline. Disposal of wastewater causing zones where recreational use is lost	(see also public health and safety)	Limited impact over which community has not expressed concern. Relevant factor which can be managed. .

Public health and safety	Construction of pipeline. Disposal of wastewater causing possible impact on public health	**Govt comments** •It is recommended that bacterial monitoring results around the diffuser be compared to criteria/guidelines by using enterococci as the primary indicator in preference to 'faecal coliforms' as enterococci are the preferred indicator for marine environments. •Once the extent of the plume and affected zones is confirmed, it should be forwarded to the Health Department of WA and the City of Bunbury, as well as being advertised in the local press. •An increased in the crayfish population along pipeline/diffuser may attract more divers; how will this be properly managed? **Public comments** •Any restrictions around the outlet pipeline should be supported by the restricted areas being clearly physically marked, for example with buoys, in addition to the other measures proposed in the PER. It should remain a responsibility of the Water Corporation to maintain these markers.	Impact of construction of pipeline and disposal of wastewater on public health considered to be a relevant factor.
Aboriginal Heritage	Construction of pipeline	**Govt comments** •Advice should be obtained from the Department of Aboriginal Affairs regarding cultural and archaeological sites and how work should proceed**.**	Possible impact of construction of pipeline on aboriginal heritage considered to be a relevant factor.
Amenity	Construction of pipeline on aesthetical values. Disposal of wastewater causing possible impact on aesthetical values of the area	**Public comments** •It is considered that the WWTP is located in one of the most attractive landscapes of Bunbury. Sites for the outlet other than the centre of the sand bowl, for example further south, should be seriously considered to protect the amenity of the area. The sand dunes are a spectacular natural feature and should be an integral part of the proposed Regional Park.	Limited impact from this proposal that can be managed. Not considered to be a relevant factor..
Road transport	Construction of pipeline causing possible Impact of noise, vibration and increased traffic on public safety and amenity.		Limited impact that can be managed. Not considered to be a relevant factor.

Community consultation		**Public comments** •Water Corporation is requested to undertake a system of Environmental Reporting to the community during the construction phase of the project and every 6-12 months on an ongoing basis, once the project is complete. •It is important that the ocean outlet is viewed as a short-term wastewater disposal option by the Water Corporation and that there is ongoing community consultation.	Water Corporation has committed to provide information during construction of outlet and monitoring of operations to community groups Consider community objectives
OTHER			
Commonwealth issues		**Public comments** •If underwater blasting is to be undertaken in the construction of the pipeline, it needs to be considered whether blasting operations are controlled actions under the Commonwealth Government's Environmental Protection and Biodiversity Conservation Act and whether the operations need to be referred to the Commonwealth.	Not relevant to EPA's assessment of this proposal.
Economic issues		•**Public comments** The costs of the community's ecological impacts should be internalised to provide cost signals to drive efforts to reduce impacts in the longer term. This could be achieved by the use of alternative disposal methods or placing strict conditions on ocean disposal through licence conditions.	Not relevant to EPA's assessment of this proposal.
WWTP buffer		•No development should be allowed in the buffer surrounding the wastewater treatment plant. The buffer provides a screen against noise, dust and visual pollution. •The buffer surrounding the wastewater treatment plant should be extended and upgraded through rehabilitation processes. Local providence species should be used for all rehabilitation work.	Not relevant to EPA's assessment of this proposal
Issues outside of proposal influence		**Public comment** •Fig 5.1 does not accurately depict the geology/geomorphology of the wastewater treatment plant site. Just outside the eastern boundary the upper level of the Tamala limestone drops. There is a seasonally inundated wetland here. The water quality of this wetland may be affected by lagoon 7. Has the water quality been tested and what results were obtained? •With the purchase of Bunbury land the wastewater treatment plant expanded into the System 6 C70 area. As much as possible of this area should be included into the Regional Open Space and become part of the proposed Bunbury Ocean to Preston River Regional Park, or at least be accessible for visitors.	While Water Corporation may wish to consider these community concerns, they are outside of the proposal being assessed by the EPA.

Table 5: Summary of Assessment of Relevant Environmental Factors

Relevant Factor	Environmental Objectives	Assessment	Advice
Coastal formations Dune, foreshore and nearshore areas	Maintain or improve the integrity, function and environmental values of the dune and foreshore area.	• Water Corporation now proposes to revegetate only the low foredune at the western extent of the dune blow out and leave the sand bowl as it is. • Water Corporation has made appropriate commitments to prepare and implement dune management and beach rehabilitation plans.	Having particular regard to: • amendments made to proposal; and • the proponent's commitments, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Terrestrial flora and fauna	Protect threatened ecological communities and critical habitats. Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950.*	• An additional search of CALM Threatened (Declared Rare) Flora and WA Herbarium Specimen databases has been undertaken. Results of these searches indicate that no declared rare or priority flora are expected in the project area. • The section on "disturbed coastal complex" has been revised. • Water Corporation has committed to including weed management in construction EMP. • Water Corporation has committed to managing groundwater level changes to prevent loss of significant flora. They will continue to operate a community reference group. • The fauna section of the PER has been revised. • Water Corporation has made an appropriate commitment to prepare and implement a terrestrial fauna management plan.	Having particular regard to: • additional information provided in response to submissions; and • the proponent's commitments, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Marine flora	Maintain or improve the ecology consistent with Environmental Quality Objectives (EQO 1): Maintenance of Ecosystem Integrity (level 2-high protection) defined in the Southern Metropolitan Coastal Waters Study (1996) and Perth Coastal Waters - Environmental	**Construction impacts** • A survey of the pipeline route has been carried out and shows a well vegetated transect, which appears typical of the general area. The transect shows a few reef features, which will sustain damage. No declared rare or priority flora were identified. • The proponent has committed to prepare and implement a management plan which outlines procedures to minimise impacts of marine construction on marine flora.	Having particular regard to: • Additional information provided through assessment; • Predicted impact on environmental quality objectives; • Commitment to limiting ocean discharge of total nitrogen to 60 tonnes per annum;

Relevant Factor	Environmental Objectives	Assessment	Advice
	Values and Objectives (EPA, 2000). Where level 2 protection cannot be maintained, minimise areas of lower ecosystem integrity protection. (revised objective) Protect Declared Rare and Priority Flora, consistent with the provisions of the *Wildlife Conservation Act 1950* Encourage the development and implementation of practical technical solutions for the rehabilitation of the environment.	**Operational impacts** • Proposal will result in an E4 zone around outlet. Therefore will not meet objective of maintaining or improving ecology consistent with EQO1, E2 level on a local scale. However this is unavoidable without a high level of treatment for wastewater. Area of zone of loss of environmental value is small and will not affect ecosystem integrity on regional scale. The EPA objective is to minimise E4 and E3 zones. Water Corporation has committed to operate WWTP such that agreed EQOs and EQCs are met. Zones will comply with 95% confidence contour. • With respect to nutrient and chlorophyll a guideline levels for assessing biological impact on ecological system, it has been found that some values in the marine system in area already exceed recommended guideline values in ANZECC, (2000). Therefore site specific indicators and guideline values and standard criteria will need to be developed. Water Corporation has committed to developing site specific indicators. Indicators for ecosystem change may be more appropriate than water quality criteria for nutrient impact. • Water Corporation has also committed to undertaking a nitrogen study to determine whether sources of nitrogen in the marine ecosystem are natural or anthropogenic. • Water Corporation has committed to monitoring both biological and physical parameters in the marine environment to detect early change and to include plans for management options if criteria are exceeded in the EMP. • Water Corporation has committed to develop management options for emergency events and contingency plans if monitoring shows unacceptable impacts.	• Commitment to undertaking a study to establish anthropogenic and natural sources of nitrogen in the marine environment; • Proponent's operational management commitments; and • Requirement for an operational licence from the DEP, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that recommended conditions 7 and 9 are implemented.

Relevant Factor	Environmental Objectives	Assessment	Advice
Marine fauna	Maintain or improve the ecology consistent with Environmental Quality Objectives (EQO 1): Maintenance of Ecosystem Integrity (level 2-high protection) defined in the Southern Metropolitan Coastal Waters Study (1996) and Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000). Where level 2 protection cannot be maintained, minimise areas of lower ecosystem integrity protection. (revised objective). Protect Specially Protected (Threatened) Fauna, consistent with the provisions of the Wildlife Conservation Act 1950.	**Construction Impacts** • If blasting is required the management plan should address the protection of marine mammals, especially migratory and threatened whale species that are found in the area. Digging or ripping will be preferred construction techniques. • Water Corporation has committed to preparing and implementing a management plan which outlines procedures to minimise impacts of marine construction on marine fauna. • From previous experience marine habitats have fully recovered after laying of the pipeline within a year. Negligible impact on habitat is expected from the construction phase. **Operational Impacts** • As with marine flora, there will be small to large changes in the E4 zone and loss of environmental quality on a local scale. • Water Corp has committed to meeting agreed criteria for EQO zones, which protect fauna as well as flora. • Provisional guideline trigger values for contaminants in water have been adopted from the ANZECC (2000) guidelines. The 99% species protection guidelines for toxicants have been adopted as the E2 zone guideline values and the 90% species protection guidelines as the E3 zone guideline values. No standard criteria are available. • Water Corporation has committed to monitoring both biological and physical parameters in the marine environment to detect early change and to include plans for management options if criteria are exceeded in the EMP. Management options for emergency events will also be included. • Water Corporation has committed to contingency planning to improve water quality or reduce loads of contaminants and nutrients discharged if monitoring shows that agreed criteria are not met	Having particular regard to: • Additional information provided through assessment; • Predicted impact on environmental quality objectives; • Commitment to limiting ocean discharge of total nitrogen to 60 tonnes per annum; • Commitment to undertaking a study to establish anthropogenic and natural sources of nitrogen in the marine environment; • Proponent's operational management commitments; and • Requirement for an operational licence from the DEP, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that recommended conditions 7 and 9 are implemented.

Marine water and sediment quality	Maintain or improve marine water and sediment quality consistent with Environmental Quality Objectives (EQO 1) and Environmental Quality Criteria (EQC's) defined in the Southern Metropolitan Coastal Waters Study (1996) and Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000).). Where level 2 protection cannot be maintained, minimise areas of lower ecosystem integrity protection. (revised objective).	• Water Corporation has committed to operate WWTP such that agreed EQOs and EQC are met. Zones will comply with 95% confidence contour. No water quality criteria for nutrients have been adopted. No criteria have been adopted for the E4 zone. Criteria for this zone will depend on wastewater discharge criteria. • Sediment quality guidelines from ANZECC (2000) will be adopted. • Water Corporation has committed to operating the WWTP such that national guidelines for toxicant concentrations in marine waters are met. • Water Corporation has committed to designing and implementing monitoring programs for the sediments in the vicinity of the outlet. • Water Corporation has committed to designing and implementing water quality monitoring programs which have the ability to measure long-term changes in water quality, including changes in productivity, biodiversity and ecosystem processes and including a reference site for comparison. • Water Corporation has committed to contingency planning to improve water quality or reduce loads of contaminants and nutrients discharged if monitoring shows that agreed criteria are not met.	Having particular regard to: • Additional information provided through assessment; • Predicted impact on environmental quality objectives; • Commitment to limiting ocean discharge of total nitrogen to 60 tonnes per annum; • Commitment to undertaking a study to establish anthropogenic and natural sources of nitrogen in the marine environment; • Proponent's operational management commitments; and • Requirement for an operational licence from the DEP, it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that recommended conditions 7 and 9 are implemented.
Management of wastewater effluent	Ensure that the management of wastewater effluent during construction and operation is environmentally acceptable. Consider waste minimisation hierarchy.	• It is the EPA's preference for reduction, reuse or recycling of waste. However there are limited currently available alternative disposal options. Proponent has made commitment to continue to investigate reuse options and to report triennially on investigation and implementation. • Reduction of waste discharge would be possible with an upgrade of treatment technology. No commitment to upgrade of existing technology before 60 tpa discharge ceiling has been reached, has been made. Water Corporation has made the commitment that they will upgrade the wastewater treatment system earlier if unacceptable impacts found.	Having particular regard to: • the proponent's commitments; and • the limitations on practicably feasible reuse in the immediate area, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.

		• Water Corporation has committed to bring forward upgrade of wastewater treatment system if monitoring shows unacceptable environmental impacts. • Water Corporation has committed to discontinue the current practice of discharging treated wastewater to unlined lagoons, except where flows are required to reduce stress on nearby trees. • Water Corporation has committed to ensure maximum annual average nitrogen load to the ocean from the outlet is less than 60 tpa. • Water Corporation has committed to preparing contingency plans for non-standard operation of the WWTP. • Water Corporation has committed to monitoring of contaminant levels in treated wastewater at Bunbury WWTP.	
Recreation	Not to compromise recreational uses of the area, as developed by planning agencies. Protect the recreational value of the area consistent with Environmental Quality Objectives (EQO 2,3,4,5): Fishing and Aquaculture and Recreation and Aesthetics as defined in the Perth Coastal Waters - Environmental Values and Objectives (EPA, 2000).	• Proposal will result in loss of recreational zones around outlet. A S2 zone (not safe to take seafood) will extend 500m from the diffuser ports. A S3 zone (not safe to swim) will extend 100m from the diffuser ports. • No community submissions were received expressing concern at the extent of these zones. The proponent has committed to marking on charts and publishing the zones.	Having particular regard to: • no expressed concerns from the community being noted; • the small size and off-shore location of the zones; and • the proponent's commitments, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.

Public health and safety	Maintain public safety during construction. Ensure discharge does not pose a public health risk to recreational users or fishers.	Proponent has made a commitment to prepare public safety plan for construction which addresses the issues of: • Restriction of public access to the construction site; • Marine equipment complies with Department of Transport regulations; and • Public notification of any restrictions. Proponent has made a commitment to prepare a recreational water quality management plan which addresses the following issues: • Design a bacterial monitoring program which will establish whether primary contact criteria are met within 100 m of the diffuser and whether shellfish harvesting criteria within 500 m of the diffuser; and • Contingency planning to improve water quality if monitoring shows that agreed criteria are not met. Enterococci will be used as the primary bacterial indicator.	Having particular regard to: • the proponent's commitments; and • the proponent's undertaking to ensure that public is adequately informed of the location of the diffuser and the extent to bacterial plume, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Aboriginal Heritage	Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972.	The proponent has made a commitment to prepare a plan which addresses the issues of: • consultation with local Aboriginal groups; and • obtaining advice from the Aboriginal Affairs Department on work practices.	Having particular regard to: • the proponent's commitment; it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Community consultation	Inform community of proposal and consult to obtain best environmental and social outcome. Address community concerns.	The proponent has made a commitment to: • provide information during construction of outlet and monitoring of operations; and • consider community objectives.	The EPA commends the Water Corporation for its initiatives in this area.

Appendix 6

Recommended Environmental Conditions and

Proponents Consolidated Commitments

Appendix 7

Summary of Submissions and

Proponent's Response to Submissions