Munster Pump Station No. 3 and Bibra Lake Main Sewer Extension, Munster, City of Cockburn

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Water Corporation

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice to the Minister for the Environment on the proposal by the Water Corporation to construct and operate an extension of the existing Bibra Lake main sewer from the existing sewer pump station at Mayor Road (Munster Pump Station No. 2), and a new sewer pump station (Munster Pump Station No. 3) on the west side of Lake Coogee.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment 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

Although a number of environmental factors were considered by the EPA in the assessment, it is the EPA's opinion that the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) vegetation communities - physical disturbance during construction to Bushplan sites and Beeliar Regional Park;

(b) wetlands - impacts during construction on Lake Coogee and Market Garden Swamps;

(c) groundwater and surface water quality - impacts on water quality of wetlands;

(d) soil contamination - disturbance of contaminated soil during construction of pipeline; and

(e) odour - impacts on amenity.

Conclusion

The EPA has considered the proposal by the Water Corporation to construct and operate Munster Pump Station No. 3 and the extension of the Bibra Lake main sewer.

The key issues for the proposal are the protection of Lake Coogee and Market Garden Swamps Nos 2 and 3 and the vegetation associated with these wetlands, the protection of the amenity of other land users from odour, and the management of contaminated soil along a section of the pipeline route.

The EPA has concluded that the proposal can be 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.

The EPA notes that any proposal in the future for open storage of sewage associated with the proposed pump station would be subject to the provisions of the EP Act.

Recommendations

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

1. That the Minister notes that the proposal being assessed is for the construction and operation of Munster Pump Station No. 3 and Bibra Lake main sewer extension, Munster, City of Cockburn.

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 the proposal can be managed such 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 5, and summarised in Section 4, including the proponent's commitments.

4. That the Minister imposes the conditions and procedures recommended in Appendix 5 of this report.

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 Munster Pump Station No. 3 and Bibra Lake main sewer extension is approved for implementation. These conditions are presented in Appendix 5. Matters addressed in the conditions include the requirement that the proponent fulfil the commitments also included in Appendix 5.

Contents

1. Introduction

The Water Corporation proposes to construct and operate:

- a gravity feed sewer main being an extension of the existing Bibra Lake main sewer from a point immediately upstream of the existing sewer pump station at Mayor Road (Munster Pump Station No. 2) to the proposed Munster Pump Station No. 3; and
- Munster Pump Station No. 3, a sewage pump station, on the west side of Lake Coogee, Munster.

These works are required as part of the upgrade of the sewerage system for the southern Perth metropolitan area to handle the expected growth in the population of the region through to the year 2050.

The proposed gravity sewer main encroaches on Market Garden Swamp No. 2 adjoining the existing Water Corporation causeway at the northern end of Lake Coogee.

The main issues relating to this proposal are the protection of the wetlands and the wetland dependent vegetation of Lake Coogee and Market Garden Swamps Nos 2 and 3. These wetlands are of high conservation value. The proposal also raises soil contamination and odour issues.

The proposal has been formally assessed at the Public Environmental Review (PER) level. The public review period was for 8 weeks, closing on 1st March 1999. A total of 35 submissions were received from the public, organisations and government authorities.

This report provides the EPA's advice to the Minister for the Environment on the proposal. Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment 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 compiling this report, the EPA has considered the relevant environmental factors associated with the proposal, issues raised in public submissions, specialist advice from the Department of Environmental Protection (DEP) and other government agencies, the proponent's response to submissions and the EPA's own research and expertise.

Further details of the proposal are presented in Section 2 of this report while Section 3 discusses environmental factors relevant to the proposal. The conditions and procedures to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 presents the EPA's conclusions and Section 6, the EPA's recommendations.

A table outlining the considerations in the identification of the relevant environmental factors is included in Appendix 1. A summary of the assessment of the relevant environmental factors is in Appendix 2.

A list of people and organisations that made submissions is included in Appendix 3. References are listed in Appendix 4, and recommended environmental conditions and procedures and the proponent's commitments are provided in Appendix 5.

Appendix 6 contains a summary of the submissions from the public, organisations and government authorities. The proponent's response to the submissions is in Appendix 7, and additional information from the proponent on proposed construction methods is in Appendix 8. The summary of submissions and the proponent's response are included as a matter of information only and do not form part of the EPA's report and recommendations. The EPA has considered issues raised in submissions when identifying and assessing relevant environmental factors.

2. The proposal

The proposal by the Water Corporation is to construct and operate an extension to the Bibra Lake main sewer; and a new sewer pump station (Munster Pump Station No. 3) at Munster, as shown in Figure 1 and the figures in Appendix 8. It is proposed that a portion of gravity sewer main will traverse the wetlands between Lake Coogee and Market Garden Swamp No. 2.

The Water Corporation advises that Munster Pump Station No. 2, the existing pump station at Mayor Road, Munster, is operating at full capacity and has reached its design pumping capacity. There is only sufficient storage available in the sewer mains upstream of the pump station to cater for half an hour of flow during peak flow conditions. Works are urgently needed to reduce the possibility of sewage overflow from Munster Pump Station No. 2 to the environment (Woodman Alliance 1999).

The construction of the new pump station will result in increased pumping capacity. The new pump station and extension to the main sewer are expected to provide sufficient storage capacity within the system for the next 10 to 15 years so that overflow of sewage to the wetlands and Lake Coogee would be a highly improbable event (Woodman Alliance 1999).

A detailed description of the proposal was provided in Section 3 of the PER (GHD 1998). Since the release of the PER, however, a number of modifications to the proposal have been made by the proponent, as detailed in the proponent's response to submissions (Woodman Alliance 1999) in Appendix 7 and correspondence from the proponent dated 29 July 1999 in Appendix 8. Further information on the environmental factor of odour was provided on 9 September 1999 and 7 December 1999, and is reproduced in Appendix 8.

The main characteristics of the revised proposal are summarised in Table 1 below.

Table 1. Summary of key proposal characteristics

Item	Feature	Characteristic
Pump station	Location	Munster Pump Station No. 3 located within Water Corporation land to the west of Lake Coogee (Lot Number 20 Certificate of Title 2120/283) and contained within the Woodman Point Wastewater Treatment Plant Odour Buffer Zone, as shown in Figure 1
	Depth	Approximately 20 metres below natural ground level
	Construction - groundwater removal	A maximum of 3 000 cubic metres of groundwater may be displaced, subject to compliance with commitment 2
	Pumping capacity	4 600 litres per second
	Emergency overflow	No emergency overflow basins are proposed at Munster Pump Station No. 3 at this time
Gravity sewer main	Location	Generally west-south west connecting into the Bibra Lake main sewer immediately upstream of the existing Munster Pump Station No. 2 on Mayor Road. Across Lot 505 and through Lot P2 to Lot 703. Across wetlands adjacent to the existing pressure mains to the north of Lake Coogee before turning generally south-south west approximately parallel to Lake Coogee to the new Munster Pump Station No. 3 site, as shown in Figure 1.

	Maximum flow capacity	9 200 litres per second (ultimate capacity)
	Total length	Approximately 1 600 metres
	Diameter	Approximately 2.25 metres internal diameter and 2.55 metres external diameter
	Maximum height of sewer across wetland	4.8 metres above wetland ground surface to the top of the handrails of the dual-use path located over the structure
	Length of exposed sewer (wetland crossing)	Approximately 155 metres.
Pump station and sewer main, as above	Odour control	All access points will be sealed with manhole covers which will be bolted down to withstand a 9 metre head of water. There will be no vents within the proposal.
	No open storage of sewage	The proposal does not include open storage of sewage

The modifications to the proposal since the release of the PER (GHD 1998) to reduce the environmental impacts include the following:

- construction techniques for the sewer wetland crossing have been revised to reduce the clearing of wetland vegetation from approximately 0.26 hectares to 0.14 hectares;
- an extra bend in the sewer pipeline and the use of local trench boxes are proposed at the western end of the wetland, to reduce the need for clearing of tuarts to four small trees;
- dewatering requirements associated with the construction phase for the pump station have been considerably reduced;
- the external diameter of the pipe has been reduced from 3.9 metres to 2.55 metres;
- the length of exposed pipe has been reduced to approximately 155 metres; and
- the height of the midpoint of the pipe structure above the natural surface of the wetland has been reduced from 4.2 metres to 3.6 metres (with a handrail above that).

To manage the impacts of the proposal the proponent has made the commitments in Appendix 5.

The proponent identified other options for the location of the pump station and the extension of the sewer main. A number of submitters also sought that alternative options for the alignment of the sewer should be further examined.

In assessing the option preferred by the proponent for the alignment of the sewer, the EPA has taken into account that the alternative options for the location of the pump station and the sewer main are associated with disadvantages, as addressed in the table in Appendix 3 under "Other issues raised during the public review period".

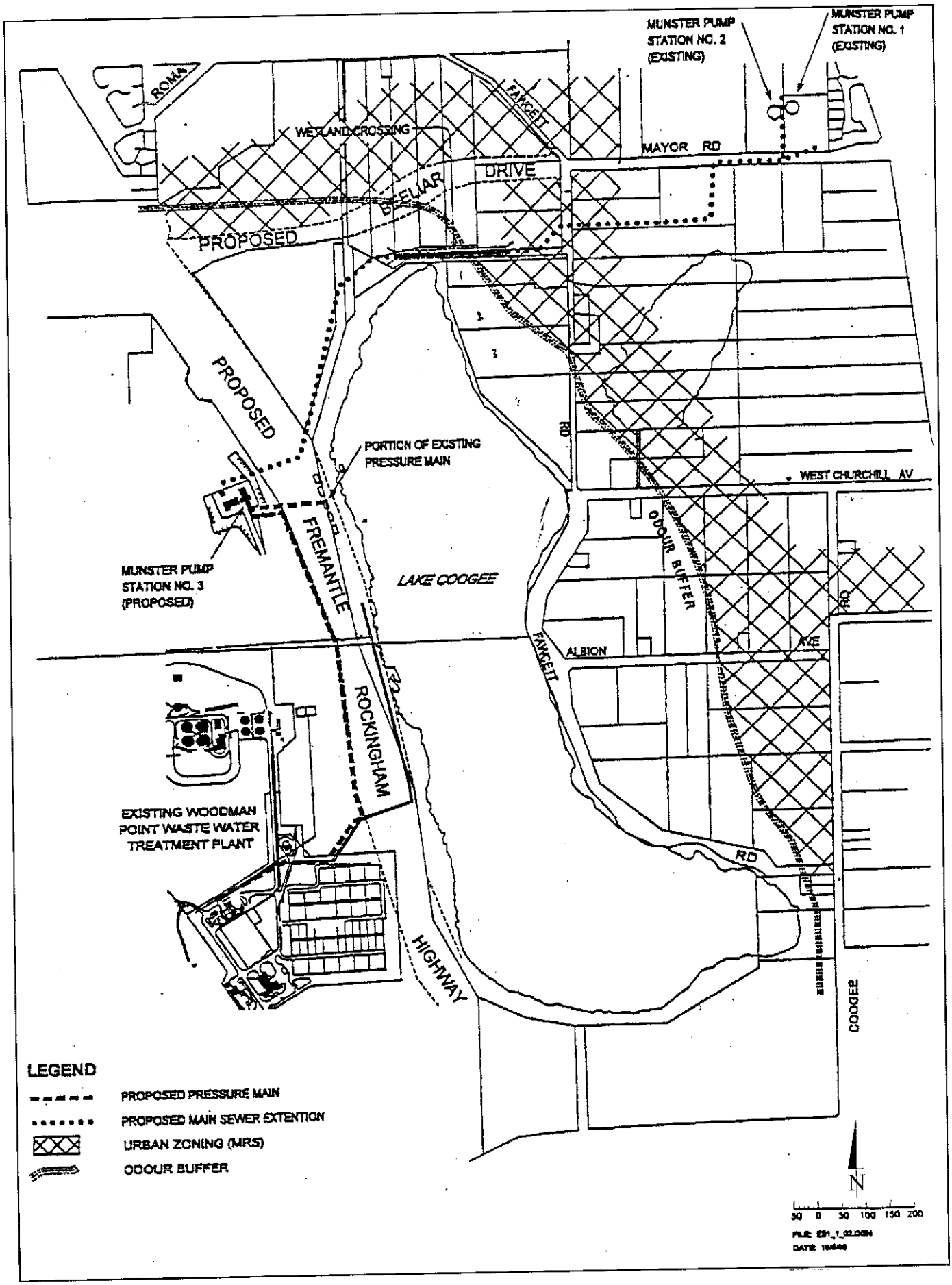


Figure 1. Location of proposed works (Source: Woodman Alliance).

3. Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment 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 is summarised in Appendix 1.

Having considered appropriate references, public and government submissions and the proponent's response to submissions, in the EPA's opinion, the following are the environmental factors relevant to the proposal:

(a) vegetation communities - physical disturbance during construction to Bushplan sites and Beeliar Regional Park;

(b) wetlands - impacts during construction to Lake Coogee and to Market Garden Swamps;

(c) groundwater and surface water quality - impacts on water quality of wetlands;

(d) soil contamination - disturbance of contaminated soil during construction of the pipeline; and

(e) odour - impacts on amenity.

Details on the relevant environmental factors and their assessment is contained in Sections 3.1 - 3.5. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. Submissions on the PER are summarised before the EPA assessment for each relevant factor.

In assessing each relevant environmental factor, the EPA determines whether or not the proposal can meet the objective set for that factor.

A summary of the assessment of the environmental factors is presented in Appendix 2.

3.1 Vegetation communities - physical disturbance during construction on Bushplan sites and Beeliar Regional Park

Description

The proposed route of the sewer pipeline traverses Bushplan site no. 261 - Lake Coogee and Adjacent Bushland, Munster, and is within the Beeliar Regional Park. The vegetation communities within Bushplan site no. 261 in the route of the proposed pipeline comprise *Melaleuca cuticularis* low woodland, *Eucalyptus gomphocephala* (tuart) open woodland and cleared land.

The mapping in Perth's Draft Bushplan (WAPC 1998) shows that the wetland vegetation in the route of the proposed pipeline is regionally significant bushland. Perth's Draft Bushplan identifies Bushplan site no. 261 as having the largest area of non-estuarine *Melaleuca cuticularis* low woodland to low closed forest in the Perth Metropolitan Region.

The proposed pump station is located on land that has been cleared, though some remnant individuals of indigenous species are present. The pump station site is not within a Bushplan site nor the Beeliar Regional Park.

East of Lake Coogee, a portion of the pipeline route adjoins regionally significant remnant vegetation in Bushplan site no. 429 - Market Garden Swamps, Spearwood/Munster. Vegetation communities in this Bushplan site include *Melaleuca rhaphiophylla* low open forest, *Melaleuca cuticularis* low woodland and *Eucalyptus gomphocephala* open forest.

The location of the sewer pipeline route in relation to Bushplan sites is shown in Figure 2.

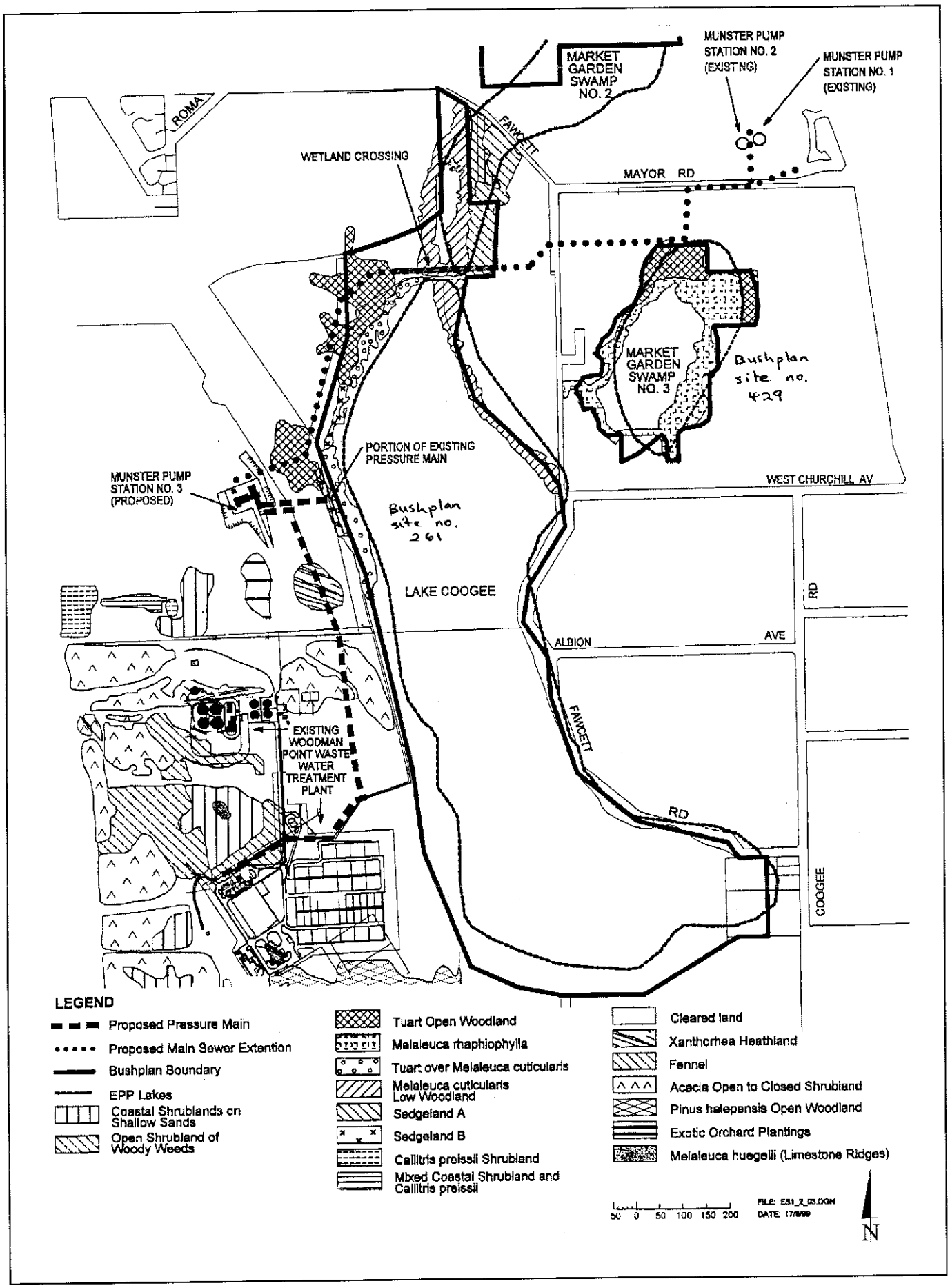


Figure 2. Environmental features around proposed works (Source: Woodman Alliance, with additions by DEP).

Submissions on the PER

In response to the PER, several submissions sought that vegetation loss be minimised or avoided, particularly in the tuart woodland and in areas of *Melaleuca cuticularis,* and that any areas damaged be rehabilitated with indigenous species. Submitters also contended that, in addition to replacement plantings, given the gains made by the proponent in using sensitive portions of the park, the proponent should contribute to other management works within the park.

Concern was expressed about the incremental loss of the condition of the Beeliar Regional Park, and that alternative alignments should be considered more thoroughly.

Proponent commitments

Following the public review period, the proponent has made revisions to the proposal and commitments as follows:

- the temporary construction causeway will abut the existing causeway, and the width of the temporary causeway is reduced so that clearing requirements across the wetland are reduced from approximately 0.26 hectares to approximately 0.14 hectares of *Melaleuca cuticularis* low woodland;
- the route of the pipeline to the west of the wetland crossing has been adjusted to avoid impacts on larger tuarts;
- the proponent will prepare and implement a Landscape and Vegetation Management Plan to minimise impacts on native vegetation, landforms of significance and visual amenity, prevent spread of weeds as a result of construction activities, rehabilitate disturbed areas, undertake 50 per cent more revegetation of wetland vegetation than disturbed by construction activities, and to ensure no net loss of the values and functions of wetlands and of vegetation in Bushplan sites;
- 50 per cent more wetland will be revegetated than is disturbed by construction activities; and
- the construction of the structure over the wetlands to the north of Lake Coogee will occur between December and May when the water level will be at its lowest, to minimise disturbance to the wetlands.

Assessment

The area considered for assessment of this factor is the Swan Coastal Plain.

The EPA's environmental objectives for this factor are to:

- maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities; and
- ensure that regionally significant flora and vegetation communities in Bushplan sites and Regional Parks are adequately protected.

The PER states that the *Melaleuca cuticularis* low woodland community is best described as vulnerable (GHD 1998 page 51). It is also described in the PER as being in poor condition. However, the City of Cockburn notes that bushland shown as poor to very poor south of Mayor Road may improve significantly through regeneration.

The open tuart woodland traversed by the proposed pipeline is disturbed land with little native understorey. It is described in the PER as in poor condition.

A portion of the proposed sewer pipeline route east of Lake Coogee adjoins regionally significant vegetation in Bushplan site no. 429 - Market Garden Swamps, Spearwood/Munster.

Impacts on vegetation communities will occur during the construction phase. However, as a result of modifications to the design and construction methods and the proponent's commitments since the public review period (as outlined above), these impacts have been reduced. The most significant impact will result from the clearing of approximately 0.14 hectares of *Melaleuca cuticularis* woodland to accommodate a 13 metre wide temporary causeway for pipeline construction purposes. It is considered that the impacts of the clearing for the causeway can be managed through the proponent's undertakings which include the removal of the temporary causeway, and rehabilitation of a greater area than is disturbed during construction, to ensure no net loss of the values and functions of the vegetation in Bushplan sites.

It is considered that impacts on the open tuart woodland in the Bushplan site can be managed through locating the pipeline so that no large tuarts need to be removed, as proposed.

Potential impacts on Bushplan site no. 429 can be prevented through the proponent's commitment to implement the proposal in accordance with the Landscape and Vegetation Management Plan referred to above.

To ensure adequate rehabilitation upon decommissioning of the proposal, the EPA's standard condition should be imposed requiring that a Decommissioning and Rehabilitation Management Plan is prepared and subsequently implemented.

Summary

Having particular regard to the:

(a) revised design and construction techniques;

(b) the commitment made by the proponent to prepare and implement a Landscape and Vegetation Management Plan to minimise impacts on native vegetation, landforms of significance and visual amenity, prevent spread of weeds as a result of construction activities, rehabilitate disturbed areas, undertake 50 per cent more revegetation of wetland vegetation than disturbed by construction activities, and to ensure no net loss of the values and functions of wetlands and of vegetation in Bushplan sites;

(c) the commitment made by the proponent to construct and remove the temporary causeway over the wetlands between December and May when the water level will be at its lowest;

(d) impacts on vegetation being largely limited to short term construction impacts; and

(e) potential for a positive contribution to the rehabilitation of areas currently in poor condition;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that the conditions include the EPA's standard Decommissioning and Rehabilitation Management condition.

3.2 Wetlands - impacts during construction on Lake Coogee and Market Garden Swamps

Description

The proposed gravity sewer main crosses the southern end of Market Garden Swamp No. 2, adjoining an existing Water Corporation causeway. This causeway abuts the northern end of Lake Coogee and contains three sewer pressure mains. A small culvert in the causeway links Lake Coogee with Market Garden Swamp No. 2.

Part of the proposed route of the sewer is near Market Garden Swamp No. 3. However the proposed route is over 50 metres from the edge of the wetland vegetation as mapped in the PER.

The proposed pump station is located approximately 150 metres from Lake Coogee.

The proposal involves disturbance to Market Garden Swamp No. 2 and adjoining land during the construction phase. Impacts on the wetland will result from the clearing of wetland vegetation and the construction of a temporary causeway, as referred to in section 3.1; the construction of pipeline pile footings; and may result from the disposal of drainage water and minor quantities of groundwater.

The original proposal involved extensive dewatering associated with the construction of the sewer pump station. Under the revised construction method using the caisson sinking technique, the proponent advises that disposal of groundwater will be reduced to approximately 3 000 cubic metres.

Following rehabilitation, ongoing impacts on the wetlands are not expected, provided that leaks from the sewer are prevented. This is addressed in section 3.3 below.

Submissions on the PER

Several submissions raised concerns about the potential for environmental impacts on Lake Coogee. Of concern were the impacts of dewatering, inconsistency with the Environmental Protection (Swan Coastal Plain Lakes) Policy, and cumulative effects of developments around Lake Coogee. Action to improve the hydrological connectivity through the existing causeway was sought.

Proponent commitments

Since the public review period, the proponent has revised the proposed construction techniques for the pipeline and pump station, and its commitments. The need for dewatering during the construction of the new pump station has been removed.

The proponent has committed to:

- prepare and implement a Landscape and Vegetation Management Plan that includes minimising impacts on landforms and wetland vegetation, rehabilitating areas disturbed during construction, and weed management, to ensure no net loss of the values and functions of wetlands;
- prepare and implement a Water Management Plan for the construction of the main sewer and pump station, to address prevention of direct discharge of excess water and storm water runoff to Lake Coogee and other adjacent wetlands, and disposal of groundwater;
- prepare and implement a strategy to increase the hydraulic connectivity through the causeway, if an initial report shows that such action is likely to improve the quality and viability of the wetlands; and
- construct and remove the temporary causeway over the wetlands between December and May to minimise disturbance to the wetlands.

Assessment

The area considered for assessment of this factor is Lake Coogee and Market Garden Swamps Nos 2 and 3 and buffers around those wetlands.

The EPA's environmental objective for this factor is to maintain the integrity, functions and environmental values of wetlands.

Lake Coogee and Market Garden Swamps Nos 2 and 3 are subject to the provisions of the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992. This Policy protects lakes by prohibiting the carrying out of activities such as filling, excavation and disposal of drainage water, unless the works are authorised under the Environmental Protection Act 1986 (EP Act). Authorisation includes conditions set following the environmental assessment process, under section 45 of the EP Act.

Lake Coogee is mapped as a conservation management category wetland in the wetland mapping work undertaken for the Water and Rivers Commission dated April 1998, while Market Garden Swamps Nos 2 and 3 are mapped as resource enhancement management category. The mapping shows that Market Garden Swamp No. 3 has been verified as requiring rehabilitation as a management priority.

The existing causeway between Lake Coogee and Market Garden Swamp No. 2 currently limits the natural connectivity between these water bodies. The presence of the causeway since 1972 may have affected the types of vegetation communities and salinity of the adjacent bodies of water that have developed since that time. At this stage, it is not known whether or not increasing the hydrological connection between the water bodies is likely to be associated with environmental benefits. The proponent has accordingly committed to a two part commitment. The proponent will firstly examine the implications of increasing the hydrological connectivity between Lake Coogee and Market Garden Swamp No. 2, and then, if it is likely to improve the quality and viability of the wetlands, will implement a strategy to increase the hydrological connectivity.

Taking into account the management objectives for the wetlands, it is considered that provided there is satisfactory implementation by the proponent of the commitments, there should be no net loss of the values and functions of the wetlands.

Summary

Having particular regard to the:

(a) revised design and construction techniques; and

(b) the proponent's revised commitments to:

- prepare and implement a Landscape and Vegetation Management Plan to ensure no net loss of the values and functions of wetlands;
- prepare and implement a Water Management Plan for the construction of the main sewer and pump station, to address prevention of direct discharge of excess water and storm water runoff to Lake Coogee and other wetlands, and disposal of groundwater;
- prepare and implement a strategy to increase the hydraulic connectivity through the causeway, if an initial report shows that such action is likely to improve the quality and viability of the wetlands; and
- construct and remove the temporary causeway over the wetlands between December and May, to minimise disturbance to the wetlands;

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

3.3 Groundwater and surface water quality - impacts on water quality of wetlands

Description

Impacts resulting from the proposal on the water quality of the Lake Coogee and Market Garden Swamps Nos 2 and 3 wetlands may potentially arise from stormwater drainage from the sewer pipeline construction corridor and pump station site during the construction phase, from stormwater drainage from the pump station site, and from leaks or catastrophic damage to the main sewer or pump station following commissioning of the sewer.

During the construction phase stormwater drainage may contain sediment and discharges such as oils from vehicles.

The sewer across the wetland, being a gravity (non-pressurised) main, will be under hydrostatic pressure only.

The PER states that stormwater drainage for the operational phase of the pump station will be directed to a sump within the bunded area of the pump station, to be agreed with the appropriate authorities.

In the PER, dewatering for the pump station excavation was identified as a potentially major issue. However, after the public review period the construction method for the pump station was reviewed and no longer involves substantial dewatering.

The proposal reduces the risk of an overflow to the environment compared with the existing system by providing additional storage within the large diameter gravity sewer and new wet well, and through additional pumping capacity.

The PER advises that additional enclosed and open storage will be pursued at Munster Pump Station No.2. This is, however, not part of this proposal, and would be subject to the requirements of the EP Act.

The Water Corporation advises that flows in pressure mains and sewage pumped to wastewater treatment plants are continuously measured and recorded. The need for additional open or enclosed storage is reviewed every five years or whenever the flow increases to a pre-set level as set by the management plan for the asset. This provides a five year lead time to allow for approvals and construction (correspondence from WA21, 7 December 1999).

Submissions on the PER

Most submissions on this factor expressed concern about the dewatering process and its impacts, based on the information provided in the PER.

Proponent commitments

Since the public review period, the proponent has revised the proposed construction techniques for the pipeline and pump station, and its commitments, as follows:

- the revised construction methods to be used for the pump station will reduce the volume of water to be removed during construction to approximately 3 000 cubic metres;
- the sewer is to be made of pre-stressed concrete lined with plastic, and instead of 75 pipe joints where will be two joints, one at each end of the wetland crossing;
- a commitment is made to prepare and implement a Water Management Plan for construction of the main sewer and pump station, to prevent direct discharge of excess water and storm water runoff to Lake Coogee and other adjacent wetlands, and to address groundwater disposal; and
- a commitment is made to prepare and implement a Leak Management Plan to ensure the integrity of the main sewer, minimise the potential for leaks and manage spillage of sewage at the wetland crossing in the event of catastrophic damage to the main sewer.

Assessment

The area considered for assessment of this factor is Lake Coogee and Market Garden Swamps Nos 2 and 3 and buffers around those wetlands.

The EPA's environmental objective for this factor is to maintain or improve the quality of groundwater and surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).

The beneficial use of the groundwater in the locality which may potentially be significantly affected by the proposal as modified during the assessment process is ecosystem maintenance of the wetlands.

The water quality of the wetlands is influenced by both surface water runoff and groundwater flows.

Investigations by the proponent (GHD 1998) established that there were high nutrient levels in lake samples both north and south of the causeway and in groundwater samples, and that Lake Coogee is a saline lake of variable salinity with the water about twice as saline as water from the wetland area to the north of the causeway.

Provided there is satisfactory implementation by the proponent of the proposal and the commitments, the proposal is not expected to cause any significant risk of deterioration of the quality of the groundwater and the surface water that flows into Lake Coogee and adjacent wetlands.

Summary

Having particular regard to:

(a) the revised design and construction techniques that remove the need for substantial dewatering, and reduce the number of joints in the section of the pipe over the wetland to one at each end of the wetland crossing; and

(b) the proponent's commitments to prepare and implement a Water Management Plan and a Leak Management Plan;

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

3.4 Soil contamination - disturbance of contaminated soil during construction of pipeline

Description

Land to the north of Market Garden Swamp No. 3 has been filled with material which appears to be of demolition origin. Soil samples taken from along the proposed pipeline route between the existing Munster pump station and Fawcett Road were found to contain lead, pesticides, sulphate, mercury and asbestos sheeting.

Submissions on the PER

A submission from the WRC recommended that a comprehensive soil and groundwater assessment since some contaminants may enter the dewatering discharges requiring some form of treatment prior to disposal.

Proponent commitments

To manage this factor the proponent has committed to:

- prepare and implement a Soil Contamination Management Plan to identify and manage any contaminated fill encountered during construction of the main sewer to the appropriate standard.

Assessment

The area considered for assessment of this factor is the construction corridor for the sewer pipeline.

The EPA's environmental objectives for this factor are to:

- ensure that contamination does not pose a threat to beneficial uses of the soil and public health; and
- ensure the rehabilitation of the site is to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria.

It is considered that provided there is satisfactory implementation by the proponent of the commitments, subject to auditing and verification of compliance with cleanup criteria by the DEP, this factor can be managed to meet the EPA's objectives.

Summary

Having particular regard to the proponent's commitment to prepare and implement a Soil Contamination Management Plan, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's environmental objectives for this factor subject to auditing and verification of clean up criteria.

3.5 Odour - impacts on amenity

Description

Sewage is associated with odorous air that has the potential to adversely impact on the welfare and amenity of other land users. The opportunities for odour emission from the pump station and sewer main, however, will be reduced through the retention of all sewage within enclosed structures.

The proposed pump station is located approximately 500 metres inside the boundary of the Woodman Point Wastewater Treatment Plant buffer, and is over 600 metres from the nearest residences.

Submissions on the PER

Submissions on this factor were conditionally supportive of the proposal to locate the pump station on the west side of Lake Coogee. The main comments were that:

- an odour buffer around the existing pump station should not be required, and the existing pump station should be decommissioned as soon as possible;
- the new pump station should not require a buffer which will restrict any future residential development in the locality; and
- the proposed facilities should not cause unacceptable odours or in any way compromise the landowners' efforts to have the Woodman Point Wastewater Treatment Plant Odour Buffer reduced back to the eastern side of Lake Coogee.

Proponent commitments

Since the public review period, the proponent has provided additional information relevant to the environmental factor odour as contained in Appendix 8, and has committed to controlling odours so that odours associated with the proposal are contained within the existing odour buffer surrounding the Woodman Point Wastewater Treatment Plant, except during annual maintenance of the main sewer. Outlets at Munster Pump Station No. 3 and along the portion of the Bibra Lake main sewer in the proposal, will be restricted to manholes. All covers will be bolted down to withstand a 9 metre head of water and airtight, and remedial actions will be taken if necessary.

Assessment

The area considered for assessment of this factor is the potential extent of odour impacts around the proposed sewer pipeline extension and pump station.

The EPA's environmental objective for this factor is that odours emanating from the proposal should not adversely affect the welfare and amenity of other land users.

Provided there is satisfactory implementation by the proponent of the above commitments, it is considered that this factor can be managed to meet the EPA's objectives. In particular, the EPA notes that the pump station will be located within the existing Woodman Point Wastewater Treatment Plant buffer and that its operation is not predicted to require any increase in that buffer.

Summary

Having particular regard to:

(a) the restriction of outlets at Munster Pump Station No. 3 and along the portion of the Bibra Lake main sewer in the proposal to bolted down airtight manholes;

(b) the proponent's commitment to ensure that odours, except during annual maintenance of the main sewer, are contained within the existing odour buffer surrounding the Woodman Point Wastewater Treatment Plant; and

(c) the location of the proposed pump station inside the Woodman Point Wastewater Treatment Plant buffer and approximately 500 metres from the perimeter of the buffer;

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 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. They do, however, 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.

The EPA may, of course, also recommend conditions additional to those relating to the proponent's commitments.

4.1 Proponent's commitments

The proponent's commitments as modified during the PER assessment process and included in Appendix 5, should be made enforceable.

4.2 Recommended conditions

Having considered the proponent's commitments and the 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 Munster Pump Station No. 3 and the extension of the Bibra Lake main sewer, is approved for implementation.

These conditions are presented in Appendix 5. Matters addressed in the conditions include the requirement that the proponent fulfil the commitments in the Consolidated Commitments statement set out in Schedule 2 to the recommended conditions in Appendix 5.

It should be noted that other regulatory mechanisms relevant to the proposal include Part V of the EP Act, the Environmental Protection (Noise) Regulations, the Aboriginal Heritage Act, the Wildlife Conservation Act, and planning requirements under the Town Planning and Development Act and the Metropolitan Region Town Planning Scheme Act.

5. Conclusions

The EPA has considered the proposal by the Water Corporation to construct and operate Munster Pump Station No. 3 and the extension of the Bibra Lake main sewer.

The key issues for the proposal are the protection of Lake Coogee and Market Garden Swamps Nos 2 and 3 and the vegetation associated with these wetlands, the protection of the amenity of other land users from odour, and the management of contaminated soil along a section of the pipeline route.

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.

The EPA notes that any proposal in the future for open storage of sewage associated with the proposed pump station would be subject to the provisions of the EP Act.

6. Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment 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.

Recommendations

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

1. That the Minister notes that the project being assessed is for the construction and operation of Munster Pump Station No. 3 and the Bibra Lake main sewer extension, Munster, City of Cockburn;
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 the proposal can be managed such that the EPA's objectives will not be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 5 and summarised in Section 4, including the proponent's commitments;
4. That the Minister imposes the conditions and procedures recommended in Appendix 5 of this report.

Appendix 1

Identification of Relevant Environmental Factors

Identification of Relevant Environmental Factors

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Biophysical			
Terrestrial Flora - Vegetation Communities	The proposed pipeline passes through *Melaleuca cuticularis* low woodland, tuart open woodland and fennel within Bushplan site no. 261 - Lake Coogee and Adjacent Bushland, Munster. Outside this Bushplan site the proposed pipeline and pump station are located in land that has been cleared, though some remnant individuals of indigenous species, including tuarts, are present. The PER states that the *Melaleuca cuticularis* low woodland community is best described as vulnerable (GHD 1998 page 51). Part of the proposed pipeline is adjacent to Bushplan site no. 429 - Market Garden Swamps, Spearwood/Munster.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • Vegetation loss should be minimised, particularly in the tuart woodland and areas of *Melaleuca cuticularis*. • Damaged areas should be rehabilitated using indigenous species grown from local seed, where appropriate. • Rehabilitation should be in accordance with CALM's Management Plan for Beeliar Regional Park and the City of Cockburn's Management Plan for Lake Coogee. • CALM's dieback management guidelines should be implemented. • In addition to replacement plantings, additional trees should be planted. • There is concern that satisfactory rehabilitation of areas of tuart and paperbarks may not be achievable. • The proposal to clear vegetation to construct a pump station is of concern. • The proposed rehabilitation program can lead to the conservation of Lake Coogee. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Ministry for Planning (MfP)** • MfP recognises that with appropriate planning the proposed works may contribute positively to revegetation. • Further consideration should be given to avoiding the stands of tuart and *Melaleuca cuticularis*. The later is not common in the metropolitan area. • All indigenous trees that are removed should be mulched and stockpiled at a weed free area on the site for spreading following construction. Seed from species endemic to the site should be collected and used on site. **Department of Conservation and Land Management** • Rehabilitation should be to the satisfaction of CALM. • The removal of vegetation around the proposed pump station should be minimised. **Aboriginal Affairs Department** • The Aboriginal community recommends that the proponent avoids or minimises the impact on native flora. **Water and Rivers Commission (WRC)** • Clearing of native vegetation has the potential to impact on Lake Coogee and the System 6 area. • Dewatering during construction may result in stress and/or death of wetland plant species. **City of Cockburn** • Bushland shown as poor to very poor south of Mayor Road may improve significantly through regeneration. • The proponent's approach of minimising the impacts of the sewer construction on the tuart woodland and *M. cuticularis* woodland is commendable. Revegetation should be from local provenance. The proponent should commit to carry out weed control and revegetation on and in the vicinity of the existing causeway.	Considered to be a relevant factor.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Terrestrial Flora - Beeliar Regional Park/ System 6 M92	The proposed pipeline is partially located within the Beeliar Regional Park and System 6 area M92 - Cockburn Wetlands - Western Chain. The System 6 site in the vicinity of the proposal has been redefined as Bushplan site no. 261 - Lake Coogee and Adjacent Bushland, Munster, and no. 429 - Market Garden Swamps, Spearwood/Munster. The proposed pump station is not within the Beeliar Regional Park or Bushplan sites.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • Submitters are not satisfied that adequate investigation has been made of alternatives for the required infrastructure to be located in an area of least impact to the Beeliar Regional Park, such as the Mayor Road - Beeliar Drive extension options. • Given the gains made by the proponent in using sensitive portions of the park, the proponent should go beyond its commitments and contribute to other management works within the park. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Department of Conservation and Land Management** • This proposal is one of many infrastructure projects which will result in incremental loss of the condition of regional parks. • Infrastructure proposals should be consolidated in an area of least impact to the regional park. • CALM is not satisfied that adequate investigation has been made of alternatives. **Ministry for Planning** • There are reservations regarding the preferred route for the pipeline given the potential for adverse environmental impacts on the primary objectives of Beeliar Regional Park. • It is essential that appropriate planning is undertaken with CALM. **City of Cockburn** • As the vesting agency for the Beeliar Regional Park in this case, the City request that they have an advisory capacity in relation to the majority of the proponent's commitments. • The proponent should go beyond its commitments and contribute to other management works within the park. **Australian Heritage Commission** • Although the proposal will adversely impact on the national estate values of the Park, it appears that feasible alternatives have been considered and that measures are proposed to minimise adverse impacts. **Water and Rivers Commission** • The proposal may impact on the Beeliar Regional Park through clearing, dewatering, discharge of stormwater, leaks and visual impacts.	Considered to be a relevant factor

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Terrestrial Flora - Declared Rare and Priority Flora	No Declared Rare and Priority Flora (DRF) were identified during vegetation and floristic surveys, and searches of Rare and Priority Flora databases held by CALM indicated there are no records of any DRF or priority species in the Lake Coogee area.	**SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Department of Conservation and Land Management** • CALM noted the PER finding that CALM databases indicate that there are no records of DRF or priority flora species in the Lake Coogee area.	Taking into account: • the absence of records of DRF or priority species in the Lake Coogee area in CALM databases; • no DRF species were found during vegetation and floristic surveys; • the proponent's commitment to seek comments from CALM on the Landscape and Vegetation Management Plan before construction works; and • the provisions of the Wildlife Conservation Act 1950; no further evaluation of this factor is required by the EPA.
Terrestrial Fauna	The construction of the pipeline will impact on the habitats within Bushplan site no. 261 outlined above for the factor "Vegetation Communities". The PER found that the habitat integrity for the tuart woodlands is poor-fair, and for the stands of emergent *M. cuticularis* poor-fair (page 56 GHD 1998).	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • The extension of the main sewer into the Beeliar Regional Park is of concern in terms of habitat loss. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Ministry for Planning** • The impact that the low bridge may have over the movement of fauna, including kangaroos, particularly if the bridge is fenced, is of concern. • An estimated time line for works should be provided to enable an evaluation of the possible impacts on habitat that the project may cause.	Protection of habitat is addressed through the protection of vegetation communities/Bush plan sites. No further evaluation of this factor required by the EPA.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Terrestrial Fauna - Specially Protected (Threatened) Fauna	The PER reports a single sighting of the Short Billed Black Cockatoo *Calyptorhynchus latirostris* a Schedule 1 species under the Wildlife Conservation Act.		The single sighting is not considered to represent a particular association of the Short Billed Black Cockatoo with the area. No further evaluation of this factor required by the EPA.
Wetlands	The proposed pipeline will cross Market Garden Swamp No. 2 and is in proximity to Market Garden Swamp No. 3 and Lake Coogee. The Environmental Protection (Swan Coastal Plain Lakes) Policy applies to these three wetlands. The updated wetland mapping work undertaken for the WRC dated 1998 classifies Lake Coogee as mostly verified Conservation Management Category, while Market Garden Swamps Nos. 2 and 3 are resource enhancement management category wetlands. Under the 1998 WRC mapping, Market Garden Swamp No. 3 is also verified as requiring rehabilitation as a management priority.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • The pipeline has the potential for adverse environmental impacts upon Lake Coogee. If the proposal is approved, all work should be carried out to minimise pollution and damage to Lake Coogee. • The proposal is not consistent with the Environmental Protection (Swan Coastal Plain Lakes) Policy. • The cumulative effects of all the proposed developments near Lake Coogee and the coastal wetland chain need to be addressed before any are allowed to proceed. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Department of Conservation and Land Management** • The PER acknowledges that no studies have been carried out on the wetland biota of Lake Coogee. Until this is done it is difficult to predict potential impacts on lake ecology (eg impacts of dewatering). **City of Cockburn** • There should be no disposal of dewatering liquid directly to Lake Coogee. • The proponent's commitment to investigate opportunities for increasing the hydrological connectivity through the existing causeway should be strengthened to include undertaking action to improve connectivity. • The existing Mayor Road pump station should be decommissioned as soon as possible to avoid the potential for overflows to impact on Market Garden Swamp No. 2. **Water and Rivers Commission** WRC has no objection to the plan but notes that the proposal has the potential to impact on Lake Coogee through clearing of vegetation, dewatering, discharge of stormwater, visual impacts and leaking.	Considered to be a relevant factor.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Groundwater	The construction of the pump station as envisaged in the PER was associated with a substantial dewatering requirement which had the potential to affect the beneficial uses of the groundwater, including maintenance of the Lake Coogee wetland system and irrigation for market garden uses. Following the public review period, the proposed method of construction of the pump station has been modified. Substantial dewatering is no longer required. The volume of water to be removed is down to approximately 3 000 cubic metres. Minor dewatering may be required for the footings for the sewer wetland crossing.	**SUBMISSIONS FROM THE PUBLIC** • Works below the groundwater level should be undertaken in the shortest possible time. Construction over 7 days or even 2 shifts would reduce construction time and hence problems from dewatering. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **City of Cockburn** • There should be no disposal of dewatering liquid directly to Lake Coogee. The City's preference would be for dewatering liquid to be disposed of by re-injection or irrigation, with the use of the Woodman Point WWTP or emergency sewer outfall as the next most desirable approaches. **Ministry for Planning** • There is no estimation of the amount of groundwater that will be pumped up in the dewatering process. An approximation of the amount and location of the re-injection area, and timelines, should be included. • An estimated time line for works should be provided to enable an evaluation of the possible groundwater impacts that the project may cause. **Water and Rivers Commission** The development of a detailed dewatering plan is supported.	As a result of modifications to the proposal, significant impacts on the quantity of groundwater will be avoided. Disposal of groundwater during construction is addressed under the factor Surface Water Quality, below. No further evaluation of this factor required by the EPA.
Pollution Management			
Air - Odour	This factor was raised in the proponent's PER document and during the public submission period. The nearest residences are over 600 metres from the proposed location of the pump station, which is within the odour buffer associated with the Woodman Point Wastewater Treatment Plant. The proposal does not include storage of sewage. Open storage may be needed in about 2025. The proponent recognises that future open storage would be subject to the provisions of the Environmental Protection Act. A section of the proposed pipeline passes through urban zoned land and land reserved for Parks and Recreation purposes.	**SUBMISSIONS FROM THE PUBLIC** • The location of the pump station on the western side of Lake Coogee is supported, provided that odours associated with the new pump station will not require a buffer which will restrict any future residential development in the locality. • The new pump station and gravity main sewer extension is supported subject to these facilities not causing unacceptable odours or in any way compromising the landowners' efforts to have the Woodman Point Waste Water Treatment Plant Buffer reduced back to the eastern side of Lake Coogee. • The existing Mayor Road pump station should be decommissioned as soon as possible to avoid adverse odour impacts on nearby residential areas. • The proponent should provide a commitment that a buffer around the existing pump station, which will remain semi-operational, will not be required. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **City of Cockburn** • The location of the pump station on the western side of Lake Coogee is supported, and should be constructed as a priority to allow the decommissioning of the existing Mayor Road pump station to be brought forward. • The proponent should provide a commitment that a buffer around the existing pump station, which will remain semi-operational, will not be required.	Considered to be a relevant factor.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Air - Particulates / Dust	There is potential for dust generated during the construction phase of the pipeline to impact on adjacent residences. The PER considered nuisance from dust in accordance with the methodology in "Land Development Sites and Impacts on Air Quality" (DEP 1996) and found that the proposed pump station is associated with negligible dust risk, but sections of the pipeline are associated with medium risk. The proponent has committed to preparing and implementing a Dust Management Plan.		Operations likely to generate significant volumes of dust are not a feature of this proposal Dust may be an issue for some residences for a short time but this can be managed through the consultation required between the proponent and the local authority, and the proponent's commitment. No further evaluation of this factor is required by the EPA.
Water - Groundwater Quality	The proposal as described in the PER had the potential to substantially impact on groundwater quality as a result of dewatering during the construction phase. Following the public review period the proponent has reviewed the method of construction for the pump station and pipeline, and substantial dewatering is no longer proposed. However, following construction, leaks or a catastrophic break in the pipeline may potentially affect groundwater quality and the beneficial uses of the groundwater which include ecosystem maintenance of the Lake Coogee wetland system and market garden use.	**SUBMISSIONS FROM THE PUBLIC** • Works below the groundwater level should be undertaken in the shortest possible time. Construction over 7 days or even 2 shifts would significantly reduce construction time and hence problems from dewatering. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **City o Cockburn** • There should be no disposal of dewatering liquid directly to Lake Coogee. **Water and Rivers Commission** • A comprehensive groundwater contamination assessment is required so that the potential for any environmental harm may be assessed. This is especially required because some contaminants (including lead and pesticides) may enter the dewatering discharges. • The development of a detailed dewatering plan is supported. The Commission's preference is for disposal of dewatering via recharge or reinjection. **Ministry for Planning** • An estimated time line for works should be provided to enable an evaluation of the possible groundwater impacts that the project may cause.	Considered to be a relevant factor.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Water - Surface Water Quality	There is a potential for nutrients and contaminants in stormwater drainage, leaks and other discharges to impact on the water quality and hence the ecosystems of Lake Coogee and Market Garden Swamps 2 and 3. These are wetlands to which the Environmental Protection (Swan Coastal Plain Lakes) Policy applies, and are associated with regionally significant vegetation. Prior to the public review period, substantial dewatering in association with the new pump station was proposed. Although construction techniques have been reviewed, and substantial dewatering is no longer proposed, some groundwater would still require disposal. The quality of this water has a potential to impact on the wetlands/Bushplan sites.	**SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **City of Cockburn** • There should be no disposal of dewatering liquid directly to Lake Coogee. There may be an impact on water quality and water chemistry. The Water Corporation should commit to an open programme for monitoring the impacts of dewatering disposal on both water quality and the hydrological regime of Lake Coogee. **Ministry for Planning** • The proposed location and size of surface drainage ponds to contain surface run-off from construction, and the clean-up methods of these ponds, should be agreed to following consultation with CALM. **Water and Rivers Commission** • There is potential for leakage from the sewer main into Lake Coogee (small leakage only). • Stormwater management should incorporate best management practices for urban stormwater design and these are outlined in the WRC's Manual for Managing Urban Stormwater Quality in Western Australia (1998). Stormwater should be disposed of onsite in infiltration basins with the capacity to hold a 1 in 10 year storm event.	Considered to be a relevant factor.
Land - Soil contamination	Some contaminants in fill along the route of the proposed pipeline, north of Market Garden Swamp No. 3 were found to be at levels which are higher than are considered suitable for residential development.	**SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Water and Rivers Commission** • The Commission recommends that a comprehensive soil and groundwater contamination assessment be required, to be reported to the Commission. This is especially required since some contaminants may enter the dewatering discharges.	Considered to be a relevant factor.
Non-Chemical Emissions - Noise	The construction phase will be associated with noise, as will the operation of the proposed pump station. The proposed pump station, however, is not in close proximity to residences.	**SUBMISSIONS FROM THE PUBLIC** • The preferred option for the new pump station and gravity main sewer extension is supported subject to these facilities not causing unacceptable noise. • To construct another pump station in Mayor Road would be a shortsighted decision given that the existing pump station has caused serious social problems such as the noise of the starting and closing down of pumps at all hours.	Taking into account that both construction noise and noise from ongoing operations are regulated under the Environmental Protection (Noise) Regulations, no further evaluation of this factor is required by the EPA.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 6)	Identification of relevant factors
Non-Chemical Emissions - Vibration	There is the potential for rock breaking activities to occur within 100 metres of residences during the construction of the pipeline. The proponent has committed to undertake a property condition survey of houses along the route of the main sewer.	**SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **City of Cockburn** • The proponent should provide a commitment that pre-commencement inspections of buildings located near the works will be undertaken to ensure that any damage that is caused through vibration from the works is addressed by the proponent.	Taking into account that pollution from vibration may be addressed under Part V of the Environmental Protection Act, and that the proponent is required to consult with the City of Cockburn prior to construction of the sewer main, no further evaluation of this factor is required by the EPA.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 4)	Identification of relevant factors
Social Surroundings			
Aesthetic - Visual Amenity	The development of the pipeline and pump station will result in both short-term and long term impacts on the visual character of the area. The wetland sewer crossing is in an area of high scenic quality. The pump station is in an area of low scenic quality outside, but visible from, the Beeliar Regional Park. The pump station and pipeline crossing form part of the viewscape from housing to the north and from local and regional roads, as well as from points around the lake. The public sensitivity of these sites is high. Following the public review period the proponent has prepared a revised visual assessment with management recommendations. The proponent has also modified the design of the wetland crossing. The modified proposal is for a pipe 2.55 metres in external diameter with the proposed hand rail on top of the pipe to be 4.8 metres above the wetland ground surface (top of pipe 3.6 m above wetland surface). The pipe is to be above ground for approximately 155 metres. The proponent has committed to preparing a Landscape and Vegetation Management Plan that will address impacts on visual amenity.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • The net result will be loss of visual amenity. • The proposal is supported subject to the low level bridge profile alternative at the northern end of Lake Coogee to minimise the visual impact of the crossing. • The visual intrusion of a bridged pipe which can be camouflaged by greenery will be nothing compared to the visual intrusion of the present pump station which is an ugly blob on the landscape. • There is no way a three metre wide pipe some 800 metres long can be visually screened. • Consideration should be given to transforming the appearance of the proposed bridge, such as by the formation of murals along the sides of the pipe. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Ministry for Planning** • The proposed sewer, pump station and loss of mature trees will create undesirable visual impacts. An alternative route to the north may reduce such impacts. • The Water Corporation should undertake extensive revegetation and re-contouring works around the proposed pump station site to reduce its visual impact. **City of Cockburn** • Suitable detail is not available in the PER to determine whether or not the approach to mitigation of visual impact, landscaping and revegetation is appropriate. The landscape plan which the Water Corporation has committed to developing should be prepared in consultation with Council and the local community to ensure that all local concerns are adequately addressed. **Department of Conservation and Land Management** • The visual assessment methodology and management recommendations in the PER are inadequate. • CALM undertook an assessment of the potential visual impact of the low-bridge option and found that this option would have considerable impact on the natural landscape character for a considerable viewshed surrounding the lake. On the basis of potential visual impact, it is strongly preferred that the pipeline is located outside of the regional park. • The visual and amenity impacts of the proposed pump station are of concern. The pump station should be designed and built to be consistent with rural landscape character, and to a high aesthetic standard.	The wetland pipeline crossing and proposed pump station are on land reserved for the purposes of Parks and Recreation and Public Purposes under the Metropolitan Region Scheme. Referral of the parts of the proposal within these reserves to the Western Australian Planning Commission is required. Protection of visual amenity in these locations is appropriately addressed through the planning process. No further evaluation by the EPA required.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 4)	Identification of relevant factors
Social Surroundings			
Culture and Heritage - European Heritage	The Beeliar Regional Park and adjacent areas are listed with the Australian Heritage Commission on the register of the national estate. The City of Cockburn Municipal Heritage Inventory also lists a number of places of heritage value in the general vicinity. These include tuart trees, and the ruins just south of the proposed pump station site.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • The work and resulting structures should be closely monitored to minimise adverse impacts on national estate values. • The proponent should restore the ruined heritage cottages on the western side of Lake Coogee. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Department of Conservation and Land Management** • No assessment was included in the PER as to the probable effect of the interim listing of Lake Coogee as having "possible national heritage value". There may be a loss of heritage value for Lake Coogee, if the proposal is approved in its present form. **City of Cockburn** • The proponent should make a further commitment in relation to the Lake Coogee ruins to contribute towards the restoration or improvement of the condition of the ruins, rather than just fencing the area off.	Protection of places of heritage is afforded through the Heritage of Western Australia Act. No further evaluation by the EPA required
Culture and Heritage - Aboriginal Heritage	A recorded site is in the locality but is not impacted by the proposal. An Aboriginal heritage survey including meetings with Aboriginal groups has been undertaken and a report sent to the Aboriginal Cultural Materials Committee.	**SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **The Aboriginal Affairs Department** • While no Aboriginal sites are impacted by the proposal, the Aboriginal community has recommended that the proponent avoid or minimise the impact on native flora. If disturbance is unavoidable, disturbed areas should be revegetated. • The wording of commitment 19 should be changed to: During the excavation or construction stage, the area of the proposed alignment and pump station be monitored for Aboriginal skeletal and artefactual material by a qualified archaeologist, on obtaining a section 16 from the Aboriginal Affairs Department.	Protection of Aboriginal sites is afforded under the Aboriginal Heritage Act. Impact on native flora is addressed through the environmental factor - vegetation communities. No further evaluation by the EPA required.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 4)	Identification of relevant factors
OTHER ISSUES RAISED DURING THE PUBLIC REVIEW PERIOD			
Options for alignment and design of sewer main	The options identified in the PER include: • the new pump station on the west side of Lake Coogee, and the sewer main in the proposed Beeliar Drive road reservation; • the new pump station and sewer main extension on the eastern and southern sides of Lake Coogee; • a "high bridge" gravity-feed sewer crossing over the wetland; • a sewer under the wetland; • increase pumping capacity on Mayor Road and put pressure mains across the wetland near the existing pressure mains; and • the option preferred by the proponent, namely a "low bridge" gravity-feed sewer crossing the wetland, and pump station on the western side of Lake Coogee.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • The EPA should investigate further the option to align the main sewer extension along the east side of Lake Coogee and divert around the south end of the lake to Woodman Point Wastewater Treatment Plant. • The community were presented with three unacceptable options that do not meet environmental objectives. • The Beeliar Drive alignment is preferred. **SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **CALM and Ministry for Planning** • It is queried that adequate investigation has been made of alternatives for the required infrastructure to be located in an area of least impact to the Beeliar Regional Park. All the alternative options for extension of the sewer should be elaborated on, including detailed explanation of the precise environmental impacts likely to result from other alignments. • there may be other options not tabled in the PER which could be considered. **City of Cockburn** • It is preferred that the alignment for the main sewer extension is located within the proposed Beeliar Drive road reservation to consolidate the wetland crossing with infrastructure between Lake Coogee and Market Garden Swamp No. 2 into one central corridor. • The EPA is urged to consider a critical review of the projections relating to the proposal in terms of future requirements to ensure that the size and scale of the proposal is minimised along with consequent physical impacts on the local environment.	Taking into account: • the alignment of the proposed Beeliar Drive is not yet finalised, and is itself likely to require referral to EPA; • the eastern sewer alignment is substantially longer; • a "high bridge" crossing would not be associated with any environmental advantages compared with the proponent's preferred option; • additional pressure mains across the wetland are associated with potential adverse environmental impacts, and necessitate a pump station near Mayor Road to which there is strong community opposition; the EPA will consider the option preferred by the proponent. No further evaluation of this issue required by the EPA.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 4)	Identification of relevant factors
Disposal at sea	The proposed pump station and sewer main extension form part of upgrading works to accommodate the predicted sewage flow from the southern Perth metropolitan catchment to the year 2050. Treated effluent passes from the Woodman Point Wastewater Treatment Plant to an ocean outfall in Cockburn Sound.	**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • The extra sewerage effluent that will be dumped at sea is a worrying aspect. The EPA should decide whether they support the continuation of ocean disposal of sewage.	Approvals have previously been granted for the upgrading of the Woodman Point Wastewater Treatment Plant. The upgrading includes advanced secondary treatment of effluent which will significantly reduce the nutrient load to the ocean. No further evaluation of this factor required by the EPA.
Other		**SUBMISSIONS FROM THE PUBLIC AND ORGANISATIONS** • Efforts to minimise the impacts of the proposal should be made through a number of means including public consultation. • Some landowners in the locality submit that environmental clearance of the proposals is required urgently. • The proposal will have a major adverse effect both during the works and after on the social and environmental fabric of the area. • A public access walkway on top of the bridge would be of less value to the public than a dual use path where the current causeway lies to complete a loop around the lake. Walkers on top of the bridge would be exposed to noise and traffic of the Beeliar Drive extension assuming it goes ahead, and the views are better by the eastern, southern and western sides of the lake. • The development ignores the environmental requirements laid down in the MRS Amendments for the initial Jervoise Bay development in 1979 (255/31) emphasising the need to restore and retain the recreational opportunities of the coastal wetlands. • The sewer will detract from the visual amenity of the area, reducing the commercial value of property. • Locating the sewer on Lots Pt 1 and 2 Fawcett Road as depicted on Figures 3 and 7 is objected to as it will restrict the future development of the land and adversely affect the value of the land. However, an alternative alignment may be accepted. • A number of landowners in the "Lake Coogee Urban Development Area" support the proponent's "preferred option" subject to satisfactory arrangements including compensation if appropriate being made with the landowners whose properties are traversed by the gravity sewer. • If the pump station is constructed on the south side of Mayor Road or the odour buffer extended, some landowners advise that they will be seeking compensation.	These submissions are noted. They either raise issues that are addressed in part by the review of potential environmental factors, or that are beyond the scope of the assessment process, as provided for in the Environmental Protection Act 1986 and cannot be taken into account by the EPA.

Preliminary environmental factor	Proposal characteristic	Summary of Government agency and public comments (See Appendix 4)	Identification of relevant factors
Other (cont)		**SUBMISSIONS FROM GOVERNMENT AUTHORITIES** **Ministry for Planning** • The proponent should commit to providing community input to the project no matter which option is selected. • The recreational and social impacts from the proponent's preferred option are of concern, both during the period of the works and after. • The impact that the low bridge option may potentially have over the movement of people through the site is of concern, particularly if the bridge remains fenced following construction. **City of Cockburn** • sensitive environmental areas and the local community would still bear the cost of overflows should they occur. It is unacceptable to delay work on the additional enclosed and open storage at the new pump stations until 2011-2015. • Portions of the existing pump station site have significant potential to be incorporated into public open space associated with the Market Garden Swamps once the pump station has been decommissioned. In particular the western portion of the site which contains the historic lime kilns and remnant vegetation should be incorporated into public open space as a means of offsetting some of the impacts associated with the overall proposal.	

Appendix 2

Summary of Assessment of Relevant Environmental Factors

Summary of Assessment of Relevant Environmental Factors

Relevant Environmental Factor	EPA Objectives and Relevant Area	EPA Assessment	EPA Advice
Biophysical			
Vegetation communities - physical disturbance during construction on Bushplan sites and Beeliar Regional Park	**EPA Objectives** • Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities. • Ensure that regionally significant flora and vegetation communities in Bushplan sites and Regional Parks are adequately protected. **Relevant Area** Swan Coastal Plain	In order to construct the sewer main over Market Garden Swamp No. 2, the proponent plans to build a temporary causeway a maximum of 13 metres wide, adjoining the existing Water Corporation causeway, to the immediate north of Lake Coogee. This would involve the clearing of approximately 0.14 ha of wetland vegetation namely *Melaleuca cuticularis* low woodland, being regionally significant vegetation within Bushplan site no. 261 (Lake Coogee and Adjacent Bushland) and the Beeliar Regional Park. This community is described in the PER as "vulnerable" and in poor condition. The proposed pipeline also traverses open tuart woodland within and adjoining Bushplan site no. 261. The open tuart woodland is disturbed land with little native understorey. It is described in the PER as in poor condition. The proposed pipeline route traverses private property adjoining Bushplan site no. 429 (Market Garden Swamp No. 3). Several submissions sought that vegetation loss is minimised, particularly in the tuart woodland and in areas of *Melaleuca cuticularis,* and that any areas damaged are rehabilitated with indigenous species. Submitters also contended that, in addition to replacement plantings, given the gains made by the proponent in using sensitive portions of the park, the proponent should contribute to other management works within the park. Concern was expressed about the incremental loss of the condition of the Beeliar Regional Park, and that alternative alignments should be considered more thoroughly. In order to manage the impacts on vegetation communities, and taking into account matters raised during the public submission period, the proponent has committed to prepare and implement a Landscape and Vegetation Management Plan "to minimise impacts on native vegetation, landforms of significance and visual amenity, prevent spread of weeds as a result of construction activities, rehabilitate disturbed areas, and undertake revegetation in excess of that required for rehabilitation of areas disturbed by construction activities, to ensure no net loss of the values and functions of wetlands and of vegetation".	Having regard to: • the revised design and construction techniques; • the commitment made by the proponent to prepare and implement a Landscape and Vegetation Management Plan to minimise impacts on native vegetation, landforms of significance and visual amenity, prevent spread of weeds as a result of construction activities, rehabilitate disturbed areas, undertake 50 per cent more revegetation of wetland vegetation than disturbed by construction activities, and to ensure no net loss of the values and functions of wetlands and of vegetation in Bushplan sites; • the commitment made by the proponent to construct and remove the temporary causeway over the wetlands between December and May when the water level will be at its lowest; • impacts on vegetation being largely limited to short term construction impacts; and • potential for a positive contribution to the rehabilitation of areas currently in poor condition; it is the EPA's opinion that the proposal can be managed to meet the EPA's objective for vegetation communities, provided that the conditions include the EPA's standard Decommissioning and Rehabilitation Management condition.

Relevant Environmental Factor	EPA Objectives and Relevant Area	EPA Assessment	EPA Advice
Wetlands - impacts during construction on Lake Coogee and Market Garden Swamps	**EPA Objective** Maintain the integrity, functions and environmental values of wetlands. **Relevant Area** Lake Coogee and Market Garden Swamps Nos 2 and 3 and buffers around those wetlands	The proposed sewer main traverses Market Garden Swamp No. 2, close to an existing causeway that contains three sewer pressure mains. The proposed route is also adjacent to the northern end of Lake Coogee, and to Market Garden Swamp No. 3. The proposed pump station is located approximately 150 metres from Lake Coogee. Lake Coogee and Market Garden Swamps Nos. 2 and 3 are subject to the provisions of the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992. Lake Coogee is classified as verified conservation management category wetland under the updated wetland mapping work undertaken for the WRC dated 1998, while Market Garden Swamps Nos. 2 and 3 are of the resource enhancement management category. Under the 1998 WRC mapping, Market Garden Swamp No. 3 is also verified as requiring rehabilitation as a management priority. The proposal involves disturbance to Market Garden Swamp No. 2 and adjoining land during the construction phase. Following revisions to the proposal after the public review period the following are proposed - the clearing of approximately 0.14 ha of wetland vegetation and approximately four tuarts, construction of a temporary causeway up to 13 m wide, construction of pipeline pile footings, and disposal of drainage water and minor quantities of groundwater. Following rehabilitation, ongoing impacts on the wetlands are not expected, provided that leaks are prevented (addressed in assessment of factor of Groundwater and Surface Water Quality). Several submissions raised concerns about the potential for environmental impacts on Lake Coogee, including the impacts of dewatering, inconsistency with the EPP, and cumulative effects of developments around Lake Coogee. Action to improve the hydrological connectivity through the existing causeway was sought. Since the public review period the proponent has revised the proposed construction techniques for the pipeline and pump station, and its commitments. The need for dewatering during the construction of the new pump station has been removed. The proponent has committed to; • Prepare and implement a Landscape and Vegetation Management Plan that includes minimising landform modification, and rehabilitating areas disturbed during construction; • Prepare and implement a Water Management Plan for the construction of the Main Sewer and Pump Station, to address prevention of discharge of excess water and storm water runoff to Lake Coogee and other wetlands along the construction route, and disposal of groundwater; and • Prepare and implement a strategy to increase the hydraulic connectivity through the causeway if it is likely to improve the quality and viability of the wetlands and Lake Coogee; and • Construct the wetland crossing between December and May to minimise disturbance to the wetland.	Having regard to: • the revised design and construction techniques; and • the proponent's revised commitments to: * prepare and implement a Landscape and Vegetation Management Plan to ensure no net loss of the values and functions of wetlands; * prepare and implement a Water Management Plan for the construction of the main sewer and pump station, to address prevention of direct discharge of excess water and storm water runoff to Lake Coogee and other wetlands, and disposal of groundwater; and * prepare and implement a strategy to increase the hydraulic connectivity through the causeway, if an initial report shows that such action is likely to improve the quality and viability of the wetlands; and * construct and remove the temporary causeway over the wetlands between December and May, to minimise disturbance to the wetlands; it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for wetlands.

Relevant Environmental Factor	EPA Objectives and Relevant Area	EPA Assessment	EPA Advice
POLLUTION MANAGEMENT			
Groundwater and surface water quality - impacts on water quality of wetlands	**EPA Objective** Maintain or improve the quality of groundwater and surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993). **Relevant Area** Lake Coogee and Market Garden Swamps Nos 2 and 3 and buffers around those wetlands	Surface run-off containing silt and oils from vehicles during the construction phase, and drainage waters from the pump station site, dewatering and any leaks from the pipeline and pump station have the potential to impact on the quality of water which ultimately ends up in the wetland system, and to effect wetland ecology. Groundwater as well as surface water flows into the Lake Coogee wetland system. Most submissions on this factor expressed concern about the dewatering process and its impacts, based on the information provided in the PER. The proposal as described in the PER involved extensive dewatering in order to construct the pump station. Dewatering would also be required for the piles for the wetland crossing. To manage the impacts of the proposal on groundwater and surface water quality, the proponent has revised the construction techniques for the pipeline and pump station, and its commitments, as follows: • the revised construction methods to be used for the pump station will reduce the volume of water to be removed during construction to approximately 3,000 cubic metres • the sewer is to be made of pre-stressed concrete lined with plastic, and instead of 75 pipe joints where will be two joints, one at each end of the wetland crossing; • a commitment is made to prepare and implement a Water Management Plan for construction of the Main Sewer and Pump Station, to prevent direct discharge of excess water and storm water runoff to Lake Coogee and other wetlands along the construction route, and to address groundwater disposal; • a commitment is made to prepare and implement a Sewer Maintenance Plan to minimise the potential for leaks; and • a commitment is made to prepare and implement, as appropriate, an Emergency Action Plan to manage spillage of sewerage at the wetland crossing in the event of damage to the main sewer.	Having regard to: • the revised design and construction techniques that remove the need for substantial dewatering, and reduce the number of joints in the section of the pipe over the wetland to one at each end of the wetland crossing; and • the proponent's commitments to prepare and implement a Water Management Plan and a Leak Management Plan; it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for groundwater and surface water quality.

Relevant Environmental Factor	EPA Objectives and Relevant Area	EPA Assessment	EPA Advice
Soil contamination - disturbance of contaminated soil during construction of pipeline	**EPA Objectives** • Ensure that contamination does not pose a threat to beneficial uses of the soil and public health. • Ensure the rehabilitation of the site is to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria. **Relevant Area** the construction corridor for the sewer pipeline	Land to the north of Market Garden Swamp No. 3 has been filled with material which appears to be of demolition origin. Soil samples taken from along the pipeline route between the existing Munster pump station and Fawcett Road were found to contain lead, pesticides, sulphate, mercury and asbestos sheeting. A submission from the WRC recommended that a comprehensive soil and groundwater assessment since some contaminants may enter the dewatering discharges requiring some form of treatment prior to disposal. Since the public review period, the proponent has advised that substantial dewatering is not required. To manage this factor the proponent has committed to: • prepare and implement a Soil Contamination Management Plan to identify and manage any contaminated fill encountered during construction of the main sewer to the appropriate standard.	Having particular regard to the proponent's commitment to prepare and implement a Soil Contamination Management Plan, it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's environmental objectives for this factor subject to auditing and verification of clean up criteria.

Relevant Environmental Factor	EPA Objectives and Relevant Area	EPA Assessment	EPA Advice
Odour - impacts on residential amenity	**EPA Objective** Odours emanating from the proposal should not adversely affect the welfare and amenity of other land users. **Relevant Area** the potential extent of odour impacts around the sewer pipeline extension and pump station	Odours may potentially result from any outlets in the pump station and sewer main. The proposal does not include open storage of sewage. The proponent recognises that future open storage would be subject to the provisions of the Environmental Protection Act. The proposed pump station is located approximately 500 metres from, the perimeter of the odour buffer of the Woodman Point Wastewater Treatment Plant, and is over 600 metres from the nearest residences. Submissions on this factor were conditionally supportive of the proposal to locate the pump station on the west side of Lake Coogee. The main comments were that: • an odour buffer around the existing pump station on Mayor Road should not be required, and it should be decommissioned as soon as possible; • the new pump station should not require a buffer which will restrict any future residential development in the locality; and • the proposed facilities should not cause unacceptable odours or in any way compromise the landowners' efforts to have the Woodman Point Waste Water Treatment Plant Odour Buffer reduced back to the eastern side of Lake Coogee. To manage this factor the proponent has committed to controlling odours so that odours associated with the proposal are contained within the existing odour buffer surrounding the Woodman Point Wastewater Treatment Plant, except during annual maintenance of the main sewer. Outlets at Munster Pump Station No. 3 and along the portion of the Bibra Lake main sewer in the proposal, will be restricted to manholes and stop-log openings. All covers will be bolted down to withstand a 9 m head of water, and remedial actions will be taken if necessary.	Having particular regard to: • the restriction of outlets at Munster Pump Station No. 3 and along the portion of the Bibra Lake main sewer in the proposal to bolted down manholes and stop-log openings; • the proponent's commitment to ensure that odours, except during annual maintenance of the main sewer, are contained within the existing odour buffer surrounding the Woodman Point Wastewater Treatment Plant; and • the location of the proposed pump station inside the Woodman Point Wastewater Treatment Plant buffer and approximately 500 metres from the perimeter of the buffer; it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objectives for Odour.

Appendix 3

List of submitters

Government Authorities:

Department of Conservation and Land Management
City of Cockburn
Ministry for Planning
Aboriginal Affairs Department
Australian Heritage Commission
Water and Rivers Commission

Organisations:

Beeliar Regional Park Community Advisory Committee
Conservation Council of Western Australia Inc.
Spearwood District Residents' Association (Inc.)
Wetlands Conservation Society (Inc.)
Waterbird Conservation Group Inc.

Individuals:

J and NE Kapor
E Santich
PP Rosiejak
AE Ingrilli
VEC and T Giuffre and V Galati
G Ingrilli
R and M Lambasa
L and M Mihaljevich
PI Tolich
RT and KB Leslie
CR Boughen
K and F Zuvela
JM Radonich
WA Evans
Y and P Jakovcevic
V Ingrilli
MR Phillips and FW van Wees
V and P Jakovcevic
FM, T and U Da Costa
David James
Irene Kitching
E, C T and T Mollica
LB Gianoli
M and V Zuvela

Appendix 4

References

Environmental Protection Authority (1993) *Draft Western Australian Water Quality Guidelines for Fresh and Marine Waters*, Bulletin 711, Environmental Protection Authority, Perth WA, October 1993

Environmental Protection Authority (1993a) *Strategy for the Protection of Lakes and Wetlands of the Swan Coastal Plain*, Bulletin 685, Environmental Protection Authority, Perth WA, July 1993

Environmental Protection Authority (1993b) *A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area: an Update to EPA Bulletin 374*, Bulletin 686, Environmental Protection Authority, Perth WA, July 1993

Environmental Protection Authority (1997) *Guidelines for Environment and Planning,* No. 33 in series entitled "Guidance for the Assessment of Environmental Factors" Environmental Protection Authority Perth WA, 1997

GHD and Water Corporation (1998) *New Munster Pump Station and Bibra Lake Main Sewer Extension Public Environmental Review: Final Report*, GHD and Water Corporation, Perth WA, 1998

Hill, A.L.; Semeniuk, C.A.; Semeniuk, V. and Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain, Volume 2B Wetland Mapping, Classification and Evaluation, Wetland Atlas,* Water and Rivers Commission and the Department of Environmental Protection, Perth WA, 1996

Western Australian Government (1998) *Perth's Bushplan: Keeping the Bush in the City (for Public Comment*), Western Australian Planning Commission, Perth WA, 1998

Western Australian Government (1992), *Environmental Protection (Swan Coastal Plain Lakes) Policy Approval Order 1992: Environmental Protection Act 1986*, Western Australian Government Gazette No. 179 of Friday 18 December 1992, Perth WA

Western Australian Planning Commission et al (1998) *Perth's Bushplan: Keeping the Bush in the City (for Public Comment)*, Volume 2 Part C, Department of Environmental Protection, Perth WA, 1998

Whelans et al (1993) *Planning and Management Guidelines for Water Sensitive Urban (Residential) Design,* prepared for the Department of Planning and Urban Development, the Water Authority of Western Australia and the Environmental Protection Authority, Whelans, Mount Hawthorn WA, 1993

Woodman Alliance (1999) *New Munster Pump Station and Bibra Lake Main Sewer Extension Public Environmental Review: Response to Submissions*, Woodman Alliance, Perth WA, 1999

Appendix 5

Recommended Environmental Conditions and Proponent's Consolidated Commitments

MUNSTER PUMP STATION NO. 3 AND BIBRA LAKE MAIN SEWER EXTENSION, MUNSTER, CITY OF COCKBURN

Proposal: The construction and operation of:

- a gravity feed sewer main being an extension of the existing Bibra Lake Main Sewer from a point immediately upstream of the existing sewer pump station at Mayor Road (Munster Pump Station No. 2) to Munster Pump Station No. 3; and
- Munster Pump Station No. 3, a sewage pump station, on the west side of Lake Coogee, Munster;

as documented in schedule 1 of this statement.

Proponent: Water Corporation

Proponent Address: 629 Newcastle Street, Leederville WA 6007

Assessment Number: 1237

Report of the Environmental Protection Authority: Bulletin 963

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Decommissioning and Rehabilitation Management Plan

3-1 At least six months prior to decommissioning, the proponent shall prepare a Decommissioning and Rehabilitation Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall address:

1 removal or, if appropriate, retention of plant and infrastructure;

2 final rehabilitation of all disturbed areas to a standard suitable for agreed new land uses; and

3 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

3-2 The proponent shall implement the Decommissioning and Rehabilitation Management Plan required by condition 3-1 until such time as the Minister for the Environment determines that decommissioning and rehabilitation are complete.

4 Performance Review

4 -1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to the Department of Environmental Protection:

- to document the outcomes, beneficial or otherwise;
- to review the success of goals, objectives and targets; and
- to evaluate the environmental performance over the six years;

relevant to the following:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 963;

2 proponent's consolidated environmental management commitments documented in schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 environmental management system environmental performance targets;

4 environmental management programs and plans; and/or

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.

5 Proponent

5-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

5-2 Any request for the exercise of that power of the Minister referred to in condition 5-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

5-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

6 Commencement

6-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

6-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

6-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 6-1 and 6-2.

6-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

7 Compliance Auditing

7-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

7-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal, written advice that the requirements have been met.

7-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Schedule 1

The Proposal

This proposal is to construct and operate:

- a gravity feed sewer main being an extension of the existing Bibra Lake Main Sewer from a point immediately upstream of the existing sewer pump station at Mayor Road (Munster Pump Station No. 2) to Munster Pump Station No. 3, as shown in figures 1, 3, 4 and 5 of this schedule; and
- Munster Pump Station No. 3, a sewage pump station, on the west side of Lake Coogee, Munster, as shown in figures 1 and 2 of this schedule.

The key characteristics of the proposal are described in Table 1 below.

Table 1. Key Characteristics of the Proposal

Item	Feature	Characteristic
Pump station	Location	Munster Pump Station No. 3 located within Water Corporation land to the west of Lake Coogee (Lot Number 20 Certificate of Title 2120/283) and contained within the Woodman Point Wastewater Treatment Plant Odour Buffer Zone, as shown in Figure 1
	Depth	Approximately 20 metres below natural ground level
	Construction - groundwater removal	A maximum of 3 000 cubic metres of groundwater may be displaced, subject to compliance with commitment 2
	Pumping capacity	4 600 litres per second
	Emergency overflow	No emergency overflow basins are proposed at Munster Pump Station No. 3 at this time
Gravity sewer main	Location	Generally west-south west connecting into the Bibra Lake main sewer immediately upstream of the existing Munster Pump Station No. 2 on Mayor Road. Across Lot 505 and through Lot P2 to Lot 703. Across wetlands adjacent to the existing pressure mains to the north of Lake Coogee before turning generally south-south west approximately parallel to Lake Coogee to the new Munster Pump Station No. 3 site, as shown in Figure 1.4
	Maximum flow capacity	9 200 litres per second (ultimate capacity)
	Total length	Approximately 1 600 metres
	Diameter	Approximately 2.25 metres internal diameter and 2.55 metres external diameter
	Maximum height of sewer across wetland	4.8 metres above wetland ground surface to the top of the handrails of the dual-use path located over the structure

	Length of exposed sewer (wetland crossing)	Approximately 155 metres.
Pump station and sewer main, as above	Odour control	All access points will be sealed with manhole covers which will be bolted down to withstand a 9 metre head of water. There will be no vents within the proposal.
	No open storage	The proposal does not include open storage of sewage.

Figure 1 Location of Proposed Works
Figure 2 Conceptual Pump Station Arrangement
Figure 3 Pipe Bridge Across Wetland Conceptual Construction Method
Figure 4 Temporary Construction Causeway
Figure 5 Location of Trench at Western End of Wetland Crossing (2 plans)

(See figures in Section 2 and Appendix 8 of EPA report)

Schedule 2

Proponent's Consolidated Environmental Management Commitments

December 1999

Munster Pump Station No. 3 and Bibra Lake Main Sewer Extension, Munster, City of Cockburn (1237)

WATER CORPORATION

Proponent's Commitments December 1999
Munster Pump Station No. 3 and Bibra Lake Main Sewer Extension (Assessment No. 1237)

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
1	Leak management	Prepare and implement a Leak Management Plan for the Main Sewer which includes: • internal inspection with a maximum interval of 7 years; • routine visual inspections of the above ground section; • criteria on which decisions to initiate repairs will be made; • repairs and maintenance; • emergency actions for that section of the Main Sewer passing over the wetlands to the north of Lake Coogee in the event of catastrophic damage.	To ensure the integrity of the Main Sewer, minimise the potential for leaks and manage spillage of sewage at the wetland crossing in the event of catastrophic damage to the Main Sewer.	Prepare Plan prior to commissioning, and implement in accordance with the Plan	DEP	City of Cockburn, Water and Rivers Commission and Department of Conservation and Land Management	Submission to DEP, accompanied by letters from relevant agencies. Performance and Compliance reports.
2	Water management	Prepare and implement a Water Management Plan for construction of the Main Sewer and Pump Station. The Plan shall address the following: • prevention of direct discharge of excess water and storm water runoff to Lake Coogee and other adjacent wetlands; • disposal of groundwater.	To ensure water quality in Lake Coogee, Market Garden Swamp No. 2 and Market Garden Swamp No. 3 remains within the seasonal range established prior to construction within three days of any incident attributable to construction activities.	Prepare Plan prior to construction, and implement in accordance with the Plan	DEP	Water and Rivers Commission and City of Cockburn	Submission to DEP, accompanied by letters from relevant agencies. Performance and Compliance reports.
3	Dust management	Prepare and implement a Dust Management Plan for construction of the Main Sewer and Pump Station.	To ensure adverse impacts on adjacent areas are minimised.	Prepare Plan prior to construction, and implement in accordance with the Plan	DEP	City of Cockburn	Submission to DEP accompanied by a letter from the City of Cockburn. Performance and Compliance reports.
4	Soil contamination	Prepare and implement a Soil Contamination Management Plan for the section of Main Sewer passing through the area of uncontrolled fill to the east of Lake Coogee which includes: • identification of areas of soil contamination; and • management of identified contaminated soils.	To identify and manage any contaminated fill encountered during construction of the Main Sewer to the appropriate standard.	Prepare Plan prior to construction, and implement in accordance with the Plan.	DEP		Submission to DEP. Performance and Compliance reports.

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
5	Landscape and vegetation	Prepare and implement a Landscape and Vegetation Management Plan. This plan will: • identify the areas to be disturbed during construction; • assess options; • specify procedures to minimise impacts on landforms, native wetland vegetation, Tuarts, other significant vegetation, and visual amenity; and • use weed-free material (i.e. clean fill) for the construction of a temporary causeway. The plan will also include a rehabilitation strategy that will: • identify the areas to be revegetated; • specify revegetation planting; • specify landform modification and monitoring procedures; • incorporate weed management; and • specify responsibilities for on-going maintenance of rehabilitated and landscaped areas.	To achieve the following: • minimise impacts on native vegetation, landforms of significance and visual amenity; • prevent spread of weeds as a result of construction activities; • rehabilitate disturbed areas; • undertake 50% more revegetation of wetland vegetation than disturbed by construction activities; • ensure no net loss of the values and functions of wetlands, and of vegetation in Bushplan sites.	Prepare Plan prior to construction, and implement in accordance with the Plan.	DEP	CALM and City of Cockburn	Submission to DEP, accompanied by letters from relevant agencies. Performance and Compliance reports.
6	Odour control	Control odour through the following measures: • restrict openings at Munster Pump Station No. 3 and along the portion of the Bibra Lake Main Sewer in the proposal to manholes; • Seal all manholes within the proposal with airtight covers which will be bolted down to withstand a 9 m head of water; and • undertake remedial actions if necessary.	To ensure that odours, if any, associated with the proposal (except during annual maintenance of the Main Sewer) are contained within the existing odour buffer surrounding the Woodman Point Wastewater Treatment Plant	During commissioning	DEP		Submission to DEP. Performance and Compliance Report
7	Wetland crossing	Undertake the construction and removal of the temporary causeway over the wetlands to the north of Lake Coogee in the period between December and May.	To minimise disturbance to the wetlands to the north of Lake Coogee by limiting causeway construction activities to a time when the water level will be at its lowest.	During construction	DEP	City of Cockburn, CALM, Water and Rivers Commission	Performance and Compliance Report

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
8	Market Garden Swamp No. 2	Examine and report on opportunities and impacts of increasing the hydrological connectivity between Lake Coogee and Market Garden Swamp No. 2 through the existing causeway. Prepare and implement a strategy to increase the hydrological connectivity through the existing causeway in the event that such action is likely to improve the quality and viability of Market Garden Swamp No. 2 and Lake Coogee.	To improve the quality and viability of Lake Coogee and the wetlands to the north.	Prepare report and strategy (as appropriate) prior to commissioning	DEP	Water and Rivers Commission, City of Cockburn, and DEP	Report and strategy (as appropriate) submitted to DEP accompanied by a letter from relevant agencies. Performance and Compliance Report.
9	Recreation	Incorporate a walkway on the top of the structure over the wetlands to the north of Lake Coogee.	To link the existing and proposed dual use paths on the eastern and western shores of Lake Coogee.	During construction	City of Cockburn	City of Cockburn, CALM	Performance and Compliance Report
10	Ruins	Erect an exclusion fence approximately 10 m from the perimeter of the ruins located on the southern side of the Munster Pump Station No. 3 site.	To prevent inadvertent impacts during construction.	Prior to construction	DEP	City of Cockburn	Performance and Compliance Report
11	Culture and Heritage	Monitor the area of the proposed Main Sewer and Pump Station for Aboriginal and European skeletal and artefactual material and engage a qualified archaeologist upon finding any evidence of possible material.	To prevent inadvertent impacts on items of cultural or heritage value.	During excavation and construction	Aboriginal Affairs Department		Performance and Compliance Report
12	Vibration	Undertake a Property Condition Survey of houses along the route of the Main Sewer, with documentary evidence acquired and stored for later reference.	To provide evidence if there are any claims of damage during construction.	Prior to construction	DEP		Submission to DEP.

Appendix 6

Summary of submissions

SUMMARY OF SUBMISSIONS

NEW MUNSTER PUMP STATION AND BIBRA LAKE MAIN SEWER EXTENSION - PUBLIC ENVIRONMENTAL REVIEW (ASSESSMENT NO. 1237)

BIOPHYSICAL FACTORS

1 Vegetation Communities

1-1 Vegetation loss should be minimised, including in the tuart woodland and in areas of *Melaleuca cuticularis* (uncommon in the metropolitan area).

1-2 All indigenous trees that are removed should be mulched and stockpiled at a weed free area on the site for spreading following construction.

1-3 All areas which are damaged during construction should be rehabilitated.

1-4 Rehabilitation should be based on indigenous species.

1-5 Rehabilitation should use local seed where appropriate. Seed from species endemic to the site should be collected at the appropriate time of year and grown as tube stock or used in a seed mix for direct seeding.

1-7 Rehabilitation should be in accordance with CALM's Management Plan for Beeliar Regional Park and the City of Cockburn's Management Plan for Lake Coogee.

1-8 All clearing/rehabilitation should be under the guidance of CALM.

1-9 The Water Corporation must provide a commitment to carry out weed control and revegetation on and in the vicinity of the existing causeway.

1-10 To prevent the introduction or spread of dieback, the Water Corporation should implement CALM's dieback management guidelines, in consultation with CALM.

1-11 In addition to replacement plantings, additional trees should be planted. In view of the major impact of the proposal on the environment, enhancement of the environmental values around Lake Coogee should be undertaken by the proponent, including substantial replanting of endemic vegetation to the east and north of Lake Coogee with on-going maintenance.

1-12 The construction of the pipe across the wetland can lead to the conservation of Lake Coogee by eliminating the gradual destruction of the flora surrounding the lake as observed over the past thirty years, through the proposed rehabilitation program.

1-13 Tuart tall open woodland is irreplaceable in the area. All tuarts succumb to insect attack. The proponent has not committed to diligent tree husbandry to ensure the survival of replanted tuarts or demonstrated to the DEP's satisfaction that tuart plantings can survive in the long term in the Munster area.

1-14 The area at the northern end is in the proposed "Perth's Bushplan" which in Bushplan is good peripheral vegetation. This would be drastically damaged during construction with the larger paperbarks being removed and taking a lfetime to recover, if ever.

1-15 The proposal to clear vegetation to construct a pump station is of concern. This area is part of the Beeliar Regional Park and the clearing will result in long term damage and habitat loss.

1-16 The removal of vegetation around the proposed pump station should be minimised and agreed to the satisfaction of CALM.

1-17 The bushland condition mapping of the wetland area between Lake Coogee and Mayor Road shown as poor to very poor on figure 26 of the PER may be somewhat misleading as the regeneration of this vegetation over coming years is likely to result in the bushland condition improving significantly.

1-18 The site has been identified in the System 6 Report as having significant environmental values.

1-19 Dewatering during construction may result in stress and/or death of wetland plant species (see also 23-1 Dewatering Plan).

2 Fauna

2-1 The extension of the main sewer into the Beeliar Regional Park is of concern in terms of habitat loss.

2-2 The impact that the low bridge may have over the movement of fauna, including kangaroos, particularly if the bridge is fenced, is of concern.

2-3 An estimated time line for works should be provided to enable an evaluation of the possible impacts on habitat that the project may cause.

3 Regional Parks/Beeliar Regional Park

3-1 There are reservations regarding the preferred route for the pipeline given the potential for adverse environmental impacts on the primary objectives of Beeliar Regional Park.

3-2 This proposal is one of many infrastructure proposals or projects which will result in incremental loss of the natural condition of regional parks.

3-3 For infrastructure proposals generally, infrastructure should be consolidated in an area of least impact to the regional park, and within land set aside for infrastructure purposes, such as a road reserve.

3-4 Submitters are not satisfied that adequate investigation has been made of alternatives for the required infrastructure to be located in an area of least impact to the Beeliar Regional Park, such as the Mayor Road and Beeliar Drive extension options. (see also section 11-1)

3-5 Given the gains made by the proponent in using sensitive portions of the park for the construction of infrastructure, the proponent should go beyond its

commitments and contribute to other management works within the park to ensure that the impacts associated with the proposal are offset by additional contributions. Submitters suggest:

- a small portion of the capital funding associated with the proposal should be set aside for localised improvements to Beeliar Regional Park;
- completion of a dual use path around Lake Coogee, such work to minimise any removal of vegetation and the path to utilise the section already constructed by the City of Cockburn on its eastern and southern sides and using the causeway on the northern side;
- rehabilitation of the northern and eastern sections of the reserve in accordance with CALM's Management Plan for Beeliar Regional Park and the City of Cockburn's Management Plan for Lake Coogee (as referred to in section 1 above); and
- the Water Corporation should consult with CALM Regional Parks unit regarding signage to explain the importance of the Lake Coogee wetlands and the function of the new sewer and pump facilities.

3-6 Consultation should occur between CALM and the Water Corporation to ensure appropriate planning and to identify an appropriate alignment for any paths or boardwalks, also management tracks and storage areas.

3-7 The PER has not correctly identified management responsibilities for Beeliar Regional Park. The day to day management issues remain the responsibility of the vesting agency, in this case the City of Cockburn. The City request that they have an advisory capacity in relation to the majority of the Water Corporation's commitments, in particular, commitments 1 - 7, 10.1 - 10.3, 11, 12, 13.1, 13.2, 14.1, 14.2, 15, 16.1, 16.2, 16.3, 17.1, 17.2 and 18.

3-8 In Section 3.1: *Alignments Avoiding the System 6 Areas* there is no discussion on avoiding the site because it is zoned Parks and Recreation or that it is a part of the Beeliar Regional Park.

4 Wetlands

4-1 There are concerns regarding the preferred route for the pipeline given the potential for environmental impacts upon Lake Coogee. If the proposal is approved all work should be carried out to minimise pollution and damage to Lake Coogee.

4-2 The proposal is not consistent with the Environmental Protection (Swan Coastal Plain Lakes) Policy. The EPP prohibits activities such as excavation or filling of wetlands and provides protection against the discharge of substances that may affect the quality of the wetland.

4-3 The cumulative effects of all the proposed developments near Lake Coogee and the coastal wetland chain need to be addressed before any are allowed to proceed (see also 3-2).

4-4 The PER acknowledges that no studies have been carried out on the wetland biota of Lake Coogee. Until this is done it is difficult to predict potential impacts on lake ecology (eg impacts of dewatering).

4-5 There should be no disposal of dewatering liquid directly to Lake Coogee. The Water Corporation should commit to an open programme for monitoring the impacts of dewatering disposal on the hydrological regime of Lake Coogee.

4-6 The Water Corporation commitment to investigate opportunities for increasing the hydrological connectivity through the existing causeway should be strengthened to include undertaking action to improve connectivity.

4-7 The existing Mayor Road pump station should be decommissioned as soon as possible to avoid the potential for overflows to impact on Market Garden Swamp No. 2.

The grounds in 23-1 Dewatering Plan are also relevant to this factor (Wetlands).

5 Groundwater

5-1 There should be no disposal of dewatering liquid directly to Lake Coogee. The City of Cockburn's preference would be for dewatering liquid to be disposed of by re-injection or irrigation, with the use of the Woodman Point WWTP or emergency sewer outfall as the next most desirable approaches. The issue of dewatering should be resolved a soon as possible in consultation with the City and stakeholders, rather than rely on this issue being resolved further down the track. (See also 7-1)

5-2 There is no estimation of the amount of groundwater that will be pumped up in the de-watering process for the low bridge sewer line option. An approximation of the amount and location of the re-injection area should be included. Re-injection should be undertaken with consideration to predominant groundwater flow.

5-3 An estimated time line for works should be provided to enable an evaluation of the possible groundwater impacts that the project may cause.

5-4 Works below the groundwater level should be undertaken in the shortest possible time. Construction over 7 days or even 2 shifts would significantly reduce construction time and hence problems from de-watering.

5-5 The development of a detailed dewatering plan is supported (see 23-1 Dewatering Plan).

POLLUTION MANAGEMENT FACTORS

6 Odour

6-1 The location of the pump station on the western side of Lake Coogee is supported, provided that odours associated with the new pump station will not require a buffer which will restrict any future residential development in the locality.

6-2 The preferred option for the new pump station and gravity main sewer extension is supported subject to these facilities not causing unacceptable odours or in any way compromising the landowners' efforts to have the Woodman Point Waste Water Treatment Plant Buffer reduced back to the

eastern side of Lake Coogee. In this regard it is noted with concern that a "future open storage" area (not part of current proposal) is mooted at the proposed pump station site.

6-3 The existing Mayor Road pump station should be decommissioned as soon as possible to avoid adverse odour impacts on nearby residential areas. The Water Corporation should bring forward its construction of the second pump station on the western side of Lake Coogee to allow the decommissioning of the existing pump station to be brought forward.

6-4 The Water Corporation should provide a commitment that a buffer around the existing pump station, which will remain semi-operational, will not be required.

7 Surface Water Quality

7-1 There should be no disposal of dewatering liquid directly to Lake Coogee. There may be an impact on water quality and water chemistry. Water quality in the lake appears finely balanced based on monitoring by the City of Cockburn over the last 2 to 3 years. The City of Cockburn's preference would be for dewatering liquid to be disposed of by re-injection or irrigation, with the use of the Woodman Point WWTP or emergency sewer outfall as the next most desirable approaches. The issue of dewatering should be resolved a soon as possible in consultation with the City and stakeholders, rather than rely on this issue being resolved further down the track. The Water Corporation should commit to an open programme for monitoring the impacts of dewatering disposal on both water quality and the hydrological regime of Lake Coogee. (See also 5-1)

7-2 The proposed location and size of surface drainage ponds to contain surface run-off from construction, and the clean-up methods of these ponds, should be agreed to following consultation with CALM.

7-3 Discharge of stormwater could impact upon water quality in the Lake Coogee wetland during construction and once the project is completed.

7-4 There is potential for leakage from the sewer main into Lake Coogee (small leakage only).

7-5 Stormwater management should incorporate best management practices for urban stormwater design and these are outlined in the WRC's Manual for Managing Urban Stormwater Quality in Western Australia (1998). Stormwater should be disposed of onsite in infiltration basins with the capacity to hold a 1 in 10 year storm event.

Grounds under factor 4 "Wetlands" may also be relevant to this factor (Surface Water Quality).

See also 23-1 Dewatering Plan.

8 Groundwater Quality

8-1 A comprehensive groundwater contamination assessment is required by the WRC so that the potential for any environmental harm may be assessed, prior

to acceptance of the proposal by the WRC. This is especially required because some contaminants (including lead and pesticides) may enter the dewatering discharges. The assessment should determine the full suite of contaminants present in excess of guideline concentrations, and the lateral and vertical extent of contaminants detected above the guideline concentrations. The WRC's Groundwater Contamination Investigations Section is able to provide advice.

See also 21A Dewatering Plan.

5-3 and 5-4 may also relate to this factor.

9 Noise

9-1 The preferred option for the new pump station and gravity main sewer extension is supported subject to these facilities not causing unacceptable noise.

9-2 To construct another pump station in Mayor Road would be a shortsighted decision given that the existing pump station has caused serious social problems such as the noise of the starting and closing down of pumps at all hours.

10 Vibration

10-1 The Water Corporation should provide a commitment that pre-commencement inspections of buildings located near the works will be undertaken to ensure that any damage that is caused through vibration from the works is addressed by the proponent.

11 Soil Contamination

11-1 A comprehensive soil contamination assessment is required by the WRC so that the potential for any environmental harm may be assessed, prior to acceptance of the proposal by the WRC. This is especially required because some contaminants (including lead and pesticides) may enter the dewatering discharges. The assessment should determine the full suite of contaminants present in excess of guideline concentrations, and the lateral and vertical extent of contaminants detected above the guideline concentrations. The WRC's Groundwater Contamination Investigations Section is able to provide advice.

See also 23-1 Dewatering Plan.

SOCIAL SURROUNDINGS FACTORS

12 Heritage

12-1 No assessment was included in the PER as to the probable effect of the interim listing of Lake Coogee as having "possible national heritage value". There may be a loss of heritage value for Lake Coogee, if the proposal is approved in its present form.

12-2 The work and resulting structures should be closely monitored to minimise adverse impacts on national estate values.

12-3 The proponent should make a further commitment in relation to the Lake Coogee ruins to contribute towards the restoration or improvement of the condition of the ruins, rather than just fencing the area off.

12-4 The wording of commitment 19 should be changed to: During the excavation or construction stage, the area of the proposed alignment and pump station be monitored for Aboriginal skeletal and artefactual material by a qualified archaeologist, on obtaining a section 16 from the Aboriginal Affairs Department.

13 Visual Amenity

13-1 The proposed sewer will detract from visual amenity in the Beeliar Regional Park area.

13-2 The loss of mature indigenous trees will create undesirable visual and amenity impacts.

13-3 Suitable detail is not available in the PER to determine whether or not the approach to mitigation of visual impact, landscaping and revegetation is appropriate. The landscape plan which the Water Corporation has committed to developing should be prepared in consultation with Council and the local community to ensure that all local concerns are adequately addressed.

13-4 The visual assessment methodology and management recommendations in the PER are inadequate in a number of ways:

- Water was not used as a criterion for scenic quality.
- There is no geographic basis to define appropriate management treatment.
- The reported "public sensitivity levels" appear to in fact relate to the quality of the view (to the lake and surrounds).
- The reported "seen-area" assessment appears to only identify views.
- The methodology referred to is used only in part, with the result that the assessment and management recommendations appear to be arbitrary, generic and inconsistent.

13-5 CALM undertook an assessment of the potential visual impact of the low-bridge option and found that this option would have considerable impact on the natural landscape character for a considerable viewshed surrounding the lake. On the basis of potential visual impact, it is strongly preferred that the pipeline is located outside of the regional park.

13-6 The proposal is supported subject to the low level bridge profile alternative at the northern end of Lake Coogee to minimise the visual impact of the crossing.

13-7 The visual intrusion of a bridged pipe which can be camouflaged by greenery will be nothing compared to the visual intrusion of the present pump station which can only be described as an ugly blob on the landscape.

13-8 There is no way a three metre wide pipe some 800 metres long can be visually screened.

13-9 Consideration should be given to transforming the appearance of the proposed bridge, such as by the formation of murals along the sides of the pipe, sensitive to the pipe's location in Beeliar Regional Park, and conditional on minimal disturbance of the vegetation. Visual representation of both indigenous and non-indigenous values for the area would be appropriate.

13-10 The visual and amenity impacts of the proposed pump station are of concern. The pump station should be designed and built:

- to be consistent with rural landscape character;
- to a high aesthetic standard;
- with extensive revegetation and re-contouring works around it.

OTHER ENVIRONMENTAL ISSUES

14 Alternative Sewer Alignments

14-1 It is queried that adequate investigation has been made of alternatives for the required infrastructure to be located in an area of least impact to the Beeliar Regional Park. All the alternative options for extension of the sewer should be elaborated on, including detailed explanation of the precise environmental impacts likely to result from other alignments.
Options which should be further investigated include:

- the Mayor Road and Beeliar Drive extension options;
- locations outside the regional park, in an area where there would be least impact on the Beeliar Regional Park;
- align the main sewer extension along the east side of Lake Coogee and divert around the south end of the Lake to Woodman Point WWTP; and
- there may be other options not tabled in the PER which could be considered.

14-2 It is preferred that the alignment for the main sewer extension is located within the proposed Beeliar Drive road reservation to consolidate the wetland crossing with infrastructure between Lake Coogee and Market Garden Swamp No. 2 into one central corridor.

- Are there alternative engineering approaches which could allow the sewer in this alignment without requiring the substantial fill outlined in the PER?
- The natural fall can be maintained in the pipe.

14-3 The community were presented with three unacceptable options that do not meet environmental objectives.

15 Discrepancies with regard to the "low bridge" option

15-1 The PER contains discrepancies with regard to the "low bridge" option. Page 21 states that "The height from the natural surface of the wetland to the top of the sewer pipe is 4.5 m at the midpoint of the bridge". It should read "bottom" instead of "top". Also scale 2 on figure 10 is incorrect. It should be 1:50.

16 Latest Technology

16-1 The latest technology (world best practice) is required for the Waste Water Treatment Plant works so that they are environmental friendly.

17 Public Consultation and Community Input

17-1 The Water Corporation should be committed to providing community input to the project no matter which option is selected. This may involve some type of artwork to the bridge section or in the area around the site.

17-2 Efforts to minimise the impacts of the proposal should be made through a number of means including public consultation.

17-3 The City of Cockburn recognises the significant effort by the WC to consult with local stakeholders but, regarding comments in section 10 of the PER, notes:

- information in the Cockburn Gazette would not have got to all residences within the City, particularly the rural zones; and
- the City and Beeliar Regional Park Advisory Committee did not attend public consultation meetings because they were given separate detailed briefings.

17-4 In the PER summaries of community responses would be useful.

18 Size and Scale of the Proposal

18-1 The EPA is urged to consider a critical review of the projections relating to the proposal in terms of future requirements to ensure that the size and scale of the proposal is minimised along with consequent physical impacts on the local environment.

19 Disposal of Effluent at Sea

19-1 The extra sewerage effluent that will be dumped at sea is a worrying aspect. The EPA should decide whether they support the continuation of ocean disposal of sewage.

20 Timing

20-1 Some landowners in the locality submit that environmental clearance of the proposals is required urgently.

21 Social/Recreation

21-1 The recreational and social impacts from the Water Corporation's preferred option are of concern, both during the period of the works and after. All efforts to minimise the impacts should be made through appropriate design, public consultation and management and maintenance of the site.

21-2 The impact that the low bridge may potentially have over the movement of people through the site is of concern, particularly if the bridge remains fenced following construction.

21-3 Although it is noted that the risk of an overflow to the environment is reduced by the proposal, sensitive environmental areas and the local community would still bear the cost of overflows should they occur. It is unacceptable to delay work on the additional enclosed and open storage at the new pump stations until 2011-2015.

21-4 A public access walkway on top of the bridge would be of less value to the public than a dual use path where the current causeway lies to complete a loop around the lake. Walkers on top of the bridge would be exposed to noise and traffic of the Beeliar Drive extension assuming it goes ahead, and the views are better by the eastern, southern and western sides of the lake.

21-5 The development ignores the environmental requirements laid down in the MRS Amendments for the initial Jervoise Bay development in 1979 (255/31) emphasising the need to restore and retain the recreational opportunities of the coastal wetlands.

22 Additional Public Open Space

22-1 Portions of the existing pump station site have significant potential to be incorporated into public open space associated with the Market Garden Swamps once the pump station has been decommissioned. In particular the western portion of the site which contains the historic lime kilns and remnant vegetation should be incorporated into public open space as a means of offsetting some of the impacts associated with the overall proposal.

23 Dewatering Plan

23-1 The development of a detailed dewatering plan is supported. This should evaluate and quantify options for disposal of groundwater. The Dewatering Plan will need to outline how groundwater, vegetation, and lake water levels will be monitored, and what action will be taken to prevent unacceptable impacts occurring. The environmental acceptability/sustainability of the various options depends on the volume of water required for disposal. In general, the WRC would support the option requiring the lowest volume of water and disposal of this water where the potential for environmental harm would be minimal. The Commission's preference is for disposal of dewatering via recharge or reinjection. Depending on the option selected, dewatering could result in upconing/intrusion of saline groundwater, and impacts could include impacts on wetland plant species, wetland ecology, local hydrology and Lake Coogee water chemistry, water levels and water regimes.

OTHER GROUNDS OF SUBMISSION

24 Development Application

24-1 The Ministry for Planning advise that the Water Corporation is required to lodge a Development Application with the City of Cockburn who will forward it to the WAPC for consideration of any proposed works within the Parks and Recreation Reserve.

25 Economic

25-1 The sewer will detract from the visual amenity of the area, reducing the commercial value of property.

25-2 Locating the sewer on Lots Pt 1 and 2 Fawcett Road as depicted on Figures 3 and 7 is objected to as it will restrict the future development of the land and adversely affect the value of the land. However, an alternative alignment may be accepted subject to a number of criteria relating to no adverse effect on zoning, location within a future road reserve, and compensation for any loss of land value.

25-3 A number of landowners with property in the "Lake Coogee Urban Development Area" support the "preferred option" for the new pump station and gravity main sewer extension subject to satisfactory arrangements including compensation if appropriate being made with the private landowners whose properties are traversed by the gravity sewer.

25-4 If the pump station is constructed on the south side of Mayor Road or the odour buffer extended, some landowners advise that they will be seeking compensation.

Appendix 7

Proponent's Response to Submissions

The Woodman Alliance

New Munster Pump Station and Bibra Lake Main Sewer Extension

Public Environmental Review

Response to Submissions

Rev	Date	Description	Prepared	Checked	Approved
0	10/06/99	Released to Department of Environmental Protection			
D	09/06/99	For Review by Robert Jones	E Wajon		
C	07/06/99	Incorporated Changes	E Wajon		
B	27/05/99	For discussion at review meeting	E Wajon		
A	24/05/99	Initial responses for review by Core Management Team and selected others	E Wajon		

WA21

Contents

1. INTRODUCTION

1.1 BRIEF DESCRIPTION OF THE PROPOSAL

1.1.1 Objectives

The existing Munster Pump Station No. 2 (the existing Pump Station) at Mayor Road is operating at full capacity and has reached its design pumping capacity. In addition, there is only sufficient storage available in the sewer mains upstream of the pump station to cater for half an hour of flow during peak flow conditions. Consequently, if a failure were to occur at the existing Pump Station at present, e.g. power outage, pump malfunction, etc, sewage would overflow to an uncovered emergency overflow basin within the pump station grounds after half an hour. The emergency overflow basin would in turn overflow into an abandoned quarry and then into the wetlands immediately to the north of Lake Coogee. Works are urgently needed to reduce the possibility of sewage overflow to the environment.

The purpose of the proposal described in the Public Environmental Review (PER) is to upgrade the system to accommodate the predicted sewage flow from the southern Perth Metropolitan Catchment through to the year 2050. In addition, this would minimise the possibility of sewage overflows to the environment.

1.1.2 Proposed works

The proposed work includes construction of the Munster Pump Station No. 3 (the new Pump Station) on the western side of Lake Coogee and an extension of the existing Bibra Lake Main Sewer (Main Sewer), a gravity sewer, to the new Pump Station (see Figures 1 and 2). A new pressure main would be constructed from the new Pump Station to the Woodman Point Wastewater Treatment Plant. The extension to the Main Sewer would be designed to cater for the ultimate growth of the southern Perth Metropolitan Catchment.

The Main Sewer would be extended from a point immediately upstream of the existing Pump Station at Mayor Road. The Main Sewer would then cross the wetlands to the north of Lake Coogee to the new Pump Station site on Water Corporation land to the west of Lake Coogee.

1.1.3 Benefits

The construction of the new Pump Station would result in increased pumping capacity. The addition of the new Pump Station and extension to the Main Sewer would provide sufficient storage capacity within the system for the next 10 to 15 years so that overflow of sewage to the wetlands and Lake Coogee would be a highly improbable event. The proposed works includes an allowance for the future construction of emergency on-site storage facilities alongside the new Pump Station. However, this additional emergency storage would not be required until warranted by further increases in flow from the southern Perth Metropolitan catchment. Separate approval for this would be sought in due course when this is required.

Attachments

Appendix 1 – Revised Visual Resourcing Analysis and Management

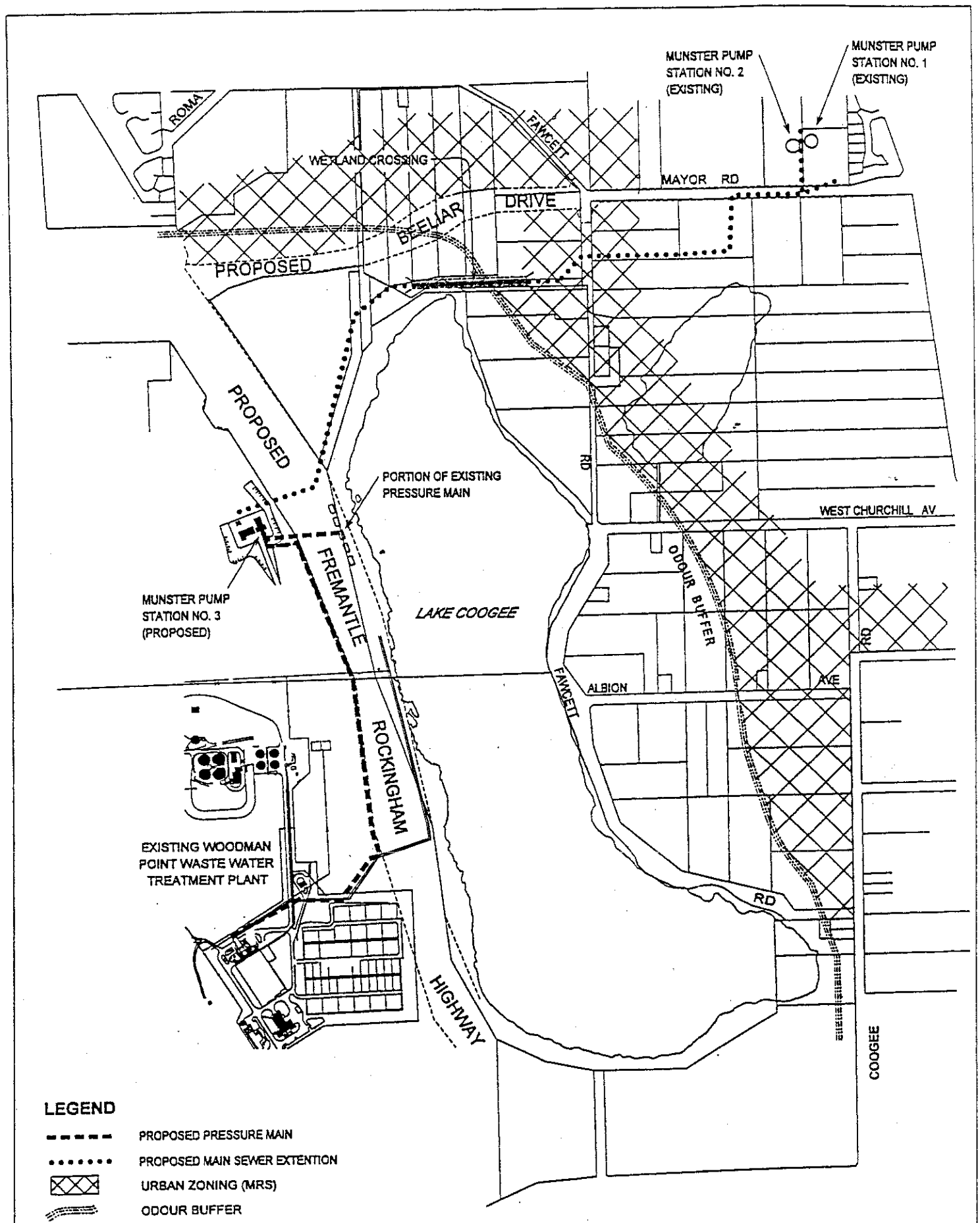


Figure 1
Location of Proposed Works

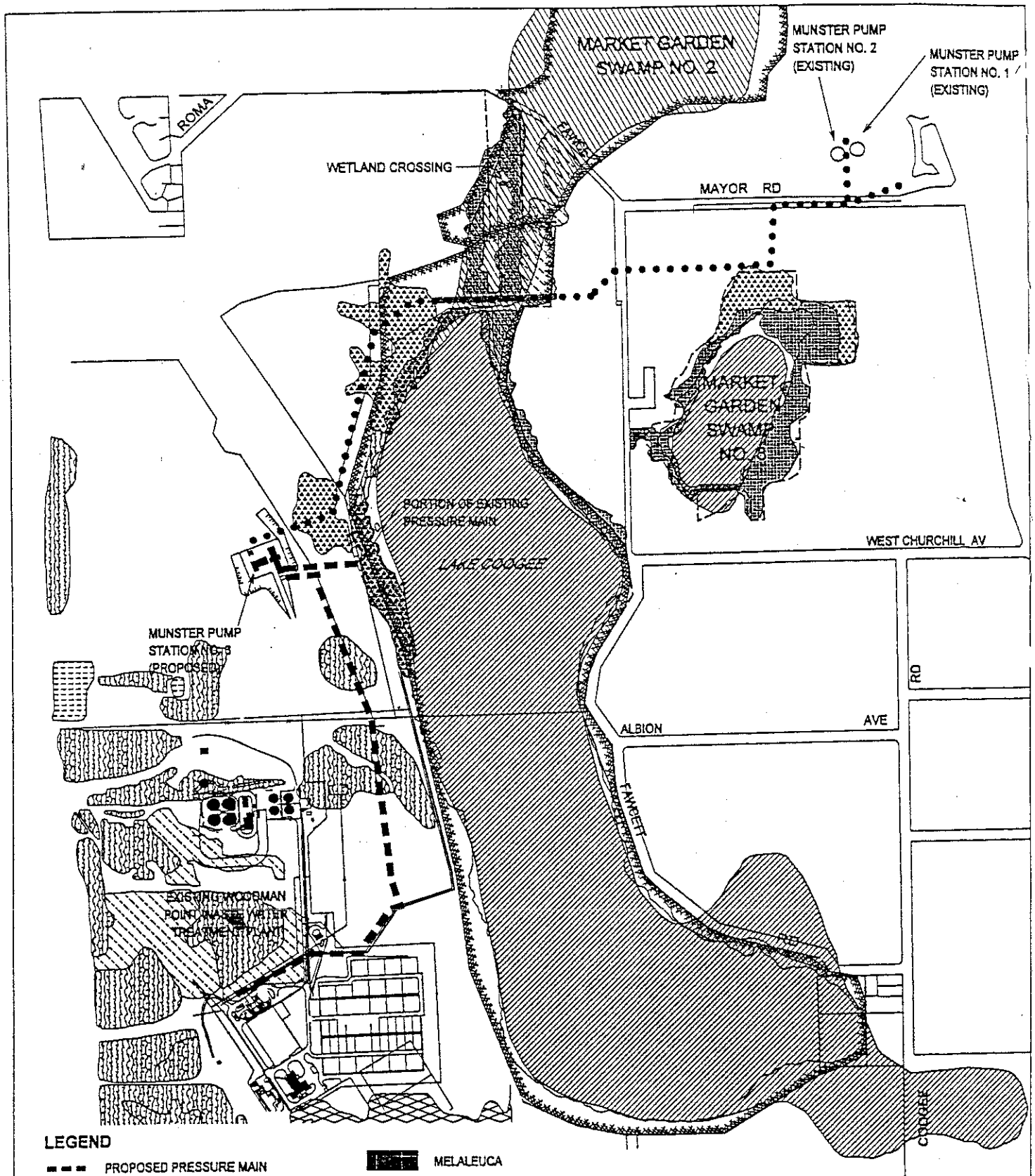


Figure 2

Natural Features Around Proposed Works

The implementation of this proposal would allow for the eventual decommissioning of the existing Pump Station on Mayor Road (currently envisioned to be after 2050). In the interim, and once the new Pump Station is commissioned, the existing Pump Station would be taken off line and refurbished. The existing Pump Station would then be recommissioned. This work is expected to take up to 12 months following commissioning of the new Pump Station. The existing Pump Station would then be used to provide back-up pumping capacity to the new Pump Station.

1.2 REVISIONS TO THE PROPOSAL

1.2.1 Introduction

Since the publication of the PER document, the Water Corporation has made a number of changes to the proposal to construct the new Pump Station and to extend the Main Sewer between the new and existing Pump Stations. These changes have been made through continuous improvement of the design, and in response to comments from government agencies and the public. The revisions to the proposal are described in the following sections.

1.2.2 Dewatering

The need for dewatering during the construction of the new pump station has been removed. The current proposal is to excavate down to the water table, and then to excavate a "hole" (sufficient to accommodate the pump station structure) without removing the groundwater. On reaching full depth (approximately 7 to 8 metres below the water table), the hole would be filled with clean sand. The pump station structure would then be constructed on top of the sand-filled hole and "sunk" into the sand using conventional caisson-sinking methods. This involves progressively excavating the sand from within the structure, and allowing the structure to settle into the void thus created. A concrete floor would then be constructed by pouring concrete underwater. At this point, the interior of the pump station structure, albeit full of water, would become totally isolated from the surrounding environment.

After the concrete floor has gained sufficient strength and sufficient mass has been built into the balance of the structure above the water table to resist buoyancy forces, the water inside the structure would be removed. The volume of water removed (approximately 3,000 m^3) would be roughly equivalent to 1 day's use of groundwater by all the market gardens in the Coogee area. The water removed would be returned to the groundwater by surface infiltration through the same bunded area in the adjacent abandoned quarry that was used to dispose of water during pump drawdown tests conducted recently in order to examine the dewatering characteristics of the site.

1.2.3 Main Sewer wetland crossing

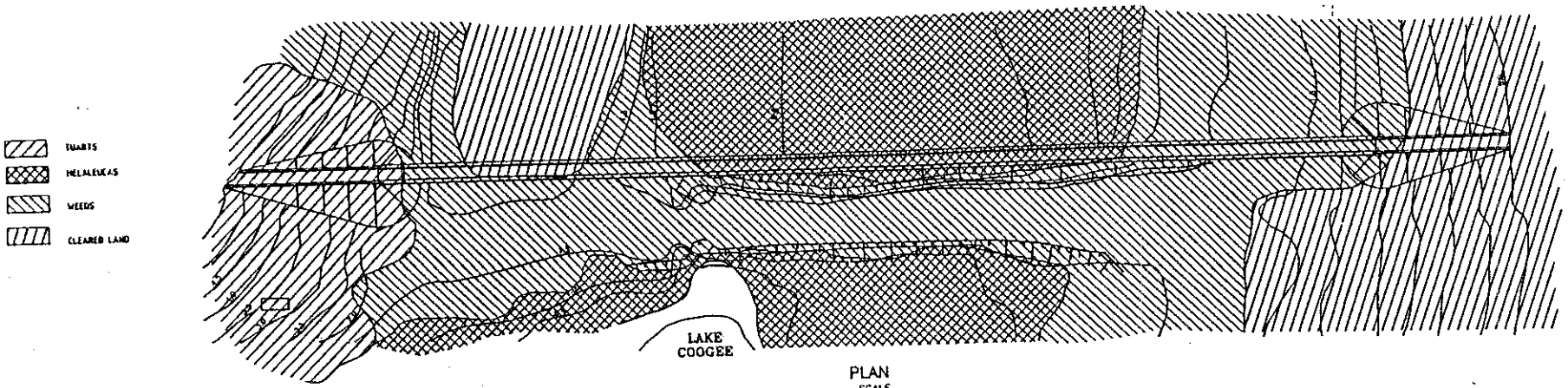
The design of the Main Sewer across Market Garden Swamp No. 2 at the northern end of Lake Coogee has been changed to further reduce the impact of the above-ground structure on the wetland. The internal diameter of the sewer within the structure has been reduced from 2.7 m to 2.4 m, and the external diameter of the structure has been reduced from 3.9 m to 2.8 m. The top of the sewer pipe itself would become the base of a walkway across the wetland which could connect to a dual-use path which may be constructed around Lake Coogee in the future. In addition, to accommodate the reduction in internal diameter of the sewer, the slope of the Main Sewer has been increased from 1 in 1500 to 1 in 800. This in turn has resulted in the inlet of the Main Sewer to the new Pump Station being 0.5 m deeper. The upper surface of the sewer would now be above ground for approximately 280 m; the lower surface would be above ground for approximately 200 m. These changes are shown in Figure 3.

These design changes have resulted in the height of the top of the structure above the mean natural surface of the wetland (0.5 m AHD) at the midpoint of the structure being reduced from 4.2 m to 3.6 m. The height of the top of the handrail above the wetland at the midpoint of the structure has thus been reduced from 5.3 m to 4.7 m. Further, as a consequence of the revised design, there is now a minimum 0.3 m clearance below the structure, even at maximum water level in Market Garden Swamp No. 2. At low water, the clearance would be 1.1 m (see Figure 3). This is considered sufficient for wildlife to cross under the structure into and out of Market Garden Swamp No. 2 from Lake Coogee.

The PER described a structure supported on 16 piers at 15 metre spacings, each containing 4 piles. The current proposal involves a single, prestressed concrete structure, supported on 8 piers at approximately 34 metre spacings, each containing 2 piles. Further, instead of having some 75 conventional pipe joints along the length of the structure (each with a potential for a leak), there would now only be two (2) joints, one at each end of the structure. Provision would be made at these two joints for leak detection and containment.

1.3 REVISED VISUAL IMPACT ASSESSMENT

A revised report on the visual resource analysis, seen area assessment and assessment of the impact of the proposal upon visual amenity has been prepared, and is included as Appendix 1.



PLAN
SCALE
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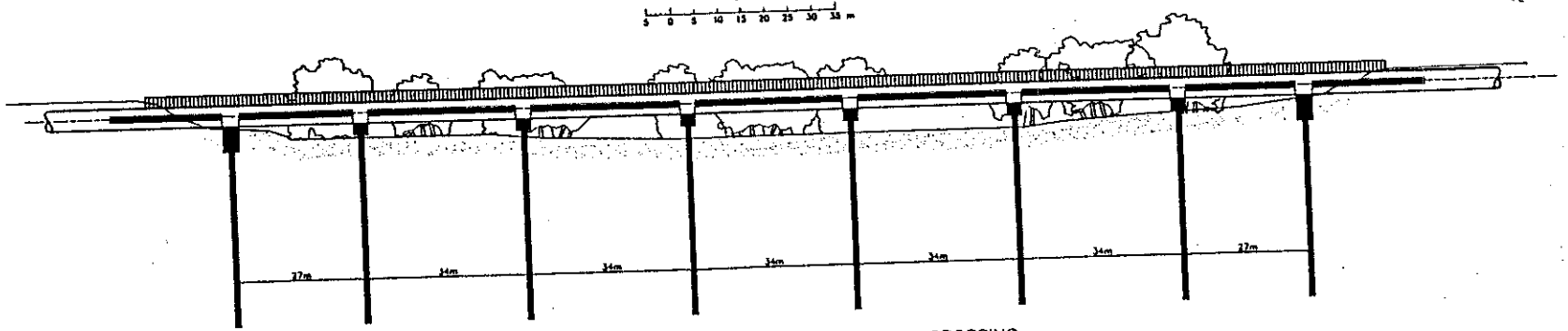

SECTION ALONG PROPOSED WETLAND CROSSING
SCALE
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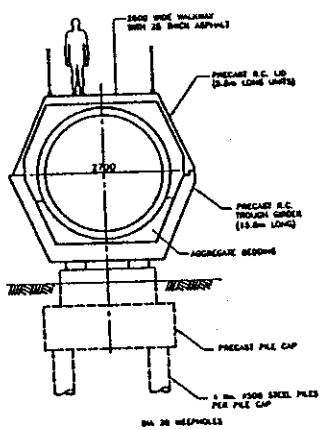
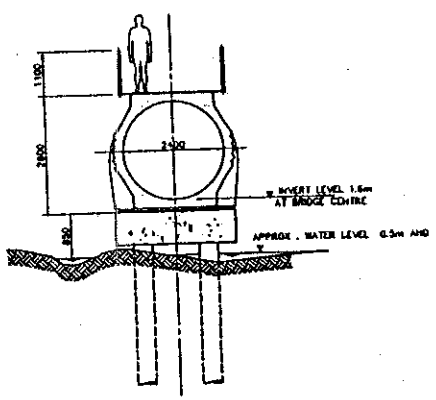


ORIGINAL SECTION AS PROPOSED
IN P.E.R. DOCUMENT



REVISED SECTION THROUGH
SEWER PIPE AT CENTRE
OF WETLAND CROSSING

FIG.3
PROPOSED MAIN SEWER
WETLAND CROSSING

SK-6320-11-0001

SK-6320-11-0001.DWG

1.4 KEY PROPOSAL CHARACTERISTICS

A summary of the key proposal characteristics is presented in Table 1.

Table 1. Key Characteristics

Item	Feature	Characteristic
Pump station	Location	Munster Pump Station No. 3 centrally located within Water Corporation land to the west of Lake Coogee (Lot Number 20 C/T 2120/283) and contained within the Woodman Point Wastewater Treatment Plant Odour Buffer Zone. Approx. 600 m to the nearest private property and 400 m from Cockburn Road.
	Depth	Approx. 20 m below natural ground level
	Pumping capacity	4,600 L/s (3,500 L/s until 2025)
	Emergency overflow	Uncovered overflow basin to the northwest of the existing Munster Pump Station No. 2 (approx. capacity 25 ML. No emergency overflow basins are proposed at Munster Pump Station No. 3 at this time.
Main Sewer Extension	Location	Generally west south west connecting into the Bibra Lake Main Sewer immediately upstream of the existing Munster Pump Station No. 2 on Mayor Road. Across Location 505 and through Location P2 to Location 703. Across wetlands adjacent to the existing pressure mains to the north of Lake Coogee before turning generally south-south west approximately parallel to Lake Coogee to the new Munster Pump Station No. 3 site.
	Maximum flow capacity	9,200 L/s (ultimate capacity)
	Total length	Approx. 1,600 m
	Diameter	Approx. 2.4 m internal diameter and 2.8 m external diameter
Wetland crossing	Location	On the northern side, and within 11 m, of the causeway containing the existing pressure mains across the wetlands, immediately to the north of Lake Coogee
	Footings	Approx. 16 piles with approx. 34 m separation between sets of two piles
	Maximum height	4.7 m above wetland ground surface to the top of the handrails of the dual-use path located over the pipe support structure

	Length	Approx. 280 m upper surface and 200 m lower surface
Pressure main	Location	Generally south from the new Munster Pump Station No. 3 to the Woodman Point Wastewater Treatment Plant
	Maximum flow capacity	4,600 L/s
	Total length	Approx. 1,100 m
	Diameter	Approx. 1.4 m internal diameter

1.5 REVISED COMMITMENTS

As a consequence of revising the proposal, and in response to submissions, the Water Corporation has revised and consolidated its list of Commitments. The revised Commitments are presented in Table 2.

Table 2. Revised Commitments

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
1	Environmental Management System	Prepare a Construction Environmental Management System as part of that prepared for the Woodman Point Wastewater Treatment Plant.	To ensure all commitments and responsibilities are fully met during construction of the proposal.	Prior to construction	DEP		Submission to DEP.
2	Environmental Management System	Prepare an Operation Environmental Management System as part of that prepared for the Woodman Point Wastewater Treatment Plant.	To ensure all commitments and responsibilities are fully met during operation of the proposal.	Prior to commissioning	DEP		Submission to DEP.
3	Leak management	Prepare a sewer maintenance plan for the Main Sewer which includes: • internal inspection with a maximum interval of 7 years; • routine visual inspections of the above ground section; and • criteria on which decisions to initiate repairs will be made.	To ensure the integrity of the Main Sewer and minimise the potential for leaks.	Prior to commissioning	DEP		Submission to DEP.
4	Leak management	Implement the approved sewer maintenance program.	To achieve the objectives of Commitment 3.	Operation	DEP		Performance and Compliance Report
5	Leak management	Develop an Emergency Action Plan for that section of the Main Sewer passing over the wetlands to the north of Lake Coogee.	To manage spillage of sewage at the wetland crossing in the event of catastrophic damage to the Main Sewer.	Prior to commissioning	WRC and DEP	City of Cockburn	Submission to DEP accompanied by a letter from the City of Cockburn
6	Water management	Prepare a water management plan for construction of the Main Sewer and Pump Station.	To prevent direct discharge of excess water and storm water runoff to Lake Coogee and other wetlands along the construction route.	Prior to construction	DEP	Water and Rivers Commission and City of Cockburn	Submission to DEP accompanied by letters from the City of Cockburn and Water and Rivers Commission

Table 2. Revised Commitments

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
7	Water management	Implement the approved water management plan.	To achieve the objectives of Commitment 6.	Construction	DEP		Performance and Compliance Report
8	Dust management	Prepare a dust management plan for construction of the Main Sewer and Pump Station.	To ensure adverse impacts on adjacent areas are minimised.	Prior to construction	DEP	City of Cockburn	Submission to DEP accompanied by a letter from the City of Cockburn
9	Dust management	Implement the approved dust management plan.	To achieve the objectives of Commitment 8.	Construction	DEP		Performance and Compliance Report
10	Soil contamination	Prepare a soil contamination management plan for the section of Main Sewer passing through the area of uncontrolled fill to the east of Lake Coogee which includes: • identification of areas of soil contamination; and • management of identified contaminated soils	To identify and manage any contaminated fill encountered during construction of the Main Sewer to the appropriate standard.	Prior to construction	DEP		Submission to DEP
11	Soil contamination	Implement the approved soil contamination management plan.	To achieve the objectives of Commitment 10.	Construction	DEP		Performance and Compliance Report

Table 2. Revised Commitments

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
12	Landscape and vegetation	Prepare a Landscape and Vegetation Management Plan. This plan will: • identify the areas to be disturbed during construction; • assess options; and • specify procedures to minimise impacts on native wetland vegetation, Tuarts, other significant vegetation, and visual amenity • use weed-free material for the construction of a temporary causeway. The plan will also include a rehabilitation strategy that will: • identify the areas to be revegetated; • specify revegetation planting; • specify landform modification and monitoring procedures; and • incorporate weed management.	To minimise impacts on native vegetation and visual amenity, prevent spread of weeds as a result of construction activities, rehabilitate disturbed areas, and undertake revegetation in excess of that required for rehabilitation of areas disturbed by construction activities.	Prior to construction	DEP	CALM and City of Cockburn	Submission to DEP accompanied by letters from CALM and the City of Cockburn.
13	Landscape and vegetation	Implement the approved Landscape and Vegetation Management Plan.	To achieve the objectives of Commitment 12.	Construction	DEP		Performance and Compliance Report
14	Wetland Crossing	Undertake construction of the structure over the wetlands to the north of Lake Coogee between December and May.	To minimise disturbance to the wetlands to the north of Lake Coogee by limiting construction activities to a time when the water level will be at its lowest.	Construction	DEP	City of Cockburn, CALM, Water and Rivers Commission	Performance and Compliance Report

Table 2. Revised Commitments

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	To requirements of (To Whom)	Advice (From Whom)	Evidence (of complying with commitment)
15	Wetland crossing	Examine opportunities for increasing the hydrological connectivity between Lake Coogee and the wetlands to the north through the existing causeway. A strategy to increase the hydraulic connectivity through the causeway will be prepared and implemented if it is likely to improve the quality and viability of the wetlands and Lake Coogee.	To improve the quality and viability of Lake Coogee and the wetlands to the north.	Prior to commissioning	DEP	Water and Rivers Commission, City of Cockburn, and DEP	Report submitted to DEP accompanied by a letter from Water and Rivers Commission
16	Recreation	Incorporate a walkway on the top of the structure over the wetlands to the north of Lake Coogee.	To link the existing and proposed dual use paths on the eastern and western shores of Lake Coogee.	Construction	City of Cockburn	City of Cockburn, CALM	Performance and Compliance Report
17	Ruins	Erect an exclusion fence approximately 10m from the perimeter of the ruins located on the southern side of the Pump Station site.	To prevent inadvertent impacts during construction.	Prior to construction	DEP	City of Cockburn	Performance and Compliance Report
18	Culture and Heritage	Monitor the area of the proposed Main Sewer and Pump Station for Aboriginal and European skeletal and artefactual material and engage a qualified archaeologist upon finding any evidence of possible material.	To prevent inadvertent impacts on items of cultural or heritage value.	During excavation and construction	Aboriginal Affairs Department		Performance and Compliance Report
19	Vibration	Undertake a dilapidation survey of houses along the route of the Main Sewer, with documentary evidence acquired and stored for later reference.	To provide evidence if there are any claims of damage during construction	Prior to construction	DEP		Submission to DEP.

2. RESPONSE TO SUBMISSIONS

2.1 BIOPHYSICAL FACTORS

2.1.1 Vegetation Communities

1 –1 Vegetation loss should be minimised, including in the tuart woodland and in areas of Melaleuca cuticularis (uncommon in the metropolitan area).

A large proportion of the construction would occur within previously cleared land that does not contain any significant vegetation community. However, there are three types of vegetation that could be affected by the implementation of the proposal. These are as follows:

- the wetland vegetation adjacent to the causeway where the proposed pipe structure would be constructed;
- the stand of Tuarts opposite the existing causeway on the western side of Lake Coogee;
- isolated grass trees on the western shores of Lake Coogee.

The alignment of the pipeline and location of Munster Pump Station No. 3 will dictate the actual vegetation that would be removed. The final alignment of the pipeline and the location of the Pump Station have not yet been decided. However, the Water Corporation is committed to minimising the impact on vegetation as a result of the construction of the gravity sewer and pump station, and all reasonable measures would be undertaken to minimise damage to, or loss of, vegetation.

A temporary causeway would be required in order to construct the sewer over the wetlands to the north of Lake Coogee. While the actual construction technique has not been decided, the causeway and wetland sewer crossing would have the following features:

- a minimum separation of 9 m between the centrelines of the nearest pressure main in the existing causeway and the proposed Main Sewer to avoid the risk of rupturing the pressure main
- a maximum 15 m wide temporary causeway to accommodate heavy construction equipment
- a 0 to 5 m wide variable gap between the existing causeway and the proposed temporary causeway
- a maximum 22 m wide construction corridor, including the separation between the pressure mains and Main Sewer, and the construction causeway.

The impact of clearing any *Melaleuca cuticularis* adjacent to the existing causeway would be minimised by placing the pipe structure as close to the causeway as construction methods would allow. The clearing of wetland vegetation near Lake Coogee would thus be limited to a maximum of about 0.5 ha (230 m long x 22 m wide).

The other area of vegetation that may be impacted during construction of the Main Sewer is the stand of Tuarts to the west of the existing causeway. Preliminary investigations indicate

that the Main Sewer can be located through the Tuarts to avoid all but a few of the smaller trees.

The Water Corporation proposes to replace Commitments 13.1, 13.2, 14.1, 14.2, 16.1, 16.2 and 16.3 in the PER with the following commitment (Commitment No. 12):

Prior to construction, the Water Corporation will prepare a landscape and vegetation management plan. This plan will identify the areas to be disturbed during construction, assess options and specify procedures to minimise impacts on native wetland vegetation, Tuarts and other significant vegetation and visual amenity. The plan will also include a rehabilitation strategy that would identify the areas to be revegetated, specify revegetation planting, landform modification and monitoring procedures, and incorporate weed management. The landscape and vegetation management plan will be prepared with advice from CALM and the City of Cockburn to the requirements of the DEP.

The landscape and vegetation management plan would:

- identify the area and type of native vegetation that may be disturbed by construction of the pipe structure across the wetland;
- ensure the alignment of the Main Sewer structure across the wetland minimises impacts on existing native vegetation;
- define a route for the Main Sewer through the Tuarts on the western side of Lake Coogee that will minimise the removal of mature Tuarts;
- include specialist advice on, and supervision of, any activities, including root pruning, that may be necessary during construction to minimise adverse impacts on adjacent Tuarts.

1-2 All indigenous trees that are removed should be mulched and stockpiled at a weed free area on the site for spreading following construction.

This requirement would be incorporated into landscape and vegetation management plan that would be developed (Commitment No. 12).

1-3 All areas which are damaged during construction should be rehabilitated.

Prior to construction, a rehabilitation strategy would be prepared as part of the landscape and vegetation management plan (Commitment No. 12). This plan would include details on areas that would be cleared or disturbed, areas that would be rehabilitated, the vegetation species to be used in each location, and programs for weeding and monitoring activities. The Water Corporation has agreed to rehabilitate not only the vegetation directly affected by the proposal but will also improve some additional areas of degraded vegetation near Lake Coogee. The extent of the additional area to be rehabilitated has yet to be defined.

1-4 Rehabilitation should be based on indigenous species.

Local indigenous species would be used where possible in the rehabilitation activities.

1-5 Rehabilitation should use local seed where appropriate. Seed from species endemic to the site should be collected at the appropriate time of year and grown as tube stock or used in a seed mix for direct seeding.

Local seed would be used where possible in the rehabilitation activities. This would include the collection of local native seed at the appropriate time, subject to necessary approvals. Whether seed would be broadcast or grown as tube stock would be decided as part of the rehabilitation strategy that would be developed in consultation with CALM.

1-7 Rehabilitation should be in accordance with CALM's Management Plan for Beeliar Regional Park and the City of Cockburn's Management Plan for Lake Coogee.

A rehabilitation strategy would be prepared consistent with recommendations in the Management Plan for the Beeliar Regional Park and the City of Cockburn's Management Plan for Lake Coogee.

The Water Corporation proposes to replace Commitments 13.1, 13.2, 14.1, 14.2, 16.1, 16.2 and 16.3 in the PER with the following commitment (Commitment No. 12):

Prior to construction, the Water Corporation will prepare a landscape and vegetation management plan. This plan will identify the areas to be disturbed during construction, assess options and specify procedures to minimise impacts on native wetland vegetation, Tuarts and other significant vegetation and visual amenity. The plan will also include a rehabilitation strategy that would identify the areas to be revegetated, specify revegetation planting, landform modification and monitoring procedures, and incorporate weed management. The landscape and vegetation management plan will be prepared with advice from CALM and the City of Cockburn to the requirements of the DEP.

The rehabilitation strategy would:

- state clearly defined objectives;
- provide details of areas that would be rehabilitated;
- indicate the species to be used in each location;
- include the collection and use of local native seed stock, subject to necessary approvals;
- incorporate weed management activities;
- include monitoring of the rehabilitation program for a period of five years;
- include contingencies to be implemented in the event that the objectives are not being achieved; and
- identify opportunities to involve the local community in rehabilitation activities where practical.

1-8 All clearing/rehabilitation should be under the guidance of CALM.

The vegetation management and rehabilitation plans would be prepared with advice from CALM and the City of Cockburn to the requirements of the DEP (Commitment No. 12).

1-9 *The Water Corporation must provide a commitment to carry out weed control and revegetation on and in the vicinity of the existing causeway.*

The Water Corporation has agreed to rehabilitate not only the vegetation directly affected by the proposal but will also improve some additional areas of degraded vegetation near Lake Coogee (Commitment No. 12). The extent of the additional area to be rehabilitated has yet to be defined.

1-10 *To prevent the introduction or spread of dieback, the Water Corporation should implement CALM's dieback management guidelines, in consultation with CALM.*

It is unlikely that dieback is an issue in areas likely to be affected by construction. Nevertheless, this issue will be addressed in the vegetation management plan and construction activities will be undertaken in accordance with CALM's dieback management guidelines if required (Commitment No. 12).

1-11 *In addition to replacement plantings, additional trees should be planted. In view of the major impact of the proposal on the environment, enhancement of the environmental values around Lake Coogee should be undertaken by the proponent, including substantial replanting of endemic vegetation to the east and north of Lake Coogee with on-going maintenance.*

The Water Corporation has agreed to rehabilitate not only the vegetation directly affected by the proposal but will also improve some additional areas of degraded vegetation near Lake Coogee (Commitment No. 12). The extent of the additional area to be rehabilitated has yet to be defined.

The Water Corporation is holding discussions with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities.

1-12 *The construction of the pipe across the wetland can lead to the conservation of Lake Coogee by eliminating the gradual destruction of the flora surrounding the lake as observed over the past thirty years, through the proposed rehabilitation program.*

The Water Corporation agrees that there would be opportunity to improve the quality of the environment around Lake Coogee as a result of implementing this project. The Water Corporation has agreed to rehabilitate not only the vegetation directly affected by the proposal but will also improve some additional areas of degraded vegetation near Lake Coogee (Commitment No. 12). The extent of these works has yet to be defined.

The Water Corporation is holding discussions with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities. The plans prepared and implemented by the Water Corporation as a result of these discussions would compliment the management objectives for the Beeliar Regional Park and would be prepared in consultation with CALM and the City of Cockburn.

However, the responsibility for the implementation of wider plans for Beeliar Regional Park rests with the vested authority (CALM and the City of Cockburn). If the Water Corporation activities can assist with the implementation of the vested authority's plans, this will be done whenever practical.

1-13 Tuart tall open woodland is irreplaceable in the area. All tuarts succumb to insect attack. The proponent has not committed to diligent tree husbandry to ensure the survival of replanted tuarts or demonstrated to the DEP's satisfaction that tuart plantings can survive in the long term in the Munster area.

These issues would be addressed as part of the rehabilitation plan to be developed (Commitment No. 12). The Water Corporation has every intention of ensuring the survival of the planted Tuarts as it is integral to the Water Corporation's enhanced environmental outcome for this project. In addition, the DEP would audit compliance with the Water Corporation's commitment contained in the rehabilitation plan.

1-14 The area at the northern end is in the proposed "Perth's Bushplan" which in Bushplan is good peripheral vegetation. This would be drastically damaged during construction with the larger paperbarks being removed and taking a lifetime to recover, if ever.

The final alignment of the Main Sewer has not yet been decided. However, the Water Corporation is committed to minimising the impact on vegetation as a result of the construction of the sewer wetland crossing, and all reasonable measures would be undertaken to minimise damage to, or loss of, the large paperbarks (Commitment No. 12). The preferred option at this time is to place the structure as close as possible to the causeway. This would result in the minimum removal of paperbarks, and the removal of some weeds, particularly fennel, which is common on the edge of the causeway.

1-15 The proposal to clear vegetation to construct a pump station is of concern. This area is part of the Beeliar Regional Park and the clearing will result in long term damage and habitat loss.

The proposed area for the pump station is already cleared of vegetation, most of which was removed more than one hundred years ago. There are a few grass trees present on the site and these would be removed, maintained in a healthy condition, and re-established in accordance with the landscape and vegetation management plan (Commitment No. 12).

1-16 The removal of vegetation around the proposed pump station should be minimised and agreed to the satisfaction of CALM.

The proposed area for the new Pump Station is already cleared of vegetation, most of which was removed more than one hundred years ago. There are a few grass trees present on the site and these would be removed, maintained in a healthy condition, and re-established in accordance with the landscape and vegetation management plan (Commitment No. 12).

1-17 The bushland condition mapping of the wetland area between Lake Coogee and Mayor Road shown as poor to very poor on figure 26 of the PER may be somewhat misleading as the regeneration of this vegetation over coming years is likely to result in the bushland condition improving significantly.

While the regeneration of the vegetation between Lake Coogee and Mayor Road may result in better quality stands of vegetation in the future, the mapping presented in the PER shows the current status of this vegetation. The Water Corporation has not made any assumptions about the eventual quality of vegetation in the vicinity of the site other than that which will be managed as a result of the rehabilitation plans committed to as part of the proposal.

1-18 The site has been identified in the System 6 Report as having significant environmental values.

The EPA's objective with respect to System 6 areas is to ensure that their conservation values are not compromised and regionally significant flora and vegetation communities in System 6 are adequately protected, with 'no net loss'. The Water Corporation intends to minimise the amount of clearing, and to re-establish some of the vegetation that would have originally grown in this area. More vegetation would therefore be established than currently exists. These actions would enhance the long-term integrity of the fringing vegetation and restore the visual amenity of the area. In addition, the provision of a walkway across the north end of Lake Coogee would enhance the recreational aspects of the area by providing better access.

1-19 Dewatering during construction may result in stress and/or death of wetland plant species (see also 21A Dewatering Plan).

The current proposal is to construct the new Pump Station without the need for dewatering (see Section 2.1). There would only be a need to remove the water from within the space occupied by the pump station, once it is buried. The water would be allowed to re-enter the groundwater by surface infiltration through a bunded area in an disused quarry adjacent to the site. There would be no temporary or long term effect on the water table, and there would be no impact on trees or wetland vegetation.

2.1.2 Fauna

2-1 The extension of the main sewer into the Beeliar Regional Park is of concern in terms of habitat loss.

The greatest impact of the proposal in terms of habitat loss would arise from the proposed sewer crossing over the wetland immediately to the north of Lake Coogee. This area is comprised of seasonally inundated open water surrounded by a band of *Melaleuca cuticularis* Low Woodland that ranges between 20 and 80 m in width. It is probable that this habitat originally extended down both sides of Lake Coogee, but has now been replaced by market gardens or expanses of weeds, notably Fennel.

Waterbird such as herons, egrets, spoonbills, darters, cormorants and ibis may nest in the trees in this wetland area. The sedge and rush beds may provide nesting sites for rails,

crakes, waterhens, warblers and grassbirds. Brush-tailed possums may also nest in hollows in mature *Melaleucas*. Bats may make use of flaking bark as shelter during the winter months. This area also supports amphibians and reptiles.

Construction of the Main Sewer across the wetland would have impacts. However, no specially protected fauna would be affected by this proposal. Rehabilitation measures would restore some of the existing habitat but a small area (a maximum of 0.5 ha) of *Melaleuca cuticularis* habitat would be permanently removed. There are opportunities to rehabilitate other currently degraded areas around Lake Coogee and to restore some of the affected wetland habitat. These opportunities would be examined during preparation of the landscape and vegetation management plan. The area of vegetation that would be cleared would less than the area to be restored.

2-2 *The impact that the low bridge may have over the movement of fauna, including kangaroos, particularly if the bridge is fenced, is of concern.*

The sewer crossing of the wetland would be raised above the ground as it is intended to maintain a link across the northern end of Lake Coogee. The height of the structure above the water level in the wetland would range between 0.3 and 1.1 m, depending upon the season. Fauna would be able to pass under, or around, or over, the structure to gain access to Lake Coogee, or the wetlands to the north, as appropriate. The only "fence" is a handrail along the walkway at the top of the structure.

There is no evidence that the Lake Coogee area supports a population of kangaroos. No evidence of their presence was observed during field surveys, and their presence was not reported in the Market Garden Swamps or Lake Coogee Management Plans.

2-3 *An estimated time line for works should be provided to enable an evaluation of the possible impacts on habitat that the project may cause.*

Construction of the Main Sewer and Pump Station is currently estimated to take place over an 18 month period commencing in early 2000.

Construction of the wetland crossing would occur during the summer months when the water level in the wetlands is the lowest. At the present time, it is estimated that construction of the wetland crossing would take place over a 4 month period during the summer of 2000/2001.

2.1.3 Regional Parks/Beeliar Regional Park

3-1 *There are reservations regarding the preferred route for the pipeline given the potential for adverse environmental impacts on the primary objectives of Beeliar Regional Park.*

The preferred route is considered to be the best option taking all factors into account. All options required some degree of compromise because selecting a different sewer route affected sewer slope and height which in turn affected the location and depth of the new Pump Station, and vice versa.

The option of routing the Main Sewer along the eastern and southern sides of Lake Coogee were not preferred for the following reasons:

- there would be a need for a pump station either at the southern end of Lake Coogee or at the existing Pump Station. Either way, the location of the Pump Station would impact residential areas
- the significantly greater length of the Main Sewer, as well as pressure main, would result in increased construction and operational, including energy, costs.

The option of routing the Main Sewer along the proposed extension of Beeliar Drive with a new Pump Station on the western side of Lake Coogee was not favoured because:

- the proposed extension of Beeliar Drive is currently in the planning stages and may be changed by either Main Roads WA or the City of Cockburn. The proposal does not yet have environmental clearance. The Water Corporation cannot undertake planning and installation of infrastructure on the basis of a concept that may change significantly in the future during the approvals processes yet to be undertaken by other proponents. The required environmental clearance would not be obtained in sufficient time to allow the proposed extension to Beeliar Drive to be constructed in conjunction with the Main Sewer
- Market Garden Swamp No. 2 would need to be crossed and an embankment would be required to raise the Main Sewer over the wetland
- constructing the Main Sewer within the proposed extension of Beeliar Drive would require an increase in the height of the road embankment by up to 2 m to cover the pipeline, with a corresponding increase of 12m in the width of the base of the embankment.

3-2 *This proposal is one of many infrastructure proposals or projects, which will result in incremental loss of the natural condition of regional parks.*

A substantial portion of the habitat of the Beeliar Regional Park is in poor condition. The proposed area for the pump station is already cleared of vegetation. There would be some loss of vegetation during the construction phase of the project but the affected areas would be rehabilitated and substantial additional revegetation would also be undertaken. The vegetation and habitat will, as closely as practical, reflect the values of the environment that would have been present at the site prior to European settlement. This would result in an increased area of good quality vegetation and habitat within the Beeliar Regional Park.

3-3 *For infrastructure proposals generally, infrastructure should be consolidated in an area of least impact to the regional park, and within land set aside for infrastructure purposes, such as a road reserve.*

The only section of the proposed works that would be located within the Beeliar Regional Park is the Main Sewer crossing of the wetlands immediately to the north of Lake Coogee. This would be adjacent to three existing sewage pressure mains so this proposal would not create a new infrastructure corridor within the Regional Park. The pump station would be located within land owned by the Water Corporation adjacent to the Beeliar Regional Park.

There are currently no road reserves within the Beeliar Regional Park that could be used as infrastructure corridors. It is proposed to extend Beeliar Drive from Mayor Road across the wetlands in the northern section of the Beeliar Regional Park. However, this proposal has not been environmentally assessed at this stage and there is no guarantee that it would proceed. Further, the construction of the gravity sewer along this route would result in the loss of an additional 12 m wide strip of wetland adjacent to the road.

Construction of the pipeline along the southern end of Lake Coogee adjacent to existing slurry pressure mains owned by Cockburn Cement is not favoured, for the reasons given in the response to Question 3-1.

3-4 *Submitters are not satisfied that adequate investigation has been made of alternatives for the required infrastructure to be located in an area of least impact to the Beeliar Regional Park, such as the Mayor Road and Beeliar Drive extension options. (see also section 11-1)*

The Mayor Road-Beeliar Drive extension is only a proposal. The proposal has not been through any of the required environmental assessments at this stage and consequently its status is only preliminary. With the changes to the design described Section 1.2, the present proposal would result in considerably less destruction of wetland vegetation than the construction of Beeliar Drive and the gravity sewer alongside it.

3-5 *Given the gains made by the proponent in using sensitive portions of the park for the construction of infrastructure, the proponent should go beyond its commitments and contribute to other management works within the park to ensure that the impacts associated with the proposal are offset by additional contributions. Submitters suggest*

- *a small portion of the capital funding associated with the proposal should be set aside for localised improvements to Beeliar Regional Park;*
- *completion of a dual use path around Lake Coogee, such work to minimise any removal of vegetation and the path to utilise the section already constructed by the City of Cockburn on its eastern and southern sides and using the causeway on the northern side;*
- *rehabilitation of the northern and eastern sections of the reserve in accordance with CALM's Management Plan for Beeliar Regional Park and the City of Cockburn's Management Plan for Lake Coogee (as referred to in section 1 above); and*
- *the Water Corporation should consult with CALM Regional Parks unit regarding signage to explain the importance of the Lake Coogee wetlands and the function of the new sewer and pump facilities.*

In the PER, the Water Corporation made a number of commitments to undertake revegetation in excess of that required for rehabilitation of areas disturbed by construction activities. Currently, the Water Corporation is holding discussions with the City of Cockburn, CALM and other government agencies contemplating undertaking landscaping and revegetation works in the vicinity of Lake Coogee to cooperate and consolidate efforts.

The intent of these efforts would be to improve the cultural and natural heritage features of the Lake Coogee area (Commitment No. 12).

An Environmental Management Plan was prepared for Lake Coogee for the City of Cockburn in 1993. The Management Plan identified a number of strategies, including the eradication of weeds, rehabilitation of degraded vegetation around the fringes of Lake Coogee with particular emphasis on Tuart communities, increasing the width of Melaleuca communities along the edge of Lake Coogee, and the completion of a dual use path around the lake.

The commitments made by the Water Corporation complement these management strategies. The rehabilitation plans that would be prepared by the Water Corporation would include weed management and establishment of appropriate vegetation communities. An integral part of the design of the main sewer includes a path on top of the sewer across the wetlands at the northern end of Lake Coogee (Commitment No. 14). This path or walk would serve as a link between the eastern and western shores of the lake while providing an elevated perspective of the lake and adjacent wetlands.

The detail and extent of the proposed works would be determined in conjunction with all major stakeholders if and when the project proceeds.

3-6 *Consultation should occur between CALM and the Water Corporation to ensure appropriate planning and to identify an appropriate alignment for any paths or boardwalks, also management tracks and storage areas.*

The Water Corporation is currently holding discussions with the City of Cockburn, CALM and other government agencies contemplating undertaking landscaping and revegetation works in the vicinity of Lake Coogee to cooperate and consolidate efforts. This includes discussion regarding the alignment of any paths, boardwalks, tracks and storage areas.

3-7 *The PER has not correctly identified management responsibilities for Beeliar Regional Park. The day to day management issues remain the responsibility of the vesting agency, in this case the City of Cockburn. The City request that they have an advisory capacity in relation to the majority of the Water Corporation's commitments, in particular, commitments 1 - 7, 10.1 - 10.3, 11, 12, 13.1, 13.2, 14.1, 14.2, 15, 16.1, 16.2, 16.3, 17.1, 17.2 and 18.*

The Water Corporation notes the City of Cockburn's interest, responsibility and role in planning and activities around Lake Coogee. The Water Corporation agrees with the City of Cockburn's request to provide advice relating to all relevant previous commitments, as follows:

- 1 – Develop an EMS: the City of Cockburn would be invited to comment upon those elements (such as management plans for stormwater, vegetation and heritage) that fall within the City's responsibility (now Commitment No. 1).
- 2 – Dewatering Plan: no longer relevant as dewatering has been eliminated.
- 3 – Leaks from pipeline: the procedures developed would be cognisant of the objectives of the City of Cockburn's Management Plan for Lake Coogee (now Commitments No. 3 and 4).

- 4 – Emergency action plan: the City of Cockburn would be invited to comment (now Commitment No. 5).
- 5 – Stormwater: the Water Corporation has made a commitment to prepare a water management plan for which the City of Cockburn's advice would be sought (now Commitments No.6 and 7).
- 6-9 – Construction dust, noise, vibration and contamination would be addressed consistent with City of Cockburn's requirements (now Commitments No. 8, 9, 10 and 11).
- 11, 12 – Dewatering: no longer relevant as dewatering has been eliminated
- 10, 13, 14, 16 – Vegetation and landscape: commitments revised, and the City of Cockburn would be invited to comment (now Commitments No. 12 and 13)
- 15 – Run-off: Construction of the sewer over the wetlands to the north of Lake Coogee would occur during December to May when the water level in the wetlands are at their lowest. The City of Cockburn would be informed (now Commitments No. 6 and 14).
- 17 – Wetland crossing: The City of Cockburn would be invited to comment (now Commitments No. 15 and 16).
- 18 – Ruins: The City of Cockburn would be invited to comment (now Commitment No. 17).

3-8 In Section 3.1: Alignments Avoiding the System 6 Areas, *there is no discussion on avoiding the site because it is zoned Parks and Recreation or that it is a part of the Beeliar Regional Park.*

As indicated in the response to Question 3-1, the Water Corporation did examine other alternative routes to that of crossing the wetland north of Lake Coogee, but these were not favoured for a number of reasons, including potentially greater environmental impacts.

2.1.4. Wetlands

4-1 There are concerns regarding the preferred route for the pipeline given the potential for environmental impacts upon Lake Coogee. If the proposal is approved all work should be carried out to minimise pollution and damage to Lake Coogee.

The Water Corporation examined alternative routes to that of crossing the wetland north of Lake Coogee, but these were not favoured for a number of reasons, including potentially greater environmental impacts (see the response to Question 3-1).

Similarly, a number of alternative crossings of the wetland north of Lake Coogee were considered. The alternative options were not preferred for the following reasons:

- the option of constructing the main sewer extension on or above the existing causeway carrying pressure mains was not possible because the pipeline in this proposal is very heavy and this would cause subsidence of the causeway and damage to the three pressure mains inside it.

- the option of removing the existing causeway and placing the existing pressure mains along with the new sewer across the wetland was not favoured because
  - the weight on an already heavy structure would add significantly to the engineering requirements of the proposal
  - the existing pressure mains could not be moved until the sewage flow was diverted to the new sewer
- the option of a high sewer across the wetland was not favoured because
  - it would be visually very intrusive with the top of the walkway being 9m above the wetland at its lowest point and the structure spanning 330m
  - there would be a need for substantial filling along Mayor Road to provide cover over the pipeline, and
  - a house would need to be demolished.
- the option of burying the sewer below the wetland was not favoured because:
  - there would need to be very deep trenching throughout the entire length of the main sewer
  - there would be a need to construct a wide, deep trench through the wetland which would result in significant disturbance of the wetland sediments and a greater loss of wetland vegetation
  - hydraulic connectivity between Lake Coogee and Market Garden Swamp No. 2 would be even further disrupted
  - it would require the new pump station to be constructed very deeply into the limestone, increasing the potential construction impacts
  - one Aboriginal group has objected to the proposal.

If the proposal is approved, the Water Corporation has made a number of commitments to not only minimise pollution and damage to Lake Coogee (Commitments No.3, 5 and 6), but also to improve the local environment surrounding the lake (Commitment No. 12).

4-2 The proposal is not consistent with the Environmental Protection (Swan Coastal Plain Lakes) Policy. The EPP prohibits activities such as excavation or filling of wetlands and provides protection against the discharge of substances that may affect the quality of the wetland.

The DEP has advised that, following a formal assessment by the EPA and setting of relevant Ministerial Conditions, proponents can undertake activities consistent with the approvals received. If the approvals allow excavation or filling of wetlands, or allows for pumping from or discharge to an EPP Lake, this activity is permitted.

4-3 The cumulative effects of all the proposed developments near Lake Coogee and the coastal wetland chain need to be addressed before any are allowed to proceed (see also 3-2).

This is a strategic assessment issue that the EPA or government needs to consider. However, if this proposal is delayed or does not occur, the chances of a significant environmental incident due to failure of the existing sewage system increases. The relative environmental benefits and commitments for rehabilitation of affected areas associated with the proposal far out-weigh the potential environmental impact of doing nothing.

4-4 The PER acknowledges that no studies have been carried out on the wetland biota of Lake Coogee. Until this is done it is difficult to predict potential impacts on lake ecology (e.g. impacts of dewatering).

Although no previous work has been carried out on the wetland biota of Lake Coogee, some inferences can be made from studies of comparable wetlands from the same suite, such as Lake Mt Brown and Brownman Swamps. The salinity of Lake Coogee varies seasonally, ranging from brackish in winter/spring to saline in late summer. Both salinity and eutrophication are important determinants in faunal composition of wetlands. As indicated in the PER, the studies that have been undertaken indicate that the species assemblage of saline lakes such as Lake Coogee was quite distinct from that of other, fresher, wetlands. Higher salinities were associated with lower diversity of species, but this appeared to be a natural occurrence rather than a sign of wetland degradation.

From the measurements undertaken to date, the surface water of Lake Coogee appears to be eutrophic (i.e. it contains high levels of nutrients), but the growth of algal blooms is probably prevented by the high salinity encountered during the summer. Discharging large volumes of freshwater into Lake Coogee could change its salinity, thus stimulating algal blooms. However, as indicated in Section 1.2, dewatering is no longer proposed. Thus, large volumes of freshwater would not be discharged into Lake Coogee, and the growth of algal blooms is highly unlikely.

Other construction impacts could arise due to siltation and loss of fuel and oil etc. It is proposed to contain surface run-off in constructed ponds to allow time for settlement and capture of any other contaminants. Most construction activities close to the wetland will take place in summer, so that stormwater runoff would be minimal.

Management plans would be prepared to address all these potential impacts (Commitments No. 3, 4, 5, 6 and 7), so that although little is known specifically about the wetland biota, preventative measures would be in place to minimise the potential for impact.

4-5 There should be no disposal of dewatering liquid directly to Lake Coogee. The Water Corporation should commit to an open programme for monitoring the impacts of dewatering disposal on the hydrological regime of Lake Coogee.

As indicated in Section 1.2, dewatering is no longer proposed, so monitoring is not required.

4-6 The Water Corporation commitment to investigate opportunities for increasing the hydrological connectivity through the existing causeway should be strengthened to include undertaking action to improve connectivity.

Improving the hydraulic connectivity between Lake Coogee and the wetland to the north may or may not be desirable. The presence of the causeway for more than 25 years (the causeway was constructed in 1972) has limited the connectivity between Lake Coogee and the wetland resulting in the establishment of a slightly different vegetation community in the wetland. Re-establishing the hydraulic connection could result in the flow of more saline water from Lake Coogee to the wetland disrupting the vegetation community and possibly causing deaths. Conversely, re-establishing the hydraulic connection could result in the flow of fresh water from the wetland into Lake Coogee, possibly stimulating algal blooms in Lake Coogee. More information, and discussion with CALM and the City of Cockburn, would be required to determine the desirability of this action.

Improving the connectivity would require opening the causeway. This is not likely to be possible until after the existing pressure mains have been decommissioned-currently envisaged to occur around 2050 when the new pump station is duplicated. The actual position of the pressure mains relative to each other and the wetland ground level would need to be determined to assess whether this could be brought forward, and occur without decommissioning and removing the pipelines.

4-7 The existing Mayor Road pump station should be decommissioned as soon as possible to avoid the potential for overflows to impact on Market Garden Swamp No. 2.

As indicated in Section 1.2, the existing Pump Station would be taken off line and overhauled once the new Pump Station is commissioned. Maintenance work would be undertaken, and the existing Pump Station would then be recommissioned. It would then be used as a backup to the new Pump Station, in case of failure of the new Pump Station. There are no plans to decommission the existing Pump Station on Mayor Road before 2050 because it is integral to the operation of the sewage pumping and emergency overflow management strategy. Construction of the new Pump Station and main sewer significantly reduces the likelihood of any overflows into Market Garden Swamp No. 2.

2.1.5. Groundwater

5-1 There should be no disposal of dewatering liquid directly to Lake Coogee. The City of Cockburn's preference would be for dewatering liquid to be disposed of by re-injection or irrigation, with the use of the Woodman Point WWTP or emergency sewer outfall as the next most desirable approaches. The issue of dewatering should be resolved a soon as possible in consultation with the City and stakeholders, rather than rely on this issue being resolved further down the track. (See also 7-1)

As indicated in Section 1.2, dewatering is no longer proposed.

5-2 There is no estimation of the amount of groundwater that will be pumped up in the de-watering process for the low bridge sewer line option. An approximation of the amount and location of the re-injection area should be included. Re-injection should be undertaken with consideration to predominant groundwater flow.

As indicated in the Section 1.2, dewatering is no longer proposed in the construction of the new Pump Station. Any dewatering required for the sewer wetland crossing would be limited to very small areas associated with the sewer footings. Overall, however, the amount of dewatering required could be regarded as negligible.

5-3 An estimated time line for works should be provided to enable an evaluation of the possible groundwater impacts that the project may cause.

Construction of the Main Sewer and Pump Station is currently estimated to take place over an 18 month period commencing in early 2000.

Construction of the wetland crossing would occur during the summer months when the water level in the wetlands is the lowest. At the present time, it is estimated that construction of the wetland crossing would take place over a 4 month period during the summer of 2000/2001.

5-4 Works below the groundwater level should be undertaken in the shortest possible time. Construction over 7 days or even 2 shifts would significantly reduce construction time and hence problems from de-watering.

As indicated in Section 1.2, dewatering is no longer proposed.

5-5 The development of a detailed dewatering plan is supported (see 23-1 Dewatering Plan).

As indicated in Section 1.2, dewatering is no longer proposed, so a dewatering plan is no loner required.

2.2. POLLUTION MANAGEMENT FACTORS

2.2.1. Odour

6-1 The location of the pump station on the western side of Lake Coogee is supported, provided that odours associated with the new pump station will not require a buffer which will restrict any future residential development in the locality.

The proposed Munster Pump Station No. 3 would be constructed on land owned by the Water Corporation. All the land within 500 m of the proposed location of the new Pump Station is owned either by the Water Corporation, LandCorp or Main Roads WA. The new Pump Station would be located within the odour buffer zone of the nearby Woodman Point Wastewater Treatment Plant, which has been incorporated into the Metropolitan Region Scheme. No additional odour buffer zone would be required around the pump station to

contain odours within the buffer. The nearest residences are approximately 650 m from the proposed location of the pump station (see Figure 1), and current zoning would not allow any new residential developments closer to the pump station.

6-2 The preferred option for the new pump station and gravity main sewer extension is supported subject to these facilities not causing unacceptable odours or in any way compromising the landowners' efforts to have the Woodman Point Waste Water Treatment Plant Buffer reduced back to the eastern side of Lake Coogee. In this regard it is noted with concern that a "future open storage" area (not part of current proposal) is mooted at the proposed pump station site.

The plans for the new Pump Station incorporate newer equipment and facilities designed to greatly minimise the opportunities for odour emission compared with the existing Munster Pump Station No. 2. These include better seals to wet wells receiving incoming sewage and no uncovered emergency overflow basin (until at least 2025). The open storage would be required once flows generated by the southern Perth Metropolitan Area are such that this storage volume is required for emergency purposes. However, because of the extra pumping and storage capacity and pumping flexibility provided by the proposal, the probability of the uncovered storage at the new Pump Station being required are significantly less than that presently associated with the existing Pump Station.

It is expected that odour emissions from the new Pump Station would be very low and any odours would be contained within the generic odour buffer associated with the Woodman Point Wastewater Treatment Plant. Consequently, there would be no need to expand the odour buffer zone, and it is expected that the operation of the pump station would not compromise the opportunity to have the Woodman Point Wastewater Treatment Plant Odour Buffer reduced back to the eastern side of Lake Coogee. Future open storage would undergo separate environmental assessment when required.

6-3 The existing Mayor Road pump station should be decommissioned as soon as possible to avoid adverse odour impacts on nearby residential areas. The Water Corporation should bring forward its construction of the second pump station on the western side of Lake Coogee to allow the decommissioning of the existing pump station to be brought forward.

As indicated in Section 1.2, the existing Pump Station would be taken off line and overhauled once the new Pump Station is commissioned. Maintenance work would be undertaken, and the existing Pump Station would then be recommissioned. It would then be used as a backup to the new Munster Pump Station. There are no plans to decommission the existing Pump Station on Mayor Road before 2050 because it is integral to the operation of the sewage pumping and emergency overflow management strategy.

The equipment at the existing Pump Station has not yet reached the end of its useful life to warrant decommissioning and scrapping the equipment at the present time. It would be extremely difficult to justify scrapping it and bringing the construction of Munster Pump Station No. 4 forward.

6-4 *The Water Corporation should provide a commitment that a buffer around the existing pump station, which will remain semi-operational, will not be required.*

There is currently no official odour buffer around the existing Pump Station on Mayor Road. Currently the odour buffer is unofficially assumed as the site boundary given encroachment of urban development upto the site boundary. If the new Munster Pump Station No. 3 was built alongside the existing Pump Station, an official, well defined odour buffer would be required.

2.2.2. Surface water quality

7-1 *There should be no disposal of dewatering liquid directly to Lake Coogee. There may be an impact on water quality and water chemistry. Water quality in the lake appears finely balanced based on monitoring by the City of Cockburn over the last 2 to 3 years. The City of Cockburn's preference would be for dewatering liquid to be disposed of by re-injection or irrigation, with the use of the Woodman Point WWTP or emergency sewer outfall as the next most desirable approaches. The issue of dewatering should be resolved a soon as possible in consultation with the City and stakeholders, rather than rely on this issue being resolved further down the track. The Water Corporation should commit to an open program for monitoring the impacts of dewatering disposal on both water quality and the hydrological regime of Lake Coogee. (See also 5-1)*

As indicated in Section 2.1, dewatering is no longer proposed, so monitoring is not required. Nevertheless, groundwater monitoring programs have already been put in place to monitor the depth and quality of groundwater.

7-2 *The proposed location and size of surface drainage ponds to contain surface run-off from construction, and the clean-up methods of these ponds, should be agreed to following consultation with CALM.*

The Water Corporation proposes to prepare a water management plan (Commitment No. 6, replacing Commitments 5.1 and 5.2 in the PER). As part of the management plan, the Water Corporation proposes to manage stormwater runoff using detention basins. All stormwater run-off from the pipeline and pump station construction sites would be diverted to detention basins designed to detain the run-off from a 1:10 year storm for a period of 72 hours prior to discharge to the environment.

7-3 *Discharge of stormwater could impact upon water quality in the Lake Coogee wetland during construction and once the project is completed.*

As indicated in the response to Question 7-2, stormwater runoff would be allowed to settle and probably be allowed to infiltrate to the groundwater, before being allowed to discharge to the environment.

Based on these measurements, vibration levels would be well below the levels likely to cause any structural damage to houses more than 40 meters from the rock breaker. Nevertheless, the Water Corporation would undertake a dilapidation survey prior to construction, with documentary evidence acquired and stored for later reference (Commitment No. 19).

2.2.6. Soil contamination

11-1 A comprehensive soil contamination assessment is required by the WRC so that the potential for any environmental harm may be assessed, prior to acceptance of the proposal by the WRC. This is especially required because some contaminants (including lead and pesticides) may enter the dewatering discharges. The assessment should determine the full suite of contaminants present in excess of guideline concentrations, and the lateral and vertical extent of contaminants detected above the guideline concentrations. The WRC's Groundwater Contamination Investigations Section is able to provide advice.

As indicated in Section 1.2, dewatering is no longer proposed in order to construct the pump station, and the entire main sewer would be constructed above the water table. Nevertheless, monitoring programs have already been put in place to monitor the depth and quality of groundwater. The Water Corporation would call upon the WRC's Groundwater Contamination Investigations Section for advice if required.

Prior to construction, a soil contamination assessment from an environmental and health perspective would be undertaken along the route of the main sewer in areas where uncontrolled fill was identified south of Mayor Road (Commitments No. 10 and 11). Any contaminated material would be disposed of in an approved landfill or in accordance with Department of Environmental Protection requirements.

2.3 SOCIAL SURROUNDINGS FACTORS

2.3.1. Heritage

12-1 No assessment was included in the PER as to the probable effect of the interim listing of Lake Coogee as having "possible national heritage value". There may be a loss of heritage value for Lake Coogee, if the proposal is approved in its present form.

As indicated in the PER, Lake Coogee is currently on the Interim List of the Register of the National Estate as part of the Beeliar Wetlands. Like several other wetlands within the Beeliar Wetlands chain, Lake Coogee is in a modified condition, though it has potential for some restoration.

It is acknowledged that the placement of the main sewer across a portion of the wetland will impact upon the lake. However, the Water Corporation has made a commitment to undertake revegetation in excess of that required for rehabilitation of areas disturbed by

construction activities (Commitment No. 12). The intent of these efforts would be to improve the cultural and natural heritage features of the Lake Coogee area.

Further, an integral part of the design of the main sewer includes a path on top of the structure across the wetlands at the northern end of Lake Coogee. This path or walk would serve as a link between the eastern and western shores of the lake while providing an elevated perspective of the lake and adjacent wetlands. This would greatly improve the amenity and value of the area.

Consequently, it is considered that the proposal would not affect the final determination regarding the placement of the Beeliar Wetlands on the Register of the National Estate, or on the Municipal Heritage Inventory for the City of Cockburn, and would not diminish the overall heritage value of Lake Coogee.

12-2 The work and resulting structures should be closely monitored to minimise adverse impacts on national estate values.

The Water Corporation is committed to minimising the impact on vegetation as a result of the construction of the gravity sewer and pump station, and all reasonable measures would be undertaken to minimise damage to, or loss of, vegetation (Commitment No. 12). The impact of clearing any *Melaleuca cuticularis* adjacent to the existing causeway over the wetlands to the north of Lake Coogee would be minimised by placing the Main Sewer structure as close to the causeway as construction methods would allow. This would limit the disturbance to a 22 m wide band parallel to the causeway. Preliminary investigations also indicate that the gravity sewer could be located through the stand of Tuarts to the west of the existing causeway to avoid all but a few of the smaller trees.

12-3 The proponent should make a further commitment in relation to the Lake Coogee ruins to contribute towards the restoration or improvement of the condition of the ruins, rather than just fencing the area off.

No ruins would be directly affected by the implementation of the proposal. The nearest earthworks around the proposed pump station are 35 m from a ruined cottage. The site is in poor condition with many materials, such as sheets of tin and limestone rubble scattered around the remains of the cottage. The site would be fenced prior to the commencement of earthworks in order to prevent any inadvertent impacts during construction (Commitment No. 17).

The Water Corporation does not have a direct responsibility for restoring ruins which, although they may have heritage value and may be on Water Corporation property, would not be affected by Water Corporation activities. Nevertheless, the issue of restoration or improvement would be considered as part of the discussions the Water Corporation is holding with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities.

12-4 The wording of commitment 19 should be changed to: During the excavation or construction stage, the area of the proposed alignment and pump station be monitored for Aboriginal skeletal and artefactual material by a qualified archaeologist, on obtaining a section 16 from the Aboriginal Affairs Department.

The Aboriginal Affairs Department has indicated that no aboriginal sites would be impacted by the proposal. Nevertheless, the Water Corporation proposes to replace Commitment 19 in the PER with the following commitment (Commitment No. 17):

During excavation and construction, the Water Corporation would monitor the area of the proposed main sewer and pump station for Aboriginal and European skeletal and artefactual material and engage a qualified archaeologist upon finding any evidence of possible material, to the requirements of the Aboriginal Affairs Department.

2.3.2. Visual amenity

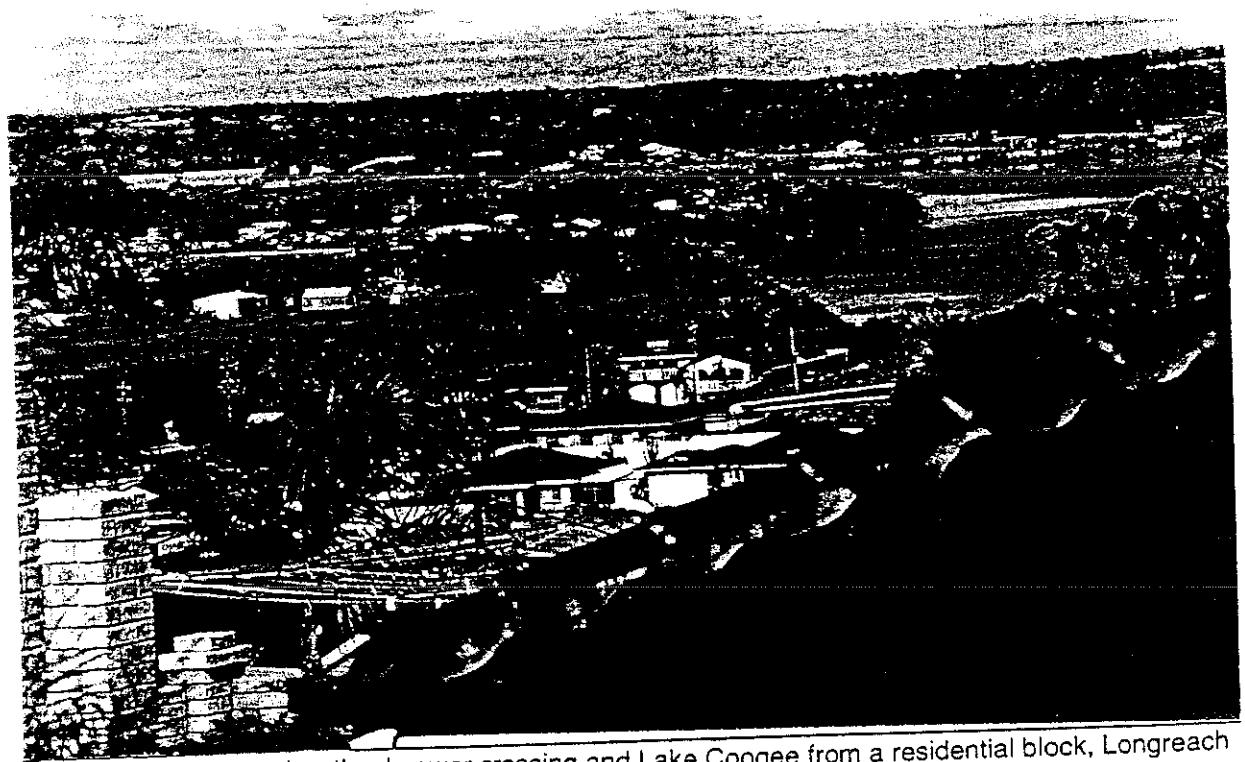
13-1 The proposed sewer will detract from visual amenity in the Beeliar Regional Park area.

It is acknowledged that the proposed sewer crossing of the wetland north of Lake Coogee has the potential to detract from the visual amenity of the Beeliar Regional Park. However, as indicated in Section 1.2, the design of the wetland sewer crossing has been changed since the release of the PER to further reduce its impact. As a consequence, the handrail on top of the sewer is just below the height of the surrounding tree canopy.

A line containing orange flags was erected along the existing causeway crossing the wetland north of Lake Coogee at the approximate height of the handrail of the proposed sewer crossing. Photographs of the views of the flag line from many vantage points around Lake Coogee were taken; two of these to the north and north west of Lake Coogee are presented in Figure 4. These photographs indicate that while the handrail and Main Sewer may be visible from a number of vantage points, the entire structure would not be highly visually obtrusive. Further, these and other photographs show that there is no existing location where a view of Lake Coogee would be interrupted by the sewer wetland crossing.

Landscape and architectural input would be sought to ensure that the sewer wetland crossing was designed in a manner to ensure that any possible adverse impact would be minimised and was compatible with and in keeping with the surrounding environment as much as possible.

View of the proposed wetland sewer crossing from the ridge to the north west of Lake Coogee with flag line in orange



View of the proposed wetland sewer crossing and Lake Coogee from a residential block, Longreach Parade, Cockburn Heights, with flag line in orange

Figure 4. Views of proposed wetland sewer crossing from two vantage points

13-2 The loss of mature indigenous trees will create undesirable visual and amenity impacts.

The alignment of the Main Sewer and location of the new Pump Station will dictate the actual vegetation that would be removed. The final alignment of the Main Sewer and the location of the Pump Station have not yet been decided. However, the Water Corporation is committed to minimising the impact on vegetation as a result of the construction of the Main Sewer and Pump Station, and all reasonable measures would be undertaken to minimise damage to, or loss of, vegetation (Commitment No. 12).

Loss of mature trees, both in the wetland and in the stand of Tuarts to the west of Lake Coogee, would be minimised through careful selection of the Main Sewer corridor. Preliminary investigations indicate that the Main Sewer can be located through the Tuarts to avoid all but a few of the trees. Specialist advice on, and supervision of, any activities, including root pruning, would be obtained during construction to minimise adverse impacts on adjacent Tuarts.

Further, the Water Corporation has made a commitment to undertake revegetation in excess of that required for rehabilitation of areas disturbed by construction activities (Commitment No. 12). Currently, the Water Corporation is holding discussions with the City of Cockburn, CALM and other government agencies contemplating undertaking landscaping and revegetation works in the vicinity of Lake Coogee to cooperate and consolidate efforts. The result of these efforts would be to improve the visual amenity of the Lake Coogee area.

13-3 Suitable detail is not available in the PER to determine whether or not the approach to mitigation of visual impact, landscaping and revegetation is appropriate. The landscape plan which the Water Corporation has committed to developing should be prepared in consultation with Council and the local community to ensure that all local concerns are adequately addressed.

Visual resource assessment indicates that scenic quality in the study area ranges from low to high, with public sensitivity highest for the viewsheds accessed from the residential development in Coogee Heights. Visual intrusion from the wetland sewer crossing can be largely mitigated through appropriate landscaping and the planting of additional native vegetation, though screening will take several years as the appropriate species to use in this environmentally sensitive area are relatively slow growing. Visual intrusion from the new Pump Station has a greater potential but can also be mitigated using contouring, landscaping and sensitive selection of external treatments of the buildings to minimise the visual impact and maintain the overall existing visual amenity of the viewshed.

As indicated in the response to Question 3-5, the Water Corporation is currently holding discussions with the City of Cockburn, CALM and other government agencies contemplating undertaking landscaping and revegetation works in the vicinity of Lake Coogee to cooperate and consolidate efforts. The intent of these efforts would be jointly to improve the visual, cultural and natural heritage features of the Lake Coogee area. The Water Corporation's landscape and vegetation management plan would be prepared with advice from CALM and the City of Cockburn to the requirements of the DEP (Commitment No. 12).

13-4 The visual assessment methodology and management recommendations in the PER are inadequate in a number of ways:

- *Water was not used as a criterion for scenic quality in the Beeliar Regional Park;*
- *There is no geographic basis to define appropriate management treatment;*
- *The reported "public sensitivity levels" appear to in fact relate to the quality of the view (to the lake and surrounds);*
- *The reported "seen-area" assessment appears to only identify views;*
- *The methodology referred to is used only in part, with the result that the assessment and management recommendations appear to be arbitrary, generic and inconsistent.*

The visual assessment methodology and management recommendations in the PER have been revised to address the issues mentioned. The results of this revised assessment are given in Appendix 1.

13-5 CALM undertook an assessment of the potential visual impact of the low-bridge option and found that this option would have considerable impact on the natural landscape character for a considerable viewshed surrounding the lake. On the basis of potential visual impact, it is strongly preferred that the pipeline is located outside of the regional park.

As indicated in Section 1.2, the design of the Main Sewer across the wetland has been changed to reduce its impact. As a consequence, the structure is just below the height of the surrounding tree canopy. Photographs of a flag line erected at the likely height of the handrail along the walkway on top of the Main Sewer indicated that while the handrail and sewer may be visible from a number of vantage points, the entire structure would not be highly visually obtrusive (see Figure 4). Rehabilitation of the surrounding vegetation, and the use of aesthetically pleasing design and colours so that the structure blends in with the surroundings, would further reduce the visual impact of the structure.

The management objectives set by CALM for the area of the wetland sewer crossing stress the need to avoid permanent changes and to promote positive experiences. The wetland sewer crossing will provide a permanent change to the site. However, the use of the Main Sewer to provide public access into this area provides opportunities to enhance public experience of the site and should be viewed as a benefit that would offset the visual change that would result from construction of the Main Sewer.

13-6 The proposal is supported subject to the low level bridge profile alternative at the northern end of Lake Coogee to minimise the visual impact of the crossing.

The Water Corporation's preferred option is the low level crossing of the wetland north of Lake Coogee. As indicated in the response to Question 13-1, the design of the main sewer across the wetland has been changed to further reduce its impact. As a consequence, the structure is just below the height of the surrounding tree canopy. Rehabilitation of the

surrounding vegetation, and aesthetically pleasing design and colours so that the structure blends in with the surroundings, would further reduce the visual impact of the structure.

13-7 The visual intrusion of a bridged pipe which can be camouflaged by greenery will be nothing compared to the visual intrusion of the present pump station which can only be described as an ugly blob on the landscape.

Munster Pump Station No. 2 was designed with only minimal reference to visual impact. Landscape and architectural input would be sought to ensure that the proposed wetland sewer crossing was compatible with and in keeping with the surrounding environment as much as possible.

13-8 There is no way a three metre wide pipe some 800 metres long can be visually screened.

The Main Sewer would only be above ground for approximately 280 m, not 800 m. In addition, as indicated in Section 1.2, the internal diameter of the Main Sewer has been reduced from 2.7 m to 2.4 m, and the top of the sewer itself would be the base of the walkway.

Photographs of a flag line erected at the likely height of the handrail along the walkway on top of the Main Sewer indicated that while the handrail and sewer may be visible from a number of vantage points, the entire structure would not be visually obtrusive (see Figure 4). There is no existing location where a view of Lake Coogee would be interrupted by the sewer wetland crossing. Rehabilitation of the surrounding vegetation, and the use of aesthetically pleasing design and colours so that the structure blends in with the surroundings, would further reduce the visual impact of the structure.

13-9 Consideration should be given to transforming the appearance of the proposed bridge, such as by the formation of murals along the sides of the pipe, sensitive to the pipe's location in Beeliar Regional Park, and conditional on minimal disturbance of the vegetation. Visual representation of both indigenous and non-indigenous values for the area would be appropriate.

Consideration of the aesthetics of the Main Sewer crossing of the wetland would be part of the design process. The appearance of the structure, including its shape, material and colour, are an integral part of this process. The suggestion of using murals, representing both indigenous and non-indigenous themes, would be considered as part of the design. The Water Corporation is holding discussions with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities. The plans prepared and implemented by the Water Corporation as a result of these discussions would compliment the management objectives for the Beeliar Regional Park and would be prepared in consultation with CALM and the City of Cockburn (Commitment No. 12).

13-10 The visual and amenity impacts of the proposed pump station are of concern. The pump station should be designed and built:

- *to be consistent with rural landscape character;*
- *to a high aesthetic standard;*
- *with extensive revegetation and re-contouring works around it.*

It is considered that with appropriate management of the visual impacts, through landscaping and by the design the various structures, the level of visual change and intrusion can be minimised. The Water Corporation would employ the services of an architect and a landscape architect during the early stages of design to ensure that an aesthetically pleasing structure is designed to mitigate visual impacts associated with the proposal. This would include some or all of the following:

- contouring the area to mimic natural contours and to integrate the new Pump Station into the hillside
- using locally provenanced indigenous trees and shrubs, including fast growing Acacias and Tuarts for rapid screening of the pump station site, and for all revegetation and rehabilitation works
- enhancing views into degraded land by planting clumps of indigenous vegetation with trees grouped to promote views to the ridge
- designing the new Pump Station to fit into the rural character of the site.

2.4 OTHER ENVIRONMENTAL ISSUES

2.4.1. Alternative sewer alignments

14-1 It is queried that adequate investigation has been made of alternatives for the required infrastructure to be located in an area of least impact to the Beeliar Regional Park. All the alternative options for extension of the sewer should be elaborated on, including detailed explanation of the precise environmental impacts likely to result from other alignments. Options that should be further investigated include:

- *the Mayor Road and Beeliar Drive extension options;*
- *locations outside the regional park, in an area where there would be least impact on the Beeliar Regional Park;*
- *align the main sewer extension along the east side of Lake Coogee and divert around the south end of the Lake to Woodman Point WWTP; and*
- *there may be other options not tabled in the PER which could be considered.*

As indicated in the response to Question 3-1, a number of alternatives, including routing the Main Sewer outside the Beeliar Regional Park, were considered, but the preferred route is considered to be the best option taking all factors into account. All options required some

degree of compromise because selecting a different sewer route affected sewer slope and height which in turn affected the location and depth of the new Pump Station, and the height and width of the wetland sewer crossing, and vice versa.

The environmental impacts of the various options were taken into account before the preferred option was chosen. The preferred option has the least number of impacts and these impacts can all be addressed and managed much better than those associated with the other alternatives.

14-2 It is preferred that the alignment for the main sewer extension is located within the proposed Beeliar Drive road reservation to consolidate the wetland crossing with infrastructure between Lake Coogee and Market Garden Swamp No. 2 into one central corridor.

- *are there alternative engineering approaches which could allow the sewer in this alignment without requiring the substantial fill outlined in the PER?*
- *the natural fall can be maintained in the pipe.*

Unfortunately, as indicated in the response to Question 3-1, extension to the Bibra Lake Main Sewer above ground along the proposed Beeliar Drive road reservation would require the width of the embankment for the proposed road to be increased by an additional 12m. The options to decrease the area of disturbance are to bury the Main Sewer in the wetland, to utilise an inverted siphon, or to pump the sewage across the wetland along Beeliar Drive. Also, one local Aboriginal group would object to burial of the main sewer, while pumping the sewage along the wetland would require either a new or an upgraded pump station to be retained at the existing site on Mayor Road.

None of the alternative options is considered acceptable.

14-3 The community were presented with three unacceptable options that do not meet environmental objectives.

The Water Corporation believes the preferred option, and associated commitments, meet the EPA's environmental objectives. All other options have their own environmental impacts.

2.4.2. Discrepancies with regard to the "low bridge" option

15-1 The PER contains discrepancies with regard to the "low bridge" option. Page 21 states that "The height from the natural surface of the wetland to the top of the sewer pipe is 4.5 m at the midpoint of the bridge". It should read "bottom" instead of "top". Also scale 2 on figure 10 is incorrect. It should be 1:50.

The scale in Figure 10 is incorrect: the scale should have been 1:50.

However, the statement that 'The height from the natural surface of the wetland to the top of the sewer pipe is 4.5 m at the midpoint of the bridge" is correct.

2.4.3. Latest technology

16-1 The latest technology (world best practice) is required for the Waste Water Treatment Plant works so that they are environmental friendly.

The Woodman Point Wastewater Treatment Plant is subject to a separate environmental approval process. As part of this process, the Water Corporation prepared an Environmental Assessment and Management Plan. The Department of Environmental Protection assessed this document and have recently given Works Approval for the construction of the plant, subject to a number of conditions being met. The Water Corporation has made a commitment that the wastewater treatment plant will be designed, constructed and operated to best practice standard with a view to minimising environmental impacts at all stages.

2.4.3. Public Consultation and Community

17-1 The Water Corporation should be committed to providing community input to the project no matter which option is selected. This may involve some type of artwork to the bridge section or in the area around the site.

As indicated in the response to Question 1-7, the landscape and vegetation plans would identify opportunities to involve the local community in rehabilitation activities where practical. For example, it is likely that community involvement would be sought in collecting seed or planting vegetation associated with the rehabilitation of crossing of Lake Coogee and re-establishing the understory of Tuarts and Grass Trees to the west of Lake Coogee. The use of murals, representing both indigenous and non-indigenous themes, would be considered as part of the design of the wetland sewer crossing.

17-2 Efforts to minimise the impacts of the proposal should be made through a number of means including public consultation.

The Water Corporation is holding discussions with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities. The plans prepared and implemented by the Water Corporation as a result of these discussions would compliment the management objectives for the Beeliar Regional Park and would be prepared in consultation with CALM and the City of Cockburn. Community input would also be available through the Beeliar Regional Park Advisory Committee.

17-3 The City of Cockburn recognises the significant effort by the WC to consult with local stakeholders but, regarding comments in section 10 of the PER, notes:

- *information in the Cockburn Gazette would not have got to all residences within the City, particularly the rural zones; and*
- *the City and Beeliar Regional Park Advisory Committee did not attend public consultation meetings because they were given separate detailed briefings.*

The Water Corporation believes that those people most affected by, or likely to have been interested in, the proposal were contacted and consulted. The Water Corporation acknowledges that representatives from the City of Cockburn and the Beeliar Regional Park Advisory Committee had no need to attend the public consultation meetings because they had been briefed separately.

17-4 In the PER summaries of community responses would be useful.

While there is no summary of community concerns in the PER, there are allusions to these concerns throughout the document. It is considered that all the issues raised by the community have been addressed in the PER.

2.4.4. Size and Scale of the Proposal

18-1 The EPA is urged to consider a critical review of the projections relating to the proposal in terms of future requirements to ensure that the size and scale of the proposal is minimised along with consequent physical impacts on the local environment.

The Main Sewer is sized to accommodate the ultimate flow expected from the southern Perth Metropolitan Area while the new Pump Station is sized for half that flow. A further identical pump station is envisaged to be required around 2050 subject to flow demands. These flow projections are based on the best available knowledge, but could decrease if water conservation measures are widely adopted in the future. Nevertheless, while Perth's population keeps growing, the volume of wastewater that needs to be pumped and eventually treated will also grow.

2.4.5. Disposal of Effluent at Sea

19-1 The extra sewerage effluent that will be dumped at sea is a worrying aspect. The EPA should decide whether they support the continuation of ocean disposal of sewage.

The aim of the extension to the Bibra Lake Main Sewer and construction of a new pump station is to cater for growth in the southern Perth Metropolitan Area, transferring the wastewater to the Woodman Point Wastewater Treatment Plant for treatment. Amplification of the existing Woodman Point Wastewater Treatment Plant is also being undertaken by the Water Corporation, with the treatment plant being upgraded from a

primary treatment facility to advanced secondary treatment facility. The resultant treated wastewater that is dispersed into the ocean will be of much better quality, particularly with regard to nutrient and bacterial concentrations, so that the impact on the ocean will be much reduced. Untreated wastewater (sewage) will not be disposed into the ocean. With the amplification and upgrade of the Woodman Point Wastewater Treatament Plant, it is intended that the total annual discharge of nitrogen to the ocean would be less than the annual nitrogen discharge in 1994, despite almost a doubling of flow.

The need for and feasibility of ocean disposal of treated wastewater was discussed in the PER which highlighted that two studies were undertaken by the Water Corporation (then the Water Authority) at the request of the Environmental Protection Authority. These studies concluded that the existing ocean disposal systems are performing well and are not endangering the ecological processes in the marine environment. However, as wastewater flows for the Perth region could treble over the next fifty years, only ongoing monitoring will provide indications to what extent these future increased loads could be similarly sustained, assuming the unlikely scenario that current treatment practices and ocean disposal of treated wastewater continue unchanged in the long term future.

The Water Corporation referred the proposal to amplify and upgrade the Woodman Point Wastewater Treatment Plant to the Environmental Protection Authority and prepared an Environmental Assessment and Management Plan. This document was assessed and the Department of Environmental Protection have recently given Works Approval for the construction of the plant, subject to a number of conditions being met. The Water Corporation has made a commitment that the wastewater treatment plant will be designed, constructed and operated to best practice standard with a view to minimising environmental impacts at all stages.

2.4.6. Timing

20-1 Some landowners in the locality submit that environmental clearance of the proposals is required urgently.

It is agreed that finalisation of environmental approval is required as soon as possible to minimise the risk of sewage overflows.

2.4.7. Social /Recreation

21-1 The recreational and social impacts from the Water Corporation's preferred option are of concern, both during the period of the works and after. All efforts to minimise the impacts should be made through appropriate design, public consultation and management and maintenance of the site.

The Water Corporation has made a number of commitments to taking all reasonable measures to minimise damage to, or loss of, vegetation as a result of the construction of the Main Sewer and new Pump Station, and not only minimising pollution and damage to Lake Coogee (Commitment No. 12). The Water Corporation has also made a number of commitments to improving the local environment surrounding the lake. These commitments would be extend to the design process and seeking input to the plans for the project.

21-2 The impact that the low bridge may potentially have over the movement of people through the site is of concern, particularly if the bridge remains fenced following construction.

The Water Corporation's intent is to construct a path on the top of the wetland sewer crossing that could be incorporated into the dual-use pathway system being planned around Lake Coogee. This would enhance people's ability to move across the area, not detract from it. It is not intended that the sewer crossing be fenced once construction is complete. However, a handrail would be constructed on either side of the top of the structure to ensure public safety whilst using it as a public accessway. The rehabilitation works may be fenced off from time to time but this would need to be examined and determined when the rehabilitation plans are prepared.

It is not envisaged that people would try to go under the structure to move from Lake Coogee into Market Garden Swamp No.2, though that would still be possible because there would be between 0.3 and 1.1 m clearance under it, depending upon water level.

21-3 Although it is noted that the risk of an overflow to the environment is reduced by the proposal, sensitive environmental areas and the local community would still bear the cost of overflows should they occur. It is unacceptable to delay work on the additional enclosed and open storage at the new pump stations until 2011-2015.

As indicated in Section 1.2, the proposal provides complete backup pumping capacity (including emergency power) and sufficient storage capacity within the Main Sewer for the next 10 to 15 years so that overflow of sewage to the market gardens wetlands and Lake Coogee would be a highly improbable event. Additional emergency storage would not be required until an increase in flow warrants construction of on-site storage facilities.

21-4 A public access walkway on top of the bridge would be of less value to the public than a dual use path where the current causeway lies to complete a loop around the lake. Walkers on top of the bridge would be exposed to noise and traffic of the Beeliar Drive extension assuming it goes ahead, and the views are better by the eastern, southern and western sides of the lake.

The Main Sewer wetland crossing immediately to the north of the existing causeway would incorporate a publicly accessible path that would link up with the proposed dual use path around Lake Coogee. This crossing would offer a safe, legal and elevated route across the wetlands immediately to the north of Lake Coogee that is currently not available. This would present a different perspective to users of the park while not preventing them from taking advantage of the views of the lake from the eastern, southern and western sides of the lake. The path on top of the structure would be below the height of the surrounding vegetation, especially after rehabilitation. It is not expected that walkers on top of the structure would be much more greatly affected by noise and traffic than they would if walking along the existing causeway, even if the Beeliar Drive extension goes ahead, which is by no means certain.

21-5 The development ignores the environmental requirements laid down in the MRS Amendments for the initial Jervoise Bay development in 1979 (255/31) emphasising the need to restore and retain the recreational opportunities of the coastal wetlands.

T the Water Corporation has agreed to rehabilitate not only the vegetation directly affected by the proposal but would also improve some additional areas of degraded vegetation near Lake Coogee (Commitment No. 12). The extent of the additional area to be rehabilitated has yet to be defined.

The Water Corporation is also holding discussions with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities. The plans prepared and implemented by the Water Corporation as a result of these discussions would compliment the management objectives for the Beeliar Regional Park and would be prepared in consultation with CALM and the City of Cockburn, and would result in the restoration and enhancement of recreational opportunities.

2.4.8. Additional Public Open Space

22-1 Portions of the existing pump station site have significant potential to be incorporated into public open space associated with the Market Garden Swamps once the pump station has been decommissioned. In particular the western portion of the site which contains the historic lime kilns and remnant vegetation should be incorporated into public open space as a means of offsetting some of the impacts associated with the overall proposal.

As indicated in Section 1.2, the existing Pump Station on Mayor Road is to be refurbished and it would then be recommissioned. The existing Pump Station would not be decommissioned until the commissioning of Munster Pump Station No. 4 which is currently envisioned to be after 2050. Munster Pump Station No.2 would be used as a backup in case of failure of the new Pump Station.

It is therefore currently envisaged that the site of existing Pump Station would not be revegetated and incorporated into public open space until at least 2050. The current proposal already includes commitments to rehabilitate a significantly larger area than will be disturbed and to co-operate with other stakeholders to identify opportunities for joint environmental enhancement activities. It is considered that these commitments are more than sufficient to counter any disturbance that may result from the implementation of the project.

2.4.9. Dewatering Plan

23-1 The development of a detailed dewatering plan is supported. This should evaluate and quantify options for disposal of groundwater. The Dewatering Plan will need to outline how groundwater, vegetation, and lake water levels will be monitored, and what action will be taken to prevent unacceptable impacts occurring. The environmental acceptability/sustainability of the various options depends on the volume of water required for disposal. In general, the WRC would support the option requiring the lowest volume of water and disposal of this water where the potential for environmental harm would be minimal. The Commission's preference is for disposal of dewatering via recharge or reinjection. Depending on the option selected, dewatering could result in upconing/intrusion of saline groundwater, and impacts could include impacts on wetland plant species, wetland ecology, local hydrology and Lake Coogee water chemistry, water levels and water regimes.

As indicated in Section 1.2, the current proposal is to construct the new Pump Station without the need for dewatering. Different options are being explored that would achieve this goal. There would only be a need to remove a small quantity of water (approximately 3,000 m^3) from within the space occupied by the pump station, once it is buried. This is roughly equivalent to 1 day's use of groundwater by all the market gardens in the Coogee area. The water would be allowed to re-enter the groundwater by surface infiltration through the same bunded area in the adjacent abandoned quarry. This quarry was used to dispose of water during pump drawdown tests conducted recently in order to examine the dewatering characteristics of the site. It is not considered necessary to prepare a dewatering plan for such a small quantity of water, but the process would be managed according to a water management plan to be developed (Commitment No. 6).

2.5 OTHER GROUNDS OF SUBMISSION

2.5.1. Development Application

24-1 The Ministry for Planning advise that the Water Corporation is required to lodge a Development Application with the City of Cockburn who will forward it to the WAPC for consideration of any proposed works within the Parks and Recreation Reserve.

This application will be submitted once the environmental requirements of the EPA and Minister for the Environmental have been established and agreed. The Water Corporation will then submit the appropriate development application to the City of Cockburn incorporating the range of issues raised by the City during the EPA process.

2.5.2. Economic

25-1 The sewer will detract from the visual amenity of the area, reducing the commercial value of property.

Every effort would be made to reduce the visual impact of the Main Sewer across the wetland north of Lake Coogee. The Water Corporation has agreed to rehabilitate not only the vegetation directly affected by the proposal but will also improve some additional areas of degraded vegetation near Lake Coogee. The Water Corporation is holding discussions with various other stakeholders who are planning developments in the area, as well as the City of Cockburn, to identify opportunities for joint environmental enhancement activities.

25-2 Locating the sewer on Lots Pt 1 and 2 Fawcett Road as depicted on Figures 3 and 7 is objected to as it will restrict the future development of the land and adversely affect the value of the land. However, an alternative alignment may be accepted subject to a number of criteria relating to no adverse effect on zoning, location within a future road reserve, and compensation for any loss of land value.

Neither of the options referred to in Figures 3 and 7 of the PER is the Water Corporation's preferred option. If the current proposal is accepted by the Minister for the Environment on the advice of the Environmental Protection Authority, the proposed sewer main will not be located on Lots Pt 1 and 2 Fawcett Road as depicted on Figures 3 and 7 of the PER.

25-3 A number of landowners with property in the "Lake Coogee Urban Development Area" support the "preferred option" for the new pump station and gravity main sewer extension subject to satisfactory arrangements including compensation if appropriate being made with the private landowners whose properties are traversed by the gravity sewer.

The subject of compensation by the Water Corporation would be addressed, if appropriate, by the Water Corporation's Commercial and Real Estate Divisions once the Minister for the Environment has given approval for the project to proceed on the advice of the Environmental Protection Authority.

25-4 If the pump station is constructed on the south side of Mayor Road or the odour buffer extended, some landowners advise that they will be seeking compensation.

If the current proposal is approved by the Minister for the Environment on the advice of the Environmental Protection Authority, the new pump station would not be built on Mayor Road, and the odour buffer would not be extended.

APPENDIX 1

Revised Visual Resource Analysis and Management

BIBRA LAKE MAIN SEWER & MUNSTER PUMP STATION NO 3

Response to Public Submissions
Visual Resource Analysis & Management

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·ECOSCAPE·

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BIBRA LAKE MAIN SEWER & MUNSTER PUMP STATION NO 3

Response to Public Submissions
Visual Resource Analysis & Management

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ACKNOWLEDGEMENTS

Ecoscape would like to thank Mr John Cleary of CALM for his valuable input into the revision of these sections of the environmental assessment and for providing us with copies of the relevant CALM management objectives.

1. INTRODUCTION

This report presents the revision of the Visual Resource Assessment and Visual Quality Management sections of the Environmental Assessment for the Bibra Lake Main Sewer and Munster Pump Station No 3. The original report was part of the PER documentation. Several submissions received during the public comment period referred to the potential visual intrusion from the development. The submission from CALM referred to the methodology used in the analysis. Following discussions with Mr John Cleary of CALM, it was decided to revise the relevant sections of the report.

The analysis has been amended to include landscape management objectives developed and recommended by CALM. The Seen Area Assessment and Public Sensitivity sections have also been revised and new material has been included.

The relevant section on reconciliation with the EPA requirements has also been revised and is included.

2. VISUAL RESOURCE ASSESSMENT

The development of the pipeline and pump station in the northern Lake Coogee area will result in a combination of short-term and long-term impacts on the visual character of the area. The extent of the impacts will vary, depending on the final mode of construction. Therefore, this section defines the landscape character types and the visual character types for the Lake Coogee area. It also presents the results of a scenic quality assessment of the landscape and identifies major viewsheds. Public sensitivity levels are also defined. This section provides the basis for identifying the potential impacts on the visual character of the area, and for mitigation and management of visual impacts, which will be addressed in subsequent sections.

2.1. Methodology

In order to define the existing visual resources and determine the magnitude and extent of any short-term or long-term changes, a standard assessment methodology is required. VRMS is a technique used by the USA Forests Department, the Forests Commission of Victoria and the Department of CALM. This methodology has also been used for a visual resource assessment of the Darling Range sub-region by the Department of Planning and Urban Development (Stuart-Street and Kirkpatrick, 1993). Subsequently, the methodology has been adapted by Main Roads (WA) as a part of its Visual Quality Management Process and by CALM (CALM, 1997).

The Visual Resource Assessment of the Darling Range Sub-Region (Stuart-Street and Kirkpatrick, 1993) utilises scenic quality assessment as a process for identifying landscape features. In particular, scenic quality classification was used which provides descriptive frames of reference that assume qualitative attributes can be assessed according to a set of criteria which includes naturalness, topographic relief, vegetative diversity and mixture. Frames of reference used for comparison of the Swan Coastal Plain Landscape Character Type (Appendix 3) provide a useful basis for analysis. The frames of reference for the study area were assessed from roadways and where necessary traversing sites on foot.

2.2. Results

Based on the frames of reference provided in Appendix 3 the following results were achieved. These results are based on visual analysis undertaken in September 1998.

2.2.1. Landscape Character Type

The landscape of the Lake Coogee area contains a number of distinctive elements. Four character units can be distinguished; these are:

- Natural - wetlands and their fringing vegetation, together with larger stands of remnant vegetation.
- Rural - areas where the landscape is dominated by rural small holdings and market gardens. This also includes areas of cleared land now covered in annual and perennial grasses.
- Settlement - urban landscapes, dominated by residential development and including schools, sporting and recreational facilities.
- Industrial - includes the Woodman Point Wastewater Treatment Plant and Cockburn Cement Plant as well as industrial areas south of Russell Road.

The location of these character units is indicated on Figure 1. The location of the ridgeline, which limits views to the west, is also indicated.

Stuart-Street and Kirkpatrick (1990) provide an overview of Landscape Character Type for the Swan Coastal Plain. As a part of the visual assessment for the Bibra Lake Main Sewer, the visual characteristics of Lake Coogee, as they pertain to the overall Swan Coastal Plain Landscape Character have been described in Table 1 below.

Table 1 Visual Characteristics of the Lake Coogee area.

Landform	Form:	Steep limestone ridge to the west, lowlying land to the east
	Line:	Strong horizontal form.
	Colour:	Soft yellows and pale greys.
	Texture	Coarse, rough limestone, dusty sands.
	Scale	Long open views to the north and south. The ridge truncates views to the west, but also provides views to the east.
Vegetation	Form	Tall Tuarts, singly or in stands, swathes of grassland, clusters of low green shrubs, bands of paperbarks and sedges,
	Line	Vertical Tuart Trunks, dense horizontal lines of paperbarks, low plains of grasses. Sedges provide a vertical line.
	Colour	Yellow swathes of grass in summer, replaced by green fresh growth in late winter, olive green Tuart foliage, deep green and grey green of paperbarks with white slabs of bark. Soft pink of Geraldton Wax in spring.
	Texture	Rough textured grasses, fibrous trunks of Tuarts, broad ribbons of paperbark, sharp, spiky Parrot bush and soft mounds of Acacias.
	Scale	Vegetation largely cleared, extensive views provided by landform.
Waterform	Form	Sheets of quiet lake water.
	Line	Elongated, linear
	Colour	Shimmering blue, pinkish tinge, pale shallows, brown muds exposed in summer.
	Texture	Smooth, glassy, ruffled, baked fissures in dried mud at the margins in summer
Land Use - Rural	Form	Uneven, open spaces, rectangular market gardens and ploughed bare earth.
	Line	Regular parallel rows of vegetables, strong horizontal lines.
	Colour	Lush greens and earthy browns in the market gardens, yellow swathes of grass in summer.
Land Use - Settlement	Form	Strong rectangular and triangular houses and rooflines, dense garden landscaping.
	Line	Geometrical domestic architecture rising on the northern ridgeline.
	Colour	Pale and medium contrasting tones of bricks and render, red tiles and silver corrugated iron roofs.

Land Use - Industrial	Form	Domes and geometric industrial shapes, often placed high in the landscape.
	Line	Rounded domes and firm horizontal lines. Vertical lines along the ridge from lighthouse, turbine, communication tower and industrial stacks.
	Colour	White domes and white or pale grey structures.

2.2.2. Scenic Quality Assessment

The scenic quality assessment frames of reference used here are those developed by Stuart-Street & Kirpatrick (1990) for the Swan Coastal Plain Character Type. Their frames of reference provide a standardised comparison base upon which scenic quality can be assessed as high, medium or low for each of the categories of landform, vegetation, waterform and land use. The results of this comparison are provided below. It should be noted that the frames of reference are based on the assumption that scenic quality increases with greater degrees of:

- Naturalness and lesser degrees of man-made alterations
- Relative topographic relief and ruggedness
- Vegetative diversity and crop patchwork effects in agricultural landscapes
- Vegetative diversity and edge diversity of vegetated areas

(DPUD, 1993)

Table 2 Scenic Quality Assessment

Natural Landscape:	
Landform	High scenic quality
Vegetation	High (on bund), Medium (stands of Tuarts, remnant vegetation around Lake), Low (highly modified or cleared areas)
Waterform	High scenic quality
Rural Landscape:	
Pattern	Medium (market gardens area) Low (cleared slopes of western ridge)
Transition	Medium scenic quality
Structure	Medium scenic quality
Roadside	Not applicable
Settlement Landscape:	Not assessed
Industrial Landscape:	Not assessed

The results show that overall scenic quality in areas of natural landscape is high. Landform, waterform, and the remaining vegetation are the primary factors contributing to the scenic quality. This is due to the setting of Lake Coogee in the interdunal swale of the Spearwood Dune system, its distinctive and dramatic vegetation patterns and the presence of open water surrounded by vegetation. Examples of areas low, moderate and high scenic quality within the study area are shown in Figure 2.

The scenic quality of the areas of rural landscape character is generally low to medium. Scenic quality is highest in areas of tended market gardens, rural residences and stands of native or exotic trees. Scenic quality is lower in areas of cleared vegetation. It should be noted that the rural scenic quality in the area of the pump station site is low.

The scenic quality of the settlement areas and industrial character were not assessed as the scenic quality of these areas do not affect the visual quality management of the development.

2.2.3. Seen Area Assessment

Seen area assessment is based on a public's eye view from travel routes and accessible vantage points into the viewshed. The assessment is based on landform screening and excludes vegetation screening as vegetation cover may change over time. Seen Area can be mapped using the topography of the surrounding area. However, the focus of this project is on identifying and mitigating the visual impacts from a small area within the overall seen area based around Lake Coogee, rather than the management of the visual resources of the whole of the seen area. Therefore seen area assessment focuses on the area of development as it is seen from various vantage points in the surrounding area. Although this is a departure from the standard CALM methodology, it is appropriate given the focus of the study.

Seen Area Viewsheds are divided into three distances:

- Foreground – 0 to 500 m from viewer
- Midground – 500 m to approximately 6.5 km from viewer
- Background – 6.5 km to approximately 16 km from viewer

In the Lake Coogee area, viewsheds are generally restricted by landform to foreground and midground, though views from the Coogee Heights area along the length of the lake may include all three. Parts of the ridge between Mayor Rd and Russell Rd are visible from high points in the Spearwood area, such as sections of Phoenix Rd between Bullfinch & Doolette Streets. Phoenix Rd is approximately 6 – 7 km from the site and though the egg shaped digestors are clearly visible, the remainder of the built structures of the wastewater treatment plant are not clearly visible.

The main vantage points into the area affected by the pipeline and associated infrastructure are as follows:

- the residential area on the ridgeline northwest of Lake Coogee;
- Stock Road;
- Mayor Rd & Fawcett Rd;
- Russell Rd East, Yangebup Rd and Watson Rd
- bush tracks west of Lake Coogee and
- the Dual Use Path around the southern end of the Lake.

The Wastewater Treatment Plant is also an access point for views into the area, however, this is discounted in terms of this analysis because it is not a public vantage point. It should be noted that in future additional vantage points may be developed

with the construction of the Controlled Access Highway (CAH) and the proposed extension of Beeliar Drive. Future urban development, should it occur on the eastern shores of Lake Coogee, may also provide some additional vantage points, depending on the location of developments. The potential for urban development is constrained by the Woodman Point Wastewater Treatment Plant buffer zone, which affects several lots to the west of Fawcett Rd, namely lots 704, 2 and 3.

Figure 3 provides an indication of the views both into and from the site using panoramas taken from a number of vantage points.

2.2.4. Public Sensitivity Levels

CALM (1997) identified a number of criteria for identifying the sensitivity level of visual resources, adapted from the criteria developed by Williamson & Calder (1979). These criteria focus on both the level of usage of travel routes and vantage points, as well as the expectations of the users. The criteria were then classified into four levels from high to very low sensitivity. Criteria developed by CALM (1997) relevant to this project are:

Level 1 – High Sensitivity

1. Freeways and State Highways with more than 500 vpd (vehicles per day)
2. Main sealed roads with more than 75 vpd
3. Residential areas with high degrees of scenic concern

Level 2 – Moderate Sensitivity

1. Main sealed roads with more than 50 vpd
2. Residential areas with moderate degrees of concern

Level 3 – Low Sensitivity

1. Utility roads with occasional recreational traffic up to 10 vpd
2. Walking tracks of local significance

Level 4 – Very Low Sensitivity

1. Bush tracks with infrequent recreational traffic of less than 3 vpd

The CALM criteria listed above are based on the volume of users. The perceptions of viewers can also be used to determine public sensitivity. This can be accomplished using a variety of techniques, however for the purposes of this study, it is assumed that pedestrians on both formal and informal access tracks around the lake are using the tracks at least in part because of the aesthetics of the surrounding areas. Therefore although the DUP and informal bush tracks around the lake have few users, the perceptions of the viewers will elevate the sensitivity of those routes.
Using the above criteria, public sensitivity is currently highest in the viewshed accessed from the Coogee Heights residential area. This provides the most panoramic views of the affected area. The views contribute to high property values and are reflected in the orientation of houses and incorporation of large windows to take advantage of the views.

Table 3 summarises the public sensitivity levels for all vantage points.

Table 3 Public sensitivity levels for current potential future vantage points into the area affected by the proposed development of the sewer pipe and associated infrastructure at the northern end of Lake Coogee.

Vantage point	Sensitivity Level
Existing Vantage Points	
Coogee Heights residential area	High (see Figure 6)
Stock Road/Rockingham Road	High
Mayor Road	Moderate
Russell Road	Moderate
Fawcett Road	Low
Dual Use Path, southern end of Lake	High
Bush Tracks west of Lake	High
Potential Future Vantage Points	
CAH	High
Beeliar Drive extension	Moderate
Future urban development	Not possible to predict.

Both the pipeline and the pump station will be visible from the CAH, the pump station from the western carriageway and the pipeline from the eastern carriageway. As viewed from the western carriageway, the pump station will form an extension of the Woodman Point Wastewater Treatment Plant. Although the public sensitivity level for this area is high, the existing visual character has only low aesthetic value. The area retains very little original vegetation and is largely covered with invasive grassy weeds. The pipeline will intrude into views of Lake Coogee, though the viewshed is very narrow and the potential exists to further reduce visual impacts with appropriate landscaping.

2.2.5. Outcomes of Assessment

The visual resource assessment of the pipeline across the wetland and the pump station can be summarised as detailed in Table 4. Although the scenic quality varies between the two sites, public sensitivity is high for both. It should also be stated that the two sites are present in the foreground or midground of the majority of views into the area. Therefore it can be concluded that the wetland crossing site is sensitive, and could be classed as Landscape Management Zone A (maximum retention) based on the CALM methodology (Appendix 2). However, the pump station site, due to its lower scenic quality is classed as Landscape Management Zone B (moderate retention), but due to its high public sensitivity, it is classed as Zone A for the purposes of this project.

Table 4 Outcomes of Assessment. This table summarises the scenic quality and public sensitivity of the wetland crossing and pump station sites.

Site	Scenic Quality	Public Sensitivity	
		Travel Route	Distance
Wetland Crossing	High	High	Fore to midground
Pump Station	Low	High	Fore to midground

2.3. Management Objectives

CALM has developed objectives for visual resource management in natural areas based on the presence of different categories of landscape management zones for both rural and natural landscapes. The appropriate management objectives have been supplied by Mr John Cleary of CALM.

The objectives for Natural Landscape Management Zone A are detailed as follows:

- *Natural aesthetic significance and its setting should be protected where the feature is not well represented.*
- *Natural aesthetic significance and its setting should be protected where the feature is well represented, allowing minor or temporary changes that provide an adequate and representative area of significance to be protected.*
- *Natural landscape character should be protected in the long term where it is located within an 'A' public sensitivity zone, as seen from Level 1 and 2 travel routes. Protection can include:*
    - *Positive changes to the character (those that aim to enhance the human experience of the natural character) if of minor, localised impact.*
    - *Rehabilitation.*
    - *Negative changes if inevident, or evident for a short period and of minor impact.*
- *Access and views in an 'A' public sensitivity zone should be protected through:*
    - *Maintaining access to existing positive experiences.*
    - *Maintaining access routes to a high aesthetic standard.*
    - *Broadly maintaining access route side-view patterns.*
    - *Actively managing key views.*

The pump station site, although of lower scenic quality is in an area of high public sensitivity. The management objectives applied by CALM to such situations are detailed as follows:

- *Rural landscape character should be protected in the long term where it is located within an 'A' public sensitivity zone. Protection can include:*
    - *Positive changes to the character (those that aim to enhance the human experience of the rural character) if of minor, localised impact.*
    - *Rehabilitation.*

- *Negative changes if inevident, or evident for a short period and of minor impact.*

The visual quality management of the wetland crossing and pump station sites is presented in the following section.

3. VISUAL QUALITY MANAGEMENT

The previous section analysed the sensitivity of the locations for the pump station and the pipeline across the wetland. It determined the appropriate landscape management zones and set out the CALM objectives for those zones. This section identifies the visual change resulting from the proposed construction and sets out strategies to mitigate visual impacts. It then assesses to what extent the landscape management objectives can be achieved.

3.1. Visual Change

Visual change refers to the impact of the proposed works in relation to the current landscape values as detailed in section 2. To understand the impacts of the development, further description of the extent of works and their visual impact is required.

3.1.1. Extent of Works

Two components of the proposed sewer and associated infrastructure have the potential to alter the visual character of the site on a permanent basis. These are:

- the pipeline, where this is present above ground; and
- the pump station on the northwestern slopes of Lake Coogee.

The aerial section of the pipeline will be approximately 225 m long, dropping 300 mm from east to west. Its base will be approximately 0.85 m above ground surface at the mid point. This places the upper surface of the structure at approximately 3.65 m above ground surface in the central channel area. The upper surface of the pipeline will be above ground for approximately 280 m; the lower surface will be above ground for approximately 225 m. Amongst the 120 m wide band of fringing and emergent Melaleucas, the pipe will be approximately as high as the treetops (noting that *M cuticularis* can grow to 7 m, but does not reach that height in this location). However, outside of this band, vegetation is currently sparse and low growing, therefore potential exists for visual intrusion unless otherwise mitigated.

The pump station will occupy approximately 0.8 ha of land west of the CAH reserve. The site is located in a shallow saddle on the eastern slope of the ridge, and includes part of the eastern slope of the ridge. The pump station will include two buildings, as detailed in the main PER document prepared by GHD. The largest pump station building will rise to a height of approximately 7 m above ground level.

It should be noted that the size of the pump station and the pipeline across the wetland have been reduced through further design work by the Woodman Alliance since the PER was submitted for public comment.

3.1.2. Expected Visual Change and Visual Impacts

Ranking of the visual impact is based on the visual impact of the works on the scenic quality and visual character. Ranking of these impacts forms part of the basis for the recommendations for minimising visual impacts.

The following table identifies and ranks the visual impacts for the proposed works.

Table 5: Identification and ranking of visual impacts associated with the proposed Munster Pump Station No 3 and the extension of the Bibra Lake Sewer Main.

Proposed Works	Visual Impact	Ranking
Construction of a 3 m diameter sewer pipe between the Munster Pump Station and Fawcett Rd, Coogee	The pipeline will be placed below ground in this section. The primary visual intrusion will be from the construction works. As the area affected has been previously cleared for agriculture, but is currently fallow, there will be no perceived change of land use.	Low
Construction of a 3 m diameter sewer pipe between Fawcett Rd and the west bank of Lake Coogee.	The pipeline will emerge from the ground on the east bank of the Lake and will cross the wetland north of the existing causeway supported on a piers to a maximum height of 5 m above ground level. The pipe will re-enter the ground at an appropriate point in the topography. The major visual intrusion is from the pipeline across the wetland, which will be set amongst the paperbark trees in the wetland channel, and from the exposed sections either side of the existing wetland vegetation.	High
Construction of sewer between the northern end of Lake Coogee and the Munster No 3 Pump Station site.	The major visual intrusion will be during the period of construction. Careful choice of alignment for the pipeline will minimise the number of existing trees removed as a part of works. The majority of the route passes through previously cleared land.	Low
Construction of Munster Pump station No 3 and associated infrastructure.	The pump station will be located within a shallow saddle within the coastal ridgeline. This will minimise visual intrusion from viewpoints lower in the landscape, however the site is visible from homes on the ridgeline in the suburb of Cockburn and from a number of roads north and east of the site.	High

3.2. Visual Quality Management Objectives

Apart from the objectives developed and used by CALM, which are broadscale and generic, specific objectives for the visual quality management of the wetland crossing and pump station have been developed from the visual analysis undertaken for this project. The visual management objectives are:

- Minimise impacts of the pipeline across the wetland on viewscapes.
- Minimise impacts of the pump station and associated infrastructure on viewscapes
- Ensure background and foreground perceptions landscape character types are maintained.
- Make use of the opportunities provided by this project to enhance community perceptions of the north Lake Coogee area.

These objectives provide a more specific framework for addressing the potential visual impacts from the proposed development within the overall CALM objectives detailed in section 2.3.

3.3. Recommendations

The following recommendations (Table 6) have been made taking into account the visual character, existing vantage points and viewsheds, features of visual significance, the type of viewers and their expectations and the expected visual impact that the proposed Munster pump station and pipeline will have. The recommendations cover landform, vegetation, waterform, and land use – each a component of the visual character.

Table 6: Recommendations

OBJECTIVE	STRATEGY	RECOMMENDED ACTIONS
Landform – Protection of aesthetic significance.	• Minimise changes to existing landform	• Contour pump station area to mimic natural contours. • Minimise the use of cut and fill. • Contour the areas where the pipe emerges above ground to minimise intrusion.
Vegetation – Protection of natural landscape character. – Protection of aesthetic significance. – Protection of views.	• Maximise retention of existing native vegetation, particularly mature indigenous trees • Rehabilitate vegetation adjacent to the developments • Screen out undesirable views of the pipeline and pump station. • Improve scenic quality of cleared areas along pipeline route.	• Use appropriate vegetation to screen pipeline. • Select pipeline route to maximise use of existing cleared areas and minimise loss of mature trees. • Views into degraded land to be enhanced by planting clumps of indigenous vegetation. Trees grouped to promote views to ridge. • Transplant and retain existing mature *M cuticularis* and *M rhaphiophylla*. • Use local indigenous trees and shrubs for all revegetation and rehabilitation works. • Use native species to landscape the areas between the existing wetland vegetation adjacent to the wetland crossing and the point at which the pipeline re-enters the ground. • Accentuate planting along pipeline route along western shore where original vegetation has been lost and at wetland crossing area using indigenous species. • Use *Acacias* and Tuarts for rapid growth and screening of pump station site.
Waterform – Protection of natural landscape character. – Protection of aesthetic significance. – Protection of views.	• Retain and accentuate views where possible. • Minimise visual intrusion from pipeline. • Integrate conservation and recreation where possible. • Unify area.	• Provide for community access to this area through placement of a walkway on top of the pipeline across the wetland. • Design bridge to promote integration into the landscape. • Use dark colours on the aerial pipeline to blend it into the surrounding vegetation for mid-ground and background views. • Design the pump station to fit in to the rural character of the site, ie hipped roofs, eaves to shade the walls, appropriate choice of structural materials.
Land Use – Protection of both rural and natural landscape character. – Protection of aesthetic significance.	• Instigate landscape master plan for the area to ensure that all stakeholders work co-operatively to unify the area	• Use landscape design & management of the area to unify & maintain a rural feel of open fields, clumped or scattered trees and areas of native vegetation. • Provision of accessible recreation area in conjunction with other stakeholders. • Historic areas to be recognised and

		incorporated possibly through access, interpretation. • Interpretive signage detailing natural, cultural, historical and industrial land uses.

3.4. Evaluation

Permanent visual change is limited to two areas:

- The pipeline across the wetland at the northern end of Lake Coogee
- The site of the pump station and its associated infrastructure.

In both cases, the sites form part of the viewscape from housing constructed to the north and from local & regional roads, as well as from various points around the lake. The public sensitivity of these sites is high.

It is considered that with appropriate management of the visual impacts, through landscaping and choice of appropriate building materials, as detailed in the objectives and recommendations in the previous section, the level of visual change and intrusion can be minimised. This is also assisted by the design work carried out since the submission of the PER, which has further reduced the extent of the visual intrusion.

The landscape management objectives for the pump station site can be met by appropriate landscaping and by designing the above ground structures to blend with the rural character of the surrounding landscape.

The management objectives set by CALM for the area of the wetland crossing stress the need to avoid permanent changes and to promote positive experiences. The pipeline across the wetland will provide a permanent change to the site, and therefore the project does not meet the landscape management objectives in this regard. However, the use of the pipeline to provide public access across the wetland into this area provides opportunities to enhance public experience of the site and should be viewed as a benefit that will offset the visual change that would result from construction of the pipeline.

4. RECONCILIATION WITH EPA REQUIREMENTS

4.1. Aesthetics

EPA Requirements
Visual amenity of the area adjacent to the proposal should not be unduly affected by the proposal

Response
Work has been undertaken as required.

Summary
Visual resource assessment indicates that the wetland crossing site is a Natural Landscape Management Zone A area due to its high scenic quality and public sensitivity. Technically the pump station site falls into Rural Landscape Management Zone B, however, due to the high public sensitivity of the site, it was treated as a zone A site for the purposes of this report. Visual intrusion from the pipeline across the wetland can be largely mitigated through appropriate landscaping. The existing *Melaleucas* will be transplanted both to minimise disruption to the ecosystem and to promote rapid screening of the pipeline across the wetland. Visual intrusion from the pump station will require mitigation using contouring, landscaping and sensitive selection of external treatments of the buildings to minimise the visual impact and maintain overall existing visual amenity of the site.

REFERENCES

Cleary, J, Department of CALM, pers. comm. and unpublished reports

Conservation and Land Management, Department of, (1994) *Reading the Remote: Landscape Characters of Western Australia.* CALM, Perth, 185 pp.

Conservation and Land Management, Department of, (1997) *Leeuwin – Naturaliste Landscape Assessment Study: Stage 1 Report.* Department of CALM, Perth, 42 pp.

Conservation and Land Management, Department of, and the National Parks and Nature Conservation Authority (1995) *Yalgorup National Park Management Plan 1995 – 2005.*

Department of Planning and Urban Development (1993) *Darling Range Regional Park and Landscape Study: for public comment.* DPUD, Perth, 76 pp.

Milthorpe, S and Filia, J (1998) *Visual Quality Management, Main Roads WA: Stage 2. Summary of Position Paper and recommended visual quality management process and guidelines (Draft).* Main Roads WA, Perth. 22 pp + app.

Smith P.G.R. and Theberge J.B. (1986) *A Review of Criteria for Evaluating Natural Areas* Environmental Management **10**: 715-734

Stuart-Street, A and Kirkpatrick, B (1993) Visual Resource Assessment of the Darling Range Sub-region: Darling Range Regional Park Supplementary Report No 3. Department of Planning and Urban Development, Perth. 19pp + app.

Williamson, D N & Calder, S W (1979) Visual resource management of Victoria's forests: a new concept for Australia. *Landscape Planning* **6**:313-341

KEY

INDUSTRIAL

NATURAL

RURAL

SETTLEMENT

TITLE: LANDSCAPE CHARACTER UNITS

CLIENT: THE WOODMAN POINT ALLIANCE

FIGURE 1

• E C O S C A P E •

ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
21A Fairbairn Street Fremantle Western Australia, 6160
Telephone (08) 9430 8955 • Facsimile (08) 9430 8977
email: ecoscape@wantree.com.au

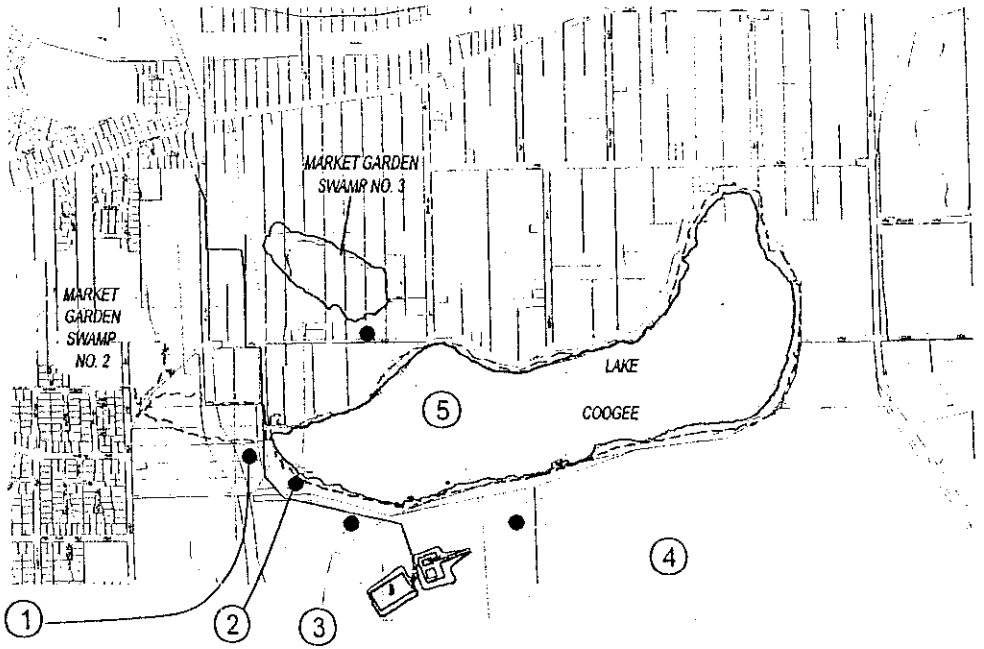
SCALE: 1:15000

DATE: MAY 99

DRAWING No: V3_2D_01.DGN

N

(5) High Scenic Quality - Natural Landscape



(1) Moderate Scenic Quality - Agricultural Landscape

(2) Moderate Scenic Quality - Natural Landscape

(3) High Scenic Quality - Natural Landscape

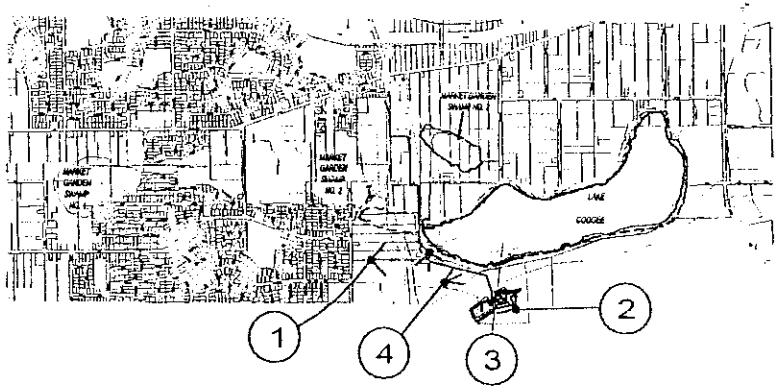
(4) Low Scenic Quality - Natural Landscape

FIGURE 2	PROJECT:	CLIENT:		• E C O S C A P E •	SCALE: 15 000	DATE: MAY 99
EXAMPLES OF SCENIC QUALITY CLASSES FOR NATURAL AND AGRICULTURAL LANDSCAPES WITHIN THE STUDY AREA	BIBRA LAKE MAIN SEWER & MUNSTER PUMP STSTION	THE WOODMAN ALLIANCE		ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS 21A Pakenham Street Fremantle Western Australia, 6160 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977 e-mail: ecoscape@wantree.com.au	DRAWING No: 0511S-QUAL.DGN	N
					ORIGINAL DRAWING SIZE A3	

Panorama of Low Bridge Site (1)

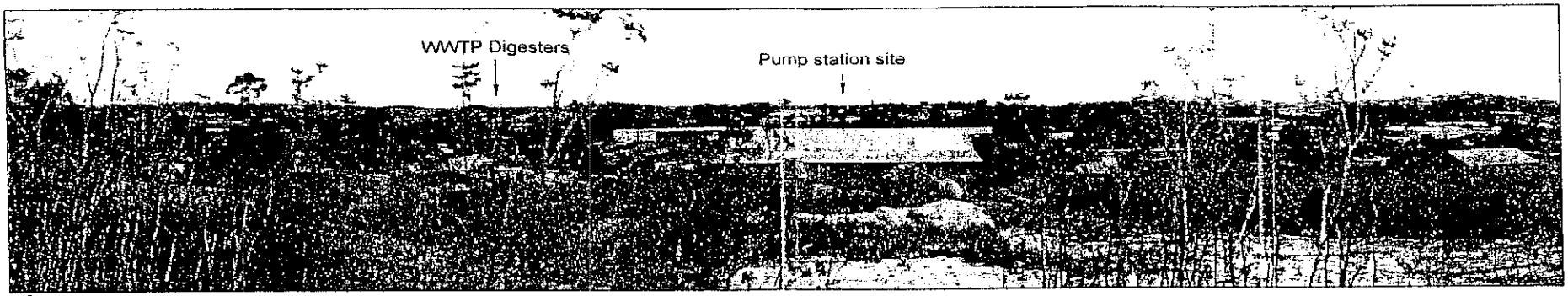
(2) Panorama of Pump Station Site
Note residents on ridge in background

Panorama of stand of Tuarts
adjacent to pipeline (4)

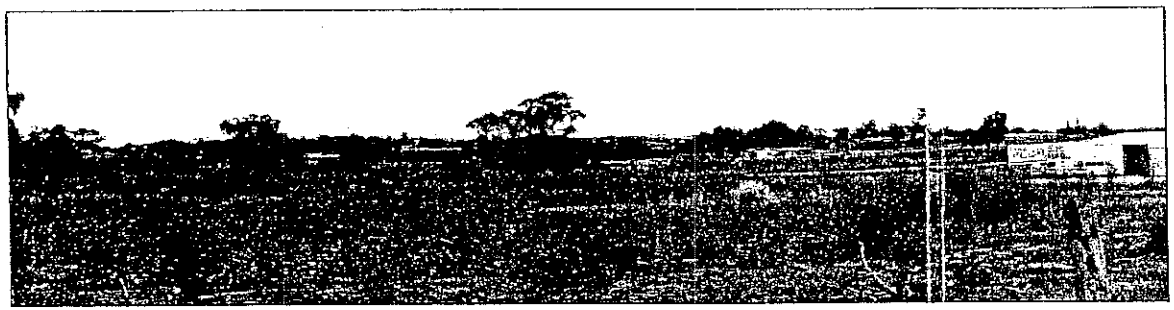


Panorama of stand of Tuart trees,
(Listed of the City of Cockburns Municipal Heritage Inventory). (3)

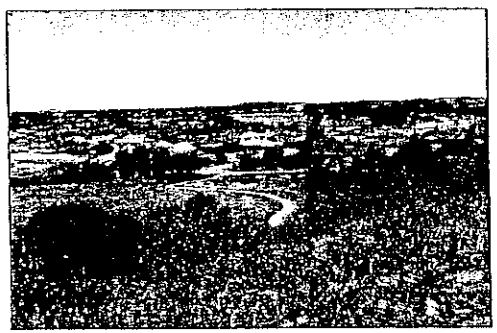
FIGURE 3A	PROJECT:	CLIENT:		• E C O S C A P E •	SCALE: 30 000	DATE: MAY 99
PANORAMAS OF MAJOR VIEWSHEDS WITHIN THE STUDY AREA	BIBRA LAKE MAIN SEWER & MUNSTER PUMP STATION	THE WOODMAN ALLIANCE		ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS 21A Pakenham Street Fremantle Western Australia, 6160 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977 email: ecoscape@wantree.com.au	DRAWING No: 0511v-sheds.dgn	N
					ORIGINAL DRAWING SIZE A3	



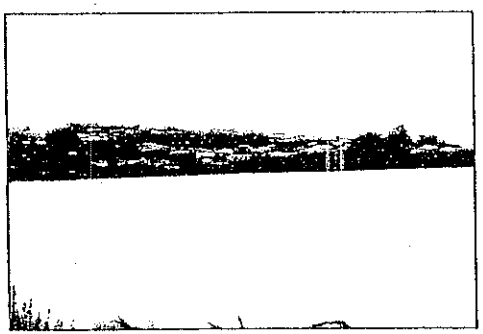
1 Panorama of Pump station from Stock Road



2 Panorama of Pump station from Rockingham Road



3 View from Lucca Crt, Cockburn Heights



4 View from DUP Southern end of Lake Coogee

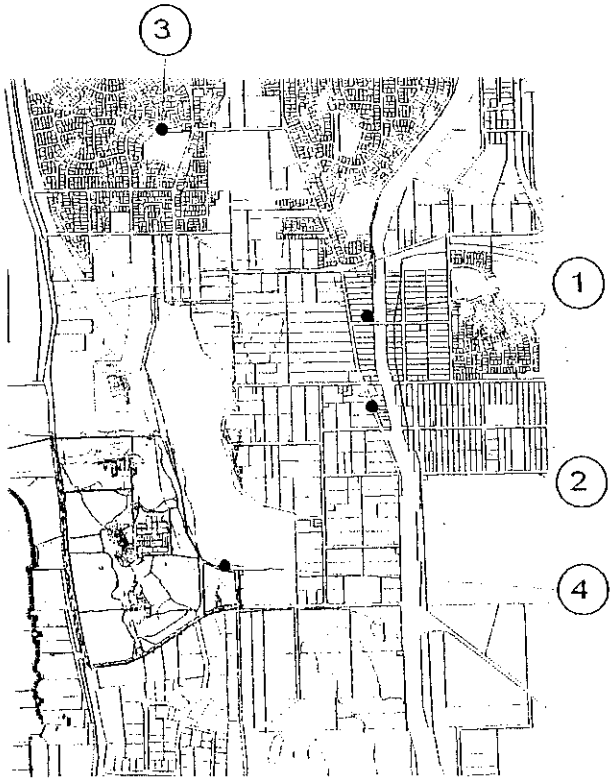


FIGURE 3B	PROJECT:	CLIENT:		• E C O S C A P E •	SCALE 1:30 000	DATE: MAY 99
PANORAMAS OF MAJOR VIEWSHEDS WITHIN THE STUDY AREA	BIBRA LAKE MAIN SEWER & MUNSTER PUMP STATION	THE WOODMAN ALLIANCE		ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 475 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS 21A Pakenham Street Fremantle Western Australia, 6160 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977 email: ecoscape@wanlees.com.au	DRAWING No: WA21_02_V3.dgn ORIGINAL DRAWING SIZE A3	N

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2

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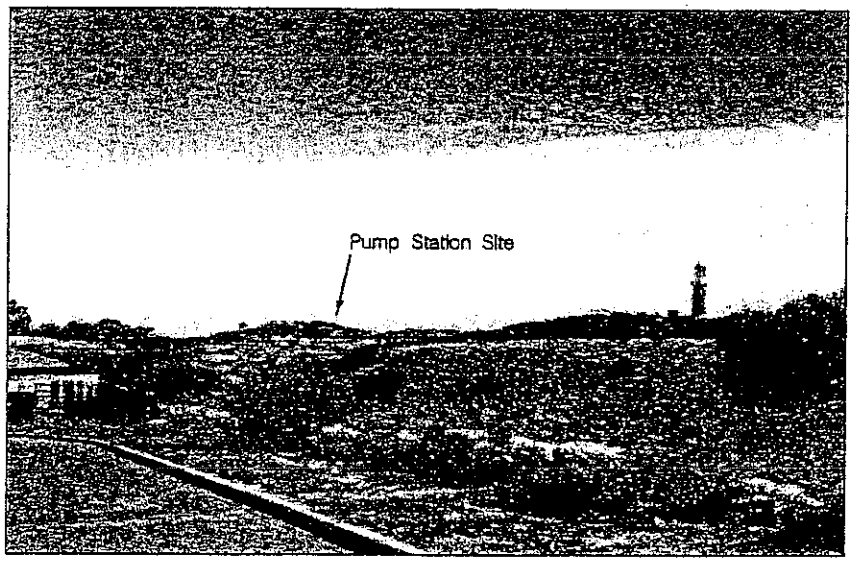

FIGURE 4
Views from vantage points in Coogee Heights indicating views into the area of the low bridge and pump station site

File: 0511coog-hts2.dgn

• E C O S C A P E •
ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
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APPENDIX ONE: LANDSCAPE MANAGEMENT ZONES AND SCENIC QUALITY FRAMES OF REFERENCE

Excerpt from Appendix 2 of Stuart-Street & Kirkpatrick (1993).

APPENDIX 2

LANDSCAPE MANAGEMENT ZONE MATRIX

MATRIX		(2) DISTANCE ZONE - SENSITIVITY LEVEL							
		fg-1	mg-1	bg-1	fg-2	mg-2	bg-2	fg-3	U
(1) SCENIC QUALITY CLASS	H	A	A	A	A	B	B	B	B
	M	A	B	B	B	B	C	C	C
	L	B	B	B	B	C	C	C	C
		(3) LANDSCAPE MANAGEMENT ZONE							

Matrix Key:

(1)Scenic Quality Classes
- H - High
- M - Moderate
- L - Low

(2) Distance Zones
- fg - foreground
- mg - middleground
- bg - background
- u - uninventoried and unseen

(2) Sensitivity Levels
- 1 - High
- 2 - Moderate
- 3 - Low

Matrix Formula:

(1) Scenic Quality Class
+ (2) Distance Zone - Sensitivity Level

= (3) Landscape Management Zone

Examples:

fg1 + H = Zone A
bg2 + L = Zone C

(3) Landscape Management Zone = Visual Quality Objectives
- A = IA - Maximum Retention
- B = AA - Moderate Retention
- C = DA - Partial Retention / Enhancement

Source: Landscape Character Types of Victoria
Hammond and Leonard, 1984

TABLE 3: AGRICULTURAL LANDSCAPES - SCENIC QUALITY CLASSIFICATIONS
SUPPLEMENTAL FRAME OF REFERENCE

Description	High Scenic Quality	Moderate Scenic Quality	Low Scenic Quality
PATTERN	• Distinctive variation in vegetative pattern created by contrasting landuses as woodland, pasture, orchard, plantation and cropland. Patchwork effects of colour, texture, and form are visually dominant over relatively small areas.	• Variation in vegetative pattern created by adjacent land uses evident but not distinctive in the landscape. Patchwork effects of colour, texture and form are evident over moderate to broad-scale areas.	• Expanses of similar vegetative pattern, texture and form. Few patterns or textural changes over relatively large to extensive areas.
TRANSITION	• Gradual naturally appearing transitions between agricultural land uses and adjacent forested land, line edges generally irregular.	• Transition between agricultural land use and adjacent land use combining both gradual and sharp edge contrast, but seldom appearing as an unbroken straight line.	• Transition between agricultural land and adjacent forest land is sharp and geometric, generally appearing as a line.
STRUCTURE	• Unique farm buildings complementing traditional rural architectural styles which borrow from form, line and colour found frequently in the surrounding landscape	• Farm buildings which partially borrow from landscape features and traditional architectural styles found commonly throughout the character type.	• Farm buildings which contrast sharply from landscape characteristics of form, line, colour and texture are often in traditional rural architectural styles.
ROADSIDE	• Unique feature trees or tree rows which become a point of focus of view due to position, colour, form or texture in contrast to those found commonly in the surrounding landscape	• Expanses of roadside vegetation similar in spacing, form, colour and texture to that commonly found in the character type which provide moderate visual interest but which seldom become a distinctive focus of view.	• Long straight segments of roadside with sparse vegetation of little visual interest.

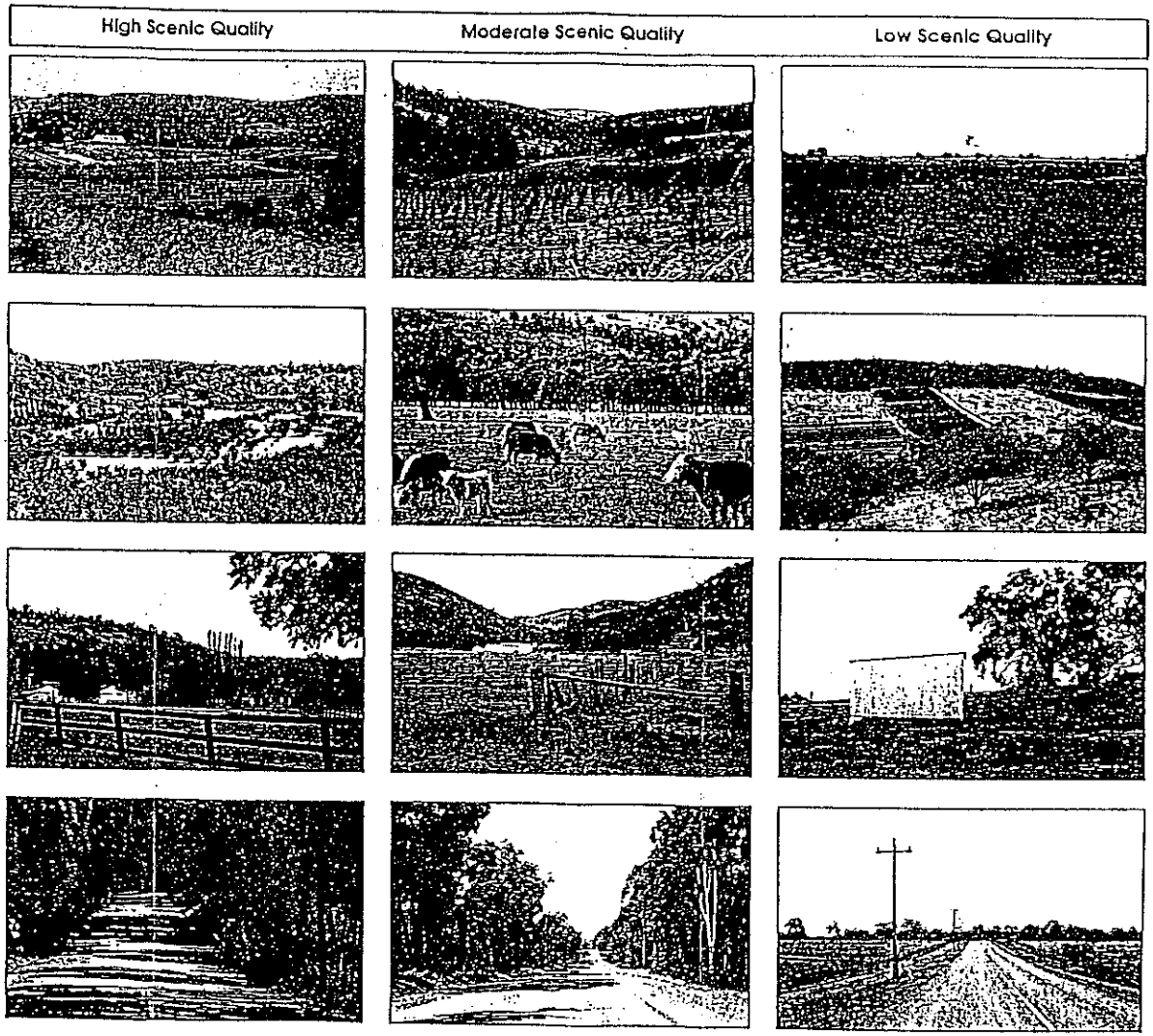
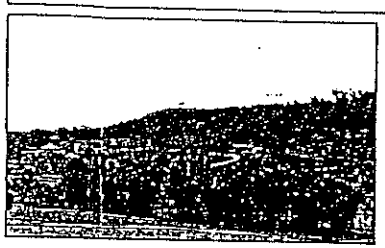
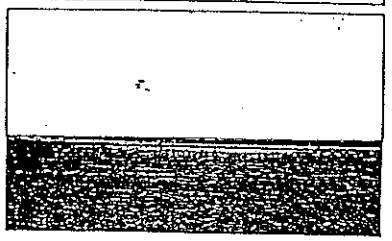
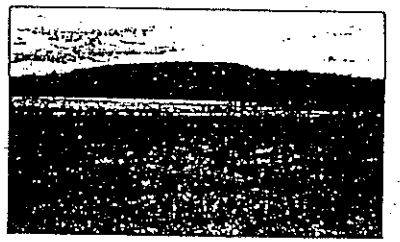


TABLE 2: SWAN COASTAL PLAIN LANDSCAPE CHARACTER TYPE
SCENIC QUALITY CLASSIFICATION FRAMES OF REFERENCE

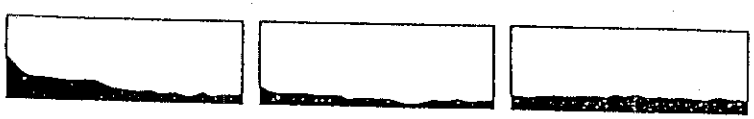
Description	High Scenic Quality	Moderate Scenic Quality	Low Scenic Quality
LANDFORM	• Rounded laterals with steep slopes • Distinctly dissected valleys • Gently undulating areas with well defined drainage patterns • Rock outcrops and large scattered boulders • Plains with distinctive drainage patterns	• Areas of plains with common patterns of dissection evident but not distinctive • Areas of uniform undulation with less distinct drainage	• Areas of uniformly flat, indistinctly dissected plains with few features of visual interest
VEGETATION	• Remnant or other areas of native vegetation exhibiting an unusual diversity of colour, height or species • Areas with combinations of pasture/land, vegetation exhibiting attractive patterns of diversity in texture and colour • Distinctive displays of seasonal colour (eg. WA Christmas Tree)	• Less diversity in vegetation combinations of agriculture and native vegetation with more regular patterns appearing • Remnant and extensive areas of native vegetation with some structural diversity and common patterns of colour and texture evident	• Extensive areas of agricultural and native vegetation with repetitive or similar patterns • Extensive areas of vegetation with little pattern variation or diversity
WATERFORMS Rare	• Permanent or intermittent watercourses continually changing in flow characteristics with attractive features such as rapids • Wetlands with an undisturbed appearance • Reservoirs with dominant natural characteristics i.e. shape borrowed from surrounding landforms and fringing vegetation remaining	• Permanent or intermittent watercourses with long stretches of unchanging flow characteristics • Partially undisturbed wetlands • Reservoirs with some natural characteristics of shape and vegetation	• Waterbodies with little evident natural characteristics (shape, vegetation etc) • Waterforms absent






LANDFORM PROFILES



Appendix 8

Information from proponent on:

- **proposed construction methods (29th July 1999)**
- **the environmental factor odour (9 September 1999 and 7 December 1999)**

WA21
THE WOODMAN ALLIANCE

Originator: Dr Eddy Wajon
Direct: (08) 9214 3738
File: P001-7106.1.15
0280:sam

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Perth WA 6000
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Email wa21@wa21.com.au

29 July 1999

Ms Maxine Dawson
Department of Environmental Protection
Westralia Square
141 St Georges Terrace
PERTH WA 6000

Dear Maxine

WOODMAN PT ENVIRONMENTAL ENHANCEMENT PROJECT
MUNSTER PUMP STATION NO. 3 & BIBRA LAKE MAIN SEWER EXTENSION

In response to your facsimile dated 15 July 1999 regarding further information about our proposal for the wetland crossing structure and construction method, we make the following comments.

Wetland Crossing Structure

In the Response to Submissions, a 22 metre wide construction corridor was proposed within which a 15 metre wide temporary causeway was required. This was based on a proposal for the construction of the wetland crossing using a large crane on an embankment to the north of the proposed wetland crossing structure. This proposal is indicated on the enclosed drawing DWG-6320-02-9003. The proposed crane was large enough to provide sufficient capacity to lift heavy pipe segments on to the support structure. The 15 metre width of the temporary causeway was required to accommodate the crane and included a 2 metre wide access clearance on each side for safety.

In this proposal, a separation of 9 metres was required between the existing, most northerly pressure main in the existing causeway embankment and the centreline of the wetland crossing structure. To the east of the wetland crossing, the existing pressure main rises up the hill towards Fawcett Road. Here (refer to section B on the attached drawing DWG-6320-02-9002), the proposed sewer is approximately 3 metres below (deeper than) the existing pressure main. The construction area has to be excavated to RL 1.0 and this excavation must not undermine the existing pressure main. A minimum separation of 9 metre between the centreline of the proposed sewer main and the existing pressure main is required to avoid this.

However, following further investigation and the discovery of limestone 2 metres below ground, such a large separation is no longer required (in order to protect the pressure main).

In the Response to Submissions, it was also indicated that there would be a gap between the existing and proposed temporary access causeways of 0 to 5 metres. This range was quoted because the edge of the existing causeway is not completely straight. No surveys had been undertaken at that time to determine the exact location of the edge of the existing causeway, so it was not possible to be more precise regarding the separation.

Subsequent to this original proposal, the construction method for the wetland crossing structure has been revised to reduce the width of the construction corridor. It is now proposed to construct the sewer using an incremental launch technique. In this technique, construction of incremental lengths of the structure would occur on dry land at the eastern end of the crossing, and sections would be gradually pushed over the wetland onto previously constructed piers. A schematic drawing showing the progress of construction and rehabilitation during this construction technique is enclosed.

As a consequence of the revised construction technique, the construction footprint is now only 13 metres. The components of this width are shown on enclosed drawing DWG-6320-02-9002. This drawing shows that in order to build the wetland crossing structure, a reasonably large crane is still required to install the piles to support the structure. The crane would operate from a purpose-built temporary access causeway immediately north of the existing embankment. As shown in section A on the enclosed drawing DWG-6320-02-9002, a minimum separation of 9 metres is necessary between the centreline of the proposed wetland crossing structure and the existing causeway to allow safe access and ensure the crane does not put an unacceptable load on the existing pipes within the existing embankment.

As a consequence of this change, the estimated area of wetland that would need to be cleared is now about 0.1 ha (80 m x 13 m) as compared to 0.18 ha (80 m x 22 m) previously.

Main Sewer Route

The route of the sewer through the tuarts at the western end of the wetland has also been revised. In the original proposal, two large tuart trees, T1 and T8 (see enclosed drawing SK-6310-11-9002) would have been removed. It is now proposed to include an extra bend in the pipe route and to use local trench boxes, if required, to ensure the excavation for the sewer clears trees T1 and T8 located immediately west of the wetland crossing. Use of trench boxes or similar is also proposed where the pipe route impacts a group of tuarts approximately 40 metres further west to ensure only four small trees in poor condition (trees T3 to T6) need to be removed.

A minor deviation of the pipe route may also be required during construction to minimise the impact on two tuart trees to the west of Lake Coogee (see enclosed drawing SK-6310-11-9003).

Munster Pump Station No. 3

A plan and section of the proposed Munster Pump Station No. 3 is shown in enclosed drawing SK-6310-11-9004.

Overall, we believe the modifications to the Main Sewer route (both east of and across the wetland), as well an innovative construction technique for the wetland crossing structure, will result in a greatly reduced disturbance to the environment compared with the previous proposal. In particular, disturbance of the wetland has now been reduced to an absolute minimum, commensurate with safety requirements.

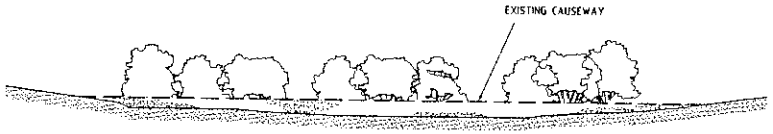
List of Commitments

We also enclose a proposed revised List of Commitments.

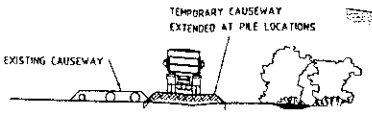
We trust that you find the above information satisfactory.

Yours faithfully
The Woodman Alliance

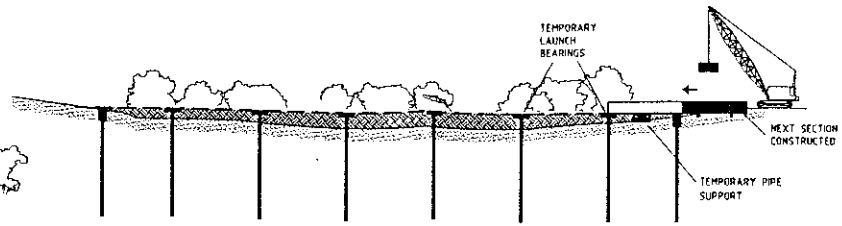
Robert Jones
Project Director



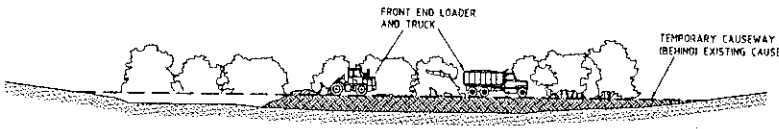
EXISTING WETLANDS (1)



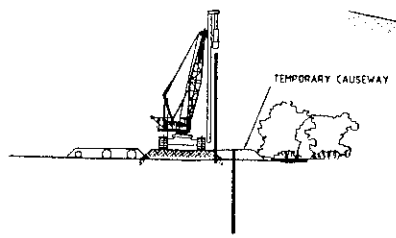
TYPICAL SECTION DURING CAUSEWAY CONSTRUCTION



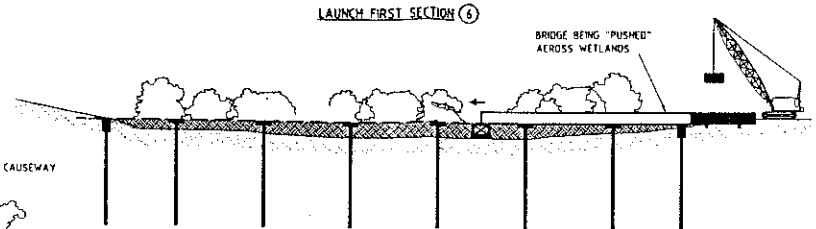
LAUNCH FIRST SECTION (6)



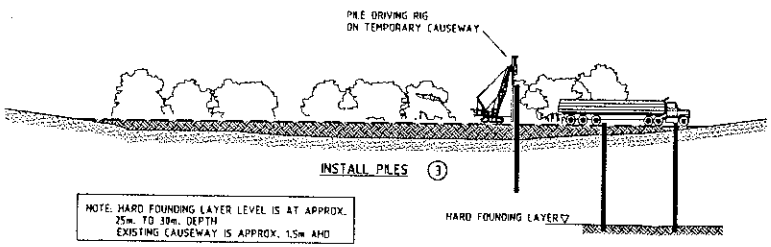
CONSTRUCT TEMPORARY CAUSEWAY (2)



TYPICAL SECTION DURING PILE CONSTRUCTION

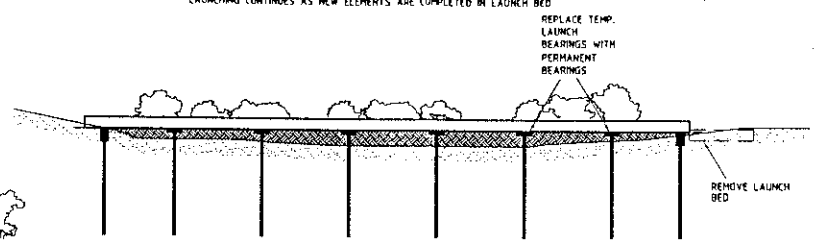


CONTINUE LAUNCHES (7)
LAUNCHING CONTINUES AS NEW ELEMENTS ARE COMPLETED IN LAUNCH BED

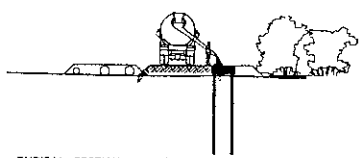


INSTALL PILES (3)

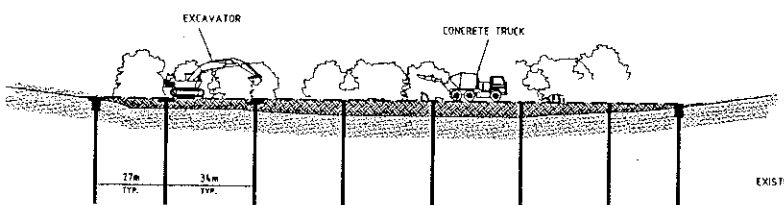
NOTE: HARD FOUNDING LAYER LEVEL IS AT APPROX.
25m. TO 30m. DEPTH
EXISTING CAUSEWAY IS APPROX. 1.5m AHD



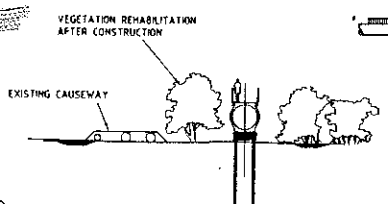
COMPLETED LAUNCH (8)



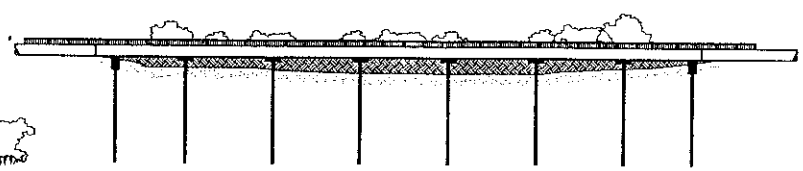
TYPICAL SECTION DURING PILE CAP CONSTRUCTION



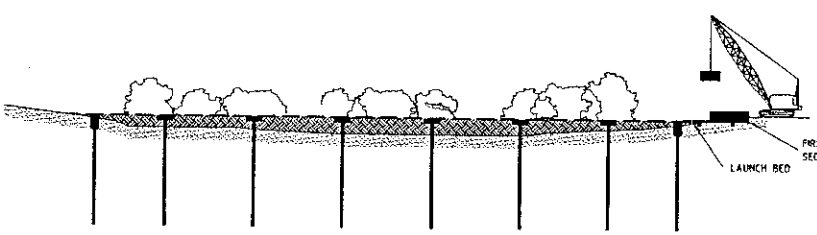
CONSTRUCT PILE CAPS (4)
EXCAVATE - TRIM PILES - FORM PILECAPS - POUR CAPS



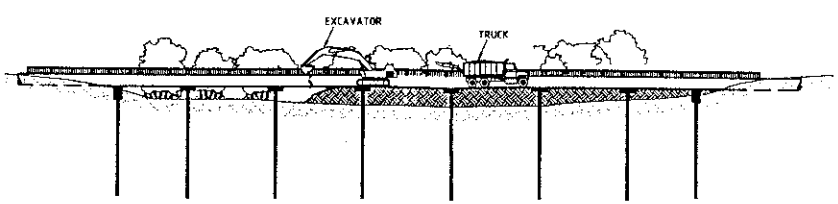
TYPICAL SECTION AT COMPLETION



WALKWAY AND HANDRAIL ADDED (9)



CONSTRUCT LAUNCH BED AND FIRST BRIDGE SECTION (5)



TEMPORARY CAUSEWAY REMOVED - CROSSING COMPLETE (10)

NOTES
1. THIS DRAWING IS DIAGRAMMATIC ONLY WITH A VERTICAL SCALE EXAGGERATION.

ISSUE	DATE	GRID	REVISION	DRN	REC	APPD

SURVEY BOOKS | DATUM AHD | DES REF | DES CALC | DES CHD | DRN | O.C. CHD | NORTH POINT

APPROVED REVIEW TEAM LEADER
APPROVED PROJECT ENGINEER
DRAWING No. DWG-6320-02-9001 REVISION C

WA21 DESIGN RESOURCES

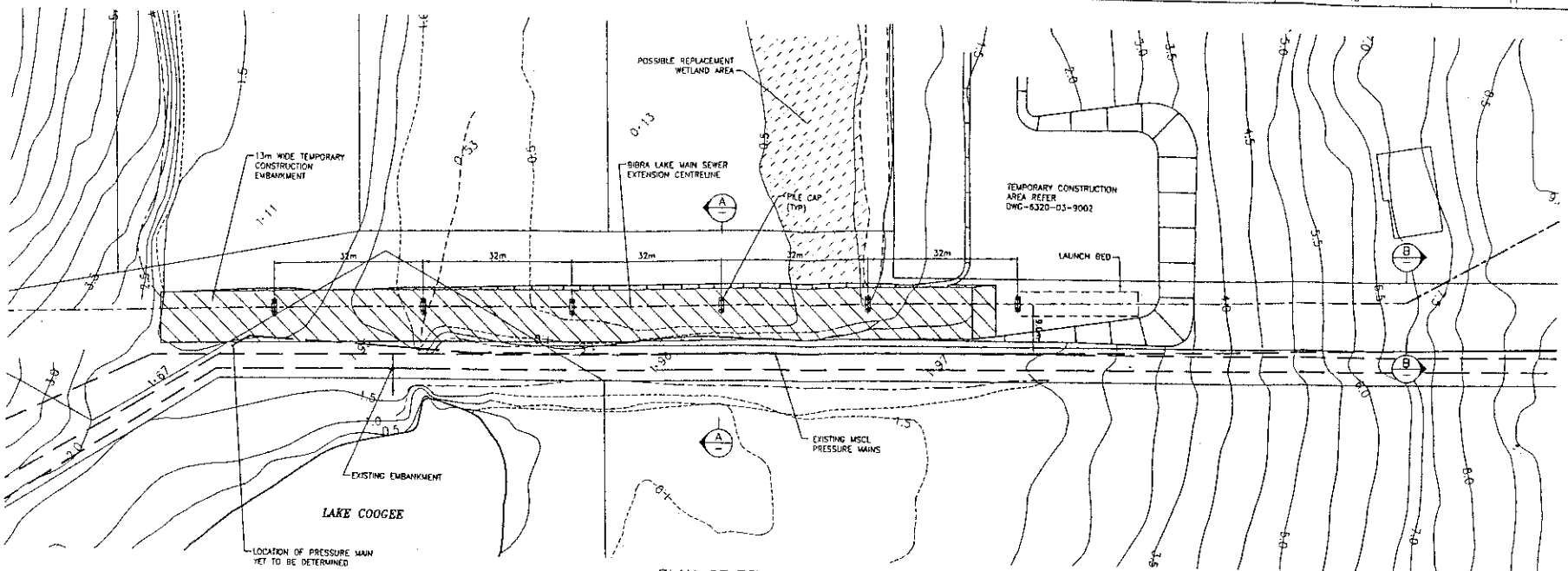
RECOMMENDED CONSULTANT TECHNICAL APPROVAL
APPROVED CONSULTANT PROJECT APPROVAL

WATER CORPORATION

WOODMAN POINT WWTP AMPLIFICATION PROJECT
BIBRA LAKE MAIN SEWER - PIPE BRIDGE ACROSS WETLAND
CONCEPTUAL CONTRUCTION METHOD

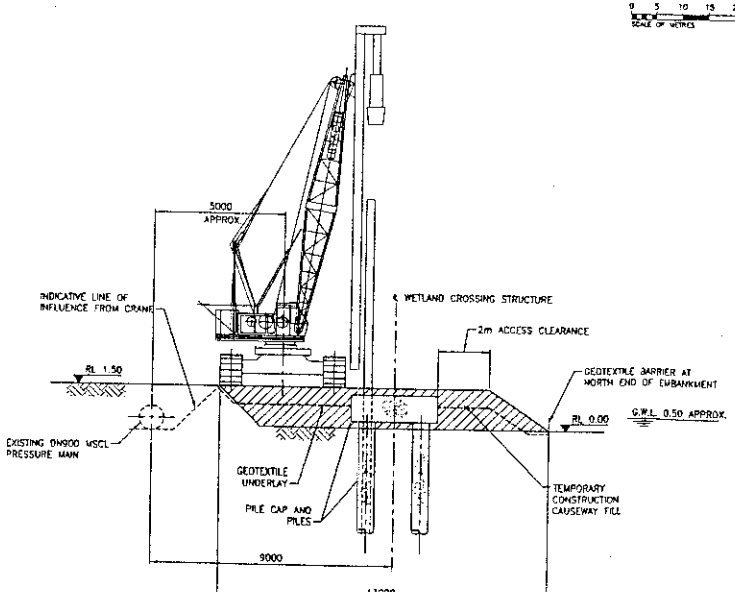
FILE	PROJECT	PLAN	CAD	ISSUE
				C

ORIGINAL SHEET SIZE A1



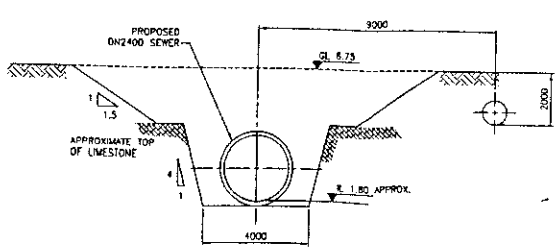
PLAN OF TEMPORARY CONSTRUCTION CAUSEWAY

SCALE OF METRES



SECTION A

SCALE OF MILLIMETRES



SECTION B

SCALE OF MILLIMETRES

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C	21.7.99		CONST. EMBANKMENT WIDENED, ISSUED FOR EPA MEETING	SJW		SR
B	12.7.99		WAS DWG-6320-03-9005, ISSUED FOR PTC ESTIMATE	SJW		SR
A	8.7.99		ISSUED FOR SINGLE DISCIPLINARY CHECK	SJW		SR

SURVEY BOOKS

DATUM AHD

DES REF

DES CALC

DES CHD

DRN S.Whinnen

D.C. CHD

NORTH POINT

APPROVED

REVIEW TEAM LEADER

APPROVED

PROJECT ENGINEER

WA21

DWG-6320-02-9002 D

AUTHORISED

CONTRACTOR'S PROJECT DIRECTOR

ACCEPTED

WATER CORP. PROJECT DIRECTOR

WATER CORPORATION

METROPOLITAN WASTEWATER
WOODMAN POINT ENVIRONMENTAL ENHANCEMENT PROJECT
WETLAND CROSSING STRUCTURE
TEMPORARY CONSTRUCTION CAUSEWAY

FILE | PROJECT | PLAN | CAD | ISSUE

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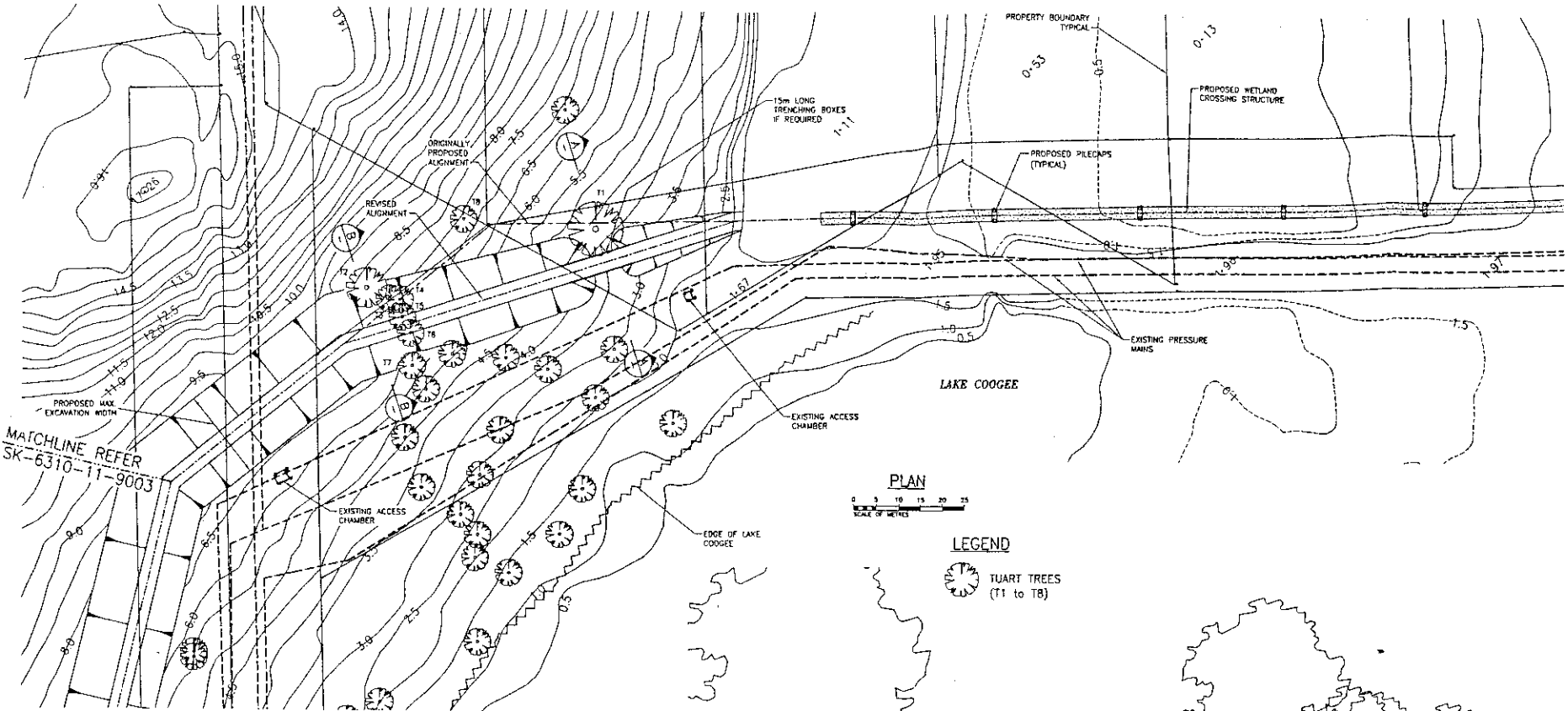
Last Edited: WhinnenS 28 Jul, 1999 - 5:08pm Cad File: dwg-6320-02-9002.dwg Xrefs: X-008

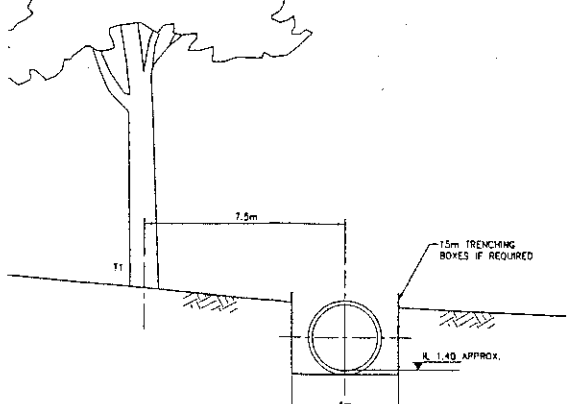


PLAN

SCALE OF METRES 0 5 10 15 20 25

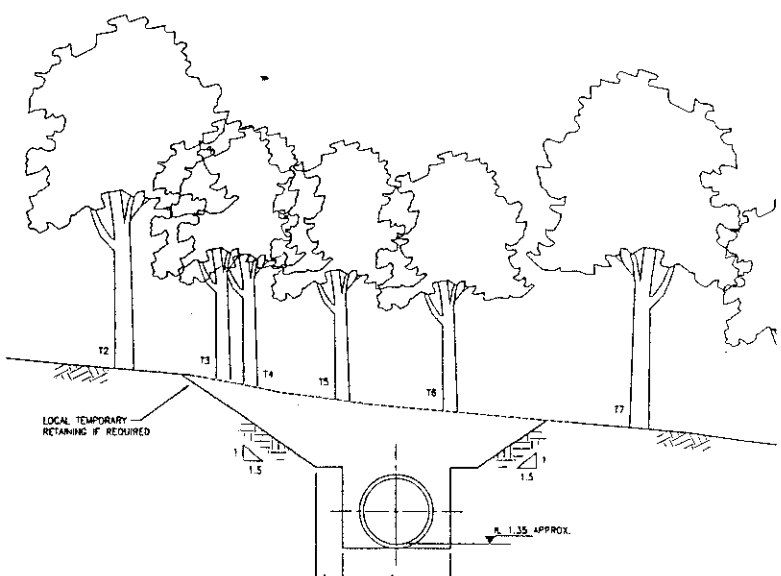
LEGEND

TUART TREES (T1 to T8)



SECTION A

SCALE OF METRES 0 1 2 3 4 5



SECTION B

SCALE OF METRES 0 1 2 3 4 5

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A	22.7.99		ISSUED FOR EPA MEETING	SJW		

SURVEY BOOKS

DATUM AHD

DES REF

DES CALC

DES CHD

DRN S.Whinnen

D.C. CHD

NORTH POINT

APPROVED REVIEW TEAM LEADER

APPROVED PROJECT ENGINEER

WA21 SK-6310-11-9002 B

AUTHORISED CONTRACTOR'S PROJECT DIRECTOR

ACCEPTED WATER CORP. PROJECT DIRECTOR

WATER CORPORATION

METROPOLITAN WASTEWATER
WOODMAN POINT ENVIRONMENTAL ENHANCEMENT PROJECT
BIBRA LAKE MAIN SEWER EXTENSION
TRENCHING DETAILS AT WESTERN END OF WETLAND CROSSING

FILE | PROJECT | PLAN | CAD | ISSUE

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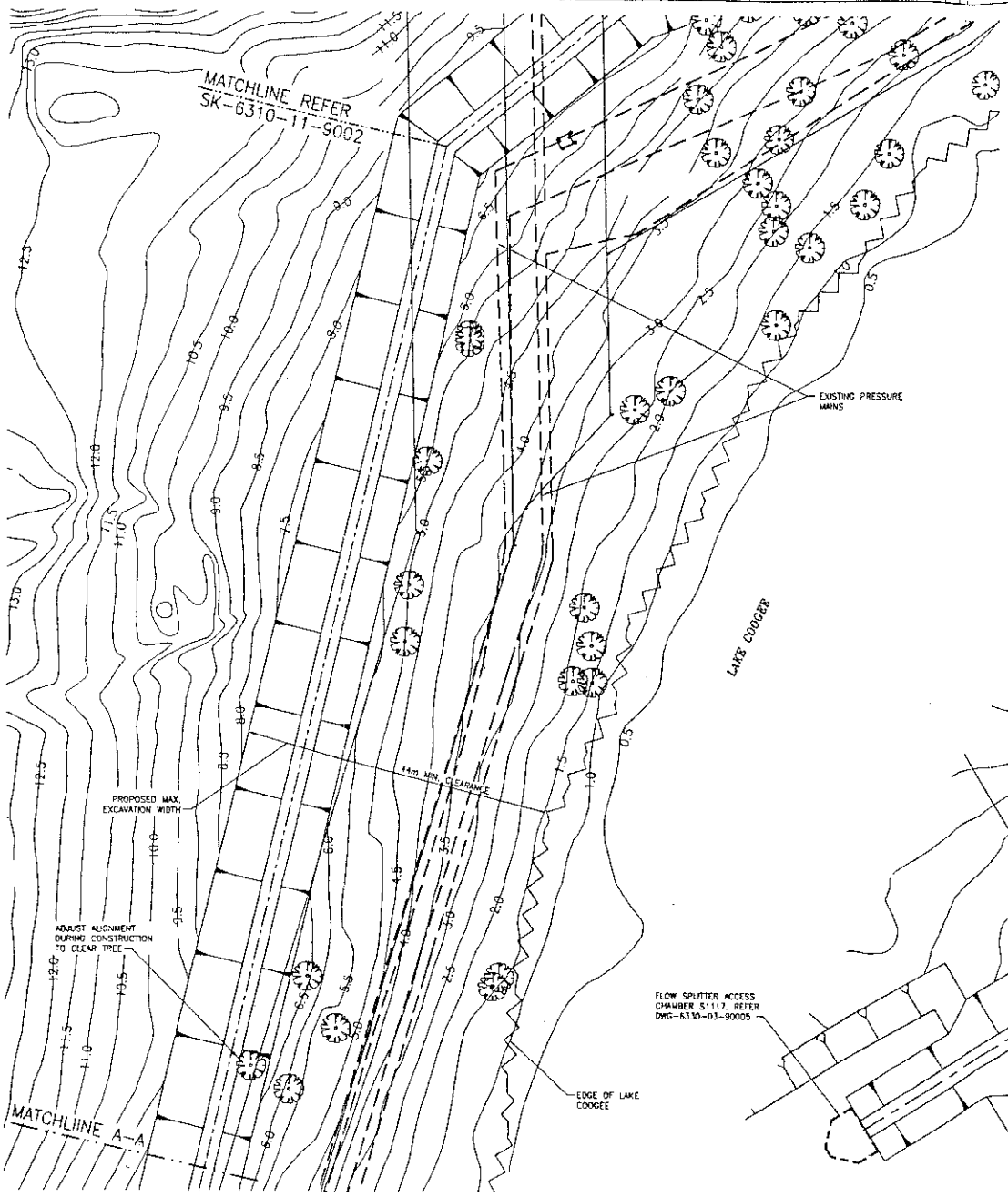
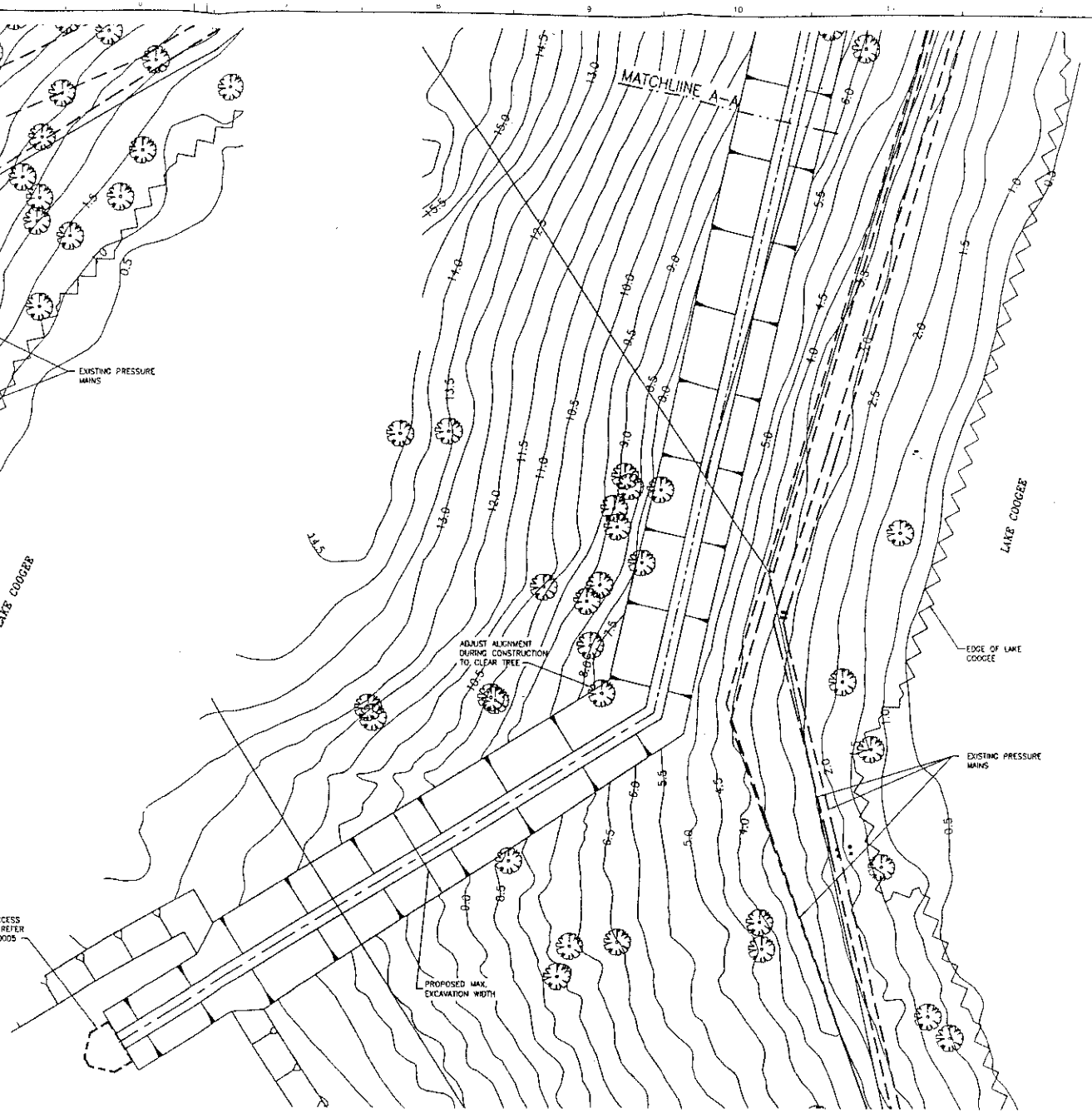


PLAN

SCALE OF METRES 0 5 10 15 20 25



PLAN

SCALE OF METRES 0 5 10 15 20 25

LEGEND

TUART TREES

ISSUE	DATE	GRID	REVISION	DRN	REC	APPD
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A	23.7.99		ISSUED FOR EPA MEETING		SJW	SR

Last Edited: WhinnenS 28 Jul, 1999 - 5:13pm Cad File: SK-6310-11-9003.dwg Xrefs: ?

SURVEY BOOKS

DATUM AHD

DES REF

DES CALC

DES CHD

DRN S.Whinnen

D.C. CHD

NORTH POINT

APPROVED

REVIEW TEAM LEADER

APPROVED

PROJECT ENGINEER

WA21

SK-6310-11-9003 B

AUTHORISED

CONTRACTOR'S PROJECT DIRECTOR

ACCEPTED

WATER CORP. PROJECT DIRECTOR

WATER CORPORATION

METROPOLITAN WASTEWATER
WOODMAN POINT ENVIRONMENTAL ENHANCEMENT PROJECT
BIBRA LAKE MAIN SEWER EXTENSION
TRENCHING DETAILS - SHEET 2 OF 2

FILE | PROJECT | PLAN | CAD | ISSUE

ORIGINAL SHEET SIZE A1

FACSIMILE TRANSMISSION

Attention:	**Maxine Dawson / Alice O'Connor**	Date:	9 September 1999
Company:	Department of Environmental Protection	Facsimile:	(08) 9322 1598
From:	Eddy Wajon	No of Pages: (including cover)	1
Internal co:		Ref No.	0493

The Woodman Alliance
Level 13, QV1 Building
250 St Georges Terrace
PERTH WA 6000

Phone: (08) 9214 3777
Fax: (08) 9226 3293

Email: wa21@wa21.com.au

Munster Pump Station No. 3 and Bibra Lake Main Sewer Extension
Public Environmental Review
Environmental Factor Odour

The plans for the new Munster Pump Station No. 3 incorporate newer equipment and facilities designed to greatly minimise the opportunities for odour emission compared with the existing Munster Pump Station No. 2. These include better seals to wet wells receiving incoming sewage and no uncovered emergency overflow basin (until at least 2025). An open storage would be required once flows generated by the southern Perth Metropolitan Area are such that this storage volume is required for emergency purposes.

The Water Corporation is currently undertaking a study on the management of odours associated with the whole of the Bibra Lake Main Sewer. As part of this study, consideration is being given to extraction and treatment of odorous air from within the sewer. The extraction and treatment facilities would be located near Bibra Lake with air inlets at a variety of locations along the sewer. If shown to be practical, one of these air inlets would be located at the Munster Pump Station No. 3. This would ensure that odorous air would not be released at the Munster Pump Station No. 3.

In addition, and in case the sewer air extraction system is deemed not to be suitable for Munster Pump Station No. 3, the Water Corporation would install a vent at the Munster Pump Station No. 3 to release any air. This vent would be equipped with a Granular Activated Carbon adsorption unit to treat and remove the odours from the air before release.

As a consequence of these measures, any odorous air generated at the Munster Pump Station No. 3 would be contained and treated before release. Any residual odour emission would be very small and the odours would be dispersed within the Woodman Point Wastewater Treatment Plant boundary. Consequently, as well as not increasing the current buffer zone associated with the Woodman Point Wastewater Treatment Plant, the operation of the Pump Station would not compromise the opportunity to have the odour buffer reduced.

Yours faithfully,

for:
Eddy Wajon
Environmental Manager

WA21 THE WOODMAN ALLIANCE

Origination: D. E Wajon
Direct: (08) 9214 3738
File: P001-7106.01.16
1138:asm

The Woodman Alliance
Level 13, QV1
250 St Georges Terrace
Perth WA 6000
Telephone +61 (0)8 9214 3777
Facsimile +61 (0)8 9226 3293
Email wa21@wa21.com.au

07 December 1999

Ms Maxine Dawson
Department of Environmental Protection
Westralia Square
141 St George's Terrace
PERTH WA 6000

Dear Maxine

WOODMAN POINT ENVIRONMENTAL ENHANCEMENT PROJECT
MUNSTER PUMP STATION NO. 3 & BIBRA LAKE MAIN SEWER EXTENSION
PUBLIC ENVIRONMENTAL REVIEW ODOUR CONTROL

The current plans are that openings at Munster Pump Station No. 3 and along the portion of the Bibra Lake Main Sewer in the proposal would be restricted to manholes. These manholes would provide access to wet wells as well as to stop-gate locations within the sewer, and would be equipped with covers that would be sealed to be airtight and withstand a pressure of 9 m water. There are no longer any plans to install a vent with an odorous air treatment system at the Munster Pump Station No. 3 to release any air.

Please find attached a slightly revised List of Commitments which is consistent with the above paragraph and the Table of Key Characteristics.

While the Water Corporation is still planning to undertake a study on the management of odours associated with the whole of the Bibra Lake Main Sewer, through extraction and treatment of odorous air from within the sewer, as indicated in our letter of 9 September 1999, this is not part of the present proposal.

Routine maintenance of the Munster Pump Station No. 3 and Bibra Lake Main Sewer would include Pump Station wet well cleaning and Main Sewer inspections. Wet wells would be cleaned annually and would require 1 – 2 nights work. The Main Sewer would be inspected every 5 years with approximately 2 km of the sewer being inspected per shift.

The work would always be undertaken during periods of low flows, generally between 11:00 pm and 7:00 am. The sewer would be isolated by installing stop-gates to prevent sewage entering the part to be inspected, and ventilated using mechanical blowers. The blower would be located over an upstream manhole and would direct fresh air into the section of the sewer to be inspected or maintained, with the foul air being forced into the atmosphere from two downstream manholes. The work may require several night shifts to complete, but would be programmed to enable the sewer is returned to service by 7:00 am each day.

The Water Corporation would ensure that residents who may be affected by the work would be provided with a minimum of 48 hours written notice prior to the work being carried out.

Yours faithfully
The Woodman Alliance

Robert Jones
Project Director

Attach.

S:\Environmental\01 Correspondence\L16 To DEP\1158 PER Odour Control DEP let.doc