East Clontarf Residential Development

Trustees of the Christian Brothers Inc.

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 1156
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Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
28 January 2004	Level of Assessment set (following any appeals upheld)	
8 June 2004	Proponent Document Released for Public Comment	19 weeks
3 August 2004	Public Comment Period Closed	8 weeks
11 November 2004	Final Proponent response to the issues raised	5 ½ weeks
6 December 2004	EPA report to the Minister for the Environment	3 ½ weeks

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Summary and recommendations

The Trustees of the Christian Brothers Inc. propose to develop the 18 hectare (ha) site of East Clontarf in Waterford for a residential development creating up to 200 residential allotments. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors relevant to the proposal.

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

The EPA decided that the following environmental factors relevant to the proposal required detailed evaluation in the report:

- Resource Enhancement management category wetland identified in the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (Lakes EPP) and *Draft Environmental Protection (Wetlands) Policy 2004* (Wetlands EPP);
- the potential for development to affect the hydrological regime supplying fresh water to Clontarf Bay and the Canning River; and
- soil and groundwater contamination from previous and adjacent land uses.

There were a number of other factors which were very relevant to the proposal, but the EPA is of the view that the information set out in Appendix 4 provides sufficient evaluation.

Conclusion

The EPA has considered the proposal by the Trustees of the Christian Brothers Inc. to develop the East Clontarf site bounded by Manning Road, Centenary Avenue and the Canning River for residential purposes.

The EPA notes that the proposal will result in the clearing of 1.57ha wetland vegetation and habitat. The proponent has proposed this loss will be offset by 2.1ha of wetland rehabilitation and revegetation including land adjacent to the existing drainage line to Clontarf Bay and the Canning River. The river foreshore area will also be increased by approximately 6000m^2.

The wetland has been placed on the draft register for the 2004 Wetlands EPP as it was previously identified by the 1992 Lakes EPP. In assessing the East Clontarf development proposal an analysis of the environmental quality criteria provided in Part 1 (5)(6)(7) of the Draft 2004 EPP Regulations, for the identification and registration of wetlands has been undertaken. The EPA considers that the East Clontarf wetland does not meet the minimum environmental quality criteria to support registration on the Draft 2004 Wetlands EPP. While there is a loss in area of the wetland, it is the EPA's opinion that the proposal does not represent a loss of wetland

values or function. After taking account of the mitigation and offset proposed by the proponent which provides for 2.1ha rehabilitation and revegetation establishing a vegetated link to the foreshore, the proposal will result in no net loss of wetland area. Design changes by the proponent to roads and access ways which provide for a management boundary to the development are supported.

The hydrology of the wetland is an important factor as there is a year round fresh water supply to Clontarf Bay and the Canning River in the vicinity of the wetland. The supply of fresh water, despite known soil and groundwater contamination, was initially attributed to the wetland function itself, either through contaminant uptake by vegetation or sediment accumulation. However, following further investigations it has been concluded that the wetland is located at a point of dilution of the regional groundwater. Groundwater inflow to the wetland is primarily from a diffuse seepage face along the northern boundary contributing approximately 83% of the total wetland inflow with the remaining 17% attributed to surface water flow. The proponent has predicted that the proposal will result in a reduction of 20% of the northern seepage face of the wetland and the development will decrease the surface inflow to the wetland by approximately 9%. It is therefore unlikely that the existing hydrological regime will be significantly impacted by the proposed development.

The soil and groundwater of the site is currently considered contaminated as a result of former on site and adjacent activities with a range of contaminants identified including pesticides, heavy metals and asbestos. Advice received by the EPA in relation to remediation is that it is manageable provided the appropriate reports and proposed management strategies are submitted for approval prior to ground disturbing activities at the site.

There is also considered to be a risk of the generation of acid sulfate soils on site through the remediation of on site contamination and by the draining, filling and construction activities associated with the wetland that are likely to disturb peaty soils. The construction aspects of the proposal will require diligent management which is provided for in the proponent's commitments.

Given the importance of maintaining the hydrological regime and managing site contamination, the proponent has acknowledged the requirement to meet the environmental quality objectives and criteria of the recently released Riverplan management framework (Govt. WA, 2004). With the application of this framework and the recommended Environmental Condition, the EPA is satisfied that the objectives of the *Environmental Protection (Swan and Canning Rivers) Policy 1998* can be met.

The proponent has also indicated a willingness to undertake some foreshore management including rehabilitation and revegetation within the existing Bush Forever site, in addition to work planned for the proposed 6000m^2 addition to site 333. The EPA encourages the proponent to work with the relevant authorities on this issue with a view to securing the best environmental outcome for this regionally significant foreshore area.

The EPA has therefore concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of its

commitments and the recommended conditions set out in Appendix 5, and summarised in Section 4.

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 residential development of the land at East Clontarf, Waterford;
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3;
3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 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 that the EPA recommends be imposed if the proposal by the Trustees of the Christian Brothers Inc. to develop the site of East Clontarf in Waterford for residential purposes is approved for implementation. These conditions are presented in Appendix 5. Matters addressed in the conditions include the following that the proponent:

- shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 5;
- prepare and implement a Wetland Revegetation, Rehabiliation and Management Plan;
- prepare and implement a Drainage Nutrient and Water Quality Management Plan; and
- prepare and implement a Site contamination Investigation, Remediation and Validation Plan.

Contents

1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to the proposal by the Trustees of the Christian Brothers Inc. to develop the site of East Clontarf in Waterford for a residential subdivision creating up to 200 allotments. The subject land is adjacent to the Clontarf Aboriginal Campus in the City of South Perth, it is approximately 18hectares (ha) in size and is located between Manning Road, Centenary Avenue and the Canning River.

The proposed residential development of the site was referred to the EPA on 16 January 2003 pursuant to section 38 (1) of the *Environmental Protection Act 1986* (EP Act). It was determined that the potential environmental impacts arising from the proposal warranted further investigation and assessment was set at Public Environmental Review (PER) on 28 January 2003, with a public review period of eight weeks from 8 June and to 3 August 2004.

The environmental characteristics of the site include:

- Resource Enhancement management category wetland identified in the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (Lakes EPP) and *Draft Environmental Protection (Wetlands) Policy 2004* (Wetlands EPP);
- soil and groundwater contamination from previous and adjacent land uses;
- an existing hydrological regime supplying fresh water to Clontarf Bay and the Canning River;
- potential acid sulfate soil risk;
- potentially significant fauna habitat;
- Aboriginal heritage values; and
- regionally significant foreshore and associated vegetation identified as Bush Forever site 333;

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

Appendix 6 contains a summary of submissions and the proponent's response to submissions and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process, and which have been taken into account by the EPA, appear in the report itself.

2. The proposal

The Trustees of the Christian Brothers Inc. in Western Australia have owned the land at Clontarf, including the Clontarf Aboriginal Campus for over 100 years. The site is bounded by Manning Road, Centenary Avenue and the Canning River. The East Clontarf site that is the subject of this assessment is approximately 18ha in size. It is zoned *Urban* in the Metropolitan Region Scheme (MRS) and *Residential* in the City of South Perth Town Planning Scheme. The foreshore area adjacent to the proposed development is identified for protection as Bush Forever site 333 and reserved for *Parks and Recreation* in the MRS.

The proponents provided the following description of the proposed residential development of the site in the PER (ATA, 2004):

1. creating up to 200 residential allotments;
2. setting aside approximately 4ha of rehabilitated and re-contoured wetland area in addition to approximately 6000m^2 of public open space (approximately 24% of the developable area of the site);
3. improving the riparian environment along the banks of the Canning River including constructing a 2.1ha Paperbark and Flooded Gum wetland adjacent to the river and connecting the foreshore environment to the inland wetland;
4. providing additional protection of the existing Canning River foreshore area by widening the river flats/foreshore by approximately 6000m^2;
5. protecting a stand of mature Marri trees on the site; and
6. revegetating and integrating upland native vegetation to the site between the wetland and the Clontarf Aboriginal Campus buildings.

The main characteristics of the proposal are summarised in Table 1 below and identified on Figure 1 the East Clontarf Concept Plan. A detailed description of the proposal is provided in Section 2 of the PER (ATA, 2004).

Table 1: Summary of key proposal characteristics

Element	Description
Proposal	Creation of up to 200 residential allotments
Area of disturbance	Approximately 16ha
Major components – • Wetland modification • Dewatering • Disturbance to site hydrology • Remediation of site contamination • Potential acid sulfate soils disturbance • Created wetland • Noise and dust creation	Draining and filling approximately 1.57ha of Resource Enhancement wetland Creation of 2.1ha of Paperbark/Flooded Gum wetland Hydrological maintenance – water quality and quantity Remediation of on site contamination

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

- the bulrushes in the wetland area are now proposed to be retained and managed;
- commitment to install two additional monitoring bores and perform additional ground and surface water monitoring;
- provision of dog-proof fencing along the foreshore; and
- provision of road frontage/multiple use pathway frontage along both the wetland and the river foreshore to provide for a management boundary to the development. The western section of Public Open Space (POS) will be revegetated to dryland buffer.

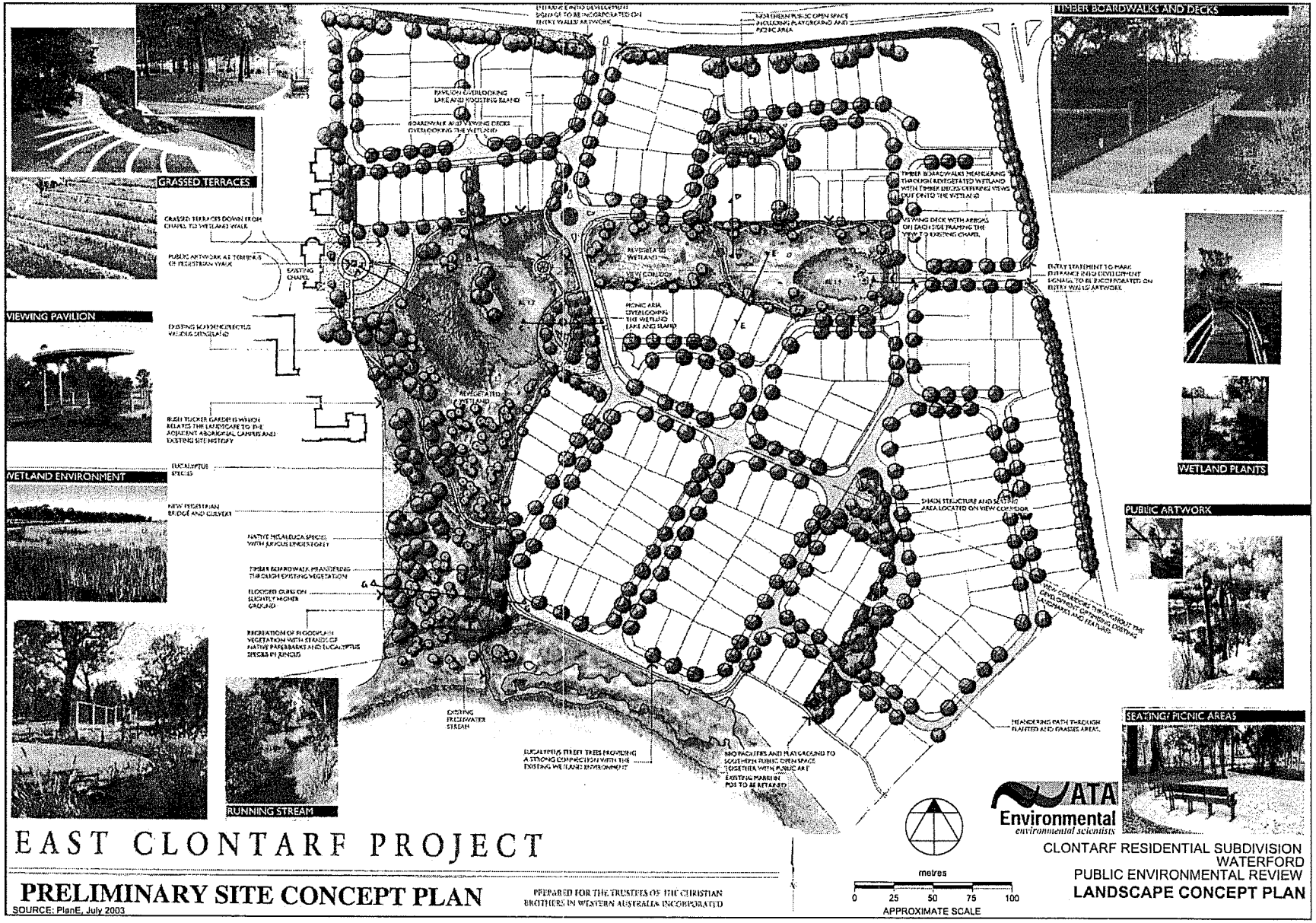

Figure 1: East Clontarf Concept Plan

3. Relevant environmental factors

Section 44 of the EP Act 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 for the relevant factors selected for detailed evaluation in this report is summarised in Appendix 4. The reader is referred to Appendix 4 for the evaluation of factors not discussed below. A number of these factors, such as

- Foreshore *Bush Forever* site 333;
- Fauna;
- noise and dust; and
- Aboriginal culture and heritage.

are very relevant to the proposal, but the EPA is of the view that the information set out in Appendix 4 provides sufficient evaluation.

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

- Resource Enhancement management category wetland identified in the Lakes EPP and Wetlands EPP;
- maintenance of the hydrological regime supplying fresh water to Clontarf Bay and the Canning River; and
- soil and groundwater contamination from previous and adjacent land uses.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors generated from the PER document and the submissions received, in conjunction with the proposal characteristics.

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

3.1 Resource Enhancement wetland

Description

The East Clontarf site contains a permanently inundated wetland of the Swan Estuary suite (Hill *et. al.* 1996) that is approximately 4ha in size. As part of this assessment, the wetland was re-evaluated in accordance with Department of Environment (DoE) guidelines/protocols and assigned a Resource Enhancement management category on

the DoE wetlands database. The wetland is also identified for protection in the Lakes EPP and the recently released Draft Wetlands EPP.

The wetland is considered to have undergone significant modification over time including filling and draining for market gardening and cattle grazing, infilling to create a sports field and the excavation of a drainage line to Clontarf Bay and the Canning River (ATA, 2004).

The wetland is covered in a mix of native vegetation and weed species and currently does not exhibit significant areas of open water. The areas of native vegetation are relatively small but considered to be in *Good* condition. Vegetation mapping contained within the PER identifies significant areas of the following species:

- Bulrush (*Typha orientalis*)
- Lake Club-rush (*Schoenoplectus validus*)
- Paspalum Grass (*Paspalum dilatatum*)
- Tree Lucerne (*Cytissus proliferus*)
- Bracken Fern (*Pteridium esculentum*). (ATA, 2004)

The hydrology of the wetland has been considered a significant factor warranting detailed investigation in this assessment. Initially, the provision of year round fresh water to Clontarf Bay despite known soil and groundwater contamination was attributed to the wetland function itself, either through contaminant uptake by vegetation or sediment accumulation. As discussed in the following section, investigations have concluded that the wetland is located at a point of dilution of the regional groundwater and this is primary reason for fresh water to Clontarf Bay and the Canning River.

Fauna assessments undertaken as part of this assessment have confirmed the habitat value of the wetland for a variety of fauna including:

- Long-neck tortoise;
- frogs and reptiles;
- gilgies; and
- a variety of wetland dependant birds including the Spotless Crake and Clamorous Reed Warbler.

To offset the proposed clearing and filling of 1.57ha of the East Clontarf wetland the proponent has committed to creating a 2.1ha Paperbark and Flooded Gum wetland linking the remaining wetland to Clontarf Bay around the existing drainage channel.

Submissions

Many submissions focused on the proposed clearing and filling of the wetland and the potential impact on its values including loss of vegetation, potential changes to the hydrological regime and loss of fauna habitat. Submissions also included the position that the wetland should be retained in its current form, with a buffer or separation distance to any development, within a residential environment.

Specific concerns raised with respect to the potential impacts to the wetlands hydrological function and risk of releasing contaminants into Clontarf Bay and the Canning River or generating acid sulfate soils are discussed in further detail in section 3.2.

Policy Framework
The primary documents applicable to this relevant environmental factor are:

Position Statement No. 4 *Environmental Protection of Wetlands* (EPA, 2004);

the Lakes EPP;

the recently released Draft Wetlands EPP; and

Preliminary Position Statement No. 9 *Environmental Offsets* (EPA, 2004).

Position Statement No. 4
Position Statement No. 4 provides the EPAs principles for environmental protection of wetlands which include an overarching statement of goals as follows:

- to protect the environmental values and functions of wetlands in Western Australia;
- to protect, sustain and, where possible, restore the biological diversity of wetland habitats in Western Australia;
- to protect the environmental quality of the wetland ecosystems of Western Australia through sound management in accordance with the concept of "wise use", as described in the Ramsar Convention, and ecologically sustainable development principles, regardless of land use or activity; and
- to have as an aspirational goal no net loss of wetland values and functions.

This statement of goals relates directly to the significant environmental values of wetlands established by Position Statement No. 4 including:

- primary production;
- recreational and landscape amenity;
- hydrological balance;
- water quality protection; and
- wildlife habitat.

Lakes EPP and Wetlands EPP
Background
In 1999 a statutory review of the Lakes EPP was required under Part 3 of the EP Act. As part of this statutory process a *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 1999* was released for public comment. Following consideration of comments, a *Revised Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 1999* was then prepared by the EPA and transmitted to the Minister for the Environment for consideration.

The aim of the revised draft EPP was to declare and protect the environmental values of important wetlands on the Swan Coastal Plain by controlling activities that can degrade or destroy those environmental values. In summary, no filling, draining, mining, discharges or clearing without authorisation under the EP Act.

The EPA released a new draft Wetlands EPP for public comment on 19 July 2004 for a period of 10 weeks. This draft EPP protects wetlands of high ecological value on the Swan Coastal Plain, with these being determined through an amalgamation of the datasets for the Lakes EPP and for Conservation Category wetlands currently identified on the Department of Environment database.

As the East Clontarf wetland was identified on the 1992 Lakes EPP it is now identified on the Draft Wetlands EPP.

Preliminary Position Statement No. 9 Environmental Offsets
The recently released Preliminary Position Statement No. 9 has been developed to provide overarching guidance and to establish a consistent policy approach to the issue of environmental offsets.

Section 5. Scope, states that this Position Statement applies to all environmental issues, matters and advice for which the EPA has jurisdiction. However it must be recognised that this is a preliminary document.

In considering the Preliminary Position Statement, the East Clontarf site is not considered to meet the criteria for a Critical Asset for which the EPA is unlikely to approve a proposal. However, it may be considered a High Value Asset, described as follows:

those environmental assets that are in good to excellent condition, are considered valuable to the community and/or government but are not identified as 'critical assets'. Project proposals and offset activities for these assets may be referred to and assessed by the EPA on a case by case basis but are otherwise assessed by relevant environmental government agencies.

An evaluation of the mitigation sequence established by Preliminary Position Statement No. 9 is therefore considered appropriate for this assessment.

Assessment
The area considered for assessment of this factor is the East Clontarf wetland of approximately 4ha.

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

Position Statement No. 4
While modification and loss of the wetland is proposed, it is not considered inconsistent with the EPA's Position Statement No.4 in the following ways;

- the proposal does not represent a net loss of wetland area, value or function;

- the hydrological balance is predicted to be remain relatively unchanged;
- the dilution of contaminants by the regional groundwater is predicted to continue to provide Clontarf Bay and the Canning River with a year round supply of fresh water;
- the assessment to date indicates the loss of wetland fauna habitat is not likely to be significant. The creation of a 2.1ha Paperbark and Flooded Gum wetland will link the remaining wetland to the river providing a range of habitat for fauna.

Lakes and Wetlands EPP

The wetland has been placed on the draft register for the 2004 Wetlands EPP as it was identified by the 1992 Lakes EPP. In assessing East Clontarf development proposal an analysis of the environmental quality criteria provided in Part 1 (5)(6)(7) of the Draft 2004 EPP Regulations, for the identification and registration of wetlands has been undertaken. This is presented as Appendix 1.

It is considered that the East Clontarf wetland does not meet the minimum environmental quality criteria to support registration on the Draft 2004 Wetlands EPP and as such, the wetland is not considered one of the most important Swan Coastal Plain wetlands (EPA, 2004) to be protected from draining, filling or alteration as per the definition of environmental harm in the Draft Policy and Regulations.

Preliminary Position Statement No. 9

The proposed offset package and specific proponent management commitments are described in Appendix 4, but are noted to include the following:

- creation of a 2.1ha Paperbark and Flooded Gum wetland;
- comprehensive weed eradication program;
- revegetating and restoring foreshore POS areas with appropriate indigenous flora of the Canning River;
- creation of habitat and wildlife corridors;
- water conservation principles;
- avoiding direct and minimising indirect impacts on the wetland;
- ensuring no net loss of wetland values and functions;
- selection of appropriate local wetland and dryland species to maintain and enhance existing habitats;
- increase the area contained within POS adjoining Bush Forever Site No. 333 by 6000m^2;
- controlling vehicle and pedestrian access;
- construction of a dog-proof fence along the existing Foreshore Reserve;
- provision of educational and interpretative materials within the area to raise awareness of JAMBA/CAMBA species that frequent the area;
- encouraging community involvement and awareness promoting control of pets (eg cats and dogs); and

- monitoring re-establishment or native and exotic plant species for a period of not less than 2 years followed by review.

The implementation of these commitments is considered consistent with the EPA's requirements for the application of both Primary and Secondary offset activities. In addition, the 2.1ha Paperbark and Flooded Gum wetland represents a positive offset ratio in the order of 1.3:1.

Summary

Having particular regard to:

- the loss of 1.57ha of Resource Enhancement wetland;
- the wetland is not considered one of the most important wetlands on the Swan Coastal Plain warranting protection as described in the Draft Wetlands EPP;
- the remaining wetland is to be revegtated and rehabilitated;
- the proponents proposed offset/mitigation activities and commitments including the creation of a 2.1ha Paperbark Flooded Gum wetland;
- the provision of a hard edge to the development in the form of a road or other paved surface to separate the wetland from individual lots as depicted on Figure 2 Wetland Interface Diagram; and
- the preparation and implementation of a Wetland Management Plan.

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

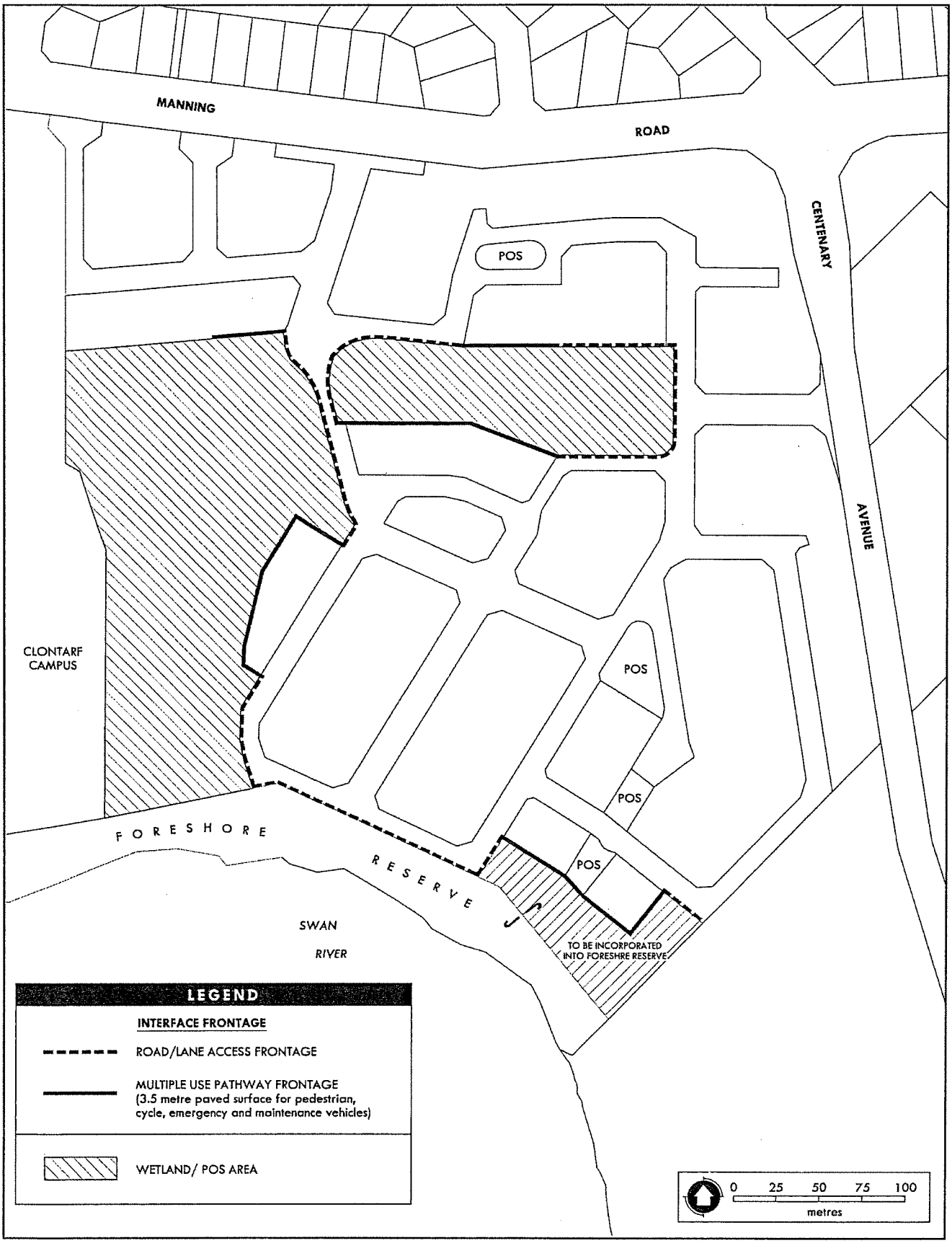

Figure 2: Wetland Interface Diagram

3.2 Water quality

Description

Surface and groundwater investigations over the site have confirmed a range of contaminants including cadmium, zinc, copper, lead, dieldrin, nitrogen and phosphorous with some samples at levels either above or equal to assessment levels [Australia New Zealand Conservation Council (ANZECC)].

The surface and groundwater contamination is likely to be the result of previous activities undertaken on site including the establishment of orchards and market gardening and offsite impacts such as the adjacent landfill and inflow from the greater catchment.

Despite this contamination, the drainage channel connecting the existing wetland to Clontarf Bay and the Canning River appears to contain relatively fresh water. Previous studies have indicated that this supply of fresh water may be significant to the breeding habits of Black Swans, Musk Ducks and other avifauna at Clontarf Bay.

As described in section 3.1, this year round supply of fresh water to Clontarf Bay was initially considered an element associated with the wetlands hydrological regime whereby the wetland itself was potentially filtering contaminants from the ground water either through sediment absorption or uptake by vegetation.

Further investigations have concluded that the most likely cause of the fresh water is the dilution provided by the regional groundwater. The superficial aquifer extends down to approximately 25m below AHD and is underlain by the Leederville formation aquifer which is approximately 300m thick. Available information indicates an upward head between the two aquifers whereby the area is one of groundwater discharge from the Leederville aquifer to the superficial aquifer.

Groundwater inflow to the wetland is primarily from a diffuse seepage face along the northern boundary contributing approximately 83% of the total wetland inflow with the remaining 17% attributed to surface water flow. The proponent has predicted that the proposal will result in a reduction of 20% of the northern seepage face of the wetland and the development will decrease the surface inflow to the wetland by approximately 9%.

Submissions

Submissions received raised concerns that the proposed changes to the wetland would alter its current hydrological function and affect both the quality and quantity of water entering Clontarf Bay and the Canning River with potentially significant impacts to the fauna that utilise this resource.

Policy Framework

The primary documents applicable to this relevant environmental factor are:

Environmental Protection (Swan and Canning Rivers) Policy 1998 (Swan Canning EPP); and

Riverplan - An Environmental Management Framework for the Swan and Canning Rivers – Comprehensive Management Plan and Implementation Strategy for the

Environmental Protection (Swan and Canning Rivers) Policy 1998 (Govt. WA, August 2004).

Swan Canning EPP
The purpose of the Swan Canning EPP is cited as:

To restore, enhance, preserve and protect the environmental quality, ecological processes and ecological integrity of the Swan and Canning Rivers.

The Swan Canning EPP provides environmental quality objectives for the policy area including a general objective to restore and maintain the beneficial uses for the protected waterways and the protected catchments. Beneficial uses include:

- habitat values;
- biodiversity maintenance;
- ecological processes;
- recreation; and
- landscape protection.

Urban development and the associated potential impacts of road construction, excavation and the improper management of drainage are all cited as activities which can cause the waterways and catchments to be degraded and are applicable to the East Clontarf residential development proposal.

Riverplan
Riverplan is the principle mechanism for implementation of the Swan Canning EPP. The environmental management framework of Riverplan reflects the model used by the EPA in the State Water Quality Management Strategy and proposes to use the targets from the Swan Canning Cleanup Plan. While the targets are not specified in Riverplan, it is proposed that ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters are used.

Riverplan provides relevant environmental values, objectives and quality indicators to assist in the preparation of a management framework that should aim to protect the environmental, aesthetic, recreational and commercial importance of the Swan Canning River system.

Any proposal that impacts an area identified by the Swan Canning EPP should ensure consistency with Riverplan in order that the EPA's objectives as prescribed by the Swan Canning EPP are met.

Assessment
The area considered for assessment of this factor is the 18ha East Clontarf site and the receiving environment of Clontarf Bay and the Swan Canning River system.

The EPA's environmental objective for this factor is to maintain the quality and quantity of water so that existing and potential environmental values, including ecosystem maintenance, are protected and to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

Swan Canning EPP and Riverplan

The proposal to develop the East Clontarf site for residential purposes can be considered consistent with meeting the EPA's objective to *restore, enhance, preserve and protect the environmental quality, ecological processes and ecological integrity of the Swan and Canning Rivers* in that the proponent proposes to:

- restore and revegetate the western portion of the wetland;
- create a 2.1ha Paperbark and Flooded Gum wetland with a variety of appropriate indigenous flora of the Swan Canning River;
- create habitat and wildlife corridors;
- ensure no net loss of wetland values and functions;
- prepare and implement a Drainage, Nutrient, Irrigation and Water Quality Management Plan;
- increase the area contained within POS adjoining Bush Forever Site No. 333;
- construct a dog-proof fence along the existing Foreshore Reserve; and
- monitor the re-establishment of native and exotic plant species for a period of not less than 2 years followed by review.

The clearing and filling activities proposed for the wetland are considered unlikely to significantly alter the existing hydrological balance of the wetland. The steady discharge of groundwater to the superficial formation aquifer is likely to continue to dilute regional and on site contaminants that are present prior to water entering Clontarf Bay and the Canning River.

In addition, the proponent has committed to further groundwater monitoring to establish baseline water quality criteria and the development of contingency measures as part of the Water Quality Management Plan should monitoring detect an increase in contaminant discharge to the Canning River.

The current ANZECC guidelines are considered to appropriately address the water column itself but do not consider pore water quality, the synergistic effect of a mix of contaminants or the bioaccumulation of contaminants such as cadmium. As part of the response to submissions (Appendix 6), the proponent has agreed to undertake additional ecotoxological testing to address these issues.

Summary

Having particular regard to the:

- surface and groundwater contamination present on site;
- the important hydrological regime supplying fresh water to Clontarf Bay and the Canning River;
- the objectives of the Swan Canning EPP;
- the Riverplan management framework;
- the proponents commitments for the preparation and implementation of a Water Quality Management Plan in accordance with *Riverplan*; and
- additional ecotoxological testing;

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

3.3 Site contamination

Description

As described in section 3.2 the soil and groundwater of the site is currently considered contaminated as a result of former on site and adjacent activities with a range of contaminants identified including pesticides, heavy metals and asbestos.

Areas of uncontrolled fill over the site have been investigated and are known to contain a mix of building rubble that includes traces of brick blocks, concrete fragments, wood fragments, aluminium sheets, steel rods, plastics, tile bricks and asbestos cement sheets.

A number of samples taken across the site indicate contaminant concentrations in excess of Ecological Investigation Levels including the arsenic, cadmium, zinc, organochlorine dieldrin and chrysotile/crocidolite asbestos.

Acid Sulfate Soils

Acid sulfate soil is the common name given to naturally occurring soil or sediment containing iron sulfides. When these sulfides are exposed to air, oxidation takes place and sulphuric acid can be produced along with the leaching of contaminants naturally occurring in soils. Areas of the site have the potential to generate acid sulfate soils (ATA, 2004).

Asbestos

Investigations undertaken as part of the PER process have identified the presence of asbestos on site, however advice from the Department of Health (DoH) indicates that insufficient information has been provided to enable the DoH to make a complete assessment of the potential health risks associated with the proposed residential development at this time.

Submissions

A number of submissions identified specific concerns regarding the nature and extent of contamination, the lack of detail in the PER regarding the potential for Acid Sulfate Soils and significant concerns over the presence of asbestos on site.

Assessment

The area considered for assessment of this factor is the entire 18ha East Clontarf site and the receiving environment of Clontarf Bay and the Canning River.

The EPA's environmental objective for this factor is to ensure that rehabilitation achieves an acceptable standard compatible with the intended land use, and consistent with appropriate criteria.

The EPA's specific environmental objective for acid sulfate soils is to minimise the risk to the environment resulting from acid sulfate soils, to be achieved by implementing appropriate detection and management strategies.

Acid sulfate soils
The impacts associated with the disturbance of acid sulfate soils has been a significant issue for development on the Swan Coastal Plain in recent times with potential impacts including:

- ecological damage to aquatic and riparian ecosystems;
- effects on estuarine fisheries and aquaculture projects;
- contamination of groundwater with arsenic, aluminium and heavy metals; and
- damage to infrastructure through the corrosion of concrete and steel pipes, bridges and other sub-surface assets (DoE, 2003)

There is considered to be a risk of the generation of acid sulfate soils on site through the remediation of on site contamination and by the draining, filling and construction activities associated with the wetland that are likely to disturb peaty soils. Each of the potential impacts described above is considered a potential risk for the proposed East Clontarf development.

The issue of acid sulfate soils has not been substantially addressed in the PER however the proponent has committed to addressing the issue through the established approvals process and understands that the dewatering must be carried out in a staged manner to minimise the disturbance of acid sulfate soils. The proponent commitments (Appendix 5) specifically address the issue of acid sulfate soils on site and the issue is considered manageable.

Asbestos
The DoH remains concerned over the presence of asbestos on site and has requested further information which can be provided as part of the development, which details the sampling and analysis conducted to delineate the extent of asbestos contamination in the areas of uncontrolled fill and details of any remediation and/or validation efforts.

Overall, the site is not considered to be significantly contaminated and the EPA has received advice that the remediation of the site is manageable provided the appropriate reports and proposed management strategies are submitted for approval prior to ground disturbing activities at the site.

The specific issues of acid sulfate soils and asbestos will need to be managed in accordance with and to the satisfaction of the DoE and DoH, while the issue of groundwater contamination is to be managed as outlined in section 3.2 and through the proponents commitments contained in Appendix 5.

Summary
Having particular regard to the:

- contamination present on site;
- important hydrological regime supplying fresh water to Clontarf Bay and the Canning River;
- sensitive receiving environment of Clontarf Bay and the Canning River;
- presence of potential acid sulfate soils;
- presence of asbestos;

- additional water quality monitoring; and
- the proponents commitments for the preparation and implementation of;
    1. Dewatering Program;
    2. Detailed Remediation Assessment of Contaminated Soils (including a Health Safety Management Plan to address asbestos);
    3. Acid Sulfate Soils Management Plan; and
    4. Construction Dust Management Procedures.

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 EP Act 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, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure enforceability, then form part of the conditions to which the proposal should be subject, if it is to be implemented.

4.1 Proponent's commitments

The proponent's commitments as set in the PER and subsequently modified, as shown in Appendix 5, should be made enforceable. These include:

- Construction Management Plan
- Foreshore Management Plan
- Wetland Management Plan
- Groundwater Management Plan
- Drainage, Nutrient, Irrigation and Water Quality Management Plan
- Site Contamination Assessment
- Water Conservation Principles
- Noise Management Plan
- Dust Management Plan
- Acid Sulfate Soil (ASS) Plan

- Archaeological Investigations.

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 that the EPA recommends be imposed if the proposal by Trustees of the Christian Brothers Inc. to develop the East Clontarf site at Waterford for residential purposes is approved for implementation.

These conditions are presented in Appendix 5. Matters addressed in the conditions include the following:

- Wetland modification and offset;
- Water quality and quantity maintenance;
- Site contamination investigation, remediation and validation.

It should be noted that other regulatory mechanisms relevant to the proposal are the:

- *Swan River Trust Act 1988;* and
- *Town Planning and Development Act 1928.*

5. Other Advice

The EPA is aware that the proponent is agreeable to undertaking some foreshore management including rehabilitation and revegetation within the existing Bush Forever site, in addition to work planned for the proposed 6000m^2 addition to site 333.

The EPA would encourage the proponent to work with the relevant authorities on this issue with a view to securing the best environmental outcome for this regionally significant foreshore area.

6. Conclusions

The EPA has considered the proposal by the Trustees of the Christian Brothers Inc. to develop the East Clontarf site bounded by Manning Road, Centenary Avenue and the Canning River for residential purposes.

The EPA notes that the proposal will result in the clearing of 1.57ha wetland vegetation and habitat. The proponent has proposed this loss will be offset by 2.1ha of wetland rehabilitation and revegetation including land adjacent to the existing drainage line to Clontarf Bay and the Canning River. The river foreshore area will also be increased by approximately 6000m^2.

The wetland has been placed on the draft register for the 2004 Wetlands EPP as it was previously identified by the 1992 Lakes EPP. In assessing the East Clontarf development proposal an analysis of the environmental quality criteria provided in Part 1 (5)(6)(7) of the Draft 2004 EPP Regulations, for the identification and registration of wetlands has been undertaken. The EPA considers that the East Clontarf wetland does not meet the minimum environmental quality criteria to support

registration on the Draft 2004 Wetlands EPP. While there is a loss in area of the wetland, it is the EPA's opinion that the proposal does not represent a loss of wetland values or function. After taking account of the mitigation and offset proposed by the proponent which provides for 2.1ha rehabilitation and revegetation establishing a vegetated link to the foreshore, the proposal will result in no net loss of wetland area. Design changes by the proponent to roads and access ways which provide for a management boundary to the development are supported.

The hydrology of the wetland is an important factor as there is a year round fresh water supply to Clontarf Bay and the Canning River in the vicinity if the wetland. The supply of fresh water, despite known soil and groundwater contamination, was initially attributed to the wetland function itself, either through contaminant uptake by vegetation or sediment accumulation. However, following further investigations it has been concluded that the wetland is located at a point of dilution of the regional groundwater. Groundwater inflow to the wetland is primarily from a diffuse seepage face along the northern boundary contributing approximately 83% of the total wetland inflow with the remaining 17% attributed to surface water flow. The proponent has predicted that the proposal will result in a reduction of 20% of the northern seepage face of the wetland and the development will decrease the surface inflow to the wetland by approximately 9%. It is therefore unlikely that the existing hydrological regime will be significantly impacted by the proposed development. The soil and groundwater of the site is currently considered contaminated as a result of former on site and adjacent activities with a range of contaminants identified including pesticides, heavy metals and asbestos. Advice received by the EPA in relation to remediation is that it is manageable provided the appropriate reports and proposed management strategies are submitted for approval prior to ground disturbing activities at the site.

There is also considered to be a risk of the generation of acid sulfate soils on site through the remediation of on site contamination and by the draining, filling and construction activities associated with the wetland that are likely to disturb peaty soils. The construction aspects of the proposal will require diligent management which is also provided for in the proponent's commitments.

Given the importance of maintaining the hydrological regime and managing site contamination, the proponent has acknowledged the requirement to meet the environmental quality objectives and criteria of the recently released Riverplan management framework (Govt. WA, 2004). With the application of this framework and the recommended Environmental Condition, the EPA is satisfied that the objectives of the Swan Canning EPP can be met.

The proponent has also indicated a willingness to undertake some foreshore management including rehabilitation and revegetation within the existing Bush Forever site, in addition to work planned for the proposed 6000m^2 addition to site 333. The EPA encourages the proponent to work with the relevant authorities on this issue with a view to securing the best environmental outcome for this regionally significant foreshore area.

The EPA has therefore concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of its commitments and the recommended conditions set out in Appendix 5, and summarised in Section 4.

7. 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 residential development of the 18ha site at East Clontarf, Waterford by the Trustees of the Christian Brothers;
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3 of this report;
3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 5, and summarised in Section 4.1, including the proponent's commitments.
4. That the Minister imposes the conditions and procedures recommended in Appendix 5 of this report.

Appendix 1

Wetlands EPP evaluation

Wetlands EPP evaluation

Criteria	Evaluation
The wetland is recognised internationally, nationally or regionally as provided in regulation 5 of the regulations. 5. International, national or regional recognition of wetlands (1) For the purposes of the policy, a wetland is recognised internationally if the wetland is an important feeding, breeding or resting site for birds listed under either or both of the following agreements — (a) the China-Australia Migratory Bird Agreement (CAMBA), being the Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and Their Environment 1986, Australian Treaty Series No. 22, Department of Foreign Affairs and Trade, AGPS, Canberra, 1988; (b) the Japan-Australia Migratory Bird Agreement (JAMBA), being the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in danger of extinction and Their Environment 1974, Australian Treaty Series No. 6, Department of Foreign Affairs, AGPS, Canberra, 1981.	Although recognised, the 3 species identified during surveys were all recorded in habitats associated with the Canning River Foreshore and further information collected does indicate that the 3 species would prefer the river/foreshore habitat rather than the dense vegetation of the wetland.

Criteria	Evaluation
(2) For the purposes of the policy, a wetland is recognised internationally, nationally or regionally if it is recognised in one or more of the following publications — (a) A Directory of Important Wetlands in Australia, 2nd edition, Australian Nature Conservation Agency, Canberra, 1996;	No
(b) Conservation Reserves for Western Australia, Vols 1-6, Environmental Protection Authority, Perth, 1976;	No
(c) L. Pen, A Systematic Overview of Environmental Values of the Wetlands, Rivers and Estuaries of the Busselton-Walpole Region, Water Resource Allocation and Planning Series, report no. WRAP 7, Water and Rivers Commission, Perth, 1997;	No
(f) the United Nations Educational, Scientific and Cultural Organisation Convention on Wetlands of International Importance Especially as Waterfowl Habitat 1971, Australian Treaty Series No. 48, Department of Foreign Affairs, AGPS, Canberra, 1975	No
(e) Perth's Bush Forever, Government of Western Australia, Perth, 2000;	No
(f) the United Nations Educational, Scientific and Cultural Organisation Convention on	No

Criteria	Evaluation
Wetlands of International Importance Especially as Waterfowl Habitat 1971, Australian Treaty Series No. 48, Department of Foreign Affairs, AGPS, Canberra, 1975	
The wetland has at least one of the significant natural attributes referred to in regulation 6 of the regulations. 6. Significant natural attributes of wetlands. For the purposes of the policy, a wetland has a significant natural attribute if — (a) it supports protected flora as defined in section 6(1) of the Wildlife Conservation Act 1950;	No
(b) it supports fauna specified in a notice in operation under section 14(2)(ba) of the Wildlife Conservation Act 1950 as fauna that is likely to become extinct, or is rare, or otherwise in need of special protection;	No
(c) it supports vegetation in "good, very good, excellent or pristine condition" as described by B J Keighery in Bushland Plant Survey. A Guide to Plant Community Survey for the Community, Wildflower Society of WA (Inc), Nedlands, Western Australia, 1994;	No – the vegetation on site is predominantly weed species. This factor applies to native vegetation.

Criteria	Evaluation
(d) it supports an ecological community listed as "threatened" in Category 1, 2, 3 or 4 as described by V J English and J Blyth in — (i) "Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province", (Project N702) published in Final Report to Environment Australia, Department of Conservation and Land Management, Como, Western Australia, 1997; or (ii) "Development and application of procedures to identify and conserve threatened ecological communities in the South West Botanical Province of Western Australia", published in Pacific Conservation Biology No. 5, 1999, at pp. 124-38, Surrey, Beatty and Sons, New South Wales, 1999;	No
(e) it is a wetland of a natural wetland type that is part of a natural wetland group of which fewer than 30% of wetlands of that type in that group are represented in the conservation estate on the Swan coastal plain, according to the wetland type and geomorphic classification system in Hill, AL, Semeniuk, CA, Semeniuk, V and Del Marco, A, Wetlands of the Swan coastal plain, Volume 1: Wetland Mapping, Classification and Evaluation — Main Report and Volume 2: Wetland Mapping, Classification and Evaluation — Wetland Atlas, Water and Rivers Commission and Department of Environmental Protection, Perth, Western Australia, 1996;	Data not available but preliminary information suggests that there is more than 30% remaining.
(f) it is a significant habitat or refuge for native or migratory fauna; or	While it does provide some habitat value, the wetlands itself is not considered a

Criteria	Evaluation
	significant habitat or refuge.
(g) it supports a concentration of a species of native or migratory fauna.	No
The wetland has at least 2 of the environmental values listed in regulation 7 of the regulations. 7. Other environmental values of wetlands. For the purposes of clause 6(c) of the policy, the following environmental values are listed — (a) the wetland is a significant site of pollen records, unusual sediments (as indicators of historical change), unusual geomorphology or hydrology for the scientific community;	No
(b) the wetland is a public resource for water-based and land-based recreation;	No
(c) the wetland is a significant archaeological or historical heritage site;	No
(d) the wetland is an Aboriginal site as defined in section 4 of the Aboriginal Heritage Act 1972;	Yes – but clearance has been received
(e) the wetland is a significant field study site for educational purposes.	No

Appendix 2

List of submitters

Government agencies

Department of Environment – Regional Swan Goldfields Office

Department of Environment – Wetlands section

Department of Environment – Land and Water Quality Branch (2 submissions)

Department of Health

Department for Conservation and Land Management

Swan River Trust

Local authorities

City of Canning

City of South Perth

Community organisation

South East Regional Centre for Urban Landcare

Public

Syrinx Environmental

Appendix 3

References

A L Hill et al. (1996). *Wetlands of the Swan Coastal Plain, Volume 2b.* Water and Rivers Commission, Perth.

ATA Environmental (2004). Trustees of the Christian Brothers Inc. *Clontarf Residential Subdivision, Waterford Public Environmental Review Volumes I & II.* ATA, Perth.

Department of Environment (2003). *General Guidance on Managing Acid Sulfate Soils.* DoE, Perth.

Environmental Protection Authority (1992). *Environmental Protection (Swan Coastal Plain Lakes) Policy.* EPA, Perth.

Environmental Protection Authority (1998). *Environmental Protection (Swan and Canning Rivers) Policy.* EPA, Perth.

Environmental Protection Authority (2004). *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy.* EPA, Perth.

Environmental Protection Authority (2004). *Environmental Protection of Wetlands Position Statement No. 4.* Environmental Protection Authority, Perth.

Environmental Protection Authority (2004). *Preliminary Position Statement No. 9 Environmental Offsets.* EPA, Perth.

Government of Western Australia (2000). *Bush Forever – Volumes 1, 2 and 3.* Department of Environmental Protection, Perth.

Government of Western Australia (2004). *Riverplan An Environmental Management Framework for the Swan and Canning Rivers Comprehensive Management Plan and Implementation Strategy for the Environmental Protection (Swan and Canning Rivers) Policy 1998.* EPA, Perth.

Appendix 4

Summary of identification of relevant environmental factors

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Resource Enhancement Wetland Environmental Protection *(Swan Coastal Plain Lakes)* Policy 1992 Draft Environmental Protection *(Swan Coastal Plain Wetlands)* Policy 2004	The proposal will result in the clearing of 1.57ha of wetland and associated vegetation. A 2.1ha wetland is proposed to be constructed linking the remaining wetland to the Canning River along the existing drainage channel.	The subdivision design will result in considerable fill being deposited over the bulk of the woodland, shrubland and most of the healthy sedgeland for subsequent housing development. Preference for improvement of the existing wetlands rather than creation of new wetland areas. The total extent of the wetlands quoted as being filled in the reports does not appear to equate with other estimates The maps are incongruent. There are significant discrepancies in the information provided regarding the amount of land reserved as well as a wetland corridor. The wetland on site should not have been downgraded from Conservation to Resource Enhancement. Deepening the western portion of the wetland should not be considered 'rehabilitating to a more natural wetland'. Natural wetlands of this type are naturally vegetated without large open water areas and naturally subject to seasonal flooding. The area of deepening should be included as a loss. The area to be created is a floodplain vegetation type which is relatively common regionally and should not be considered a replacement for the loss of a freshwater seepage wetland which is not common regionally. The lack of discussion of the wetlands in terms of the regional context is an important omission. The development will destroy parts of an RE wetland, is likely to impact	This is a relevant environmental factor and is discussed in Section 3.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		on the hydrology of the remaining wetland and increase the speed of nutrient transfer to the Canning River. The preparation of a Wetland Management Plan which addresses issues such as weed control and provides for the revegetation of 2.1ha of land within the site with native vegetation is supported. There is an implied assumption that because there is some water exchange in the wetlands mosquitos and midges will not breed. This may not be the case. An appropriate separation distance should be addressed by the applicant. It is appropriate that the potential affects on mosquito breeding and implementation of associated control programs be addressed.	The issue of mosquitos is addressed by the Proponent Commitments in Appendix 4.
Vegetation Foreshore vegetation Bush Forever site 333	The proposal will result in the clearing of 1.57ha of wetland associated vegetation and the revegetation/rehabilitation of a 2.1ha Paperbark/Flooded Gum wetland. The project does not propose any direct impacts on the Foreshore itself however indirect impacts could include weed invasion and increased use of the area by visitors.	The vegetation mapping and site description is inaccurate as it fails to identify the true extent of most the different vegetation types known to occur there. The vegetation condition should be shown with the subdivision overlayed. The protection of the Marri trees is considered to be critical, however the current subdivision design places their longevity in question. A comprehensive vegetation survey should be a requirement. A more detailed description of the vegetation communities present needs to be provided including the species found in each community. Concern over revegetation species needs to be addressed.	The vegetation associated with the wetland is a relevant environmental factor and discussed in Section 3. The EPA has provided advice regarding the Foreshore in the Section Other Advice and the issue is further addressed by the Proponent Commitments in Appendix 4.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		The proponents commitment to retain and rehabilitate an area of Public Open Space is supported. The road will shade the saltmarsh causing a reduction of this vegetation type. Increased access pressures to the river foreshore must be addressed. This is a major cause of river degradation. A buffer of riverine vegetation sufficient to maintain the value of the breeding on the site and the integrity of the foreshore should be planned between any proposed development and the foreshore zone. Insufficient information is presented in the PER for instance there is an assumption that the main fauna habitat (the foreshore) will not be significantly impacted by the subdivision however there is little information to back up this claim. Factors such as domestic animals, increased public use of the area and the removal of vegetation need to be addressed in the management of this area. The Public Open Space abutting on to the saltmarsh in the south-east corner of the development may encourage people to enter that area and measures will need to be taken to control access. All lots should be separated from the reserve by a road interface as this will ensure that a buffer is created impeding the movement of exotic species and providing a point for site drainage. The increased urbanization of the adjoining development site could impact negatively on the foreshore environment. The preparation of a Foreshore Management Plan is supported and this should address issues such as access and increased use by residents.	

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		The PER deals predominantly with construction impacts not ongoing potential impacts that the change inland use adjacent to the river is likely to cause. The introduction of weeds, the creation and proliferation of informal pathways and predation of native fauna by domestic pets and an increase in light and noise could affect the fauna of the site unless addressed. It may be appropriate to undertaken monitoring of the area for the first two years after project completion to give an indication as to the type and mix of native fauna utilising the area.	
Fauna	The subject site is approximately 18 ha. The proposal will result in the clearing of 1.57ha of wetland and associated vegetation. A 2.1ha wetland is proposed to be constructed linking the remaining wetland to the Canning River along the existing drainage channel.	No trapping was undertaken, a walk around survey is considered insufficient. There is no mention of the terrestrial and aquatic invertebrate fauna that are an important food source for many of the persisting larger fauna. The current subdivision results in the loss of flooded gum and most of the shrubland which houses substantial populations of honeyeaters. There is no mention of the importance of the springs for Black Swans utilizing the adjoining Canning River. Professional advice regarding the potential effects of disturbance from alien populations to birdlife should be followed. A bird survey over a 12 month period should be undertaken. The fauna list is incomplete. The impact from the development on invertebrate fauna has not been considered. The fauna list should include all ecological layers including both terrestrial and aquatic macroinvertebrates.	This is not considered a relevant environmental factor. While it is noted that the wetland does exhibit some fauna habitat values, it is considered that with the Proponent offsets including the creation of a 2.1ha Paperbark and Flooded Gum wetland, this will create a more diverse habitat for a range of fauna. The hydrological regime of the site is considered a relevant environmental factor and is discussed in Section 3. Given the size, scale and nature of

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		There is either limited or no buffer zones planned between the development and existing river, marshland and wetland habitat areas. The site is recognized under the JAMBA/CAMBA international treaties and the development is likely to disturb bird breeding and roosting areas due to increased people and pets accessing the area.	the project it is not considered necessary for the Proponent to undertake macroinvertebrate surveys. The 3 JAMBA/CAMBA species identified were all identified utilizing the Foreshore river habitat and further investigation has confirmed that these species would be likely to prefer this environment rather than the dense vegetation of the wetland.
POLLUTION			
Soil contamination	The subject site is approximately 18 ha. Implementation of the proposed residential development will require the remediation of contaminated material to appropriate standards.	Insufficient information to satisfactorily characterise potential health concerns, particularly a lack of soil sampling results for asbestos contamination information. Soil sampling appears to suitably characterise soil contamination at the site with the exception of the area beneath building pads. No justification for proposed clean up method. Concern about the release of contaminants with the extensive heavy earthworks proposed. Provided additional information on the asbestos remediation at the site meets the DoH and DoE requirements, the proposed approach to the management of soil and groundwater contamination at the site appears acceptable. Anecdotal evidence suggests that historically the land may have been exposed to contaminants leached from poor storage practices in adjacent	This is a relevant environmental factor and is discussed in Section 3.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		land. Additional subsurface core testing should be carried out to determine if remedial action is required prior to extensive earth moving should the development be approved.	
Surface and Groundwater contamination	Implementation of the proposal may impact the current hydrological regime of the site including the wetland and drainage channel to the Canning River.	Support for continued groundwater monitoring – attention drawn to cadmium concentrations exceeding drinking water guidelines at MW5. Concern about the release of contaminants to groundwater and to the river and the impact on aquatic species. The use of soakwells and on-site infiltration for residential stormwater are not supported. A system of settling and filtration ponds to control drainage and potential pollution of the river from Manning Road and roads associated with the development should be included in this proposal. There is concern about the possible use of bores in the area because of potential bacterial threat as the site is downstream of the only remaining unsewered part of the City. Proposed changes to water entering the wetland and a reduction in the size of the wetland in response to any development may increase the rate of nutrients entering the Canning River.	This is a relevant environmental factor and is discussed in Section 3.
Acid Sulfate Soils	The subject site is approximately 18 ha. The proposal will result in the excavation of soils as part of the development that have the	The proponent will need to apply to the DoE to dewater the site and will need to address the potential for Acid Sulfate Soils. Concern about the potential release of acid sulfate given the	This is a relevant environmental factor and is discussed in Section 3.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	potential to generate acid sulfate soils.	presence of peaty soils. It the soil is of high acid sulfate risk then disturbance of those areas should not take place. The removal of bulrushes in the wetlands and the construction of a dual use path may result in the disturbance of acid sulfate soils.	
Noise and dust	Surrounding area including nearby residences	Existing residents may be affected by noise and dust from construction activities, a Noise and Dust Management Plan is required.	This is not considered a relevant environmental factor. However the issue is addressed by the Proponent Commitments in Appendix 4.
SOCIAL SURROUNDINGS			
Aesthetics	The subject site is approximately 18ha.	The site is part of a major aesthetic focus for the local community. It is essential that any development proposal contains elements that will secure the integrity of the river system and its associated flora and fauna so that equity is maintained for present and future generations.	This is not considered a relevant environmental factor. However, the proponent will be required to seek approval from the Swan River Trust for any proposed development within its Management Area and will need to consider visual amenity as required.
Centenary Park	The subject site is immediately adjacent to	The PER and subdivision concept does not acknowledge the potential impact of the redevelopment plans for the	This is not considered a relevant environmental factor.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	Centenary Park.	adjoining Centenary Park.	The issue of connectivity to Centenary Park is most appropriately addressed through the planning framework.
OTHER			
Aboriginal culture and heritage	The subject site is approximately 18ha.	This matter was not raised in any submissions although it is noted that the Department of Indigenous Affairs provided conditional consent to the proposal in June this year.	This is not considered a relevant environmental factor.

Appendix 5

Recommended Environmental Conditions and Proponent's Consolidated Commitments

Statement No.

RECOMMENDED CONDITIONS AND PROCEDURES

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

EAST CLONTARF RESIDENTIAL DEVELOPMENT, WATERFORD, CITY OF SOUTH PERTH

Proposal: The residential development of the East Clontarf site, Waterford, as documented in schedule 1 of this statement.

Proponent: The Trustees of the Christian Brothers Inc.

Proponent Address: C/- Richard Noble and Associates, PO Box 7071 Cloisters Square Perth, 6850.

Assessment Number: 1467

Report of the Environmental Protection Authority: Bulletin 1156

The proposal referred to above may be implemented by the proponent subject to the following conditions and procedures:

1 Implementation

1-1 The proponent shall implement the environmental management commitments documented in schedule 1 of this Statement subject to the conditions of this statement.

2 Proponent Commitments

2-1 The proponents shall implement the proposal as documented in schedule 2 of this Statement to the requirements of the Minister for the Environmental on advice of the Environmental Protection Authority.

3 Proponent Nomination and Contact Details

3-1 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 as the proponent for the proposal.

3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this Statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with

this Statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.

3-3 The nominated proponent shall notify the Department of Environment of any change of contact name and address within 60 days of such change.

4 Commencement and Time Limit of Approval

4-1 The proponent shall substantially commence the proposal within five years of the date of this Statement or the approval granted in this Statement shall lapse and be void.

Note: The Minister for the Environment will determine any dispute as to whether the proposal has been substantially commenced.

4-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this Statement to the Minister for the Environment, prior to the expiration of the five-year period referred to in Condition 4-1.

The application shall demonstrate that:

1. the environmental factors of the proposal have not changed significantly;
2. new, significant, environmental issues have not arisen; and
3. all relevant government authorities have been consulted.

Note: The Minister for the Environment may consider the grant of an extension of the time limit of approval not exceeding five years for the substantial commencement of the proposal.

5 Compliance Audit and Performance Review

5-1 The proponent shall prepare an audit program and submit compliance reports to the Department of Environment which address:

1. the status of the implementation of the proposal as defined in Schedule 1 of this Statement;
2. evidence of compliance with the conditions and commitments; and
3. the performance of the environmental management plans and programs.

Note: Under Sections 48(1) and 47(2) of the *Environmental Protection Act 1986*, the Chief Executive Officer of the Department of Environment is empowered to monitor the compliance of the proponent with the Statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this Statement.

6 Wetland

6-1 The proponent shall limit residential development to the area shown on Figure 1 of schedule 1 to the requirements of the Minister on advice of the EPA.

6-2 Within 6 months following subdivision/development approval the proponent shall construct a Paperbark/Flooded Gum wetland of not less than 2.1hectares shown on Figure 1 of Schedule 1, as Public Open Space to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This wetland shall include the following:

1. revegetation with local indigenous species;
2. landform recontouring;
3. establishment and maintenance of wetland connection to Clontarf Bay and the Canning River;
4. weed control measures;
5. water quality and quantity monitoring; and
6. contingency measures to maintain or improve water quality to Clontarf Bay and the Canning River.

6-3 Within 3 months following the completion of the wetland referred to in condition 6-2, the proponent shall prepare a Wetland Management Plan that includes identification of species to be used in revegetation works on site, to the satisfaction of the Minister for the Environment on advice from the Environmental Protection Authority.

6-4 The proponent shall implement the Wetland Management Plan required by condition 6-3 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority

6-5 The proponent shall make the Wetland Management Plan required by condition 6-3 publicly available to the requirements of the Environmental Protection Authority.

7 Water Quality

7-1 Prior to an application for subdivision or development the proponent shall prepare a Drainage Nutrient Irrigation and Water Quality Management Plan to the satisfaction of the Minister for Environment on advice of the Environmental Protection Authority.

This Plan shall address the following environmental quality objectives as described in *Riverplan*:

1. protection, restoration and maintenance of ecosystem health;
2. protection, restoration and maintenance of biological diversity;
3. protection, restoration and maintenance of natural landscape;
4. protection, restoration and maintenance of recreation; and
5. protection, restoration and maintenance of water supply.

7-2 The proponent shall implement the Drainage Nutrient Irrigation and Water Quality Management Plan required by condition 7-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

7-3 The proponent shall make the Drainage Nutrient Irrigation and Water Quality Management Plan required by condition 7-1 publicly available to the requirements of the Environmental Protection Authority.

7-4 The proponent shall prepare a plan to conduct ecotoxological testing to monitor the benthic habitat at the wetland discharge point to Clontarf Bay to the requirements of the Minister for Environment on advice of the Environmental Protection Authority

7-5 The proponent shall implement the plan to conduct ecotoxological testing required by condition 7-4 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

7-6 The proponent shall make the plan to conduct ecotoxological testing required by condition 7-4 publicly available to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

8. Site Contamination

8-1 Prior to subdivision or development, the proponent shall prepare a Site (soil and groundwater) Contamination Investigation, Remediation and Validation Plan to the requirements of the Minister for Environment on advice Environmental Protection Authority with the concurrence of the Department of Health.

The plan will be prepared in general accordance with the Department of Environment *Contaminated Sites Management Series of Guidelines*, and shall include:

1. an Acid sulfate soil Management Plan; and
2. an Asbestos Management Plan.

8-2 The proponent shall implement the Site (soil and groundwater) Contamination Investigation, Remediation and Validation Plan required by condition 8-1 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority

8-3 The proponent shall make the Site (soil and groundwater) Contamination Investigation, Remediation and Validation Plan required by condition 8-1 publicly available to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

Schedule 1

The Proposal (Assessment No. 1467)

The proposal is for:

- the residential development of the 18hectare East Clontarf site bounded by Manning Road, Centenary Avenue, the Clontarf Aboriginal Campus and the Canning River creating up to 200 lots;
- the filling and draining of 1.57hectares of Resource Enhancement wetland identified in the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* and the *Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 2004*;
- the creation of a 2.1hectares Paperbark/Flooded Gum wetland adjacent to the wetland and Canning River;
- increasing the river foreshore area by approximately 6000m^2;
- investigation into soil and groundwater contamination and remediation as required;

- installation of two additional monitoring bores to perform additional ground and surface water monitoring; and
- provision of road frontage along both the wetland and the river foreshore not including the western section of POS which is to be a revegetated dryland buffer.

Table 1 – Key Proposal Characteristics

Element	**Description**
Proposal	Creation of up to 200 residential allotments
Area of disturbance	Approximately 16hectares
Major components – • Wetland modification • Dewatering • Disturbance to site hydrology • Remediation of site contamination • Potential acid sulfate disturbance • Created wetland • Noise and dust creation	Draining and filling approximately 1.57hectares of Resource Enhancement wetland as depicted on Schedule 1. Creation of 2.1ha of Paperbark/Flooded Gum wetland Hydrological maintenance – water quality and quantity Remediation of on site contamination

Figure 1:
Residential Development Plan. Attached.

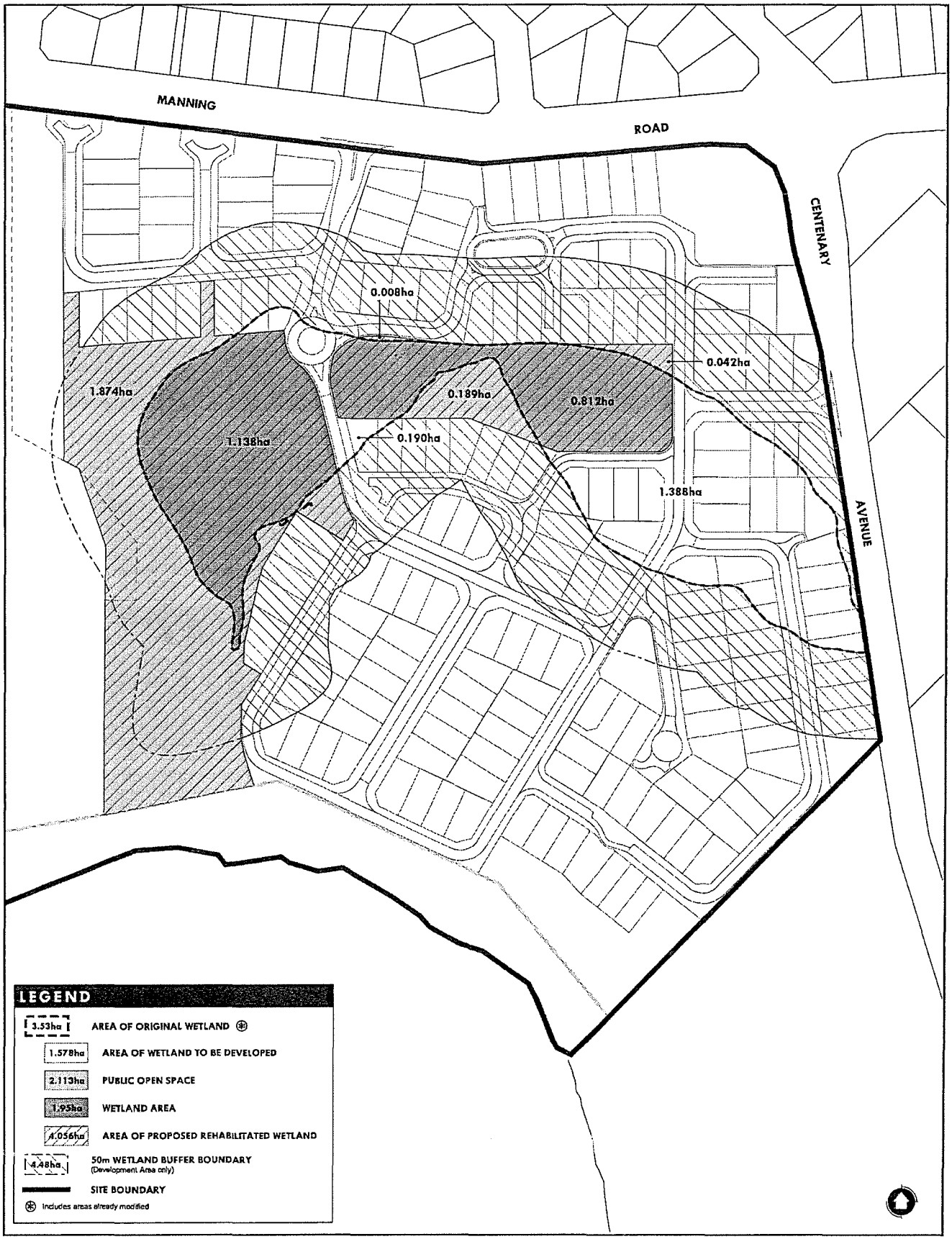

Figure 1: *Residential Development Plan*

Schedule 2

Proponent's Environmental Management Commitments

East Clontarf residential development

(Assessment No. 1467)

Trustees of the Christian Brothers Inc.

Proponent's Environmental Management Commitments – November 2004

East Clontarf Residential development (Assessment No. 1467)

Note: The term "commitment" as used in this schedule includes the entire row of the table and its six separate parts as follows:

- a commitment number;
- a commitment topic;
- the objective of the commitment;
- the 'action' to be undertaken by the proponent;
- the timing requirements of the commitment; and
- the body/agency to provide technical advice to the Department of Environment.

EAST CLONTARF RESIDENTIAL DEVELOPMENT
PROPONENTS ENVIRONMENTAL MANAGEMENT COMMITMENTS

	Topic	Objective	Action	Timing	Advice
1.	Construction Management	To protect the remnant wetland vegetation identified for protection within *Bush Forever* adjoining the development from potential impacts associated with construction. To minimise (direct and indirect) impacts associated with the construction of the residential development and surrounds on fauna, surface and groundwater quality and quantity and local residents.	Prepare and implement a Construction Environmental Management Plan (CEMP) to the satisfaction of the DoE and Cities of South Perth and Canning which addresses: 1. Dewatering Program; 2. Detailed Remediation Assessment of Contaminated Soils; 3. Acid Sulfate Soils Management Plan; 4. Construction Noise Management Procedures; and 5. Construction Dust Management Procedures.	Prepared and approved prior to construction.. Implemented during construction. Audits to be completed during construction works and post-construction.	City of South Perth DoE City of Canning
2.	Foreshore Management	To protect the conservation values identified for protection within the development adjacent to the Canning River foreshore. To mitigate proposed clearing within the development and enhance linkages and habitat value.	prepare and implement a detailed Foreshore Management Plan to the satisfaction of the DPI, SRT and City of South Perth that will include: 1. Comprehensive weed eradication program; 2. Revegetating and restoring foreshore POS adjoining conservation areas with appropriate indigenous flora of the Canning River; 3. Increase the area contained within POS adjoining Bush Forever Site No. 333; 4. Creation of habitat and wildlife corridors; 5. Controlling vehicle and pedestrian access; 6. Construction of a dog-proof fence along the existing Foreshore Reserve, if considered appropriate; 7. Provision of public facilities;	Preparation prior to construction. Implementation to be as per determined in Schedule within the Foreshore Management Plan.	Bush Forever Office (DPI) SRT City of South Perth

	Topic	Objective	Action	Timing	Advice
			8. Soil and plant source material hygiene; 9. Fire management including provision of fire hydrants; 10. Provision of educational and interpretative materials within the area to raise awareness of JAMBA/CAMBA species that frequent the area; 11. Encouraging community involvement and awareness promoting control of pets (eg cats and dogs); 12. Water conservation principles; 13. Monitoring re-establishment or native and exotic plant species for a period of not less than 2 years followed by review; 14. Monitoring criteria to determine the success of the revegetation and weed eradication program; 15. Progress and compliance reporting; and 16. Timing and implementation schedule.		
3.	Wetland Management	To minimise impacts on wetlands and to offset any wetland impacts to ensure no net loss of function or value.	The proponent will prepare and implement a Wetland Management Plan to the satisfaction of the DoE and City of South Perth that will include: 1. Identification of existing wetland area to be retained; 2. Avoiding direct and minimising indirect impacts on the wetland; 3. Ensuring no net loss of wetland values and functions; 4. Rehabilitation techniques to be employed; 5. Selection of appropriate local wetland and dryland species to maintain and enhance existing habitats; 6. Mitigation strategies for loss of any vegetation will be investigated including both on-site and off-site options;	Preparation prior to construction. Implementation to be as per determined in Schedule within the Wetland Management Plan.	DoE City of South Perth

	Topic	Objective	Action	Timing	Advice
			7. Creation of a new Paperbark/Flooded Gum wetland area to be located adjacent to the existing wetland and the river foreshore and planted with tree, understorey sedge and shrub species common to the local riverine and wetland environment; 8. adopt existing mosquito and midge management protocols currently utilised by the City of South Perth 9. Monitoring criteria to determine the success of the plan; 10. Progress and compliance reporting; and 11. Timing and implementation schedule.		
4.	Groundwater Management	To ensure emissions do not adversely affect environmental values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards. To determine the potential impacts of dewatering during the construction phase on the vegetation within the wetland areas, Canning River and groundwater quality. .	(1) The proponent will prepare and implement a Groundwater Management Plan as a component of the CEMP to the satisfaction of the DoE, SRT and Water Corporation that will include: 1. Determining the nature and extent of groundwater contamination; 2. Installation of 2 additional monitoring bores; 3. Quarterly sampling of both additional and existing monitoring bores for a 12-month period; 4. Groundwater flow characteristics; and 5. Groundwater contamination plume management. (2) Develop a Dewatering Program as a component of the CEMP to the satisfaction of the DoE (3) The proponent or their chosen contractor will apply for and obtain 'Licence to Take Water'. All dewatering will be carried out in accordance with the conditions of	Preparation of Groundwater Management Plan and Dewatering Program prior to construction. Implementation as per Plan/Program. Construction works to be timed and staged to minimise the volume of dewatering required	DoE SRT Water Corporation

	Topic	Objective	Action	Timing	Advice
			the 'Licence to Take Water'. (4) Should the dewatering activities require water to be discharged offsite, the proponent (or contractor) shall apply to the Swan River Trust for a 'Disposal Licence' to discharge water to the Swan River or Water Corporation to discharge to the sewer or stormwater drains. Any discharge of water offsite shall be carried out in accordance with the 'Disposal Licence'. (5) Monitoring programs and performance evaluation criteria will be determined in consultation with relevant government agencies.		
5.	Drainage, Nutrient, Irrigation and Water Quality Management	To maintain acceptable water quality within the wetland and the Canning River in keeping with the Riverplan framework of management and best practice in urban stormwater management. To ensure that no road surface run-off directly enters the wetland. To ensure that there is provision for contaminant spillage entrapment.	Prepare and implement a Drainage, Nutrient, Irrigation and Water Quality Management Plan (DNIWQMP) to the satisfaction of the DoE, SRT and City of South Perth that will include: 1. Design and construct the detention/infiltration basin; 2. Periodic monitoring of the infiltration basin (post-construction) to ensure continued function and maintenance as required; 3. Quarterly sampling of surface water body for a 12-month period; 4. Maximising infiltration of uncontaminated stormwater at sources to recharge the groundwater system; 5. Water conservation principles; 6. Nutrient control; 7. Prescribed fertilizer applications for areas of	Preparation prior to construction. Implementation to be as per determined within the DNIWQM Plan.	DoE SRT City of South Perth

	Topic	Objective	Action	Timing	Advice
			POS; 8. Determination of flushing requirements, associated impacts and management options; 9. Treating contaminated stormwater via gross pollutant and sediment traps; 10. Directing treated stormwater into the Canning River along the south-eastern corner boundary of the site (as per DoE advice); 11. Monitoring criteria to determine the success of the plan; 12. Develop and implement contingency measures to be implemented in the event that monitoring criteria are exceeded; 13. Progress and compliance reporting; and 14. Timing and implementation schedule. Monitoring programs and performance evaluation criteria will be determined in consultation with relevant government agencies.		
6.	Site Contamination Assessments	To determine nature and extent of any soil or groundwater contamination present within the site which may pose a risk to human health or the environment.	(1) Prepare and implement a Site Remediation (Contaminated Soils) Management Plan as a component of the CEMP to the satisfaction of the DoE. (2) Areas of soil identified as contaminated in excess of EIL or HIL (if directed by DoE) criteria will be excavated and the base and walls of the excavations validated in accordance with relevant DoE Guidelines for the Remediation of Contaminated Land (DEP, 2001, a, b and c). (3) The excavated soil will then be assessed to determine the appropriate management option. A final decision on the management of excavated contaminated soils will be	Preparation and implementation prior to site works in areas identified in the DSI as potentially contaminated.	DoE HDWA Worksafe City of South Perth City of Canning

	Topic	Objective	Action	Timing	Advice
			made once analytical results are available for excavated soil. (4) An alternative that may be considered is to screen the material to remove geotechnically unsuitable materials and then re-use the material as fill in appropriate areas on the site such as POS. Approval will be sought from the DoE before re-using excavated soils in this manner. (5) A remediation assessment report will be submitted to DoE on conclusion of remediation works that provides detailed information on: 1. The remediation strategy implemented; 2. The results of validation and stockpile sampling; and 3. Details of the management of all contaminated material. (6) Where areas have been identified as potentially affected by asbestos cement sheeting, a specific Health and Safety Plan will be prepared before works commence. This plan will address the following elements to the satisfaction of the DoE, HDWA and Worksafe: 1. Dust control to minimise airborne emissions of dust; 2. Personal protective equipment (PPE); 3. Controls over access to the vicinity of the work; 4. Hygiene measures for workers; 5. Decontamination and disposal of overalls and PPE;		

	Topic	Objective	Action	Timing	Advice
			6. Personal and ambient air monitoring; 7. Disposal of remediated soils; and 8. Other occupational health issues such as management of heat stress. This plan will be prepared as an appendix to the overall Site Remediation Management Plan.		
7.	Water Conservation Principles	Water is an important public resource and availability within the Perth Metropolitan Area is limited.	Water conservation measures will be applied within the development. These include: 1. Promoting the use of plant species that have low water and fertiliser requirements; 2. Utilising local native plant varieties in landscaping; 3. Considering re-injection of stormwater into the superficial aquifer; 4. Promoting landscape treatments sympathetic to climatic conditions and prevailing site conditions – soil types, topography, environment, wetlands etc.; 5. Utilising "cluster or clump" plantings to provide useable shade areas and better use of reticulated water in preference to single item or symmetrical planting regimes; 6. Irrigating POS areas at appropriate time so as to reduce evaporative loss and minimise transpiration losses; and 7. Ensuring the irrigation regime applied to areas of POS is responsive to prevailing weather conditions.	To be considered within preparation of the Foreshore Management Plan, Groundwater Management Plan and the DNIWQMP (Commitments 3 and 9).	DoE SRT City of South Perth
8.	Noise	To protect the amenity of nearby residents from noise	Noise Management Procedures will be prepared	Prepared and approved prior to construction.	DoE City of South

	Topic	Objective	Action	Timing	Advice
		impacts resulting from activities associated with the proposal by ensuring the noise levels meet statutory requirements and acceptable standards.	for the site as part of the overall CEMP (see Commitment 1). Measures to minimise noise levels received by proposed residences within the development from existing roadways will include: 1. Construction of noise barriers between the roadway and residential lots; 2. Specifying appropriate setbacks of proposed residences from existing roadways; and 3. Specification of construction methods and materials (in keeping with "quiet house design" principles).	Implemented during construction. Audits completed during construction works and post-construction.	Perth City of Canning
9.	Dust	To protect the surrounding land users such that dust and particulate emissions will not adversely impact on their welfare and amenity or cause health problems in accordance with the EPA's Guidance Statement No. 18: Prevention of Air Quality Impacts from Land Development Sites.	(1) Dust generated during construction will be minimised by the application of EPA guidelines and best practice in dust suppression. (2) Dust Management Procedures will be prepared for the site as part of the overall CEMP (see Commitment 1). Measures to minimise dust levels will include: 1. Watering of exposed surfaces; 2. Minimising working surfaces at any one time; and 3. Progressive rehabilitation of disturbed areas.	Prepared and approved prior to construction. Implemented during construction. Audits to be completed during construction works and post-construction.	DoE City of South Perth City of Canning
10.	Acid Sulfate Soil (ASS)	To plan and manage development that may potentially impact on ASS to avoid adverse effects on the	Prepare and implement an Acid Sulfate Soil Management Plan as a component of the CEMP (see Commitment 1) to the satisfaction of the DoE that will include but not be limited to:	Prepared prior to commencement of any earthworks or dewatering in areas identified as	DoE SRT

	Topic	Objective	Action	Timing	Advice
		natural and built environment and human activities and health.	1. The area of PASS soils to be disturbed by excavation or dewatering will be minimised as far as possible; 2. Where ASS must be disturbed: – Earthworks will be completed as quickly as possible to minimise the time that the walls and base of excavations are exposed to the atmosphere; – Un-neutralised ASS/PASS will be stored for only limited periods on on-site bunded hardstand areas constructed from alkaline materials; – The quality of groundwater and dewatering effluents will be monitored regularly to ensure early detection of any alteration in water chemistry; and – if necessary dewatering effluent will be treated to ensure appropriate water quality is maintained; and 3. 3Where excavated soils must be directed for off-site disposal, they will be directed to a site approved for acceptance and/or treatment of ASS by the DoE.	having potential for Acid Sulfate Soils. To be implemented during construction.	
11.	Archaeological Investigations	To fulfil the requirements stipulated on the Section 18 clearance of the *Aboriginal Heritage Act 1972.*	Apply for clearance under Section 18 of the *Aboriginal Heritage Act 1972* to remove both previously recorded sites and any new sites that emerge as a result of earthmoving procedures located within the site that will be impacted by the development. The proponent will also undertake further archaeological investigations if required as part of the Section 18	Site Heritage Protocol will be prepared prior to commencement of construction and implemented during construction, with any statutory processes followed as per the requirements of the	DIA

	Topic	Objective	Action	Timing	Advice
			clearance. Such investigations may include, but not be limited to: 1. Surface recording, mapping and collection of archaeological material; 2. Archaeological excavation and/or sub-surface evaluation; 3. Recovery of samples for radiometric dating; and 4. Analysis of recovered material.	*Aboriginal Heritage Act 1972.*	

List of Abbreviations: DoE - Department of Environment
SRT - Swan River Trust
DIA - Department of Indigenous Affairs
DoH - Department of Health
PASS – Potential acid sulfate soils
EIL – Ecological Investigation Levels
HIL – Health Investigation Levels
POS – Public Open Space
DSI – Detailed site investigation

Appendix 6

Summary of Submissions and
Proponent's Response to Submissions

TRUSTEES OF THE CHRISTIAN BORTHERS IN WESTERN AUSTRLALIA INCORPORATED

CLONTARF RESIDENTIAL SUBDIVISION, WATERFORD

Responses to Submissions

(EPA Assessment No. 1467)

VERSION 2

OCTOBER 2004

REPORT NO: 2004/182

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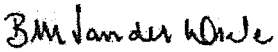
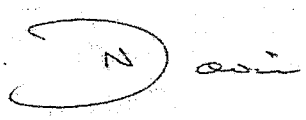
Checked by: Signed: 

Name: Bernadette Van der Wiele Date: 14 October 2004

Approved by: Signed: 

Name: Noel Davies Date: 14 October 2004

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1. INTRODUCTION

The Trustees of the Christian Brothers in Western Australia Incorporated propose to develop their land at Clontarf in Waterford for a residential subdivision. The proposed residential development involves creating up to 200 residential allotments, setting aside of rehabilitated and re-contoured wetland area, improving the riparian environment in on-site public open space abutting Bush Forever Site 333 and revegetating and integrating an area of upland native vegetation located between the existing wetland and the Clontarf Campus buildings.

The proposed residential subdivision of land at Clontarf in Manning was referred to the EPA under Section 38 of the *Environmental Protection Act 1986* in January 2003. The EPA resolved to formally assess the project on the basis of the potential environmental impacts on the project and set the level of assessment as a Public Environmental Review (PER) (Assessment No. 1467). Guidelines for the assessment were provided by the EPA, and a PER was prepared by the proponents to satisfy and address these guidelines.

The PER was available for a public review and comment period of eight (8) weeks from 8 June to 3 August 2004.

This report provides a summary of the submissions received by the EPA, and the proponent's detailed responses to each of the issues raised.

2. SUBMISSIONS

A total of 11 submissions were received by the EPA during and after the advertising period for the PER. A break down of the submitters is provided below:

- 1 from a member of the public;
- 2 from Local Government Authorities;
- 1 from a conservation organisation; and
- 7 from State Government departments.

3. GENERAL SUBMISSIONS

The following section provides a summary of the general submissions (that is, those not directly related to any one particular PER topic or issue). The wording extracted directly from submissions is in italics. The numbers in parentheses following each submission summary corresponds to the identification number assigned to each individual submitter.

3.1 Traffic Management

3.1.1 *The entrance road from the subdivision onto Centenary Avenue, and the concept plan should be redesigned to ensure all access is gained from Manning Road.* (1)

The traffic report shows that only a single access to Manning Road can be provided within the site frontage that will conform to current planning guidelines on intersection spacing. Further the vertical alignment of Manning Road fronting the site would not permit a second access that could operate in a safe and acceptable manner. The traffic report also indicates that during the morning peak hour, the access to Manning Road will operate close to capacity. A second access is therefore required.

With regard to safety and emergency access it would be inappropriate to restrict any development of a 200+ lot subdivision to a single point of access. Should the access be blocked by a crash, emergency services would not be able to access the site to attend a fire or medical situation.

3.1.2 *Should the entrance to Centenary Avenue be permitted, the entrance road to the proposed subdivision should be relocated further to the south of the site to reduce the impact on traffic congestion on Centenary Avenue adjacent to its intersection with Manning Road.* (1)

The access to the subdivision on Centenary Avenue is located approximately 170m south of the intersection of Manning Road. This distance is greater than the minimum intersection spacing requirements set out in current planning guidelines.

The subdivision access is south of the slip lanes provided on Centenary Avenue approaching the traffic signals at Manning Road and traffic leaving the site will be required to merge with a single lane of traffic queuing on the approach to Manning Road. The proponent's traffic consultant considers that traffic from the development will not significantly affect the queue lengths currently experienced on Centenary Avenue. Relocating the subdivision access will have no impact on congestion.

It would be undesirable to move the access to the south as traffic speeds on Centenary Avenue will increase further south. This could result in a detriment to road safety particularly outside of the peak hours.

Relocating the access further south would require that the existing bus stop be relocated further south. This will increase the distance that residents living to the east

of Centenary Avenue will be required to walk to access the bus stop, thereby reducing public transport accessibility.
In urban design terms, the entrance off Centenary Avenue has been specifically located to achieve views across the wetland to the Clontarf Chapel. Any suggestion to relocate the entry to the south would result in loss of this view on the entry to the estate.

3.1.3 *A pedestrian refuge/traffic island, together with turning pockets (requiring a road widening on Centenary Avenue), should be provided to improve pedestrian safety and reduce traffic congestion. It is recommended that the subdivision concept plan be amended accordingly.* (1)

The traffic report states that the access to Centenary Avenue should be provided with an urban standard right turning lane. Minor widening to the east of Centenary Avenue will be required to achieve the right turn lane.

A median island is already constructed to the south of the proposed access to provide a pedestrian crossing between the existing bus stop and the residential areas to the east. An additional median would be superfluous.

Traffic flows on Centenary Avenue are controlled by the traffic signals at Manning Road and widening of Centenary Avenue could only be justified if an additional lane were provided at the traffic signals. The current intersection layout of Manning Road cannot accept an additional lane on Centenary Avenue without compromising safety of the intersection. Widening Centenary Avenue further to the south would achieve no real benefit, it will only result in a higher traffic speed approaching the traffic signals outside of the peak hours and a wider road for pedestrians to cross. Encouraging a higher traffic speed on Centenary Avenue would be detrimental to pedestrian safety.

3.2 Subdivision Issues

3.2.1 *The PER fails to identify the key environmental attributes of the site and therefore the proposed subdivision design still downgrades the value of the site.* (2)

The proponent met with City of South Perth officers on several occasions including a workshop and also with the City's environmental consultant. At none of these meetings has the City identified what it considers to the key environmental attributes of the site to be.

The PER contains responses to most issues raised by the City. Some did not appear to have been raised at the time of meetings (eg shading of samphires) while others were not able to be accommodated in the final subdivision (eg protection of more remnant trees and shrubs and minimising retaining walls). This does not mean that the PER has failed to provide the additional information requested, nor has it ignored key environmental attributes in an attempt to devalue the site.

Key environmental attributes of the site were determined during the initial environmental assessments undertaken with detailed site investigations being undertaken to ascertain the extent of biophysical degradation and contamination. Site remediation measures have been proposed by the proponent's environmental and engineering consultants and the proponent has made a commitment to prepare and implement a series of management plans to address these issues in the event of receiving approval by the EPA to proceed with the development. It is anticipated the proposed remediation measures will value-add to the site's environmental status.

3.2.2 *The PER and subdivision concept does not acknowledge the potential impact of the City of Canning's redevelopment plans for the adjoining Centenary Park on proposed housing lots along the south-eastern boundary of the site.* (1)

The City of Canning claim that the subdivision concept plan for East Clontarf does not represent the redevelopment plans for the adjoining Centenary Park is refuted by the proponent's planners. The latest plan for the Centenary Park redevelopment provided to the proponent's planners (faxed on 3 April 2003 and confirmed recently with the City of Canning as being the latest plan), shows the subdivision layout as lodged with the WAPC for approval and it therefore appears that both plans acknowledge one another.

3.2.3 *Requests from the City of Canning for the provision of parking embayments within the adjoining road reserve (to accommodate anticipated parking demand) are not reflected in the subdivision concept.* (1)

The provision of parking embayments within the adjoining road reserve is a matter that should be addressed at the subdivision approval stage and is not an issue that relates to a PER on the environmental components of the development. Importantly, the provision of parking embayments for Centenary Park should be provided by the City of Canning as part of the redevelopment work within the park itself.

The provision of a road reserve adjoining the Centenary Park provides an excellent opportunity for the City of Canning to provide the parking bays within the Centenary Park reserve and if necessary widen the road reserve by taking land from the Centenary Park reserve to accommodate the parking bays. The expectation that the proponents provide additional road reserve to accommodate anticipated parking is not acceptable, especially considering the redevelopment plans for Centenary Park do not show any suggestion that additional parking is required.

3.2.4 *The Department of Planning and Infrastructure impose conditions regarding the staging of revegetation and clearing to provide new habitats for mobile fauna.* (2)

Except for the wetland and river foreshore, there are relatively few corridors of vegetative habitat on-site that currently allow mobile fauna protective cover. The subdivision plan includes the provision of corridors of POS linking the wetland with the river foreshore. It is intended that the on-site foreshore vegetation and fauna

corridor will be maintained and enhanced and that the habitat connection between the river and wetland will be enhanced through replanting of overstorey and understorey native species.

3.2.5 *Proposed extensive use of timber boardwalks and retaining walls will not be supported should environmental approval be granted.* (2)

Retaining walls will be constructed using reconstituted limestone. The walls would require nil or negligible ongoing maintenance. Similarly, alternatives to timber boardwalks are available and the proponent is willing to discuss the implementation or otherwise of these alternatives with the City of South Perth.

3.2.6 *The proposed subdivision design shown in the PER does not provide any comprehensive strategies to deal with the lack of management access between private lots and the wetland areas.* (2)

The City of South Perth planning officers attended the design workshops and the issue of direct lot frontage and access was not raised as an issue by them. While this form of development has been approved in other estates across the metropolitan area, in particular the award winning Peninsula Estate in Maylands (UDIA and Planning Institute Awards for excellence in environmental management), the proponent is agreeable to providing road frontage along both the wetland and the river foreshore parts of the site apart from the western section of POS abutting the western area of wetland which will be revegetated as a sloping dryland buffer. In doing so, management access to both the wetland areas and river foreshore will be provided.

3.3 PER Assessment Process

3.3.1 *The PER states that "JDA Hydrologists concluded that the subdivision design would not significantly alter the water balance of the wetland" (PER p. 75). That may be the case, however, the proposed subdivision design has not been formally considered by the City of South Perth and it is not likely to be supported in its current form. The PER process has blurred the boundary between the concept plan and final design.* (2)

As part of detailed hydrological investigations undertaken at the site, a water balance analysis of the wetland for both surface and groundwater inflow was conducted (JDA, 2004). Groundwater was found to contribute more than 80% of annual inflow to the wetland, and surface water less than 20%. Of the surface water component, the vast majority of flow is contributed from existing external urban catchments.

The principles adopted for post-development water management for the proposed subdivision designed in consultation with the DoE are maintenance of groundwater inflow to the wetland, and all stormwater from development within the site are to be diverted away from the wetland.

JDA (2004) found that based on these principles, the wetland water balance would not be significantly altered from its existing hydrological balance for the proposed

development plan. Given the nature of the existing wetland water balance, this finding is considered to be robust and not sensitive to changes in the proposed subdivision design, if the adopted principles for water management are maintained.

3.3.2 *Concerns were raised during the preparation of the PER scoping document including the loss of considerable habitat for wildlife, extensive additional filling of the wetland and the cost of future management of the POS areas. The PER has failed to address these concerns.* (2)

As a result of the development, the existing Foreshore Reserve and its associated habitat will be afforded greater protection than it has at present, and the freshwater wetland will be protected in part. It is intended that the loss of wetland area in the eastern portion of the wetland will be compensated for by the creation of wetland habitat in the south-western portion of the site between the freshwater wetland and the river foreshore reserve.

The development of the site will ultimately result in additional rates (revenue) for the City of South Perth and accordingly the ability for the City to financially manage the open space areas created as a result of the development as it does for POS areas located in other residential developments in the City.

3.3.3 *Additional assessments were requested to be undertaken – the PER has failed to provide the additional information.* (2)

The proponent met with the City of South Perth officers on several occasions including a workshop and also with the City's environmental consultant. The issues raised in the PER submission appear to originate from a discussion with the City's environmental consultant. The PER contains responses to most issues in the City of South Perth's submission. Some did not appear to have been raised at the time (eg. shading of samphires) while others raised were not able to be accommodated in the final subdivision design (eg. protection of more remnant trees and shrubs; and minimising retaining walls). This does not mean that the PER has failed to provide the additional information requested. It means that the proponent was not able to meet all the City's environmental consultant's requests.

3.3.4 *The City of South Perth has had no contact with the State agencies during the development of the draft PER. Discussions with representatives from the Department of Environment suggest that the document has been reviewed three times within the agency.* (2)

EPASU to comment.

3.3.5 *The PER does not provide an adequate description of the environmental values of the site, lacks best management principles and proposes insufficient future studies and management plans to address the environmental values of the site.* (2)

3.3.6 *The document lacks a holistic approach in the assessment of the site, in particular relating to the ecology. It is not considered that the current*

document adequately addresses all the necessary issues and is vague regarding the extent of future protection and management of the area. (5)

The assessment of both the site as a whole and wetland habitat values specifically was undertaken during fieldwork undertaken at the site between 2000 and 2002. The biological surveying was conducted prior to referral of the proposal to the EPA. The appropriateness of the surveying was considered by the EPA Service Unit during preparation of the Scoping Document for the PER. As a result, the methodology was endorsed by the EPA and no further work (future studies) was required apart from the interpretation of the results for field work already undertaken. The proponent has made a commitment to prepare and implement a number of management plans that cover what the EPA considered to be the most important environmental values pertaining to the site.

3.4 Constructed Environment

3.4.1 *Plans to use soakwells and on-site infiltration for residential stormwater are not supported due to the relatively high groundwater levels. Similar plans to use Atlantis cells are also not supported with the City's stormwater management standards.* (2)

The majority of area on the northern side of the wetland has very good clearance to groundwater and sandy soils to allow infiltration. Most areas have in excess of 2m clearance from groundwater to natural surface, increasing to in excess of 5m in some areas (refer PER, Figure 10). The use of soakwells and on site infiltration is the recommended Best Management Practice by the DoE and is also consistent with the City of South Perth's Groundwater Management Policy (Policy P303) of maximising aquifer recharge.

The site will be filled to ensure that sufficient freeboard (1.5m) above AAMGL exists such that infiltration systems can be used. This approach has been used successfully in numerous residential developments in the Perth Metropolitan area and is a Best Management Practice for water sensitive urban design.

Similarly, the use of Atlantis cells or similar direct infiltration system is a Best Management Practice for water sensitive urban design and the use of such systems should not be discouraged.

3.4.2 *Access pressures on the river foreshore must be addressed. This is a major cause of river degradation. Access by vehicles for boat launching would be inappropriate for the area because of its shallow waters and bird roosting importance. Uncontrolled and informal access by foot-traffic is also a major cause of deaths of Juncus kraussi that grow at the inter-face between the tidal zone and the dry land and are a vital component in erosion control and sustainable management of our river foreshores.* (7)

The proponent has committed to preparing and implementing a Foreshore Management Plan for the on-site area of POS abutting the existing MRS foreshore reserve. In keeping with discussions held between the proponent's environmental consultant and officers of the Bush Forever Office, it is not intended that the proponent undertake rehabilitation works within the MRS foreshore reserve. The Plan will however deal with *inter alia,* controlling vehicle and pedestrian access to the foreshore reserve. There has never been any proposal by the proponent for a boat launching facility to be constructed at East Clontarf.

The proposed on-site area of POS located at the foreshore reserve/proposed development site interface, will be rehabilitated to create a habitat for wildlife and provide an opportunity for community ownership and enjoyment.

3.4.3 *Access must be provided for the City of South Perth to maintain the revegetated area. Without this maintenance there will be a spread of exotic plants into the revegetated wetland and the possibility that it will once again become degraded.* (5)

The treatment of the interface between the proposed development and the wetland area has been sensitively considered to ensure that the long-term viability of the wetland is achieved and importantly that the amount of maintenance works required post-development is limited. The proponent is agreeable to providing road frontage along both the wetland and the river foreshore parts of the site apart from the western section of POS abutting the western area of wetland which will be revegetated as a sloping dryland buffer. In doing so, management access to both the wetland areas and river foreshore will be provided.

3.4.4 *This site is part of a major aesthetic focus for the local community. It is essential that any development proposal contains elements that will secure the integrity of the river system and it's associated flora and fauna so that equity is maintained for present and future generations.* (7)

The subdivision design aims to achieve view corridors along roads to the wetland, the Canning River and the Clontarf College to engage the river and provide public access, thereby maximising the benefit from the existing physical characteristics and providing strong relationships with the wetland areas.

3.4.5 *There is either limited or no buffer zones planned between the development and existing river, marshland and wetland habitat areas. There are unobvious linkages and buffer zones proposed in the development to maintain these discrete habitat zones. There appears to be little understanding in the report about these habitat zones and their ecological value. Reduced size and increased fragmentation of fragile and unique habitat zones will decrease the ecological value of existing habitat and potentially lead to greater degradation and aesthetic loss.* (7)

The buffering of the wetland is proposed to be provided as part of the rehabilitation works within the wetland area through to the Canning River. Significant rehabilitation works will be necessary within and around the wetland itself to enhance

the existing ecology. The excavation of the constructed wetland in the southwestern portion of the site adjacent to the Canning River will connect the wetland with the river via the existing freshwater drain.

There is no requirement to provide a buffer to the Canning River as the foreshore reserve under the Metropolitan Region Scheme has been determined and the land capable of urban development zoned for urban purposes. It should be noted that additional land adjacent to the Canning River has been provided as public open space on the plan of subdivision as a means of increasing the setback of the proposed development from the river.

3.4.6 *The edge effect is a major cause of weed contamination and remnant vegetation. More detailed studies by ecological professionals should be commissioned and advice followed prior to approval of any development.* (7)

There are extensive areas within the current proposal where the edge of the wetland is bounded by either a public road or upland areas of public open space. On the proposed subdivision design, approximately one-third of the edge is bounded by residential lots. As previously stated, the proponent is agreeable to providing road frontage along both the wetland and the river foreshore parts of the site apart from the western section of POS abutting the western area of wetland which will be revegetated as a sloping dryland buffer.

3.4.7 *The PER states that "details on stormwater management will be prepared" (PER p. 59). The PER lacks clear guiding principles for managing this issue.* (2)

The proponent has committed to preparing and implementing a Drainage, Nutrient, Irrigation and Water Quality Management Plan (commitment 9, p.20 of PER). This plan will include (but not be restricted to) the following issues:

- Design and construct the detention/infiltration basin.
- Periodic monitoring of the infiltration basin (post-construction) to ensure continued function and maintenance as required.
- Maximising infiltration of uncontaminated stormwater at sources to recharge the groundwater system.
- Water conservation principles.
- Nutrient control.
- Prescribed fertilizer applications for areas of POS.
- Determination of flushing requirements, associated impacts and management options.

- Treating contaminated stormwater via gross pollutant and sediment traps.
- Directing treated stormwater into the Canning River along the south-eastern corner boundary of the site (as per DoE advice).
- Monitoring criteria to determine the success of the plan.
- Progress and compliance reporting.
- Timing and implementation schedule.

The plan is currently to be prepared to the satisfaction of the Swan River Trust and the DoE. The proponent will ensure appropriate consultation with the City of South Perth occurs over the development of this plan.

3.4.8 *The hydrology report (Appendix 6) considers that there are unconfined seeps along the northern boundary of the wetland which discharge at considerable rates. Figure 3 shows that this area will have extensive retaining walls and offers no detailed strategies for drainage management.* (2)

Diffuse groundwater flow to the wetland along the northern boundary would be maintained following development and construction of retaining walls via subsoil drainage. The detailed engineering design of this drainage will be managed in consultation with the DoE and the City of South Perth subsequent to subdivision approval being sought.

3.4.9 *Plans for extensive retaining walls are not endorsed due to future maintenance and management requirements.* (2)

Retaining walls will be constructed using reconstituted limestone which has greater wearing characteristics than natural limestone. Notwithstanding, many of the retaining walls constructed will be in private property and will therefore be the responsibility of the lot owner. The proposed use of retaining walls in public areas is limited.

3.4.10 *There is no mention of the location of the sewage disposal for the proposed subdivision.* (2)

The proposed pump station will be located in the south-east corner of the site, adjacent to Centenary Avenue. The detail of the sewer will be managed in consultation with the Water Corporation and DoE at the time of detailed engineering design subsequent to subdivision approval being sought.

3.4.11 *Attention is drawn to the following points:*
The Government Sewerage Policy – Perth Metropolitan Region requires the provision of reticulated sewerage to all developments.
The buffer zone between residential developments and construction sites will need to be acceptable to the DoE. (9)

Reticulated sewer will be provided to the development. Water Corporation forward planning indicates a pump station will be located within the East Clontarf development area. The pumping station will service the development as well as surrounding existing residential areas. It will be constructed by Water Corporation (or by the proponent as a prefund item) and all design will be in accordance with Water Corporation and DoE criteria.

3.4.12 *The PER states that the "proposed boardwalk and pedestrian network excludes vehicular and therefore management access" (PER p. 44). While this is a limited environmental issue (shading), it will severely affect ongoing management.* (2)

3.4.13 *The PER does not provide any comprehensive management strategies to deal with lack of access between private lots and the wetland areas. Access for weed control, fire management and general boardwalk maintenance is not facilitated with the current design.* (2)

The subdivision design will be amended so that there is a road frontage between the residential areas and the majority of the wetland thereby allowing access for management purposes. This will enable access by vehicles to all parts of the wetland apart from the western section of POS which will be revegetated in the sloping dryland buffer. The proponent will also amend the subdivision design to eliminate the proposed boardwalk if required.

3.4.14 *The DUP referred to in the text as being built along the foreshore is not shown in Figure 3 as indicated in the text making it impossible to provide comment on.* (6)

The proponent acknowledges that the purpose of the foreshore reserve is generally to ensure protection and conservation of a watercourse and the ecosystems it supports. Protection of the integrity of the watercourse, including the attributes and functions associated with it, benefits to other users and values of the foreshore area such as recreational use and landscape amenity have been important determinants in the development of the proposed residential subdivision.

All of the foreshore vegetation adjacent to the Canning River and contained within Bush Forever Site No. 333 will be protected within an additional 6000m^2 of POS that will abut the Bush Forever Site and will act as a buffer between the proposed development and the Bush Forever Site.

The objective of retaining and enhancing the existing native vegetation within the POS area and foreshore reserve will be achieved by controlling access to designated paths.

Discussions held between the proponent and Parks and Recreation officers from both the City of Canning and City of South Perth encouraged the inclusion of a DUP as part of planned DUP network along the river foreshore. Allowance will be made for a DUP to be constructed by the local government authority on estate land. The inclusion and final route of the DUP will be determined as part of negotiations with relevant government agencies during the preparation of the Foreshore Management Plan.

3.4.15 *The information relating to filling the wetland, total area protected and enhanced and the foreshore areas presented in the PER vary and are unclear.* (2)

The areas of the wetland proposed to be filled, the areas to be protected and the areas enhanced are shown on the attached figure. Calculations indicate that the POS provision for the site is 1.8063ha based on 10% of the gross subdividable area. The subdivision plan shows a total of 4.7234ha of POS which equates to an open space provision (excluding the foreshore reserve) of 26.14% (ie 16.14% greater than policy requirements.

3.4.16 *Some aspects of the PER are consistent with augmenting existing landscape features with local native species, however, other aspects are contrary to the policy (ie. The Green Plan, 2002). A more suitable compromise would result in the creation of fewer linear reserves.* (2)

The whole basis of the subdivision design is to achieve view corridors along roads to the wetland, the Canning River and the Clontarf College to engage the river and provide public access, while enabling the restoration of a degraded wetland. At the same time, these linear reserves allow a habitat linkage to be created between the central wetlands and the Canning River via the existing drainage line, enabling fauna movement between these adjoining areas to take place.

3.4.17 *There is no map clearly showing the location of the compensating basin. The Trust has generally not supported the use of drainage basins in such situations other than where soil conditions necessitate that approach. The use of public space for drainage basins restricts the amount of public open space as drainage basins take up land that may otherwise be used for recreational purposes.* (5)

A drainage basin adjacent to the eastern picnic area is proposed. Its location will take recognition of existing vegetation. The drainage proposed for the site has been suggested by and agreed with the WRC as advised by the WRC on the 26 September 2002. The provision of a drainage swale in the southern area of the site is currently being investigated, though the intention was that the drainage would be treated prior to discharge into the Canning River as specified by the WRC in its advice letter. The detail of the drainage will be managed at the time of detailed engineering design subsequent to subdivision approval and best management practice urban water management design as specified by the DoE in the Stormwater Management Manual.

4. SUBMISSIONS RELATING TO BIOPHYSICAL FATORS

4.1 Wetlands

4.1.1 *The wetland is evaluated as a Resource Enhancement management category wetland possessing important values and functions including:*

- *'Good' vegetation condition which qualifies it as possessing 'significant natural attributes'*
- *location at which the groundwater contaminant dilution process occurs*
- *yields the daily fresh water required by the large Black Swan population at Clontarf Bay*
- *provides habitat for a variety of wetland fauna*
- *is significant to the Aboriginal community*
- *the wetland type is uncommon for the consanguineous suite and the habitat is uncommon for the consanguineous suite*

The proposal to develop over a portion of this wetland and to construct a 'wetland' is not consistent with the objectives of managing, restoring and protecting the existing wetland. (10)

The DoE's Wetlands Program consider the wetland to be a high value Resource Enhancement wetland because it possesses important values and functions, such as the condition of the vegetation, the importance of the fresh water that passes through the wetland and enters Clontarf Bay, as habitat for wetland fauna, its significance to the Aboriginal people and the uncommon type of wetland in the Swan River Estuary suite.

The importance of maintaining the volume and quality of fresh water through the wetland and out into Clontarf Bay has been considered extremely high by the proponent's project team. The hydrological studies (PER Appendix 6) have provided information as to the functioning of the wetland both in terms of process and quantitatively with respect to flows. The role of the wetland in the hydrological system and the dilution of groundwater contaminants have also been examined with the result that the process is most likely to be one of dilution rather than absorption or uptake within the wetland itself. The hydrological studies have shown that the proposed development will not affect the volume or quality of water entering Clontarf Bay in the long-term.

The proponent has committed to preparing and implementing a Dewatering Program as part of the overall Construction Environmental Management Plan for the site. This Program will detail mitigation measures designed to protect wetland vegetation, surface water and groundwater quality during construction activities.

All wetlands provide some habitat for wetland fauna. This attribute in itself does not automatically mean that the wetland has important values and functions. The DoE's Wetlands Program has not demonstrated which particular fauna habitat is considered to give the wetland its important values and functions. Nevertheless, the proposal to retain approximately 60% of the original wetland and replace the area to be developed

with a newly constructed wetland linking the wetland with the Swan River will increase the type of habitat available to wetland fauna.
The proposal will lead to significant positive results for Aboriginal people including:

- inclusion of Aboriginal interpretive material in open space areas;
- inclusion of indigenous plants in the areas to be revegetated;
- participation by Aboriginal people in the rehabilitation works;
- a green edge to the eastern side of the Clontarf Campus; and
- provision of funds to enable the continued maintenance of the Clontarf Campus when it is handed over to the Aboriginal people.

Consultation with Aboriginal people by the proponent resulted in endorsement of the proposal provided that the existing wetland area to be kept and the wetland area to be constructed are done in a natural way rather than as a highly landscaped ornamental lake. The PER provides guidelines and diagrams on the type of natural wetland areas that are envisaged for the development. The development of the wetland areas will be guided by the preparation and implementation of a Wetland Management Plan.

The objective for Resource Enhancement wetlands is to manage, restore and protect the wetland towards improving their conservation value is not possible for the East Clontarf wetland. The initial proposal in the PER to remove areas of Bulrushes (*Typha orientalis*) and replace with native reed species is now considered to be extremely difficult and without any precedence in Perth in areas of shallow water to indicate that permanent replacement of the Bulrushes is possible. Several submissions have also indicated this position. As a result, the areas of Bulrush that occur in the part of the wetland to be retained will not be removed. This means that the objective of restoring and improving Resource Enhancement wetlands such that in the long term they may become Conservation Category Wetlands is not possible due to the inability to remove the large stands of Bulrush. In addition, any other practices that could improve the value of the wetland even without removing the Bulrushes would come at considerable expense.

4.1.2 *The proposed 'no net loss of wetland area, vegetation and function' is not considered to be an equivalent of the EPA objective, "To maintain the integrity, ecological functions and environmental values of the wetlands environment". The PER assumes that a wetland with equivalent values and functions to the East Clontarf wetland will be created by excavating an area, connecting it hydrologically to an existing wetland, and planting it with selected species of wetland vegetation. It has not demonstrated that the replacement wetland will have equivalent functions and values, or will function as a wetland at all.*(10)

The area to be created as a wetland is large enough (approximately 2.1ha) to include a range of wetland vegetation types, including sedgeland, shrubland heath and woodland. The final design of the wetland will be addressed in the Wetland

Management Plan and will require approval from the relevant government agencies. There are numerous constructed wetlands in the Perth Metropolitan Region that have been built and function as wetlands. The newly constructed wetland area on the Perth foreshore near the causeway constructed by government agencies is touted as an example of how a wetland can be built next to the Swan River with ecological and nutrient attenuating functions.

It is true that the wetland has evolved over geological time but it is contended in the PER that recent human activities have had a significant impact on the original condition of the wetland. Such impacts include filling in part of the wetland on the southern side, establishment of small market garden plots on the wetland, excavation of a drain to connect the wetland with the river, clearing of all of the buffer and replacement with a pine plantation and stands of Tree Lucerne and other non-local tree species, dumping of uncontrolled fill in the land south of the wetland, and the draining of stormwater from the roads directly into the wetland.

The proposal has the objective of maintaining the current hydrological and ecological values and functions of the wetland and improving the overall environmental position in the context of a residential development, without which the improved environmental position would not occur. The proposed improvements to the wetland include the creation of fauna habitat between the wetland and the river providing greater wildlife corridor value, removal of uncontrolled fill from the site, and treatment of stormwater within the wetland system.

4.1.3 *It is considered technically feasible to retain the existing wetland within a residential subdivision that sensitively integrates the wetland with the residential estate and Canning River, in order to maintain a sustainable wetland environment. The proponent has not sought to demonstrate otherwise.* (10)

The rehabilitation of the entire site together with proposed integration and funding of Clontarf Campus will involve significant capital works. This requires rehabilitation and reshaping of the wetland, removal of uncontrolled fill throughout, development and implementation of numerous management plans for foreshore wetland, river and drainage etc.

Retaining the existing wetland boundary and associated buffer would reduce the developable area by 37% or 64 lots. This would significantly compromise the project feasibility given the high level of fixed costs and restrict options for rehabilitation of the site. Furthermore the site would effectively be separated into two nodes with limited traffic access to adjoining roads.

4.1.4 *The wetland is registered under both the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 and the Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004 and as such is designated a 'critical asset' of which the EPA has state that "it does not consider it appropriate to validate or endorse the use of environmental offsets where projects will have significant impacts.." The proposal is inconsistent with the principles outlined in EPA Preliminary Position*

State No. 9, particularly that "Protection and conservation of existing environmental assets will always remain a priority above the use of environmental assets."(10).

The draft position statement (Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004) designates that for 'critical assets' the EPA will not consider it appropriate to validate or endorse the use of environmental offsets where projects will have significant adverse impacts. The proponent contends through the PER that the proposal will not have a significant adverse impact. In fact, the proposal should lead to an improved environmental outcome by the creation of fauna habitat between the wetland and the river, providing greater wildlife corridor value, removal of uncontrolled fill from the site, and treatment of stormwater within the wetland system.

The EPA's mitigation sequence has been followed as indicated below:

- Avoid - As shown in Response 4.1.3 above, it is not possible to develop the site commercially and avoid impacting the wetland.
- Minimise - The area to be disturbed is approximately 1.57ha or 40% of the wetland.
- Offset - An area of approximately 2ha will be created as a wetland containing a variety of fauna habitats and in a favourable location between the wetland and the river.

4.1.5 *The DoE's buffer requirements are outlined in the WRC Position Statement (2001) and the proponent's justification for the absence of a buffer between the wetland and the development is not supported. Wetland buffers serve many roles and the rationale put forward by the proponent for not retaining a wetland buffers fails to address these roles. The ecological values and functions of the wetland can be maintained by having a buffer between the wetland and the development.* (10)

The application of a buffer around the wetland would result in no development on the site. Without development there is no potential to improve the wetland values and functions on the site, the uncontrolled fill would not be removed and the benefits for Aboriginal people would be far less.

The submission identifies a number of functions for wetland buffers some of which are valid others of which are not relevant. For example, take-off and landing of larger avifauna (there is currently no open water in the wetland), distance between wetlands and powerlines (there will be no powerlines), source of shade (no trees in the buffer), tannin (no paperbarks or native trees in the buffer), barrier to weed invasion (the buffer is almost completely full of weeds).

The proposal aims to improve the western section of the wetland buffer by revegetating with native upland species, most probably a mixture of Marri trees, Banksias and appropriate understorey species. This area will provide some habitat for

aestivating and burrowing frogs and habitat for birds and reptiles. Residential development close to the wetland and other areas will not increase the level of nutrients entering the wetland as the lot sizes are relatively small and the area of garden will be very small accordingly. In addition, a Drainage Nutrient Irrigation and Water Quality Management Plan will be prepared.

4.1.6 *The reasons given for the downgrading to Resource Enhancement Management Category are inadequate. A more detailed explanation should be given to provide comment on, particularly given the impact this change will have on protection of the wetland, with Figure 4 indicating portions will be excavated to provide an open water body, which is not a naturally occurring feature of the wetland present.* (6)

The boundaries of the wetland and the re-assessment of the wetland category have been endorsed by the DoE's Wetlands Program. The wetland was shown to not be a part of the peripheral estuary system although it may have been in the past prior to filling of the area between the wetland and the river. The proposal aims to re-create the link of the inland wetland section (freshwater seepage) with the river by constructing a new wetland area between the freshwater seepage wetland and river. The PER mentions that this area will be a Paperbark over *Juncus* wetland, however there is room to provide a more diverse range of wetland vegetation types.

4.1.7 *We disagree with the statement "the wetland is modified because it is completely covered in vegetation" (PER p.64). The wetland present is a typical salt marsh vegetation community called 'Schoenoplectus validus Community' and does not, in its natural state, provide a diverse natural environment. The community typically consists of a monoculture of Schoenoplectus validus and is typical vegetation of a freshwater seepage into an estuarine margin.* (6)

An examination of Figure 7 of the PER indicates that the wetland is covered by an array of plant species rather than a *Schoenoplectus validus* monoculture. Currently other more aggressive sedge species are outcompeting *S. validus*. Progressive mapping undertaken by the proponent's environmental consultant indicate that since vegetation mapping of the wetland commenced in 2000, the proportion of wetland inhabited by *S. validus* is shrinking as the areal extent of *Typha orientalis* and *Paspalum* sp. increases.

4.1.8 *It is stated within the PER that no buffer is needed near the wetland as it is operating without one now (PER p.67). This reflects a view that due to the current degradation no further protection is required. In this location there is an opportunity to enhance a wetland that has fallen into a degraded state.* (5)

The application of a buffer around the wetland (a 50m minimum) would result in no development on the site. Without development there is no potential to improve the wetland values and functions on the site, the uncontrolled fill will not be removed and the benefits for the Aboriginal people would be far less.

4.1.9 *There is an implied assumption that there will be no problem with flooding as the wetland drains to the estuary, however this does not address the event that the estuary waters back up and prevent drainage.* (5)

There is a considerable fall between the wetland and the river of approximately 1.5m. Minimum development levels are dictated by clearance to groundwater and as such are more than a metre above the indicated river flood levels.

4.1.10 *The PER states "No net loss of wetland values" (PER p.67). Subdivision design results in considerable fill being deposited over the bulk of the woodland, shrubland and most of the healthy sedgeland for subsequent housing development.* (2)

This submission statement is incorrect. The PER states that the proposed development will result in "no net loss in wetland area and will achieve a net gain in wetland function" (p.67). The proponent acknowledges that approximately 1.57ha of infilling of the eastern portion of the wetland is currently planned. Infilling will be occurring over areas vegetated by predominantly Bracken Fern, *Paspalum* sp. and *Typha orientalis*. This area of infill will be compensated for by the creation of a 2.1ha Paperbark and Flooded Gum wetland in the southwestern portion of the site providing a wider link between the western half of the wetland, the existing drainage line and the Canning River foreshore.

The area to be constructed as a wetland in the south-western portion of the site, as well as the proposed revegetation of the western dryland area, provides a relatively large area in which to provide a range of habitats including sedgeland, shrubland heath and woodland. The final percentage mix of each vegetation type and species to be used will be included in the Wetland Management Plan to be endorsed by relevant state and local government agencies. The Plan will contain agreed indicators that need to be met prior to handover of the area to the City of South Perth to manage.

4.1.11 *The statement that the development will result in no net loss of wetland vegetation is disputed. Deepening of the western portion of the wetland should not be considered 'rehabilitating to a more natural wetland' (PER p.66). Natural wetlands of these types are naturally vegetated, without large open water areas and naturally subject to seasonal flooding. The area of deepening should be included as a loss.* (6)

The initial proposal in the PER to remove areas of Bulrushes (*Typha orientalis*) and replace with native reed species is now considered to be extremely difficult and without any precedence in Perth in areas of shallow water to indicate that permanent replacement of the Bulrushes is possible. As a result, the areas of Bulrush that occur in the part of the wetland to be retained will not be removed.

4.1.12 *Without adequate assessment of the populations of animals that require habitat initially, it is not possible to justify that there will be no net loss of wetland values.* (2)

The assessment of wetland habitat values was undertaken during several visits to the site between May and December 2000. The survey was conducted prior to referral of the proposal to the EPA. The scope and findings of the assessment of was considered to be appropriate by the EPA Service Unit fauna policy advisers during preparation of the Environmental Scoping Document for the PER. As a result, the methodology was endorsed by the EPA and no further work was required apart from interpretation of the results.

4.1.13 *The area to be created, a floodplain vegetation type (Melaleuca rhaphiophylla over Juncus krausii), which is relatively common regionally should not be considered a replacement for the loss of a freshwater seepage wetland, which is not common regionally.* (6)

The area to be constructed as a wetland in the southwestern part of the site, as well as the proposed revegetation of the western dryland area provides a relatively large area in which to provide a range of habitats including sedgeland, shrubland heath and woodland. The final percentage mix of each vegetation type and species to be used will be included in the Wetland Management Plan.

4.1.14 *Proposed fill for the road along the foreshore will result in significant shading of the saltmarsh causing a reduction of this vegetation type.* (2)

The salt flats on the site are currently located straddling the existing foreshore reserve and within the urban zoned land. The proposal gives extra protection for the salt flats by protecting all salt flats outside of the development by the addition of POS. The road fill level in this area will be separated from the foreshore by a 1 in 3 batter. As the road in this area will be approximately 0.7 to 1.1m above the foreshore level, there will be no shading created by the road.

4.1.15 *The total extent of the wetlands quoted as being filled in the reports does not appear to equate with other estimates. These figures need to be checked.* (2)

4.1.16 *The development of the site will result in the loss of 1.57ha of wetland dependant vegetation in the eastern portion of the wetland.* (3)

4.1.17 *The maps provided are incongruent. There are significant discrepancies in the information provided regarding the amount of land reserved as a wetland corridor.* (7)

The areas identified in the PER document related to the loss of the eastern portion of the wetland (1.388ha) and the road crossing (0.190ha) encompass a total area of 1.578ha.

To assist with understanding the components of the wetland replacement and public open space provision across the site, we have prepared an areas plan illustrating each component (refer to Figure 1).

4.1.18 *The area of wetland vegetation to be removed is understated in its value within the text 'a small area of native shrubs exist in the south east corner of the wetland' (PER p.51). The only areas of Agonis linearifolia (Taxandria linearifolia) are being removed without the species being included in the species list for revegetation.* (6)

This submission is disputed. The Appendix 2 revegetation species list includes *Agonis linearifolia* in the shrub and herbaceous species section.

4.2 Vegetation

4.2.1 *The species list includes regionally uncommon species such as Baumea articulata and Leptocarpus diffusus (now Leptocarpus laxus), Triglochin mucronata and Villarsia albiflora. With the information provided it is impossible to tell whether these species will be part of the vegetation removed or not. A more detailed description of the vegetation communities present needs to be provided, including the species found in each community.* (6)

4.2.2 *Schoenoplectus validus is not included in the Appendix 3 species list, but appears as a dominant species in Figure 7.* (6)

4.2.3 *The biological assessment is flawed as some conspicuous plant communities (Baumea articulata stands) have not been identified in the main body of the text and maps as occurring on the site.* (2)

The 'regionally uncommon' description of some of the species including the very common *Baumea articulata* is questioned. None of the species listed is a Declared Rare or Priority Flora.

Slight inconsistencies in the species list and the text are of little consequence to the overall significance of the proposal in attempting to improve the current environmental condition of the site, particularly the wetland and its link to the river.

4.2.4 *The PER deals predominantly with construction impacts (PER p.58) and not with ongoing potential impacts that the change in land use adjacent to the river is likely to create. Access to the foreshore reserve and the increased urbanisation of the site could result in the disturbance of the existing riparian vegetation.* (3)

4.2.5 *The site contains one of the last salt flats (marshland) in the area, most likely to be significantly threatened by the influx of human and associated activity. Ecological assessment of each floristic community relating its association and importance within Swan Coastal Plain should be commissioned and followed.* (7)

4.2.6 *The public open space abutting on to the saltmarsh in the south-east corner of the development may encourage people to enter that area and measures will need to be taken to control access to the area.* (5)

4.2.7 *The central wetland areas and foreshore fringe vegetation is reported as being in good condition (PER p. 51). The foreshore area is included in Bush Forever Site 333 and is classified as a Conservation Category Wetland Site. It is acknowledged that it is not proposed to clear any vegetation from the Bush Forever site, however the increased urbanisation of the adjoining development site could impact negatively on the foreshore environment. The impact assessment with the PER focuses on impacts relating to the construction phase and does not specifically address possible impacts that the increased number of people resulting from the change in land use may have on vegetation within the Bush Forever site.* (3)

The salt flats on the site are currently located straddling the existing foreshore reserve and within the urban zoned land. The proposal gives extra protection for the salt flats by protecting all salt flats in land outside the development by the addition of an area of POS next to the foreshore reserve. The salt flat area is currently subject to disturbance from people. Currently, the proposed development includes a small retaining wall and barrier fence to deter public access to this area following development. The proponent has committed to preparing and implementing a Foreshore Management Plan to the satisfaction of agreed regulatory authorities. This plan will, in part, deal with controlled access to the Bush Forever site.

4.2.8 *Sporobulus virginicus is not a weed species, and any naturally occurring areas should be retained as it is now very uncommon along the foreshore and in some areas its reintroduction is now being encouraged.* (6)

Noted.

4.2.9 *It is suggested Baumea articulata and Leptocarpus diffusus are added to the species list for revegetation as it is already present on site, and are available from nurseries.* (6)

Noted.

4.2.10 *According to wetland mapping (Hill et al., 1996) the wetlands present are estuary (peripheral), that is, that part of the estuary is subject to seasonal flooding. The vegetation present is Swan Complex, of which only 11% remains on the Swan Coastal Plain. This basic data is not mentioned in the document.* (6)

The boundaries of the wetland and the re-assessment of the wetland category have been endorsed by the DoE's Wetlands Program. The wetland was shown not to be a part of the peripheral estuary system although it may have been in the past prior to filling of the area between the wetland and the river. The proposal aims to re-create the link of the inland wetland section (freshwater seepage) with the river by

constructing a new wetland area between the freshwater seepage wetland and the river. The PER mentions that this area will be a Paperbark over *Juncus* wetland, however there is room to provide a more diverse range of wetland vegetation types.

4.2.11 *The map of the vegetation communities (Figure 7) and the site descriptions (PER p. 50) is inaccurate as it fails to identify the true extent of most of the different vegetation types known to occur there by City of South Perth officers.* (2)

The proponent disputes this submission and has cross-referenced the information contained within pages 50-51 of the PER with Figure 7. Vegetation surveying of the site has been undertaken by professional botanists, surveying on behalf of the proponent, on a number of occasions since the initial environmental assessment in 2001. With each successive survey, vegetation mapping has been updated to reflect changes in vegetation type and extent based on the latest surveying data.

4.2.12 *The PER does not address the City of South Perth's concerns about significant vegetation loss from the river foreshore and adjoining wetlands.* (2)

The PER states (p.76) that all of the foreshore vegetation contained within Bush Forever Site No. 33 will be protected with an additional 6000m^2 of POS that will abut the Bush Forever Site to act as a buffer to development. The proponent acknowledges that approximately 1.57ha of the existing wetland will be filled (PER p. 66). This loss will be offset by the construction of 2.1ha Paperbark and Flooded Gum wetland in the south-west of the site providing a wider link between the western half of the wetland and the river foreshore. Refer to Figure 1.

4.2.13 *The PER refers to some areas of vegetation as good to very good (PER p. 51) using the vegetation condition rating of Keighery (2004). The vegetation condition should be shown with the subdivision overlayed to enable more accurate interpretation of the text against the maps.* (2)

4.2.14 *The vegetation typically associated with Estuaries is rarely intact, generally being in degraded condition, usually backed by road, recreation land or housing (Government of WA, 2000). Therefore, in a regional context, any remnants of this vegetation complex, regardless of condition, are of high conservation value.* (6)

The PER refers to the wetland vegetation classification as Good with the foreshore vegetation being classified as Very Good although there are some Completely Degraded areas that have been severely impacted by filling. The condition of the vegetation was assessed using the rating scale provided in Bush Forever (Government of Western Australia, 2000). The proponent has made a commitment to prepare and implement a Foreshore Management Plan that will, among other issues, focus on identifying degraded areas that exist on-site and incorporating rehabilitation plans in order to improve their condition.

4.2.15 *The City of South Perth's preference is for improvement of the existing wetlands rather than creation of new wetland areas, as experience has shown that there is limited capacity to adequately establish these systems prior to handover of responsibility to local government. There are considerable cost implications associated with this.* (2)

The area to be constructed as a wetland in the southwestern portion of the site, as well as the proposed revegetation of the western dryland area provides a relatively large area in which to provide a range of habitats including sedgeland, shrubland heath and woodland. The final percentage mix of each vegetation type and species to be used will be included in the Wetland Management Plan to be endorsed by relevant government agencies. The City of South Perth will be added as an agency that will be required to provide advice. The Plan will contain agreed indicators that need to be met prior to handover of the POS area to the City of South Perth to manage.

4.2.16 *The proximity of the marri stand to the housing is an issue. It will be difficult to manage overhanging branches as the trees continue to mature.* (2)

4.2.17 *The protection of the marri stand is considered to be critical, however the current subdivision design places their longevity in question.* (2)

The urban design for East Clontarf proposes to contain the majority of the stand of Marri in the south east corner of the site within POS and road reserve. The inclusion of the Marri stand within POS ensures that the long term survival of the marri trees is enhanced through retaining the natural ground levels around the trees and ensuring sufficient separation from the trees for services and retaining walls.

The retention of the trees within a lineal park as shown on the plan of subdivision also provides a strong link between the river foreshore and the remainder of the estate for pedestrian movement.

4.2.18 *City of South Perth disagrees with replacing an environmental weed in the landscaping (PER p.58). If the proponent can demonstrate that it is preferable to utilise tagasaste in the short term, while the suitable native species are developing into thickets, then the City may consider this approach.* (2)

The proponent is agreeable to utilising tagasaste in the short-term. This will be achieved by planting tagasaste thickets in the upland area located to the north of the proposed constructed wetland and in the western dryland area of POS. Native species preferred by the honeyeaters (eg. *Banksia* sp. and *Grevillea* sp.) will also be planted within this area to add diversity and attract birdlife.

4.3 Significant Flora

4.3.1 *The PER states that several flora surveys were conducted on the development site from 2001 to 2003 (PER p.54). No indication is given to the timing or methodology of the flora surveys or who conducted them.* (3)

4.3.2 *The PER refers to the list of populations of significant flora in the vicinity of East Clontarf, there is no specific indication of whether any flora survey effort was carried out on the basis of threatened species that may occur. Further detail on whether there was any effort to locate potential sensitive flora species found locally, or whether a habitat suitability assessment was carried out for the project area should be provided.* (3)

4.3.3 *No references are provided for the 'previous surveys' described, no detail is given on the survey methods, timing of flora survey, or who undertook the surveys referred to. This information is particularly important as some of the significant species are seasonal or/and are difficult to identify ie particularly sedge species such as Schoenus sp. which are often overlooked by less experienced botanists. Therefore it is impossible to know from this section (PER Section 3.3.2) if the statement that no Declared Rare or Priority Flora will be affected by the development is accurate.* (6)

Between 2000 and 2003, a number of flora and vegetation surveys were undertaken by professional botanists employed by the proponent's environmental consultant. These surveys have been undertaken during varying times of the year and using accepted survey methodology. Surveying was also undertaken during the relevant flowering seasons to verify presence or absence of Declared Rare Flora potentially occurring in the area.

There is no possibility for the Declared Rare orchid species *Caladenia huegelii* being located on-site as the site is severely disturbed/cleared apart from sections of the wetland and foreshore which are not suitable for this orchid species.

4.3.4 *A comprehensive vegetation survey should be a requirement, particularly as it is unusual Sarcocomia quinequeflora was not identified as it has been previously identified as a structural unit present in the area (Government of WA, 2000).* (6)

Sarcocomia quinequeflora was not identified during any surveys undertaken on-site. *S. quinequeflora* may be listed as an understorey riparian species in Bush Forever however it is not listed as a Significant species by either the Bush Forever study or CALM's Declared Rare Flora list. Should its normal habitat be within the Bush Forever No. 333 site, then it will be protected by virtue of the Foreshore Reserve and additional POS area that will function as a buffer to the proposed development area.

4.4 Fauna

4.4.1 *Black swans and migrating birds frequent this site. It is known locally as a breeding site for black swans and it is an important biodiversity link*

between the Canning estuary and the Canning River Regional Park. There are two issues regarding the development that will most likely have a negative affect on the entire bird population:

a. *The development plans impact significantly on the size of available wetland, thus on the available refuge for the swans and other breeding birds.*
b. *Increased human and domestic pet populations may render the site unattractive to many bird species.*
c. *Professional advice regarding the potential affects of disturbance from increased alien populations to birdlife should be followed. A buffer of riverine vegetation, sufficient to maintain the value of the breeding site and the integrity of the foreshore, should be planned between any proposed development and the foreshore zone.* (7)

It is acknowledged by the proponent that Black Swans frequent the site in autumn however breeding has not been recorded on site (ATA Environmental, Bamford Consulting Ecologists and M P Rogers and Associates, 2000). The Black Swans currently use the fresh water inflow from the creek and drains and the foreshore reserve. Both the creek and drain will remain as part of the development and the foreshore reserve will be enhanced to increase the habitat quality and use of the area by swans and other breeding birds. Therefore, there should be no reduction in habitat for Black Swans. Note that migratory bird species were rarely recorded at the site, and the habitat is generally not suitable for large numbers of migrants such as shorebirds (waders).

It is agreed that there is potential for disturbance by people and domestic pets to negatively impact upon waterbirds. Therefore the proponent has committed to constructing 'dog-proof' fences around the foreshore reserve if requested by the EPA. A low fence at Alfred Cove has been very successful in reducing disturbance impacts upon waterbirds simply by restricting (but not preventing) access.

Other initiatives to minimise the effects on native avifauna include the revegetation and restoration of foreshore POS that adjoin conservation areas with appropriate indigenous flora, and increasing the area contained within POS adjoining Bush Forever Site No 333. These will be detailed in a Foreshore Management Plan that will be developed by the proponent (See section 3.9.4 and 3.4.4). Disturbance around the resource enhancement wetland may be an issue but people, dogs and waterbirds share other wetlands in the metropolitan region through signage, education and shoreline design.

4.4.2 *The area is one of the few suitable areas in the river system for the breeding of black swans due to the existence of the freshwater springs. This development is likely to adversely impact on the number of swans using the adjacent Canning River and may impede on the freshwater source.* (3)

4.4.3 *There is no mention of the importance of the springs for Black swans utilising the adjoining Canning River. The continuous freshwater supply*

is understood to be a critical component of the attraction the river has for these birds. (2)

It is acknowledged by the proponent that Black Swans frequent the site in autumn: however breeding has not been recorded on site (ATA Environmental, Bamford Consulting Ecologists and M P Rogers and Associates, 2000). The Black Swans currently use the fresh water inflow from the creek and drains and the foreshore reserve. Both the creek and drain will remain as part of the development and the foreshore reserve will be enhanced to increase the habitat quality and use of the area by swans and other breeding birds. Dog-proof fencing around the foreshore reserve should make it more attractive to swans.

The outlet drain between the wetland and the river will be retained in the wetland reconstruction and the Paperbark/Flooded Gum wetland to be constructed in the vicinity of the outlet drain will not be connected to the drain (see section 3.8.4). As the continuous freshwater flow will continue, the attraction of the river to the Black Swans will be unchanged.

4.4.4 *A bird survey over a 12-month period should be undertaken to assist with future management of the area.* (7)

It is agreed that monitoring of birds during and following development could provide useful information in order to assess the effectiveness of conservation measures and to guide future developments. It should be noted, however, that consultation with the Terrestrial Section of the DoE indicated that a comprehensive fauna survey or long-term bird surveys were not required.

4.4.5 *Additional work needs to be undertaken for shrubland birds as some large populations of conspicuous fauna (e.g. New Holland Honeyeater) were overlooked in the initial work.* (2)

The fact that a conspicuous and readily-identified species such as the New Holland Honeyeater was not recorded in any of the five surveys indicates that it is probably an infrequent visitor to the site. This may be related to the limited array of plant species present, providing the honeyeaters with only a short seasonal period when the site provides them with food. The surveys presumably missed this seasonal period. Food plants for this and other honeyeater species could be incorporated into parts of the development.

4.4.6 *The presence of Splendid wrens (PER p.61), a sedentary resident species that is not able to move on, and Rufous night heron are of extreme importance as these birds are uncommon in urban areas.* (2)

The fairy-wrens (assumed to be Splendid Fairy-wrens as no other fairy-wren species have been recorded along the Canning River in recent times) was an exciting record; these may be the only fairy-wrens in the City of South Perth. It is intended that dryland vegetation to be developed will include habitat suitable for the species.

The Rufous (Nankeen) Night-Heron is common along the Swan-Canning Estuary but is active mainly at night. There are several well-known roosts and breeding colonies, including one in the gardens of Perth Zoo. On-site foreshore POS areas that provide habitat for the species will be improved and as part of the proposed development.

Initiatives to minimise the impacts on native avifauna include revegetation and restoration (with appropriate indigenous flora) the proposed on-site area of POS adjoining Bush Forever Site No 333. These initiatives will be detailed in a Foreshore Management Plan that will be developed by the proponent (See section 3.9.4 and 3.4.4).

4.4.7 *The presence of reptiles, particularly tortoises, is significant as there are few remaining populations within the City of South Perth.* (2)

All of the reptile species recorded or expected to be present are typical of the habitats at East Clontarf and often persist in modified areas. There can be no doubt that their population will be reduced by the development, although several of the species recorded can utilise suburban gardens. The development will result in a reduced area over which tortoises can lay eggs, but some suitable habitat for egg-laying will be retained and the Canning River, where tortoises regularly occur, will be unaffected. Furthermore, construction of an open water wetland will create more habitat for tortoises than currently exists in the wetland.

4.4.8 *PER does not mention terrestrial and aquatic invertebrate fauna that are an important food source for many of the larger fauna (e.g. birds).* (2)

4.4.9 *The extensive fill and disturbance will not enable invertebrate fauna to persist during the construction process.* (2)

4.4.10 *No mention of how invertebrate fauna losses will be managed.* (2)

4.4.11 *The fauna list is incomplete. Invertebrates are often the prime source of food for many higher order taxa, including bandicoots and most birds. The impact from the development on invertebrate populations has not been considered. The fauna list should consist of all ecological layers, including both terrestrial and aquatic macroinvertebrates. Entomological expertise regarding the potential effects from the proposed development on invertebrates and subsequent connection in effects on vertebrates should be sought and followed.* (7)

Consultation with the Terrestrial Section of the DoE indicated that a comprehensive fauna survey was not required and that the five individual assessments between May and December 2000 conducted were sufficient.

At no stage was surveying for terrestrial or aquatic invertebrates mentioned by the EPASU during preparation of the either the scoping or PER document.

However it can be assumed that direct loss of invertebrate fauna through construction related mortality and habitat loss will occur. The proponent acknowledges that it is

difficult to quantify these impacts in terms of absolute numbers of either species or individuals and it is therefore not possible to comment on the potential for disturbance or management of invertebrate fauna. However, many aquatic macroinvertebrates are aerial as adults and therefore are able to colonise modified wetlands when suitable habitats are created.

4.4.12 *The PER states that the "direct impact on fauna habitat will be negligible" (PER p. 58). No trapping was undertaken to determine the presence of fauna.* (2)

4.4.13 *A walk around survey is considered an insufficient fauna survey technique by PER standards.* (2)

The paragraph in the PER from which the quote is taken is slightly ambiguous but is intended to make the point that fauna habitats on the river foreshore will not be impacted by the proposed development. Much of the site where development will take place is cleared land and of low habitat value for fauna. Systematic trapping for fauna was not undertaken following consultation with the Terrestrial Section of the DoE indicated that a comprehensive fauna survey was not required given the sites habitat condition and that the five individual assessments between May and December 2000 conducted were sufficient.

The vertebrate fauna of remnant native vegetation in the Perth area has been well documented and therefore lists of species expected to be present can be prepared with a high degree of confidence, without the need for trapping. Only very high levels of trapping can demonstrate that an expected species is not present. Trapping would only have been warranted if there was some reason to believe that a rare species or one unusual for the Perth region might have been present.

On-site fauna surveying was undertaken in 2000, prior to the EPA issuing Guidance Statement 56 (June 2004). At the time fauna surveying was being undertaken, the methods of surveying were considered adequate given the level of habitat disturbance encountered at the site.

4.4.13 *There is considerable use of the word "may" and "could" (PER p.60), with the descriptions of the fauna. The City of South Perth does not consider this to be acceptable, and would require greater certainty about the values under threat.* (2)

The use of words such as 'may' and 'could' is necessary as detailed fauna investigations or long-term monitoring were not required as part of the assessment at Clontarf. As a result, if the species were not recorded during one of the five one-day assessments, there is a degree of uncertainty about the presence of them occurring on-site. It could be added that even with a comprehensive survey, levels of uncertainty remain. For example, there was no evidence of Quendas and if trapping had been carried out, they would almost certainly not have been caught. However, the potential for the site to support Quendas in the future remains, as they occur nearby and some habitat is suitable.

A precautionary principle has been adopted suggesting that the species 'may' utilise the area. Carnaby's Cockatoos form nomadic flocks and are relatively common throughout much of the Perth Metropolitan Region. The Peregrine Falcon is a vagrant in the area observed mostly in flooded gum woodlands along the Canning River. The Southern Brown Bandicoot has been recorded nearby in Wilson, and the Water Rat may move along the river foreshore area and colonise the section of the Canning River adjoining East Clontarf. The word 'may' and 'could' were therefore necessary in-text as these species were not recorded during surveying, however the accepted fauna databases (CALM and WA Museum) examine and report on the 'potential' for species to occur on-site in the absence of confirmed sightings.

4.4.14 *Extensive clearing and land degradation has already caused the loss of most native, resident, habitat sensitive species from the river foreshores.* (2)

This is true for a suburb as heavily urbanised as South Perth, and is the reason why the Foreshore Reserve will be afforded greater protection than it has at present, and why the freshwater wetland will be protected in part. It is intended that the loss of wetland area in the east of the site will be compensated for by the creation of similar wetland habitat between the freshwater wetland and the river foreshore reserve.
Initiatives to minimise the effects on native avifauna include the revegetation and restoration of the on-site foreshore POS area with appropriate indigenous flora. These initiatives may increase the habitat value of some of the area and will be detailed in a Foreshore Management Plan that will be developed by the proponent.

4.4.15 *The current design will significantly impact on sedentary and slow moving fauna. Protecting and rehabilitating more of the existing wetland will help protect these fauna.* (2)

There will inevitably be some deleterious impacts upon populations of sedentary species such as reptiles, although individuals of the larger species may be able to move away from areas of disturbance. It is intended that these impacts will to some extent be balanced in the long-term through rehabilitation of reserved areas.

Initiatives to minimise the effects on native avifauna include the revegetation and restoration of on-site foreshore POS that adjoin the Bush Forever Site with appropriate indigenous flora. These initiatives may increase the habitat value of some of the area and will be detailed in a Foreshore Management Plan that will be developed by the proponent.

4.4.16 *The introduction of weeds, the creation and proliferation of informal pathways and predation of native fauna by domestic pets, unless addressed, could affect the composition and number of waterbirds and other native fauna that inhabit the site. It is important that appropriate attention is given to minimising the impact on native habitats in the foreshore reserve to allow different native species to continue using the area.* (3)

Initiatives to minimise the effects on native avifauna include the revegetation and restoration of on-site foreshore POS that adjoin the Bush Forever site with appropriate indigenous flora. 'Dog-proof' fences are also planned for the foreshore reserve area, while residents will be provided with information to assist them to minimise their impacts on the reserve. These initiatives will be detailed in a Foreshore Management Plan that will be developed by the proponent (See section 3.9.4 and 3.4.4). It is possible these initiatives may increase the habitat value of some of the area.

A comprehensive weed eradication program is planned as part of the Foreshore Management Plan. Details are contained within section 4.2.2 of the PER.

4.4.17 *There will be an increase in light and noise in the foreshore area from both construction and when the residential area is established. Possible impacts on fauna species from these sources is not addressed in the PER.* (3)

Construction Noise Management Procedures are detailed in section 4.1.3 of the PER.

Measures will be included in the Foreshore Management Plan and advice will be sought from DoE and relative scientific experts for the most appropriate ways to minimise noise and light pollution in the long-term.

4.5 Significant Fauna

4.5.1 *The site is recognised under the Japanese Australia Migratory Bird Agreement and Chinese Australia Migratory Bird Agreement international treaties and the development is likely to disturb bird breeding and roosting areas due to increased people and pets accessing the areas.* (3)

There will be no net loss to vegetation in the area and the wetland vegetation in the foreshore reserve will be protected. Initiatives to minimise the effects on native fauna include the revegetation and restoration of foreshore POS adjoining the conservation areas with appropriate indigenous flora and increasing the area contained within POS adjoining Bush Forever Site No 333.

These initiatives will increase the breeding and roosting sites for birds listed under the Japanese Australia Migratory Bird Agreement and Chinese Australia Migratory Bird Agreement international treaties (JAMBA/CAMBA). Note that most of the species listed under these treaties do not breed in Australia and the site provides little suitable foraging habitat for them. The area that is recognised as important for waterbirds is the Swan-Canning Estuary of which the river foreshore reserve, which will not be disturbed, is a very small part.

Educational and interpretative materials will be used within the area to raise awareness of JAMBA/CAMBA species that frequent the site. These initiatives will be detailed in a Foreshore Management Plan that will be developed by the proponent (See section 3.9.4 and 3.4.4).

4.5.2 *Bandicoots may be on the site and if secured zones could be established for them it would provide a valuable natural asset for the local community, or trapping and re-location may need to be considered.* (7)

No bandicoots were recorded during the five on-site inspections although the PER acknowledges that they have been found in nearby Wilson. Initiatives to minimise the effects on native fauna include the revegetation and restoration of foreshore POS adjoining the conservation areas with appropriate indigenous flora and increasing the area contained within POS adjoining Bush Forever Site No 333. These initiatives (to be detailed in a Foreshore Management Plan that will be developed by the proponent) will increase the potential habitat for Southern Brown Bandicoots if they were to colonise the area from other habitats that adjoin the river in nearby localities.

4.5.3 *Insufficient information is presented in the PER. For instance there is an assumption that the main fauna habitat (the Canning River foreshore) will not be impacted in any significant way by the subdivision, however there is little information to back up this claim. Factors such as domestic animals, increased public use of the area, and the removal of surrounding vegetation need to be addressed in the management of this area.* (5)

The PER acknowledges that increased public use of the Canning River foreshore area is likely to occur. However the existing foreshore reserve will be enlarged by an additional 6000m^2 of POS. The objective within this 'buffer' area will be to retain and enhance the existing native vegetation. Management strategies to deal with domestic pets (public education and installation of dog-proof fencing) and increased public use of the area will be addressed within the Foreshore Management Plan. Even simple fencing, combined with education, has been found to be effective at minimising disturbance of wildlife by domestic pets (eg Alfred Cove).

4.5.4 *The Vulnerable Carnaby's black cockatoo may use the Marri as a seasonal summer/autumn foraging area. The PER presumes this species may use the area, but does not have specific information.* (2)

There is no specific information on the status of the species at the site because it was not observed during site visits. However, it probably visits the site occasionally. Carnaby's Cockatoos are vagrants across the whole Swan Coastal Plain during the summer and autumn months, with small numbers present throughout the year - they probably do visit the stand of Marri on the site to feed. It is the intention to retain this stand of Marri trees in the development, with further Marri being included in the landscape, where appropriate. Marri can be expected to produce fruit in less than 10 years.

5. SUBMISSIONS RELATING TO POLLUTION MANAGEMENT FACTORS

5.1 Water Quality

5.1.1 *Imposed changes to water entering the wetland and a reduction in the size of the wetland in response to any development may increase the rate of nutrients entering the Canning River. Additional monitoring will not limit the nutrient load. Potential changes in water flows need to be modelled by the appropriate government department for environmental assessment of this development proposal.* (7)

Undertaking the hydrologic assessment of the proposal and modelling of potential changes in water flows is the developer's responsibility. As previously stated in Response 3.3.1, the principles adopted for surface and groundwater management within the development area will result in the wetland water balance post-development not being significantly altered from its existing hydrological balance for the proposed development plan. The development also provides the opportunity for improving the stormwater quality current discharging untreated to the wetland from existing urban areas.

Monitoring is an integral part of any development proposal to ensure appropriate best management practices are adopted. As stated in Response 5.2.3, the PER commits to further monitoring and more detailed sampling of water quality to be undertaken during development of the Drainage Nutrient Irrigation and Water Quality Management Plan, Groundwater Management Plan, and Wetland Management Plan. These plans will also include the development of post-development monitoring programs and performance evaluation criteria in consultation with government agencies.

5.1.2 *The PER does not adequately explain how the stormwater entering the wetlands from the subdivision east of Centenary Avenue will be dealt with.* (2)

In this instance, the existing flow to the wetland will remain, albeit through a pipe designed to accommodate the proposed subdivision layout. The existing stormwater discharge point will be relocated to suit the proposed subdivision layout. The discharge point will continue to be the wetland however the proponent will install a Gross Pollutant Trap (GPT) prior to the outfall.

5.1.3 *A system of settling and filtration ponds to control drainage and potential pollution of the Canning River from Manning Road and roads associated with the development should be included in this proposal. A major objective must be to avoid any contamination of the river system which is already degraded from nutrient contamination.* (7)

All minor event stormwater from the development will pass through GPT's prior to discharging to infiltration systems. The infiltration systems will include underground

tanks in the northern portion of the site where there is sufficient freeboard to groundwater and infiltration basins within POS for the southern part of the site.

5.1.4 *There is reference to a drainage basin located adjacent to the eastern picnic area in the text (PER p.78) and nowhere else. Verbal advice from the Consultants suggests that this was an oversight. Such anomalies make it difficult to assess the text on its merits.* (2)

A drainage basin adjacent to the eastern picnic area is currently proposed. Its final location is not yet decided however the location will take into account, recognition of existing native vegetation.

5.1.5 *Insufficient evidence has been provided to demonstrate that "development will minimise changes to the water flow volume or quality from the wetland to the river" (PER p. 59) and that the PER lacks clear guiding principles for managing this issue.* (2)

Refer to response 3.3.1. Evidence of groundwater and surface water calculations are contained in detail in JDA (2004) included as Appendix 6 of the PER.

5.2 Groundwater Quality

5.2.1 *Groundwater management proposals need to comply with the City of South Perth's policies. No reference to the City's policies has been included in the PER.* (2)

The City of South Perth's Groundwater Management Policy (Policy P303) is:
"The City endorses the principles of Water Sensitive Urban Design which should be incorporated into all new developments and considered for incorporation into existing infrastructure. The City's use of groundwater resources will include principles and practices to minimise groundwater extraction and maximise recharge by the use of:

- Efficient irrigation systems;
- Development of water conservation practices for parks and landscape areas; and
- Efficient equipment selection to achieve both power and water savings"

While the PER documents makes no specific reference to the City's Groundwater Management Policy, the development proposal and its water sensitive urban design measures are consistent both with this policy and also the Water and Rivers Commission's Urban Stormwater Management in WA: Principals and Objectives Interim Position Statement (February 2003).

5.2.2 *The development's site is downstream of the only remaining unsewered part of the City of South Perth. Concerns were raised about the possible use of bores in the area because of a potential bacterial threat. Review of the PER does not appear to show any bacterial studies of the wetland and/or groundwater. This should be included in any detailed management plans for the site.* (2)

Large portions of Perth have been unsewered for many years and there is little evidence to support concerns that human pathogens are present at significant levels in ground water as a result of the use of septic tanks. This appears to be because the porous sandy soils present on the coastal plain of Perth and well oxygenated waters of the shallow layers of the superficial aquifer are an effective biological filter for such pathogens. Notwithstanding, the HDWA has maintained a consistent position, that untreated groundwater should not be used for domestic use.

The nature of the proposed development is such that lot sizes are likely to be small, as a result landscaped areas within individual houses will be limited and there will be little requirement for the installation of domestic bores.

Bores for irrigation of the public open space will be drilled into the deeper Leederville aquifer and are therefore not likely be impacted by impacts arsing locally from the superficial aquifer.

If this is a genuine concern for the East Clontarf development, then it is a more serious concern within the unsewered areas and should be addressed by the City of South Perth or the Departments of Environment and Health in these areas before being imposed as a requirement on the East Clontarf development.

5.2.3 *Wetland ground water is possibly affected by diffuse seepage from the northern boundary of the development (Manning Road). This area consists of unsewaged residential properties. There are high concentrations of Nitrogen and Phosphorus reported (PER p.70). Data on sediment samples is lacking and is strongly recommended.* (7)

Groundwater monitoring results from the bores located along the northern boundary of the site suggest that nutrient enriched groundwater is migrating onto the site from adjacent residential land to the north of Manning Road. The concentrations of total nitrogen (3.4 - 5.9mg/L in bore MW1, 3.9 - 12mg/L bore MW2 and 0.69mg/L – 2.3 mg/L in bore MW3). Total Phosphorous levels area also elevated. Whilst elevated when compared to the goals set for the Swan Canning Clean-up Program (SCCP) the nutrient concentrations are not untypical of unsewered residential areas in the Perth Metropolitan Region.

Additional testing completed by ATA and reported in the PER suggests that the nutrient levels in the wetland on the East Clontarf site are significantly lower than the levels in the ground water. The PER concludes that this could be due to dilution effects or the processing of nutrients through the wetland ecosystem.

As the nutrients are entering the East Clontarf site from outside its boundaries, it is beyond the scope of the proposed development to limit or control them.

The development itself is being undertaken in a manner which will minimise changes in the hydraulic balance of the site and will aim to maintain wetland function to maintain the ability of the wetland system to process nutrients prior to the groundwater discharging to the Canning River. As indicated in the PER, the design of

the development will incorporate a range of measures to reduce nutrient export from the site including:

- The provision of sewerage to all lots will also facilitate the connection of unsewered areas to the north of Manning Road to the sewer.
- The maintenance of the existing wetland system on the site.
- The maintenance and enhancement of good quality native vegetation on the site.
- The use of Water Sensitive Urban Design throughout the development to maximise infiltration of stormwater and trap nutrients.
- The provision of additional wetland features within the stormwater system to further treat stormwater that cannot be infiltrated on site prior to discharge to the Canning River.

As a result of these measures, it is considered that in the short-term the development will not materially affect nutrient loads to the Swan-Canning River System. In the longer-term, by virtue of facilitating the provision of sewer to previously unsewered areas, the flow of nutrients from the area north of Manning Road should be reduced.

5.2.4 *The development will destroy parts of the Resource Enhancement Wetland, is likely to impact on the hydrology of the remaining wetland area, and increase the speed of nutrient transfer to the Canning River.* (5)

As previously stated in Response 3.3.1, the principles adopted for surface and groundwater management within the development area will result in the wetland water balance post-development not being significantly altered from its existing hydrological balance for the proposed development plan.

No stormwater from the development is proposed to enter the wetland. Where possible, infiltration will be used to minimise discharge to the Canning River from the development area. All stormwater discharging to the Canning River will be treated prior to discharge.

Stormwater from existing urban development upstream of the wetland currently discharges to the wetland without any treatment. The proposed development provides an opportunity for improving water quality in the wetland through installation of Gross Pollutant Traps on these outlets.

5.2.5 *Recommend that appropriate ecotoxicological tests are carried out on groundwater samples to assess if the discharge of contaminated groundwater is currently affecting the benthic environment, and whether impacts may still take place when diluted by the additional groundwater flow after development. If this testing indicates that there is a risk of environmental impacts, then additional management measures may be required to manage these impacts.* (11)

Given the very minor nature of contamination found in the ground water testing completed to date and the presence of former landfill site operated by the City of Canning on adjacent land, this requirement is not considered to be justified at this time.

Should the results of additional monitoring proposed in these submissions indicate that more significant contamination is present then the proponent is willing to reconsider this position.

5.3 Noise

5.3.1 *WAPC and City of South Perth have been requested to amend road designs at Centenary Avenue. Consequently the forecast traffic noise contours within the PER will require a reassessment to reflect the new designs.* (1)

Noise modelling has been based on a proposed plan of subdivision and noise modelling has been undertaken to demonstrate the EPA's criteria can be achieved under this scenario through a combination of noise barriers and treatments. In the event that there is significant realignment of major access routes, impacts on noise will be further reconsidered, and noise barriers and other treatments amended such that compliance can at all times be achieved.

5.4 Acid Sulfate Soils

5.4.1 *Concern expressed regarding the release of contaminants with the extensive proposed earthworks. Given the presence of peaty soils, heavy metals and dieldrin, there is concern about the potential release of acid sulphate.* (2)

The Detailed Contaminated Site and Acid Soils Investigations undertaken to date (ATA Environmental 2003a and b), indicate that there is only limited soil contamination present, generally associated with the uncontrolled fill that has been deposited on the surface of the site. No actual acid sulfate soils were detected while potentially acid sulfate soils are generally located at depth across the portion of the site where the wetland is located. There is thus limited potential for mobilisation of contaminants.

The proponent intends that the development will occur in a manner that minimises the disturbance of the wetland and associated peat and therefore minimises the need for dewatering.

The proponent has committed to the preparation of management plans for soils remediation and acid sulfate soils. These plans will be prepared and implemented with the express aim of limiting the already low risk of mobilising contaminants either to the atmosphere or the groundwater through the remediation and development process.

Construction works will be timed and staged to minimise the volume of dewatering required (i.e. Earthworks will be carried out in late summer and autumn, typically when groundwater levels are at their lowest).

As a result of these commitments the risk of producing acidity or mobilising contaminants during or following the development process is considered to be minimal.

5.4.2 *Potential acid sulphate soils testing should be undertaken. If the soil is of high acid sulphate risk, then disturbance of those areas should not take place.* (7)

Testing has been completed and reported to the DoE. The proponent has committed to the preparation of a comprehensive Acid Sulfate Soil Management Plan to the satisfaction of the DoE.

5.5 Contamination

5.5.1 *Anecdotal evidence suggests that historically the land may have been exposed to contaminants leached from poor storage practices in adjacent land. Additional subsurface core testing should be carried out to determine if remedial action is required prior to extensive earth moving should the development be approved.* (7)

A detailed soil and groundwater investigation has been completed in accordance with DoE guidelines and reported to the DoE.

Extensive soil testing was conducted during the site investigation phase of the project. Soil testing specifically targeted the areas of the site which were potentially impacted by contaminants from the former landfill site.

The soil test results suggest some minor low-level impact where fill material from the former landfill site extends marginally onto the East Clontarf property. These impacts will be addressed by the excavation of the soils for either on-site treatment or off-site disposal to an approved landfill site. The management approach finally adopted will be developed and agreed in conjunction with the DoE.

The results of groundwater monitoring in the vicinity of the former landfill site indicated that apart from elevated nutrient levels, no significant impacts have occurred on the groundwater system as a result of past land uses either on the site or adjacent land.

Examination of the results shows that apart from elevated nutrient levels in most bores, the ground water quality is generally good. There is some variability in the results that suggest the merits of additional rounds of monitoring prior to finalising the soil remediation and subdivision design.

Through this response, the proponent commits to the installation of two additional bores along the southern boundary of the site abutting the foreshore reserve and undertaking quarterly monitoring of these and the original five bores for a period of 12 months to establish and enhance the baseline data set. It is further proposed that water quality of the surface water body will be assessed in conjunction with each round of groundwater monitoring. Monitoring programs and performance evaluation criteria will be determined in consultation with the relevant government agencies.

5.5.2 *The information contained with the PER is insufficient for the DoH to satisfactorily characterise the potential health concerns associated with the development of this site. Particularly a lack of soil sampling results and asbestos contamination and remediation data hinders the assessment.* (9)

Copies of detailed soil sampling reports with full information on the soil sampling results were provided to the DoE prior to the preparation of the PER. It appears that this information was not forwarded to the Health Department of WA. It is the experience of environmental consultants that the Health Department will only consider such reports when they referred to it for consideration by the DoE.

As a result, copies of the detailed site investigation reports were not forwarded to the DoE.

Copies of the following reports have now been provided directly to the Health Department of WA to facilitate its assessment:

1. Detailed Soil and Groundwater Investigation (ATA, December 2003).
2. Preliminary Assessment – Asbestos Contamination – East Clontarf (ATA, 2002a).
3. Remediation Report – Asbestos Contamination – East Clontarf (ATA, 2002b).

It should be noted that reports 2 and 3 above, actually relate to land on the adjacent Clontarf Aboriginal College and not the development site *per se*.

The soil sampling results presented in the PER detail the only sites where asbestos was identified as fibres and indicates that asbestos cement sheeting is located at a number of other locations associated with rubble material.

The issue of health risk associated with soil and asbestos is not considered to be relevant in view of the commitment to excavate and remove all contaminated soil and rubble and then validate the underlying soil to verify that contaminants have been removed.

A further commitment has been made to prepare a remediation management plan to the satisfaction of the DoE to ensure that the site will be remediated in accordance with relevant standards and that no environmental hazards will be created during the remediation process.

In view of the commitment to remediate any contaminated soils in accordance with an approved remediation management plan, the proponent considers that any health risk associated with the soils in the current state of the site is not a relevant environmental factor for the assessment.

5.5.3 *Should the water become more acidic, there is the potential for it to react with other contaminants identified in both the surface and groundwater.* (2)

See response 5.4.1.

5.5.4 *Concern expressed about the potential impact of contaminants on aquatic fauna in the wetland system.* (2)

5.5.5 *Section 3.4.3 of the PER identifies the threat of contaminants to the river system, without considering the impact on the wetland component.* (2)

Site investigations indicate that there is limited soil contamination on the site and relatively confined areas of potentially acidic soils. The acid sulfate soils and contaminated soils management plans that the proponent has committed to will act to minimise the possibility of impacts on aquatic fauna in the wetland.

5.5.6 *Further information requested on the proposed asbestos remediation and validation approach for the site has not been provided.* (8)

Asbestos contamination on the site is associated directly with areas of uncontrolled fill. The asbestos is present in the form of asbestos cement sheeting and no loose asbestos fibres were detected in the associated soil.
The uncontrolled fill on the site will need to be either removed from its current location or screened to remove the rubble fraction which makes it unsuitable as structural fill. The screened sand would then be suitable for use as structural fill in the development.

The presence of the asbestos cement sheeting in the uncontrolled fill means that any proposal to screen the material may act to release asbestos fibres present in the cement sheeting into the screened soil or the atmosphere. This is considered to be an unacceptable risk in a residential development. In view of this concern, the proponent does not propose treatment of the uncontrolled fill by screening to allow reuse of the screened soil fraction.

Instead the uncontrolled fill will either be excavated and removed from site to a suitably licensed facility or relocated without treatment to a dedicated containment cell located within a public open space area on the site. Should an on-site disposal option be used, the location and design of a disposal cell would be negotiated and agreed with the DoE, HDWA and the City of South Perth. Such a disposal cell would be implemented with the following safeguards:

- The cell would be located in an area of Public Open Space.
- The material would be placed and compacted in the cell to prevent subsequent subsidence.
- A testing regime would be implemented to ensure that no leachable contaminants were placed in the cell.
- 100 mm of clean sand would be placed over the deposited fill followed by brightly coloured geotextile material to act as a visual warning. A minimum of 1 meter of clean fill or topsoil would be placed over the cell.
- The title of the land used would be annotated to reflect the presence of the cell.

The final decision on the management approach will be taken prior to finalising the subdivision design and it is anticipated that the subdivision proposal and subsequent approval will incorporate specific requirements in relation to management of the uncontrolled fill.

5.5.7 *Lack of groundwater monitoring wells located down hydraulic gradient or beneath areas of uncontrolled fill contrary to DoE guidelines (2001).* (9)

The groundwater monitoring regime was developed to assess areas considered most likely to be impacted by contaminants from high risk activities on the site. The inert nature of the uncontrolled fill was not assessed as representing a threat to the groundwater system under the site.

The evidence from the detailed soil and groundwater investigations appears to confirm that the inert waste is not a threat to the groundwater.

Notwithstanding the proposal to remove the uncontrolled fill, the proponent has committed to installing some additional monitoring bores along the foreshore and monitoring these and the existing bores quarterly for the next 12 months to establish an enhanced baseline data set.

5.5.8 *Attention is drawn to cadmium concentrations exceeding the drinking water guidelines at location MW5, which suggests possible transport of contaminants from the adjacent land-**fill**.* (9)

The initial round of sampling indicated a minor exceedance of the assessment criteria for cadmium in bore MW5. In a subsequent round of monitoring, cadmium was not detected at the limit of detection in any of the bores. These results are reported in an Appendix 1. This variability in groundwater quality is not unusual in the experience of ATA Environmental, with newly installed bores often showing elevated levels of contaminants in the initial round of sampling as a result of the disturbance created in the aquifer by the drilling and well development process. Subsequent sampling often shows a declining trend, as suspended sediments are trapped soil pore spaces and monitoring is more representative of the true aquifer conditions.

The groundwater data from the two rounds of sampling completed is somewhat variable suggesting the need to conduct several further rounds of sampling to establish a good baseline for groundwater quality. The proponent has committed to completing additional monitoring (see response 5.5.1).

Overall there appears to be minimal impact on groundwater quality other than elevated nutrients arising from surrounding land uses.

5.5.9 *OC/OP investigations need to be carried out underneath any building pads that occur on-site.* (9)

Noted. These will be identified in the Contaminated Soils Management Plan and the results of validation testing reported in a post-remediation report to the DoE.

5.5.10 *Further data regarding the asbestos remediation works conducted is required before the DoH may make a complete assessment of the site.* (9)

The asbestos remediation report referenced in the PER actually relates to land on the adjacent Clontarf Aboriginal College. For completeness copies of this report have been provided to the relevant Health Department officers.

Responses 5.5.6 and 5.5.12 provide additional information regarding the management approach proposed for the uncontrolled fill identified as containing limited quantities of asbestos cement sheeting.

5.5.11 *Particular attention should be paid to soils identified as contaminated with asbestos or asbestos containing materials (ACM) when determining the remediation approach. Excavation activities are likely to facilitate the release of airborne asbestos fibres due to the demolition of ACM fragments and the generation of dust. Stringent dust control measures are there necessary during any earthworks undertaken in asbestos contaminated areas.* (9)

Where areas have been identified as potentially affected by asbestos cement sheeting, a specific Health and Safety Plan will be developed before works commence. This plan will address the following elements to the satisfaction of DoE, HDWA and Worksafe:

- Dust control to minimise airborne emissions of dust.
- Personal protective equipment (PPE).
- Controls over access to the vicinity of the work.
- Hygiene measures for workers.
- Decontamination and disposal of overalls and PPE.
- Personal and ambient air monitoring.
- Disposal of remediated soils.
- Other occupational health issues such as management of heat stress.

This plan will be developed as an appendix to the overall site remediation management plan.

5.5.12 *Appropriate control measures are required to prevent dust generation from any excavated materials that are stockpiled on-site.* (9)

Noted. This will be addressed to the satisfaction of both the DoE and the Cities of South Perth and Canning in both the Soil Remediation and Construction Environmental Management Plans.

5.5.13 *The PER states "that soils identified as contaminated in excess of EIL criteria will be excavated and the base and wall of the excavations validated in accordance with relevant DoE Guidelines for the Remediation of Contaminated Land". However, no justification has been provided as to why this is the most appropriate remediation strategy. An appraisal of all applicable remediation options should be presented, with suitable discussion to outline the reasons for the preferred choice.* (9)

The general approach of excavation and then treatment of or disposal has been adopted for the following reasons:

Much of the material identified as contaminated is geotechnically unsuitable for use without treatment and therefore needs to be removed from residential areas to allow conventional construction methods to be adopted as piling and other similar foundation methods are simply too expensive in a typical single residential lots.

The options for management of geotechnically unsuitable material are:

1. Direct disposal off-site.
2. On-site disposal within POS or areas that do not require structural fill.
3. Treatment by a methodology such as screening to separate the coarse fraction such as rubble and leave structural quality fill.

Option 1 is favoured for much of the material in view of the limited POS available and high groundwater table on the site which makes on-site containment problematic and costly.

The presence of asbestos cement material in much of the fill on the site also makes screening a difficult task as there is a risk that asbestos will be spread throughout the fill.

The high water table on the site and the close proximity to the Canning River suggest that off-site disposal of the material would be preferable to containment on site due to the threat of contaminants leaching into the groundwater table even though the contaminant levels are generally quite low.

The final management option will be determined prior to subdivision in discussion with the DoE, HDWA and City of South Perth.

5.5.14 *The site clean-up response level chosen is EIL criteria. This choice requires justification.* (9)

EIL clean-up criteria were selected in view of the close proximity of the site to the Canning River and the high watertable which suggest that a conservative approach is preferable to protect the environmental values of the river system

The proponent is willing to adopt HIL criteria if preferred by the DoE and provided any affected lots will not attract a memorial on title, to indicate the presence of soil contaminants above EILs.

5.6 Dewatering

5.6.1 *The City of South Perth sub-area of the Perth groundwater area is currently under significant pressure from the perspective of groundwater allocation. This may make the process of assessing the application more involved. The proponent should therefore submit an application for a groundwater licence well in advance of the proposed commencement of dewatering operations.* (4)

The consultant team will liaise with DoE early in the design phase of the project and submit an application for a groundwater licence well in advance of the proposed construction program.

5.6.2 *Acid Sulfate Soils and any other issues relevant to the proposed dewatering will have to be adequately addressed before a groundwater licence can be issued.* (4)

Noted. A comprehensive ASSMP will be developed and approved by the Department of Environment (DoE) prior to commencement of the development. This will provide a framework of monitoring and control strategies, within which dewatering and bulk excavation activities can be guided to avoid potential impacts associated with the direct and indirect disturbance of Potential Acid Sulfate Soils (PASS).

5.6.3 *The PER states (p. 10) that dewatering activities requiring water to be discharged off site, the proponent (or contractor) should apply to the DoE for a disposal licence. The proponent will need to obtain approval from the Swan River Trust to discharge water to the Swan River or from the Water Corporation to discharge to the sewer or stormwater drains.* (4)

Noted. The issue of dewatering will be addressed within the ASSMP to be developed and approved prior to subdivision. In conjunction with the groundwater licence, the proponent will apply for and ensure receipt of a disposal licence to the appropriate authority prior to discharging any dewatering water offsite.

It is not possible to provide absolute certainty regarding the nature and extent of dewatering until the detailed design for the project is complete. However, at this stage it is the intention of the proponent, that as far as is possible all dewatering tail waters will be reinfiltrated on the site in preference to direct discharge to the river. As a result of the presence of potential acid sulfate soils on the site, all dewatering tail

water will initially be discharged to a lined detention basin and treatment system to allow for pH adjustment and monitoring of water quality before discharge to the environment. This will occur whether the water is discharged directly to the river or reinfiltrated via an infiltration basin.

5.6.4 *The ASS Management Plan should specifically address dewatering management.* (4)

5.6.5 *Managing dewatering to prevent pyrite oxidation is extremely important at this site. Dewatering issues have not been adequately addressed in the PER, and it is important that the proponents ensure that dewatering is carried out in a staged manner to minimise the disturbance to the watertable.* (11)

Noted. The PER acknowledges that an ASSMP will be approved by the DoE prior to the commencement of development activities. Monitoring programs will also be implemented to assess surface water and groundwater quality during the dewatering and earthworks program to ensure environmental performances are met. Contingency plans will also be set out in the approved ASSMP to mitigate any deviation from the DoE approved performance standards.

The dewatering strategy will be implemented in accordance with the approved ASSMP and Construction Environment Management Plan to ensure that appropriate management and mitigation measures are implemented to minimise potential environmental effects associated with localised groundwater draw-down.

5.7 Management Plans

5.7.1 *The majority of existing residents that may be affected by noise and dust from construction works reside in the City of Canning. The City of Canning should be consulted with regards to the preparation of Noise and Dust Management Procedures for the subdivision.* (1)

Noted. The proponent will ensure appropriate consultation with the City occurs over the development of this management plan.

5.7.2 *The proposed development and construction management plans covering drainage, nutrients, irrigation and water quality, dust, noise and soil management are currently intended to be released to the DoE for endorsement. These plans should also be to the satisfaction of the City of South Perth.* (2)

Noted. The proponent will ensure appropriate consultation with the City occurs over the development of these plans. However, soil management is a specialised area and final approval should remain with the appropriate regulatory agencies.

5.7.3 *Any works within the Swan River Trust management will require a Part 5 application under the Swan River Trust Act 1988 and any works adjacent*

to the Trust Management Area will need to take into account Trust development policies. (5)

Noted. The proponent will ensure appropriate consultation with the Swan River Trust occurs regarding the proposed development area/foreshore reserve interface.

5.7.4 *The proponent has made a commitment to the preparation of a Foreshore Management Plan. It may be beneficial for the FMP to include some additional consideration of the likely impacts of increased visitation and use by residents.* (3)

5.7.5 *The FMP should specifically deal with impacts on fauna from increased human presence and increase in ambient noise and light.* (3)

5.7.6 *Additional consideration of the impact of people, pets and light on water bird use may be justified and additional design and mitigation measures may be appropriate. This could require for example provision of dog proof fencing and consideration of type and location of lighting adjacent to the foreshore.* (3)

5.7.7 *The FMP should ensure that access management is adequately addressed to minimise risk of degradation from indiscriminate use.* (3)

5.7.8 *In conjunction with the FMP it may be appropriate to undertake monitoring of the area for the first two years after project completion to give an indication as to the type and mix of native fauna that is utilising the area.* (3)

The proponent has made a commitment to prepare and implement a Foreshore Management Plan to the satisfaction of regulatory agencies. Management strategies will include (but not be limited to):

- management of the foreshore area and development interface;
- rehabilitation of degraded areas in the foreshore area;
- provision and alignment of recreational facilities, including limiting access to the foreshore area;
- installation of signage; and
- management of drainage and nutrients from the proposed development.

The implementation of a revegetation program to improve degraded areas in the POS area will assist in the enhancement of the habitat for native fauna species, intercept and assimilate the potential movements of nutrients into the river and enhance the natural buffer zone between the proposed development and the foreshore reserve. Importantly, revegetation of degraded areas will provide a natural barrier to the movement of people beyond the proposed access path.

The proponent will incorporate submission suggestions mentioned in 5.7.4 - 5.7.8 into the Foreshore Management Plan committed to.

5.7.9 *The Wetland Management Plan should also be the satisfaction of the City of South Perth.* (2)

Noted. The proponent will ensure appropriate consultation with the City occurs over the development of this plan.

5.7.10 *It is recommended that allowance be made in the Wetland Management Plan to provide continued monitoring and maintenance of the revegetated areas to control weeds and assess the success of rehabilitation.* (3)

Noted.

5.7.11 *The removal of bulrushes in the wetlands and the construction of a dual use path may result in disturbance of acid sulphate soils. An Acid Sulphate Soil Management Plan acceptable to the Trust would be required.* (5)

Noted. The proponent will ensure appropriate consultation with the Swan River Trust occurs over the development of this plan. However, soil management is a specialised area and final approval should remain with the appropriate regulatory agencies.

6. SUBMISSIONS RELATING TO SOCIAL SURROUNDINGS FACTORS

6.1 Mosquitos and Midges

6.1.1 *There is an implied assumption that because there is some water exchange in the wetlands mosquitoes and midges will not breed. This may not be the case as water exchange doesn't affect midges, and mosquitoes will shelter in the vegetation around the edges. An appropriate separation distance should be addressed by the applicant.* (5)

Appropriate separation distances range from between 50m to 1000m depending upon the source of information relating to the subject. Even with separation buffers, other methods of control (physical, chemical and biological) are often required to limit nuisance events from occurring. The EPA recognises that the use of any control measures has the potential to have a long-term environmental impact (EPA 2000). Public education is recognised as being an important element in mosquito management enabling individuals to be aware of the risks associated with mosquitoes and to take responsibility for self-protection.

The proponent is committed to ensuring appropriate management of urban stormwater run-off by using water sensitive urban design principles are incorporated into the design of the subdivision's infrastructure.

6.1.2 *Given the proposed upgrades to wetlands relative to the subdivision, it is appropriate that the potential affects on mosquito breeding and implementation of associated control programs be addressed in consultation with Cities of South Perth and Canning.* (1)

The proponents cannot guarantee against the presence of midges or mosquitoes within the water body. The proponent will adopt existing mosquito and midge management protocols currently utilised by the City of South Perth. These management protocols will be incorporated into the proposed Wetland Management Plan.

6.1.3 *The creation of open water potentially will encourage nuisance mosquito and midge breeding. There does not appear to be any strategies outlined in the PER to address these issues. The City of South Perth prefers the wetlands to remain fully vegetated.* (2)

The initial proposal in the PER to remove areas of Bulrushes (*Typha orientalis*) and replace with native reed species is now considered to be extremely difficult and without any precedence in Perth in areas of shallow water to indicate that permanent replacement of the Bulrushes is possible. As a result, the areas of Bulrush that occur in the part of the wetland to be retained will not be removed. It is still intended to construct a wetland in the southwestern portion of the site. This wetland will be hydrologically linked to the freshwater wetland and hence may provide suitable breeding sites for both mosquitos and midges. As mentioned in response 6.1.2, the proponent will adopt existing management protocols currently utilised by the City of South Perth and will be incorporated into the proposed Wetland Management Plan.

7. LIST OF ABBREVIATIONS

ASSMP	Acid Sulfate Soils Management Plan
CALM	Department of Conservation and Land Management
CAMBA	Chinese Australia Migratory Bird Agreement
DCLM	Department of Conservation and Land Management
DoE	Department of Environment
DHWA	Department of Health Western Australia
DPI	Department of Planning and Infrastructure
DUP	Dual Use Path
EIL	Environmental Investigation Limit
EPA	Environmental Protection Authority
GPT	Gross Pollutant Trap
HIL	Health Investigation Limit
JAMBA	Japanese Australia Migratory Bird Agreement
PER	Public Environmental Review
POS	Public Open Space
SRT	Swan River Trust
WAPC	Western Australian Planning Commission
WRC	Water and Rivers Commission

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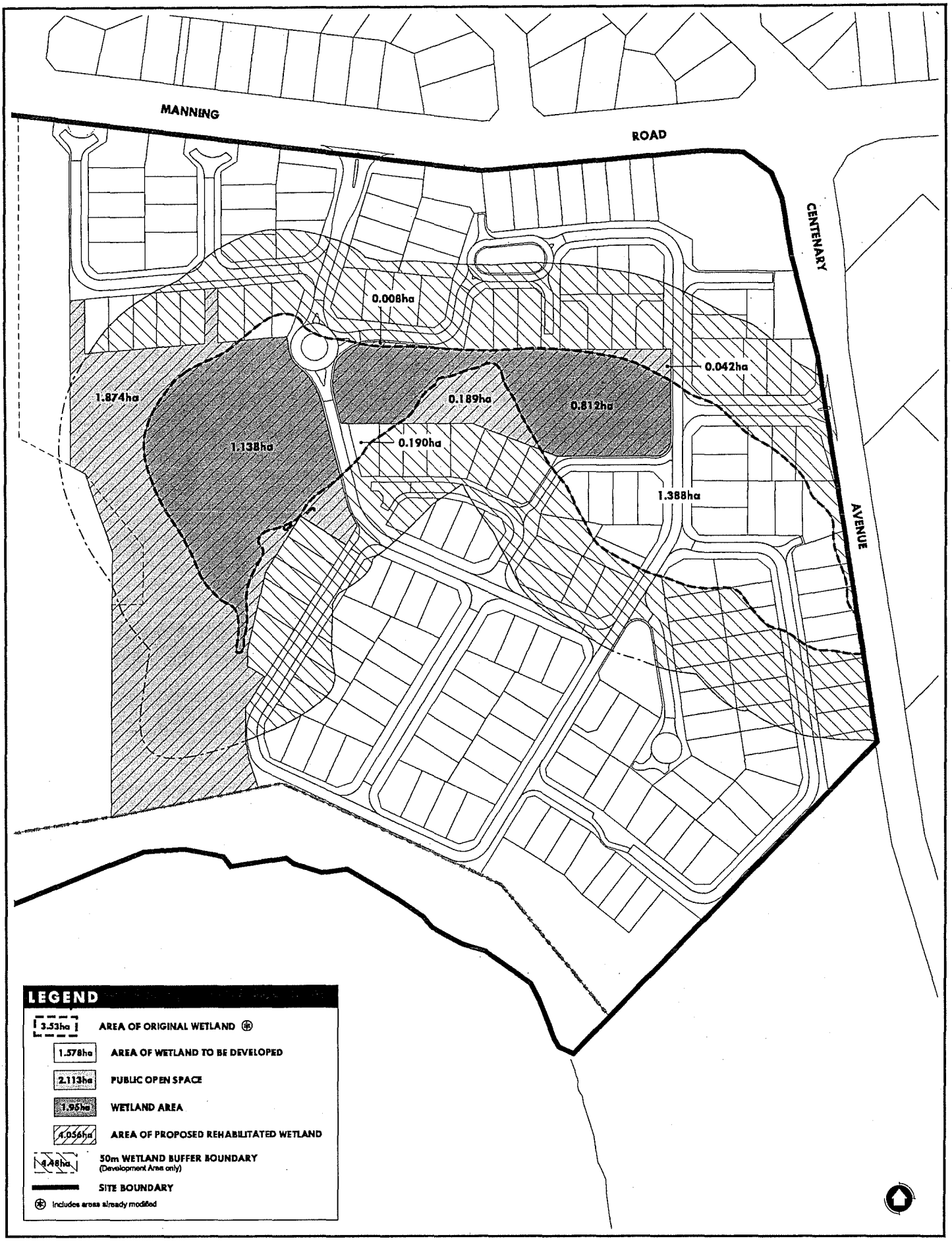
FIGURE



WETLAND & RESIDENTIAL AREAS PLAN

EAST CLONTARF

DPS
DEVELOPMENT PLANNING STRATEGIES
TOWN PLANNING
URBAN DESIGN

Development Planning Strategies, Level 2A 388 Hay Street, Subiaco 6008, Ph (08) 9388 9588 • e-mail: drafting@dpswa.com.au
Date: 6/10/2004 • Scale 1:2000@A3 • Plan No: RNCEC065

APPENDIX

UPDATED GROUNDWATER QUALITY RESULTS

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

PETROLEUM HYDROCARBONS

Sample Identification	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36
units	µg/L	µg/L	µg/L
MW 1	[NA]	[NA]	[NA]
MW 2	[NA]	[NA]	[NA]
MW 3A	[NA]	[NA]	[NA]
MW 3B	[NA]	[NA]	[NA]
MW 4	<30	<100	<100
MW 5	<30	<100	<100
Blank	<30	<100	<100
Assessment Criteria			
Fresh Water Aquatic Ecosystems	NR	NR	NR
Irrigation Water	NR	NR	NR

NA denotes not analysed
NR denotes no recommendation

These results are subject to verification by the Department of Environment in accordance with the Contaminated Sites Management Series of Guidelines.

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

ORGANOCHLORINE/ ORGANOPHOSPHATE PESTICIDES

Sample Identification	HCB	alpha-BHC	Lindane	Heptachlor	Aldrin	delta-BHC	beta-BHC	Heptachlor Epoxide	alpha-Endosulfan	gamma-Chlordane	alpha-Chlordane	p,p'-DDE	Dieldrin	Endrin
units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW 1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MW 2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MW 3A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MW 3B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MW 4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MW 5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Blank	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Assessment Criteria														
Fresh Water Aquatic Ecosystems	NR	NR	NR	0.01	0.01	NR	NR	0.01	NR	0.004	0.004	NR	0.002	NR
Irrigation Water	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

NR denotes no recommendation

These results are subject to verification by the Department of Environment in accordance with the Contaminated Sites Management Series of Guidelines.

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

ORGANOCHLORINE/ ORGANOPHOSPHATE PESTICIDES

Sample Identification	beta-Endosulfan	p,p'-DDD	p,p'-DDT	Endosulfan Sulphate	Endrin Aldehyde	Methoxychlor	Endrin Ketone	Diazinon	Chlorpyrifos	Malathion	Fenitrothion	Bromofos Ethyl	Methidathion	Ethion
units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW 1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
MW 2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
MW 3A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
MW 3B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
MW 4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
MW 5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Blank	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1
Assessment Criteria														
Fresh Water Aquatic Ecosystems	NR	NR	0.001	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Irrigation Water	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

NR denotes no recommendation

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

POLYCHLORINATED BIPHENYLS

Sample Identification	PCB Congener C28	PCB Congener C52	PCB Congener C101	PCB Congener C118	PCB Congener C138	PCB Congeners C153	PCB Congener C180
units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW 1	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 2	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 3A	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 3B	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 4	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
MW 5	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Blank	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Assessment Criteria							
Fresh Water Aquatic Ecosystems	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Irrigation Water	NR	NR	NR	NR	NR	NR	NR

NA denotes not analysed
NR denotes no recommendation

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EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

POLYCYCLIC AROMATIC HYDROCARBONS

Sample Identification	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo[a]anthracene	Chrysene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Indeno[123-cd]pyrene	Dibenzo[ah]anthracene	Benzo[ghi]perylene	Total PAH
units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW 1	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 2	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 3A	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 3B	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
MW 4	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1.7
MW 5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.8
Blank	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.8
Assessment Criteria																	
Fresh Water Aquatic Ecosystems	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Irrigation Water	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

NA denotes not analysed
NR denotes no recommendation

These results are subject to verification by the Department of Environment in accordance with the Contaminated Sites Management Series of Guidelines.

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

PHYSIOCHEMICAL AND NUTRIENTS

These results are subject to verification by the Department of Environment in accordance with the Contaminated Sites Management Series of Guidelines.

Sample Identification	Total Dissolved Solids	pH	Sulphide	Total Persulphate Nitrogen, N	Total Persulphate Phosphorus, P	Ammoniacal Nitrogen, NH3-N
units	µg/L	pH Units	µg/L	µg/L	µg/L	µg/L
MW 1	770000	***5.9***	[NA]	***5900***	***160***	[NA]
MW 2	340000	***6.3***	[NA]	***3900***	40	[NA]
MW 3A	380000	***6.3***	[NA]	690	***170***	[NA]
MW 3B	370000	***6.4***	[NA]	670	***160***	[NA]
MW 4	510000	***6.2***	<500	***1700***	40	[NA]
MW 5	830000	7	<500	***15000***	30	***14000***
Blank	<10000	6.9	<500	<50	10	8
Assessment Criteria						
Fresh Water Aquatic Ecosystems	NR	6.5-9.0	NR	NR	NR	NR
Irrigation Water	NR	4.5-9.0	NR	NR	NR	NR
Lowland River	NR	6.5-8.0	NR	1200	65	80

NA denotes not analysed

NR denotes no recommendation

160 denotes concentration is above or equal to the Lowland River assessment criterion

denotes concentrationdoes not comply with the Fresh Water Aquatic Ecosystems assessment criterion

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

METALS

These results are subject to verification by the Department of Environment in accordance with the Contaminated Sites Management Series of Guidelines.

Sample Identification	Arsenic, As	Aluminium, Al	Barium, Ba	Cadmium, Cd	Chromium, Cr	Copper, Cu	Cobalt, Co	Iron, Fe	Lead, Pb	Manganese, Mn	Magnesium, Mg	Mercury, Hg	Nickel, Ni	Zinc, Zn
units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW 1	5	***960***	[NA]	<2	[NA]	<10	[NA]	460	<10	[NA]	7100	<2	[NA]	[NA]
MW 2	4	***80***	[NA]	<2	[NA]	<10	[NA]	65	<10	[NA]	7000	<2	[NA]	[NA]
MW 3A	3	***110***	[NA]	<2	<10	<10	[NA]	50	<10	[NA]	6900	<2	[NA]	34
MW 3B	3	***110***	[NA]	<2	<10	<10	[NA]	95	<10	[NA]	7000	<2	[NA]	34
MW 4	3	[NA]	95	<2	<10	<10	[NA]	[NA]	<10	370	[NA]	<2	<10	***160***
MW 5	11	[NA]	200	*3*	<10	<10	[NA]	[NA]	<10	80	[NA]	<2	<10	31
Blank	5	10	<10	<2	<10	<10	[NA]	<10	<10	<10	39	<2	<10	<10
Assessment Criteria														
Fresh Water Aquatic Ecosystems	50	5 (<pH6.5) 100 (>pH6.5)	NR	2	10	5	NR	1000	5	NR	NR	0.1	150	50
Irrigation Water	100	5000	NR	10	1000	200	50	1000	200	2000	NR	2	20	2000

NA denotes not analysed

NR denotes no recommendation

160 denotes concentrationdoes not comply with the Fresh Water Aquatic Ecosystems assessment criterion

denotes concentration is above or equal to the Lowland River assessment criterion

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

PHYSIOCHEMICAL AND NUTRIENTS

These results are subject to verification by the Department of Environment in accordance with the Contaminated Sites Management Series of Guidelines.

NR **denotes no recommendation**

Sample Identification	Total Dissolved Solids	pH	Sulphide	Total Persulphate Nitrogen, N	Total Persulphate Phosphorus, P	Ammoniacal Nitrogen, NH3-N	Arsenic, As	Aluminium, Al	Barium, Ba	Cadmium, Cd	Chromium, Cr	Copper, Cu	Cobalt, Co	Iron, Fe	Lead, Pb	Manganese, Mn	Magnesium, Mg	Mercury, Hg	Nickel, Ni	Zinc, Zn	HCB	alpha-BHC	Lindane
units	µg/L	pH Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
MW 1	770000	***5.9***	[NA]	***5900***	***160***	[NA]	5	***960***	[NA]	<2	[NA]	<10	[NA]	460	<10	[NA]	7100	<2	[NA]	[NA]	<0.1	<0.1	<0.1
MW 2	340000	***6.3***	[NA]	***3900***	40	[NA]	4	***80***	[NA]	<2	[NA]	<10	[NA]	65	<10	[NA]	7000	<2	[NA]	[NA]	<0.1	<0.1	<0.1
MW 3A	380000	***6.3***	[NA]	690	***170***	[NA]	3	***110***	[NA]	<2	<10	<10	[NA]	50	<10	[NA]	6900	<2	[NA]	34	<0.1	<0.1	<0.1
MW 3B	370000	***6.4***	[NA]	670	***160***	[NA]	3	***110***	[NA]	<2	<10	<10	[NA]	95	<10	[NA]	7000	<2	[NA]	34	<0.1	<0.1	<0.1
MW 4	510000	***6.2***	<500	***1700***	40	[NA]	3	[NA]	95	<2	<10	<10	[NA]	[NA]	<10	370	[NA]	<2	<10	***160***	<0.1	<0.1	<0.1
MW 5	830000	7	<500	***15000***	30	***14000***	11	[NA]	200	***3***	<10	<10	[NA]	[NA]	<10	80	[NA]	<2	<10	31	<0.1	<0.1	<0.1
Blank	<10000	6.9	<500	<50	10	8	5	10	<10	<2	<10	<10	[NA]	<10	<10	<10	39	<2	<10	<10	<0.1	<0.1	<0.1
Assessment Criteria																							
Fresh Water Aquatic Ecosystems	NR	6.5-9.0	NR	NR	NR	NR	50	(<pH6.5) 100	NR	2	10	5	NR	1000	5	NR	NR	0.1	150	50	NR	NR	NR
Irrigation Water	NR	4.5-9.0	NR	NR	NR	NR	100	5000	NR	10	1000	200	50	1000	200	2000	NR	2	20	2000	NR	NR	NR
Lowland River	***NR***	***6.5-8.0***	***NR***	***1200***	***65***	***80***	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

NA **denotes not analysed**

160 **denotes concentration is above or equal to the Lowland River assessment criterion**

denotes concentrationdoes not comply with the Fresh Water Aquatic Ecosystems assessment criterion

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

PHYSIOCHEMICAL AND NUTRIENTS

These results are subject to verification by the Department of Environment in accordance

Heptachlor	Aldrin	delta-BHC	beta-BHC	Heptachlor Epoxide	alpha-Endosulfan	gamma-Chlordane	alpha-Chlordane	p,p'-DDE	Dieldrin	Endrin	beta-Endosulfan	p,p'-DDD	p,p'-DDT	Endosulfan Sulphate	Endrin Aldehyde	Methoxychlor	Endrin Ketone	Diazinon	Chlorpyrifos	Malathion	Fenitrothion	Bromofos Ethyl	Methidathion	Ethion	PCB Congener C28	PCB Congener C52	PCB Congener C101
μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	[NA]	[NA]	[NA]
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	[NA]	[NA]	[NA]
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	[NA]	[NA]	[NA]
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	[NA]	[NA]	[NA]
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.02	<0.02	<0.02
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.02	<0.02	<0.02
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.02	<0.02	<0.02

0.01	0.01	NR	NR	0.01	NR	0.004	0.004	NR	0.002	NR	NR	NR	0.001	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.001	0.001	0.001
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

EAST CLONTARF, WATERFORD

GROUNDWATER ANALYTICAL RESULTS

PHYSIOCHEMICAL AND NUTRIENTS

e with the Contaminated Sites Management Series of Guidelines.

PCB Congener C118	PCB Congener C138	PCB Congeners C153	PCB Congener C180	TRH C10 - C14	TRH C15 - C28	TRH C29 - C36	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo[a]anthracene	Chrysene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Benzo[a]pyrene	Indeno[123-cd]pyrene	Dibenzo[ah]anthracene	Benzo[ghi]perylene	Total PAH
μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]	[NA]
<0.02	<0.02	<0.02	<0.02	<30	<100	<100	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1.7
<0.02	<0.02	<0.02	<0.02	<30	<100	<100	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.8
<0.02	<0.02	<0.02	<0.02	<30	<100	<100	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.8
0.001	0.001	0.001	0.001	NR	NR	NR	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR