

**City of Rockingham Town Planning Scheme 1
Amendment 295 (Baldivis Town Centre)
City of Rockingham**

**Report and recommendations
of the Environmental Protection Authority**

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Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the Amendment by the City of Rockingham to rezone Lots 6, 13 and Pt Lot 26 on the corner of Nairn Drive and Safety Bay Rd, Baldivis from "Rural" to "Baldivis Town Centre". The area is currently zoned "Urban" under the Metropolitan Region Scheme.

Amendment 295 was initiated by the City of Rockingham in response to a proposal by Taylor Woodrow Estates Pty Ltd and Mr Macukat to develop the subject area as a town centre by integrating retail, commercial, community and residential facilities.

Relevant environmental factors

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

- (a) Public Health and Safety - risk from high pressure gas pipeline
- (b) Wetlands - provision of adequate buffer and indirect impacts
- (c) Groundwater quantity - impact on water supply and wetlands
- (d) Surface water quality - impact on wetlands and Peel-Harvey estuarine system
- (e) Groundwater quality - impact on water supply and Peel-Harvey estuarine system
- (f) Contamination - potentially contaminated soil and groundwater.

Conclusion

The EPA has considered the Amendment by the City of Rockingham to rezone Lots 6, 13 and Pt Lot 26 on the corner of Nairn Drive and Safety Bay Rd, Baldivis from "Rural" to "Baldivis Town Centre". The EPA has concluded that the scheme amendment can be implemented to meet the EPA's objectives provided the conditions recommended in Section 4, and set out in Appendix 3, are imposed.

The key factors in this assessment are Public Health and Safety (Risk and Hazard), Wetlands, Surface water quality, Groundwater quality and quantity and Contamination. The recommendations made by the EPA to ensure that its objectives for these factors can be achieved are:

- the preparation of a Drainage and Nutrient Management Plan to demonstrate how drainage will be managed to facilitate the removal of pollutants and nutrients in accordance with Water Sensitive Urban Design. This plan should also ensure that the Amendment complies with the requirements of the Peel-Harvey EPP and Statement of Planning Policy No.2 and that groundwater quantity is not altered to impact on Tamworth Hill Swamp;
- the preparation of an Wetland Management Plan to provide for protection of Tamworth Hill Swamp from direct and indirect impacts;
- the requirements of development setbacks from the CMS high pressure gas pipeline and limitations to uses allowable within the pipeline easement to minimise the risk to public safety; and
- the investigation of the nature and extent of soil or groundwater contamination resulting from previous land uses and, if necessary preparation and implementation of a remediation program.

Conditions

Section 48D of the Environmental Protection Act 1986 requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the scheme amendment and on the conditions to which the Amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

To ensure that the scheme provisions documented in the environmental review are incorporated into the Town Planning Scheme text, the EPA considers that it is necessary to impose a number of conditions to reflect the scheme provisions.

Accordingly, the EPA has developed a set of conditions which it recommends should be imposed if Amendment 295 to the City of Rockingham's Town Planning Scheme No. 1 is approved. These conditions are presented in Appendix 3 and are based on the EPA recommendations in Section 3.

Recommendations

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

1. That the Minister considers the report on the relevant environmental factors of Wetlands, Surface Water Quality, Groundwater Quality, Groundwater Quantity, Soil and Groundwater Contamination, and Public Health and Safety (Risk and Hazard);
2. That the Minister notes that the EPA has concluded that the Amendment can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment; and
3. That the Minister imposes the conditions and procedures consistent with Section 4 and set out in formal detail in Appendix 3 of this report.

Contents

Page

Summary and recommendations	i
1. Introduction and background	1
2. The scheme amendment	1
3. Environmental considerations	5
3.1 Relevant environmental factors	5
3.2 Public Health and Safety	5
3.3 Wetlands	8
3.4 Groundwater quantity	12
3.5 Surface water quality	13
3.6 Groundwater quality	16
3.7 Contamination	18
4. Conditions	18
5. Conclusions	20
6. Recommendations	20

Table

1. Summary of key characteristics of the Amendment	4
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Figures

1. Location Map	2
2. Indicative Development Plan	3
3. Management Plan for Tamworth Hill Swamp	9
4. Tamworth Hill Swamp	11
5. Aerial photograph	19

Appendices

1. List of submitters	
2. References	
3. List of recommended Ministerial Conditions to be incorporated into the Amendment	
4. List of environmental management measures submitted by the Responsible Authority in the Environmental Review	
5. Summary of Relevant Environmental Factors (Tables 2 & 3)	

1. Introduction and background

The City of Rockingham proposes to rezone Lots 6, 13 and Pt Lot 26 on the corner of Nairn Drive and Safety Bay Rd, Baldivis from "Rural" to "Baldivis Town Centre" (see Figure 1). The area is currently zoned "Urban" and "Urban Deferred" under the Metropolitan Region Scheme (MRS).

Amendment 295 was initiated by the City of Rockingham in response to a proposal by Taylor Woodrow Estates Pty Ltd and Mr Macukat to develop the subject area as a town centre by integrating retail, commercial, community and residential facilities.

Amendment 295 was referred to the EPA on 1 May 1997 and the level of assessment set at Environmental Review on 23 May 1997.

The six (6) week public submission period for the Environmental Review prepared for Amendment 295 commenced on 23 June 1998 and ended on 4 August 1998.

The purpose of undertaking an environmental impact assessment on planning schemes and their amendments is to identify if the intended land use is environmentally acceptable, in conjunction with planning approval and if so what environmental conditions/scheme provisions should apply and when these should be addressed or implemented at future stages of the planning process. Sometimes insufficient detailed information is available at the time or rezoning. Under these circumstances and where an environmental factor is not critical to the proposed change in land use, the Environmental Review process can allow particular factors to be deferred to a latter level of planning, typically when more detail is available.

Further details of the Amendment are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the Amendment. Conditions and procedures to which the Amendment should be subject if the Minister determines that it may be implemented are set out in Section 4. Section 5 presents the EPA's conclusion and Section 6 the EPA's recommendations.

A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2, and recommended conditions and procedures are provided in Appendix 3. Appendix 4 contains a list of environmental management measures submitted by the Responsible Authority in the Environmental Review. Appendix 5 contains a summary of the relevant environmental factors.

The DEP's summary of submissions and the proponent's response to those submissions has been published separately and is available in conjunction with this report.

2. The scheme amendment

The area is currently zoned "Urban" under the MRS and "Rural" by the City of Rockingham's Town Planning Scheme (TPS) No. 1. In response to a proposal by Taylor Woodrow Estates Pty Ltd and Mr V Macukat to develop the land as a town centre the City of Rockingham initiated Amendment 295 to the scheme to rezone Lots 6, 13 and Pt Lot 26 on the corner of Nairn Drive and Safety Bay Rd, Baldivis from "Rural" to "Baldivis Town Centre".

The amendment covers a total area of approximately 43 ha and is currently used for grazing and market gardening. The site is almost totally cleared of vegetation except for a few remaining mature trees.

The CMS Gas Transmission of Australia high pressure natural gas pipeline passes through the Amendment on an approximately northwest-southeast alignment in a 20m wide easement. The alignment is shown in Figure 2 which shows the Indicative Development Plan for the Amendment. This pipeline poses a risk and the development must ensure that public safety is not compromised.

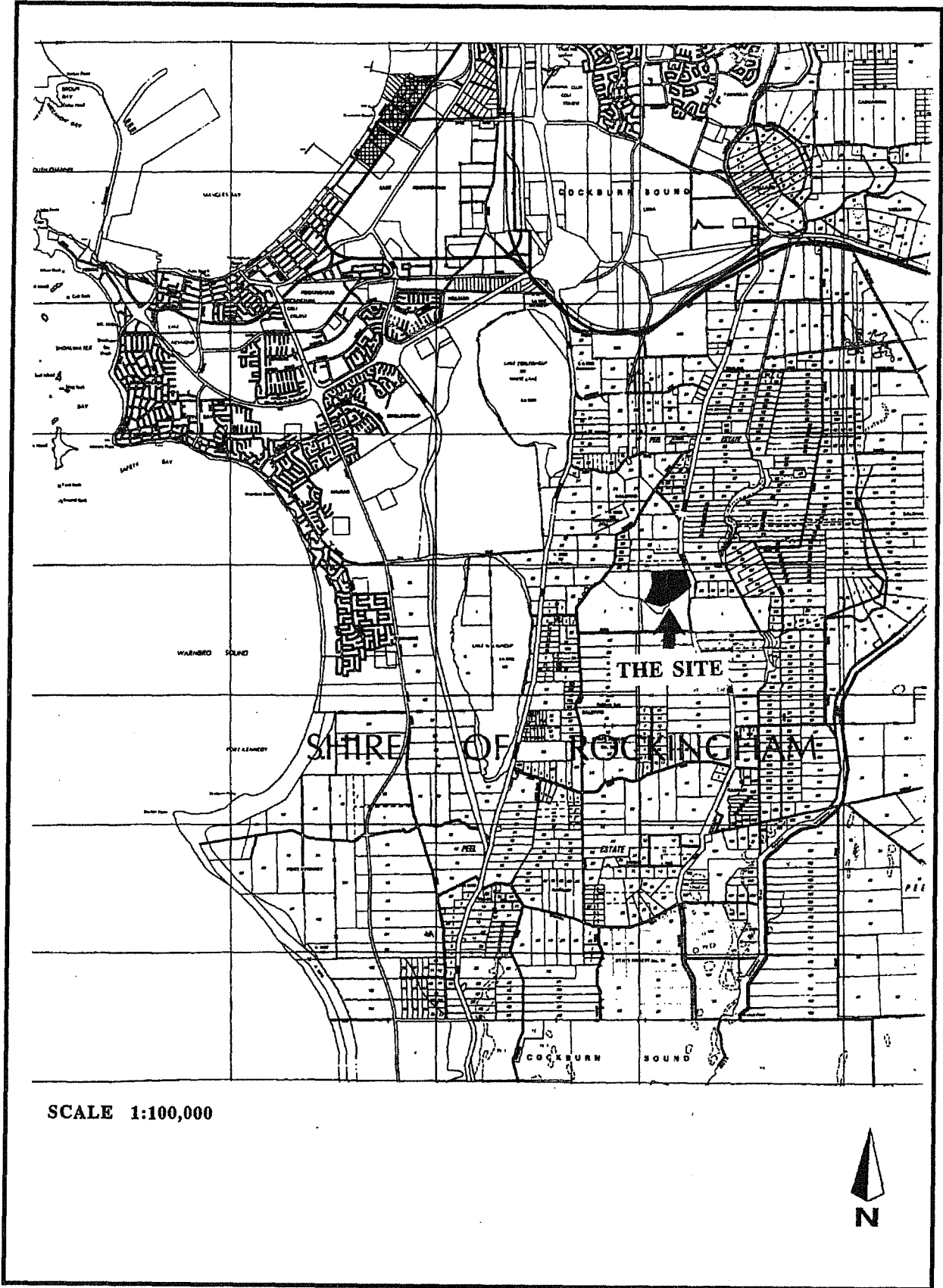
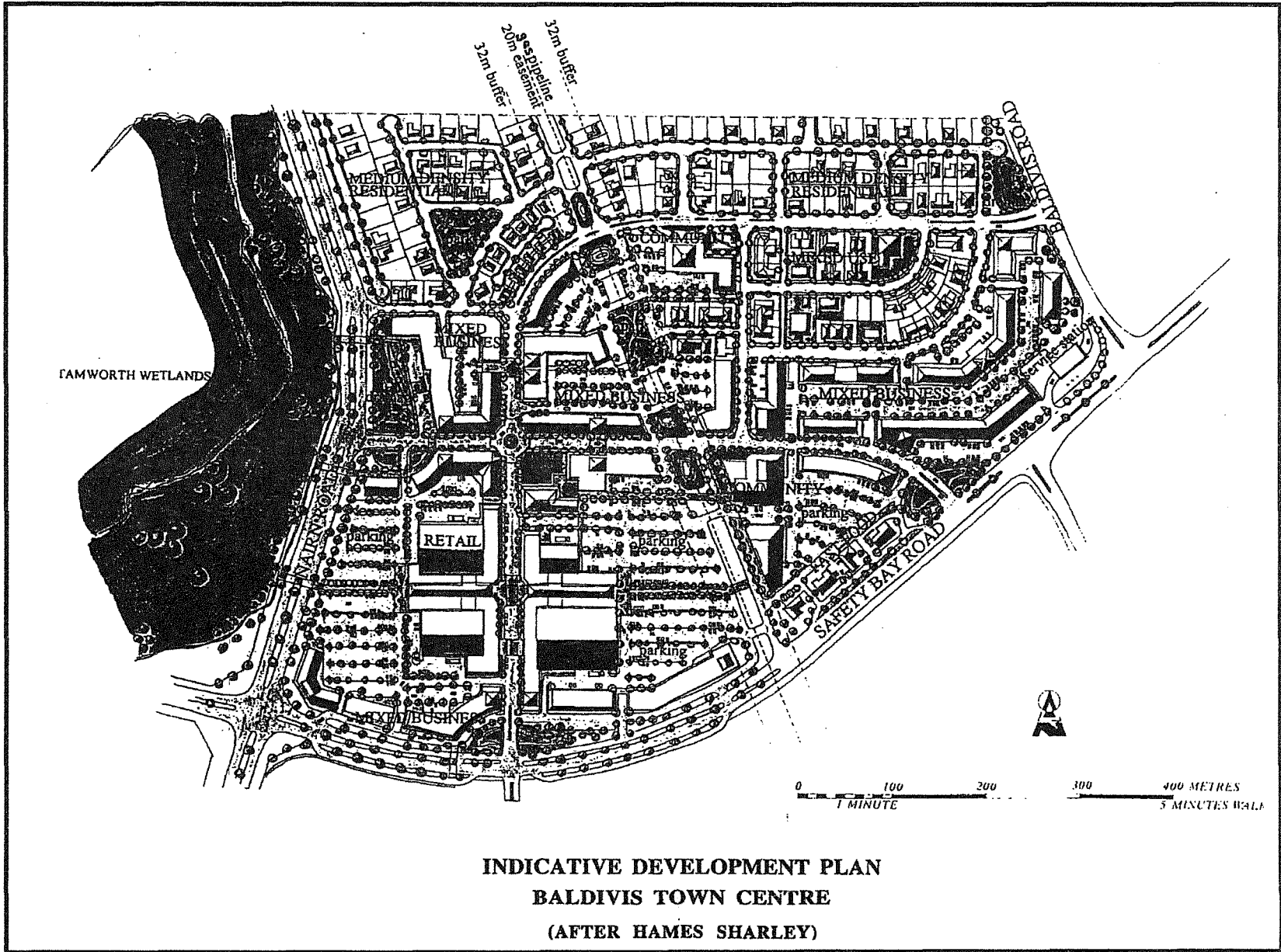


Figure 1. Location Map.

Figure 2. Indicative Development Plan.



INDICATIVE DEVELOPMENT PLAN
BALDIVIS TOWN CENTRE
(AFTER HAMES SHARLEY)

Surrounding land uses are currently characterised by predominantly rural activities comprising of land for grazing. Future residential development is proposed to the north and south of the proposed town centre.

Tamworth Hill Swamp is located west of the site, separated by the 40m wide existing Nairn Road reserve (see Figure 2). This wetland is protected by the Environmental Protection (Swan Coastal Plain Lakes) Policy (1992) and has been assigned a 'Conservation' management category. The wetland forms part of a Proposed Port Kennedy Scientific Park and is reserved for Parks and Recreation zoning in Metropolitan Region Scheme (MRS). The Department of Environmental Protection (DEP) has advised that the vegetation adjacent to the Amendment surrounding the wetland is regionally significant.

Amendment 295 is also located within the Peel-Harvey surface water catchment, but is not within the area covered by the Peel-Harvey Environmental Protection Policy and Statement of Planning Policy Number 2 (The Peel-Harvey Coastal Plain Catchment). Notwithstanding this, development of the Amendment may cause changes in the surface water and groundwater quality and quantity that may lead to increased nutrient loads in the Peel-Harvey Estuary.

The main characteristics of the Amendment are summarised in Table 1 below. The potential impacts of the Amendment and their proposed management are summarised in Table 2 (Appendix 5).

Table 1. Summary of key characteristics of key characteristics of the Amendment.

Element	Description
Existing zoning	MRS TPS 'Urban' 'Rural'
Proposed zoning	TPS 'Baldivis Town Centre'
Lot Numbers	Lots 6, 13 and Part Lot 26
Amendment area	43 hectares
Current Land use	Grazing (39 ha) and market gardening (3.9 ha) CMS high pressure gas pipeline 20m easement running through centre of the site on an approximate northwest-southeast alignment
Indicative Development Plan characteristics	Retail and car parking (5.1ha) Commercial and carparking (9.9 ha) Mixed Use and car parking (19.5ha) Residential (7.2ha, 40 dwellings per hectare or 450m ² average lot size)
Sewerage	The Amendment will be connected to reticulated sewerage. Sewage pump stations will meet DEP criteria for 'sensitive areas' (DEP 1995)
Drainage	Water run off from roads generated by storm events up to 1:100 year 24 hour will be retained on-site using infiltration basins within Public Open Space (Figure 2), with no direct discharge of stormwater to Tamworth Hill Swamp; Drainage from car parks will be infiltrated through localised side entry pits and gullies to promote local aquifer recharge through a piped dissipation system, including a 1 in 100 24 hour storm event; and Run off from houses will be disposed of in soakwells or surface infiltration.
Risk (CMS Gas Pipeline)	A minimum separation distance of 32m (excluding roads, car parking and landscaping) from the pipe centreline to the lot boundary of any development; and A minimum separation distance of 96m from the pipe centreline to the lot boundary of any sensitive development (eg. aged car, schools, hospitals or child care).
Wetlands (Tamworth Hill Swamp)	The minimum separation distance from the Amendment to the wetland is 85m, which includes the Nairn Road road reserve (50m). The average separation distance is 135m, including Nairn Road.
Surrounding Land uses	Rural land to the south, west and north which is proposed for future Residential developments
Surface Water Catchment	Tamworth Hill Swamp and Peel-Harvey Estuary

3. Environmental considerations

3.1 Relevant environmental factors

Section 48(D) of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the scheme and the conditions, if any, to which the scheme should be subject. In addition, the EPA may make recommendations as it sees fit.

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

- (a) Public Health and Safety - risk from high pressure gas pipeline
- (b) Wetlands - provision of adequate buffer and indirect impacts
- (c) Groundwater quantity - impact on water supply and wetlands
- (d) Surface water quality - impact on wetlands and Peel Harvey estuarine system
- (e) Groundwater quality - impact on water supply and Peel Harvey estuarine system
- (f) Contamination - potentially contaminated soil and groundwater.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the Environmental Review document and the submissions received, in conjunction with the Amendment characteristics (including significance of the potential impacts), the adequacy of the Responsible Authority's response, the effectiveness of current management and alternative approval processes which ensure that the factors will be appropriately managed.

The factor of Contamination was not covered in the Environmental Review document however it is the EPA's opinion that it is a relevant factor that requires addressing in this report.

The Environmental Review Instructions also identified Particulates/Dust, Noise and Aboriginal Culture and Heritage as preliminary environmental factors. The Responsible Authority in the Environmental Review provided a commitment to ensure construction activities will be managed in accordance with EPA Interim Policy No.18, Air Quality Impacts from Development Sites; this has been included as a recommended Ministerial Condition. Construction activities will also comply with Regulation 13 of the Environmental Protection (Noise) Regulations 1997. Archaeological and ethnographic surveys of the Amendment did not reveal any sites of aboriginal significance.

The identification of relevant environmental factors is summarised in Table 2, and a summary of their assessment is set out in Table 3.

The relevant environmental factors are discussed in Sections 3.2 to 3.7 of this report.

3.2 Public health and safety - risk from high pressure gas pipeline

Description

A CMS high pressure natural gas pipeline traverses the site in an approximately northwest-southeast alignment, within an existing 20 m wide easement. The route of the pipeline is clearly visible on the Indicative Development Plan proposed by the City of Rockingham (Figure 2).

The risk to public safety in relation to the location of the pipeline through a residential subdivision has previously been quantitatively assessed in accordance with EPA risk criteria (Stratex-EWI Pty Ltd, 1994). The City of Rockingham proposes to protect public safety by adopting the required separation distances from the pipeline in accordance with the EPA's criteria as well as designing the development to avoid conflicting land uses.

The City of Rockingham has proposed the three following Scheme Provisions in Amendment 295 to protect public safety.

1. *The following facilities are prohibited within the gas pipeline easement:*

- *Fences;*
- *Stormwater basins and swimming pools;*
- *Storage of material, equipment etc;*
- *Camping, caravans etc;*
- *Barbeques (permanent or temporary);*
- *The lighting of fires except for controlled burning off;*
- *Explosives, inflammables, corrosives (including storage of LPG and fuel oil);*
- *Garbage, land fill, refuse disposal; and*
- *Service stations, fuel lines and storage.*

Cycleways, walking tracks, and footpaths are permitted within the gas pipeline easement subject to the same general restrictions as for roads.

2. *Minimum safety standards required by CMS and set out in the Petroleum Pipelines Act 1969-70 and the Australian Pipeline Code AS 2885.*

3. *Development setbacks to the gas pipelines are as follows:*

- *32m - Development buffer from the centre of the pipe (excluding roads, car parking and landscaping);*
- *96m - Sensitive uses buffer from the centre of the pipe (ie Aged and Child Care);*

to the satisfaction of the Environmental Protection Authority and City of Rockingham.

Assessment

The area considered for assessment of this factor is the Amendment in the vicinity of the CMS pipeline.

The EPA's objective in regard to this environmental factor is to ensure the risk is managed to meet the EPA's criteria for individual fatality risk and the Department of Mineral and Energy's requirements in respect of public safety.

The implementation of the amendment has the potential to expose future users and residents to an unacceptable level of public risk.. The EPA has defined acceptable criteria for Individual Risk of Fatality as it relates to five main types of landuse in its Interim Guidance No. 2 for 'Risk Assessment and Management: Off-site Individual Risk from Hazardous Industrial Plant' released in July 1998. In residential zones a risk level of one in a million or less deaths per year is considered so small as to be acceptable (EPA, 1998). The DEP has advised that to meet this criteria an acceptable separation distance to residential development (ie. lot boundary) is 32m each side of the centreline of the pipeline (ie a total corridor width of 64m).

For more sensitive land uses (ie aged persons accommodation, child care centres, hospitals and schools) the EPA considers a risk level of one half (0.5) in a million or less deaths per year as being so small as to be acceptable. The DEP has advised that a greater separation distance to sensitive developments (ie. lot boundary) of 96m each side of the pipeline is required to meet this criteria (ie total corridor width of 192m).

These separation distances assume that appropriate risk mitigation measures as detailed in the quantitative assessment are implemented as agreed with the pipeline operator. In most cases the separation distances proposed in the Environmental Review from the high pressure gas pipeline meet the EPA criteria in this policy. At the moment the Indicative Development Plan shows the dwellings in the residential area adjoining the pipeline being at a distance of 32m from the pipeline. This requires modification to show the 32m distance being to the property boundary of the residential lots. The City of Rockingham has acknowledged this requirement and will modify the plan accordingly as well as noting it in the Planning Policy.

In addition, specific consideration of societal risk should be given where there are large concentrations of people present, even for a short period of time, eg. bus transfer stations (EPA, 1998). The EPA therefore considers that uses where large numbers of people may congregate should also meet the 96m development setback recommended for sensitive uses.

In addition to these buffer distances the EPA believes it is necessary to control the facilities and ground disturbing activities that can or can not occur within the pipeline easement and buffer and to identify safety standards that will apply if construction activities occur.

It should also be noted that management of the pipeline any ground disturbing activity with the easement must conform with minimum safety standards are required in accordance with the Petroleum Pipelines Act 1969-70, the Australian Pipeline Code AS 2885-1997 and HB 105.

There is the potential for a second pipeline to be installed within the existing 20m pipeline easement. If this was to be proposed the new pipeline would be required to be developed to a much higher specification and be better protected to ensure that the total risk is not significantly increased. The development setbacks would not require altering if this was to occur.

The EPA considers that with the proposed land use planning the risks from the CMS high pressure gas pipeline can be minimised and managed to acceptable levels.

The EPA agrees that the intent of the Scheme Provision in Amendment 295 to protect public safety is an appropriate way to achieve the EPA's objective and has adopted the intent of the proposed scheme provisions, with some modifications, in its recommended conditions contained in Appendix 3.

Having particular regard to:

- a) the location of the CMS high pressure gas pipeline and the EPA's criteria for Individual Risk of Fatality as outlined in the Interim Guidance Policy for 'Risk Assessment and Management: Off-site Individual Risk from Hazardous Industrial Plant'; and
- b) the proposed Indicative Development Plan and scheme provisions which restrict uses within the pipeline easement and stipulate the required separation distances from the centreline of the pipeline;

it is the EPA's opinion that if the following recommended conditions are imposed:

- 1) prescriptions for public safety and protection of the pipeline shall be prepared to the requirements of the Department of Minerals and Energy, on advice of the City of Rockingham, the Department of Environmental Protection and the CMS Gas Transmission of Australia. (eg. Australian Pipeline Code AS 2885-1997 and HB 105, or the most recent equivalent recognised by the Environmental Protection Authority);
- 2) prohibiting ground-disturbing activities within the gas pipeline easement and buffer, specifically temporary residences, storage of materials and equipment, fires and barbecues, explosives, inflammables and corrosives (including storage of liquefied petroleum gas and fuel oil), refuse disposal and land fill, service stations, fuel lines and storage of fuel, trees or shrubs with an expected growth exceeding 1 metre in height, large obstructions to line of sight along the easement;
- 3) some facilities may be permitted within the gas pipeline easement and buffer provided they are strictly supervised during construction, they are cycleways and footpaths, road crossings, public open space, and signage and other facilities that are necessary to comply with safety standards; and

- 4) minimum development setbacks from the centre of the gas pipeline shall be 32m to the property boundary of residential lots and all other development (excluding those items in c) and 96m to sensitive use development (including aged persons accommodation, child care centres, schools and hospitals) and to areas where large numbers of people may congregate;

the Amendment can be managed to meet the EPA's objective. The EPA considers it necessary to impose a number of conditions to ensure that appropriate planning mechanisms will be incorporated into the scheme amendment prior to gazettal. It is recommended that the environmental provisions set out in Appendix 3 are imposed.

3.3 Wetlands - provision of adequate buffer and indirect impacts

Description

Tamworth Hill Swamp is a sumpland which occurs west of the Amendment, separated by the Nairn Road, which is reserved as an Important Regional Road in MRS. This wetland is protected by the Environmental Protection (Swan Coastal Plain Lakes) Policy (1992) and has been assigned a 'Conservation' management category (Hill, A., Semenuik, CA., Semenuik, V and Del Marco, A. 1996). The wetland forms part of a Proposed Port Kennedy Scientific Park and is reserved for Parks and Recreation in the MRS. The management plan for the wetland shown in the Proposed Port Kennedy and Rockingham Parks Management Framework is shown in Figure 3 (WAPC 1997).

The Amendment is a minimum of 85 metres and a maximum of 240 metres from the outer most extent of the current wetland dependant vegetation, however this includes the Nairn Road road reserve, which is 50 metres in width. Seven measurements taken along boundary of the Amendment and Tamworth Hill Swamp indicate the average separation, including Nairn Road, is 135 metres. It should also be noted that because of previous clearing activities, the current extent of wetland dependent vegetation may be understated.

The Environmental Review document proposes that the existing separation distance to this wetland from the Amendment is sufficient to meet the DEP's criteria for wetland buffers. No specific scheme provisions have therefore been proposed for a buffer area. However, a scheme provision is proposed to ensure that stormwater disposal is to be designed in accordance with Water Sensitive Urban Design and prohibits any direct discharge into Tamworth Hill Swamp.

The City of Rockingham has not proposed any specific scheme provision within Amendment 295 relating to the protection of Tamworth Hill Swamp.

Assessment

The area considered for assessment of this factor is the Tamworth Hill Swamp.

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

The EPA guide for the width of a buffer area is 50 metres or 1 metre AHD higher than the furthestmost extent of the wetland (dependant) vegetation, whichever is the largest, as the minimum dryland buffer required (EPA 1997b). The dryland buffer is defined as being wetland vegetation that is less tolerant of wet and waterlogged soils surrounding the wetland vegetation.

Contour information indicates that the 1 metre AHD criteria is achieved within 20 metres of Tamworth Hill Swamp. The approximate total distance along Nairn Road between the Amendment and Tamworth Hill Swamp is 590 metres. Of this Nairn Road intrudes into the 50 metre criterion by a maximum of 15 metres and for approximately 100 of the 590 metres or a total area of 800 m². On this basis, and in almost all cases Nairn Road and the Amendment area meets or exceeds the EPA's wetland buffer requirements and where this is not achieved the intrusion is minor.

The Water and Rivers Commission (WRC) have indicated they are satisfied with the proposed buffer between Tamworth Hill Swamp, Nairn Road and the Amendment, however the

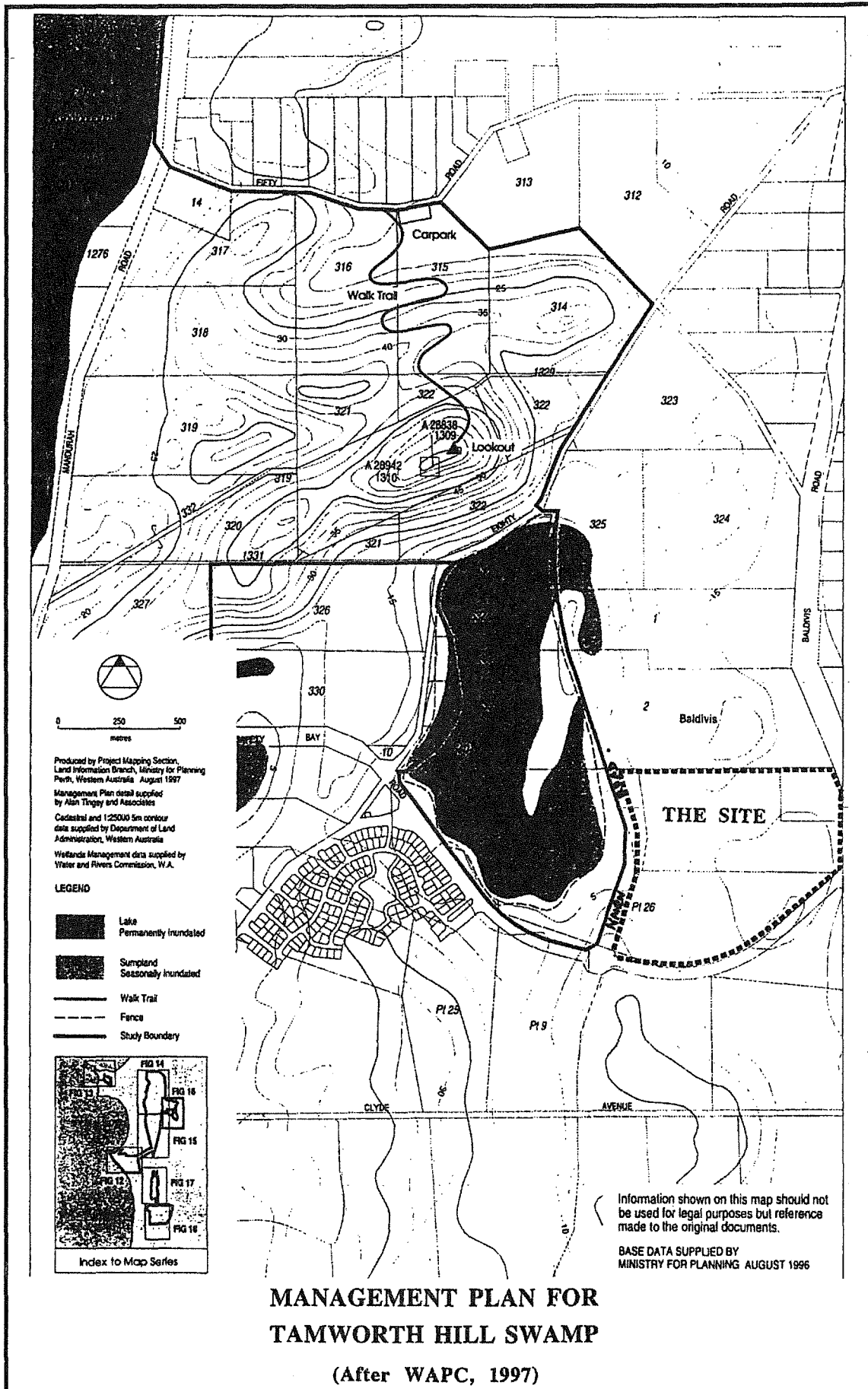


Figure 3. Management Plan for Tamworth Hill Swamp.

Department of Conservation and Land Management (CALM) recommended a uniform 200 metre buffer. The locations of the 50m and 200m buffers in relation to the Amendment are presented in Figure 4.

While the EPA acknowledges the Davies and Lane paper, it also recognises that this paper is unpublished and has not been subject to peer review. Notwithstanding this, the paper recommends “*an adequate buffer zone for maintenance of ecological processes and major food webs is recommended at 20 to 50 metres*”, further it also states “*the recommended buffer zone for protection of nutrients inputs range from 100 metres in non-sandy soils to 200 metres on sandy soil*”. The recommendation for 200 metres is based on “*high nutrient loadings*” such as unsewered residential areas and intensive agriculture/horticulture. Information provided in the Environmental Review indicates that up to 5,078 kg/N/yr and 1619 kg/P/yr may have been applied to the existing land uses (pasture and market gardens). By comparison and assuming a 10% garden/lawn area, nutrient loading could be reduced to 129 kg/P/yr and 430 kg/N/yr with the proposed land uses or a 90% reduction.

In the current Indicative Development Plan for the Amendment area the land uses that are currently shown within the 200m buffer are all sewered and will dispose of all stormwater using infiltration basins, where the closest basin to Tamworth Hill Swamp is 85 metres. On this basis the EPA does not consider the proposed land uses will have nutrient inputs comparable to managed turf or intensive agriculture/horticulture and therefore considers the Davies and Lane recommendation of 200m for nutrient input protection is conservative in this case. Given the proposed high proportion of car parks the EPA considers the pollutants most likely to threaten Tamworth Hill Swamp to be hydrocarbons, heavy metals and particulates, rather than nutrients (McRobert 1997).

The 20-50 metre buffer zone recommended for maintenance of ecological processes and major food-webs by Davies and Lane will be met or substantially exceed by the Amendment in most cases. The EPA would prefer the recommendation to be met in all cases, however given the minor intrusion considers that the existing Parks and Recreation reserve will provide a satisfactory wetland setback for the Amendment.

Notwithstanding the above and as outline in Section 3.5 the EPA is concerned regarding the location of the stormwater infiltration basin on the western side of the Amendment, closest to Tamworth Hill Swamp (85 metres). As per the recommended Ministerial Conditions the EPA believes the location of this basin should be review, based on its close proximity to Tamworth Hill Swamp and its lack of vertical separation from groundwater.

CALM have also requested that the developer contribute funds towards fencing of the Parks and Recreation reserve, signage and revegetation (if 200m buffer not met) in recognition of the indirect impacts of weeds, uncontrolled access, fire, feral animals and rubbish dumping that may occur to the wetland following development. The EPA agrees that this should be addressed as no scheme provisions were proposed to manage these issues. The EPA recommends that a Wetland Management Plan be prepared and implemented, in conjunction with CALM, to address measures to protect the wetland, including fencing, revegetation, access and maintenance.

The EPA considers that the imposition of a condition for a Drainage and Nutrient Management Plan and the Wetland Management Plan will protect Tamworth Hill Swamp from direct and indirect impacts to meet the EPA’s objective of maintaining the integrity, functions and environmental values of wetlands.

Having particular regard to:

- (a) the listing of Tamworth Hill Swamp as a Conservation Category wetland protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992;
- (b) the existing setback between the Amendment, Nairn Road and the remaining vegetation surrounding Tamworth Hill Swamp; and
- (c) scheme provisions in the amendment to incorporate Water Sensitive Urban Design;

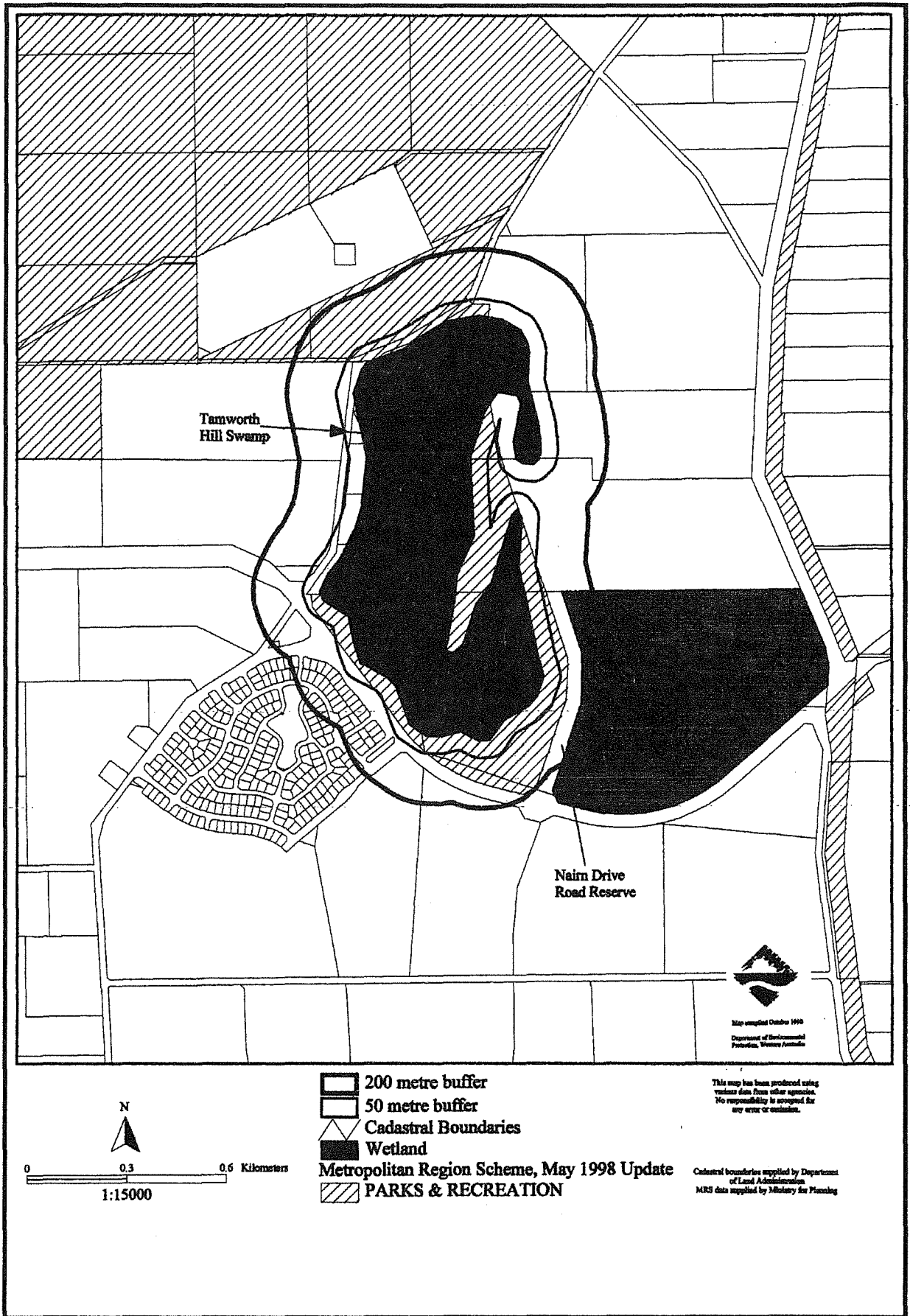


Figure 4. Tamworth Hill Swamp.

it is the EPA's opinion that if the following recommended conditions are imposed:

1. Prepare and implement a Drainage and Nutrient Management Plan to ensure that the rate, quantity and quality of water leaving the Amendment is compatible with ecological requirements and will not adversely impact on Tamworth Hill Swamp; and
2. Prepare and implement a Wetland Management Plan to address indirect and direct impacts and management responsibilities for Tamworth Hill Swamp;

the Amendment can be managed to meet the EPA's objective. The EPA considers it necessary to impose a number of conditions to ensure that appropriate planning mechanisms will be incorporated into the scheme Amendment prior to gazettal. It is recommended that the environmental provisions set out in Appendix 3 are imposed.

3.4 Groundwater quantity - impact on water supply and wetlands

Description

The Amendment is located within the Stakehill Groundwater Area which has been proclaimed under the *Rights in Water and Irrigation Act 1914*, however is not a Underground Water Pollution Control Area (UWPCA) or 'priority' catchment area. Groundwater management for the area includes licensing of groundwater abstraction typical of intensive agriculture/market gardens. A localised north-south water shed occurs on the site where the western half of the Amendment (~24ha) is towards Tamworth Hill Swamp (west) and the eastern half is towards the Peel Main Drain (east). (K Gilbert, pers comm).

During winter, localised recharge through the sandy soils of the site, together with discharge from the Stakehill Mound to the south causes groundwater movement to the north-west, west and east (Davidson 1995). In summer, when little or no recharge occurs and any localised winter mounding of the water table dissipates, groundwater movement will be to the west and north-west in accordance with regional flow characteristics.

In the Response to Submissions the City of Rockingham stated that regional groundwater flow paths provided by Davidson (1995) indicate that the site (and Tamworth Hill Swamp) is located over a groundwater col, which is a term describing the meeting point of two or more groundwater mounds. This site is above the col of the Jandakot and Stakehill Groundwater Mounds.

The City of Rockingham has not proposed specific scheme provisions for the maintenance of groundwater quantity, based on the assumption that the implementation of the Amendment will have little impact on regional hydrology, which in turn influences local groundwater levels and Tamworth Hill Swamp (City of Rockingham 1998b).

Assessment

The area considered for assessment of this factor is the Stakehill Groundwater Area.

The EPA's objective in regard to this environmental factor is to maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

The amendment is located within the Stakehill Groundwater Area and as such will be subject to well licensing through the Water and Rivers Commission (WRC) if the property is greater than 2000 m². The WRC requested that in order to protect the interests of the initial purchaser of lots with an area greater than 2000 square metres the subdivider should make arrangements to ensure that the prospective purchaser is aware that the lots are contained within the Stakehill Groundwater Area and there is a need to obtain a licence before a well/bore is constructed. The City of Rockingham has agreed to this request in the Response to Submissions.

A member of the public raised concern about the potential for large scale groundwater abstraction for grass or parkland watering and the potential detriment this may have on other users, as well as the wetland areas. However the Indicative Development Plan does not show

any proposed large parkland areas that would require large groundwater abstraction. The Office of Water Regulation at the WRC will determine appropriate groundwater abstraction volumes for any bores used within the development area and abstraction volumes will be monitored through the licensing system (City of Rockingham 1998b).

The Amendment site and the area generally has been cleared of remnant vegetation for agricultural purposes, therefore between 50 and 60 percent of direct rainfall is likely to be recharging to groundwater, compared to 12% for native bushland (Sharma and Pionke 1984). On this basis there is likely to be an historic increase in groundwater quantity and given some apparent stress and deaths of paperbarks in Tamworth Hill Swamp groundwater levels may be elevated. It has also been estimated that 21% of rainfall recharges to groundwater in Perth urban areas, therefore the Amendment is likely to maintain or slightly decrease the quantity of groundwater toward pre-clearing ground/wetland water levels. The use of bores for domestic and parkland irrigation purposes could also contribute to this decrease, however given the amount of residential bore ownership and the small area proposed for parkland this is unlikely to be significant.

The City Of Rockingham have stated in the Response to Submissions that separation distances between the constructed floor levels and the Average Annual Maximum Groundwater Level will meet the 1.2 metres required by the WRC. Installation of sub-soil drainage to lower groundwater levels is not proposed (City of Rockingham 1998b).

It is unlikely that the implementation of the Amendment will have an unacceptable impact on the regional hydrology which would in turn influence groundwater levels and Tamworth Hill Swamp. However, the EPA considers this issue should be more fully addressed in a Drainage and Nutrient Management Plan prepared to the satisfaction of the EPA on advice of the WRC and CALM.

Having particular regard to:

- a) WRC controls in place relating to the abstraction of groundwater from the Stakehill Groundwater Area; and
- b) the proposed condition to prepare and implement a Drainage and Nutrient Management Plan is designed to ensure that the rate, quantity and quality of water leaving the Amendment is compatible with ecological requirements and will not adversely impact on Tamworth Hill Swamp, Stakehill Groundwater resource and the Peel-Harvey Estuarine system,

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective. The EPA considers it necessary to impose a number of conditions to ensure that appropriate planning mechanisms will be incorporated into the scheme amendment prior to gazettal. It is recommended that the environmental provisions set out in Appendix 3 are imposed.

3.5 Surface water quality - impact on wetlands and Peel Harvey Estuarine system

Description

The amendment is located adjacent to Tamworth Hill Swamp and the eastern third of the site is located within the surface water catchment of the Peel-Harvey estuary.

The Amendment will be designed to meet Water Sensitive Urban Design Guidelines (EPA, WAWA and DPUD). Stormwater management is based on the temporary storage of water with subsequent slow release to groundwater via infiltration.

There is proposed to be no direct drainage into Tamworth Hill Swamp. Two infiltration basins are proposed, one located on the western boundary of the Amendment adjacent to Tamworth Hill Swamp. The proposed stormwater basins can be seen in the Indicative Development Plan shown in Figure 2.

The City of Rockingham has proposed the following scheme provision within Amendment 295 to manage surface water.

In considering applications for development within the Baldivis Town Centre, in accordance with requirements of the Environmental Protection Authority, Council shall require:

- *containment of water from a 1 in 100 year 24 hour storm event on-site, with no direct discharge of stormwater into any wetland, specifically Tamworth Hill Swamp;*
- *treatment of stormwater from all other storm events (including 1 in 10 year) within on-site basins, with infiltration of collected and treated stormwater from the basins to the local aquifer as recharge;*
- *collection and treatment of the “first flush” stormwater event within the on-site basins annually;*
- *drainage from car parks not to be directed into the treatment systems, but infiltrated through localised side entry pits and gullies to promote local aquifer recharge through a piped dissipation system, including a 1 in 100 24 hour storm event; and*
- *infiltration of roof run-off through localised soakage structures;*

to the satisfaction of the City of Rockingham.

Assessment

The area considered for assessment of this factor is the catchment for the Peel-Harvey Estuarine System and Tamworth Hill Swamp.

The EPA's objective in regard to this environmental factor is to maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993), Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992 and the NHMRC/ ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy 1996.

Within the development area stormwater has been designed on current Best Management Practices. The Environmental Review states that the design criteria for the project will be in accordance with the objectives for the Environmental Protection Policy and State Planning Policy for the Peel-Harvey Estuary catchment .

The proposed location of the stormwater infiltration basin at the western edge of the Amendment, adjacent to Tamworth Hill Swamp, poses some concern to the EPA. As mentioned above the potential pollutants which may be directed to this basin include hydrocarbons, heavy metals and particulates. In the Response to Submissions the City of Rockingham referred to the findings of the Appleyard 1993 report which sought to determine the impact of stormwater infiltration basins on groundwater quality in the Perth metropolitan area. The study monitored bores adjacent to three stormwater infiltration basins with various catchments including a residential area with a light industrial area, a completely residential catchment and one which collected run-off from Leach Highway and a residential area.

The results concluded that concentrations of toxic metals, nutrients, pesticides and phenolic compounds in groundwater near the infiltration basins were very low and generally well within Australian drinking water guidelines (Appleyard, 1993). Two of these infiltration basins had floor levels above that of the water table by a few metres, whilst one site had a floor level at the water table and in an existing swamp. This site exhibited higher levels of nitrogen than the other two sites, however, it was not conclusive that this was as a result of infiltration from the basin.

The catchment for the proposed stormwater basin located closest to Tamworth Hill Swamp is 24 Ha (K Gilbert, pers comm) as is shown in the Indicative Development Plan. The engineer for the project stipulates that there will be no stormwater from outside of the Amendment being

directed to the basin. It is proposed to have the basin floor level below or at the water table level in order to achieve permanent water in the basin (K Gilbert, pers comm).

The Best Management Practices for Water Sensitive Urban Design produced for the Environmental Protection Authority, Department of Planning and Urban Development and Water Authority of WA state that one of the purposes of Infiltration Retention Basins is to improve water quality by infiltration. The basins are designed to achieve a moderate to high pollutant removal capacity. The guidelines state that these basins are “feasible when soils are permeable and the water table and the bedrock are situated well below the soil surface”.

The effectiveness of pollutant removal by infiltration is variable, and is based primarily on the depth of percolation, the physical structure of the soil/substrate, and the chemical characteristics of the soil/substrate. Some soil/substrate attributes which would enhance pollutant removal include high contaminant adsorption capacity, low water table and high organic matter content (Evangelisti et al, 1991).

The proposed location of this basin is at the lowest part of the Amendment. As the base of the basin will be at or below the water table it is unknown whether the basin will achieve adequate pollutant/nutrient removal. Therefore, it is not clear whether the location and size of the detention basin is appropriate or if the design needs to be modified to be above the water table level. In addition eutrophic wetlands which are unable to dry out during summer provide suitable environments for midges and mosquitoes to breed. The EPA recommends that a Drainage and Nutrient Management Plan be produced to the satisfaction of the EPA, on the advice of the DEP, WRC and CALM which proposes a detailed design for the management of urban runoff which ensures that the rate, quantity and quality of water leaving the Amendment will not adversely impact on Tamworth Hill Swamp, Stakehill Groundwater resource and the Peel-Harvey Estuarine system. The plan will have to consider the biophysical constraints of the Amendment (eg. landform, soil types, hydrology, geology, etc.) to achieve this.

It is recommended that this plan aim to avoid pollutant concentrations close to the wetland by dispersing infiltration of stormwater throughout the catchment. The City of Rockingham has already committed to some of this principle, such as infiltration of roof run-off into localised soakage structures, however the EPA considers that additional Water Sensitive Urban Design principles should be considered, for example flush curbing, grassed swales and roadside soakwells.

The EPA recommends that the preparation of a Drainage and Nutrient Management Plan is an appropriate mechanism for the design and implementation of facilities associated with surface water quality management which can achieve surface water quality objectives for the Amendment. The Drainage and Nutrient Management Plan should include monitoring and contingency provisions in the event that the criteria for water quality and quantity are not achieved.

Having particular regard to:

- a) the requirements of the Statement of Planning Policy for the Peel-Harvey Coastal Plain Catchment;
- b) the likely reduction in nutrient loads compared with current land uses (section 3.3);
- c) the commitment to use Water Sensitive Urban Design Principles; and
- d) the proposed condition to prepare and implement a Drainage and Nutrient Management Plan which is designed to ensure that the rate, quantity and quality of water leaving the Amendment is compatible with ecological requirements and will not adversely impact on Tamworth Hill Swamp, Stakehill groundwater resource and the Peel-Harvey Estuarine system, which shall;
 - define the catchment of Tamworth Hill Swamp in relation to the Amendment;
 - provide measures to facilitate the removal of pollutants and nutrients in accordance with Water Sensitive Urban Design Best Practices;
 - incorporate best practice Water Sensitive Urban Design principles to maximise on-site water infiltration generally;

- include measures to prevent surface water runoff from entering Tamworth Hill Swamp or the Peel-Harvey Estuarine system;
- ensure that the provisions of the Statement of Planning Policy No 2, The Peel-Harvey Coastal Plain catchment and the Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992 are met;
- include a monitoring program to measure the performance of the implemented Plan against objectives and performance criteria; and
- include contingency plans in the event that criteria are not achieved

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective. It is acknowledged that the environmental review has proposed a scheme provision which, if implemented would contribute to the management of environmental impacts resulting from the Amendment. The EPA considers it necessary, however, to impose a number of conditions to ensure that appropriate planning mechanisms will be incorporated into the scheme amendment prior to gazettal. It is recommended that the environmental provisions set out in Appendix 3 are imposed.

3.6 Groundwater quality - impact on wetlands and Peel-Harvey Estuarine system

Description

The amendment is located within the Stakehill Groundwater Area and it is estimated that 24 Ha of the site is within the catchment of Tamworth Hill Swamp (K Gilbert, pers comm). In the Response to Submissions the City of Rockingham state that regional groundwater flow paths provided by Davidson (1995) indicate that the site (and Tamworth Hill Swamp) is located over the col of the Jandakot and Stakehill Groundwater Mounds.

The City of Rockingham has not proposed specific scheme provisions for the maintenance of groundwater quality, however, in the Environmental Review it is stated that the most important factors contributing to the protection of groundwater quality through the implementation of the project are:

- the control of land use and removal of potentially polluting current practices (market gardening and broadacre farming); and
- the treatment of all stormwater generated on the site from hard surfaces in appropriately designed structures for aquifer recharge, or alternatively directly infiltrated in the case of roof catchments (City of Rockingham 1998a).

Assessment

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

The EPA's objective in regard to this environmental factor is to maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance are protected.

The City of Rockingham have estimated the comparative potential nutrient applications related to pasture, market gardening and domestic/public lawns over 10% of the site. The Environmental Review estimates that domestic/public lawn nutrient loadings would be approximately 8% and 8.5% of the current potential phosphorus and nitrogen loadings respectively, ie. a potential loading reduction of more than 90% (City of Rockingham 1998a).

The issue of removal of fuels, oils, chemicals, pesticides and metals from stormwater before they are permitted to enter the groundwater, rather than merely the nutrients, was raised in the public submissions on the Environmental Review. In the Response to Submissions the City of

Rockingham stated that fuels, grease and oils will be removed in roadside gully traps prior to entry into the stormwater compensation basins. They rely on the research by Appleyard (1993), discussed previously in this report, which concluded that concentrations of toxic metals, nutrients, pesticides and phenolic compounds in groundwater near stormwater basins of various catchments were very low.

The EPA's concerns with the effectiveness of the proposed stormwater infiltration basins proposed to protect water quality have been discussed previously in this report under the factor of surface water quality. As the base of the two infiltrations basins will be at or below the water table it is unknown whether the basin will achieve adequate pollutant/nutrient removal. The EPA recommends that a Drainage and Nutrient Management Plan be produced to the satisfaction of the EPA, on the advice of the DEP, WRC and CALM which proposes a detailed design for the management of urban runoff which ensures that the rate, quantity and quality of water leaving the Amendment will not adversely impact on Tamworth Hill Swamp, Stakehill Groundwater resource and the Peel-Harvey Estuarine system.

Having particular regard to:

- a) the requirements of the Statement of Planning Policy for the Peel-Harvey Coastal Plain Catchment;
- b) the likely reduction in nutrient loads compared with current land uses (section 3.3);
- c) the commitment to use Water Sensitive Urban Design Principles; and
- d) the proposed condition to prepare and implement a Drainage and Nutrient Management Plan which is designed to ensure that the rate, quantity and quality of water leaving the Amendment is compatible with ecological requirements and will not adversely impact on Tamworth Hill Swamp, Stakehill groundwater resource and the Peel-Harvey Estuarine system, which shall;
 - define the catchment of Tamworth Hill Swamp in relation to the Amendment;
 - provide measures to facilitate the removal of pollutants and nutrients in accordance with Water Sensitive Urban Design Best Practices;
 - incorporate best practice Water Sensitive Urban Design principles to maximise on-site water infiltration generally;
 - include measures to prevent surface water runoff from entering Tamworth Hill Swamp or the Peel-Harvey Estuarine system;
 - ensure that the provisions of the Statement of Planning Policy No 2, The Peel-Harvey Coastal Plain catchment and the Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992 are met;
 - include a monitoring program to measure the performance of the implemented Plan against objectives and performance criteria; and
 - include contingency plans in the event that criteria are not achieved

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective. The EPA considers it necessary to impose a number of conditions to ensure that appropriate planning mechanisms will be incorporated into the scheme amendment prior to gazettal. It is recommended that the environmental provisions set out in Appendix 3 are imposed.

3.7 Contamination - potentially contaminated soil and groundwater

Description

Approximately 3.9 Ha of the Amendment area has been used as a commercial market garden. The market garden activity can be clearly seen in the aerial photograph of the Amendment (Figure 5). The operator of the market garden has indicated that he uses best practices as advised by Agriculture WA. However, the soil in this area could still be potentially contaminated as a result of this land use through the past use of fertilisers, pesticides or herbicides.

The EPA considers this to be an issue that will require management at a later stage of planning. This factor was not raised as part of the Instructions and therefore the Responsible Authority was not required to address the matter as part of the Environmental Review.

Assessment

The area considered for assessment of this factor is the land within the Amendment area which has been utilised for market gardening.

The EPA's objective in regard to this environmental factor is to ensure the rehabilitation of the site to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria.

A large portion of the existing market gardening site is intended for residential uses. In order to ensure the health of future residents and the environment the EPA recommends the imposition of a condition which requires the nature and extent of any contamination to be determined prior to any application of subdivision. The site is determined to be contaminated if hazardous substances occur in the soil or groundwater at concentrations above background levels and where assessment indicates it poses, or has the potential to pose, an unacceptable risk to human health or the environment (Department of Environmental Protection 1997). If there is contamination present, the land has to be remediated to a standard that is suitable for the intended land uses.

Having particular regard to:

- a) the requirement to determine the nature and extent of contamination and remediate contaminated sites to acceptable standards; and
- b) the proposed condition that requires the identification and remediation of any contaminated soil and groundwater prior to subdivision;

it is the EPA's opinion that the Amendment can be managed to meet the EPA's objective. The EPA considers it necessary to impose a number of conditions to ensure that appropriate planning mechanisms will be implemented into the scheme amendment prior to gazettal. It is recommended that the environmental provisions set out in Appendix 3 are imposed.

4. Conditions

Section 48D of the Environmental Protection Act 1986 requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the scheme amendment and on the conditions to which the Amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

To ensure that the scheme provisions documented in the environmental review are incorporated into the Town Planning Scheme text, the EPA considers that it is necessary to impose a number of conditions to reflect the scheme provisions.

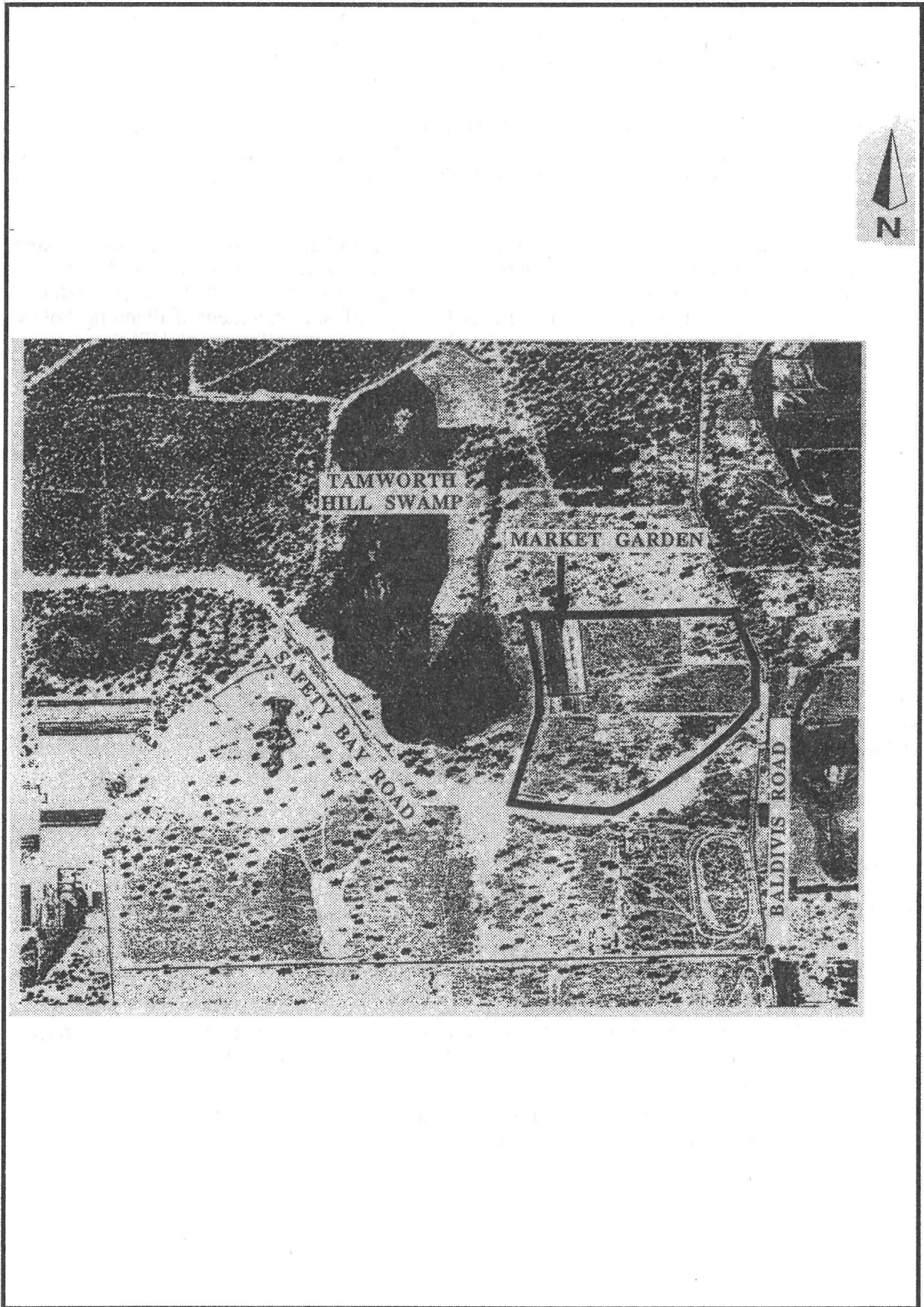


Figure 5. Aerial photograph.

Accordingly, the EPA has developed a set of conditions which they recommend should be imposed if Amendment 295 to the City of Rockingham's Town Planning Scheme No. 1 is approved. These conditions are presented in Appendix 3 and are based on the EPA recommendations in Section 3.

The key factors in this assessment are Public Health and Safety (Risk and Hazard), Wetlands, Surface water quality, Groundwater quality and quantity and Contamination. The recommendations made by the EPA to ensure the its objectives for these factors can be achieved are:

- the preparation of a Drainage and Nutrient Management Plan to demonstrate how drainage will be managed to facilitate the removal of pollutants and nutrients in accordance with Water Sensitive Urban Design. This plan should also ensure that the Amendment complies with the requirements of the Peel-Harvey EPP and Statement of Planning Policy No.2 and that groundwater quantity is not altered to impact on Tamworth Hill Swamp;
- the preparation of an Wetland Management Plan to provide for protection of Tamworth Hill Swamp from direct and indirect impacts;
- the requirements of development setbacks from the CMS high pressure gas pipeline and limitations to uses allowable within the pipeline easement to minimise the risk to public safety; and
- the investigation of the nature and extent of soil or groundwater contamination resulting from previous land uses and, if necessary preparation and implementation of a remediation program.

5. Conclusions

The EPA has concluded that Amendment 295 to the City of Rockingham Town Planning Scheme 1 to rezone Lots 6, 13 and Pt Lot 26 on the corner of Nairn Drive and Safety Bay Rd, Baldivis from "Rural" to "Baldivis Town Centre" can be implemented to meet the EPA's objectives provided the conditions recommended in Section 4, and set out in Appendix 3, are imposed and enforced.

6. Recommendations

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

1. That the Minister considers the report on the relevant environmental factors of Public Health and Safety (Risk and Hazard), Wetlands, Groundwater quantity, Surface water quality, Groundwater quality and Contamination;
2. That the Minister notes that the EPA has concluded that the Amendment can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment;
3. That the Minister imposes the conditions and procedures consistent with Section 4 and set out in formal detail in Appendix 3 of this report.

Appendix 1

List of submitters

Government Agencies:

- Water Corporation
- Water and Rivers Commission
- Department of Conservation and Land Management

Organisations:

- Mitchell Goff and Associates
- Baldivis Community Association
- Alinta Gas
- Ian Fraser & Co

Members of the Public:

- Ms L Riccio
- Mr and Mrs Charles

Appendix 2

References

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Appendix 3

**List of recommended Ministerial Conditions to be incorporated into the
Amendment**

RECOMMENDED CONDITIONS

**STATEMENT THAT A SCHEME MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF DIVISION 3 OF PART IV OF THE
ENVIRONMENTAL PROTECTION ACT 1986)**

**CITY OF ROCKINGHAM TOWN PLANNING SCHEME NO. 1
AMENDMENT NO. 295**

Scheme Purpose: (a) to rezone from 'Rural' zone to 'Baldivis Town Centre' zone Lots 6, 13 and Part Lot 26, Corner Nairn Road and Safety Bay Road, Baldivis;
(b) to introduce provisions for the Baldivis Town Centre in the scheme text and maps.

Responsible Authority: City of Rockingham

Responsible Authority Address: PO Box 2142, Rockingham, WA 6168

Assessment Number: 1120

Report of the Environmental Protection Authority: Bulletin 906

Subject to the following conditions, there is no known environmental reason why the town planning scheme amendment to which the above report of the Environmental Protection Authority relates should not be implemented:

1 Indicative Development Plan

1-1 Subdivision and development within the Amendment shall be in accordance with an Indicative Development Plan that is to the requirements of the Department of Environmental Protection, on advice of the Department of Minerals and Energy and the Water and Rivers Commission.

2 Wetland Management Plan

2-1 A Wetland Management Plan shall be prepared and implemented to provide protection for Tamworth Hill Swamp.

2-2 Prior to any subdivision or development of the Amendment, the Wetland Management Plan referred to in condition 2-1 shall be prepared in conjunction with the Department of Conservation and Land Management, to the requirements of the Department of Environmental Protection.

The Wetland Management Plan shall provide details on the following:

- 1 specific measures to protect the wetlands, associated vegetation, and fauna habitats;
 - 2 fencing and signage requirements;
 - 3 management of human pressures and public access;
 - 4 revegetation and weed control;
 - 5 maintenance of the wetland reserve; and
 - 6 timing and responsibilities for the above.
- 2-3 The Responsible Authority shall report on the implementation of this plan, consistent with Condition 7-2.

3 Drainage and Nutrient Management

- 3-1 A Drainage and Nutrient Management Plan shall be prepared and implemented to ensure that the rate, quantity and quality of water leaving the Amendment will not adversely impact on Tamworth Hill Swamp, the Stakehill Groundwater supply and the Peel-Harvey Estuarine system.
- 3-2 Prior to finalisation of the Indicative Development Plan referred to in condition 1-1, a Drainage and Nutrient Management Plan shall be prepared for the whole of the Amendment, to the requirements of the Department of Environmental Protection on advice of the Water and Rivers Commission and the Department of Conservation and Land Management.

This Plan shall:

- i) define the catchment of Tamworth Hill Swamp in relation to the Amendment;
 - ii) provide measures to facilitate the removal of pollutants and nutrients in accordance with Water Sensitive Urban Design Best Practices;
 - iii) incorporate best practice Water Sensitive Urban Design principles to maximise on-site water infiltration generally;
 - iv) include measures to prevent surface water runoff from entering Tamworth Hill Swamp or the Peel-Harvey Estuarine system;
 - v) review the siting, design and size of the stormwater infiltration basin adjacent Tamworth Hill Swamp so as to achieve a satisfactory separation between the bottom of the basin and groundwater;
 - vi) ensure that the provisions of the Statement of Planning Policy No 2, The Peel-Harvey Coastal Plain catchment and the Environmental Protection (Peel Inlet - Harvey Estuary) Policy 1992 are met;
 - vii) detail a mechanism to ensure purchasers of lots greater than 2000 m² are aware of the Stakehill Groundwater Area and the need to obtain a licence before a well/bore can be installed;
 - viii) include a monitoring program to measure the performance of the implemented Plan against objectives and performance criteria; and
 - ix) include contingency plans in the event that criteria are not achieved.
- 3-3 The Responsible Authority shall report on the implementation of this plan, consistent with Condition 7-2.

4 Risk - High Pressure Natural Gas Pipeline

- 4-1 Prior to any subdivision or development of the Amendment, prescriptions for public safety and protection of the pipeline shall be prepared to the requirements of the

Department of Minerals and Energy, on advice of the City of Rockingham, the Department of Environmental Protection and the CMS Gas Transmission of Australia.

Note: Minimum safety standards are required in accordance with the Petroleum Pipelines Act 1969-70, the Australian Pipeline Code AS 2885-1997 and HB 105, or the most recent equivalent recognised by the Environmental Protection Authority.

4-2 Ground-disturbing activities are prohibited within the gas pipeline easement (unless specified in condition 4-3) as are the following facilities:

- i) Temporary residence (including caravans, camping and similar);
- ii) Storage of materials and equipment;
- iii) Fires and barbecues;
- iv) Explosives, inflammables and corrosives (including storage of liquefied petroleum gas and fuel oil);
- v) Refuse disposal and land fill;
- vi) Service stations, fuel lines and storage of fuel;
- vii) Trees or shrubs with an expected growth exceeding 1 metre in height;
- viii) Large obstructions to line of sight along the easement.

4-3 The following facilities may be permitted with the approval of the City of Rockingham, within the gas pipeline easement, subject to compliance with condition 4-1 and the works being strictly supervised during construction:

- i) Cycleways and footpaths;
- ii) Road crossings;
- iii) Public Open Space;
- iv) Signage and other facilities that are necessary to comply with condition 4-1.

4-4 Minimum development setbacks from the centre of the gas pipeline shall be:

- i) metres to the property boundary of residential lots and all other development (excluding those items in condition 4-4-2, roads, carparking, cycleways, footpaths and landscaping) subject to condition 4-1; and
- ii) metres to sensitive use development (including aged persons accommodation, child care centres, schools and hospitals) and to areas where large numbers of people may congregate;

to the requirements of the Department of Environmental Protection on advice of the Department of Minerals and Energy.

4-5 The prescriptions for public safety and protection of the CMS pipeline referred to in condition 4-1 shall be implemented.

4-6 The Responsible Authority shall report on the implementation of Conditions 4-1 to 4-5, consistent with Condition 7-2.

5 Construction

5-1 The development of the Amendment area shall comply with the Environmental Protection Authority Interim Policy No.18 - Air Quality Impacts from Development Sites (1997) or the most recent equivalent recognised by the Environmental Protection Authority.

6 Contamination

- 6-1 Areas of soil and groundwater contamination resulting from previous activities in the Amendment shall be identified and remediated to a standard suitable for the intended land uses.
- 6-2 Any subdivision or development application for land in the Amendment that has been utilised for market gardening shall be accompanied by a report of an investigation of the area to determine the nature and extent of any soil and groundwater contamination, to the requirements of the Department of Environmental Protection. The site is determined to be contaminated if substances occur in the soil or groundwater at concentrations above background levels and where assessment indicates it poses, or has the potential to pose, an unacceptable risk to human health or the environment.
- 6-3 If unacceptable soil or groundwater contamination is identified by the investigation referred to in condition 6-2, a remediation program shall be prepared and implemented, and if necessary, a management plan shall be prepared, to the requirements of the Department of Environmental Protection, prior to subdivision.
- 6-4 The management plan referred to in condition 6-3 shall be implemented.
- 2-3 The Responsible Authority shall report on the implementation of Condition 6-1 to 6-3 consistent with Condition 7-2.

7 Audit of Environmental Conditions

- 7-1 Prior to any development or works associated with the 'Baldivis Town Centre' zoning, the subject of this amendment, a report describing the environment in the Amendment and adjoining wetland reserve in relation to the key environmental factors identified in the Environmental Protection Authority's report (Bulletin 906) shall be prepared.

Note: This report will form the basis of any review of the environmental performance of the development within the Amendment.

- 7-2 The responsible authority shall review the effectiveness of the environmental conditions to which this amendment is subject, every five years after the amendment is approved and published in the Government Gazette, or as the Minister for the Environment so directs. The report of this review shall be to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.
- 7-3 The responsible authority shall provide the Department of Environmental Protection with a report of the review required by condition 7-2.

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

Appendix 4

**Environmental management measures submitted by the Responsible Authority
in the Environmental Review**

- i) Stormwater disposal to be designed in accordance with water sensitive design to ensure:
- containment of water from a 1 in 100 year 24 hour storm event on-site, with no direct discharge of stormwater to any wetlands, specifically Tamworth Hill Swamp;
 - treatment of stormwater from all other storm events (including a 1 in 10 year) within on-site basins, with infiltration of collected and treated stormwater from the he basins to the local aquifer as recharge;
 - collection and treatment of the “first flush” stormwater event within the on-site basins annually;
 - drainage from car parks not be directed into the treatment systems, but infiltrated through localised side entry pits and gullies to promote local aquifer recharge through a oped dissipation system, including a 1 in 100 year 24 hour storm event; and
 - infiltration of roof rainfall run-off through localised soakage structures;

to the satisfaction of the City of Rockingham.

- ii) The applicant be mindful of the Environmental Protection Authority’s dust and noise control guidelines for development sites during the construction period.

- iii) The following facilities are prohibited within the gas pipeline easement:

- Fences;
- Stormwater basins and swimming pools;
- Storage of material, equipment etc;
- Camping, caravans etc;
- Barbecues (permanent or temporary);
- The lighting of fires except for controlled burning off;
- Explosives, inflammables, corrosives (including storage of LPG and fuel oil);
- Garbage, land fill, refuse disposal; and
- Service stations, fuel lines and storage.

Cycleway, walking tracks, and footpaths are permitted within the gas pipeline easement subject to the same general restrictions as for roads.

- iv) Minimum safety standards required by CSM and set out in the Petroleum Pipeline Act 1967-70 and the Australian Pipeline Code AS2885.

- v) Development setbacks to the gas pipeline are as follows:

- 32m - Development Buffer from the centre of the pipe (excluding roads, car parking and landscaping);
- 96m - Sensitive Uses Buffer from the centre of the pipe (ie. Aged and Child Care);

to the satisfaction of the Environmental Protection Authority and City of Rockingham.

Appendix 5
Summary of Relevant Factors

Table 2. Identification of Relevant Environmental Factors

Preliminary Factor	Proposal characteristics	Government Agency and Public comments	Identification of Relevant Environmental factors
BIOPHYSICAL			
<p>Wetlands - provision of adequate buffer and indirect impacts</p>	<p>Tamworth Hill Swamp is a sumpland which occurs west of the amendment area, separated by the proposed Nairn Drive alignment.</p> <p>The wetland is protected by the Environmental Protection (Swan Coastal Lakes) Policy (1992) and has been assigned a 'Conservation' management category.</p> <p>The wetland forms part of a Proposed Port Kennedy Scientific Park and is proposed for protection in Draft Perth's Bushplan.</p> <p>A small wetland also exists approx. 200m south-east of the site, separated by Baldvis Road. This sumpland has been assigned a 'Multiple Use' category and is significantly degraded with few natural attributes.</p> <p>The amendment proposes an 80m buffer from the vegetation line of Tamworth Hill Swamp.</p>	<p>Government:</p> <p>The Water and Rivers Commission (WRC) supports establishing an 80m buffer (measured from the outer most extent of wetland dependant vegetation) from Tamworth Hill Swamp.</p> <p>The EPP prohibits unauthorised filling, draining, mining, discharge of effluent or alteration of water levels. Adjacent land use activities may have impacts, such as run-off of nutrients and sedimentation (WRC).</p> <p>Department of Conservation and Land Management (CALM) is responsible for the management of Tamworth Hill Swamp (as part of the Rockingham Lakes Regional Park) and thus has a significant interest in this adjacent development.</p> <p>For the purpose of designating an appropriate dryland buffer, the Environmental Review (ER) defines the eastern boundary of the wetland as the vegetation line on the eastern margin of the wetland due to previous clearing. This is an inappropriate method for determining the boundary of the wetland.</p> <p>For determination of appropriate buffers, it is essential that the furthest extent of wetland vegetation is determined.</p> <p>As a guide only, the EPA suggests that 50 metres or 1 metre AHD higher than the furthest extent of wetland vegetation would be the minimum dryland vegetation buffer required. This meaning of a "dryland buffer" is qualified in these guidelines as the dryland vegetation that is less tolerant of wet and waterlogged soils surrounding the wetland vegetation. The ER has incorrectly attempted to apply this buffer by defining the open space between the vegetation line (incorrectly applied as the wetland boundary) and the development area boundary as an appropriate "dryland" buffer. However, this area is devoid of vegetation and therefore does not qualify as a dryland buffer.</p> <p>A more comprehensive assessment of adequate buffers specific to wetlands of the Swan Coastal Plain, is provided in Davies and Lane (1995). Davies and Lane (1995) define a buffer zone as an area of terrestrial vegetation that is upslope of the outer edge of wetland dependent vegetation.</p> <p>CALM advise that compromising the width of the vegetation buffer to less than 200m will not protect the wetland from excessive nutrients. In addition to the potential eutrophication that could occur, increased nutrients will also increase midge and mosquito problems. Accordingly, CALM recommends that a buffer width of 200m of dryland vegetation applied (measured from the outer edge of the wetland dependent vegetation).</p>	<p>Requires further evaluation.</p> <p>Considered to be a relevant factor.</p>

Preliminary Factor	Proposal characteristics	Government Agency and Public comments	Identification of Relevant Environmental factors
Wetlands - provision of adequate buffer and indirect impacts (cont)		<p>CALM does not believe the conservation value of Tamworth Hill Swamp has been properly recognised, nor the issues appropriately addressed. CALM recommends that the conservation value of Tamworth Hill Swamp be properly recognised and issues appropriately addressed.</p> <p>The ER fails to acknowledge or address, the detrimental effects which will occur from this development.</p> <p>The construction of a residential development within such close proximity to the wetland, will inadvertently cause an increase in the human usage of the area. Increased human usage of the area will create a vector for weeds, fire, feral animals, rubbish dumping and cultivation of introduced plants.</p> <p>These have the potential to denigrate the conservation value of the area. To assist in ameliorating these impacts, CALM believes the proponent should be responsible for a number of measures which will help minimise the impacts of humans on this area:</p> <ul style="list-style-type: none"> • To control access into the area, the proponent should commit funds to the construction of a fence around Tamworth Hill Swamp to the satisfaction of CALM. • To assist in preventing pets from entering the wetland, the proponent should commit funds for the erection of signage (to the satisfaction of CALM) around the fence perimeter, alerting owners that domestic pets (in particular dogs and cats) are prohibited from the wetland. • To assist in improving the awareness of residents to the conservation values of the area, the proponent should commit funds to the development of interpretive signage (to the satisfaction of CALM) to outline these values. • If a dryland vegetation buffer does not exist, the proponent should commit funds to revegetating an appropriate area between the wetland and the development (to the satisfaction of CALM). <p>Public:</p> <p>Paramount in the construction of the proposed Town Centre is the protection of Tamworth Hill Swamp, Baldivis Swamp and other seasonal wetlands together with the larger lakes system.</p> <p>One third of the site has been established as flowing eastward, and partly feeds Sumpland 60Sm, to the south-east. The remaining two-thirds flows westward, and would partly feed Sumplands 25Sc, 24Sc, 22Sr, and 23Sc.</p> <p>As Tamworth Hill is reserved as Parks and Recreation land under the Metropolitan Region Scheme, limited access should be permitted. It is noted that it is proposed to fence it along its entirety along the yet to be constructed Nairn Road, in order to protect vegetation.</p>	<p>Requires further evaluation.</p> <p>Considered to be a relevant factor.</p>

Preliminary Factor	Proposal characteristics	Government Agency and Public comments	Identification of Relevant Environmental factors
<p>Groundwater quantity - impact on water supply and wetlands</p>	<p>The amendment area is located adjacent to Tamworth Hill Swamp.</p> <p>The site does not exhibit a high water table.</p> <p>The vegetation has been mostly cleared over the site for farming activities. Rainfall will mostly recharge aquifer with little uptake by shallow rooted plants (studies estimate 50-60%) compared to estimated 12% of rainfall over native bushland.</p> <p>The proponent estimates that recharge rates will be reduced by the development to more closely resemble the pre-clearing regime (studies estimate 21% of rainfall recharges in developed areas).</p>	<p>Government:</p> <p>The subject property is situated within the Stakehill Groundwater Area proclaimed under the Rights in Water and Irrigation Act 1914 and as such will be subject to well licensing. However, a licence will not be required if the groundwater is to be used for domestic and stock watering purposes only and the property is 2000 square metres or less (WRC).</p> <p>To protect the interests of the initial purchaser of lots with an area greater than 2000 square metres the subdivider should make arrangements to the satisfaction of the WRC to ensure that the prospective purchaser, in the initial transfer of lots with a greater area than 2000 square metres, acknowledge in writing that they are aware that the lots are located within the Stakehill Groundwater Area and there is a need to obtain a licence before a well/bore can be constructed (WRC).</p> <p>The WRC strongly recommends against the lowering of groundwater as this will lead to an export of nutrients off the site and will also adversely impact upon surrounding remnant vegetation. Subsoil drains may be installed to control rises in groundwater but should be located no lower than the Average Annual Maximum Groundwater Level (AAMGL). There should be a separation of 1.2 meters between the constructed floor level of development and AAMGL.</p> <p>Public:</p> <p>Protection of a westward flowing groundwater supply is essential to those properties surrounding the Settlers Hill development which have no access to reticulated water, and are thus dependant on their own water supply.</p> <p>The statement that groundwater recharge is likely to be decreased is disturbing. Each year, regardless of what appears to be a diminishing rainfall, seasonal recharge of wetlands and lakes which are part of our tourist attraction and lifestyle, as well as the fast disappearing natural environment seems to be progressively later each year. In years of low rainfall, full replenishment does not occur.</p> <p>The statement that a decrease in recharge would most closely resemble the pre-clearing regime is difficult to reconcile with local knowledge (also Predicted Outcome Summary Table page 5).</p> <p>Groundwater abstraction for grass or parkland watering on a large scale will require licensing from the Water Corporation. Such large scale watering could be expected to be to the detriment of other users, as well as the swampland areas. This is amply illustrated in golf course developments.</p> <p>With such a large variation in depth of the watertable, established at between 1 and 14 meters below the surface, use will need to be carefully and constantly monitored to maintain the balance between maintenance and enhancement of wetlands, accessibility to users not on a reticulated water supply, and level of the existing water table with the possibility of a rise involving land loss to salinisation.</p>	<p>Requires further evaluation.</p> <p>Considered to be a relevant factor.</p>

Preliminary Factor	Proposal characteristics	Government Agency and Public comments	Identification of Relevant Environmental factors
POLLUTION MANAGEMENT			
Surface Water Quality - impact on wetlands and Peel Harvey Catchment	<p>The amendment is located adjacent to Tamworth Hill Swamp and the eastern third of the site is located within the surface water catchment of the Peel-Harvey estuary.</p> <p>Within the development area stormwater has been designed on current Best Management Practices. Design criteria in accordance with the objectives for the Environmental Protection Policy and State Planning Policy for the catchment of the Peel-Harvey Estuary.</p> <p>The proposal will also be designed to meet Water Sensitive Urban Design Guidelines. Stormwater management based on the temporary storage of water with subsequent slow release to groundwater via infiltration.</p> <p>No direct drainage into Tamworth Hill Swamp. Two infiltration basins proposed, one located adjacent to (>80m) Tamworth Hill Swamp.</p>	<p>Government:</p> <p>Water sensitive urban design should be incorporated into the design of the stormwater drainage system. It should include onsite infiltration and prevention of direct discharge to the wetland. The detailed design of the stormwater system should be determined in consultation with the WRC.</p> <p>The portion of this development area which drains to the proposed compensating basins in the north east corner is within the catchment of the Mundijong Drainage District. Urban developments within this catchment are required to contain the flows from 1 in 100 year storm events on site. However, it appears that the storage indicated for this basin (4,400m³), is insufficient to cater for this requirement (Water Corporation - WC).</p> <p>Flow paths for major storm events should be indicated (WC).</p> <p>There is a proposed sewage pumping station required to be located in the area of the western compensating basin site. Provision for this facility should be considered in any compensating basin design undertaken and recognition of this facility should be incorporated in the Environmental Review (WC).</p> <p>Public:</p> <p>The owner of Pt Lot 13 is concerned at the potential for Pt Lot 13 to be utilised for drainage to accommodate stormwater from other land holders disproportionately to the area of Pt Lot 13.</p>	<p>Requires further evaluation.</p> <p>Considered to be a relevant factor.</p>
Groundwater quality - impact on wetlands and Peel Harvey Catchment	<p>The proposal is located over moderately deep sands which are very permeable. The site does not exhibit a high water table.</p> <p>The amendment area is located within the Stakehill Groundwater Area.</p> <p>The proposal will be fully sewered.</p> <p>Protection of groundwater quality is proposed through:</p> <ul style="list-style-type: none"> • control of land use and removal of potentially polluting current practices (market gardening and broadscale pasture); • treatment of all stormwater generated on the site from hard surface in appropriately designed structures for aquifer recharge. <p>It is estimated that the amendment will reduce the potential nutrient loadings from the existing uses by more than 90%.</p>	<p>Public:</p> <p>Provision of stripping basins as proposed are most important, however more emphasis should be placed on the necessity for the removal of fuels, grease and oils, chemicals, solvents, pesticides, metallic residues before they are permitted to enter the groundwater, rather than merely the nutrients, as covered in the Summary table (page 4).</p> <p>It should be borne in mind that the use of fertiliser and pesticides is much higher in a domestic situation than for grazing land, though not as high as commercial market (non-organic) garden use.</p>	<p>Requires further evaluation.</p> <p>Considered to be a relevant factor.</p>

Preliminary Factor	Proposal characteristics	Government Agency and Public comments	Identification of Relevant Environmental factors
Contamination - potentially contaminated soil and groundwater	<p>Approximately 3.9 Ha of the amendment area has been used as a commercial market garden. The operator of the market garden has indicated that he uses environmental best practice as advised by Agriculture WA.</p> <p>However, the soil in this area could still be potentially contaminated as a result of this land use and the possibility that fertilisers, pesticides or herbicides may have been used in the past.</p> <p>This issue was not raised as part of the Instructions and therefore the Responsible Authority has not been required to address the matter as part of the Environmental Review.</p>	Not addressed in Environmental Review document.	Requires further evaluation. Considered to be a relevant factor.
Particulates/ Dust - impacts during construction	<p>The proposal would result in the development of 43 Ha.</p> <p>Dust generation during construction activities proposed to be managed in accordance with industry practice and EPA Interim Policy No 18 Air Quality Impacts from Development Sites (1997).</p> <p>Measures will include water suppression, wind fencing and surface stabilisation techniques.</p>	No comments.	Compliance with EPA Interim Policy No. 18 - Air Quality Impacts from Development Sites (1997) is included as a Condition No further evaluation required.
Noise - impact during construction	<p>Existing rural areas occur adjacent to the site. Future residential development to the south and north may occur.</p> <p>Noise generation during construction activities is proposed to be managed in accordance with industry practice and Noise Abatement (Neighbourhood Annoyance) Regulations 1979.</p>	No comments.	The regulations referred to in the Environmental Review are outdated. The proposal should be in accordance with Regulation 13 of the Environmental Protection (Noise) Regulations 1997. No further evaluation required.

Preliminary Factor	Proposal characteristics	Government Agency and Public comments	Identification of Relevant Environmental factors
SOCIAL SURROUNDINGS			
Public Health and Safety - risk of high pressure gas pipeline	The CMS high pressure natural gas pipeline traverses the site in an approximate northwest-southeast alignment, within an existing 20 m wide easement.	<p>Government: The 32m line is to be taken to the fenceline of the residential area and not the residential buildings (DEP). The community centre should not include child care centres or areas where large numbers of people can congregate within the 96m line (DEP)</p> <p>Public: The buffer distances which have been proposed to be extended from the prescribed buffer distances are excellent, and whilst strictly controlled give restricted access in accordance with the risk assessment. The buffer easement area can also serve as an attractive and permitted dual purpose as a central walkway / cycleway.</p>	Requires further evaluation. Considered to be a relevant factor.
Aboriginal Culture and Heritage - impact on heritage sites	An archaeological and ethnographic survey of the area was conducted in 1992. No sites have been recorded and none were discovered during the course of the surveys.	No comments.	No further evaluation required.

Table 3: Summary of Assessment of Relevant Environmental Factors

Relevant Factor	Relevant Area	EPA Objective	EPA Assessment	EPA Advice
BIOPHYSICAL				
Wetlands - provision of adequate buffer and indirect impacts	Tamworth Hill Swamp	Maintain the integrity, functions and environmental values of wetlands.	<p>The wetland is located within an existing CALM managed Parks and Recreation zoned area and has considerable scientific and conservation value. It is recognised as being regionally significant in Draft Perth's Bushplan. It is separated from the amendment area by an existing road reserve and the edge of the wetland vegetation is located 80m at the closest point to the amendment area.</p> <p>The EPA guide for the width of a buffer area of 50 metres or 1 metre AHD higher than the furthest extent of the wetland vegetation, whichever is the largest, would be the minimum dryland buffer required. The dryland buffer comprises dryland vegetation that is less tolerant of wet and waterlogged soil conditions. There is no vegetation in the proposed buffer. 1 metre AHD from the remaining vegetation extends only 15m from the wetland.</p> <p>The proposed Port Kennedy Scientific Park study boundary and the boundary for Draft Perth's Bushplan correlates with the western edge of the road reserve.</p> <p>The reference 'Wetlands of the Swan Coastal Plain - Wetland Mapping, Classification and Evaluation Wetland Atlas, Volume 2b' by the Water and Rivers Commission and Department of Environmental Protection December 1995 shows the boundary of the wetland and the zone of critical influence (50 m) as well as most of the zone of secondary influence (200m) being within the existing reserve. However, the scale does appear to be incorrect in this case and 200m does extend some distance into the proposed amendment area. WRC are comfortable with the 80m buffer from the remaining vegetation at the swamp, however CALM request a 200m buffer.</p> <p>The EPA considers that the buffer guide of 50m has been met in relation to this proposal. Arbitrary setbacks however do not take into account landform, vegetation, soil types, hydrology, geology, flood prone areas etc. Of concern to the EPA is the proposed location of an infiltration basin at the western end of the amendment area closest to Tamworth Hill Swamp.</p>	

Relevant Factor	Relevant Area	EPA Objective	EPA Assessment	EPA Advice
Wetlands (cont)			<p>The catchment for the proposed stormwater basin located closest to Tamworth Hill Swamp is 24 Ha. It is proposed to have the basin floor level below or at the water table level in order to achieve permanent water in the basin . The Best Management Practices for Water Sensitive Urban Design produced for the Environmental Protection Authority, Department of Planning and Urban Development and Water Authority of WA state that one of the purposes of Infiltration Retention Basins is to improve water quality by infiltration. The basins are designed to achieve a moderate to high pollutant removal capacity. The guidelines state that these basins are “feasible when soils are permeable and the water table and the bedrock are situated well below the soil surface”.</p> <p>The effectiveness of pollutant removal by infiltration is variable, and is based primarily on the depth of percolation, the physical structure of the soil/substrate, and the chemical characteristics of the soil/substrate. Some soil/substrate attributes which would enhance pollutant removal include high contaminant adsorption capacity, alkaline soils, low water table and high organic matter content (Evangelisti et al, 1991).</p> <p>It is uncertain as to whether the location of the detention basin is appropriate. The DEP considers that there is not enough information to determine whether the proposed management of drainage and nutrients form the site can be managed to prevent adverse impacts on Tamworth Hill Swamp. A drainage and nutrient management plan is proposed as a condition to further examine this issue.</p>	<p>Having particular regard to:</p> <ul style="list-style-type: none"> a) Tamworth Hill Swamp being contained within an existing reserve; b) EPA guide of a 50m or 1m AHD buffer; c) WRC and CALM’s advice; d) Water Sensitive Urban Design principles; e) further information being required for drainage and nutrient management <p>it is the EPA’s opinion that the proposed amendment and associated scheme provisions to create the Baldvis Town Centre can be managed to meet the EPA’s objective to maintain the integrity, functions and environmental values of wetlands, subject to the preparation and implementation of a wetland management plan and drainage and nutrient management plan.</p>

Relevant Factor	Relevant Area	EPA Objective	EPA Assessment	EPA Advice
Groundwater quantity - impact on water supply and wetlands	Stakehill Groundwater Area Tamworth Hill Swamp	Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	<p>The amendment is located within the Stakehill Groundwater Area and as such will be subject to well licensing through the Water and Rivers Commission if the property is 2000 square metres or more.</p> <p>No lowering of the groundwater is proposed through subsoil drains.</p> <p>The land is mostly cleared pasture and rainfall will mostly recharge the aquifer with little uptake by shallow rooted plants (studies estimate 50-60%) compared to estimated 12% of rainfall over native bushland.</p> <p>It is estimated that recharge rates will be reduced by the development to more closely resemble the pre-clearing regime (studies estimate 21% of rainfall recharges in developed areas).</p> <p>A drainage and nutrient management plan is proposed as a condition to further examine this issue.</p>	<p>Having particular regard to:</p> <p>a) other agency controls in place; relating to abstraction of groundwater;</p> <p>b) studies on groundwater recharge;</p> <p>it is the EPA's opinion that the proposed amendment and associated scheme provisions to create the Baldivis Town Centre can be managed to meet the EPA's objective to maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected, subject to the preparation and implementation of a drainage and nutrient management plan.</p>
POLLUTION MANAGEMENT				
Surface Water Quality - impact on wetlands and Peel Harvey Catchment	Peel Harvey Catchment Tamworth Hill Swamp	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993), the Environmental Protection Peel Inlet-Harvey Estuary) Policy 1992 and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy.	<p>Within the development area stormwater will be designed on current Best Management Practices. Design criteria will be in accordance with objectives for the catchment of the Peel-Harvey Estuary and Water Sensitive Urban Design Guidelines.</p> <p>Stormwater management based on the temporary storage of water with subsequent slow release to groundwater via infiltration. The principles of stormwater management are set out in a proposed scheme provision.</p> <p>There is to be no direct drainage into Tamworth Hill Swamp. Two infiltration basins proposed, one located adjacent to (>80m) Tamworth Hill Swamp. This infiltration basin is recommended by the WRC and DEP to be relocated further from the wetland to minimise pollution risk (see Wetlands factor above).</p> <p>As discussed above it is recommended that a drainage and nutrient management plan be prepared to demonstrate in detail how stormwater will be managed to meet the specifications for the Peel-Harvey Estuary and Water Sensitive Urban Design Guidelines.</p>	<p>Having regard to:</p> <p>a) the commitment to use Water Sensitive Urban Design Principles;</p> <p>b) the objectives of the Statement of Planning Policy for the Peel-Harvey Coastal Plain Catchment;</p> <p>c) the objectives of the Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992;</p> <p>it is the EPA's opinion that the proposed amendment and associated scheme provisions to create the Baldivis Town Centre can be managed to meet the EPA's objective to maintain or improve the quality of surface water so that existing and potential uses, including ecosystem maintenance are protected, subject to the preparation and implementation of a drainage and nutrient management plan.</p>

Relevant Factor	Relevant Area	EPA Objective	EPA Assessment	EPA Advice
Groundwater quality - impact on wetlands and Peel Harvey Catchment	Peel Harvey Catchment Tamworth Hill Swamp	Maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.	<p>The proposal is located over moderately deep sands which are very permeable. The site does not exhibit a high water table.</p> <p>The amendment area is located within the Stakehill Groundwater Area.</p> <p>The proposal will be fully sewerred.</p> <p>Protection of groundwater quality is proposed through:</p> <ul style="list-style-type: none"> • control of land use and removal of potentially polluting current practices (market gardening and broadscale pasture); • treatment of all stormwater generated on the site from hard surfaces in appropriately designed structures for aquifer recharge. <p>The proponent estimates that the amendment will reduce the potential nutrient loadings from the existing uses by more than 90%.</p> <p>As discussed above it is recommended that a drainage and nutrient management plan be prepared to demonstrate in detail how stormwater will be managed to meet the specifications for the Peel-Harvey Estuary and Water Sensitive Urban Design Guidelines.</p>	<p>Having regard to:</p> <p>a) existing land use of the site for market gardening and broadscale agriculture;</p> <p>b) the commitment to use Water Sensitive Urban Design Principles;</p> <p>c) the objectives of the Statement of Planning Policy for the Peel-Harvey Coastal Plain Catchment;</p> <p>d) the objectives of the Environmental Protection (Peel Inlet-Harvey Estuary) Policy 1992;</p> <p>it is the EPA's opinion that the proposed amendment and associated scheme provisions to create the Baldivis Town Centre can be managed to meet the EPA's objective to maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance are protected, subject to the preparation and implementation of a drainage and nutrient management plan.</p>
Contamination - potentially contaminated soil and groundwater	The part of the amendment area which has been utilised for market gardening.	Ensure the rehabilitation of the site to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria.	<p>Approximately 3.9 Ha of the amendment area has been used as a commercial market garden. The operator of the market garden has indicated that he uses environmental best practice as advised by Agriculture WA.</p> <p>However, the soil in this area could still be potentially contaminated as a result of this land use and the possibility that fertilisers, pesticides or herbicides may have been used in the past.</p> <p>The EPA recommends the imposition of a condition which requires the nature and extent of any contamination to be determined. If there is contamination present, the land has to be remediated to a standard that is suitable for the intended land uses.</p>	<p>Having regard to:</p> <p>the recommended condition that requires the identification and remediation of any contaminated soil and groundwater prior to subdivision;</p> <p>it is the EPA's opinion that the proposed amendment and associated scheme provisions can be managed to meet the EPA's objective to ensure the rehabilitation of the site to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria.</p>

Factor	Relevant Area	EPA Objectives	EPA Assessment	EPA Advice
SOCIAL SURROUNDINGS				
Public Health and Safety - risk of high pressure gas pipeline	The amendment area in the vicinity of the pipeline.	Ensure that risk is managed to meet the EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety.	<p>The CMS high pressure natural gas pipeline traverses the site in an approximate northwest-southeast alignment, within an existing 20 m wide easement. The risk to public safety has been quantitatively assessed in accordance with EPA risk criteria.</p> <p>In residential zones a risk level of 1 in a million or less deaths per year is considered to be acceptable. The DEP has advised that to meet this criteria an acceptable separation distance to development is 32m each side of the centreline of the pipeline (ie a total of 64m).</p> <p>For more sensitive land uses (ie aged persons accommodation and child care centres) the DEP has advised that a greater separation of 96m each side of the pipeline is acceptable (risk of 0.5 in a million or less deaths per year).</p> <p>These separation distances assume that appropriate risk mitigation measures are implemented.</p> <p>These distances have mostly been designed into the Indicative Development Plan for both residential and commercial uses and written into proposed scheme provisions.</p> <p>Minimum safety standards required by CMS and set out in the Petroleum Pipelines Act 1969-70 and the Australian Pipeline Code AS 2885 1997 are also written into the scheme provisions. Another proposed scheme provision states the uses that are prohibited within the pipeline easement.</p> <p>In addition the proposal should comply with the risk assessment code of practice HB 105. Land uses which allow for large numbers of people to congregate should be excluded from within the 96m line.</p> <p>There is a potential for a second pipeline to be installed within the existing easement. If this was to be proposed the new pipeline would be required to be developed to a much higher specification and be better protected to ensure that the risk is not significantly increased.</p>	<p>Having regard to:</p> <p>a) DEP's recommended buffer distances being used to modify the Indicative Development Plan;</p> <p>b) proposed conditions related to restricting uses within the pipeline easement and stipulating development setbacks from the pipeline;</p> <p>it is the EPA's opinion that the proposed amendment and associated scheme provisions to create the Baldivis Town Centre can be managed to meet the EPA's objective to ensure that risk is managed to meet the EPA's criteria for individual fatality risk off-site and the DME's requirements in respect of public safety.</p>