New conventional sprinkler irrigated agricultural proposals in the Swan Coastal Plain catchment of the Peel-Harvey Estuary

Position statement and
Report and recommendations of the
Environmental Protection Authority

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Foreword

The Peel-Harvey Estuary is badly degraded. Quantities of nutrients in excess of the estuary's ability to cope flow into the Estuary from the surrounding farm land and urban areas. Algae live on the nutrients, and multiply rapidly, stifling life in the estuary in warmer weather. The algae accumulate on the shores of the Estuary and rot, causing odour problems, polluting the shore, and killing wildlife and fish.

Some years ago the Government embarked on a rescue mission for the estuary. A two-part plan was developed. One part is the Dawesville Channel which aims, amongst other things, to increase the flushing of nutrients to the sea. The other part aims to manage the activities taking place in the catchment in order to reduce the amount of nutrients flowing in to the estuary. These measures in combination will greatly improve the environmental quality of the estuary.

Implementing these plans takes time, and in the meantime the Environmental Protection Authority is still receiving proposals for development in the coastal plain catchment to the estuary. Some of these proposals are contrary to the plans to restore the estuary, and the Authority will recommend against them.

However, it is important that land holders in the coastal plain catchment to the estuary are given a clear picture of the type of developments that are acceptable. That way unacceptable proposals will not be put forward, and anyone who buys land in the coastal plain catchment of the estuary will know in advance which things they will and won't be able to do on the land.

This report deals with conventional sprinkler irrigated agriculture, such as market gardens, orchards and irrigated pasture crops in the Swan Coastal Plain catchment of the Peel-Harvey Estuary (see Figure 1). The Authority has found that some of these activities are environmentally unacceptable in the Swan Coastal Plain catchment of the Peel-Harvey Estuary. This report is both an assessment of a number of proposals recently referred to the Authority, and a statement of the Authority's position to guide future proponents.

New conventional sprinkler irrigated agricultural proposals in the Swan Coastal Plain catchment of the Peel-Harvey Estuary

Position statement

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Definition

Conventional sprinkler irrigated agriculture is agriculture which involves the artificial irrigation of crops and/or pastures and the application of nutrients (including artificial fertilizers and/or animal manures) to the soil.

Specific examples of conventional sprinkler irrigated agriculture include:

- commercial vegetable growing (market gardening);
- irrigated orchard or vine crops;
- irrigated lucerne or other pasture species;
- irrigated floriculture; and
- commercial irrigated turf farms

Acceptable sprinkler irrigated agricultural practices

Those conventional sprinkler irrigated agricultural developments that the Authority considers to be acceptable include any of those above that apply nutrients at rates of less than 15kg/ha of phosphorus and/or 150kg/ha of nitrogen per annum to the soil. Nutrients may be applied to the soil at rates higher than that specified provided that nutrient export rates offsite are not greater than 0.375kg P/hectare/year and 3.75kg N/hectare/year.

The Authority acknowledges that newer technologies and better management practices may permit nutrient usage at rates higher than that specified above. If it can be demonstrated that these newer practices attain the nutrient export criteria, then such new developments would be deemed environmentally acceptable.

As nutrient export rates from a single property are technically difficult to measure, future assessments of proposals for new conventional sprinkler irrigated agricultural developments will emphasise the rates of nutrient application to the soil, rather than nutrient export rates.

Unacceptable sprinkler irrigated agricultural practices

Those conventional new irrigated agricultural developments that the Authority considers likely to be unacceptable include any that apply nutrients at rates of greater than 15kg/ha of phosphorus and/or 150kg/ha of nitrogen per annum to the soil in a situation or in a manner such that nutrients may be exported from the application area to the drainage network entering the estuary. Nutrients export rates greater than 0.375kg P/hectare/year and 3.75kg N/hectare/year are unacceptable.
Existing irrigated landuses that exceed these export rates will be expected to evolve management strategies to reduce nutrient export rates to acceptable levels, which is in keeping with the existing Ministerial Conditions for the Peel-Harvey Stage 2 Environmental Review and Management Programme. The Authority is aware that the Horticulture Division of the Western Australian Department of Agriculture is actively investigating fertilizer and water management for a variety of irrigated vegetable crops. Similar work is urgently needed to address the environmental problems caused by other forms of irrigated agriculture.

Consideration

In examining the environmental implications of conventional sprinkler irrigated agriculture in the Peel-Harvey coastal plain catchment (Figure 1) the Environmental Protection Authority has given consideration to the following:

The problems in the estuary

The estuary is highly eutrophic (nutrient enriched), which causes the growth of large quantities of algae that rot on the beaches and greatly reduce its recreational, economic and environmental values. The cause of the eutrophication is an inflow of nutrients (phosphorus and nitrogen) mainly from the Swan Coastal Plain catchment to the estuary. The nutrient inflow is currently far above the estuary's ability to cope.

The Ministerial Conditions and their implications

The Government has taken specific action to rescue the estuary. Ministerial Conditions were set on 3 January 1989 under Section 45 of the Environmental Protection Act for the Peel-Harvey Stage 2 Environmental Review and Management Programme. A copy of the Conditions is reproduced in Appendix 3.

These Conditions impose constraints on developments in the catchment with the objective of reducing the flow of nutrients into the estuary to about half their present level. They include:

- a moratorium on further clearing and drainage in the catchment;
- the specification of interim target levels for the quantity of phosphorus flowing into the estuary;
- a requirement for the proponents to prepare an Environmental Protection Policy and a Catchment Management Plan designed to meet the targets; and
- a requirement that, for the present, approval of developments which may release phosphorus or nitrogen to the environment in the Peel-Harvey Estuary area and coastal plain catchment should be conservative.

Under the Environmental Protection Act these Ministerial Conditions have the force of law, and are binding on the proponents.

The environmental protection strategy

Procedures are in place to establish an Environmental Protection Policy (EPP) to help manage impacts from existing conventional sprinkler irrigated agricultural activities in the Peel-Harvey catchment. This report recommends that there be no new pollution sources from irrigated agriculture and horticulture in that catchment. It is recognised that there may be further development proposals from landowners who are well advanced with their proposals, but who are not yet operating and that these proponents need to be treated fairly, whilst achieving environmental objectives.

The nature and impact of conventional sprinkler irrigated agriculture

The Authority has considered the basic nature of irrigated agricultural practice on the coastal plain as it now exists and the potential for ameliorating its environmental impacts.

There are a range of soil types on the Swan Coastal Plain catchment of the Peel-Harvey Estuary, many of which are sands. The sandy soils in particular have very little capacity to retain nutrients and water. The water tends to wash the nutrients through, into the groundwater, and into the rivers and creeks which flow to the estuary. Despite this, the sandy soils are sought for vegetable growing because the structureless soil enables the growing of large, well shaped root crops; and the high price of vegetables can generally justify the huge applications of fertiliser and water required.

For market gardening on the coastal plain, where two to three vegetable crops can be grown on the same land each year, the Department of Agriculture recommends applying between 50 to120kg of phosphorus per hectare per crop; but many farmers apply twice that amount.

The story is similar for nitrogen, where the high fertiliser application associated with some market gardens has made the groundwater unfit for human consumption, or livestock, or even for watering the market garden. As environmental impacts can be caused at nitrate levels a tenth of those suitable for human consumption, these very high levels are a cause for major environmental concern.

The quantity of fertiliser applied to irrigated lucerne and other irrigated pastures is much lower, but still two to three times that for conventional dryland agriculture.

In response to the Government's policy to restore the estuary most other farmers have significantly cut back their fertiliser applications.

The problems in the estuary developed as a result of mainly dryland agriculture, over less of the catchment than is now developed. The extra development over the last few years, and the move to more intensive agriculture have made the existing estuary problems more difficult to solve, and have increased the need for stricter development controls.

The Authority's position on new conventional sprinkler irrigated agriculture in the Swan Coastal Plain catchment of the Peel-Harvey Estuary

The Environmental Protection Authority has determined that new conventional sprinkler irrigated agriculture involving nutrient application rates in excess of 15kg P/hectare/year and/or 150kg N/hectare/year to the soil or nutrient loss rates in excess of 0.375kg P/hectare/year and/or 3.75kg N/hectare/year on the Swan Coastal Plain catchment of the Peel-Harvey Estuary is environmentally unacceptable, unless located in a situation in which additional nutrient loss to the estuary drainage will not occur.

In generality this means that the Environmental Protection Authority will recommend against new applications for conventional sprinkler irrigated agriculture in the Swan Coastal Plain catchment of the Peel-Harvey Estuary.

The Authority therefore advises proponents and all relevant decision making authorities that:

- proponents should be discouraged from putting forward proposals for new or expanded conventional sprinkler irrigated agriculture in the Peel-Harvey coastal plain catchment;
- any proposal for irrigated agriculture in the Peel-Harvey coastal plain catchment which the proponent, having been informed of this position statement, is unwilling to withdraw, must be referred to the Authority for assessment; and
- the Authority will assess such a proposal formally. During this assessment the proponent will have the opportunity of satisfying the Authority that the proposal is sufficiently different from conventional sprinkler irrigated agriculture in the Peel-Harvey coastal plain catchment as defined here to make it environmentally acceptable. Unless the Authority is so satisfied, it will recommend to the Minister that the proposal is environmentally unacceptable, and that it should not be implemented.

Wider considerations

Fairness

Owners of existing broadacre agricultural holdings have, by and large, accepted the recommended constraints by making a significant reduction in the rates of phosphorus fertilisers applied to their properties, and by beginning to plant trees. The approval of new agricultural proposals involving large applications of nutrients to the soil would raise concerns over equity, and would jeopardise the gains already made. The Authority recognises that, by itself, an individual proposal may not cause a significant environmental impact, however the cumulative impacts of a number of smaller proposals are significant, and must be managed within the assimilative capacity of the environment.

The Authority is aware that the determination of this position of the environmental unacceptability of conventional sprinkler irrigated agriculture in the catchment creates the perception of inequity for those who may have purchased land with the expectation of using it to pursue conventional sprinkler irrigated agriculture. It should be noted, however, that prominent publicity has been given to the fertilizer and nutrient related problems of the Peel-Harvey Estuary and its catchment over more than a decade. Therefore ignorance of the areas problems and constraints should not be an issue. However, such ignorance of the problems is an issue, and the Authority recommends that the Government give urgent consideration to whether there is any action required to address this perception of inequity.

Existing irrigated agriculture

With regard to existing conventional sprinkler irrigated agriculture in the catchment, the Authority is aware that Ministerial Conditions for the Peel Inlet - Harvey Estuary Management Strategy (Stage 2) require that an Integrated Catchment Management Plan be developed. It is essential that this management plan be successfully implemented to provide a means of reducing the nutrient loss to the estuary from existing conventional sprinkler irrigated agriculture in the catchment. The Authority urges that the development of this plan be expedited, and that the Western Australian Department of Agriculture continue its investigation and extension to farmers of the means by which water and fertiliser application rates to irrigated crops and pastures may be reduced.

Options in the catchment

Alternatives to conventional sprinkler irrigated agriculture within the catchment should not include the clearing of existing native vegetation, or intensification of drainage. Environmentally acceptable options are likely to be restricted to dryland agriculture, hydroponics (with effluent controls), or to proposals which include compensatory nutrient reduction elsewhere in the catchment.

Options on the Swan Coastal Plain

An increasing population and an expanding export market have caused rapid growth in the Western Australian horticultural industry. This growth is expected to continue, with some 9000ha of additional land required to meet these demands by 2011. According to a report by the Western Australian Department of Agriculture (Gallagher, 1986) approximately 6000ha of this would be required on the Swan Coastal Plain, which currently provides some 90% of the State's horticultural land.

Careful planning is required to ensure that the needs of the horticultural industry and other forms of irrigated agriculture for land and groundwater are not met at the expense of the many other competing demands for land on the Swan Coastal Plain. To this end the Water Authority of Western Australia and the Western Australian Department of Agriculture have assessed the availability of land and water for horticultural purposes on the Swan Coastal Plain. That assessment has shown that the limiting resource for the expansion of this industry is the underground water supply. The Environmental Protection Authority advises those contemplating irrigated agriculture to consult those two agencies before purchasing land for that purpose.

However, the development of land for irrigated agricultural activities is not only determined by the availability of water and land. Proponents should also give careful consideration to the suitability of the land for irrigated agriculture, having regard for planning and environmental constraints. Some of the constraints which need to be considered include:

- exclusion of land not zoned rural;
- exclusion of System 6 and conservation reserves;
- exclusion of areas known to be environmentally sensitive or which are known to be under restoration, such as the Peel-Harvey coastal plain catchment;
- provision of adequate buffer zones around wetlands, rivers and estuaries;
- conservation of remnant vegetation;
- provision of adequate buffer zones (at least 500 metres) around public water supply borefields;
- consideration of the depth to groundwater and the direction of groundwater movement;
- consideration of existing infrastructure; and
- capability of the soil to support horticulture and retain water and nutrients.

If all these constraints are adequately taken into account, this will ensure that the land most suited for the pursuit of conventional sprinkler irrigated agriculture with the least environmental impact is chosen. It will also ensure that proposals for developments may proceed without environmental impact assessment, and that the intractable environmental problems which already occur in various parts of the coastal plain can be minimised or avoided.

New conventional sprinkler irrigated agricultural proposals in the Swan Coastal Plain catchment of the Peel-Harvey Estuary

Report and recommendations of the Environmental Protection Authority

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Summary and recommendations

The Environmental Protection Authority has received a number of proposals, each of which involves an application for a well licence to pursue conventional intensive irrigated agriculture. Each proposal was referred to the Environmental Protection Authority by the Water Authority of Western Australia, and each property is located within the Peel-Harvey Coastal Plain catchment. The Authority set the level of assessment of each proposal at Consultative Environmental Review (CER).

The Authority has assessed the proposals on the basis of:

- the information provided in the well licence applications;
- meetings and discussions with most proponents at the location of the proposed development;
- the Authority's knowledge of current irrigated agricultural practice and its environmental effects;
- the Authority's knowledge of the current status of the Peel-Harvey estuarine system and associated catchments; and
- in the context of the Ministerial Conditions for the Peel Inlet-Harvey Estuary Management Strategy (Stage 2).

Each proposal involves the application of substantial quantities of nutrients and water to the soils of the coastal plain catchment of the Peel-Harvey estuarine system.

General recommendation

The Environmental Protection Authority recommends that the Government give urgent consideration to whether there is any action required to address the perception of inequity by those who may have purchased land in the Swan Coastal Plain Catchment to the Peel-Harvey Estuary with the expectation of using it to pursue conventional sprinkler irrigated agriculture, and who are prevented from pursuing this landuse on environmental grounds.

Recommendation for Proposal 1

The Environmental Protection Authority concludes that there would be an inevitable increase in nutrient load to the Peel Harvey Estuary associated with this proposal, and recommends that it is environmentally unacceptable. The Environmental Protection Authority therefore recommends against approval for clearing of Lot 36 Landgren Road, Casuarina and that this proposal should not proceed. Accordingly, the Authority also recommends that a well licence should not be issued.

Recommendation for Proposals 2 and 3

The Environmental Protection Authority concludes that there would be an inevitable increase in nutrient load to the Peel Harvey Estuary associated with these proposals and recommends that they are environmentally unacceptable. The Environmental Protection Authority therefore recommends that the proposals at Lot 8 Doghill Road, Baldivis and Lot 9 Thomas Road, Anketell should not proceed. Accordingly, the Authority also recommends that a well licence should not be issued.

Recommendations for Proposal 4

The Environmental Protection Authority concludes that nutrients and irrigation could be managed at this location to ensure that the proposal is environmentally acceptable. The Environmental Protection Authority therefore recommends that this proposal may proceed. Accordingly, the Authority also recommends that a well licence may be issued.

The Environmental Protection Authority recommends that horticultural activities be restricted to the orange Spearwood soils on Lot 4 Zigzag Rd, Baldivis and that a

Western Australian Department of Agriculture approved irrigation system and fertilizer regime be used. The Environmental Protection Authority recommends that fertilization on Lot 4 Zigzag Rd, Baldivis be in accordance with recommendations arising from annual soil testing of the property.

The Environmental Protection Authority recommends that trees be planted on the northern, eastern and southern boundaries of Lot 4 Zigzag Rd, Baldivis equivalent to 800 stems per hectare to a distance of 50 metres from each of the northern and southern boundaries and at least 100 metres on the eastern boundary. The Authority recommends that the species of trees be selected by the Western Australian Department of Agriculture.

Recommendations for Proposal 5

The Environmental Protection Authority concludes that nutrients and irrigation could be managed at this location to ensure that the proposals are environmentally acceptable. The Environmental Protection Authority therefore recommends that this proposal may proceed. Accordingly, the Authority also recommends that a well licence may be issued.

The Environmental Protection Authority recommends that irrigation be restricted to the riverine and clay soils and that a Western Australian Department of Agriculture approved irrigation system and fertilizer regime be used. The Environmental Protection Authority recommends that fertilization be in accordance with recommendations arising from annual soil testing.

The Environmental Protection Authority recommends that trees be planted along any drainage lines within the irrigated areas. The Authority recommends that the species of trees be selected by the Western Australian Department of Agriculture.

Recommendation for Proposal 6

The Environmental Protection Authority recommends that it be environmentally acceptable for a new groundwater bore to be established on Lot 679 Lyon Road Mandogalup provided that the property is not further developed.

The Environmental Protection Authority recommends that fertilization be in accordance with Western Australian Department of Agriculture's recommendations arising from annual soil testing of the property.

1. Introduction

The Environmental Protection Authority has received a number of proposals outlined in Schedules 1 and 2, each of which involves an application for a well licence to pursue conventional sprinkler irrigated agriculture. Each proposal was referred to the Environmental Protection Authority by the Water Authority of WA and each property is located within the Swan Coastal Plain catchment of the Peel-Harvey Estuary (as illustrated in Figure 1). The Authority set the level of assessment of each proposal at Consultative Environmental Review (CER). The Authority has also received a number of other proposals for the same class of activity within the Swan Coastal Plain catchment of the Peel-Harvey Estuary which have been withdrawn by the proponents after they were informed by officers of the Environmental Protection Authority that their proposals would not gain approval.

2. The proposals

2.1 Proposals for conventional sprinkler irrigated horticultural production

The Environmental Protection Authority has received the proposals (summarised in Schedule 1), each of which involves an application for a well licence to pursue conventional sprinkler irrigated horticultural production within the Peel-Harvey coastal plain catchment.

Schedule 1. Summary of proponents, property locations, proposed landuse and the area of each property subject to irrigation for conventional sprinkler irrigated horticultural production proposals.

Proposal Number	Proponent	Property location	Proposed landuse	Area subject to irrigation (hectares)
1	Mr P Grubisin	Lot 36 Landgren Rd, Casuarina	Horticulture	4
2	Mr A Young	Lot 8 Doghill Rd, Baldivis	Horticulture	4
3	G-Chan Asian Vegetable	Lot 9 Thomas Rd, Anketell	Horticulture	9
4	Messrs O & R Vlajic	Lot 4 Zigzag Rd, Baldivis	Horticulture	2.8

The Western Australian Department of Agriculture phosphorus and nitrogen fertilizer recommendations for horticultural crops commonly grown on the coastal plain are 50 - 120kg of phosphorus and 198 - 1370kg of nitrogen per hectare per crop (Appendix 1). The total annual quantity of nutrients applied is dependent upon the number of crops that are grown each year and whether the proposed development is new or has been previously established. For vegetables, it is not uncommon for two or more crops to be grown each year.

2.2 Proposals for conventional sprinkler irrigated pasture production

The Environmental Protection Authority has received the proposals (summarised in Schedule 2), each of which involves an application for a well licence to pursue conventional sprinkler irrigated pasture production within the Peel-Harvey coastal plain catchment.

Schedule 2. Summary of proponents, property locations, proposed landuse and the area of each property subject to irrigation for conventional sprinkler irrigated pasture production proposals.

Proposal Number	Proponent	Property location	Proposed landuse	Area subject to irrigation (hectares)
5	Mr W Duffy	Lot 169 Paulls Rd, Coolup	Sprinkler irrigated pasture	50
6	Kaleen Holdings Pty Ltd	Lot 679 Lyon Rd, Mandogalup	Sprinkler irrigated pasture	12.2

The Western Australian Department of Agriculture fertilizer recommendations for irrigated pasture crops such as kikuyu, strawberry clover, white clover, paspalum and perennial ryegrass on the coastal

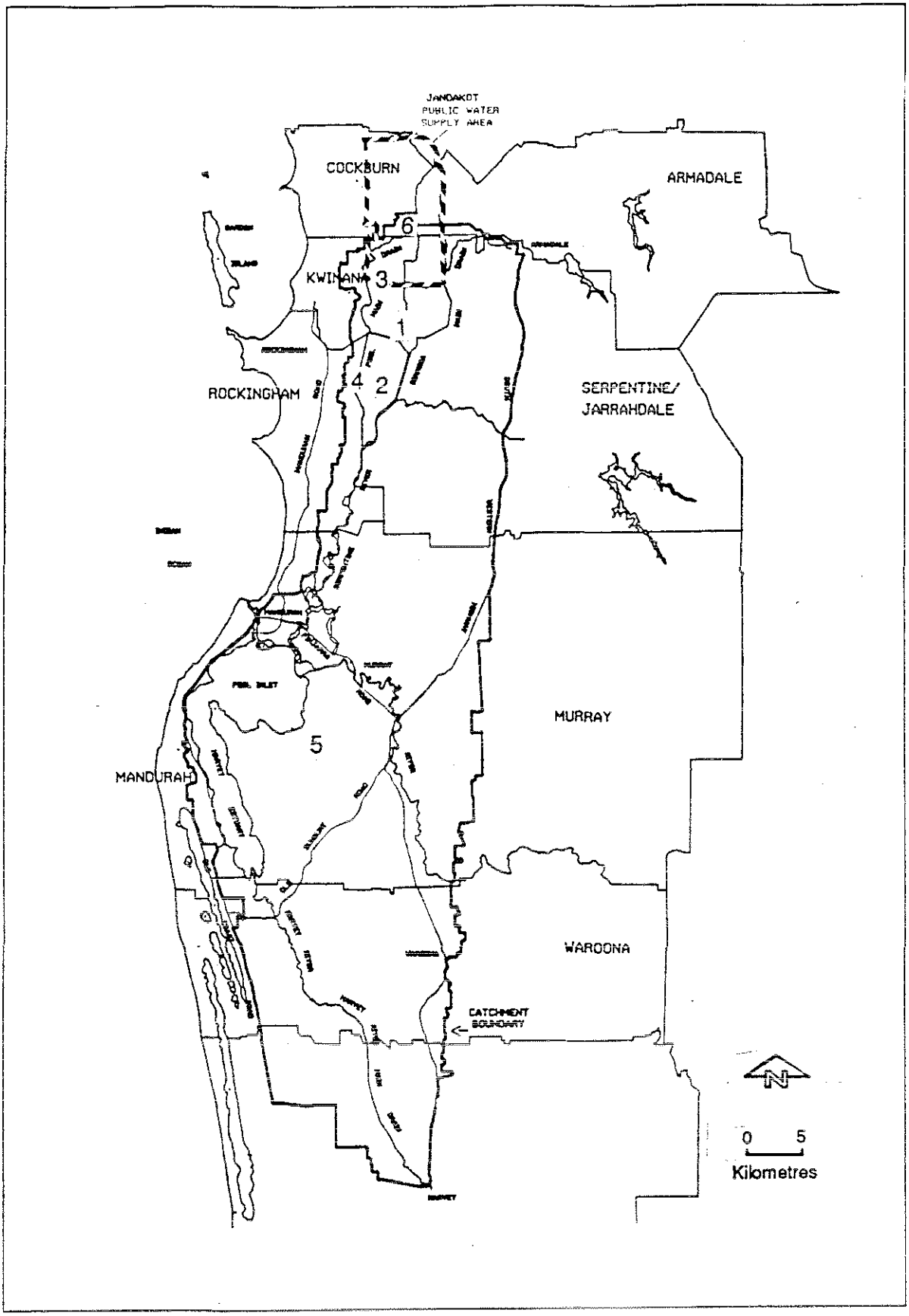

Figure 1: Location of proposals within the Peel-Harvey coastal plain catchment administrative boundary

plain are 27kg of phosphorus per hectare in the year of establishment and 16kg of phosphorus per hectare per year subsequently (Arkell, 1990). The fertilizer recommendations for irrigated pasture

crops such as lucerne are 200kg per hectare of 3:2 Super and Potash after each cut (this is equivalent to 10.6kg of phosphorus per hectare after each cut and there may be five to six cuts each year)

Typical Western Australian Department of Agriculture recommended water application rates for a range of irrigated crops are given in Appendix 2 (WAWA, 1990). A water application rate of 15000kL/ha/yr is equivalent to 1500mm of rainfall, which is almost double the annual average rainfall for the Peel-Harvey coastal plain catchment (850mm).

3. Assessment of the proposals

The Authority has assessed the proposals on the basis of:

- the information provided in the well licence applications;
- meetings, site visits and discussions with the proponents by officers of the Environmental Protection Authority;
- the Authority's knowledge of current sprinkler irrigated agricultural practice and its environmental effects;
- the Authority's knowledge of the current status of the Peel-Harvey estuarine system and associated catchments; and
- in the context of the Ministerial Conditions for the Peel Inlet-Harvey Estuary Management Strategy (Stage 2).

In each case the proponent was approached to determine if there was further information which might lead the Authority to conclude that the proposal differed significantly from the criteria specified in the position statement.

4. The existing environment

The Peel-Harvey estuarine system shows signs of severe eutrophication (nutrient enrichment), which results in excessive algal growth that greatly reduces its recreational, environmental, social and economic value. The cause of the eutrophication is an inflow of nutrients (mainly phosphorus and nitrogen) from the coastal plain catchment into the estuary. The nutrient inflow is currently far above the estuary's ability to cope — hence the huge production of algae.

The primary source of the nutrients is agricultural runoff from the sandy soils of the catchment which have been extensively cleared and drained. The sandy soils of the coastal plain are naturally infertile and require inputs of nutrients to be productive. The sandy soils, however, have little capacity to retain nutrients that are applied and a large proportion of that which is applied is lost through leaching and runoff.

The sandy soils have little capacity to retain moisture during summer and have to be irrigated frequently to maintain plant growth (eg horticulture and irrigated pasture). Often the soils are waterlogged during winter which enhances nutrient loss through runoff.

The problems that exist in the estuarine system today are largely the result of relatively small applications of nutrients, for example 10-15kg of phosphorus per hectare per year for passive agricultural activities such as annual pasture growth for stock grazing. These are known as diffuse sources of nutrients, however, point sources (sources concentrated at one small location) also contribute to the problems in the estuarine system. Point sources include intensive animal industries, stock holding yards and horticultural developments.

5. The Ministerial Conditions and their implications

Ministerial Conditions were set on 3 January 1989 under Section 45 of the Environmental Protection Act for the Peel-Harvey Stage 2 Environmental Review and Management Programme. A copy of the conditions is in Appendix 1. These conditions imposed constraints on developments in the catchment with the objective of reducing the flow of nutrients into the estuary to about half their present level.

The Stage 2 proposal by the Ministers for Transport, Agriculture and Waterways sought to improve flushing of the estuary by constructing the Dawesville Channel and to reduce the flow of nutrients by controlling developments in the catchment. The proposal included a commitment to a moratorium on further clearing and drainage in the catchment. In approving the proposal, the Minister for Environment imposed the condition that the moratorium should continue "until the Minister for Environment is satisfied that these activities would be environmentally acceptable."

The interpretation of this Condition has been that a proposal which involves some additional clearing and/or drainage may proceed provided that the proponent can demonstrate that the proposal incorporates sufficient ameliorative measures to ensure that the overall impact is consistent with the objective of reducing nutrient inflows to the estuarine system by about half.

Condition 2 specifies interim target levels for the quantity of phosphorus flowing into the estuary. In operational terms these targets mean that on average phosphorus losses to the estuary should not exceed 0.375kg of phosphorus per hectare per year. Conditions 3 and 4 require the proponents to prepare an Environmental Protection Policy and a Catchment Management Plan designed to meet the targets in Condition 2. These documents are currently in preparation.

Further, Condition 9 states that, for the present, decisions on developments which may release phosphorus or nitrogen to the environment in the Peel-Harvey Estuary area and coastal plain catchment should be conservative. The condition makes specific reference to new and expansion of existing intensive horticultural and intensive animal industries.

Under the Environmental Protection Act these Ministerial Conditions have the force of law, and are legally binding on the proponents.

6. Environmental impacts

The Authority has given consideration to the basic nature of intensive agricultural practices on the coastal plain as it currently exists and the potential for ameliorating its environmental impacts. In this regard the Authority is aware that:

- the Western Australian Department of Agriculture currently recommends applications of 50 to 120kg of phosphorus per hectare per crop for horticultural crops commonly grown on the coastal plain. Multiple cropping is common, so the recommended application rate per year is 2 to 2.5 times that amount (around 200kg of phosphorus). At these rates, only 10-20% of the applied phosphorus is taken up by the crop and removed when the crop is harvested (see Appendix 1). A high proportion of the applied phosphorus is then available for leaching to ground or surface waters;
- a recent Department of Agriculture survey of market gardeners in the Peel-Harvey coastal plain catchment revealed that they were, on average, applying 400kg of phosphorus per hectare annually;
- the existing severe algal problems in the estuary have been caused by average phosphorus applications of the order of 10-15kg per hectare annually;
- the Department of Agriculture survey showed that nitrogen application rates on market gardens are also very high — of the order of 750-1000kg per hectare per year, and sometimes higher. Again only a small proportion of the fertiliser is taken off in the crop (see Table 2). In some cases these high application rates are known to have caused significant contamination of shallow groundwater resources such that they are no longer suitable for human or animal consumption or, indeed, for irrigating horticultural crops or pastures;
- the Environmental Protection Authority has received a number of complaints from landholders with grossly polluted groundwater. In most cases the contamination has been linked to nutrient intensive activities in the vicinity;
- recent local research on market gardens (Sharma, 1990) has indicated that of the total applied phosphorus (620kg/ha), 70% was leached, 10% was exported as crop harvest and the remainder was assumed to have been retained in the soil. Of the total nitrogen applied (1963kg/ha), 44% was leached, 18% was exported as crop harvest and the remainder was assumed to have been lost through volatilisation and denitrification. The concentration of nitrate nitrogen in leachates ranged from 80 to 400mg/L (winter to summer) and the irrigating water has a nitrate nitrogen concentration of 32mg/L. Recommended nitrate nitrogen concentration in drinking water is

10mg/L (NHMRC and AWRC, 1987). Environmentally significant concentrations of nitrate nitrogen are as low as 1mg /L.

- owners of existing broadacre agricultural holdings have, by and large, accepted the recommended constraints by making a significant reduction in the rates of phosphorus fertilisers applied to their properties. The approval of new horticultural proposals involving large applications of nutrients to the soil raises concerns of equity with existing catchment landholders whose fertiliser application rates are being constrained.
- irrigation of crops on the sandy soils of the Peel-Harvey coastal plain catchment to which large quantities of phosphorus are applied can cause the nutrient leaching problem to be exacerbated by substantially reducing the time taken for nutrients to reach groundwater (Table 1). For example at high recharge (100cm/yr) and high rates of application of phosphorus (500kg/ha/yr), which can be typical of irrigated horticulture, the time taken for phosphate to travel through 1 metre of soil, typical of those of the coastal plain catchment of the Peel-Harvey estuarine system (3 and 4 in Table 1) is between about 1 and 2.5 years. At lower rates of recharge this can be extended to 4.5 years at the same rates of phosphorus application. At low rates of phosphorus application (20kg/ha/yr) the time for breakthrough to occur can be reduced by increasing the recharge (eg irrigated pasture). In the case of surface flooding soils, many of which occur in the Peel-Harvey coastal plain catchment, the loss to drainage would occur in the year of application by lateral movement of nutrient-contaminated water from the soil surface to nearby drains.

Phosphorus accumulation (kg/ha/yr) --->		**20**		**100**		**500**
Recharge (cm/yr) --->	**20**	**100**	**20**	**100**	**20**	**100**
1. Surface soil of the Darling plateau	38000	15000	11000	4500	3000	1300
2. Clay subsoil of the Darling plateau	250	170	60	45	15	11
3. Subsoil of a yellow Spearwood sand	45	30	12	7.5	4.5	2.5
4. Surface soil of a Gavin sand	6	2.5	3	1.5	1.5	<1

Table 1: Calculated times (years) for phosphate to travel through 1 metre of some soils from the South-West of Western Australia for different rates of accumulation of phosphorus and recharge (Gerritse, 1990).

7. Conclusions and recommendations

The Authority has assessed the proposals on the basis of the information provided in the well licence applications, meetings and discussions with the proponents, its knowledge of current sprinkler irrigated agricultural practice and, in the context of the Ministerial Conditions.

In general the Environmental Protection Authority will recommend against new applications for sprinkler irrigated agriculture in the Swan Coastal Plain catchment to the Peel-Harvey Estuary.

Procedures are in place to establish an Environmental Protection Policy (EPP) to help manage impacts from existing conventional sprinkler irrigated agricultural activities in the Peel-Harvey catchment. This report recommends that there be no new sources of pollution from irrigated agriculture and horticulture in the Peel-Harvey catchment. It is recognised that there may be further development proposals from landowners in the catchment who are not yet operating and that these proponents need to be treated fairly, whilst achieving environmental objectives.

General recommendation

The Environmental Protection Authority recommends that the Government give urgent consideration to whether there is any action required to address the perception of inequity by those who may have purchased land in the Swan coastal plain catchment to the Peel-Harvey Estuary with the expectation of using it to pursue conventional sprinkler irrigated agriculture, and who are prevented from pursuing this landuse on environmental grounds.

Recommendation for Proposal 1

The Environmental Protection Authority concludes that there would be an inevitable increase in nutrient load to the Peel Harvey Estuary associated with this proposal, and recommends that it is environmentally unacceptable. The Environmental Protection Authority therefore recommends against approval for clearing of Lot 36 Landgren Road, Casuarina and that this proposal should not proceed. Accordingly, the Authority also recommends that a well licence should not be issued.

Recommendation for Proposals 2 and 3

The Environmental Protection Authority concludes that there would be an inevitable increase in nutrient load to the Peel Harvey Estuary associated with these proposals and recommends that they are environmentally unacceptable. The Environmental Protection Authority therefore recommends that the proposals at Lot 8 Doghill Road, Baldivis and Lot 9 Thomas Road, Anketell should not proceed. Accordingly, the Authority also recommends that a well licence should not be issued.

Recommendations for Proposal 4

The Environmental Protection Authority concludes that nutrients and irrigation could be managed at this location to ensure that the proposal is environmentally acceptable. The Environmental Protection Authority therefore recommends that this proposal may proceed. Accordingly, the Authority also recommends that a well licence may be issued.

The Environmental Protection Authority recommends that horticultural activities be restricted to the orange Spearwood soils on Lot 4 Zigzag Rd, Baldivis and that a Western Australian Department of Agriculture approved irrigation system and fertilizer regime be used. The Environmental Protection Authority recommends that fertilization on Lot 4 Zigzag Rd, Baldivis be in accordance with recommendations arising from annual soil testing of the property.

The Environmental Protection Authority recommends that trees be planted on the northern, eastern and southern boundaries of Lot 4 Zigzag Rd, Baldivis equivalent to 800 stems per hectare to a distance of 50 metres from each of the northern and southern boundaries and at least 100 metres on the eastern boundary. The Authority recommends that the species of trees be selected by the Western Australian Department of Agriculture.

Recommendations for Proposal 5

The Environmental Protection Authority concludes that nutrients and irrigation could be managed at this location to ensure that the proposals are environmentally acceptable. The Environmental Protection Authority therefore recommends that this proposal may proceed. Accordingly, the Authority also recommends that a well licence may be issued.

The Environmental Protection Authority recommends that irrigation be restricted to the riverine and clay soils and that a Western Australian Department of Agriculture approved irrigation system and fertilizer regime be used. The Environmental Protection Authority recommends that fertilization be in accordance with recommendations arising from annual soil testing.

The Environmental Protection Authority recommends that trees be planted along any drainage lines within the irrigated areas. The Authority recommends that the species of trees be selected by the Western Australian Department of Agriculture.

Recommendation for Proposal 6

The Environmental Protection Authority recommends that it be environmentally acceptable for a new groundwater bore to be established on Lot 679 Lyon Road Mandogalup provided that the property is not further developed.

The Environmental Protection Authority recommends that fertilization be in accordance with Western Australian Department of Agriculture's recommendations arising from annual soil testing of the property.

8. References

Arkell, P and Angell, K (1990). Sprinkler-irrigated pastures for small holdings. Western Australian Department of Agriculture. Farmnote 6/90.

Gallagher, J, Eckersley, P and Brennan, D (1986). The future demand, value and transfer methods of irrigation water. Publication by Marketing and Economics Branch, Western Australian Department of Agriculture

Gerritse, R (1990). Impact of horticultural landuse on water quality in the Darling Range and Coastal Plain of WA. In proceedings of "Horticulture and the Environment", Western Australian Department of Agriculture, Division of Horticulture, Seminar. Mandurah, June 7-8, 1990. Miscellaneous Publication No. 20/90.

National Health and Medical Research Council and the Australian Water Resources Council (1987).. Guidelines for drinking water quality in Australia. Australian Government Publishing Service, Canberra.

Sharma, M (1990). Leaching of nutrients under horticultural systems on the Swan Coastal Plain, Western Australia. In proceedings of "Horticulture and the Environment", Western Australian Department of Agriculture, Division of Horticulture, Seminar. Mandurah, June 7-8, 1990. Miscellaneous Publication No. 20/90.

Water Authority of WA (1990). General principles and policy for groundwater licensing in Western Australia. Groundwater Branch, Water Resources Directorate, Report No. WG 90.

Appendix 1

Phosphorus and nitrogen fertilization rates recommended by the Western Australian Department of Agriculture for the major vegetable crops on the coastal sands of Western Australia

Phosphorus

Crop	Yield (T/Ha)	Status	Phosphorus applied (kg/ha/crop)			P removed (kg/ha/crop)	Residual P (kg/ha/crop)	Residual P as % of applied
			Total	Organic	Inorganic			
Cabbage	50	Established	100	40	60	24	76	76
		New	260	200	60	24	236	91
Carrots	44	Established	50	0	50	15	35	70
		New	74	24	50	15	59	80
Cauliflowers	50	Established	120	40	80	25	95	79
		New	280	200	80	25	255	91
Celery	100	Established	134	20	114	40	94	70
		New	214	100	114	40	174	81
Lettuce	50	Established	90	40	50	20	70	78
		New	250	200	50	20	230	92
Onions	50	Established	120	40	80	26	94	78
		New	280	200	80	26	254	91
Potatoes	40	Established	120	40	80	15	105	88
		New	280	200	80	15	265	95
Pumpkins	25	Established	100	40	60	10	90	90
		New	180	120	60	10	170	94
Rockmelons	25	Established	76	16	60	10	66	87
		New	140	80	60	10	130	93
Tomatoes	60	Established	160	40	120	33	127	79
		New	320	200	120	33	287	90

Nitrogen

Crop	Yield (T/Ha)	Status	Nitrogen applied (kg/ha/crop)			N removed (kg/ha/crop)	Residual N (kg/ha/crop)	Residual N as % of applied
			Total	Organic	Inorganic			
Cabbage	50	Established	495	120	375	147	348	70
		New	975	600	375	147	828	85
Carrots	44	Established	300	0	300	100	200	67
		New	372	72	300	100	272	73
Cauliflowers	50	Established	570	120	450	119	451	79
		New	1050	600	450	119	931	89
Celery	100	Established	400	60	340	154	246	62
		New	640	300	340	154	486	76
Lettuce	50	Established	370	120	250	100	270	73
		New	850	600	250	100	750	88
Onions	50	Established	320	120	200	90	230	72
		New	800	600	200	90	710	89
Potatoes	40	Established	260	120	140	132	128	49
		New	740	600	140	132	608	82
Pumpkins	25	Established	320	120	200	75	245	77
		New	560	360	200	75	485	87
Rockmelons	25	Established	198	48	150	75	123	62
		New	390	240	150	75	315	81
Tomatoes	60	Established	890	120	770	80	810	91
		New	1370	600	770	80	1290	94

Phosphorus and Nitrogen fertilization (applied, removed and residual in kg/ha/crop) and the percentage of that applied which is residual for the major vegetable crops on the coastal sands of Western Australia (adapted from information provided by the Western Australian Department of Agriculture). Parts of these tables have been published previously by McPharlin and Luke (1989).

Assumptions for calculations made in tables

1. Major crops on sands ranked on area basis.
2. Yield estimated as good commercial average rather than Australian Bureau of Statistics average.
3. Assumed fertilizer applied as either organic (eg poultry manure) or inorganic (eg superphosphate, urea) according to Western Australian Department of Agriculture recommendations for new or established properties in kg/ha/crop elemental N or P.
4. Nutrient removal figures based on empirical data of Huett, D O (1985) (New South Wales Department of Agriculture), Knotts Handbook for Vegetable Growers (1988) and calculations made by officers of Western Australian Department of Agriculture for nutrients removed in harvested product.
5. Where most of the crop is harvested (eg cabbage, lettuce), very little N or P remains in the organic fraction of the soil. Where only part of the crop is removed as harvested product (eg tomato, carrot root etc) large quantities of N and P may remain in the unharvested material (leaves, stems etc). This is treated as one source as it is difficult to estimate the two sources.
6. It is assumed that organic fertilizers applied preplanting (eg poultry manure) have mineralised to elemental N and P by the end of the crop life so this appears as the inorganic form of N or P remaining.
7. Poultry manure: N = 3%, P = 1% average on a dry weight basis assuming a moisture content of 50%. N and P content of poultry manure vary considerably (N = 2 - 4.5%, P = 0.4 - 1.7% dry weight basis).
8. The N and P remaining is available for leaching. It should not be assumed that all N and P remaining will leach as this will depend on soil type, irrigation refines etc. It would be reasonable to assume that almost all P not used by the crop could leach from Bassendean sands since they have an extremely low P retention ability (PRI). Spearwood sands have a high PRI relative to other coastal sands but may still only hold a few percent of P remaining. Nitrate retention would be low in both Spearwood and Bassendean sands.

References

Huett, D O (1985). Plant Nutrition. In 'Vegetable Growing Handbook' ed. by J. Salvestrin, pp 44-49.

Lorenz, O A and Maynard, H W (1988). Knotts Handbook for Vegetable Growers. 3rd ed. John Wiley and Sons, New York.

McPharlin, I and Luke, G (1989). Irrigation and fertilizer management for horticultural crops on the Swan Coastal Plain. Journal of Agriculture, Western Australia, 30, 91-95.

Appendix 2

Typical water application rates for irrigated crops recommended by the Western Australian Department of Agriculture

Typical water application rates recommended by the Western Australian Department of Agriculture

Crop		Recommended water application rate (kL/ha/yr)
Vegetables		15000
	Winter vegetables	5000
	Melons	5000
Pasture		
	Ground cover	5000
	Standard cover	7500
	Grazing or harvesting	9000
Lucerne		12000

Appendix 3

Ministerial Conditions for the Peel Inlet - Harvey Estuary management strategy (Stage 2)

MINISTER FOR ENVIRONMENT

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

PEEL INLET-HARVEY ESTUARY MANAGEMENT STRATEGY - STAGE 2

MINISTER FOR TRANSPORT
MINISTER FOR AGRICULTURE
MINISTER FOR WATERWAYS

This proposal may be implemented subject to the following conditions:

1. The proponents shall adhere to the proposal as assessed by the Environmental Protection Authority and shall fulfil the commitments made and listed in Appendix 2 of Environmental Protection Authority Bulletin 363, as amended (copy of commitments attached).

2. The proponents shall develop proposals for control of phosphorus through catchment management, to the satisfaction of the Environmental Protection Authority, and shall implement them as rapidly as possible so that, in conjunction with the Dawesville Channel, the following objective is met:

   the Peel-Harvey System becomes clean, healthy and resilient.

   To achieve this objective, the following interim targets should be used:

   (1) annual phosphorus input to the system shall not exceed 85 tonnes in more than four years out of ten (on average) and shall not exceed 165 tonnes in more than one year out of ten (on average). [These are based on 60 and 90 percentile loads]; and

   (2) average phosphorus concentration in estuary water shall not exceed 0.2 milligrams per litre in nine years out of ten (on average).

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Phone (09) 325 4133

These target figures shall be reviewed by the Environmental Protection Authority after 3 years or sooner if environmental conditions dictate, in the light of measured performance of the System and may subsequently be varied by the Environmental Protection Authority.

3. The proponents shall jointly prepare an Environmental Protection Policy for the Peel-Harvey catchment in consultation with such persons and agencies as Government may specify, to the satisfaction of the Environmental Protection Authority, in accordance with the objective and targets specified in Condition 2 above. The target date for the Draft Policy (under Section 26 of the Environmental Protection Act 1986) is 31 December 1989.

4. The proponents shall develop in consultation with such persons and agencies as Government may specify, an integrated catchment management plan designed to meet the objective and targets specified in Condition 2 above, to the satisfaction of the Environmental Protection Authority, and which shall be in accordance with the principles to be developed in the Environmental Protection Policy for the area pursuant to Condition 3. The target date for the implementation of the integrated catchment management plan shall be 31 December 1990.

5. The proponents shall ensure that the moratorium on clearing and drainage in the Peel-Harvey coastal plain catchment proposed in the Stage 2 Environmental Review and Management Programme (Commitment 3.6) continues until the Minister for Environment is satisfied that these activities would be environmentally acceptable.

6. Relevant decision-making authorities shall ensure that all developments within 2 kilometres of the Peel-Harvey Estuary System (as defined in the Estuarine and Marine Advisory Committee Report to the Environmental Protection Authority, Department of Conservation and Environment Bulletin 88, March 1981.) include appropriate nutrient-attenuating waste disposal systems and management practices, to the satisfaction of the Environmental Protection Authority.

7. Prior to construction, a dredging and spoil disposal management plan for the Dawesville Channel shall be prepared by the proponents, to the satisfaction of the Environmental Protection Authority. Dredging not already forming part of the proposals in the Stage 2 Environmental Review and Management Programme shall be the subject of separate assessment by the Environmental Protection Authority.

8. The proponents shall ensure that weed harvesting and control is continued and increased as necessary to manage the expected initial increase in the occurrence of nuisance macroalgae.

9. Decisions on developments which may release phosphorus or nitrogen to the environment in the Peel-Harvey Estuary area and coastal plain catchment area should be conservative until the new assimilative capacity of the Peel-Harvey Estuary System is determined and the effects of the management elements have been measured or are being managed. To this end, such proposals for development in these areas shall be referred to the Environmental Protection Authority for assessment. These developments include new and expansion of existing intensive horticultural and intensive animal industries.

10. The Peel-Harvey regional park concept, as originally proposed in the System 6 Redbook report (Conservation Reserves for Western Australia: The Darling System - System 6, Department of Conservation and Environment Report 13, Parts I and II, October 1983.) shall be implemented within such time as to be determined by the Minister for Environment.

11. If the Dawesville Channel is constructed, the proponents shall be responsible for ensuring that mosquito management is effective and is carried out in an environmentally acceptable manner, to the satisfaction of the Minister for Environment and the Minister for Health.

12. The proponents shall be jointly responsible for the environmental aspects of:

    (1) the construction, operation, monitoring and maintenance of the Dawesville Channel and its impacts within the estuaries and within the immediate marine environment;

    (2) the management and required monitoring of the catchment, and collection of data necessary for the development of the integrated catchment management plan for the Peel-Harvey catchment; and

    (3) all in-estuary monitoring and management, including weed harvesting.

    All of the above shall be carried out to the satisfaction of the Environmental Protection Authority.

13. Prior to the construction of the Dawesville Channel, the proponents shall prepare in stages, a monitoring and management programme, to the satisfaction of the Environmental Protection Authority. This programme shall include:

    (1) essential additional baseline monitoring required to be in place as soon as possible and prior to construction commencing;

(2) construction stage impacts and monitoring, prior to construction; and

(3) operational and long-term monitoring, in stages, to be determined by the Environmental Protection Authority.

Barry Hodge, MLA
MINISTER FOR ENVIRONMENT

- 3 JUN 1989

MANAGEMENT COMMITMENTS MADE BY THE PROPONENTS

The following list has been amended by the EPA and accepted by the proponents to reflect the 'whole of Government approach' which is essential for management of this proposal.

1. DAWESVILLE CHANNEL

1.1 The proponents will conduct a detailed survey to locate, assess and offer protection to Aboriginal sites and heritage.

1.2 During construction of the Dawesville Channel, the proponents will ensure the continuity of road access, power supply, communications, and water and sewerage services that require relocation, and will minimize dust and noise impacts upon nearby residential areas.

1.3 Spoil from the excavated channel will be used in redeveloping the fill areas as a stable and varied landscape, reflecting naturally occurring topography elsewhere on the coastal strip.

1.4 The proponents will manage spoil disposal to minimize disturbance to important land elements, including coastal dunes, tree belts along Old Coast Road and near the estuary foreshore. Spoil disposed of adjacent to the undisturbed coastal dunes will be contoured to co-ordinate with natural dune topography in order to minimize the potential for erosion.

1.5 The land area used to dispose of excavated material will be contoured to facilitate possible future development into a prime residential and holiday area. Views from existing residences near the estuary will be retained, taking into consideration that these views may have been ultimately reduced by foreshore development and landscaping, irrespective of the proposed channel development.

1.6 Littoral sand drift northwards along the ocean coast will be mechanically bypassed beyond the channel entrance, to minimize siltation within the channel and to avoid adverse effects on beaches to the north and south.

1.7 The Dawesville Channel will be maintained as a navigable waterway, although, as with the existing Mandurah Channel, sea conditions at the ocean entrance may frequently preclude its use by small boats.

1.8 The estuary will be closely monitored to evaluate the management strategy's success in reducing the algal nuisance and to enable the development of appropriate management strategies to mitigate any deleterious effects that may occur. Current and proposed future monitoring studies in the estuary are described in Section 13 of the ERMP and Section 11 of the EPA assessment report.

2. CONTROL OF WEED ACCUMULATIONS

2.1 Weed harvesting will be continued most likely at an increased rate, until the weed nuisance in the estuary is successfully reduced.

2.2 Possible methods of improving the efficiency of harvesting operations, and the possible use of algicides to control weed growth, will be evaluated by the proponents and implemented if shown to be practicable.

2.3 The Peel Inlet Management Authority will continue the existing programme of shoreline management and will rehabilitate areas where weed accumulations or harvesting operations cause excessive retreat of the shoreline.

3. CATCHMENT MANAGEMENT

3.1 The proponents will continue to provide advice to farmers on fertilizer requirements, based on accurate assessment by paddock-specific soil tests.

3.2 The proponents will encourage further development and use of individual-nutrient fertilizers, and will undertake detailed investigations of ways to overcome existing economic constraints to their production and use.

3.3 The proponents will ensure that large-scale field trials are carried out to ascertain the technical and economic feasibility of converting use of sandy soils from agriculture to forestry. Private enterprise involvement in these studies will be encouraged.

3.4 The EPA and the Department of Agriculture will continue to provide advice to producers to define and implement practicable and cost-effective waste management strategies for control of point sources of phosphorus.

3.5 The Department of Agriculture will coordinate the preparation and implementation of a detailed catchment management plan aimed at reducing phosphorus losses to the estuary to less than 85 t/a in a 60 percentile year with minimal economic or social disruption to the catchment community.

3.6 The proponents will implement a moratorium on further clearing and drainage in the catchment, pending determination of the success of the catchment management plan in reducing phosphorus losses from existing cleared land.

3.7 The success of catchment management measures in reducing phosphorus losses to the estuary will be monitored by the proponents and audited by the EPA. The social and economic effects of catchment management measures upon the catchment community will be closely monitored by the proponents. Current and proposed future monitoring studies are described in Section 13 of the ERMP and in Section 11 of the EPA assessment report. The catchment management plan will be regularly reviewed by the EPA.