

THE FEASIBILITY OF
A NEW HORTICULTURE PRECINCT
ON THE GNANGARA MOUND



CONSOLIDATED SUMMARY
PREPARED FOR THE
DEPARTMENT OF AGRICULTURE AND FOOD

NOVEMBER 2008



INTRODUCTION

Historically horticultural land has been developed on the fringes of the urban area of Perth. Land for horticulture has been taken up as freehold agricultural land and in time increasing land values have funded the purchase of larger land areas further from the fringe or retirement for the horticulturists. This pressure from urban expansion is now happening in East Wanneroo and groundwater reserves are over-allocated.

The Western Australian Planning Commission has identified an area that could be set aside as a precinct for horticulture at Carabooda (Plate 1). It is already well developed, with about 1,000 ha of the 1,800 ha precinct area under freehold and over 60% cultivated.

This study examines the advantages and disadvantages of reserving an area at Carabooda for horticulture. It does that by analyzing against a detailed background three development options available to the State Government.

DEVELOPMENT SCENARIOS

Three development scenarios are proposed (Plate 2).

1. Dedicated Horticulture Precinct

The existing freehold land can be supplemented by the new farming of up to 1000 ha of existing pine plantation. In total about 3,000 ha of pine plantation may be required to supplement the current area and meet the future urban needs now supplied by the Wanneroo area. The new land will be leased by the government to growers and irrigated by recycled water from the Alkimos Waste Water Treatment Plant (WWTP) as it comes on stream, establishing a development timetable of 40 years. Best practice irrigation should be a condition of the release of the new land and associated water licences. Projected water supply rates from the Alkimos plant will fall short of daily requirements at the hottest time of year and hence storage will be required within the precinct. Some land within the precinct could be allocated to organic vegetable production. The cost of recycled water is likely to be high compared with groundwater extraction. A government subsidy on recycled water appears necessary as it has been for similar schemes in Victoria and South Australia. To reduce the cost of any subsidy for recycled water the developed land could be sold to new growers. Strict land use conditions would be applied at sale to ensure a long term commitment of the precinct to horticulture.

2. Urban Fringe Development

Continued production on the fringe of the metropolitan area can occur even if a dedicated precinct is not set aside within the expanding urban area. This would continue the historic pattern of development and is effectively a status-quo scenario.

Suitable land is generally not a limiting factor for horticulture in Western Australia and hence this form of agricultural development can continue as long as the areas on the urban fringe have access to self supply ground water. This approach preserves a “horticultural sense of place” for Wanneroo, and maintains urban agriculture around Perth. Crops will be those requiring high labour input. Those crops with potential for mechanisation will tend to shift to larger farms more distant from the metropolitan area and in more stable locations by introducing guaranteed water allocations, mechanisation for crop management and harvesting, and a smaller but trained labour force provided with accommodation nearer to the production site.

3. Greenfields Horticulture Area

A State commitment to expanding horticulture in Western Australia could come about by allocating significant areas of suitable land and associated water resources to horticulture production away from the pressure of urban expansion. Areas to the north and south of the expanding metropolitan area are identified that can satisfy this need if water allocations are guaranteed. Although no local groundwater areas have more than 10GL/an available, this water can be allocated to horticulture along with suitable land so horticulture farms could be established. Water reserved for public water supply could be replaced by alternative sources such as desalination and managed aquifer recharge, allowing water from the reserves to be freed for horticulture. The Gingin Shire is already established as an important production area for horticultural crops, especially carrots. Similarly the Harvey Shire is establishing as an important location for vegetable production. Soft, leafy and labour intensive lines can be accommodated by retaining small self supply urban horticulture plots in the north and south of the metropolitan area.

HORTICULTURE PRODUCTION

Australia is a substantial horticulture producer both for domestic consumption and export. In gross terms, vegetables totalled 3.44 million tonnes in 2002 while fruit production totalled 1.91 million tonnes. Fruit and vegetables are grown in all Australian states with some separation based on climate. The top ten varieties by weight accounted for 88% of vegetable production and 92% for fruit (Table 1).

Table 1 Top ten vegetable and fruit varieties, Australia 2002 (tonnes)

Vegetable	Tonnes	Fruit	Tonnes
Potatoes	1,333,159	Oranges	550,201
Tomatoes	424,950	Bananas	313,314
Carrots	331,130	Apples	290,263
Onions	282,517	Pears/nashis	147,884
Melons	188,075	Pineapples	119,328
Lettuce	135,015	Peaches	88,651
Pumpkins	96,331	Table grapes	86,523
Cauliflowers	87,586	Mandarins/tangelos	78,912
Sweet corn	80,467	Mangoes	40,972
Cabbages	76,093	Lemons/limes	36,197
Other	407,935	Other	156,766
Total	3,438,958	Total	1,907,196

Source: Horticulture Australia Statistics

Fruit and vegetable production is and has always been important in and close to the metropolitan area. The major vegetable production areas in eastern Australia lie close to the capital cities and include the Sydney Basin, Werribee in Victoria and the Adelaide Plains.

The Wanneroo local government area has been important in Perth for many years as it was located on the urban fringe. The expanding urban area has now made this area attractive for residential accommodation.

The Wanneroo area has been particularly important for vegetable production where its planted area ranks fourth in the State and in 2005-6 it had nearly half of the vegetable growers in Perth. The significance of the vegetable farms of the Wanneroo area includes:

1. Low transport costs and travel time (for perishable items) compared to other rural areas.
2. Availability of labour.
3. Aesthetic factors, to break up urbanised stretches.
4. Availability of groundwater provided excessive abstraction was controlled.
5. Freedom from frost and extreme summer heat.

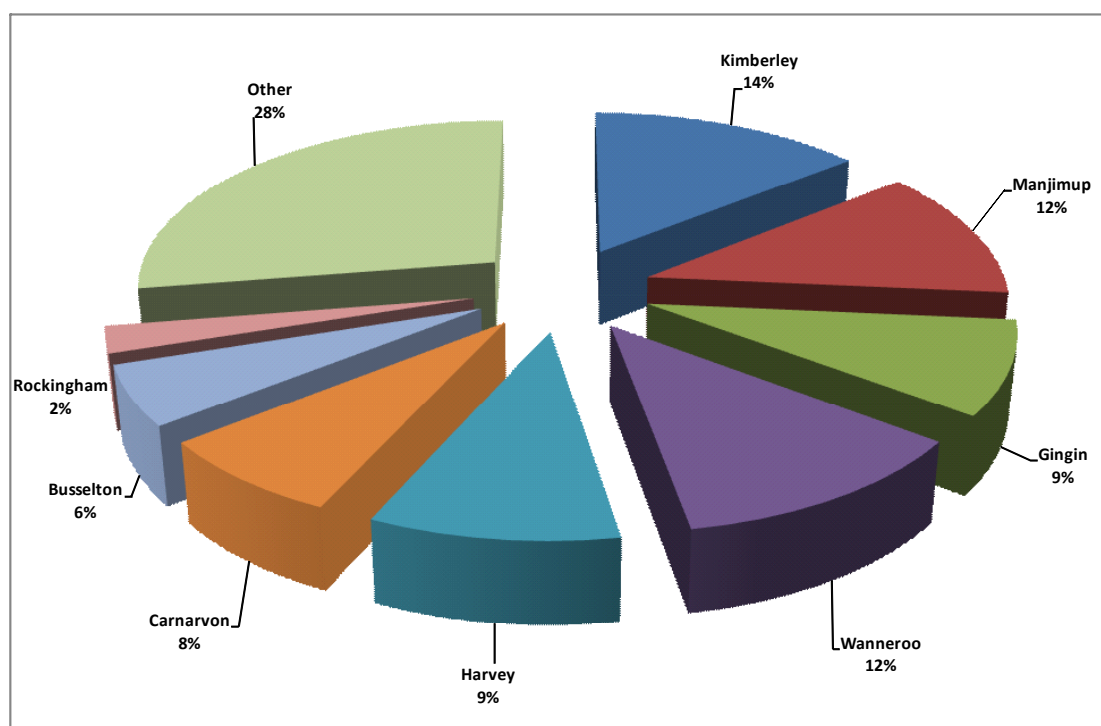
The Department of Agriculture and Food estimated the value of the horticulture sector in 2006-07 at \$646 million representing 12% of the total value of the food and fibre

sector in the State. Exports represented nearly one quarter of this production (\$150 million).

The Wanneroo accounted for 42% of the total metropolitan horticultural production area in 2005-06 and this area represented about 5% of the State area. Substantial areas were devoted to nurseries, flowers, turf farms, and vegetables.

The main vegetables in the Wanneroo area are lettuce, broccoli, sweet corn, tomatoes, beans, celery and cabbages. These crops covered 83% of the total area planted to vegetables in 2005-06. Of the fruits strawberries and avocado are most important (Figure 1). Strawberry production accounted for about 54% of WA production and avocados 36%.

Figure 1 Vegetable planted areas, 2005-06 (hectares)



The eight crops with the largest planted areas combined to cover 88% of the planted area – tomatoes, lettuce, broccoli, cabbages, strawberries, celery, beans and sweet corn. With the exception of tomatoes and beans these crops individually made up a substantial proportion of State plantings (over 35%). Wanneroo accounts for over half (58%) of the planted area in the State for strawberries, 38% of the area for nurseries and 30% of the turf farm area, but is far less significant in cut flowers.

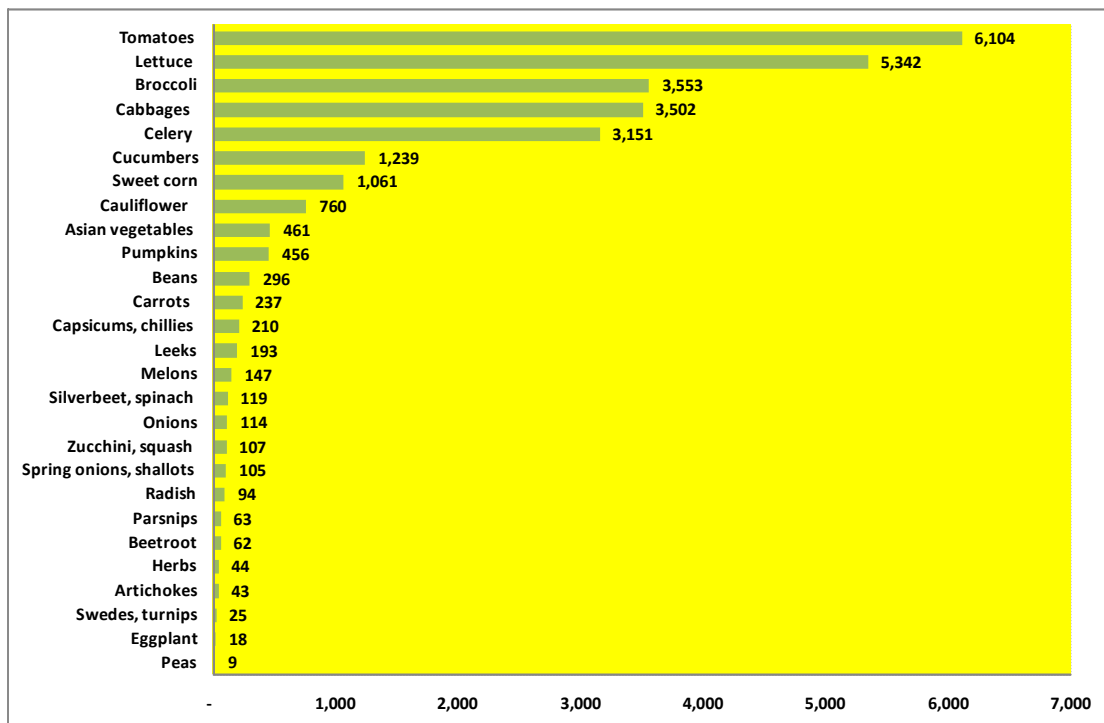
Vegetables for which the Wanneroo area provides at least 25% of State production occupied 1037 hectares in 2005-06. With buffer areas, a dedicated precinct of 2,500 hectares in 40 years time might be justified on this basis.

The pattern of horticulture production in Western Australia changes with technology, water availability, type of fruit and vegetables demanded and population movements. Changes between 2001 and 2005-06 reflected such trends with significant increases in horticulture plantings in the Kimberley, Wanneroo, Harvey, and Carnarvon and decreases in Manjimup, Gingin and Rockingham.

Significant fruit crops in Wanneroo in 2005-06 included citrus, avocados, strawberries, olives and table grapes.

A detailed breakdown of Wanneroo production in 2005-06 shows a broad range of crops. The statistics reflect the small scale of many plantings with many crops of relatively small volume (Figure 2).

Figure 2 Vegetable production in Wanneroo, 2005-06 (tonnes)



Source: ABS Cat. 7125.0, Agricultural Commodities, Small Area Data

Vegetable production from Local Government Areas located at least in part on the Gnangara Mound account for more than 20% of the State’s vegetable production with the more highly mechanized carrot cropping important on the northern edge of the mound (the Guilderton area).

A comparison of eleven vegetable producing areas in Western Australia confirmed that most were well suited to their production niche, with reliable water supplies being an advantage for Kununurra and the Swan Coastal Plain. Kununurra offers a shorter but useful production period in its dry season.

Wanneroo plays an important role in Western Australia for lettuces, Sweet corn and cabbages which are among the top ten vegetables produced in Australia. It is not a significant producer of any of the top ten fruits.

TRENDS IN HORTICULTURE PRODUCTION

According to Horticulture Australia's "FutureFocus" report¹ Australia's horticulture industry has the potential to lift the value of its production by 28% to \$10 billion by 2020 but will have to improve its "unremarkable" export performance to reach that target.

"FutureFocus" catalogues in detail the problems arising from a scattered, diverse and fragmented industry, including a lack of a clear export focus and the impact of rising imports of fresh and processed fruit and vegetables from developing countries. It says, however, the best bet for lifting growers' incomes is to "specifically and deliberately" develop market demand. The dry years in the Eastern States have seen increased interest in imported fruit and vegetables including produce from Western Australia. Large supplier groups in the Eastern States are looking at setting up operations/joint ventures in Western Australia to reduce their reliance on the apparently drying Murray/Darling Basin.

Two conflicting trends are evident in the retailing of fresh fruit and vegetables. Supermarket chains are becoming more focused and specialist in quality control, product specification aimed at consumer preferences and year round supplies of a broad product range. Meanwhile, farmer markets and smaller retailers are emphasising the "local" fresh supplies with an emphasis on fresh, organic, flavour and environmentally responsible production. The latter retail sectors are growing but are likely to remain specialist suppliers to a small but more demanding population segment.

THE CARABOODA PRECINCT

The area of the Carabooda precinct totals 1,895 hectares. The portion on the west of Old Yanchep Road is largely developed and predominantly in freehold ownership, while on the east, it is primarily State Forest under pine plantation (Table 2).

¹ Horticulture Australia Limited (2008) FutureFocus – the Australian horticulture plan. Stage 1 report. <http://www.futurefocus.org.au/images/PDF/stage1outlookreport.pdf>

Table 2 Carabooda Precinct Ownership and Land Use

	West of Old Yanchep Road (ha)	East of Old Yanchep Road (ha)	Total
Area cultivated	629	-	630
Area in freehold ownership including roads	1092	-	1092
Area in Crown ownership	75	729	804

The developed private land is generally within the Spearwood soil landscape system (Figure 3) while suitable pine plantation land to the east also includes the Spearwood soil landscape system. There is sufficient land that is well suited to vegetable production.

Figure 3 Carabooda Precinct, Horticultural Activity



Growers in the developed areas have expressed comfort with the use of recycled water on the condition of meeting industry safety and quality assurance standards. Some growers would be willing to take up leased land. Growers currently pump their own groundwater supplies at a cost of less than 10 c/kL. They promoted the need for any supply to be able to cater for cooling on very hot days.

[GROUNDWATER TO THE NORTH OF PERTH](#)

Growth in population in the South West of Western Australia has progressively increased the demand for water for domestic, agricultural, industrial and recreational uses across the region. Expansion of horticultural activities into the export market has increased water demand at rates that exceed general population growth rates. The stresses on the regional water resources have reduced the water potentially available to support further growth at an acceptable cost. The unit costs of water from the less

conventional sources (e.g. desalination) are higher than traditional sources such as self-supplied ground and surface water.

The Gngangara Mound is the most important water source in Western Australia, generating and supporting significant wealth for Perth and the greater metropolitan area. It provides more than 60% of Perth's water and supports a thriving horticulture industry which provides Perth with a significant proportion of its fresh vegetables. The Mound also serves vital and valued eco-systems such as the iconic caves system at Yanchep and the numerous wetlands and lakes of the coastal plain. Licensed groundwater allocations for irrigated horticulture over the Gngangara Mound total about 66 GL/yr (21 GL/yr in Wanneroo). A total of about 2,500 ha of land is used for irrigated horticulture in the east Wanneroo area. Regional groundwater availability figures indicate the paucity of water in the northern Perth area, but indicate that useful volumes may be available in the Perth South, Gingin and South West Coastal groundwater areas.

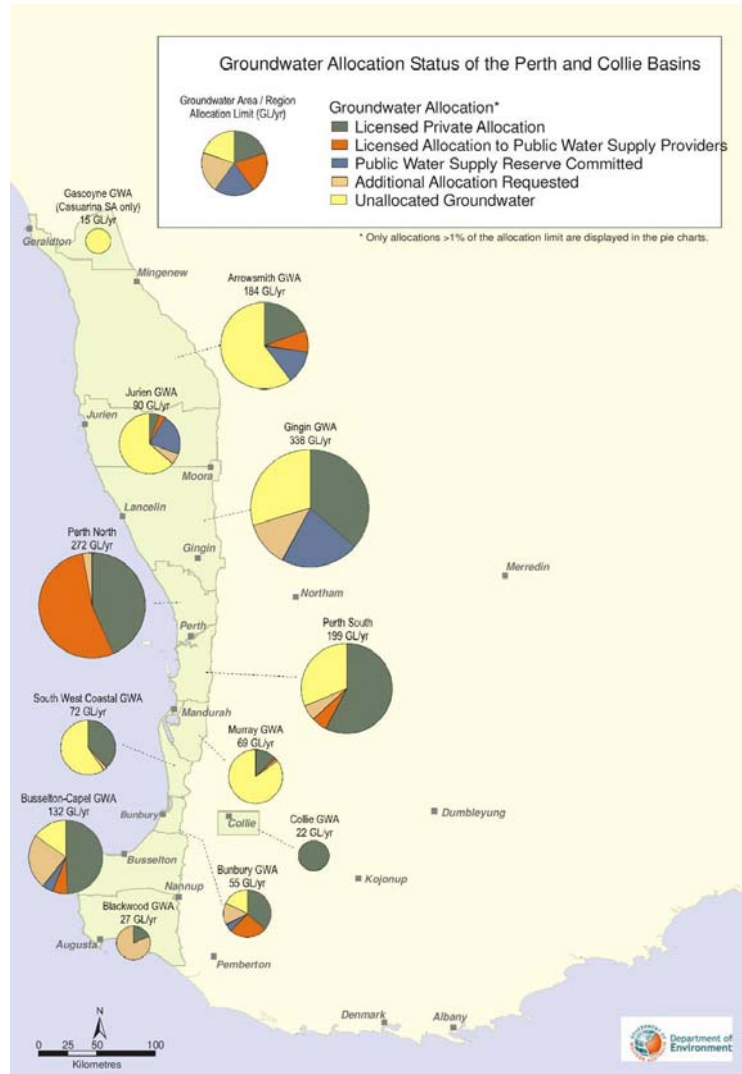
WATER SOURCES, SUPPLY AND PRICING

The availability of groundwater from the Gngangara Mound for growth in horticulture in the areas north of Wanneroo is extremely limited. The Department of Water is seeking to reduce allocations to private and public use to enable environmental water level criteria to be met. Water to support growth in horticulture could be obtained by trading allocations from properties outside the proposed precinct, or by importing water from sources other than local groundwater. Trading of allocations effectively results in a transfer of the geographical location of environmental impacts. Groundwater sources are completely allocated so opportunities for trading are limited. In any case transport costs may be prohibitive.

Groundwater availability increases north of Gingin, towards Geraldton, through the northern Gingin Groundwater Area, and the Jurien and Arrowsmith Groundwater areas (Figure 4). The volumes available for allocation within various areas are constantly changing as allocation limits are reviewed and as new allocations are issued under licence. Although no local groundwater areas have more than 10 GL/yr available this distributed water could be allocated to horticulture along with suitable land. Carrot farmers in the Lancelin area allow 10 ML/ha/yr for their irrigation. In some cases, the aggregated availability figures represent the total available from low yielding aquifers such that an impractically large number of wells would be required to abstract water for major horticultural enterprises. In others, such as the Kemerton North sub-area, the water in the aquifer with substantial unallocated volumes (Cattamarra Aquifer) is of higher salinity than would be suitable for irrigation purposes, being between 2 510 and 26 100 mg/L TDS. Some water reserved for the

public water supply could be replaced by alternative sources such as desalination and managed aquifer recharge, allowing the more distant reserves to be freed for horticulture.

Figure 4 Groundwater allocation status in the Perth and Collie Basins²



Recycled water (sometimes called reclaimed water) is former wastewater (sewage) that has been treated and purified for reuse, rather than discharged into the environment. Recycled water can be used in irrigation although the demand is seasonal and the water may need to be discharged in normal ways in periods of low irrigation demand. The cost of disposal of wastewater is increasing and the availability of new or additional conventional water supplies is diminishing as a result of increasing use and a drying climate. Recycled water provides an additional resource and its use is increasing nationally and internationally, in both developed and

² Reproduced from CSIRO (2005)

developing countries, particularly in situations where the demand is for non-potable uses.

In terms of a Carabooda horticultural precinct, the primary opportunity for supply additional water appears to be the use of recycled water from the Beenyup and Alkimos wastewater treatment plants. A detailed outline of treatment and standards for recycled water is given in the report. Only Class A water can be used for unrestricted horticulture crop irrigation. Examples of the use of recycled water for horticulture irrigation are given for the Werribee Plains near Melbourne in Victoria and Virginia Plains near Adelaide in South Australia. Both schemes serve to reduce the outflow to the ocean and meet Government recycling targets. The Werribee Plains vision statement recognises that the *“Market is not yet prepared to pay a commercial or cost recovery price for the recycled water despite the lack of water in the region.”*

In the USA recycled water is used in the key vegetable producing areas of the Salinas and San Joaquin Valleys. Agriculture dominates the economy of the Salinas Valley. Most of the salad greens consumed in the U.S. are grown within this region. The area has earned itself the nickname, "America's Salad Bowl." The national supply role of the Salinas Valley confirms that many salad vegetables can successfully be transported over large distances to market.

There are two primary options for use of recycled water in the Carabooda area:

1. Direct supply to horticultural properties through a reticulated system taking water direct from an appropriate treatment plant, via a metered connection, and subject to a charging regime.
2. Supplementation of groundwater availability through Managed Aquifer Recharge (MAR) of appropriately treated water.

MAR also has the potential to improve water quality through natural processes. It may assist in the removal of nutrients such as phosphates and organics, the degradation of chemicals (such as disinfection by-products) and improve pathogen die-off.

One important aspect of MAR, with respect to utilising the technology in association with a horticultural precinct, is that it provides storage for water delivered during the winter months, when irrigation demand is low to zero. This would enable the full yield of a treatment plant to be utilised without the need for an expensive surface storage. Without such a storage, the treatment plant would need to dispose of the water inflows through either the conventional disposal to the ocean, or supply to an alternative user.

Utilisation of MAR technology would enable growers to continue with (and expand) use of on-site wells to take groundwater. This has the advantage of growers not being

subject to temporary losses of supply through treatment plant or delivery system outages that exceed the design provisions, as would potentially be the case with direct supply. The water would be available year-round, enabling fertigation³ practices to be pursued, and the requirement to provide on-farm balancing storages would be minimised.

It appears that only the Alkimos WWTP source will be available for a Carabooda Precinct and with 5 GL/yr available by 2020 that would support only 350 to 500 ha of irrigated horticulture. The plant cannot supply 10 GL/year (650 to 1,000 ha) until 2040. Supply costs for the recycled water are likely to be range between 42 c/kL and \$1.22 /kL. These costs should be compared to the costs of direct self-supply of groundwater of 7 c/kL.

The costs associated with supply through MAR are projected to be higher than those of direct supply

WASTE STREAMS AND COMPOST

In Western Australia the average organic matter content in the topsoil ranges from 0.5% to 1.5% with many farmed soils having a sandy texture, especially the soils used for horticulture on the Swan Coastal Plain. This identifies a clear opportunity for municipal solid waste organic material to be recovered and used to replenish the organic material in our poor soils. The use of composted municipal solid wastes has been well researched and shown to benefit the growth of horticultural crops. In spite of successful trials and demonstrations the use of compost by horticulture producers in Western Australia is not widespread, it being seen as more beneficial for vines and tree crops than vegetables or broad acre field crops. The establishment of a dedicated horticultural precinct at Carabooda or elsewhere offers the opportunity to encourage the application of separated, high quality composted materials, further supporting Government recycling objectives by reducing the costs of landfill.

Uncertainty remains about the costs and benefits of urban organic wastes to compost for agricultural use. While the compost itself is proving to be a worthwhile addition to poor sandy soils, the overall community net benefit is far from clear. To this concern must be added the conflict that arises with the development of waste treatment facilities. The location of these in urban areas is creating as much controversy as landfill sites.

³ Fertigation refers to the use of distributing fertilisers to crops through the irrigation system. The practice utilises water as the transport medium, and is undertaken independently of water demand, particularly in the wetter months.

There is no compelling economic case at this stage for diversion of urban organic wastes to compost production. However, there is a government commitment to divert waste from landfill and it is sensible that organic wastes are recycled in some form. Whether the horticulture sector represents the most suitable outlet justifies further dedicated study.

ENVIRONMENTAL RISKS

Although the Environmental Protection Authority has expressed in principle support for water recycling it has noted that projects involving recharge to aquifers would require formal assessment under the *Environmental Protection Act 1986*. The EPA believes that substantial work is necessary prior to implementing large schemes if very high levels of treatment such as reverse osmosis and disinfection, were not to be employed. The EPA recommends a staged approach initially involving trials and projects of low risk.

The key environmental risks associated with recharge of recycled water have been identified by the EPA as being:

- Groundwater contamination,
- Surface and marine water contamination, and
- Ecosystem degradation.

The two primary aspects of the environmental risks directly associated with a horticultural precinct are associated with the water resource. These are water quality impacts of the proposed land use on the underlying water resources and drawdown impacts of groundwater abstraction affecting groundwater dependent ecosystems.

Other risks may be associated with local soil conditions such as the potential to develop acid sulphate soils and Carabooda lies in a low risk area.

ECONOMIC FACTORS

A reliable water supply is clearly the key driver for any irrigation enterprise. Vegetable production in Western Australia and some fruits (such as strawberries) would not be grown without an irrigation water supply. Across Australia, ABARE estimated that 82% of vegetable farms irrigated their vegetable crops in 2005-06.

Wastewater could be delivered from the Beenyup wastewater treatment plant to a precinct at Carabooda for a capital cost of about \$85 million. This would provide an annual allocation of 10 GL with a peak daily delivery of 45 ML and a scheme life of 50 years. The whole of life scheme cost is estimated to cost at least 50 c/kL depending on the water treatment level desired and the volume of storage in the precinct area.

A supply from the proposed Alkimos treatment plant would be less expensive than Beenyup due to the shorter pipeline distance but a supply of 10 GL a year is not forecast to be available before 2038.

The approximate supply cost of 50 cents/kL from Beenyup compares with an estimate of the current value placed on water of 35 cents. The cost will be very sensitive to the volume of water storage needed in the precinct area.

Farmers with an allocation now have a groundwater supply cost of less than 10 c/kL. While water is not a major part of most vegetable crops, the farmers with a groundwater supply would clearly be at a significant advantage over those reliant on recycled water.

Growers will not choose to use recycled water unless other options are not available to them or it is made financially attractive for other reasons. Growers might use it under the following conditions:

- The cost was subsidised;
- The option carried a long term guarantee of supply;
- There is no alternative water supply at lower cost in locations where the same crop can be grown and marketed at similar cost.

Horticulture Australia has prepared a strategic vision for Australia that provides guidance on the trends in that industry. The sector faces promising market developments with a rising world population, a trend to greater urbanisation and a growing awareness of the value of vegetables in diet. With increasing disposable incomes there are opportunities for increased fruit and vegetable production. On the supply side, Horticulture Australia believes that the capacity of the Australian industry to supply vegetables far exceeds domestic demand.

Farms producing vegetable crops and some fruit in the Wanneroo area range greatly in size and complexity of operation. Small farms often depend heavily on family labour and management. As farm size increase more mechanisation is introduced and casual and permanent labour become more essential. Larger farms have often sought land more distant from the metropolitan area and have encouraged a local permanent labour force by supporting their employees with travel or accommodation (Plate 3).

A simplistic economic analysis of the value of the precinct to Western Australia draws positive conclusions for the location of a precinct at Carabooda or similar locations. The largest single annual cost is the community cost associated with any lost labour, estimated at \$20 million if the production is located more remotely. To this can be added a potentially higher cost for fruit and vegetables, produced elsewhere, of \$10

million per annum. Offsetting these costs are higher energy costs of at least \$5 million and a wastewater subsidy projected at \$13 million.

While the analysis is positive the assumptions should be further tested. Significantly more work is needed to do so and current data sources will not provide the information needed.

In the current full employment economy, job losses will be minimal reducing this community cost significantly. In less prosperous times, the cost will be more important.

While the study has recognised that rapidly rising fuel prices will impact on food prices and potentially on the value of a horticultural precinct near Perth no detailed analysis has been undertaken. Such an analysis is important but considered to be beyond the scope of this study.

The Government might choose to preserve suitable land close to the metropolitan area for a horticultural precinct.

FOOD SECURITY AND FOOD MILES

Food security requires an available and reliable food supply at all times. At the global, regional and national levels, food supply can be affected by climate, disasters, war, civil unrest, population growth, lack of effective agricultural practices, and restrictions to trade. Government initiatives that encourage a policy environment based on macroeconomic stability and competitive markets can improve food availability. At the community level, food security is essentially a matter of access to food.

One aspect of Australia's approach to food security suggests the need to retain sufficient vegetable production capacity in Western Australia to satisfy local food needs. While the main contributing factor to food insecurity is living on or below the poverty line, the loss of access to local fruit and vegetables may lessen options for addressing food insecurity.

The concept of "food miles" has arisen from the belief that the true cost of food we buy is not only the price we pay, but also includes the environmental costs of its journey from its origin to our plate⁴. The "food mile" is a measure of the distance food travels from where it is grown or raised to where it is purchased by the consumer. Increasingly in Australia supermarket shelves are stocked with imported food and food products that have been hauled thousands of kilometres. Long distance food may have environmental, social, health and economic impacts. A related concept is that of "food print", or the agricultural land footprint of crops. A diet high in meat can use

⁴ Bowker (2008) Global Trade vs Fair Trade. West Weekend Magazine.

five times a corresponding vegetarian diet that is low in fat. The theory is that meat eaters take up more land than vegetarians because livestock need more land for pasture than intensive horticulture. The supermarkets are well positioned to influence attitudes and access to foods with high or low food prints. The call for food with a low “print” has supported revived interest in organic foods, farmer markets and the desire for urban agriculture, all of which have their place in the global market for horticulture produce. The Wanneroo area is an important contributor to all of these and a sufficiently large precinct could allow for a dedicated organic production area.

However, the concept of food miles needs careful evaluation on a case by case basis. This study has shown that if a rural precinct displaces medium to higher density residential development, the residential uses involve far lower overall energy use. Displacement of an urban population with a horticulture precinct is expensive in energy consumption and lost travel time for employees. A precinct located in an area of lower priority for future urbanisation would have lower costs.

The key to any difference is the distance to alternative locations, the density of urban development displaced and the distribution of the location of the new workforce. Workforce availability and the energy used in bringing the workforce to the new area appears to be the key energy variable to use in comparison with the precinct base case.

GOVERNMENT INVOLVEMENT IN PROTECTING HORTICULTURAL LAND

Traditionally, vegetable farms have been located close to urban areas due to the demands for labour and fast market access. In dry places like Western Australia towns tend to be located in areas with water supplies and the same areas are attractive for vegetable farms.

Development pressures are far higher in urban and peri-urban localities than rural and remote centres. The North West Corridor, particularly Wanneroo, has significant strength in primary production. One of the major sectors is ‘horticulture and fruit growing’ which is almost solely driven by the strength of the sector in Wanneroo. As horticulture and urban development approach each other the risk of land use conflict becomes strong. Conflicts most commonly arise from spray drift, noise, dust and odours with spray drift the greatest risk. Separation of conflicting activities and the use of vegetated buffers are accepted as the standards so urbanisation can exist relatively closely with horticulture. The role for government is to evaluate whether this progression is in the broader interests of the community or whether the dedication of land for such purposes provides greater community benefits.

The issue of food quality in this study is essentially tied to distance to market and perishability as production and packaging and handling methods are likely to be very similar for different growing locations. Any quality issue will be related to the time from harvesting to consumer. Some products are more sensitive than others.

Freehold landowners including horticulturalists have an expectation that as the urban area extends towards their property that it will be rezoned for urban development, with a consequent capital gain over and above that which could be expected over time as horticultural land. Accordingly if the Government is to provide freehold lots with access to a Government financed and subsidised (either fully or partially) recycled water scheme, it is reasonable that the Government would expect that such lots would have restrictions placed upon their disposal to subsequent buyers to ensure that any future capital gain (either partially or fully) is recouped to assist in recovering the initial outlay.

While leasehold arrangements would be possible, this is unlikely to be attractive to buyers who would be seeking to use the property as security against which they would seek to raise loans for capital expenditure.

The Carabooda precinct lies north east of the current urban front in the suburb of Butler and within 10 Km of the coast. As the urban area expands, the area will become attractive to residential development. Given it lies within 5 Km from the existing urban front and relatively close to the coast the area may come under strong urban pressure well within the 50 year lifespan of the wastewater delivery system. Based on the need to plan for future horticulture areas that have been identified in the Wanneroo Land and Water Plan, current urban planning has identified future urban development areas that do not include the Carabooda horticulture area. Such planning may be sufficient to avoid expectations for future land use changes to residential. This approach to planning is the theme of Network City, the strategic planning framework for a sustainable future for Perth and Peel. Network City promotes activity centres where particular activities are encouraged. Carabooda is an example of where horticulture has been promoted.

EVALUATION OF EAST WANNEROO REPLACEMENT SCENARIOS

Three scenarios have been introduced for the replacement of the East Wanneroo market gardens. Each has its advantages and disadvantages.

Scenario 1: Carabooda Precinct

Advantages of the establishment of the precinct include:

- the long term commitment of the land and water to horticulture production;
- the use of recycled water for a productive purpose;

- encouragement of efficient irrigation techniques;
- retention of the horticulture “sense of place” for Wanneroo;
- potentially more secure production of vegetables for Perth;
- the opportunity to contain horticulture within a relatively small area., so environmental management practices can be well planned and organised;
- the opportunity to use recycled compost, so reducing its disposal in landfill;
- ready availability of labour; and
- the opportunity for family based horticulture enterprises to access city based advantages such as education for their children.

Disadvantages include:

- loss of recycled water for other uses such as groundwater aquifer replenishment to increase availability for higher value uses such as public water supply;
- subsidised public irrigation schemes are contrary to objectives of the COAG water reforms and National Water Initiative;
- government subsidy reducing other government programs;
- the long time frame for development;
- slow and limited availability of recycled water; and
- increased energy consumption as a consequence of the inclusion of an agricultural area within an urban area;
- insertion of an agricultural area into an urban area and subsequent pressures for rezoning;
- potential contamination of groundwater compromising downstream uses such as coastal public water supply schemes.

Scenario 2: Urban Fringe Development

Advantages of horticultural plots on the fringe of urban expansion include:

- retention of the horticulture at the edge of the city;
- A “sense of place” for Wanneroo until the area moves beyond the current local government area;
- the opportunity to maintain horticulture within relatively small areas., so environmental impact can be planned and organised;
- the opportunity for family based enterprises to participate in the horticulture industry, particularly on small to medium plots;
- the opportunity for family based horticulture enterprises to access city based advantages such as education for their children; and
- retention of intact urban areas.

Disadvantages include:

- Higher energy costs for the producers as they shift further from the wholesale markets in the city;
- Longer distances for the workforce; and

- Difficulty of establishing a recycled water scheme.

Scenario 3: Greenfields Horticulture Area

Advantages of the establishment of the major production areas to the north and south of Perth, while retaining small horticultural nodes on the fringe include:

- the long term commitment of significant areas of land and water to horticulture production;
- the establishment of a larger scale future for horticulture in Western Australia;
- encouragement to establish large scale mechanised production to increase the size of the horticulture industry;
- encouragement of efficient irrigation techniques;
- more secure production of vegetables for Perth;
- the opportunity to increase vegetable exports;
- retention of the small plot horticulture “sense of place” for Wanneroo;
- retention of some urban horticulture in the metropolitan area with the associated advantages; and
- will enable change in the locations and types of horticultural production to be responsive to the relevant factors.

Disadvantages

- Inability to develop a wastewater recycling scheme;
- Accelerates trend to larger scale mechanized production due to reduced labour availability in rural areas;
- Smaller demands for recycled compost on urban horticultural land; and
- Higher energy costs for producers in transporting goods to market and labour to fields and packing facilities.

The three scenarios can be compared across a number of evaluation criteria (Table 3).

Table 3 Evaluation Criteria

Factor	Scenario 1: Carabooda Precinct	Scenario 2: Metropolitan Fringe	Scenario 3: Regional Commitment
Favoured crop types	Leafy greens, perishables, large volume crops	Perishable, labour intensive crops will be grown on small areas.	Broadacre, mechanised crops with low labour requirements.
Food Security	Long term production in metropolitan area is guaranteed	Small areas in metropolitan area will be pressured by future urban expansion.	Long term production in two substantial areas will be guaranteed.
Area of Horticultural production.	Area of up to 2,000 ha close to Perth guaranteed for decades.	Small areas (hundreds of hectares) under pressure from urban expansion.	Areas of over 2,000 ha guaranteed for decades.
Fresh Markets	Close to fresh markets	Close to fresh markets but less production.	Distant from grower markets.
Urbanisation Pressures	Urbanisation pressures likely in the time frame of water availability but can be protected by zoning	Ongoing urbanisation pressures, small areas, owners wish to superannuate their land.	No pressure for urbanisation.
Land Availability	Pine plantation land available.	Limited land amongst urban developments, water must be traded or dedicated to horticulture to preserve activity.	Land available for purchase, water allocation may be traded or released from reserves for other purpose.
Future urbanisation pressure on land	Likely to be under strong urban pressure well within the 50 year lifespan of the wastewater delivery system	Continue to move with urbanisation pressure	No pressure from urbanisation.
Labour	Labour readily available close to operations, supports labour intensive crops.	Labour readily available close to operations, allows labour intensive crops.	Labour scarce but can be overcome by providing housing, transport, and by mechanisation of crops. May need to import specialised labour
Labour Community Cost	Labour employed in the precinct and does not have to find other employment.	Lost of labour to the precinct region may cost up to \$20 million annually.	Lost of labour to the precinct region may cost up to \$20 million annually.
Employment	Employment in northern corridor horticulture will be maintained, location will move to Carabooda.	Employment in metropolitan horticulture will diminish.	Employment in metropolitan horticulture will diminish, increased employment in regional locations.

Supply Chain Characteristics	Existing supply chain will support the precinct. Some handling facilities may be developed at the precinct	Existing supply chain will support the growers.	Existing supply chain will support the precinct. Remote producers will establish their own infrastructure to supply retailers and central markets.
Cost of fruit and vegetables	Fruit and vegetable retain relative metropolitan cost	Fruit and vegetables retain relative costs	Fruit and vegetables may cost up to \$10 million more annually.
Water Availability	Limited availability, so the existing area must have allocations guaranteed. Recycled water for new development is slow to come on stream. Winter excess of recycled water may be used for MAR.	Limited availability. Can use part of allocation freed by urbanisation, or trade for allocations.	Water is available but areas are spatially separated. Medium sized distributed developments are favoured. Less irrigation required in the south than north.
Water Recycling	Important contribution to Government's recycling strategy	No or limited contribution to recycling strategy.	No contribution to recycling strategy
Recycled water on produce	Monitoring standards are well developed by major retailers and produce is already on the market.	Not applicable.	Not applicable.
Subsidy of water to farmers	Subsidy required of up to \$13 million per year for a 20GL/an supply...	No subsidy required.	No subsidy required.
Recovery of subsidy costs	Land can be sold to growers to recoup costs of water	No subsidy	No subsidy
Water cost to growers	A relatively low cost if self supply.	A relatively low cost if a government subsidy is applied to recycled water, otherwise expensive.	A relatively low cost if self supply.
Energy costs	Energy costs may be up to \$5 million greater each year.	Lower energy costs	Lower energy costs
Environmental pressures	Management required of recycled water, downstream flow effects on metropolitan lakes and residential land.	Buffers required around small horticultural developments	Distributed production leads to less intense environmental pressures, distant from Perth
Compost Recycling	Compost has potential in a compact	Limited possibility for compost as small	Only compost manufactured on-site will

	precinct, reducing landfill and improving soil properties. Compost can support an organic component of the precinct	areas.	be used.
Compost Recycling	No compelling economic case at this stage for diversion of urban organic wastes to compost production	No case for the use of organic waste in compost for small areas.	Only compost manufactured on-site will be used.
Government Subsidy	Government subsidy required for recycled water for supply and storage.	No Government subsidy required for self supply.	No Government subsidy required for self supply.
Horticultural Sense of Place	Horticulture preserved close to the city for the term of the precinct.	Horticulture preserved close to the city.	Horticulture will not be as active close to the city
Soil suitability	Suitable soils available.	Suitable soils available.	Suitable soils available.
Seasonal impacts	Continues the well established annual metropolitan production cycle.	Continues established annual metropolitan production, but limited by area.	Production affected by climatic differences to north and south of Perth. Eg Lettuce – winter production to the north and summer to the south.
Transport or freight	A relatively low cost in all locations at 2 – 5 cents per unit	A relatively low cost in all locations at 2 – 5 cents per unit.	A relatively low cost in all locations at 2 – 5 cents per unit. Larger vehicles used.