Section C

ACTION PLAN

C1.0 Planning for Action

Section B, “Assets, Goals and Targets”, provides the strategic framework for setting targets for ‘resource condition’ change to achieve the goals and objectives of the Torbay Catchment Restoration Plan. The Resource Condition Targets are based on current information and understanding of catchment-scale processes, including those for water and nutrient management. The targets for resource condition change are set for approximately 20 years into the future.

The “Action Plan” (Section C) is based on targets for management action. The options for management are considered and targets are set for implementation to achieve resource condition change within 5-10 years. The specific actions for each of the Management Action Targets (MATs) are listed in Section C2.0. The actions are proposed within a 3 year implementation program with the expectation that the Torbay Catchment Restoration Plan will be reviewed at the end of this period. The extent to which the MATs can be achieved within the 3 year period is estimated and a preliminary feasibility assessment provided.

The priority for implementation of each of the actions has been set (Section C3.0, “Achievement of Management Action Targets, Priorities, Responsibilities and Estimated Costs”). These priorities are derived from review comments provided by partner organisations, from a series of three community workshops held during February 2005, and by the Watershed Torbay project steering committee. These review processes have also provided direction on the commencement date for each of the proposed actions. Responsibilities for implementation are identified and an estimate of total cost allocation required for each action within the 3 year implementation program is provided.

Section C4.0 “Capacity for Implementation”, provides a framework for building the capacity to implement the actions and to achieve the required change management practice. It outlines the financial and human resources required through an investment planning approach.

The Torbay Catchment Restoration Plan provides direction for implementation of actions to achieve resource condition change. A review of the plan is proposed at the end of the first 3-year period. The extent to which the actions have contributed towards the targets is to be evaluated. Some revision of the targets may be required. The proposed review will also incorporate new information and knowledge where available.

C2.0 Targets for Management Action

The following Goals and Objectives for resource condition change have been developed for each of the seven Management Themes introduced in Section B. The Management Action Targets (MATs), with their associated actions, are also described for each theme.

C2.1 Targets and Actions for Theme One: Water quality and algal blooms

Improved water quality and reduced algal blooms requires extensive changes to management practice, particularly for:

- Point sources of nutrients
- Restoration of waterways
- Land use planning to control nutrient loss.

Further actions in other Management Themes, particularly those concerned with managing farming systems, will also contribute significantly to the resource condition change targets for this theme.

Goal (2025): Water in Lake Powell, Lake Manarup and Torbay Inlet is suitable for the survival and growth of native aquatic plants and animals, and algal blooms are minimal. Water in Marbellup Brook remains suitable for drinking. Other waterways and waterbodies are suitable for recreation, domestic and agricultural use.

Objectives: The source and pathways for mobile nutrients, sediments and contaminants within the catchment are known and managed so that:

- There are no fish kills due to poor water quality
- The incidence of algal blooms is reduced
- The transport of nutrients, sediments and contaminants into waterways and wetlands in minimised
- Management practices are adopted that minimise public health and environmental risks for drinking water from Marbellup Brook.

Targets: Resource Condition Change

1.1 Reduce by a third the incidence of algal blooms in Torbay Inlet, Lake Powell and Marbellup Brook by 2025

1.2 Median nutrient concentrations (mg/L) discharged from the sub-catchments meet the following targets by 2020:

Sub Catchment	**Current median concentration** (TN/TP)	**Target median concentration** (TN/TP)
Torbay Drain	1.80 / 0.110	1.20 / 0.090
Marbellup Brook	0.68 / 0.077	0.60 / 0.065
Seven Mile Creek	1.00 / 0.130	0.68 / 0.100
Five Mile Creek	1.35 / 0.460	1.00 / to be set
Cuthbert Drain	2.45 / 0.059	2.00 / 0.059
Grasmere Drain	1.40 / 0.200	1.20 / 0.150

1.3 The quality of water in Marbellup Brook meets national criteria for public drinking water supply (NHMRC & ARMCANZ, 1996) by 2015.

A significant reduction in nutrient inputs to wetlands and waterways is required to achieve the significant reduction in algal blooms. This can be achieved by control of the source of nutrients or management of nutrients within streams or in lakebed sediments.

T1MAT1: Input of nutrients to Torbay catchment from the disposal of wastewater does not increase beyond current levels. (Note: current levels are below those approved through Ministerial conditions).

Actions:

1. Review future options for wastewater disposal in Torbay catchment and provide information to the community
2. Continue monitoring water quality in stream flow for Seven Mile Creek with evaluation and reporting annually
3. Encourage source reduction of wastewater flows from the City of Albany through prevention of stormwater entering sewers, and public awareness program for wastewater reuse
4. Assess options for City of Albany and other wastewater producers to pay for 'ecosystem services' as a contribution to catchment management.

T1MAT2(a): All third and fourth-order waterways in Marbellup Brook sub-catchment have permanent vegetated stream buffers established by 2010.

T1MAT2(b): By 2015, 70% of all first and second order streams have permanent perennial vegetation.

Actions:

1. Prepare maps and tables to show the extent of stream 'orders' in the Marbellup Brook sub-catchment and the width of stream buffers provided by natural riparian vegetation
2. Prepare a nutrient and pathogen 'risk map' for the Marbellup Brook sub-catchment based on soil-type and existing pollution hazards
3. Prioritise streams within the Marbellup Brook sub-catchment for vegetated stream buffering
4. Investigate the use of agroforestry to enhance stream restoration and provide an economic benefit
5. Develop 'best practice' guidelines and other options for the required stream buffering for nutrient and pathogen control
6. Coordinate cost sharing arrangements for landholders through the Torbay Catchment Group (including consideration of a trial an 'auction-based' approach) to implement the vegetated stream buffers according to 'best practice' guidelines
7. Voluntary cost sharing arrangements are reviewed annually and finally reviewed and reported in 2010 to determine their effectiveness compared with regulatory approaches.

Diffuse sources of nutrients are also significant to total nutrient load in wetlands. There are opportunities for nutrient loss reduction by changing practices in farming systems. An estimated 30% reduction is considered feasible over a 20 year period (Weaver et al., 2003).

The targets for nutrient reduction within each sub-catchment are based on this assumption.

T1MAT3: Three trial demonstrations of nutrient reduction from stream flow and sediments implemented by 2007.

There is significant transport of nutrient within stream flow either in solution or by sediment transport. There are two options to reduce nutrient transport through these pathways:

1. Application of Phoslock™ (or similar product)

Phoslock™ is a product that may be applied occasionally or continuously for reduced in-stream free reactive phosphorus concentrations. Effective applications require low salinity. The need for repeat or continuous applications may be expensive (e.g. >$100,000/year) and nutrient reduction benefits are only experienced while applications continue. A trial application is being considered.

2. In-stream nutrient stripping (artificial wetlands)

Nutrient stripping within Marbellup Brook and/or Torbay Main Drain may be effective, however the potential benefits when considered as a part of the whole system of nutrient transport within Torbay catchment is difficult to quantify. The costs of nutrient stripping formations may be potentially costly due to the cost of earthworks, planting and maintenance (e.g. >$100,000 for capital cost and $5–30,000 ongoing maintenance costs).

Surface flow to Lake Powell from all tributaries (except Marbellup Brook) is delivered via Grasmere Drain. This waterway may be well suited for installation of a nutrient stripping feature, such as an artificial wetland, in order to reduce the nutrient concentration, hence loads, of surface waters entering Lake Powell.

Actions:

1. Investigate and assess the application of slurry injected Phoslock™ (or other nutrient binding substance) to one of the tributaries to Lake Powell (e.g. Seven Mile Creek). Implement a trial if appropriate
2. After 5 years operation (2007), assess the effectiveness of the existing Torbay constructed wetland as a nutrient reduction option for the catchment. Arrange installation of further trials of in-stream nutrient stripping techniques on one of the tributaries to Lake Powell (e.g. Grasmere Drain)
3. Review 'best practice' options to manage sediments in waterways, drains and the lakebed.

T1MAT4: Future land use development in the Marbellup Brook sub-catchment complies with public water supply objectives for the catchment.

Action:

1. Develop an appropriate land use classification that identifies potential threats to the quality of public water supply and identifies water quality criteria relevant to the Marbellup Brook sub-catchment.

C2.1.1 Water quality and algal blooms - Filling information gaps

Actions:

1. Develop a clear understanding of the relative contribution of nutrient loads from the range of sources to Torbay Inlet and Lake Powell, and the relative importance of N and P in control of algal blooms in both wetlands
2. Estimate the nutrient load contribution to Marbellup Brook (below Marbellup Plug) and Lake Powell from residential septic systems in the town of Elleker
3. Investigate the potential for nutrient release from acid sulphate soils where there are fluctuating water tables and estimate the relative proportion of this source to the total nutrient load in wetlands based on field investigations
4. Identify the extent to which a 30% reduction in diffuse source nutrient loss will reduce the incidence of algal blooms in Torbay Inlet and Lake Powell
5. Quantify the effectiveness of periodic or continuous applications of Phoslock™ as a significant contribution to nutrient load reduction.

C2.2 Targets and Actions for Theme Two: Water quantity

Water is a finite resource for which there is increasing demand for use. The high quality water from the Marbellup Brook sub-catchment is identified as a suitable source for public supply in the near future and for further self-supply use in the catchment. Restoration of wetlands is also dependant upon there being adequate water quantity for ecological functions. The actions for this theme are focused on identifying environmental water requirements and providing statutory conditions for resource protection and allocation.

Provision of water for public supply is considered to be an 'ecosystem service'. Actions within the catchment for water supply management are generally consistent with the actions required for nutrient loss reduction, especially for nitrogen management within waterways. The actions for this Management Theme are to provide resource supply and restoration services.

Goal (2025): Water is allocated for sustainable use while ensuring that adequate water is provided to all waterways and wetlands to protect their environmental values.

Objectives:

- Flow in Marbellup Brook is adequate to maintain ecological requirements
- Water Regimes for Lake Powell, Lake Manarup and Torbay Inlet are suitable for the survival and growth of native aquatic plants and animals
- The drainage district is managed to meet the needs of current land uses, future land uses, and the environment
- Those who benefit from the use of the catchment to provide environmental services contribute to the costs of restoration.

Target: Resource Condition Change

2.1: By 2015 major wetlands and waterways are receiving adequate water throughout each year to maintain ecological functions

2.2: Maximise use of surface water and groundwater resources for private and public benefit within identified sustainable yield.

T2MAT1: By 2007 Environmental Water Requirements are determined for Marbellup Brook, Lake Powell, Lake Manarup and Torbay Inlet.

Actions:

1. Prepare 'Environmental Water Requirement' assessments for Marbellup Brook, Lake Powell, Lake Manarup and Torbay Inlet
2. Use monitoring information to establish the extent to which the environmental water requirements are met under current flow regimes and the current operating strategy for the drainage system
3. If necessary, develop strategies to meet environmental water requirements, or determine the impact and acceptability of reduced flows.

T2MAT2: By 2007 water resources in the Marbellup Brook sub-catchment are proclaimed under the Rights in Water and Irrigation Act 1914 and a Water Resource Allocation Plan is prepared, including an assessment of changing land use and climate change.

Actions:

1. Develop an allocation plan for Torbay Catchment to ensure water is available for private and public users on a sustainable use basis, and meets environmental water requirements
2. The proclamation of Marbellup Brook sub-catchment under the Rights in Water and Irrigation Act 1914 so that water use allocation is controlled by licensing
3. Investigate the impacts of commercial plantations (e.g. blue gums) and farm forestry on water supply availability in Marbellup Brook, and determine an area limit for blue gums to maximise water availability and water quality
4. Assess the potential impact of climate change on water resources in the Marbellup Brook sub-catchment.

C2.3 Targets and Actions for Theme Three: Drainage management

Three of the options listed in Section B.2.3.2, for change to the operation of the drainage system, are considered the most suitable of all the options presented to meet the criteria and targets for resource condition change. There is a further requirement to apply the water balance model to these three options. This analysis will assist in further development of the actions required for the management action targets over the next 3-5 years.

Goal (2025): Drainage in the Torbay district is managed to best meet the needs of current and future land uses, and the environment.

Objectives:
- The impact of flooding on horticulture is minimised
- Flooding in residential areas is minimised
- The potential adverse effects of drainage management on fisheries in minimised (including commercial fisheries and native fish species)
- The impact of drainage management on algal blooms is minimised
- The drainage system is managed to prevent or minimize sedimentation of receiving water bodies.

Target:

Resource Condition Change

3.1: Lake Manarup, Lake Powell and Torbay Inlet are restored as functional wetland ecosystems (as indicated by successful breeding populations of waterbirds) by 2025.

3.2: Sediment transport in drains and sediment deposition in Torbay Inlet and Lake Powell is reduced by 50% by 2025.

3.3: The quality of water in all parts of the drainage system is suitable for direct contact recreational use by 2025

T3MAT1: Options for change to drainage management to maximise water quality and public amenity in Marbellup Brook (including the section downstream of the Marbellup Plug) and Lake Powell are fully assessed by 2006.

The proposed operating system changes in Option 5(a) Section B2.3.2 (ie. to remove the Marbellup Plug, remove “Gate 45” and install Lake Powell floodgates) are intended to provide the opportunity to flush (displace) greater quantities of nutrient rich water from Lake Powell than currently occurs. This diversion will result in increased volumes of stream flow from Marbellup Brook, than is possible with the existing valve. These changes would also add significant environmental flow and oxygenation to the section of Marbellup Brook currently truncated and stagnated by the Marbellup Plug.

The water balance model shows that the levels are suitable for this to occur (i.e. increased flow from the High-level system to the Mid-level system). However, the extent to which this flow to Lake Powell would be effective in flushing nutrients from the water body and reduce the occurrence of toxic algal blooms remains uncertain. Implementation of Option 5(a) needs also to consider the potential for increased flood hazards to land for residential and horticultural use.

Actions:

1. Finalise the modelling of drainage management Option 5(a) to assess social and environmental outcomes, and the expected costs
2. Undertake flood risk assessment for Option 5(a)
3. Improve ability to open and close the Marbellup valve for more frequent openings and monitor outcomes.

T3MAT2: The required regime for salt water flushing and maintenance of adequate water depth to improve environmental values in Torbay Inlet is identified and is being implemented through management of sand bar openings by 2007.

Two proposals involving changes to the drainage operating system are intended to provide greater flexibility in managing the bar openings for environmental benefit to Torbay Inlet and Lake Manarup. These are option 3(a), to pump North Creek to the Marbellup High Level Drain (the High-level system) and Option 3(b), to install floodgates on North Creek and pump to Lake Manarup as required (the Low-level system).

Option 3(a) would require all stream flow from North Creek to be pumped to the High-level system. The feasibility of doing so is limited due to the increased flood risk (due to surface water and groundwater) resulting from installation of the channel blockage required by this option.

Option 3(b) would require pumping over the proposed floodgates on North Creek only when the level in Lake Manarup is higher than stream flow in North Creek and when it is required to minimise flood risk to residential and horticultural areas. With this option, maintenance of relatively low water levels in Lake Manarup controlled by the Manarup Gates would be required. It is currently uncertain if the low water level required for floodwater management, under Option 3b, would provide adequate depth of water for rehabilitation of Lake Manarup as a functioning wetland ecosystem.

Actions:

1. Review current scientific research to determine the preferred salt water flushing regime for Torbay Inlet
2. Model the potential effect on the preferred salt water flushing regime for Torbay Inlet if drainage management were to adopt Option 1(b) or Option 3(b) (see Section B2.3.2, Management Scenarios for the Drainage Operating System)
3. Negotiate appropriate operating arrangements (ie. with Water Corporation and local stakeholders) for opening the sandbar to achieve the preferred salt-water flushing regime for Torbay Inlet.

T3MAT3: By 2007 Lake Manarup is being maintained with adequate water for functions of the wetland ecosystem (without disadvantage to Lake Powell and Torbay Inlet).

There is potential for Lake Manarup to be maintained as a functioning wetland ecosystem with the adoption of drainage management Option 3(b). Under this option, the frequency and period of inundation of the lake (the 'hydroperiod'), and the depth of water would be influenced by the sandbar opening regime if the Lake Manarup floodgates were to be kept open (or removed). Alternatively, the hydroperiod and water depth of Lake Manarup could be managed by inflow from North Creek (stream flow or pumped)as proposed under Option 3(b), and by closure of Lake Manarup floodgates.

Actions:

1. Determine preferred hydrological regime (hydroperiod and water depth) for Lake Manarup to maximise environmental values
2. Apply the hydrological model to Options 3(a), 3(a)iii and 3(b) to assess the water levels and period of inundation for Lake Manarup, particularly in relation to opening of the sandbar and other factors of drainage systems management
3. Estimate the volume of water to be pumped and the period of pumping required for Option 3(b)
4. Assess the potential flood risk associated with Option 3(b).

T3MAT4: Reduce the impacts from sediments in Lake Powell and Torbay Inlet on water quality and quantity.

Actions:

1. Assess the value of dredging and sediment remediation options and how they impact on water quality and quantity.

In the longer-term, the depth of water in Torbay Inlet and Lake Powell may be further reduced by sediment infill without appropriate catchment and drain management. This will probably increase the risk of algal blooms due to shallower water depth (higher temperatures) and increased nutrient store contained within the sediments. Management of sediment loss and transport throughout the catchment is required to meet the management action target.

T3MAT5: Public and private drains identified with high erosion risk or sediment transport are permanently stabilised by 2010.

Foreshore Condition surveys have identified sections of waterways and private drains that were eroding (Green Skills, 2000). The management requirements of public drains (ie. those drains managed by Water Corporation) have also been assessed, and guidelines for best management practice (BMP) developed (Regeneration Technology Pty Ltd and Jim Davies and Associates, 1999). These BMP guidelines were developed based on spot site assessment of the major public drains. There is a further requirement to survey the public drains to identify priorities for implementation of works.

Actions:

1. Review the 'sediment risk' of public and major private drains, including further ground survey for management needs assessment
2. Revise Best Management Practice guidelines for public and private drain maintenance including:
   a. Revegetation techniques to stabilise banks
   b. Improving channel roughness to reduce sediment transport capacity of flowing water
   c. Earthworks to re-contour drains to reduce sediment loss
3. Restore private drains at risk of erosion according to management needs assessment priorities

4. Provide information and advice to ensure that new drains include appropriate design to minimise risk of nutrient, sediment and acid transport
5 Rehabilitate and maintain public drains for multiple benefits but with the primary function of flood control remaining.

T3MAT6: The processes and extent to which sulphuric acid, nutrients and other potential pollutants are released from acid sulphate soils due to the current operating strategy of the drainage systems is known by 2006.

The community is keen to have waterways and wetlands suitable for recreation, including catching fish 'worth eating'. The quality of water is a key determinant of this expectation. Management of nutrients in the catchment is important for water quality improvement (Management Theme 1 (Water quality and algal blooms) and Theme 5 (Farming systems), however change to the operating strategy for the drainage system may also be significant.

The current operating strategy for the drainage system causes the groundwater level to fluctuate. These processes cause oxidation of acid sulphate soils and the release of sulphuric acid. It may also cause significant release of nutrient from organic soils (DoE, 2004b). The extent to which the current operating strategy increases the risk of acid and nutrient release compared with the natural sequence of flooding and bar openings is not clear. There is a requirement to better understand the contribution to poor water quality in water ways and water bodies due to controlled fluctuations of groundwater levels in acid sulphate soils.

Actions:

1. Determine the distribution and level of acidity (actual and potential) in soils of the lower Torbay catchment
2. Undertake sampling and analysis of drainage water, groundwater, aquatic sediments and biota to determine the environmental impacts of acid drainage on the lower Torbay waterways
3. Evaluate the most appropriate drainage design to minimize mobilization of acid and nutrients from soil profiles
4. Develop and implement training programs for on-farm land management practices that minimise the disturbance of acid sulfate soils.

C2.3.1 Drainage Management - Filling information gaps

The current operating strategy for the drainage system provides benefits particularly through flood protection and management of water levels for horticulture. Changes to the system could be in two forms:

- Changes to the current operating system without change in infrastructure (i.e. by changes to timing and frequency control actions or the level at which water is managed
- Changes to infrastructure and significantly different operating strategies.

The first of these is relatively low risk but may not meet the high expectations of community for environmental benefits. The second has the potential risk of increased flooding, but there is also uncertainty about the environmental benefits that can be derived by changes to drainage operation alone. Further information is required to clarify these issues.

The required reduction in the incidence of toxic algal blooms in Lake Powell may entail:

- Flushing of the lake through operation of the drainage system (Option 5(a))
- Reduction of nutrient input by catchment and 'in-stream' management
- Treatment of lakebed sediments to reduce in situ nutrient release.

The relative contribution of lake flushing through changes to the operating strategy for the drainage system is not currently well understood. There is a requirement to model the potential benefits from drainage management Option 5(a).

C2.4 Targets and Actions for Theme Four: Habitat and Biodiversity Management

Many management actions for Theme Four (Habitat and Biodiversity Management) will be compatible with actions for other management themes, particularly those for wetland, waterway and drainage management.

Goal (2025): Biodiversity values are enhanced through improvement in the habitat of wetlands, waterways, the bush and the coast.

Objectives:

- Minimum water quality and depth for aquatic ecosystem functions in wetlands is maintained
- The condition of foreshore vegetation and in-stream habitat is maintained or improved
- The habitat value and habitat connectivity for native fauna is improve and increased
- Population sizes and diversity of native freshwater fish and crustacean are maintained
- Requirements for fish passage and spawning in waterways are maintained
- Representative and adequate areas of pre-European vegetation types are retained
- The impact of exotic pest animal species on native fauna is reduced
- The impact of weeds on native vegetation and aquatic ecosystems is reduced.

Target: Resource Condition Change

4.1: Major wetland systems have suitable water quality and adequate water depth for sustainable ecosystem functions by 2025

NOTE: *actions for this target are included in Themes 1, 2, 3 & 5*

4.2: All 'pristine' (A-Grade) foreshore vegetation is permanently maintained and all 'good' (B-Grade) foreshore vegetation is returned to 'pristine' condition by 2025

4.3: All third and fourth– order waterways have established permanent foreshore vegetation by 2015.

4.4: Identified waterway and terrestrial vegetation corridors are established for wildlife habitat as a part of a regional 'macro-corridor' by 2015

4.5: Sedge lands and other vegetation types with inadequate regional representation are managed for permanent protection by 2015

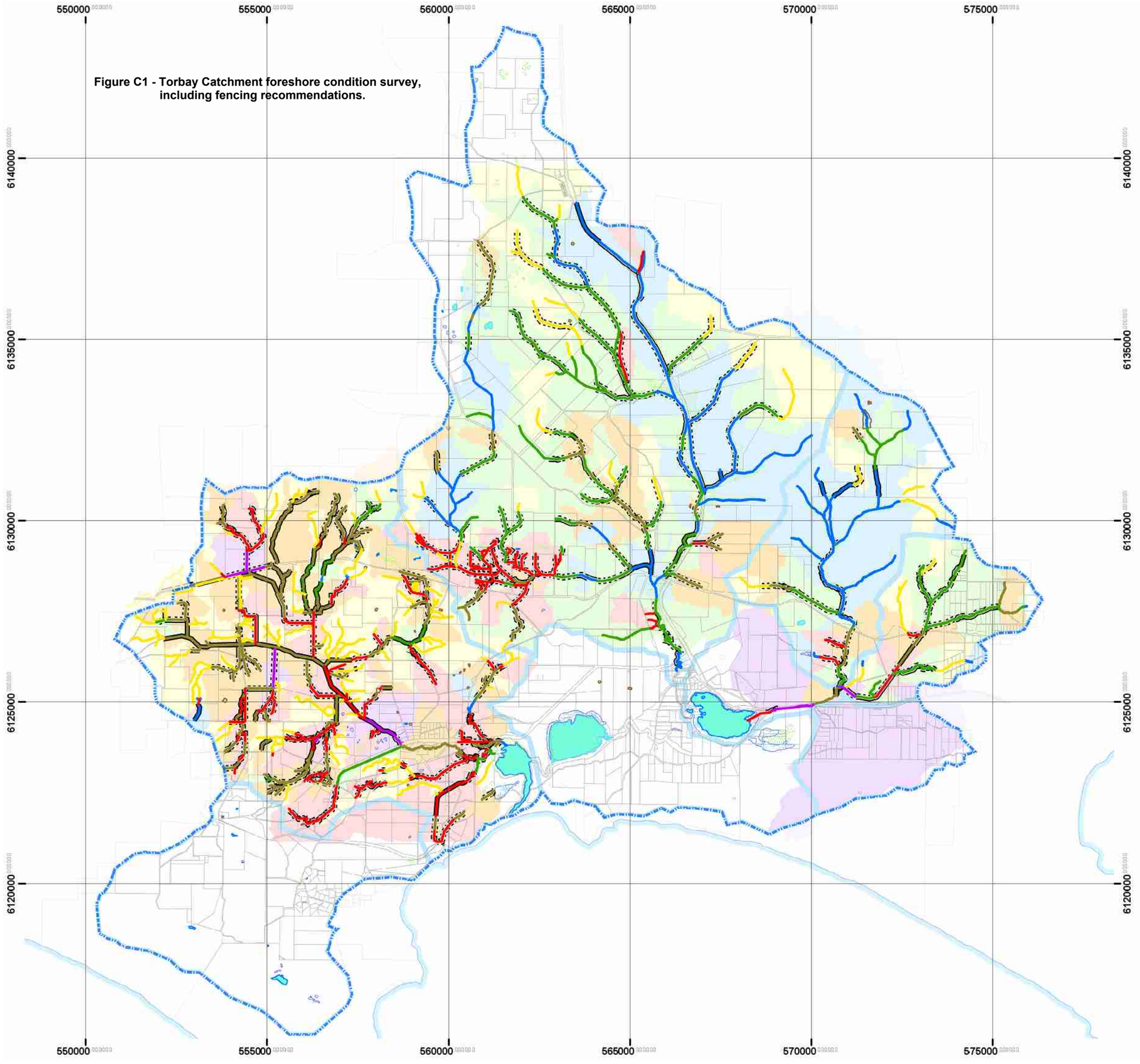
4.6: All major wetlands have permanent functioning foreshore vegetation ecosystems by 2015

4.7: Populations of native fish and crustacea are maintained or are increasing to sustainable numbers within aquatic ecosystem communities by 2025.

Fencing waterways to restrict stock access and enable revegetation of the riparian zone is important to reduce soil loss by channel erosion and to provide nutrient filtering (mainly nitrogen) by in-stream vegetation. A buffer of permanent vegetation adjacent to waterways also creates a temporary nutrient sink within the nutrient transport pathway and provides biodiversity and habitat benefits.

The extent of stream restoration required in Torbay catchment as measured by foreshore surveys is shown in Figure 1 and Tables C1 and C2.

Figure C1 - Torbay Catchment foreshore condition survey, including fencing recommendations.



WATERSHED Torbay

Watershed Condition

Legend

Foreshore Condition
- A/1
- B/2
- C/3
- D/4
- 5
- SW

Existing fencing
- Both
- Left
- None
- Right

Recommended Fencing
- Both
- Left
- Right

Watershed Waterway Condition
- to A/1
- to B/2
- to C/3
- to D/4
- to 5
- to Swale
- Primary Subcatchments

Stream Foreshore Condition
A/1 - Pristine to Slightly Degraded
B/2 - Degraded
C/3 - Erosion-prone to eroded
D/4 - Eroding Ditch or Weed-Infested drain
5 - Drain in worse condition

Watershed Waterway Condition indicates the foreshore condition of the waterway to which this part of the catchment drains

2.5 0 2.5
Kilometers

1:100,000

GDA

Data Sources
Waterways fencing and Foreshore condition from DoE Stream Condition Surveys (2001-2005)
Watersheds based on foreshore condition estimated from Landmonitor DEM (2004) (Ecotones & Associates for DoE)
Note - DEM errors have limited watershed assessment to the areas shown.
Reserves from DLI Cadastre (2005)

Department of Environment

ECOTONES & ASSOCIATES

Analysis and mapping using ArcGIS 9.1

T4MAT1a. More than 150 km of priority waterways within the Torbay catchment currently unfenced to be fenced and revegetated according to current 'best practice' for permanent management of foreshore vegetation by 2010.

T4MAT1b. A further 100 km of vegetated stream buffers established based on priority areas by 2010.

Actions:

1. Combine all foreshore survey information for Torbay catchment onto one base map. Show stream 'ordering' on the map. Establish priorities for fencing and revegetation based on criteria of:
   - 'pristine' (Class A) and 'good' (Class B) foreshore vegetation
   - Third and Fourth order streams
   - Channel erosion risk
   - Regional connectivity
2. Prepare information sheets of current local 'best practice' for riparian zone rehabilitation and management ('Streamlining')
3. Develop cost-sharing arrangements for vegetated stream buffering, including trial of an 'auction-based' system, considering regional and catchment priorities as well as public and private benefits
4. Organise and provide on-ground support services to ensure that information is available to priority areas.

	Assessed Grade of Waterway	A		B		C		D		DR		DRSW		DRWC		NA		SW	
		km	%	km	%	km	%	km	%	km	%	km	%	km	%	km	%	km	%
All surveyed sub-catchments	Existing Fence (both sides in km)	19.9	19	15.2	13	16.6	22	2.1	3	11.4	19	0.3	1	33.9	45	0.0	0	0.8	1
	Recommend -ed Fence (km)	21.5	21	78.1	65	53.9	72	60.5	89	47.9	79	0.0	0	34.0	45	0.0	0	14.2	10
	No Fence (km)	63.3	60	27.7	23	4.2	6	5.6	8	1.0	2	18.6	99	8.0	11	5.8	100	127.3	89
	Total Waterway Foreshore Length (km)	104.7	100	121	100	74.7	100	68.2	100	60.3	100	18.9	100	75.9	100	5.8	100	142.3	100

Table C1 - Fencing recommendations based on stream condition.

To meet the MATs to protect A & B grade foreshores, 99.6 km of fencing is required over the whole catchment.

	Assessed Grade of Waterway	1		2		3		4		5	
		km	%	km	%	km	%	km	%	km	%
All surveyed sub-catchments	Existing Fence (both sides in km)	25.9	7	28.2	18	31.5	32	7.9	28	6.7	45
	Recommended Fence (km)	148.7	40	86.2	56	55.5	56	15.5	56	4.1	27
	No Fence (km)	201.1	54	39.2	26	12.8	13	4.2	15	4.3	28
	Total Waterway Foreshore Length (km)	375.7	100	153.5	100	99.8	100	27.6	100	15.1	100

Table C2 - Fencing recommendations based on stream order.

To meet the MATs to protect higher order streams (3rd, 4th & 5th order), 75.1 km of fencing will be required.

T4MAT2: More than 50% of sedge lands within Torbay catchment are managed to maintain or restore ecological values by 2010.

Actions:

1. Undertake detailed mapping of the sedge land vegetation type within Torbay catchment and identify threats (e.g. invasion by Typha orientalis) and management requirements for permanent protection.
2. Prepare information sheets of local 'best practice' for sedge land management.
3. Identify areas that may be suitable for restoration of sedge land vegetation (some areas of land contaminated with chemicals is suggested).
4. Arrange funding and cost-sharing arrangements for management of sedge lands in priority areas within the catchment.
5. Initiative a public awareness and involvement program for sedge land management.

T4MAT3: All viable remnant vegetation patches of regionally inadequate vegetation types greater than one hectare are fenced and managed according to current local 'best practice' by 2010.

Actions:

1. Prepare a catchment map and database of vegetation types that identifies:
   - Areas that are inadequately represented
   - Areas greater than one hectare in size
   - Fencing status

2. Prepare information sheets of local ‘best practice’ for remnant vegetation management
3. Arrange funding and cost-sharing arrangements for management of priority remnant vegetation within the catchment.
4. Initiative a public awareness strategy on the value of remnant vegetation.

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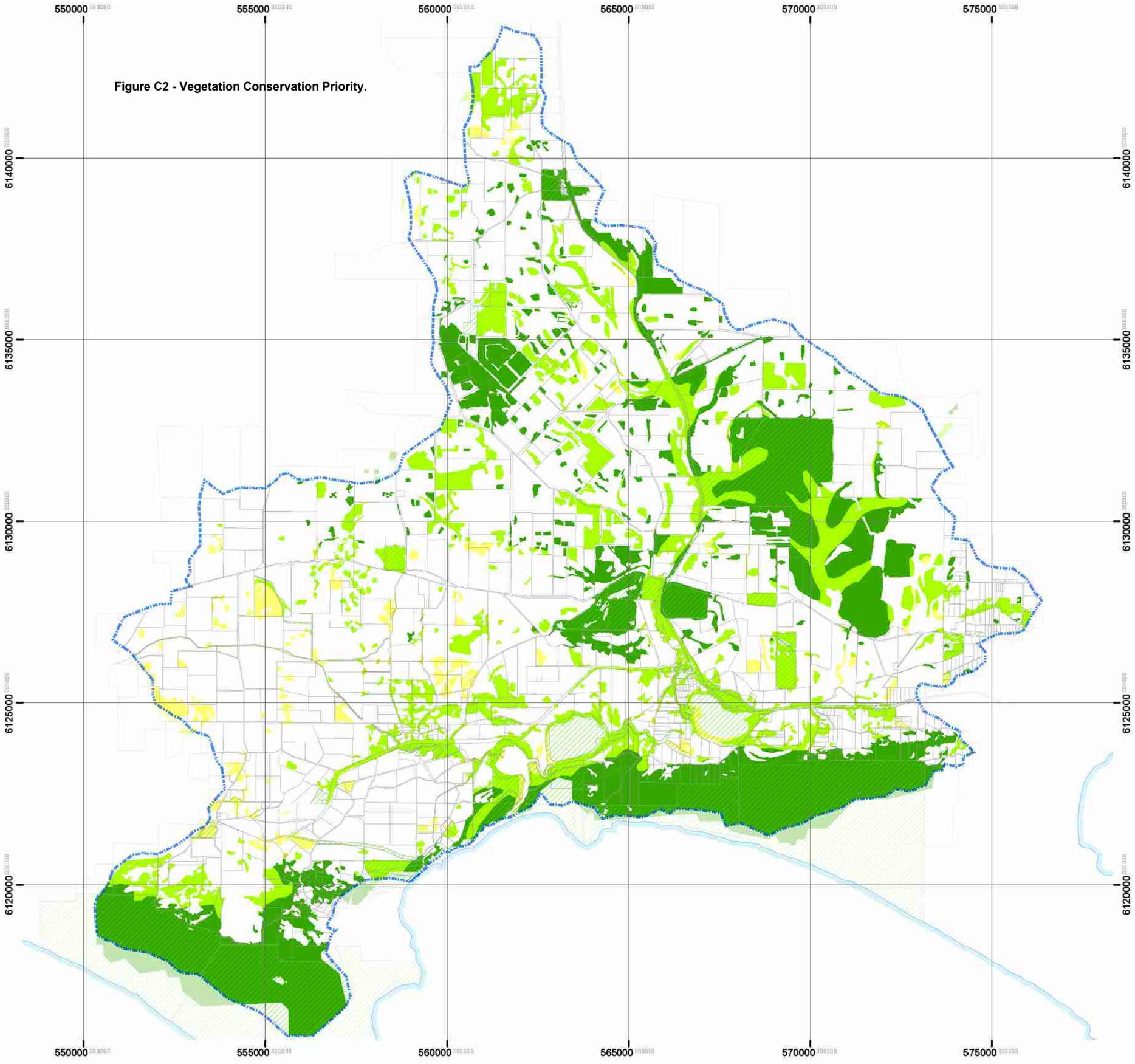
Figure C2 - Vegetation Conservation Priority.



WATERSHED Torbay

Vegetation Conservation Priority

Legend

reserves

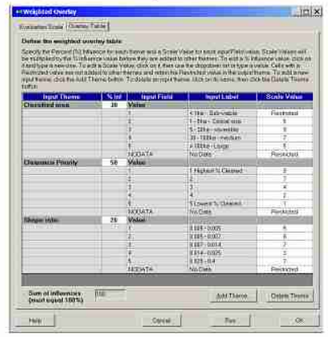
Vegetation Conservation Priority

- High Priority
- Medium Priority
- Low Priority

Data Sources
Vegetation occurance from data supplied by DoE.
Priority Analysis based on:
- % of each vegetation type cleared in Torbay catchment.
- Size of contiguous vegetation area.
- Shape of each contiguous area.
(Ecotones & Associates for DoE).

Areas within reserves may not require active conservation works.
Reserves from cadastre supplied by DLI.

Vegetation Priority Model



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Kilometers

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Analysis and mapping using ArcGIS 9.1

T4MAT4: More than 75% of each of the foreshore lengths of Lake Powell, Lake Manarup and Torbay Inlet to have a minimum twenty metre foreshore vegetation margin by 2015.

Actions:

1. Undertake foreshore vegetation surveys for the three major wetlands assessing also threatening processes (including weeds), management requirements and practical suitability for rehabilitation or extension of wetland foreshore vegetation.
2. Clarify landowner boundaries and other cadastral information to ensure clear understanding of land ownership status.
3. Review options for increased vegetation buffers through land purchase, increased reserve status, covenants, management agreements and others.
4. Prepare information sheets of current local 'best practice' for wetland vegetation management.
5. Arrange funding and cost-sharing arrangements for rehabilitation and management of priority wetland vegetation within the catchment.

T4MAT5: Priority environmental weeds are mapped and have management programs for control to achieve 10% per annum reduction with total control by 2015.

Actions:

1. Undertake catchment-scale environmental weed mapping program.
2. Prepare environmental weed control programs for priority species.
3. Prepare local information sheets of current 'best practice' for weed management.
4. Arrange funding and cost-sharing arrangements for implementation of annual environmental weed management program.

T4MAT6: The environmental requirements of freshwater and marine fish and crustacea in waterways and wetlands of the Torbay catchment are understood and being managed by 2010.

Actions:

1. Undertake surveys as required to establish the species of fish and crustacea that utilize the waterways and wetlands for the catchment as habitat or passage, and the environmental requirements for their use.
2. Prioritise stream reaches and wetlands for in-stream habitat enhance programs.
3. Trial stream habitat enhancement (revegetation for temperature control, organic matter and food sources, and woody debris for shelter).
4. Prepare information sheets of local 'best practice' for stream habitat enhancement specific to Torbay catchment.

C2.5 Targets and Actions for Theme Five: Farming systems

Management actions for farming systems are focussed on developing and adopting 'best management practice' at a catchment scale particularly for reduction in point and diffuse sources for nutrients.

Management change requirements need to account for the mix of viable agricultural enterprises with non-viable farms (due either to off-farm income or lifestyle residential use). It is proposed that assessment of resource condition change (such as a nutrient loss reduction) is arranged on a sub-catchment basis.

Goal (2025): The farming communities have adopted 'best practice' systems for sustainable land use resulting in measurable agricultural and environmental benefits.

Objectives:
- Sustainable farming systems are developed to maximise the efficiency of use of fertilisers, chemicals and energy
- Farm nutrient loss is reduced
- Soil loss from farms is reduced
- The impact of weeds on agricultural production is reduced.

Target: Resource Condition Change

5.1: The total catchment nutrient load is reduced by 38% for nitrogen and 24% for phosphorus by 2025.

C2.5.1 Intensive Animal Industries

T5MAT1: Intensive animal industries and annual horticulture located in high or medium risk sites have adopted management practices that result in a reduction of the current industry nutrient surplus by 40% by 2010.

Actions:

1. Calculate the current nutrient surplus from intensive animal or horticultural enterprises.
2. Review management practices for nutrient reduction adopted for similar industries in other coastal rural areas (e.g. Busselton, Peel-Harvey catchment) and determine practices applicable to Torbay catchment.
3. Prepare and implement nutrient management plans for intensive animal and horticultural industries.
4. Evaluate and implement cost-sharing options and other policy instruments that provide incentives for adoption of 'best practice' management.
5. Provide information and support for adoption of environmental management systems in the catchment.

C2.5.2 Nutrient Surplus Reduction Targets

T5MAT2: More than half of the landholders in Torbay catchment who derive more than 50% of their income from farming their properties have prepared a 'farm nutrient surplus' calculation and response plan by 2010.

Actions:

1. Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research.
2. Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment.
3. Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment (Theme One – Water quality and algal blooms). The revised targets are to be achievable (i.e. by acceptable levels of change within farming systems) and remain relevant to nutrient reduction levels for waterway and wetland restoration.
4. Prepare demonstration property plans for one large and one small property within Torbay catchment to show 'best practice' management for nutrient loss reduction.
5. Initiate a program for 'continuous improvement' of best management practices to achieve sub-catchment nutrient surplus reduction targets through review and evaluation of updated information by the catchment group, industry and the community.
6. Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program.
7. Arrange state, national and international 'farming systems' study tours for innovative landholders (eg. through a Churchill Fellowship).
8. Establish visible community indicators (eg a "nutrient reduction barometer" at Elleker community store and other locations) and regular updates in newsletters and newspapers to show the level to which the targets are being achieved.

A regional survey of agricultural soils in the South Coast region has shown that the level phosphorus (P) and potassium (K) in soils are now at levels greater than plant requirements due to annual fertiliser applications and that sulphur (S) is the commonly deficient nutrient (Weaver and Reed, 1998). High fertilizer application levels including P are often used to address the deficiency in S.

The pathways for transport of P in sandy duplex profile soils include:

- Leaching in deep sand soils with low P retention capacity,
- Transmissive zone leaching including sand-filled alluvial channels, macropores, relic root channels and other transmissive cracks or fissures,
- Sub-surface flow above the clay layer n duplex soils
- Surface flow without soil loss (nutrient transport in solution)
- Surface flow with soil loss (nutrient transport in solution and in soil particles)

Nitrogen (N) transport pathways are more complex. Some of N that is excess to plant requirements is lost in solution through leaching however it is also lost through volatilisation.

The proposed management strategies for effective fertiliser use include:

1. Soil testing and analysis – so as to recommend fertiliser applications that are required to meet plant requirements
2. Fertiliser use and management - e.g. fertiliser types, time of application, buffer areas with reduced fertiliser applications (including firebreaks),
3. Increase nutrient use through increased productivity - by extending the period of production and increasing the depth of root zone use, particularly on deep leaching sandy soils, and
4. Surface and subsurface water management - to reduce soil erosion and water logging.

Viable agricultural enterprises for grazing and horticulture are where substantial amounts of fertiliser are applied. Responses from the catchment wide community survey undertaken for Watershed Torbay (April, 2003) suggest that 30% of the area under grazing and 25% of the area used for horticulture is fertilised using best practice principles. Table C3 shows that 'best practice' fertiliser use should be applied to an additional 10,500 hectares of grazing or horticultural land in the catchment, to achieve the resource condition change target for nutrient loss reduction.

Torbay Catchment	Area (km^2)
Total area of catchment where grazing is the dominant land use	170 km^2
Estimated area of grazing fertiliser BMP as at April 2003	51 km^2
Total area of catchment where horticulture is the dominant land use	19 km^2
Estimated area of horticulture fertiliser BMP as at April 2003	5 km^2
Total area of fertiliser BMP needed to meet 85% target	161 km^2
Post-April 2003 area of grazing or horticulture fertiliser BMP needed to meet target	105 km^2

Table C3 The area of land required to adopt effective fertiliser management to meet the resource condition change target.

Figures C3 & C4 show the N & P high risk export areas. These are the areas that are at the highest risk of exporting nutrients to the waterbodies (Lakes Powell & Manarup, Torbay Inlet). These areas are the highest priority for nutrient control works.

Figure C3 - Nitrogen Export Risk

WATERSHED Torbay

Nitrogen Export Risk

Estimated nitrogen delivered to inlets

Legend

Primary Subcatchments

Nitrogen Export Risk

Low (0 - 1.5 kg/ha)

Medium (1.6 - 5.0 kg/ha)

High (5 - 15 kg/ha)

Data Sources - Nutrient Risk mapping
Lakes and other hydrological features from hydrology extracted from 1:25,000 topography maps (DLI 2005).
Cadastre from DLI (2005).

Estimates of nutrient risk- nitrogen and phosphorus at source, nitrogen and phosphorus export - have been modeled using SSPRED, the support system for Phosphorus Reduction Decisions.
(Ecotones & Associates for DoE, 2006).

Perth

Location

N

3 0 3
Kilometers

1:100,000

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Analysis and mapping using ArcGIS 9.1

550000 555000 560000 565000 570000 575000

6140000 6135000 6130000 6125000 6120000

Figure C4 - Phosphorus Export Risk

WATERSHED Torbay

Phosphorus Export Risk

Estimated phosphorus delivered to inlets

Legend

Primary Subcatchments

Phosphorus Export Risk

- Low (< 0.2 kg/ha)
- Medium (0.2 - 0.5 kg/ha)
- High (0.6 - 2.7 kg/ha)

Data Sources - Nutrient Risk mapping
Lakes and other hydrological features from hydrology extracted from 1:25,000 topography maps (DLI 2005).
Cadastre from DLI (2005).

Estimates of nutrient risk- nitrogen and phosphorus at source, nitrogen and phosphorus export - have been modeled using SSPRED, the support system for Phosphorus Reduction Decisions.
(Ecotones & Associates for DoE, 2006).

Perth
Location

3 0 3
Kilometers

1:100,000

GDA

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Analysis and mapping using ArcGIS 9.1

The targets for management of fertiliser use, surface water and soil erosion to reduce nutrient loss from farming systems are:

T5MAT3: More than 30 viable farming enterprises are adopting 'best management' practices according to nutrient management plans and are demonstrating achievements of defined nutrient surplus target reductions without production loss by 2010.

Actions:

1. Promote and encourage adoption of soil and plant testing and analysis to guide appropriate fertiliser application according to production requirements
2. Develop a proforma and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties
3. Increase community understanding of efficient fertiliser use, particularly the efficient use of sulphur sources and trace elements
4. Develop a "Nutrient Management" information series, including developing 'best practice' notes for a range of farming systems and interest groups
5. Promote and support research and development with fertiliser manufacturers to develop, trial and produce a slow-release fertiliser suitable for use in Torbay catchment (eg 'Redcoat' fertiliser)
6. Improve community awareness of efficient fertiliser use by
   - paddock-scale demonstrations and associated field-days
   - a bus tour for members of the Torbay Catchment Group to the Peel Harvey Catchment
   - disseminate information about productivity and environmental benefits associated with soil ameliorants fertiliser options (including the use of lime and soil amendments such as 'Alkaloam')
7. Evaluate the potential for delivery of bulk 'Alkaloam' supplies to the Torbay catchment
8. Demonstrate and promote the adoption of surface water control and interception drainage structures in priority areas with high surface water run-off and potential soil loss
9. Arrange integrated surface water management plans on a sub-catchment basis for priority areas with high surface water run-off and potential soil loss.

C2.5.3 Establishment of Perennial Pastures, Shrubs and Trees

Perennial pastures, shrubs and trees are considered to have significantly higher nutrient assimilation capacity than annual pastures.

Current adoption of perennial pastures within Torbay catchment is mapped based on information from a catchment survey (April, 2003) and field verification. It is estimated that 33% of land in the Torbay Catchment is under perennial pastures.

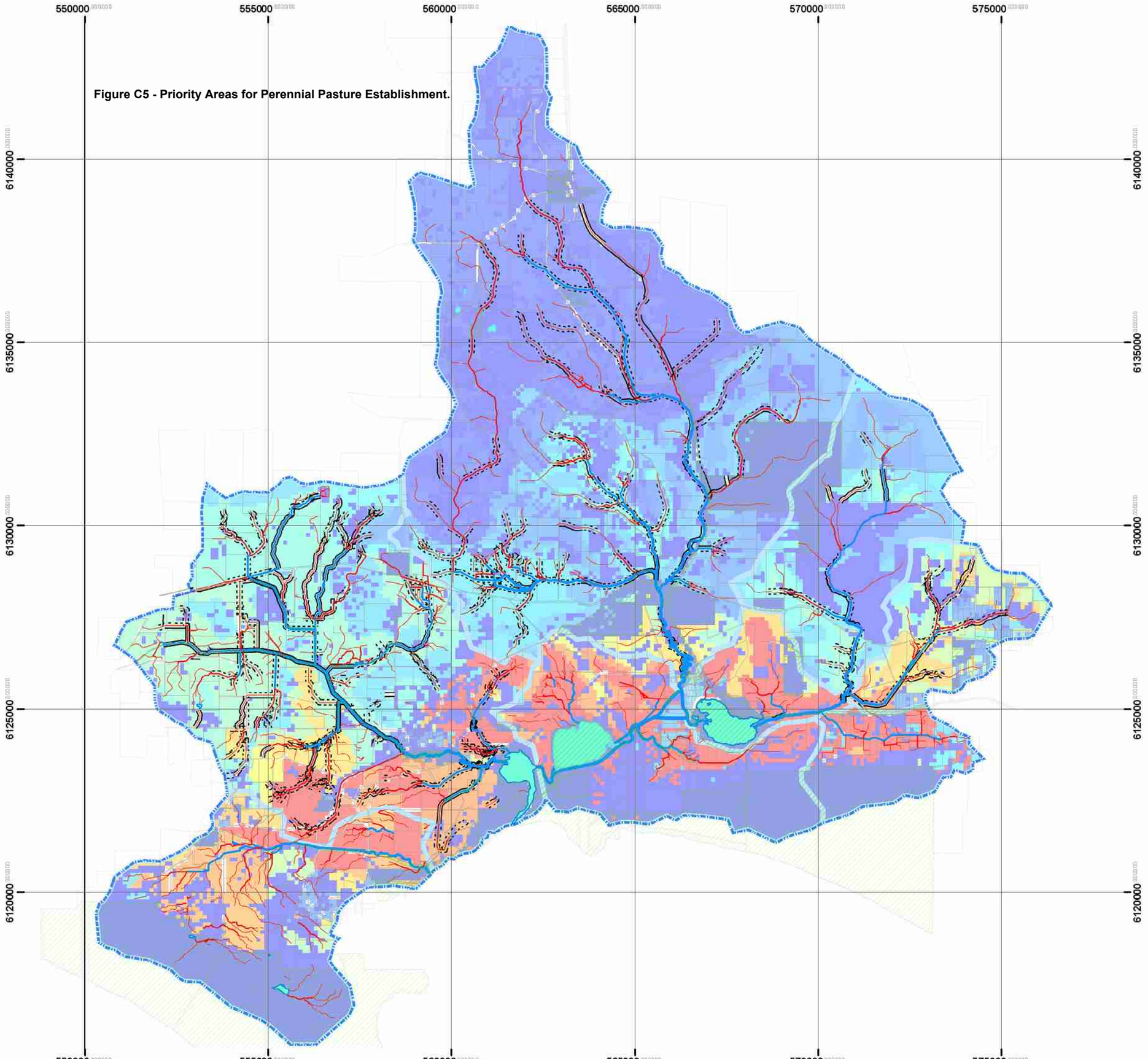
It is estimated that 85% of land used for grazing needs to be established to perennial plants to achieve the required resource condition change. This means the establishment of an additional 8,900 hectares is required to meet the target (Table C4).

Torbay Catchment	Area
Total area of catchment where grazing is the dominant land use	170 km^2
Estimated area of grazing under perennial pasture as at April 2003	56 km^2
Estimated proportion of grazing area under perennial pasture as at April 2003	33%
Area of perennial pasture required to meet 85% target	145 km^2
Post-April 2003 area of annual pasture requiring conversion to meet target	89 km^2

Table C4 - The area of land required to be established with perennials to meet the resource condition change target.

The priority areas for further establishment of perennial pastures shrubs or trees based on nutrient loss risk is shown in Figure C5.

Figure C5 - Priority Areas for Perennial Pasture Establishment.



WATERSHED Torbay

Perennial Pasture Assessment

Indicative Locations Only

Legend

Combined P and N exports

High

Low

Perennials highly desirable

Stream Order (Strahler)

1
2
3
4
5

reserves

Primary Subcatchments

Existing fencing

Both
Left
None
Right

Recommended Fencing

Both
Left
Right

Data Sources
Waterways fencing from DoE Stream Condition Surveys (2001-2005)
Lakes and other hydrological features extracted from 1:25,000 topo maps (DLI 2005).
Stream order according to Strahler. (Ecotones & Associates for DoE).
Cadastre from DLI (2005).

Estimates of nutrient risk- nitrogen and phosphorus at source, nitrogen and phosphorus export - have been modeled using SSPRED, the support system for Phosphorus Reduction Decisions.
(Ecotones & Associates for DoE, 2006).

This map indicates high P & N export locations, where reductions in nutrient loss from perennial pasture would be of benefit. The establishment of perennials on these sites should be investigated. While perennial pastures can assist in reducing nutrient loss from grazing systems, this is subject to appropriate species selection. Selection and establishment of perennial pastures should only be undertaken with expert assessment and advice.

2 0 2
Kilometers

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Analysis and mapping using ArcGIS 9.1

T5MAT4: A total of 75% of land used for grazing is established with perennial plants (trees, shrubs or pastures) by 2015.

Actions:

1. Undertake map analysis with field verification survey to identify the area of soils in each sub-catchment that have high nutrient leaching capacity and are suitable for establishment of perennial pastures, shrubs or trees.
2. Develop a Perennial Pastures support and extension program suitable for both larger and smaller farm enterprises within Torbay catchment (could be linked to or based on the existing 'Prograze' program).
3. Initiate large-scale demonstrations of a range of perennial pastures, shrubs and trees options.
4. Develop a series of "Pastures Management" field days and information notes with support from industry organisations (e.g. the West Australian Lucerne Growers Association) for both perennials and annual pastures (focussing on both production and environmental benefits).
5. Undertake a catchment-scale program with cost-sharing arrangements establish perennial grasses and legumes in priority areas within the catchment.
6. Establish a trial of Agonis juniperina as a perennial shrub with potential commercial and nutrient loss reduction benefits.
7. Develop agroforestry as an alternative land use:
   - Implement 50 hectares of wide-spaced commercial saw log agroforestry to in the catchment by 2008
   - Develop an Agroforestry Information Series
   - Promote and carry out a Master Tree-Growers Course
   - Undertake research into the production and water quality benefits of perennial pastures (current postgraduate studies initiated).
8. Undertake research into the farm production and the benefits to water quality by nutrient loss reduction through the adoption of perennial pastures, shrubs and trees.

C2.5.4 Information gaps

There is a further requirement to better understand the significance of farming systems management for benefits to resource condition within Torbay catchment. Some points to be addressed are:

- The relative nutrient surplus use by perennials and annual pastures
- A comparison of nutrient surplus reduction for a range of perennials (e.g. kikuyu, phalaris)
- The extent to which P in soil (i.e. nutrient surplus) is actually available for uptake by pastures
- The potential for soil ameliorants to reduce nutrient loss from farming systems
- Development of slow release fertilisers that are suitable for use in Torbay catchment.

C2.6 Targets and Actions for Theme Six: Landuse planning

The policy and planning mechanisms that relate to implementation of the Torbay Catchment Restoration Plan are described in Section B2.6.1. There is also consideration of additional planning mechanisms that may be required for effective implementation of the plan.

Incentives may be required for individual landholders to engage in planning practices and to implement 'best practice' actions for net environmental benefit. Ensuring that information is relevant and easily available is a first step in encouraging engagement in planning. Incentives for adoption of actions for change management in order to deliver public benefits (e.g. improved water quality) can be provided through cost-sharing arrangements.

Improved understanding of the policy and institutional change framework relevant to Torbay catchment, particularly in relation to regulatory instruments will also provide incentives for industry self-regulation through planning.

The Management Action Targets and actions required to achieve the goals and objectives for the Land Use Planning theme are outlined below.

Goal (2025): Regional and local planning provides the policies and mechanisms to implement new actions that are beneficial for natural resource condition, ensure that land is used according to its capability and that further agricultural, industrial, commercial or residential development within the catchment does not compromise the environment.

Objectives:

- Future land use, including new development proposals, should not exceed the capability of land resources and should demonstrate net nutrient reduction compared to current land use
- Land use intensification and further residential development within defined floodplain and buffer areas for Lake Powell, Ewart's Swamp, Lake Manarup and Torbay Inlet are controlled according to environmental management guidelines
- Construction of new public and private drains and maintenance of existing drains does not increase the risk of flooding, nutrient enrichment, acidification and sedimentation of waterways and wetlands
- Priority water resources are protected for beneficial use now and into the future
- Commercial tree plantations are controlled to ensure beneficial groundwater resources are not reduced and that the landscape visual amenity is maintained
- Future townsite growth within the catchment does not result in increased nutrient input to waterways and wetlands
- The area of reserves or other secure arrangements for wetland and biodiversity conservation are increased in priority locations
- The value of 'environmental services' to the City of Albany provided from Torbay catchment is realised and arrangements are developed for payment by those that benefit
- The current landscape mosaic characterised by agriculture and natural vegetation is maintained
- Rural lifestyle and social values, including passive and active recreation opportunities, are enhanced.

Target: 6.1: Land use is matched to land capability within all local planning frameworks.

C2.6.1 Adopting 'Land Capability' and 'Net Nutrient Reduction' Principles

Land capability analysis is a process for systematic assessment of land attributes with respect to its use. Sustainable land use is based on the land resource being used within its capability. If use exceeds the capability of land, then resource degradation is expected. Acid sulphate soils require additional consideration in land capability assessment.

The principles of land capability should prevail through planning and management. The current Town Planning Scheme (TPS) for the City of Albany and the revised TPS adopt land capability principles. However, the effectiveness of land capability analysis is limited by the level of information that is available about the land. Information for land in Torbay catchment is generally at a higher level that in other catchments in the region as a result of the Watershed Torbay project. Planning processes should be adjusted to make best use of the information that is available.

There is further potential through policy and planning mechanisms to arrange 'net nutrient reduction' to result from land use change proposals. Nutrient management plans can be required for some proposed developments that there is zero nutrient loss from the proposed development and that there is additional nutrient reduction strategies. Opportunities for 'environmental off-sets' to reduce nutrients can also be considered. For example, proposals that may result in increased nutrient discharge compared to the pre-development can undertake addition works within a sub-catchment (e.g. revegetation using local native species) that result in a net nutrient reduction for that area.

T6MAT1: Assessment of all applications for land development or sub-division are based on a revised land capability analysis framework for Torbay catchment using currently available land resource information and adoption of 'Net Nutrient Reduction' principles for planning proposals by 2007.

Actions:

1. Prepare a revised land capability framework for Torbay catchment that makes best use of current information and is suitable for management and planning purposes,
2. Ensure the revised land capability processes are adopted within the Local Planning Strategy and Town Planning Scheme for the City of Albany (this may require a TPS Amendment)
3. Ensure that the requirement for Nutrient Management Plans is prescribed in the LPS and TPS for significant Development Applications,
4. Promote revised 'land capability' and 'net nutrient reduction' principles to landholders within the catchment for management through existing communication processes and to development proponents through planning processes.

C2.6.2 Land Use Intensification

Planning can be applied to ensure that further land use intensification and residential development adjacent to Lake Powell, Ewart Swamp, Lake Manarup and Torbay Inlet are controlled to minimise nutrient, flood and other environmental risks.

T6MAT2: Assessment of all applications for land development or sub-division are based on a revised land capability analysis framework for Torbay catchment using currently available land resource information by 2007.

Actions:

1. Map priority areas within Torbay catchment where further development may increase the risk to environmental values for consideration within the (draft) Lower Great Southern Regional Planning Strategy and the (draft) Local Planning Strategy and Town Planning Scheme for the City of Albany, including areas of high conservation value, buffers adjacent to wetlands and waterways, floodplains and vegetated corridors
2. Ensure the TPS and LPS contain conditional requirements for development applications for areas of floodplains and buffers
3. Prepare provisions for proposed development within the mapped priority areas for consideration within the LPS and TPS
4. Map priority areas that may be suitable for regional open space or additional public access for consideration within the RPS
5. Define the Marbellup Brook sub-catchment as a priority to be considered in the RPS, LPS and TPS
6. Ensure subdivision proposals are referred to the appropriate agencies for consideration of ceding foreshore reserves within mapped priority areas.

C2.6.3 Development and Maintenance of Drains

Construction of additional drains and maintenance of existing drains with Torbay catchment has potential to increase the acidification of wetlands where they occur in acid sulphate soils, sedimentation in soils with unconsolidated sands and increased flooding. There are opportunities within policy and planning mechanisms to control the potential impacts of drains.

T6MAT3: All proposals for additional deep drainage and significant maintenance works within Torbay catchment are assessed as Development Applications and on the basis of a presumption against drainage in areas identified at risk by 2007.

Actions:

1. Prepare provisions to define deep drainage construction and maintenance as development for planning purposes and provide an additional 'Landuse Class' for drainage within the TPS and associated planning processes
2. Include a presumption of no additional drainage construction within identified risk areas and prepare a set of approval conditions for inclusion in the LPS and TPS for proposed drainage construction and maintenance within these areas

3. Prepare policies and management guidelines for inclusion in the LPS and TPS to provide direction for planning approval processes and to promote 'best practice' drainage construction and maintenance
4. Arrange for drainage development applications to be referred to the appropriate agencies and authorities (including the Department of Environment as a key agency and a partner of the Torbay Catchment Group)
5. Communicate the risk of drainage construction and maintenance within the identified risk areas to landholders and responsible authorities within the catchment and promote 'best practice' management through catchment group communications and through planning processes.

C2.6.4 Commercial Tree Plantations

The community has expressed concern about the effect of uncontrolled expansion of commercial tree plantations within Torbay catchment. The concerns are particularly in relation to social and environmental impacts, including the potential loss of groundwater resources. Planning provides some opportunity to control the undesirable development of extensive tree plantations through the land capability processes and planning zones although this will require additional information about the potential impact of plantations on the catchment water balance.

T6MAT4: Proposals for commercial tree plantations within identified priority areas of Torbay catchment are assessed as Development Applications through the TPS for the City of Albany with the presumption against this development in these areas by 2007.

Actions:

1. Map priority areas in which commercial tree plantations should receive greater consideration due to water use and landscape amenity issues
2. Provide definitions for 'commercial tree plantations' and 'farm forestry' or 'agro-forestry' for planning purposes
3. Ensure that consideration of 'commercial tree plantations within identified priority areas' as Development Applications is continued in the revised TPS for the City of Albany.

C2.6.5 Urban Growth

While the urban communities within Torbay catchment are currently quite small, there is potential for increased growth. Policy and planning can ensure that additional urban development does not result in increased nutrient input to waterways and wetlands. The potential for this to occur is greatest for the town of Elleker.

T6MAT5: By 2007 urban growth in the town of Elleker is planned to ensure no additional risk to waterways and wetlands and that the potential for flooding of residential development is minimal.

Actions:

1. Identify and evaluate the on-site and environmental risk due to further urban development in the Elleker town site, including potential for increased nutrients to waterways and wetlands, impacts of acid sulphate soils, flooding and mal-odours
2. Submit comments and information to the consultation processes for the (draft) Lower Great Southern Regional Planning Strategy and the (draft) LPS and TPS for the City of Albany to ensure the environmental risk of further urban development within the Torbay catchment is recognised.

C2.6.6 Maintaining the Character of Agricultural Landscapes

The community has expressed concern about the loss of the current agricultural character of landscapes within Torbay catchment. Agriculture is effectively preserved in Priority Agricultural Areas as described by the Statement of Planning Policy for Agriculture and Rural Land Use Planning.

T6MAT6: Priority Agricultural Areas in Torbay catchment are revised and a preferred landscape description prepared for consideration by regional and planning processes by 2005.

Action:

1. Revise current areas classified of Priority Agricultural Area and General Agriculture within Torbay catchment to ensure that these meet the expectations of the community, protect water supplies and environmental values.

C2.7 Targets and Actions for Theme Seven: Community Education and Information

Goal (2025): The community and partners understand the values of the catchment and are pro-active in implementing on ground works to achieve the shared vision for the catchment.

Objectives:
- All key stakeholders are willingly involved in implementing the restoration plan.
- A high level of community awareness about the values of the catchment and about the best practices for sustainable management.
- Further research in the catchment addresses priority issues, meeting community needs and is communicated to increase community understanding of environmental processes.
- There is a significant level of community involvement in reviewing the restoration plan on a five yearly basis.

Target:
7.1 By 2015 positive progress has been made to make restoration plan targets for improving catchment health measurable.
7.2 By 2008 further funds have been received for on-going implementation of the catchment restoration plan.

C2.7.1 Developing a 'Shared Vision'

T7MAT1: More than half of landholders and residents in Torbay catchment are able to express clear understanding and support for the catchment Vision and Restoration Plan by 2010.

Actions:

1. Appoint a full-time Torbay Catchment Group Coordinator (3 year contract)
2. Conduct community forums and catchment tours to recommit to the vision, report on restoration plan implementation progress to date and provide opportunities for community involvement in reviewing priority actions
3. Report on achievements of Targets and Actions in an annual 'Report Card' format
4. Prepare a summary version of the Restoration Plan targeting specific interest groups and further engage community in reviews and amendments to the plan
5. Prepared a set of maps (for Management Themes) with clearly identified locations and tasks for local involvement
6. Arrange clear and localised 'best practice' information that is relevant and achievable
7. Identify key 'barriers to change' and develop incentives or other measures to overcome these barriers
8. Initiate information and skills development opportunities for 'special interest' groups (e.g. small-scale landholders)
9. Identify and support community leaders into specific roles for which they are well recognised
10. Provide public recognition for individual and community actions undertaken according to the Restoration Plan
11. Engage the community through involvement with schools and other related interest groups
12. Initiate community projects that have achievable outcomes and contribute to the targets of the Torbay Catchment Restoration Plan
13. Organise cost-sharing arrangements and publicise these in ways that ensure that they are considered available to all in the catchment, including both small and large-scale landholders
14. Show that key partners (e.g. government agencies) are committed to the project and are contributing within the partnership framework
15. Provide a clear statement of 'roles and responsibilities' for actions and information in the form of 'partner profiles' about the expected roles for involvement
16. Develop and update a local skills audit and where ever possible use local people to undertake contract catchment restoration works.

C2.7.2 Communications and Information Management

T7MAT2: More than 40% of landholders are attending at least one group event annually and have copies of or direct access to current research and information relevant to actions for implementation of the Restoration Plan by 2010.

Actions:

1. Survey all landholders and residents biennially to monitor support for vision as well as review key issues or actions, and gauge attitudes to changing land management.
2. Review the social benchmark survey information to identify key 'drivers' or 'barriers' for communication and information management for differing landholder interests and cultural or age groups.
3. Maintain the 'Communications Learning Log' and ensure that a short summary of new group learning is widely distributed.

C3.0 Achievement of Management Action Targets, Priorities, Responsibilities and Estimated Costs

An estimate has been made of the extent to which each of the Management Action Targets (MATs) can be achieved within the first 3 year period of implementation. Some actions will fully achieve the MAT within that time, while for other targets only initial actions may be taken within that time. For example, change management that is dependent upon demonstrations to develop 'best practice' and understanding by landholders may take longer. An assessment of the feasibility for achievement of the MATs is also included in Table C1.

The priority for implementation of each of the actions has been derived from review comments provided by partner organisations and from community workshops held during February 2005. The proposed commencement year during the 3 year Implementation program is shown for each project. Some are ongoing processes expected to continue beyond the 3 year period.

Responsibilities for implementation are identified and an estimate of total cost allocation required for each action within the 3 year implementation program is provided in Tables C5 (a-f) which follow. The costs are provided as budget estimates within a 3 year period. The organisations identified to adopt lead responsibility for implementation of the action area also identified in the table. Information provided by Weaver (2003) has provided a guide for some cost estimates (Table C6).

Note 1: All actions relating to how changes to farming systems will contribute to improved water quality are contained in Section 5 – Farming Systems.

Note 2: Abbreviations are explained in full in the Table of Contents, page *xii*.

Theme 1 – Water Quality and Algal Blooms

Goal

Water in Lake Powell, Lake Manarup and Torbay Inlet is suitable for the survival and growth of native aquatic plants and animals, and algal blooms are minimal. Water in MarbellupBrook remains suitable for recreation, domestic and agricultural use.

Objective

The Source and pathways for mobile nutrients, sediments and contaminants within the catchment are known and management so that:

- There are no fish kills due to poor water quality
- The incidence of algal blooms is reduced
- The transport of nutrients, sediments and contaminants into waterways and wetlands is minimised
- Management practices are adopted that minimise public health and environmental risks for drinking water from Marbellup Brook.

Targets for Resource Condition Change

1.1 Reduce by a third the incidence of algal blooms in Torbay Inlet, Lake Powell and Marbellup Brook by 2025
1.2 Median nutrient concentrations from the sub-catchments meet the set reduction targets.
1.3 The quality of water in Marbellup Brook meets national criteria for public water supply by 2015.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T1MAT1: Discharge of nutrients to the Torbay catchment from the disposal of wastewater does not increase beyond current levels. (Note, current levels are well below Ministerial approval).	1. Review future options for wastewater disposal in Torbay catchment and provide information to the community.	(ongoing) H	WC	5	2	3	5	1	Water Corporation is currently assessing options, including on-site and off-site water reuse
	2. Continue monitoring water quality in stream flow for Seven Mile Creek with evaluation and reporting annually.	(ongoing) H	WC	4.8	1	5	4	1	Ongoing under Ministerial conditions
	3. Encourage source reduction of wastewater flows from the City of Albany through prevention of stormwater entering sewers, and public awareness program for wastewater reuse.	(06 and ongoing) M	WC, CoA	4	2	4	3	1	Include in urban land development design, and longer-term initiatives to be built into infrastructure maintenance and replacement program. WC is suggested funding source
	4. Assess options for City of Albany and other wastewater producers to pay for 'ecosystem services' as a contribution to catchment management.	(06) L	WC, CoA	4.1	2	2	2	2	Feasibility study to assess application of "ecosystem service" costs in this situation.
T1MAT2(a): All third and fourth-order waterways in Marbellup Brook have permanent vegetated stream buffers established by 2010. T1MAT2(b): By 2015, 70% of all first and second order streams have permanent perennial vegetation.	1. Prepare maps and tables to show the extent for stream 'orders' in the Marbellup Brook sub-catchment and the width of stream buffers provided by natural riparian vegetation.	(05) H	DoE	4.3	2	5	4	1	Small task that would show the extent of works required
	2. Prepare a nutrient and pathogen 'risk map' for the Marbellup Brook sub-catchment based on soil-type and existing pollution hazards.	(05) H	DoE, DAWA	4.2	1	5	5	3	Map compilation from existing information
	3. Prioritise streams within the Marbellup Brook sub-catchment for vegetated stream buffering.	(05) H	DoE, DAWA	3.8	1	5	4	2	Essentially achieve, but broaden to include criteria related to nutrient assimilation.
	4. Investigate the use of agro-forestry to enhance stream restoration and provide an economic benefit.	(06) L	FPC, DAWA	2.9	2	2	2	3	Link to farming systems theme. Included here as a potentially profitable option for stream buffering for nutrient reduction with some habitat and biodiversity benefit.
	5. Develop 'best practice' guidelines and other options for the required stream buffering for nutrient and pathogen control.	(06) M	DoE, TCG, WC	3.5	1	4	3	2	To be linked with preparation of the Water "Source Protection Plan for MarbellupMarbellup Brook. Service provider to prepare guidelines in close association with TCG.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
	6. Cost sharing arrangements for landholders to be coordinated through the Torbay catchment group (including consideration of a trial an 'auction-based' approach) to implement the vegetated stream buffers according to 'best practice' guidelines.	(05) H	TCG	3.5	1	5	3	3	Costs based on $5000/km for stream buffers (estimated from Weaver, 2003) and restoration of 30 km each year for 3 years. Initial cost sharing of 80:20+labour suggested although trial of an auction based system is recommended. Preparation of a detailed cost-sharing schedule is required.
	7. Voluntary cost sharing arrangements are reviewed annually and finally reviewed and reported in 2010 to determine their effectiveness compared with regulatory approaches.	(ongoing and annually) M	TCG, DoE	3.5	1	5	3	2	On-going review and assessment of cost-sharing arrangements is essential to ensure efficient use of public and private investment funding.
T1MAT3: Three trial demonstrations of nutrient reduction from stream flow and sediments implemented by 2007.	1. Investigate and assess the application of slurry injected Phoslock™ (or other nutrient binding substance) to one of the tributaries to Lake Powell (e.g. Seven Mile Creek). Implement a trial if appropriate.	(06) L	DoE	2.3	2	2	4	1	Need to fully assess the benefits, risks and cost-effectiveness of this trial before consideration of long term application.
	2. After 5 years operation (2007), assess the effectiveness of the existing Torbay artificial wetland basin as a nutrient reduction option for the catchment. Arrange installation of further trials of in-stream nutrient stripping techniques on one of the tributaries to Lake Powell (e.g. Grasmere Drain).	(07) H	DoE, TCG	4.3	2	4	2	2	Ongoing monitoring of existing artificial wetland is essential.
	3. Review 'best practice' options to manage sediments in waterways, drains and the lakebed.	(05) H	DoE, WC	4.4	2	4	4	3	Review existing best practice guidelines for public drains (Regeneration Technology and JDA, 1999). Link with current lake bed sediment research. Contract services to provide a preliminary assessment of sediment removal options, including dredging, from drains and lake beds.
T1MAT4: Future land use development in the Marbellup Brook catchment complies with public water supply objectives for the catchment.	1. Develop an appropriate land use classification that identifies potential threats to the quality of public water supply and identifies water quality criteria relevant to the Marbellup Sub-catchment.	(05) H	CoA, DoE, TCG	4.2	1	5	5	2	Implement through land use planning actions. Link to water source protection plan.

Theme 2 – Water Quantity

Goal

Water is allocated for sustainable use while ensuring that adequate water is provided to all waterways and wetlands to protect their environmental values.

Objectives

- Flow in Marbellup Brook is adequate to maintain ecological requirements
- Water Regimes for Lake Powell, Lake Manarup and Torbay Inlet are suitable for the survival and growth of native aquatic plants and animals
- The drainage district is managed to meet the needs of current land uses, future land uses, and the environment
- Those who benefit from the use of the catchment to provide environmental services contribute to the costs of restoration.

Targets for Resource Condition Change

2.1: Major wetlands and waterways are receiving adequate water throughout each year to maintain ecological functions by 2015
2.2: Maximum use of surface water and groundwater resources for private and public benefit within identified sustainable yield.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T2MAT1: Environmental Water Requirements are determined for Marbellup Brook, Lake Powell, Lake Manarup and Torbay Inlet by 2007	1. Prepare 'Environmental Water Requirement' assessments for Marbellup Brook, Lake Powell, Lake Manarup and Torbay Inlet.	(05) H	DoE	4.5	4	5	4	2	Contract services to be arranged for assessment of each wetland. Water Corporation would be expected to undertake for MarbellupMarbellup, as part of approval process for water supply abstraction.
	2. Use monitoring information to establish the extent to which the environmental water requirements are met under current flow regimes and the current operating strategy for the drainage system.	(ongoing) H	DoE	4.3	4	5	3	2	Assessment to be based initially on current stream flow monitoring with recommendations for additional measures if required.
	3. If necessary, develop strategies to meet environmental water requirements, or determine the impact and acceptability of reduced flows.	(06) M	DoE	4.2	3	4	3	2	Linked to water allocation planning for MarbellupMarbellup Brook and also to land use impact assessments, including the effect of commercial tree plantations on ground and surface water resources.
T2MAT2: Water resources in the Marbellup Brook Catchment are proclaimed under the Rights in Water and Irrigation Act (1914) and a Water Resource Allocation Plan is prepared, including an assessment of changing land use and climate change, by 2007.	1.Develop an allocation plan for the Torbay Catchment to ensure water is available for private and public users on a sustainable use basis, and meets environmental water requirements.	(06) H	DoE	4.9	3	5	4	2	According to requirements under Rights in Water and Irrigation Act
	2. The Marbellup Sub-catchment is proclaimed under the *Rights in water and Irrigation Act (1929)* so that water use allocation is controlled by licensing.	(06) H	DoE	4.5	1	5	2	1	Subject to approval by Water and Rivers Commission Board.
	3. Investigate the impacts of commercial plantations (e.g. blue gums) and farm forestry on water supply availability in Marbellup Brook, and determine an area limit for blue gums to maximise water availability and water quality.	(06) M	OWP, DAWA, FPC, DoE	5	1	2	3	2	Contract for services for water balance model to show impact of land use and climate change on water resources.
	4. Assess the potential impact of climate change on water resources in the Marbellup Brook Catchment.	(06) M	DoE, DAWA	4.2	2	3	1	2	Include in water balance model for previous action.

Table C5 (b)

Theme 3 – Drainage Management

Goal

Drainage in the Torbay district is managed to best meet the needs of current land uses, future land uses, and the environment.

Objectives

- The impact of flooding on horticulture is minimised
- Flooding in residential areas is minimised
- The potential adverse effects of drainage management on fisheries in minimised (including commercial fisheries and native fish species)
- The impact of drainage management on algal blooms is minimised
- The drainage system is managed to prevent or minimize sedimentation of receiving water bodies.

Targets for Resource Condition Change

3.1 Lake Manarup, Lake Powell and Torbay Inlet are restored as functional wetland ecosystems (as indicated by successful breeding populations of waterbirds) by 2025.
3.2 Sediment transport in drains, and sediment deposition in Torbay Inlet and Lake Powell, is reduced by 50% by 2015.
3.3 The quality of water in all parts of the drainage system is suitable for direct contact recreational use by 2025

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T3MAT1: Options for change to drainage management to maximise water quality and public amenity in Marbellup Brook (including the section downstream of the Marbellup Plug) and Lake Powell are fully assessed by 2006.	1. Finalise the modelling of drainage management Option 5a (Remove Marbellup Plug, remove 'Gate 45' and install Lake Powell flood gates) to assess social and environmental outcomes, and the expected costs.	(05) H	DoE	4.7	4	4	5	3	Existing model can be applied to all components of Option 5a and linked to the flood risk assessment.
	2. Undertake flood risk assessment for Option 5a.	(05) H	DoE	5	3	4	5	2	Use of existing bathymetry and land survey information with internal planning or contract for services to prepare flood risk assessment.
	3. Improve ability to open and close the Marbellup valve for more frequent openings and monitor outcome.	(05) H	WC	5	2	5	3	1	
T3MAT2: The required regime for salt water flushing and maintenance of adequate water depth to improve environmental values in Torbay Inlet is identified and between key stakeholders, and is being implemented through management of sand bar openings by 2007.	1. Review current scientific research to determine the preferred salt water flushing regime for Torbay Inlet.	(05) H	DoE	4.8	4	5	3	Unable to rate	Linking to information provided in the recent review of water quality in Torbay Inlet (WRC, 2004a)
	2. Model the potential effect on the preferred salt water flushing regime for Torbay Inlet if drainage management were to adopt Option 1b (Current operating strategy with bar open during commercial fishing season) or Option 3b (North Creek bridge gates & pump (low-level system)).	(06) H	DoE	5	3	4	3	Unable to rate	
	3. Negotiate appropriate operating arrangements for opening the sandbar to achieve the preferred salt water flushing regime for Torbay Inlet.	(06) H	DoE, WC, TCG	5	3	5	3	Unable to rate	Negotiations required by the Water Corporation with commercial fishing licensees and community adjacent to Torbay Inlet. Consideration of potential effects on potato industry also to be considered.
T3MAT3: Lake Manarup is being maintained with adequate water for functions of the wetland ecosystem (without disadvantage to Lake Powell and Torbay inlet) by 2007.	1. Determine preferred hydrological regime (hydroperiod and water depth) for Lake Manarup to maximise environmental values.	(06) H	DoE, TCG	4.7	4	3	3	Unable to rate	Links to action in T2MAT1. TCG to clarify the preferred environmental values expected by managing the lake hydrology.
	2. Apply the hydrological model to Options 3a (Pump North Creek to Marbellup Creek Drain (high system)), 3aiii (Remove Lake Manarup Gates) and 3b (North Creek bridge gates & pump (low-level system)), to assess the water levels and period of inundation for Lake Manarup particularly in relation to opening of the sandbar and other factors of drainage systems management.	(06) H	DoE	4.5	2	3	3	Unable to rate	See T3MAT2 Action 2

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
	3. Estimate the volume of water to be pumped and the period of pumping required for Option 3b,	(05) H	WC, DoE	4	2	3	4	Unable to rate	Streamflow monitoring and hydrological modelling should be adequate to estimate pump volume under a range of rainfall event probabilities.
	4. Assess the potential flood risk associated with Option 3b.	(05) M	DoE, WC	3.8	2	3	3	Unable to rate	As above
T3MAT4: Reduce the impacts from sediments in Lake Powell and Torbay Inlet on water quantity and water quality	1. Assess the value of dredging and sediment remediation options and how they impact on water quantity and water quality.	(06) M	DOE, WC, TCG	4.8	1	2	4	3	Links to Theme 1, Target 3, Actin 3
T3MAT5: Public and private drains identified with high erosion risk or sediment transport are permanently stabilised by 2010.	1. Review the 'sediment risk' of public and major private drains, including further ground survey for management needs assessment,	(06) H	WC, TCG	5	1	5	5	3	Link to T1MAT3 Action 3. That action related to existing sediments, this action related to reducing sediment sources based on restoration and management. All related actions to be integrated.
	2. Revise Best Management Practice guidelines for public and private drain maintenance including: ▪ Revegetation techniques to stabilise banks, ▪ Improving channel roughness to reduce sediment transport capacity of flowing water, ▪ Earth works to re-contour drains to reduce sediment loss.	(06) H	WC, TCG	5	1	5	4	3	
	3. Restore private drains at risk of erosion according to management needs assessment priorities.	(06) H	WC, TCG	4.9	1	3	3	2	Resources required are estimates only. Action 1 will improve cost estimates
	4. Provide information and advice to ensure that new drains include appropriate design to minimise risk of nutrient, sediment and acid transport.	(07) M	WC	4.6	2	3	2	4	
	5. Rehabilitated and maintain public drains for multiple benefits but with the primary function remaining as flood control.	(ongoing) M	WC	4.7	1	3	3	2	
T3MAT6: The processes and extent to which sulphuric acid, nutrients and other potential pollutants are released from acid sulphate soils due to the current operating strategy of the drainage systems is known by 2006.	1. Determine the distribution and level of acidity (actual and potential) in soils of the Lower Torbay catchment.	(06) H	DoE, DAWA	4.2	1	4	4	4	
	2. Undertake sampling and analysis of drainage water, groundwater, aquatic sediments and biota to determine the environmental impacts of acid drainage on the Lower Torbay waterways.	(05 and ongoing) M	DoE	4.3	2	2	4	4	
	3. Evaluate the most appropriate drainage design to minimize mobilization of acid and nutrients from soil profiles.	(07) L	WA, DAWA, Potato Industry	3.9	1	3	1	4	
	4. Develop and implement training programs for on-farm land management practices that minimise the disturbance of acid sulfate soils.	(07) H	TCG	4.3	1	4	4	4	Potato industry to contribute to design to minimise on-site and off-site impacts by drainage in acid sulphate soils.

Theme 4 – Habitat and BiodiversityManagement

Goal

Biodiversity values are enhanced through improvement in the habitat of wetlands, waterways, the bush and the coast.

Objectives

- Minimum water quality and depth for aquatic ecosystem functions in wetlands is maintained
- The condition of foreshore vegetation and in-stream habitat is maintained or improved
- The habitat value and habitat connectivity for native fauna is improve and increased
- Population sizes and diversity of native freshwater fish and crustacean are maintained
- Requirements for fish passage and spawning in waterways are maintained
- Representative and adequate areas of pre-European vegetation types are retained
- The impact of exotic pest animal species on native fauna is reduced
- The impact of weeds on native vegetation and aquatic ecosystems is reduced.

Targets for Resource Condition Change

4.1 Major wetland systems have suitable water quality and adequate water depth for sustainable ecosystem functions by 2025.
4.2 All 'pristine' foreshore vegetation (A Grade) is permanently maintained and all 'good' foreshore vegetation (B Grade) is returned to 'pristine' condition by 2025.
4.3 All 3rd and 4th – order waterways have established permanent foreshore vegetation by 2015.
4.4 Identified waterway and terrestrial vegetation corridors are established for wildlife habitat as a part of a regional 'macro-corridor' by 2015.
4.5 Sedge lands and other vegetation types with inadequate regional representation are being managed for permanent protection by 2015.
4.6 All major wetlands have permanent functioning foreshore vegetation ecosystems by 2015.
4.7 Populations of native fish and crustacea are maintained or are increasing to sustainable numbers within aquatic ecosystem communities by 2025.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T4MAT1a More than 150km of priority waterways within the Torbay catchment currently unfenced are fenced and revegetated according to local 'best practice' for permanent management of foreshore vegetation by 2010. T4MAT1b A further 100km of vegetated stream buffers are established according to priority areas by 2010.	1. Combine all foreshore survey information for the Torbay catchment onto one map base. Show Stream 'ordering on the map. Establish priorities for fencing and revegetation based on criteria of: • 'pristine' and 'good' (classes A and B) foreshore vegetation, • 3rd and 4th order streams, • Channel erosion risk, and • Regional connectivity.	(05) H	DoE, TCG	5	3	5	3	1	Linked with T1MAT2 Action 1 Include stream monitoring information in format suitable for community interpretation.
	2. Prepare information sheets of local 'best practice' for riparian zone rehabilitation and management ('Stream-lining').	(06) M	DoE, TCG	3.4	3	4	3	2	Link to T1MAT2 Action 4
	3. Develop cost-sharing arrangements for vegetated stream buffering, including trial of an 'auction-based' system, considering regional and catchment priorities as well as public and private benefits.	(05) H	TCG	3.2	2	5	2	2	Link to T1MAT2 Action 5 (a basis for cost-sharing is proposed)
	4. Organise and provide on-ground support services to ensure that information is available to priority areas.	(05) H	TCG, DoE	4.7	1	5	4	1	Include services for advice on species selection, establishment of an arboretum (to show species suitable for multi-purpose corridors).
T4MAT2. More than 50% of sedge lands within the Torbay catchment are managed to maintain or restore ecological values by 2010.	1. Undertake detailed mapping of the sedge land vegetation type within the Torbay catchments and identify threats (e.g. invasion by *Typha orientalis*) and management requirements for permanent protection.	(06) M	DoE, CALM	3.8	3	3	3	2	Mapping to show distribution, current 'resource condition' and areas that could be restored a sedge lands.
	2. Prepare information sheets of local 'best practice' for sedge land management.	(06) L	DoE, CALM	3.3	3	3	2	1	Include options for re-establishment of sedge-lands (e.g. on land with chemical residues)

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T4MAT3 All viable remnant vegetation patches of regionally inadequate vegetation types greater than 1 Ha are fenced and managed according to local 'best practice' by 2010.	1. Prepare a catchment map/data base of vegetation types that identifies: • areas that are inadequately represented • areas greater than 1 ha in size • fencing status • priorities for protection.	(05) H	CALM, DAWA	4.4	4	5	3	2	Map to be developed from existing information.
T4MAT3 All viable remnant vegetation patches of regionally inadequate vegetation types greater than 1 Ha are fenced and managed according to local 'best practice' by 2010.	2. Prepare information sheets of local 'best practice' for remnant vegetation management.	(05) M	TCG, CALM, DAWA	4.5	3	3	4	2	Based on existing management information with review for local relevance by TCG.
	3. Arrange funding and cost-sharing arrangements for management of priority remnant vegetation within the catchment.	(05) H	TCG	4	2	5	1	2	Cost sharing to be consistent with regional arrangements (e.g. for the Kent River Recovery Catchment)
	4. Initiative a public awareness strategy on the value of remnant vegetation.	(06) M	TCG, CALM	4.3	3	5	1	1	Link with other public awareness for habitat and biodiversity management.
T4MAT4. More than 75% of the length of foreshore for Lake Powell, Lake Manarup and Torbay Inlet have a minimum 20 metre foreshore vegetation margin by 2015.	1. Undertake foreshore vegetation surveys for the 3 major wetlands, assessing threats, management requirements, and suitability for rehabilitation or extension of wetland foreshore vegetation	(05) H	DoE	4.5	4	4	1	1	A review of the appropriate buffer width for each of the wetlands should be undertaken following the survey. It is recognised that Lake Powell may have limited options for buffer width extension. Lake Manarup may have most to gain so is likely to be a higher priority.
	2. Review landowner boundaries and other cadastral information.	(05) L	COA, TCG	3.5	3	4	1	1	Combine review with clarification of land ownership associated with public drains.
	3. Review options for increased vegetation buffers through land purchase, increased reserve status, covenants, management agreements and others.	(06) L	DPI, CoA, DoE	4.2	3	3	1	1	Links with Land Use Planning theme.
	4. Prepare information sheets of local 'best practice' for wetland vegetation management on private.	(06) L	DoE, TCG	3.2	3	4	1	1	Link with a program of field involvement with group projects.
	5. Source funding and arrange cost-sharing for rehabilitation and management of priority wetland vegetation.	(05) H	TCG	4.1	2	5	1	1	Include community-based projects.
T4MAT5. Priority environmental weeds are mapped and have management programs for control to achieve 10% per annum reduction, with total control by 2015.	1. Undertake catchment - scale environmental weed mapping program	(06) L	TCG	4.2	3	3	1	3	Note that priorities for weeds have been previously established by the City of Albany and DoE, and that the TCG has a current weed eradication program for Watsonia.
	2. Prepare environmental weed management programs for priority species.	(06) L	TCG	4.2	3	3	1	3	Include review of options for *Typha* in Lake Powell and consider potential for community involvement, including progressive manual removal.
	3. Prepare information sheets of local 'best practice' for weed management.	(06) L	TCG, DoE	3.9	3	3	1	3	Adapt existing information (many sources) for local application. Seek advice from networks
	4. Arrange funding and cost-sharing arrangements for implementation of annual environmental weed management program.	(06) M	TCG	3.9	3	3	1	2	Funding to be available for individual landholder, but especially for community group initiative focused on environmental weed eradication.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T4MAT6. The environmental requirements of freshwater and marine fish and crustacea in waterways and wetlands of the Torbay catchment are understood and being managed by 2010.	1. Undertake surveys as required to establish the species of fish and crustaceans that utilise the waterways and wetlands as habitat or passage, and the environmental requirements for their use.	(current research) L	DoE	4.3	3	2	2	1	Include 'historical survey' to indicate what was there originally. Additional field survey may be required.
	2. Prioritise stream reaches and wetlands for in-stream habitat enhancement programs.	(07) L	DoE, TCG	3.6	2	2	2	1	Link with prioritisation of waterways for protection or restoration.
	3. Trial stream habitat enhancement (revegetation for temperature control, organic matter and food sources, and woody debris for shelter).	(07) L	TCG, DoE	3.4	2	3	1	1	Include assessment of options for re-introduction of native fish.
	4. Prepare information sheets of local 'best practice' for stream habitat enhancement specific to the Torbay catchment.	(06) L	DoE	3.4	2	4	1	1	Link to field activities and community involvement.

Theme 5 – Farming Systems

Goal

The farming communities have adopted bet practice systems for sustainable land use resulting in measurable agricultural and environmental benefits.

Objectives

- Sustainable farming systems are developed to maximise the efficiency of use of fertilisers, chemicals and energy
- Farm nutrient loss is reduced
- Soil loss from farms is reduced
- The impact of weeds on agricultural production is reduced.

Targets for Resource Condition Change

5.1 The total catchment nutrient load is reduced by 38% for nitrogen and 24% for phosphorus by 2025.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T5MAT1. Intensive animal industries and annual horticulture located in high or medium risk sites have adopted management practices that result in a reduction of the current industry nutrient surplus by 40% by 2010.	1. Calculate the current nutrient surplus from intensive animal or horticultural enterprises.	(06) H	DAWA	4.7	1	5	5	5	Need to develop a clear and easy to use process that is not too time-consuming for landholders. The process should be clear about the purpose and provide information to support the need for nutrient control, and possible incentive arrangements.
	2. Review management practices for nutrient reduction adopted for similar industries in other coastal rural areas (e.g. Busselton, Peel-Harvey catchment) and determine practices applicable to Torbay	(05) H	DAWA	3.8	1	5	5	5	Provide an indication of differing capacity within farm management to change (i.e. some may be near 'best practices', others not)
	3. Prepare and implement nutrient management plans for intensive animal and horticultural industries.	(06) H	DAWA, landholders	4.6	1	5	5	5	Seek opportunities to link these plans to industry accreditation (e.g. quality assured production programs).
	4. Evaluate and implement cost-sharing options and other policy instruments that provide incentives for adoption of 'best practice' management.	(05) H	DAWA, TCG	3.9	1	4	4	5	Link to current policy development for intensive animal industries. Compare with other similar areas in WA. Consider options for non-cooperation. Some cost sharing could be linked with Environment Investment Initiative as 'nutrient off-set' investment (through Water Corporation).
	5. Provide information and support for adoption of environmental management systems in the catchment.	(07) M	DAWA, landholders	4.4	2	4	3	5	Need to be clear about benefits to the industry to gain adoption.
T5MAT2.More than half of the landholders in the Torbay catchment, who derive more than 50% of their income from farming their properties, have prepared a 'farm nutrient surplus' calculation and response plan by 2010.	1. Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research.	(05) H	DAWA, TCG	4.9	1	5	5	5	Need to develop a clear and easy to use process that is not too time-consuming for landholders. The process should be clear about the purpose and provide information to support the need for nutrient control, and possible incentive arrangements.
	2. Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment.	(05) H	TCG, DAWA	4.6	1	5	5	5	Role for proposed TCG projects coordinator.
	3. Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment (Theme One – Water Quality and Algal Blooms).	(06) H	DAWA, DoE, TCG	4.5	1	4	4	4	The revised targets are to be achievable (i.e. by acceptable levels of change within farming systems) and remain relevant to nutrient reduction levels for waterway and wetland restoration.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
	4. Prepare demonstration property plans for one large and one small property within the Torbay catchment to show 'best practice' management for nutrient loss reduction.	(06) M	TCG, DAWA, DoE	4.5	1	4	3	4	Role for TCG Coordinator.
	5. Initiate a program for 'continuous improvement' of best management practices to achieve sub-catchment nutrient surplus reduction targets through review and evaluation of updated information by the catchment group, industry and the community.	(06) M	DAWA, DoE, TCG	4.3	1	3	3	4	Link to Monitoring and Evaluation plan.
	6. Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program.	(05) H	TCG, DAWA, DoE	4.8	1	5	4	3	Build on experience from other areas (e.g. the Peel-Harvey catchment).
	7. Arrange state, national and international 'farming systems' study tours for innovative landholders (eg. through a Churchill Fellowship).	(06) L	TCG	3.8	1	2	2	2	National and international travel could attract a bursary or similar funding opportunity.
	8. Establish visible community indicators (eg a nutrient reduction "barometre" at Elleker community store and other locations) and regular updates in the Albany Advertiser to show the level to which the targets are being achieved.	(06) M	TCG	3.9	1	5	3	3	Will require considerable support and require appropriate information available. Could also be located at other sites, such as prominent wetlands or demonstration sites.
T5MAT3 (a). More than 30 viable farming enterprises are adopting 'best management' practices according to nutrient management plans and are demonstrating achievement of defined nutrient surplus reduction targets without production loss by 2010. T5MAT3 (b)The use of slow release fertiliser or other appropriate fertiliser options for nutrient reduction is adopted over 25% of the catchment by 2010.	1. Promote and encourage adoption of soil and plant testing and analysis to guide appropriate fertiliser application according to production requirements.	(05) H	DAWA	5	3	5	5	5	Costs of analysis are considered to be too high and inhibit routine soil and plant testing. While the production benefits of testing should justify the costs, there is a need to review financial options to encourage broader adoption. This needs to consider the high proportion of non-viable farm units.
	2. Develop a *proforma* and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties,	(06) H	TCG, DAWA	4.3	2	5	4	5	Key role for TCG Co-ordinator. Contract for services required to develop 'audit and budget' tools.
	3. Increase community understanding of efficient fertiliser use, particularly of sulphur sources and trace elements.	(05) H	TCG, DAWA	5	2	5	4	5	TCG Coordinator to arrange. Specialist advice and support required.
	4. Develop a "Nutrient Management" information series, including developing 'best practice' notes for a range of farming systems and interest groups.	(06) H	TCG, DAWA	3.8	2	5	4	5	TCG Coordinator to arrange specialist advice and support.
	5. Promote and support research and development with fertiliser manufacturers to develop, trial and produce a slow-release fertiliser suitable for use in the Torbay catchment (eg 'Redcoat' fertiliser)	(05) M	DAWA	4	1	2	3	4	
	6. Improve community awareness of efficient fertiliser use by: • paddock-scale demonstrations and associated field-days • a bus tour for members of the Torbay Catchment Group to the Peel Harvey Catchment • disseminate information about productivity and environmental benefits associated with soil ameliorants fertiliser options (including the use of lime and 'Alkaloam')	(05) H	TCG, DAWA	4.8	2	5	3	4	TCG Coordinator to arrange.

Table C5 (e) - 2

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
	7. Evaluate the potential for delivery of bulk 'Alkaloam' supplies to the Torbay catchment.	(05) L	DAWA	3.5	1	2	3	4	Considering rail and road transport opportunities.
	8. Demonstrate and promote the adoption of surface water control and interception drainage structures in priority areas with high surface water run-off and potential soil loss.	(06) H	DAWA	4.8	1	3	5	5	Design and implement a demonstration site with interception drainage in an area where high soil loss potential is related to nutrient loss. Review existing Torbay catchment and Wilson Inlet drainage works.
	9. Arrange integrated surface water management plans on a sub-catchment basis for priority areas with high surface water run-off and potential soil loss.	(06) M	TCG, DAWA	4.5	1	3	4	4	Key role for TCG Coordinator.
T5MAT4. A total of 75% of land used for grazing is established with perennial plants (trees, shrubs or pastures) by 2015.	1. Undertake map analysis with field verification survey to identify the area of soils in each sub-catchment that have high nutrient leaching capacity and are suitable for establishment of perennial pastures, shrubs or trees.	(05) H	DAWA	4.4	3	5	5	5	Base on existing soil/landscape mapping and soil sampling. Some field verification required for land capability assessment.
	2. Develop a Perennial Pastures support and extension program suitable for both larger and smaller farm enterprises within the Torbay catchment (could be linked to or based on the existing 'Prograze' program).	(05) H	TCG, DAWA	4.4	1	5	3	5	Support group in a way that provides 1-on-1 farmer support (as occurs with WA Lucerne Growers Association).
	3. Initiate large-scale demonstrations of a range of perennial pastures, shrubs and trees options.	(06) M	TCG, DAWA	4.4	3	4	3	4	Selection of suitable properties could occur during 2005. Include both large and small-scale properties. Set up economic 'benchmark' indices.
	4. Develop a series of "Pastures Management" field days and information notes with support from industry organisations (e.g. the WA Lucerne Growers Association) for both perennials and annual pastures (focussing on both production and environmental benefits).	(06) M	TCG	3.9	2	4	3	5	Key task for TCG Coordinator role.
	5. Undertake a catchment-scale 'roll-out' program with cost-sharing arrangements establish perennial grasses and legumes in priority areas within the catchment	(05) H	TCG	4.1	1	5	3	4	'Roll-out' program to follow demonstration projects (Action 3).
	6. Establish a trial of Agonis juniperina as a perennial shrub with potential commercial and nutrient loss reduction benefits.	(06) L	TCG, FPC	3.9	2	2	2	2	Undertake in partnership with FPC. Link to CALM 'SEARCH' project. A 'trial plan' required to show expected site benefits (commercial, nutrient reduction) and risks (excess water use, invasive potential). Assume a trial of approximately 10 Ha.
	7. Develop agroforestry as an alternative land use: • Implement demonstration agro-forestry site (up to 50 Ha). • Develop an agro-forestry Information Series • Develop a Master Tree-Growers Course	(07) L	SCRIPT, FPC	3.1	1	2	1	2	There is resistance within the community to plantation forestry due to concern about spray drift and lowering ground water tables. This has influenced attitudes against agro-forestry. A large-scale demonstration (50Ha) with a range of species is suggested by some community members with the expectation that increased knowledge about the options will increase opportunities for adoption.
	8. Undertake research into the farm production and the benefits to water quality by nutrient loss reduction through the adoption of perennial pastures, shrubs and trees.	(07) M	DAWA	4	1	2	4	5	Undertake in partnership with DAWA.

Theme 6 – Land Use Planning

Goal

1. Regional and local planning provides the policies and mechanisms to implement new actions that are beneficial for natural resource condition, ensure that land is used according to its capability, and that further agricultural, industrial, commercial or residential development within the catchment does not compromise the environment.

Objectives

- Future land use, including new development proposals, should not exceed the capability of land resources and should demonstrate net nutrient reduction compared to current land use
- Land use intensification and further residential development within defined floodplain and buffer areas for Lake Powell, Ewart's Swamp, Lake Manarup and Torbay Inlet are controlled according to environmental management guidelines
- Construction of new public and private drains and maintenance of existing drains does not increase the risk of flooding, nutrient enrichment, acidification and sedimentation of waterways and wetlands
- Priority water resources are protected for beneficial use now and into the future
- Commercial tree plantations are controlled to ensure beneficial groundwater resources are not reduced and that the landscape visual amenity is maintained
- Future townsite growth within the catchment does not result in increased nutrient input to waterways and wetlands
- The area of reserves or other secure arrangements for wetland and biodiversity conservation are increased in priority locations
- The value of 'environmental services' to the City of Albany provided from the Torbay catchment is realised and arrangements are developed for payment by those that benefit
- The current landscape mosaic characterised by agriculture and natural vegetation is maintained
- Rural lifestyle and social values, including passive and active recreation opportunities, are enhanced.

Targets for Resource Condition Change

6.1 Landuse is matched to land capability within all local planning frameworks

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T6MAT1.Assessment of all applications for land development or sub-division are based on an analysis of land capability for the Torbay catchment using currently available land resource information, and adopt a 'Net Nutrient Reduction' principle.	1. Prepare a revised land capability assessment for the Torbay catchment that makes best use of current information and is suitable for management and planning purposes.	(06) M	DAWA, CoA	4.8	2	4	3	5	Contract for service to review current information particularly in relation to soil nutrient status and acid sulphate soils.
	2. Ensure the land capability assessment processes are included within the Local Planning Strategy and Town Planning Scheme for the City of Albany.	(05) H	CoA	4.6	2	5	4	3	Include as a part of service contract for Action 1.
	3. Ensure that the requirement for Nutrient Management Plans is prescribed in the LPS and TPS for significant Development Applications.	(05) H	DoE, CoA	5	2	5	5	1	Ensure format for required plans are standardised (i.e. as required under water resource protection plans
	4. Promote revised 'land capability' and 'net nutrient reduction' principles to landholders within the catchment through existing communication processes, and to development proponents through planning processes.	(06) H	CoA	4.9	2	4	4	5	Role for TCG catchment coordinator
T6MAT2 Assessment of all applications for land development or sub-division are based on a revised land capability analysis framework for the Torbay catchment using currently available land resource information by 2007.	1. Map priority areas within the Torbay catchment where further development may increase the risk to environmental values for consideration within the (draft) Lower Great Southern Regional Planning Strategy and the Local Planning Strategy and Town Planning Scheme for the City of Albany, including areas of high conservation value, buffers adjacent to wetlands and waterways, floodplain, and vegetation corridors.	(0) H	TCG, DoE, CoA, DPI	5	5	5	5	3	Consultation processes with community through TCG required. Contract required for GIS services.
	2. Ensure the TPS and LPS contain conditional requirements for development applications for areas of floodplains and buffers	(05) H	DoE	4.8	3	5	2	2	'Buffers' to be define in consultation with CoA and DPI
	3. Prepare provisions for proposed development within the mapped priority areas for consideration within the LPS and TPS	(06) M	CoA, DoE	4.4	3	5	4	2	
	4. Map priority areas that may be suitable for Regional Open Space or additional public access for consideration within the (draft) Lower Great Southern Regional Planning Strategy.	(05) H	TCG, CALM, DoE	4.2	3	4	2	1	To be undertaken with Action 1.

Table C5 (f) - 1

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
	5. Define the Marbellup Brook sub-catchment as a priority area to be considered in the Lower Great Southern Regional Planning Strategy and the LPS and TPS for the City of Albany.	(05) H	DoE	4.5	2	5	5	2	
	6. Ensure sub-division proposals are referred to the appropriate agencies for consideration of ceding Foreshore Reserves within mapped priority areas.	(05) H	CoA	4.1	3	5	2	1	
T6MAT3 All proposals for additional deep drainage and significant maintenance works within the Torbay catchment are assessed as Development Applications and on the basis of a presumption against drainage in areas identified at risk by 2007.	1. Prepare provisions to define deep drainage construction and maintenance as development for planning purposes and provide an additional 'Land Use Class' for drainage within the TPS and associated planning processes.	(05) H	DoE, WC, CoA	5	2	2	3	3	Link with proposed actions for drainage maintenance
	2. Include a presumption of no additional drainage construction in the LPS and TPS.	(06) H	DoE	4.3	1	5	3	3	
	3. Prepare policies and management guidelines for inclusion in the LPS and TPS to provide direction for planning approval processes and to promote 'best practice' drainage construction and maintenance	(06) M	CoA, DoE	4.4	2	4	3	4	
	4. Arrange for drainage development applications to be referred to the appropriate agencies and authorities (including the Department of Environment as a key agency and a partner of the Torbay Catchment Group).	(05) H	CoA, DoE	4.5	4	5	3	2	
	5. Communicate the risk of drainage construction and maintenance to landholders and responsible authorities within the catchment and promote 'best practice' management through catchment group communications.	(05) H	CoA	4.6	3	5	3	3	Role for TCG coordinator in association with other communication actions
T6MAT4 Proposals for commercial tree plantations within identified priority areas of the Torbay catchment are assessed as Development Applications through the TPS for the City of Albany with the presumption against this development in these areas by 2007.	1. Map priority areas in which commercial tree plantations should receive greater consideration because of water use and landscape amenity issues.	(06) L	DoE	3.4	1	3	4	1	The information should show that the onus is on the proponent to asses the impact of commercial tree plantations on groundwater resources in defined priority areas
	2. Provide definitions for 'commercial tree plantations' and 'farm forestry' or 'agro-forestry' for planning purposes.	H (05)	DoE	4.1	1	5	2	3	
	3. Ensure that consideration of 'commercial tree plantations within identified priority areas' as Development Applications is continued in the revised TPS for the City of Albany.	(05) H	DoE	4.4	1	5	2	2	
T6MAT5. Urban growth in the town of Elleker is planned to ensure no additional risk to waterways and wetlands and that the potential for flooding of residential development is minimal by 2007.	1. Identify and evaluate the on-site and environmental risk due to further urban development in the Elleker town site, including potential for increased nutrients to waterways and wetlands, impacts of acid sulphate soils, flooding and mal-odours.	(06) H	DoE, FPC, CoA	4.6	2	5	2	3	Informed assessment of risk by representatives of responsible government authorities as required.

Table C5 (f) - 2

Theme 7 – Community Education and Information

Goal

The community and partners understand the values of the catchment and are pro-active in implementing on ground works to achieve the share vision for the catchment.

Objectives

- All key stakeholders are willingly involved in implementing the restoration plan
- A high level of community awareness about the values of the catchment and about the best practices for sustainable management
- Further research in the catchment addresses priority issues, meeting community needs and is communicated to increase community understanding of environmental processes
- There is a significant level of community involvement in reviewing the restoration plan on a five yearly basis.

Targets for Resource Condition Change

7.1 By 2015 positive progress has been made to make restoration plan targets for improving catchment health measurable
7.2 By 2008 further funds have been received for ongoing implementation of the catchment restoration plan

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
T7MAT1. More than half of landholders and residents in the Torbay catchment are able to express clear understanding and support for the catchment Vision and restoration plan by 2010.	1. Appoint a full-time TCG Coordinator (3-year contract)	(05) H	TCG, DoE	5	5	5	5	5	Cost estimate includes salary, vehicle and on-costs.
	2. Conduct community forums and catchment tours to recommit to the vision, report on restoration plan implementation progress to date and provide opportunities for community involvement in reviewing priority actions.	Ongoing H	TCG	5	3	4	4	4	Awareness of the project in the catchment is generally quite low. Need to identify what it takes to get people involved: • Actions that get people involved, • Information days (including field trips) • Recognition of effort (building local pride in the project) • Provide incentives for community effort (benefits from group initiative) • Provide 'special interest' forums (e.g. for small landholders).
	3. Report on achievement of Targets and Actions in an annual 'Report Card' format	Annual H	TCG, DoE	4.6	3	5	4	2	
	4. Prepare a summary version of the Restoration Plan targeting specific interest groups and further engage community in reviews and amendments to the plan.	(05) H	TCG, DoE	4.4	2	5	2	2	
	5. Prepared a set of maps (for management Themes) with clearly identified locations and tasks for local involvement.	(05) H	DoE	4.7	2	5	3	3	Link with other actions for map preparation.
	6. Arrange clear and localised 'best practice' information that is relevant and achievable.	(05) H	TCG	4.2	2	4	3	4	Link with other 'best practice' information actions.
	7. Identify key 'barriers to change' and develop incentives or other measures to overcome these barriers.	(ongoing) M	DoE, TCG	3.9	2	5	3	4	Ongoing processes with group development.
	8. Initiate information and skills development opportunities for 'special interest' groups (e.g. small-scale landholders).	(ongoing) M	TCG	4.4	2	3	1	5	Key role for TCG Coordinator.
	9. Identify and support community leaders into specific roles for which they are well recognised.	(ongoing) H	TCG	4.7	1	4	3	3	Identify leadership in a range of forms, but particularly for the Management Themes.

Management Action Target	Actions	When	Who	1 - low priority, 5 - high priority					Comments
				TCG	CALM	DoE	WC	DAWA	
	10. Provide public recognition for individual and community actions undertaken according to the Restoration Plan.	(ongoing) H	TCG	4.4	1	4	3	1	Ongoing processes but with specific forms of recognition (e.g. identifying people with successful projects).
	11. Engage the community through involvement with schools and other related interest groups.	(ongoing) H	TCG, DoE	4.5	2	5	4	2	Link with existing programs, including 'Ribbons of Blue'
	12. Initiate community projects that have achievable outcomes and contribute to the targets of the Restoration Plan.	(ongoing) H	TCG, agencies	5	3	5	4	2	
	13. Organise cost-sharing arrangements and publicise these in ways that ensure that they are considered available to all in the catchment, including both small and large-scale landholders.	(ongoing) H	TCG	4.5	1	5	3	2	A key role for the TCG Committee
	14. Show that key partners (e.g. government agencies) are committed to the project and are contributing within the partnership framework.	(ongoing) H	TCG, agencies	4.8	4	5	4	4	Development of Partnership Agreements.
	15. Provide a clear statement of 'roles and responsibilities' for actions and information in the form of 'partner profiles' about the expected roles for involvement	(05) H	TCG, partner organisations	4.3	4	5	4	4	Informative brochures that clearly show the partnership arrangements.
	16. Develop and update a local skills audit and where ever possible use local people to undertake contract catchment restoration works.	(ongoing) M	TCG	4.6	1	3	1	2	Role for TCG Coordinator.
T7MAT2. More than 40% of landholders are attending at least one group event annually and have copies of or direct access to current research and information relevant to actions for implementation of the Restoration Plan by 2010.	1. Survey all landholders and residents biennially to monitor support for vision as well as review key issues or actions, and gauge attitudes to changing land management.	Biannual M	TCG, DoE	4.6	1	3	1	1	The 2003 social survey provides benchmark information for comparative analysis. Indicator Repeat social surveys show that the level of community involvement has increased to over 50% by 2010.
	2. Review the social benchmark survey information to identify key 'drivers' or 'barriers' for communication and information management for differing landholder interests and cultural or age groups.	(05) M	TCG	3.4	2	4	2	3	
	3. Maintain the 'Communications Learning Log' and ensure that a short summary of new group learning is widely distributed	(ongoing) L	TCG	3.6	1	3	1	1	Role for TCG Coordinator.

Best Management Practices (BMP)	Capital Cost of BMP Implementation	Net Cost or (Benefit) / Year
1st order vegetated stream buffers	$6110 / km	$475 / km
2nd order vegetated stream buffers	$5030 / km	$225 / km
3rd order + vegetated stream buffers	$3975 / km	$175 / km
Perennial pastures	$135 / ha	($60) / ha
Effective fertiliser use	$10 / ha	($9.40) / ha
1st order stock control, water management	$750 / km	$50 / km
2nd order stock control, water management	$1250 / km	$50 / km
3rd order + stock control, water management	$20 000 / km	$50 / km
Dairy effluent management	$75 / source	($3) / source
Piggery effluent management	$100 / source	($3) / source
Alkaloam soil amendment (5-20 tonnes / ha)	$70–$280 / ha	($40) / ha

(adapted from Weaver, 2003).

Table C6 - Cost estimates for implementation of Best Management Practices in Torbay Catchment.

Broad costs estimates for the drainage options are provided in Table C7. The infrastructure of the Albany Drainage District drainage system includes:

Infrastructure item	% of total replacement value
Drains and channels	29.0
Timber bridges	28.3
Concrete bridges	10.8
Pipe bridges and box culverts	15.0
Concrete structures	5.6
Timber checks	10.8

A financial analysis for the physical assets of the complete Albany Drainage System undertaken in 1991-92 shows the replacement costs to be $6.74m (Water Corporation, 1996). With the assumption that approximately half the infrastructure is within the Torbay catchment, then the replacement costs are estimated to be $3.35m. Based on a 5% rate of return, the Net Present Value (NPV) of the replacement costs is $6.3m. The NPV for the write-down value of infrastructure is estimated to be $2.94m.

OPTION SUMMARY

Options 1b, 3b and 4 considered most acceptable by the drainage management sub-committee.

- Option 1b provides better operating criteria for Lake Manarup, with the fishing industry constraint on bar openings removed.
- Option 4 provides for better operating criteria at Marbellup Brook, which should result in improved water quality and aesthetic impacts.
- Option 3b will have higher costs but does provide potato farmers with management flexibility while also providing benefit for Lake Manarup.

DRAINAGE MANAGEMENT OPTION	ESTIMATED COSTS	ACCEPTABILITY
1(a) Current Operating Strategy	• Continue with existing drainage management practices • Current operating and maintenance costs estimated to be $50 000/annum • Capital investment on an 'as needs basis' for upgrading or replacement of infrastructure • Capital replacement costs are estimated to be $6.3m	• Current operating and maintenance costs estimated to be $50 000/annum • There has been some opposition to management decisions performed at specific times in the past (e.g. bar openings during summer and commercial fishing season) from local residents and fishing licensees • Environment not specifically considered as part of the drainage system operating criteria.
1(b) Current operating Strategy with Bar Open during Commercial Fishing Season: Operation of the drainage system as for 1(a) but with Torbay Inlet sandbar opened during salmon fishing season.	• No additional infrastructure or management costs • Improved flexibility with drainage management for environmental outcomes and horticultural management.	• Requires written agreement between licensed fisherman and Water Corporation • Lake Manarup is not required as a flood compensating basin under this option • The community prefers Lake Manarup to attract aquatic and birdlife; and to reduce wind erosion of dry bed sediments (social benefit).
3. NORTH CREEK OPTIONS 3(a) Pump North Creek (Low-level system) to Marbellup High Level Drain (High-level system)	• Estimated capital cost to build pump station of $300 000 (including survey costs, approvals etc.) • Annual operational and management costs estimated to be up to $50 000	• A Cost/Benefit Analysis is required to realise the effectiveness of investment in this option • Inflow to Lake Manarup will be reduced if all stream flow from North Creek is pumped to the High-level system • Impact assessment of diverting acidic stream flow from North Creek to Torbay Inlet is required • This option could improve the quality of water in North Creek.
3(b) North Creek Bridge Gates & Pump (Low-level System)	• Construct Check Structure (floodgates and penstocks) at narrow bridge - estimated to cost $500,000 (current condition of the bridge needs to be considered) • Pumping equipment estimated to cost $100 000 • Annual operational and management costs estimated to be up to $50 000	• This option should provide improved ground water and surface water control in potato growing areas • Will allow increased flexibility in water levels in Lake Manarup (i.e. Lake Manarup will not require specific bar openings to be filled) • Upstream flood protection will be dependent upon the reliability of the pump system.
4. Open Marbellup Plug Valve	• Cost to remove existing earth bund estimated to be $10 000 • Cost to build larger capacity control valve and operating platform at Marbellup plug, retaining existing earth bund estimated to be $50 000.	• This option should achieve improvements to water quality in the currently stagnant section of Marbellup Brook. • There is a need to develop operating criteria if a new control valve is installed.
5. LINK LAKE POWELL TO HIGH-LEVEL SYSTEM Remove Marbellup Plug, Remove 'Gate 45' and install Lake Powell floodgates:	• Cost to remove existing earth bund estimated to be $10,000 • Remove floodgates and penstocks from Bridge 45 estimated to cost $50,000. • Build new structure [floodgates and penstocks] at Lake Powell estimated to cost $500,000. • Construction of a levee system to reduce flood risk estimated to cost $500,000. • Improve water channel capacity to accommodate significantly higher flows estimated to cost in excess of $500 000.	• Many unknown factors associated with this option (including suitability of soils, affect on the drainage system, the extent of area at risk to flooding, access to private land, stream flow velocities and volume). • In the event of failure of levees, there is potential for flooding of homes and properties. Who would be liable?

Table C7 - Estimated costs and level of acceptance for draining options In the Lower Torbay catchment.

C4.0 Capacity for Implementation

Implementing the Torbay Catchment Restoration Plan is dependent upon the effectiveness of partnership arrangements between the community, government agencies, non-government organisations, research institutions and industry bodies. The Torbay Catchment Group provides the appropriate forum for development of partnership arrangements.

C4.1 Leadership through the Torbay Catchment Group

The Torbay Catchment Group (TCG) is the lead organisation for implementation of the Torbay Catchment Restoration Plan. The community-based group formed out of concern for the effect of changing land use within the catchment, with particular concern for the degraded condition of waterways and wetlands. The TCG has provided the basis for development of the Watershed Torbay project with sub-committee structures contributing over a 4 year period to preparation of the catchment restoration plan . The Executive Committee of the TCG is responsible for implementation of the actions according to the targets in the Restoration Plan.

For implementation of the plan, the TCG will require a revised structure with increased focus on project management, community engagement and communication. It is proposed that this occur through a single Implementation Steering Committee to provide skills-based support for implementation of the Catchment Restoration Plan. The Implementation Steering Committee should report to the TCG Executive Committee.

Membership to the Implementation Steering Committee should include people with the appropriate skills from community and partner organisations. The key roles of the proposed Implementation Steering Committee are to:

- Review priorities for implementation of actions
- Prepare a 3 year Investment Plan
- Arrange investment funding for implementation
- Develop project management arrangements for implementing high priority actions
- Arrange appropriate service providers for implementation of actions
- Development of ‘best practice’ information
- Develop processes for information sharing and management
- Engagement of community and landholders
- Initiation of community involvement projects.

It is proposed that the roles of the Implementation Steering Committee are supported by a full-time employed Coordinator. This position would report to the Implementation Steering Committee. A cost allocation for this position in included with Action 1 for T7MAT1.

C4.2 Partnership Arrangements

The key partner organisations required for effective implementation of the Torbay Catchment Restoration Plan are listed in Table C4. Formal arrangements for each of these organisations with the TCG are required. These arrangements are to clarify the roles and responsibilities and provide commitment for provision of resources for implementation. The resources required are to be identified in the proposed Investment Plan.

The lead roles for organisations are shown in Table C8. The table also shows the organisations that are recommended for member representation on the Implementation Steering Committee.

Partner Organisation	Key Roles
Department of Environment	• Water resource protection • Project management • Communications • Community engagement • Monitoring and evaluation
Western Australian Department of Agriculture	• Diffuse source nutrient management • Farming systems development
Water Corporation	• Operation of the drainage system
Department of Conservation and Land Management	• Management of conservation reserves • Developing opportunities for increased biodiversity values
City of Albany	• Development and application of appropriate policy and planning mechanisms
South Coast Regional Initiative Planning Team	• Provision of resources for regional priority actions • Monitoring resource condition change
Centre of Excellence for Natural Resource Management	• Research and information support
Department of Planning and Infrastructure	• Regional policy and planning initiatives
Forest Products Commission	• Development of appropriate commercial farm forestry options

Note: the partner organisations identified in bold are recommended for member representation on the Implementation Steering Committee.

Table C8 - Partner Organisations for implementation of the Restoration Plan.

C4.3 Investment Planning

The Torbay Catchment Restoration Plan provides a long term strategic direction with medium term targets for achievement of actions, and a 3-year Implementation Program of prioritised actions. An Investment Plan is required to arrange funding from partner organisations and external sources.

Table C5 provides budget estimates for external source funding for the proposed set of actions for the 3-year Implementation Program. The Investment Plan will identify the respective partner organisation contributions to these actions (staff time and other resources).

The total budget estimates for external funding for all 3 Year Implementation Program actions are listed in Appendix 6.

Torbay Catchment Restoration Plan Theme	Cost
Theme One: Algal Blooms and Water Quality	$478 000
Theme Two: Water Quantity	$95 000
Theme Three: Drainage Management	$315 000
Theme Four: Habitation and Biodiversity Management	$244 000
Theme Five: Farming Systems	$181 000
Theme Six: Land Use Planning	$41 000
Theme Seven: Community Education and Information	$255 000
TOTAL 3 Year External Fund Budget Estimate	$1 609 000

Table C9 - Estimated costs of implementation of catchment restoration plan.

C4.4 Direction for Research and Development

There are key areas where additional information is required for management decisions. The research requirements for these areas are outlined below.

1. **Groundwater interactions as a source of nutrients to Lake Powell, Lake Manarup and Torbay Inlet.**

   Analysis of groundwater from 26 piezometers around the three water bodies has identified the potential for fluctuating groundwater tables to be a source of nutrients within areas of acid sulphate soils. The extent to which this is a contributor to nutrient enrichment requires further investigation.

2. **Nutrient discharge from potato farms to Lake Powell via flooding and or surface drainage.**

   There is an ongoing requirement to determine the interaction between potato farms and Lake Powell to assess the potential source of nutrient through both inundation due to Lake flooding, or localised surface water drainage to the Lake.

   Surface water flows to Lake Powell, or flood water receding into Lake Powell could be potential nutrient pathways.

3. **Sources of Nitrogen to Lake Powell and Torbay Inlet.**

   Analysis of aquatic plants is required to determine if the most significant source of nutrients in plants (algae) is from sewage, agricultural fertilisers or through nitrogen fixation. The outcome from this research will also help clarify community perceptions about the impact of the WWTP on Lake Powell.

4. **Sediment – Water Interactions and nutrient release.**

   Understand the interaction between sediments and the water column in Lake Powell and Torbay Inlet is critical to understand the overall nutrient balance, and role of sediments in providing nutrients to support algal blooms in summer. Lake Powell does not become anoxic due to its shallow depth (there is limited stratification of the water body due to mixing by wind). Some areas of Torbay Inlet do experience anoxic conditions on a seasonal basis.

   There is a further requirement to determine the N potential contained in the sediments within Lake Powell and Torbay Inlet. Sediments are to be collected, incubated under anaerobic conditions to release ammonia, and then analysed. This provides information on the potential for N release from sediments should anaerobic conditions

prevail. While low oxygen is not an issue for Lake Powell at the water interface, anaerobic sediments may be contributing to high pore water values and may be contributing significantly to nutrient cycling in Lake Powell.

5. **Environmental Criteria for Lake Powell, Lake Manarup and Torbay Inlet.**

   Research is required to enable further development of the decision criteria for assessment of drainage scheme options for management. This will require refinement of water level criteria to sustain viable aquatic ecosystems and to minimise algal bloom frequency and other impacts. Specific hydro-period and water level criteria required are to:

   - protect and aid recruitment of fringing vegetation, provide water-bird habitat, and protect other values (fish, invertebrates etc).
   - aid nutrient cycling (e.g. is bed drying required to aid denitrification?)
   - manage Typha spp. invasion in Lake Powell.