APPENDIX 5

POSSIBLE INDICATORS OF CATCHMENT HEALTH

(adapted from Duxbury, 2003)

NATURAL

Table A - Characteristic: quality of water in waterways and lakes.

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Frequency, size and content of algal blooms	State	✓	Not annually	Long term	✓	✓	✓	✓	✓	Do not currently measure size. Current sampling by DoE is a bit coarse as only monthly. Need to show the waterbodies separately.	The number of blooms and how toxic.
Flow of rivers and streams	Driving Force	✓	✓	✓	✓	✓	✓	✓	✓	Important for ecological requirements of rivers and lakes. Currently monitored by DoE. This is a central question in Paul Close's PhD. It is needed if water is to be extracted from Marbellup Brook.	
Can you drink the water?	State	✓	✓	✓	✓	✓	✓	?	✓	Not currently collecting data on pathogens or chemicals only salinity. Need to record on each river. Monitoring beyond salinity would need more frequent sampling and funding.	
Can you swim in the water?	State	✓	✓	✓	✓	✓	✓	?	✓	Same as above.	Relates to recreational use.
Estimated tonnes of P and N discharged from point sources	Driving force	✓ estimates	✓	✓ estimates	✓	✓	✓	✓estimates	✓	Can use estimates and model developed by Simon Neville and David Weaver. If want greater accuracy expensive to collect data.	
Estimated tonnes of P and N discharged from diffuse sources	Driving force	Estimates need to be calculated	✓	No – needs land use survey	✓	✓	✓	?	✓	Estimates from diffuse sources for Torbay catchment have not yet been calculated.	

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Estimated tonnes of P and N discharged from point sources	Driving force	✓ estimates	✓	✓ estimates	✓	✓	✓	✓estimates	✓	Can use estimates and model developed by Simon Neville and David Weaver. If want greater accuracy expensive to collect data.	
Estimated tonnes of P and N discharged from diffuse sources	Driving force	Estimates need to be calculated	✓	No – needs land use survey	✓	✓	✓	?	✓	Estimates from diffuse sources for Torbay catchment have not yet been calculated.	
Loads of N and P from rivers	State	Not really	Very long term - >10yrs	✓	✓	✓	✓	✓	✓	Currently done by Dept of Env. Good for comparison across different waterways but not over time because of yearly variability due to weather conditions.	
Concentrations of N and P from rivers	State	Not really	Long term - >5yrs	✓	✓	✓	✓	✓limited sampling points	✓	Currently done by Dept of Env. For 6 sites. Monitoring points are at the bottom of each sub catchment and are therefore insensitive to changes in part of sub catchments. Sampling 60 sites would show local changes.	
Catchment nutrient balance	Driving force	Not bad	Should be	✓	Data not yet fully collected	✓	Don't know yet	✓	✓		
Invertebrate species and numbers of each species	State	✓	✓	✓	✓	✓	✓	✓high for compreh-ensive sampling	✓	Quite high labour and testing costs. Does the community understand the importance of invertebrates as an indicator?	

Technical input: Andrew Maughan, Naomi Arrowsmith, Dave Rushton - DoE

Table B - Characteristic- Weed infestation in the catchment.

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Number of different problem weed species	State	✓	Not bad	✓	Not bad	✓	State of Veg	For limited weeds	✓	City of Albany road survey and TCG, but no private land info.	
Extent of weed infestation	State	✓	Depends on weeds chosen	✓	Okay for limited number	✓	State of veg	✓	✓	Would need to select specific weeds. Linked to quarantine issues – imported hay, utility land management.	
Number of new weeds	State	✓	✓	✓	✓	Less so	✓	✓	✓	Linked to quarantine issues – imported hay, utility land management.	
Area of weed control annually & cumulative – 1, 2 and 3 years	Response & driving force	✓hard for private land	✓	✓	✓	✓	✓	No	✓	City of Albany road survey and TCG, but no private land info readily available. Good feedback for TCG.	
% of households removing problem plants from gardens	Driving force	✓	?	?	No	✓	✓	✓if by survey	✓	Difficult to gather meaningful data. Would be good for awareness raising.	
Amount of imported hay	Driving force	Hard to quantify	Don't need exact numbers	✓	✓?	✓	✓very good		Hard	Important contributor to introduction of weeds. But not an issue in the Torbay catchment as it is typically an exporter rather than importer of hay.	There is little hay imported, in fact more is sold out of the catchment. So not relevant to Torbay.

Table C - Characteristic: Level of protection and extent of native vegetation and fauna.

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Area of vegetation protected in conservation estate	Response	✓	Depends	No	✓	? is this a community goal?	✓		Hard	Will remain static in terms of extent but there may be changes in the health of the vegetation.	
No. of ecosystem types represented in protected areas	State	✓	Depends	✓	✓	?	✓		✓to come with IMGs	Fairly static. Extent and health will depend on management particularly of vegetation on City of Albany reserves and private property.	
% of catchment area with tree cover	State	✓	✓	✓	✓	✓	✓	✓	✓	DoE will do this data collection.	
Annual biodiversity plantings	Response	Depends	✓	✓	Okay	✓	Raises awareness	✓	✓		
Area of land cleared annually for farming or urban development.	Driving force	✓	✓	✓	✓	✓	✓	✓ Should be!	✓	Dept of Env is intending to collect this data. Areas by location. Will only collect on people who have applied for permits to clear no incremental clearing by default.	
Status of threatened species	State	✓	Not so good locally	✓	✓	✓	✓	?	✓	Status of threatened species is a state wide measure – is it relevant to the catchment? A measure of biodiversity of native fauna and number of species might be more appropriate.	

Technical input: Melanie Price Department of Environment (previously environmental officer, City of Albany); Sarah Comer, ecologist, Department of Conservation and Land Management, Albany region.

Table D- Characteristic: Level of rehabilitation of waterways and drains with vegetation and bank stabilising.

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Fringing vegetation species and abundance	Driving Force	Long term	Long term	✓	Hard to monitor	✓	✓	Expensive	No	Needs extensive botanical knowledge for high level of data – costly.	
Level of foreshore protected – km of waterways fenced at different stream orders, area of revegetation	Response	✓	✓	✓	✓	✓	Not really	✓	✓	Is being collected already. Helps measure community interest and motivation levels.	
Foreshore condition including regeneration rates (every 5 years)	State	✓	✓	General trends	Medium	✓	✓	Every 5 years	No	Has been done once for most of major streams in Torbay. Provides good information on general condition and trends. It is labour intensive.	
Level of stock access to waterways – number of constructed stock crossings & offstream watering points	Response	✓	✓	✓	✓	✓	✓	✓	✓	Is being collected already. Helps measure community interest and motivation levels.	

Technical input: David Rushton, Department of Environment.

Table E- Characteristic: Status of fish stocks in the Inlet and waterways

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Fish harvest rates compared to the growth rate of the fish – using target species Black Bream.	State	✓	Long term	✓	Often used	✓	Top of food web	?	✓	Overall collection of fish harvest rates over growth is difficult as fish are hard to gather. Setting up a tagging study on black bream is reliant on fishermen, good media, signage and funding.	Ask Fisheries – Rod Lenentan Perth
Observed over expected range of species in waterways including number of exotics.	State	✓	Not great	✓	✓	Not high priority	✓	✓	No	We lave low diversity of species as a baseline so more difficult to measure change. Could include this in the invertebrate sampling.	Presence or absence
Observed over expected range of species in the inlet including number of exotics	State				Easy to monitor & commonly used					This would require a study of the fish community and how it works in Torbay especially as the estuarine environment is so changeable do to the opening of the bar and behaviour at different times of the year. Would need frequent sampling.	
How well do the streams function?	Driving Force	✓	✓	✓	✓	✓	✓	Not immedia-tely	No	Use index of stream condition developed elsewhere includes how good is habitat for fish, how stable are stream banks. Could be done at same time as five year foreshore condition surveying.	

Technical input: Paul Close PhD student, Centre for Excellence in Natural Resource Management.

ECONOMIC

Table F - Characteristic: Income levels of people living in the catchment.

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Weekly family income compared to state average.	State	✓	✓	✓	✓	✓	✓	✓	✓	Measures economic health	
Level of local employment.	Driving force	What does it mean?	?	✓	Needs a survey	Not really	Don't know	Needs a survey		Does this reflect an economically healthy community?	
Profitability of local business.	Driving force									Covered by income.	
Level of diversification of farm businesses.	Driving Force	Reasonably	✓	✓	Needs a survey	✓	✓	Needs a survey	✓	This is a characteristic of a successful region – less vulnerable to shocks in individual industries.	
Level of education achieved.	Driving force	✓	✓	✓	✓	Not really	✓	✓	✓	ABS collects. Don't look at in isolation from other indicators.	
Distribution of income gap between richest 10% and poorest 10%	State									Assumes income equality is a good thing. More relevant to industrial based economies.	
Where do people spend their money?	Driving force	✓	✓	✓	No data	✓	?	Needs a survey		People live in Torbay for lifestyle – how important do they see local spending?	
Good infrastructure eg internet, roads, electricity	Driving force	Hard	Subjective	?	No data	✓	✓	Needs a survey			

SOCIAL

Table G - Characteristic: Level of community participation in local organisations

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Number of farmers adopting best management land use practices (testing soil before fertilising, tree planting, fencing streams, perennial pastures etc)	Response	Provided you have data!	General - whether adopting or not	✓	Needs a survey	✓	✓	Needs survey		Is being gathered as part of Watershed Torbay project.	
Number of households involved in community groups and number of community groups	State				Needs a survey			Needs a survey		Was included in the catchment survey 2002.	
% voting in local government elections (every 2 years)	State	✓	✓	✓	✓	✓	✓	✓	✓		

Technical input: Duane Schouten, Great Southern Development Commission.

WELLBEING

Table H - Characteristic: Degree of satisfaction about living in the catchment area.

Possible Indicator	SMART – Simple, Measurable, Accessible, Relevant, Timely									Indicators selected by Technical Support and Comments	Indicators selected by Community Members of WTG
	Driving force, State or Response	Easy to interpret	Statistically meaningful	Can show trends	Easy to monitor, commonly used	Relevant to community goals	A good warning for other problems	Affordable	Action-based with targets & timeline		
Average number of years residing in catchment.	State	✓	✓	✓	✓	Not so much	✓	✓	Not really	ABS data	
Level of satisfaction.	State	Qualitative - needs a survey	Difficult	Maybe	Needs a survey				Not really	Requires regular surveying – responses can be variable very subjective!	Perhaps include in survey with a list checklist: safety, services, living rurally etc
Catchment population growth rates.	Response	✓	✓	✓	✓	✓	✓	✓	✓	Either high or negative growth rate can be a problem. Age profile is important – want an even spread.	
Attractive residential destination – measures by number and value of housing approvals.	Response	✓	✓	✓	✓	✓	✓	✓	✓	City of Albany data. Useful as long as there are not constraints to subdivisions in Torbay that would bias data.	
Feelings of Safety	Response	Not bad	✓	✓	Needs a survey	✓	✓	Needs a survey	✓	Could also tie this into local crime rate trends.	

Technical input: Duane Schouten Great Southern Development Commission.