### 4.4.2 Overall impacts of salinity

The true cost of salinity is the summation of the social, economic and environmental impacts. However, the environmental and social costs are difficult to quantify and even the quantification of the economic costs is limited. In an attempt to assimilate the economic, environmental and social costs of salinity across the region, a subjective assessment of social and environmental impacts was added to the quantitative economic assessment previously outlined. This process involved the following steps:

- The Technical Groups were asked to provide a social and environmental impact rating of between 0 (no impact) and 5 (high impact) for each of the regional asset classes and each Salinity Management Area. The Technical Groups were provided quantitative and qualitative information on the intersection of high watertables with various assets in each Salinity Management Area.
- The economic costs calculated for each Salinity Management Area and each asset were converted to a scale between 0 (no impact) and 5 (high impact)
- The social, environmental and economic impacts were summed for each region to give a score out of 15.

The results of the assessment are given in Table 10.

▪ **Table 10: Results of subjective assessment of total environmental, social and economic impacts**

| Salinity Management Area | Predominantly dryland or irrigated | Average Social Impact Rating (1 = no impact; 5 = high impact) | Average Environmental Impact rating (0 = no impact; 5 = high impact) | Average Economic Impact Rating (0 = no impact; 5 = high impact) | TOTAL SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT RATING (0 = no impact; 15 = high impact) |
|---|---|---|---|---|---|
| Clydebank | Irrigated | 2.9 | 2.4 | 5 | 10.3 |
| Port Albert | Dryland | 2.3 | 2.6 | 5 | 9.9 |
| Rosedale | Dryland | 2.1 | 2.3 | 4 | 8.4 |
| Heyfield | Irrigated | 2.4 | 1.9 | 4 | 8.3 |
| Nambrok | Irrigated | 2.4 | 1.8 | 4 | 8.2 |
| Maffra | Irrigated | 2.2 | 1.9 | 3 | 8.1 |
| Foster | Dryland | 1.8 | 1.8 | 4 | 7.6 |
| Bengworden | Dryland | 2.2 | 2.4 | 2 | 6.6 |
| Boisdale | Irrigated | 1.7 | 1.7 | 3 | 6.4 |
| Reeve | Dryland | 2.2 | 1.9 | 2 | 6.1 |
| Stratford | Dryland | 1.7 | 1.7 | 2 | 5.4 |
| Trafalgar | Dryland | 1.5 | 1.9 | 2 | 5.4 |
| Wellington | Dryland | 1.8 | 1.9 | 1 | 4.7 |
| Wilsons Promontory | Dryland | 1.4 | 1.5 | 1 | 3.9 |
| Walhalla | Dryland | 1.3 | 1.5 | 1 | 3.8 |

The assessment in Table 10 shows that the Clydebank Salinity Management Area has the highest salinity impact mainly due to the environmental significance of the wetlands in the area, the high economic cost of salinity to agriculture and the perceived social inequity of irrigation induced salinity affecting dryland properties in the downslope areas. Port Albert has the second highest impact due to the high economic impacts of both natural and induced salinity on infrastructure and agriculture. The Stratford, Wilsons Promontory and Walhalla Salinity Management Areas are all relatively unaffected by salinity.

chosen to determine future depth to watertable maps were based on the availability of bore monitoring information and the proximity to saline discharge areas and include:

- The Salinity Management Areas covering the Macalister Irrigation District and surrounds;
- Areas around observation bores in the southern regions of the Port Albert and Foster Salinity Management Areas;
- Areas around observation bores in the southern regions of the Bengworden Salinity Management Area.

There is no shallow aquifer bore monitoring data for the other Salinity Management Areas, so future depth to watertable maps could not be created.

***Macalister Irrigation District and surrounds***

Existing calibrated groundwater models for Nambrok, Clydebank, Maffra and Heyfield Salinity Management Areas were used to predict the watertable depth in 2020 and 2032. The future depth to watertable for the Boisdale Salinity Management Area was not determined due to the absence of a groundwater model for the area.

A summary of the current and future areas of less than 2 metres depth to watertable for each of the modelled sub-regions is given in Table 11.

- **Table 11: Current and predicted future depth to watertable from modelling results. Future depth to watertable assumes average rainfall and continuation of current salinity control works (eg private and public groundwater control pumping and conversion from flood to spray irrigation)**

| Salinity Management Area | Year | Area of less than 2 metres depth to watertable (Ha) | Percentage increase in area of less than 2 metres depth to watertable from 2003 levels |
|---|---|---|---|
| Nambrok | 2003 | 5110 | NA |
| | 2020 | 5760 | 13% |
| | 2032 | 6410 | 25% |
| Clydebank | 2003 | 9290 | NA |
| | 2020 | 10270 | 11% |
| | 2032 | 10210 | 10% |
| Heyfield | 2003 | 3310 | NA |
| | 2020 | 3420 | 3% |
| | 2032 | 3270 | -1% |
| Maffra | 2003 | 2050 | NA |
| | 2020 | 2040 | 0% |
| | 2032 | 1810 | -12% |
| Boisdale | 2003 | 1530 | NA |

The figures in Table 11 show that despite the salinity control measures already in place in the irrigated areas and the continuing conversion of land from flood to spray irrigation, the watertable will continue to rise in the Nambrok and Clydebank Salinity Management Areas assuming a return to average rainfall conditions. The watertable is likely to remain steady in Heyfield. In Maffra, the existing salinity control measures and continued conversion of land from flood to spray irrigation are likely to result in a decrease in area with a high watertable.

The significant investment into public groundwater control pumping and the free flowing bore network through the Lake Wellington SMP and even as far back as the 1960s has reduced the water levels in many parts of Nambrok and Clydebank. Without public groundwater control pumping and the free flowing bores, the area affected by a high watertable in these areas would have been significantly larger.

***Bengworden Salinity Management Area***

The predicted changes in the area of less than 2 metres depth to watertable for the Bengworden Salinity Management Area are given in Table 12. The figures in Table 12 were determined from extrapolation of groundwater hydrograph trends (Appendix C).

- **Table 12: Predicted change in area of less than 2 metres depth to watertable in the Bengworden Salinity Management Area assuming a return to average rainfall.**

| Year | Area of less than 2 metres depth to watertable (Ha) | Percentage increase in area of less than 2 metres depth to watertable from 2003 levels |
|---|---|---|
| 2003 | 6000 | NA |
| 2020 | 6090 | 2% |
| 2032 | 6290 | 5% |

The results in Table 12 suggest that if no action is taken, by 2032 the area of less than 2 metres depth to watertable is likely to increase by about 5% assuming a return to average rainfall conditions.

***Port Albert and Foster Salinity Management Areas***

A predicted 2032 depth to watertable map was compiled for the Port Albert and Foster Salinity Management Areas assuming a return to average rainfall (Appendix C). The percentage change in depth to watertable across the Salinity Management Areas is shown in Table 13. The future predictions were determined by extrapolation of water level trends from observation bores (Appendix C).

▪ **Table 13: Predicted change in area of less than 2 metres depth to watertable in the Port Albert and Foster Salinity Management Areas assuming a return to average rainfall***

| Salinity Management Area | Year | Area of less than 2 metres depth to watertable (Ha)* | Percentage increase in area of less than 2 metres depth to watertable from 2003 levels |
|---|---|---|---|
| Port Albert | 2002 | 20110 | NA |
| Port Albert | 2020 | 24590 | 22% |
| Port Albert | 2032 | 25840 | 28% |
| Foster | 2002 | 5990 | NA |
| Foster | 2020 | 6040 | 0.8% |
| Foster | 2032 | 6050 | 1% |

* The limited monitoring bore network in the South Gippsland region restricted the creation of depth to watertable maps. There are a number of areas on the South Gippsland depth to watertable maps for which no data was available so these figures should be taken to be an underestimate of the area of less than two metres depth to watertable.

The results in Table 13 indicate that in the dryland areas of the Foster and Port Albert Salinity Management Areas the watertable is expected to continue to rise assuming a return to average conditions and that landuse remains essentially unchanged.

### 4.5.2 Future salinity impacts without a plan

The future depth to watertable maps presented in Appendix C suggests that in 30 years, the area of salinity affected land and water is likely to significantly increase in many areas if there is no additional investment in salinity remediation.

Using the future predictions of depth to watertable, estimates of the future economic costs of salinity were calculated using a similar methodology to the estimates of current costs (Table 14 and Table 15). The details of the calculations are given in Sinclair Knight Merz (2004b).

The increase in the social and environmental impacts is likely to be of a similar order of magnitude although are very difficult to quantify.

Environmental impacts are largely unquantifiable in economic terms, but are likely to include:

- Increased river, lake and wetland salinities
- Reduction in the environmental value of lakes and wetlands, including those that are Ramsar listed
- Loss of biodiversity through loss of vegetation communities and habitat

Social impacts are likely to include:

- Reduction in tourism to the area
- Loss of amenity
- Reduced financial income to support communities

▪ **Table 14: Estimated Current and Future Costs of Salinity by Salinity Management Area**

| Salinity Management Area | Estimated Current Cost of Salinity<br>($ per year,<br>rounded to nearest $ 100k) | Estimated Cost of Salinity in 2020<br>($ per year) |
|---|---|---|
| Port Albert | $ 1,300,000<br>$ 2,100,000 | $ 2,000,000<br>$ 2,900,000 |
| Clydebank | $ 1,900,000 | $ 2,400,000 |
| Nambrok | $ 1,000,000 | $ 1,300,000 |
| Rosedale | $ 1,000,000 | $ 1,300,000 |
| Foster | $ 500,000<br>$ 1,100,000 | $ 600,000<br>$ 1,200,000 |
| Heyfield | $ 1,000,000 | $ 1,200,000 |
| Maffra | $ 600,000 | $ 700,000 |
| Boisdale | $ 600,000 | $ 600,000 |
| Reeve | $ 200,000<br>$ 400,000 | $ 200,000<br>$ 600,000 |
| Bengworden | $ 500,000 | $ 500,000 |
| Stratford | $ 300,000 | $ 300,000 |
| Trafalgar | $ 200,000 | $ 200,000 |
| Walhalla | > $ 0 | > $ 0 |
| Wellington | < $ 100,000 | < $ 100,000 |
| Wilsons Promontory | > $ 0 | > $ 0 |
| **Total** | **$9,200,000 -<br>$ 10,800,000** | **$ 11, 400,000 -<br>$ 13,300,000** |

▪ **Table 15: Estimated Current and Future Costs of Salinity in West Gippsland Salinity Management Plan Area by Cost Category**

| Cost Category | Estimated Current Cost of Salinity<br>($ per year) | Estimated Cost of Salinity in 2020<br>($ per year) |
|---|---|---|
| Lost Agricultural Production | $ 7,600,000<br>$ 8,600,000 | $ 8,400,000<br>$ 9,500,000 |
| Roads and infrastructure | $ 700,000<br>$ 1,100,000 | $ 1,600,000<br>$ 1,900,000 |
| Buildings | $ 800,000<br>$ 900,000 | $ 1,200,000<br>$ 1,600,000 |
| Underground Services | $ 100,000<br>$ 200,000 | $ 200,000<br>$ 300,000 |
| **Total** | **$ 9,200,000 -<br>$ 10,800,000** | **$ 11,400,000 -<br>$ 13,300,000** |

### 4.5.3 Impacts of climate change

The degree to which climate change will affect West Gippsland is not clear, but CSIRO (2002) suggests annual average temperatures will increase by up to 1.4°C by 2030 and by up to 4.3°C by 2070. A 10% to 100% increase in the number of hot summer days (over 35°C) is expected by 2030 and a 30% to 400% increase by 2070 (DSE, 2004d). Increased temperatures, particularly during the summer months, will lead to an increased demand for irrigation water in irrigated areas thus potentially increasing irrigation recharge. Increased temperatures would also increase bushfire frequency (CSIRO, 2002) and the loss of large areas of native vegetation may increase recharge to the groundwater system. Higher temperatures, particularly in summer, may increase the melting of tar in roads (CSIRO, 2002). In areas where roads are already being affected by land salinity, this could exacerbate the problem and lead to a more rapid degradation of the road surface. Warmer conditions will also lead to increased evaporation (DSE, 2004d). Increased evaporation is likely to increase capillary rise from a shallow watertable thus increasing the rate of soil salinisation.

The overall indication for West Gippsland from CSIRO (2002) modelling is a decrease in rainfall with a change in the timing of rainfall. Lower average rainfall is likely to reduce the recharge to the groundwater system overall which should have a positive impact on land salinisation. This may also reduce the impact of salinity on infrastructure such as roads, buildings and underground services. However, lower rainfall would lead to reduced leaching of salts through the soil profile and the salinity of irrigation water would need to be more carefully monitored.

Based on the projected range of regional rainfall and potential evaporation changes, runoff has been estimated by CSIRO to decrease by up to 20% in the Latrobe River and by up to 25% in the Thomson River by 2030 (DSE, 2004d). A decrease in rainfall would lead to increased demand for water from both rivers (that would already be more stressed with a reduced flow due to lower rainfall) and groundwater. Lower river flows due to decreased average runoff (DSE, 2004d) would increase instream salinity in some rivers due to a higher proportion of saline baseflow. This may have additional impacts on biodiversity and river health. Increased river salinity would also limit the shandying capacity of irrigators extracting from the shallow aquifer system who currently shandy their saline groundwater with fresh channel or river water to ensure irrigation water is of a safe salinity level to use on pastures.

Sea level rise due to higher global temperatures melting the polar icecaps is likely to lead to increased coastal salinity, particularly in low lying areas such as parts of South Gippsland. The sea level is predicted to rise by 7cm to 55cm by 2070 (0.8cm to 8cm per decade) (DSE, 2004d). The water level in the Gippsland Lakes is also likely to rise due to the artificial entrance at Lakes Entrance and ocean induced salinity around the lake margins would increase. Any increase in the water level in the lakes would cause increased salinisation of wetlands adjacent to the lakes.

The rate at which global warming occurs will impact on the ability of the region to deal with the change and as more data becomes available, additional assessments of the impacts and potential mitigation measures will be necessary.