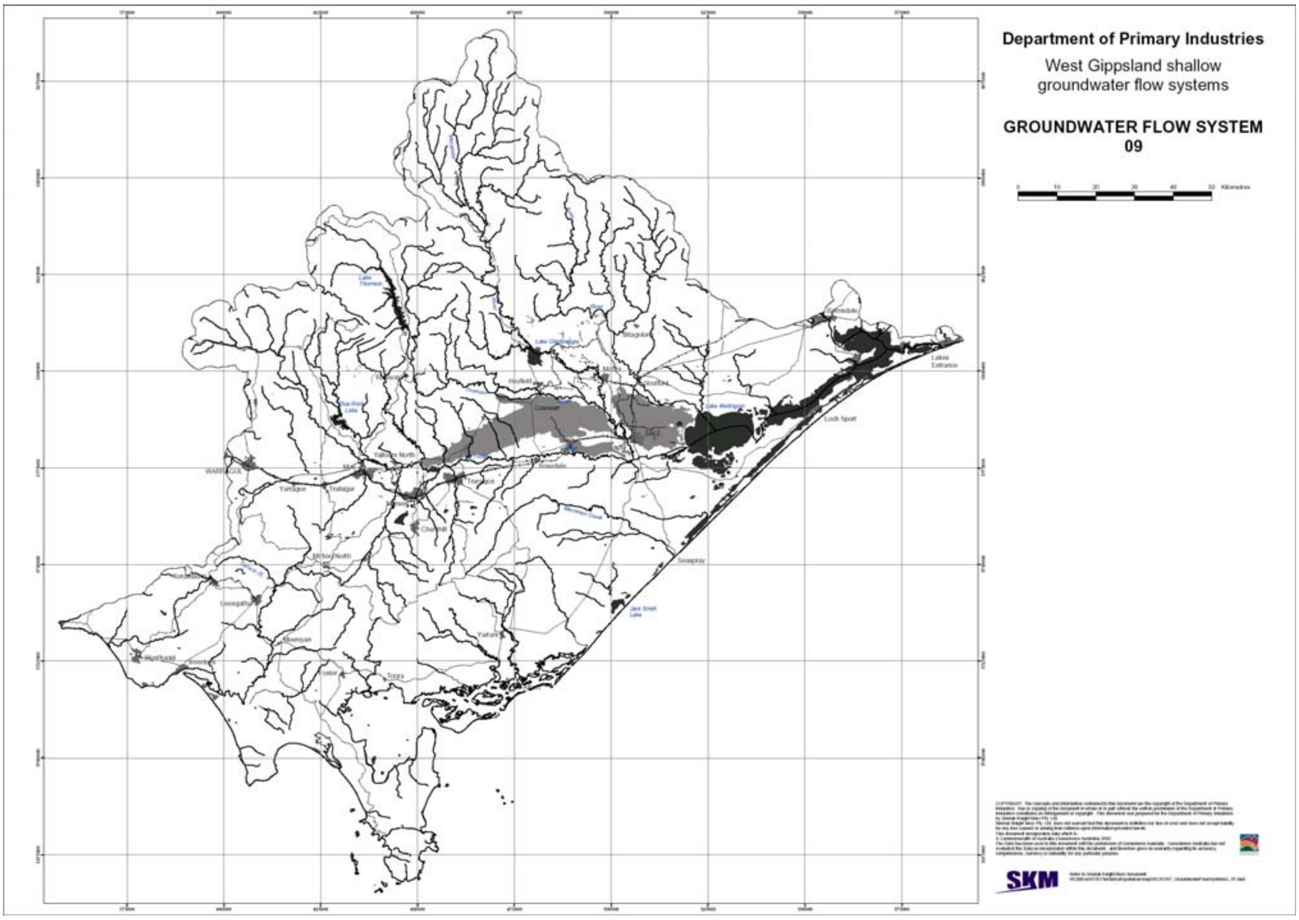
GFS 9: Quaternary sediments – MID

1. GFS definition



Geology constraint: Qpa

Slope Constraint: None

Area constraint: North of Latrobe River and west of Avon River

Rationale for choice of GFS: The water table in the Macalister Irrigation District and surrounds is known to be controlled by a semi-confined gravel alluvial aquifer between 10 and 20 metres deep. The proximity of this area to the source bedrock areas for the alluvial sediments means that it is a high energy depositional area with large gravels and sands being deposited but not seen elsewhere in the region.

GFS priority: High

2. The salinity problem

Salinity occurrence: Most severe salinity occurs in the dryland plain areas of Nambrok and Clydebank areas adjacent to the irrigated areas. Lower level salinity occurs within the low lying areas of the irrigated areas. (Source: West Gippsland Land Salinity GIS layer, SKM (2001a), SKM (2001b), SKM (2002a), SKM (2003))

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Assets being affected: Irrigated and dryland dairy agriculture with a smaller extent of beef and horticulture, wetlands, roads, buildings and other infrastructure (eg RAAF Base). (Source: WGCMA (2005))

Area of mapped land salinity: 3389ha Class 1, 1712ha Class 2, 1053ha Class 3, 169ha undifferentiated (Source: SKM (2001a), SKM (2001b), SKM (2002a), SKM (2003), West Gippsland Land Salinity GIS layer)

Area of primary and secondary land salinity: 6203ha secondary salinity, 119ha unknown (Source: West Gippsland Land Salinity GIS layer, WGCMA (2005))

Area of wetland salinity: Key wetlands being affected by salinity include Clydebank Morass, the Heart Morass, Sale Common, Lake Kakydra plus numerous other smaller wetlands.

Surface water salinity: Saline drains intersect high water table areas and carry saline water from Public Pumps to rivers and Lake Wellington. (Source: SKM (2002b)) Monitoring stations with less than 100% attainment of 90^{th} percentile salinity SEPP: Avon River at Stratford (94%)

Salinity process: Irrigation and clearing results in recharge to a semi-confined gravel aquifer that discharges in low lying areas down-gradient (Source: SKM (1998))

Current area of less than 2m depth to water table: 8404ha <2m (West Gippsland DTWT GIS layer, SKM (2004c))

Groundwater salinity: Variable, low to high (500 to 40,000µS/cm). (Source: SKM (1998))

Land salinity trend: Currently stabilised (Source: WGCMA (2005))

Groundwater level trend: Decreasing trend over last few years due to below average rainfall. Longer term increase in water table levels corresponding to the introduction and expansion of irrigation. Modelling indicates water table levels are likely to continue to increase in the Clydebank and Nambrok areas but remain steady in the Heyfield area and decrease in the Maffra salinity sub-regions due to the gradual introduction of more efficient spray irrigation on the higher permeability soils. (Source: SKM (2004c))

3. Landscape attributes

Area: Plains

Geology: Quaternary sediments (Qpa)

Topography: Low flat plains

Soil permeability: Generally very low, moderate or high with some areas of low permeability.
(Source: West Gippsland Soil Permeability GIS layer)

Annual Rainfall: <600-700mm on average. (Source: West Gippsland Annual Rainfall GIS layer)

Annual Evaporation: 950->1000mm on average. (Source: West Gippsland Annual Evaporation GIS layer)

Landuse: Predominantly dairy, some beef. Small areas of native vegetation and dairy.
(Source: West Gippsland Landuse GIS layer)

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4. Hydrogeology

Geology: Sands, gravels, clays

Aquifer type: Unconsolidated sediments

Hydraulic conductivity: Shallow gravel aquifer: 0.1 to 50m/d
Water table aquifer: 0.001 to 0.1 m/d (Source: SKM (1998) and SKM (2004c))

Aquifer transmissivity: Shallow gravel aquifer: 10 to 2000m2/d
Water table aquifer: 0.001 to 0.5 m2/d (Source: SKM (1998) and SKM (2004c))

Aquifer storage coefficient: 0.005 to 0.05 (average for gravel aquifer = 0.02) d (Source: Toogood (2000) and SKM (2004c))

Hydraulic gradient: Downwards in top part of catchment, upwards in bottom part

Yield Variable, generally between 0.4 and 4ML/d

Temporal recharge distribution: Recharge in irrigated areas is reasonably even throughout the year. Recharge in dryland areas greatest during spring and winter rainfall periods. (Source: SKM (2004c)

Spatial recharge distribution: Recharge varies spatially depending on soil type and irrigation type. (Source: SKM (2001c)

Recharge estimate: Typical recharge rates:

Soil permeability	Spray irrigation recharge (mm/year)	Flood irrigation recharge (mm/year)
High to very high	144	795
Moderate to high	114	307
Very low to low	27	63

Aquifer uses: Stock and domestic, irrigation. Increased use of aquifer for irrigation over last 10 years especially in Nambrok Denison areas which is covered by the Denison Groundwater Management Area.

Scale of groundwater flow path: Intermediate flow systems with strong influence of shallow semi-confined gravel aquifer

Responsiveness to land management: Very responsive to groundwater pumping by far less responsive to vegetation changes

National GFS type most like (ref Coram et al., 1998): Intermediate 1 – Capillary discharge from unconfined aquifers in valley floors

Groundwater flow between GFSs: Groundwater flow from GFS 9 to GFS 12 (recent alluvials) especially along the flood plains of the Latrobe, Macalister, Thomson and Avon Rivers

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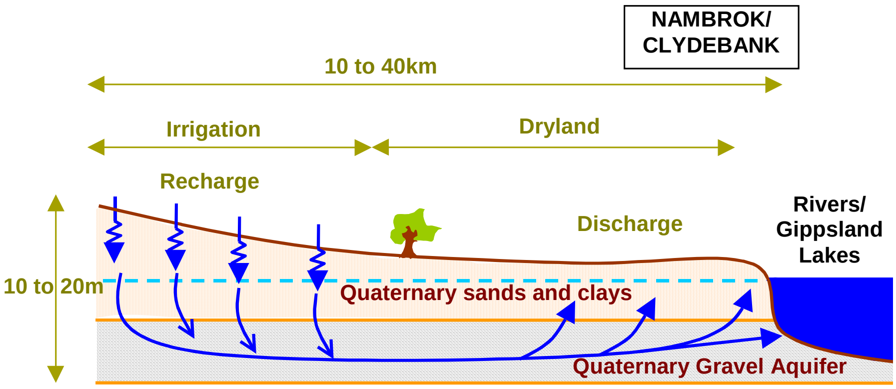
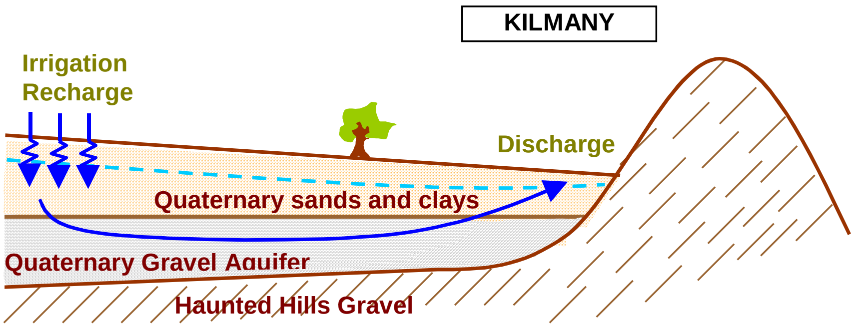
- **Figure 21: View from Kilmany overpass into the MID**

5. *Conceptual model of recharge discharge relationship*





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- **Figure 22: Clydebank salinity (Class 3)**

6. Salinity Management Options

Current salinity management: 19 Groundwater Control Pumps with another 7 in various stages of investigation (Source: WGCMA (2005))

Recharge control options: More efficient irrigation is a viable and effective option to reduce groundwater recharge. Revegetation options are limited to tree and perennial pasture establishment in dryland areas up-gradient of discharge areas. (Source: WGCMA (2005))

Pasture or crop potential	*Trees for biodiversity potential*	*Trees for forestry potential*	*Surface drainage potential*	*Irrigation management potential*
Weak	Weak	Weak	Moderate	Strong

Groundwater discharge enhancement options: Potential for further increase in private and public groundwater pumping to reduce water table levels. (Source: SKM (2002) and WGCMA (2005)). Potential for break of slope tree planting above saline discharge areas to intercept shallow groundwater.

Public groundwater control pumping potential	*Private groundwater pumping potential*	*Tile and mole drain potential*	*Break of slope tree planting potential*
Strong	Strong	Weak	Strong

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Living with salt options: Potential for using salt tolerant crops and pastures to increase productivity of saline land. (Source: WGCMA (2005))

Conflicts with other NRM programs: 1) Conflict between nutrient and salinity programs – nutrient program attempting to increase drain diversion of high nutrient drainage water but Public Pumps discharge saline water into drains potentially causing water to become unusable. 2) Conflict between groundwater management program aiming to maintain water table levels to ensure sustainability and salinity program aiming to reduce water table levels (Source: WGCMA (2005))

Synergies with other NRM programs: Ensuring more efficient irrigation is consistent with nutrient and water saving programs (Source: WGCMA (2005))

- **Figure 23: Lower river terrace on the Sale-Maffra Road**