CHOWILLA MODEL 2004

Purpose

This model was developed as part of a project investigating the design and construction of a groundwater management scheme for the Chowilla floodplain in 2004. As described in Yan, Howles and Marsden (2004), the model was used to:

- estimate groundwater flux and salt load entering the anabranch creeks from the aquifer system under low flow conditions
- predict salt load to the River Murray under different groundwater management options 100 years into the future under low flow condition
- improve the understanding of the hydrogeology of the regional aquifer system and processes in the Chowilla floodplain
- assist with broad scale planning of conceptual wellfield designs targeting the Monoman Formation, and predict the changes in groundwater levels that would be expected to occur under different Salt Interception Scheme scenarios, and the reduction in the low flow salt load being delivered to the River Murray
- assist with the design and location of investigation wells, production wells, and observation wells for pumping tests on the Chowilla floodplain.

Background

From Yan, Howles and Marsden (2004), a steady-state model was initially used to model pre-locking (Lock 6) conditions, after which a transient model was developed and applied to the historic period (1930–2004) to investigate the historic salt load being delivered to the river. The transient model was then applied to the prediction scenarios for a period of 100 years to determine the salt load being delivered to the river, and the EC impact at Morgan. Again, the calibration and all scenarios tested in 2004 were under low flow condition. Historical flood events were not simulated in 2004 modelling.

Between 2005 and 2010, the existing Chowilla model was used to simulate the aquifer hydraulic response to historic flood events and flooding induced by a regulator, using a simplified version (30 days interval) of the River Murray flow hydrograph of the past 30 years (Howe et al. 2007; Yan et al. 2008). The fundamental model parameters and conditions were not changed since model development in 2004, other than to apply the conditions necessary to simulate flooding.

Visual MODFLOW was used to develop the model and scenario modelling.

Location

The location of the model domain is shown in Figure 1.

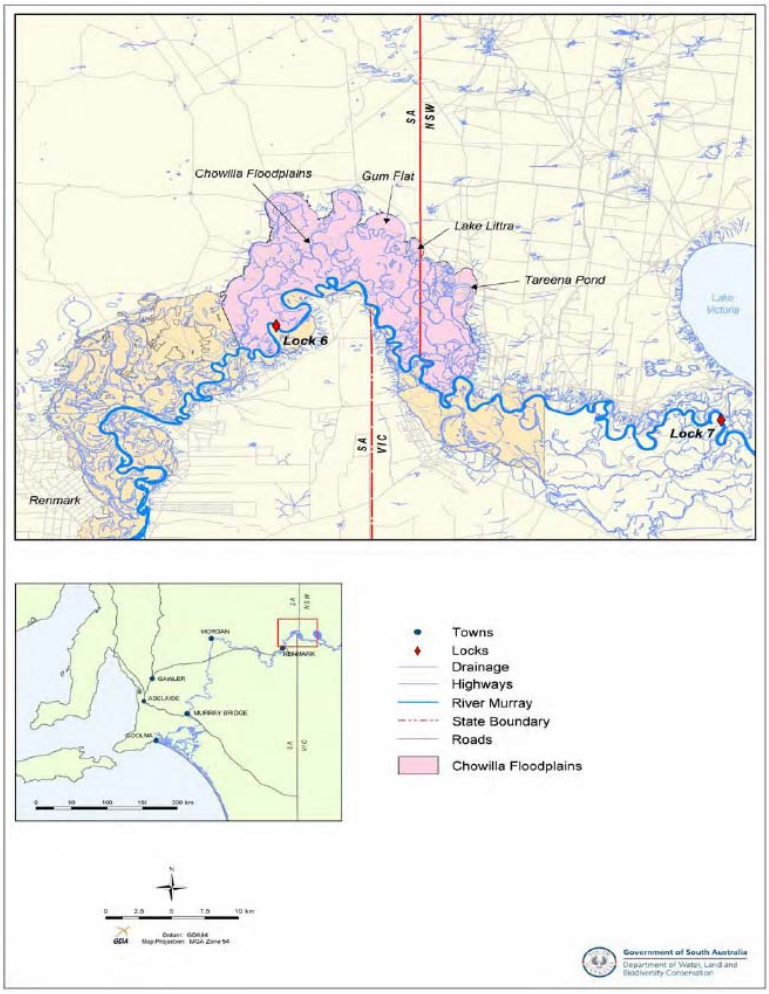

Figure 1. Chowilla model domain

Model structure

Model domain and grid size

The model domain simulates an area 55 km (east to west) by 45 km (north to south) and includes the western part of Lake Victoria and the entire Chowilla floodplain (Figure 1). The bounding coordinates are 470000E, 6220000N (south-west) and 525000E, 6265000N (north-east) (GDA 1994, MGA Zone 54).

The rectangular model grid is divided into 393 rows and 390 columns. The minimum grid size is 76.5 m x 62.5 m in the Chowilla floodplain. The maximum grid size is 305 m x 250 m in the remaining model area. The model grid was applied to five layers resulting in 312 500 finite difference cells.

Model layers

The regional aquifer system underlying the Chowilla floodplain was conceptualised as five layers, including four aquifer layers and one aquitard layer (Table 1 and Figure 2) and hydrogeological conceptual model in Figure 3.

Table 1 Model layers

Layer	Hydrogeological unit	Aquifer/Aquitard	MODFLOW layer
1	Upper Monoman Formation and highland Upper Pliocene Sands (upper part)	Aquifer	Type-3
2	Lower Monoman Formation and highland Upper Pliocene Sands (lower part)	Aquifer	Type-3
3	Lower Pliocene Sands	Aquifer	Type-3
4	Bookpurnong Formation	Aquitard	Type-0
5	Murray Group Limestone	Aquifer	Type-0

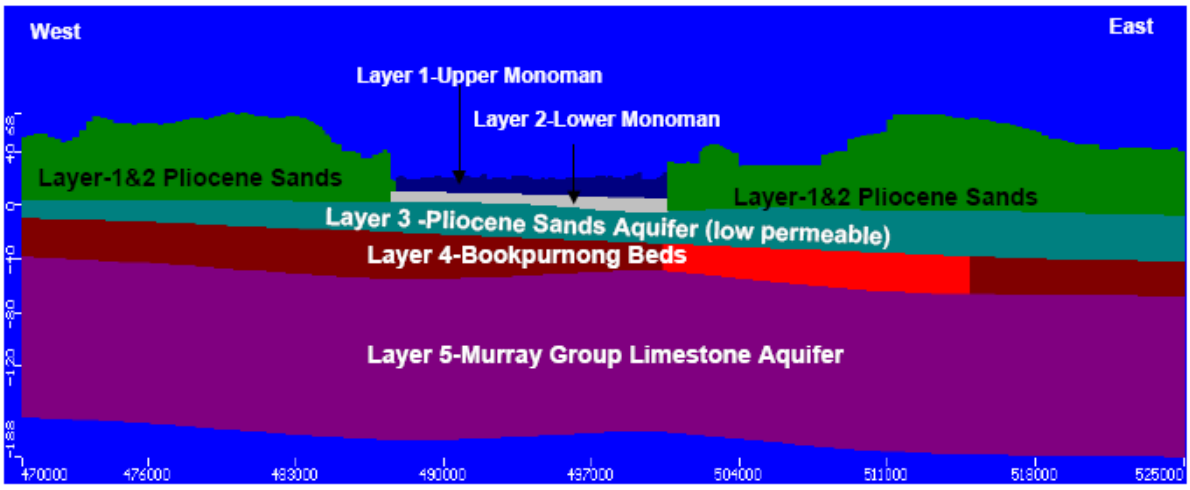

Figure 2. Cross-section

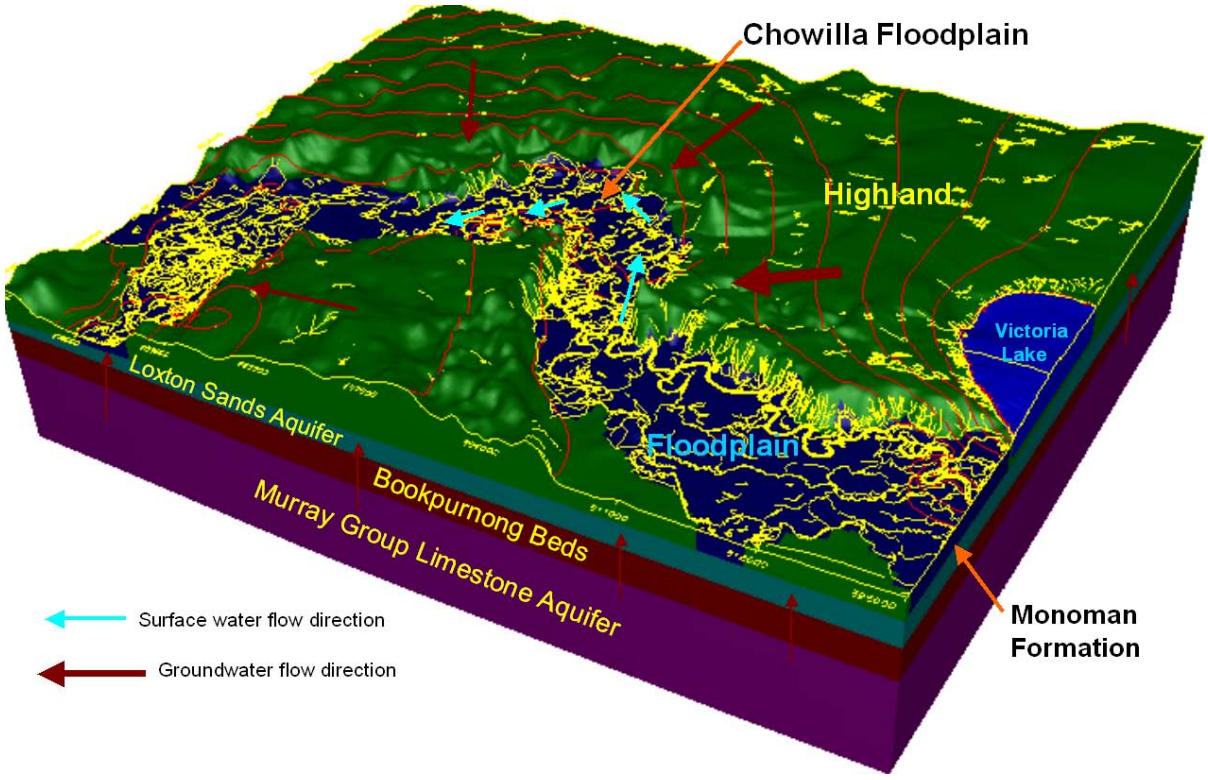

Figure 3. **Hydrogeological conceptual model**

Reports

Yan W, Howles S and Marsden Z, 2004, *Chowilla Floodplain Numerical Groundwater*, Report DWLBC 2004/65, Department of Water, Land and Biodiversity Conservation, Adelaide

Howe B, Yan W and Stadter M, 2007, *groundwater Impact Assessment of the Proposed Chowilla Regulator using the Chowilla Numerical Groundwater Model: Report 1*, Report DWLBC 2007/28, Department of Water, Land and Biodiversity Conservation, Adelaide

Yan, W and Howe, B (2008), *Chowilla Floodplain Groundwater Model*, Water Down Under Conference Paper 2008