

24 February 2015  
Project Number: PGW130005.01

Mr Nick Sibbel  
Manager Environmental Approvals  
Tronox  
Chandala Processing Plant  
PO Box 22  
Muchea WA 6501

Dear Nick

**RE: Review of groundwater modelling for Cooljarloo West expansion**

I am writing to provide comments on groundwater modelling undertaken by WorleyParsons Consulting to assess potential impacts of the proposed Cooljarloo West expansion.

**Basis for this review**

CDM Smith has reviewed all stages of development of the current model, and has provided regular feedback to Tronox and WorleyParsons that has influenced the model and the final report.

This letter has been prepared after reviewing a report prepared by WorleyParsons Consulting entitled "Cooljarloo West Expansion Groundwater modelling Report", Report 301012-01796, dated 30 January 2015.

**Australia Groundwater Modelling Guidelines**

The current Guidelines (Barnett et al., 2012) were released in mid-2012. The Guidelines state explicitly that they are guidelines rather than standards. They were prepared largely to help stakeholders (clients, regulators and the community) to understand the process of modelling, rather than to help modellers in their day-to-day work.

The Guidelines suggest a number of ways of planning and managing modelling projects, and make specific recommendations about reporting, reviewing and auditing. There is no specific requirement for a reviewer to complete checklists provided by Barnett et al. (2012). It is more important that the main stages in modelling be considered and assessed.

**Objectives**

The objectives of modelling are clearly stated. A clear description is provided of the history of mining and of the need to assess the potential impacts of the expansion project.

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### **A staged approach**

The model has been developed using a staged approach, with data analysis and conceptualisation leading to development and calibration of the model, followed by prediction.

### **Confidence level classification**

The Guidelines (Barnett et al., 2012) introduced the concept of a confidence level classification which provides a means of ranking the relative confidence with which a model can be used in predictive mode. The confidence level classification is based on assessment of the data on which a model is based (both for conceptualisation and calibration), the manner in which a model is calibrated and how predictions are formulated.

The Cooljarloo West model has a Class 2 level of confidence, which is not the highest possible level, but this level is believed to be appropriate for a brownfield mining expansion, where considerable experience has been gained during mining, and useful data have been collected, yet at the same time model calibration to represent all observations remains difficult.

### **Construction and calibration of the model**

The report describes a model developed using MODFLOW-NWT and the Groundwater Vistas graphical user interface.

The hydrogeological structure and choice of boundary conditions are reasonable, as is the method of representing dredge ponds that migrate across the landscape.

The model has been calibrated using observations of water table elevations and piezometric heads at depth during the period from January 1990 to March 2013. At a high level, agreement between observed and simulated heads seems reasonable. Discrepancies can be seen at the level of individual bores, but this is a regional scale model designed to show regional scale impacts, so some discrepancies are to be expected.

### **Predictions**

Figures in Section 8 of the report show predicted drawdown of the water table at the end of each year from year 2 to 17 of the mine expansion. The results are consistent with the movement of active dredge ponds. Maximum drawdown and the time at which maximum drawdown occurs are shown in Figure 8-10. The choice of “specified head” and “general head” boundary conditions on the eastern and western boundaries may limit predicted drawdown near these boundaries, but drawdown a kilometre or so inside the model boundaries is unlikely to be affected by the boundary conditions.

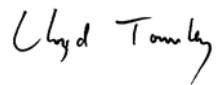
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It would be useful to see further discussion of the water balance of dredge ponds during mining. Some discussion of mechanisms that explain how the water table will recover following the end of mining would also be useful.

**Summary remarks**

Overall the model appears to represent historical mining at Cooljarloo reasonably well, and this provides confidence in predictions of drawdown during the Cooljarloo West expansion.

Regards



Lloyd Townley  
Principal Environmental and Water Engineer

*References:*

Barnett B, Townley LR, Post V, Evans RE, Hunt RJ, Peeters L, Richardson S, Werner AD, Knapton A and Boronkay A. (2012). Australian Groundwater Modelling Guidelines, Waterlines Report Series No.82, National Water Commission, Canberra.