



Appendix G

Non-Saline Groundwater Thermal Modelling

The formation and other parameters used in the model were summarized in [Table 1](#). Representative aquifer properties were assigned based on available data.

The ambient groundwater temperature was assumed to be 5, °C with a specific heat capacity of 4204 kJ/kg-K at that temperature. Specific heat capacities of the formations were assumed to vary insignificantly from one another, lower compared to the specific heat capacity of groundwater and were adopted as 835 kJ/kg-K for all formations. The ratio of specific heat capacities of groundwater and the aquifer material was used in the calculation of retardation coefficient in the model.

Table 1: Formations and Parameters Used in the Thermal Plume Model

| Formation (and Aquifer) | Material Type | Thickness (m) | Porosity Effective (V/V) | Kh (m/s) | Horizontal Hydraulic Gradient (m/m) | Ss (1/m) | Borehole radius (inches) |
|-----------------------------|------------------------------------|---------------|--------------------------|----------|-------------------------------------|----------|--------------------------|
| Undifferentiated Quaternary | Sand, some gravel | 20 | 0.30 | 5E-5 | 1E-2 | 2E-5 | 20 |
| Undifferentiated Empress | Sand fine to coarse | 40 | 0.25 | 2E-4 | 4E-3 | 7E-6 | 14 3/4 |
| Grand Rapids (Lower) | Sands to poorly cemented sandstone | 40 | 0.20 | 2.4E-5 | 2.5E-3 | 3E-6 | 14 3/4 |

3.0 RESULTS

The results of the modeling are presented in figures as temperature contour maps in each aquifer down gradient of the injection site. [Figure 2, 3 and 4](#), illustrate the predicted thermal plumes developed in the Undifferentiated Quaternary Aquifer, the Undifferentiated Empress Formation Aquifer and the Lower Grand Rapids Formation Aquifer, respectively, after 15 years. Based on the modelling results, after 15 years the plumes are expected to approximately 550 m in length in the Undifferentiated Quaternary and Lower Grand Rapids Formation Aquifers. The plume length is predicted to be approximately 820 m long in the Undifferentiated Empress Formation Aquifer.

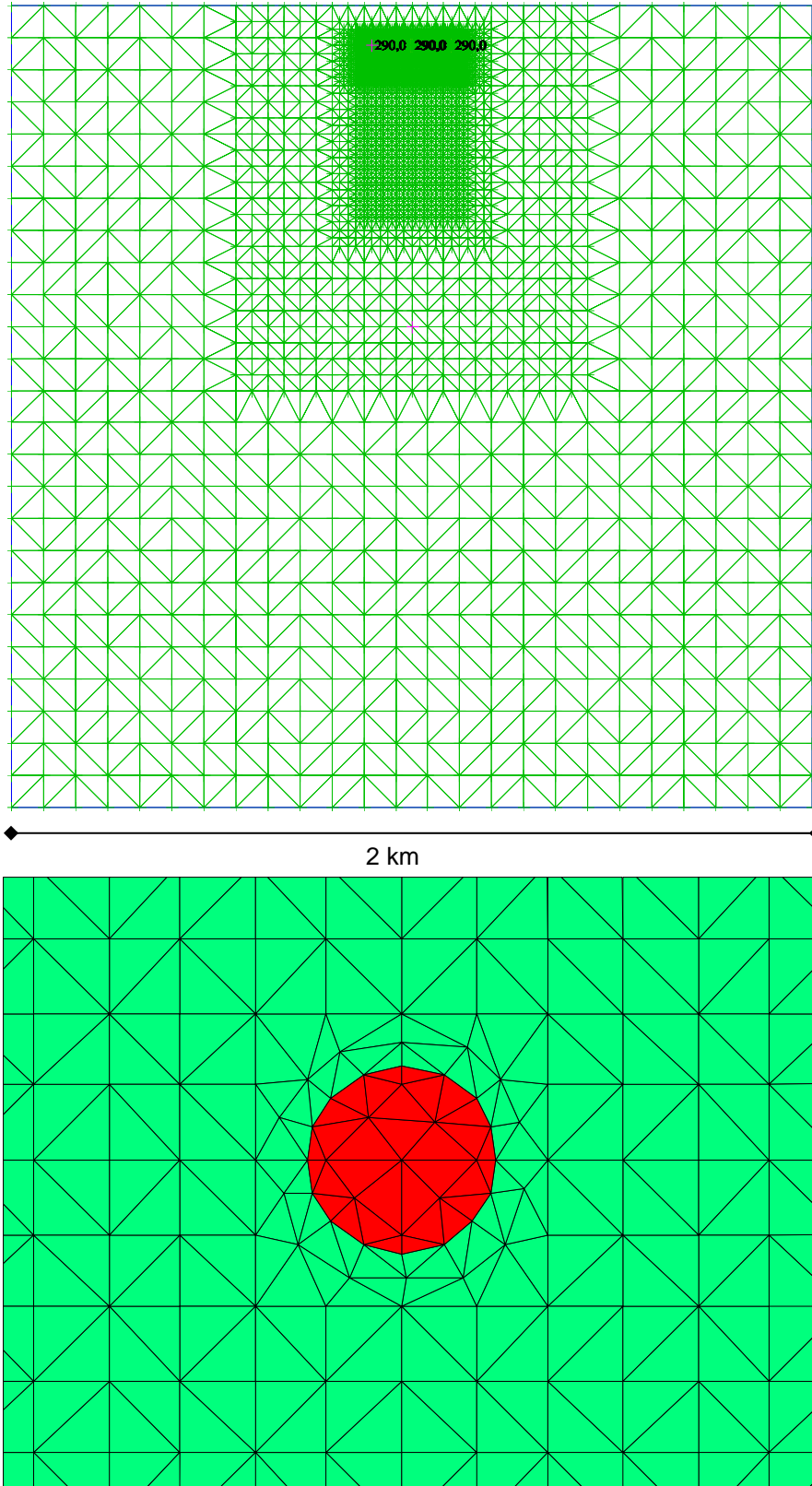
4.0 CLOSURE

We trust the information provided herein is sufficient for your requirements. If you have any questions please contact the undersigned.



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Associate Hydrogeologist

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**FIGURE 1 – Finite Element Model Grid and One Injection Well (50 cm OD)
Location Detail**

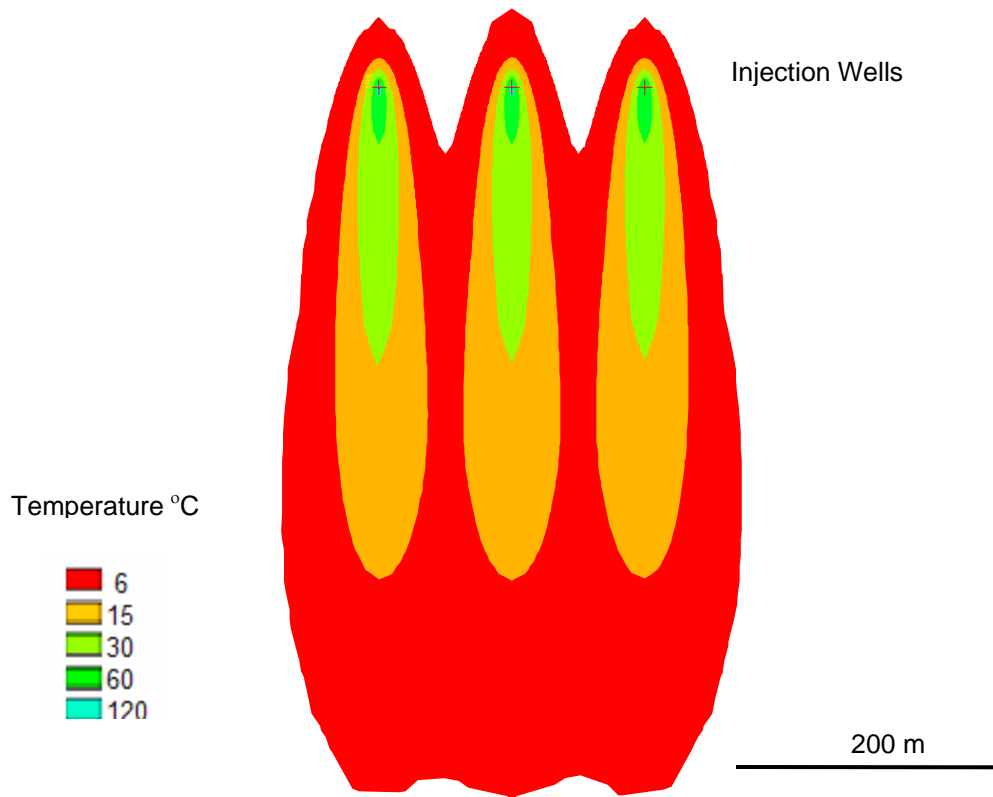


FIGURE 2 - Quaternary (Bonyville) Aquifer Temperature Contours at the End of 15 Years of Operation

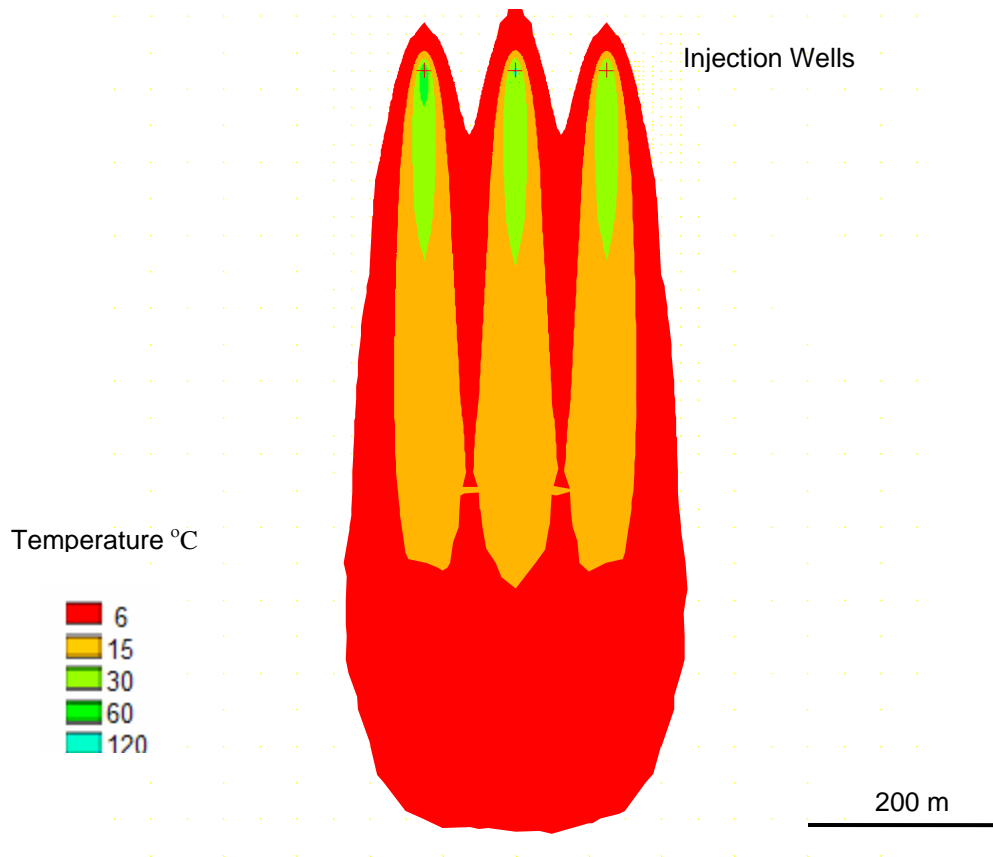


FIGURE 3 – Tertiary Empress 1 Aquifer Temperature Contours at the End of 15 Years of Operation

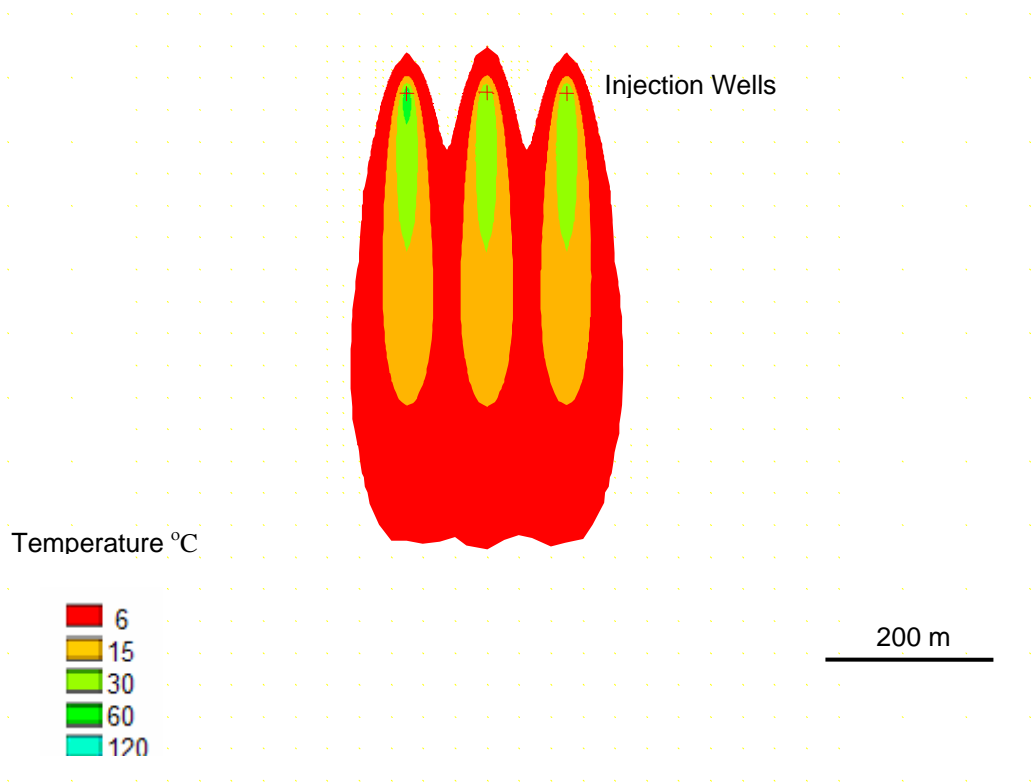


FIGURE 4 – Grand Rapid Aquifer Temperature Contours at the End of 15 Years of Operation