Technical Note

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Subject	Groundwater Impacts Assessment		

Introduction

The site of the proposed hospital is just south-east of the town of Bega. The plot is on gently sloping ground on the western flank of the shallow valley in which the Bega River flows in a south-easterly direction towards the coast. Locally, the land slopes towards the east and north, and the Bega River runs about 600 metres to the east of the site. Parallel to the main river channel, some 250 metres to the east of it (towards the site), there is a chain of partially interconnected lakes or ponds which are floodplain features associated with the river and probably mark a former course of the main channel.

The site is currently grassland with scattered trees, and there are isolated outcrops of rock, and scattered boulders.

An Environmental Impact Statement for the development is in preparation, and the requirements for the environmental assessment were set out in a letter (Ref 1) from the Director General (Metropolitan & Regional Projects South) of the Planning and Infrastructure directorate of the NSW Government. These requirements included, *inter alia*, consideration of impacts on surface water and groundwater in light of the relevant policies, guidelines and rules.

This Technical Note presents a hydrogeological assessment of the proposed development in relation to groundwater conditions at the site.

Proposed Development

The proposed development is a 136 bed hospital which will include structures up to three storeys in height, with a single level basement below most of the building footprint. The development will include a helipad, car parking and access roads. The earthworks plan (Ref 2) indicates that basement excavations will extend to a maximum of just less than 2.5 metres below the current site

surface levels, and that excavation for the construction of the access roads will extend to less than 2.4 metres below surface.

Hydrogeological Setting

The 1:250 000 Bega – Mallacoota Geological Series Sheet (Ref 3) shows that the site is underlain by granodiorite of the Brogo Suite (early Devonian age). All the test pits and boreholes constructed as part of the site investigation by Douglas Partners (Ref 4) encountered granodiorite at depths of less than 3 metres and in most of these the rock was found less than 1.5 metres below ground surface. The rock was weathered to depths of between 1 metre and 12 metres below surface. Groundwater was found just above the fresh bedrock surface, at depths of 5.6 metres and 8.2 metres below ground level. The permeability of the weathered granodiorite was measured at two locations and values of 1.5×10^{-6} m/s and 5.6×10^{-6} m/s were obtained: these are low permeability figures.

The weathered granodiorite is overlain by topsoil and a thin layer of shallow silty, clayey sand. Shallow groundwater was observed in this material in one of the boreholes.

The geological map shows the floor of the valley to be occupied by alluvium which forms an aquifer that provides the water supply to the town of Bega and surrounding villages. The water supply, known as the Bega-Tathra system, comprises a bore field consisting of six bores aligned parallel to the Bega to the west of the town, where the river flows in a northerly direction towards the confluence with the Brogo River. The bores are about 20 metres deep, and extract water at an average rate of 1,100 Ml/year (Ref 5). The Bega Valley Shire Council Water restrictions policy document (Ref 6) states that water extracted from the bores whilst the river is flowing is essentially drawn from the surface flow or “aquifer recharge” component of river flows, rather than from stored aquifer water (groundwater), and that upon the cessation of surface flow in the river, the water extracted comes increasingly from stored aquifer water.

On the basis of the available information, it is concluded that the Bega River alluvial aquifer functions on the basis of throughput, with recharge coming predominantly from the flow in the river. The aquifer geometry corresponds to the extent of the alluvial deposit: the boundaries are represented by the contact with the crystalline bedrock at the base of the aquifer and by the edge of the alluvium on either side. It is likely that the weathered granodiorite beneath the alluvium is in hydraulic continuity with the aquifer, providing some additional storage and transmissivity. Inflow to the aquifer from the weathered bedrock beyond the limits of the alluvium is likely to represent a very minor component of recharge. Groundwater quality in the alluvial aquifer is likely to be controlled by the quality of the river water.

The strata beneath the hospital site therefore do not constitute an aquifer, and they have a very limited interaction with the adjacent Bega River alluvial aquifer. There may be a very thin saturated zone at the base of the weathered granodiorite, and the contained groundwater is likely to drain towards the alluvial aquifer, under the influence of the topographic gradient. The permeability of this material is low, and the volumes of such drainage are consequently likely to be very small.

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Assessment of Potential Impacts

The construction of the proposed development will involve excavation to a maximum depth of just less than 2.5 metres below current ground level. The highest measured groundwater level in the weathered granodiorite was 5.6 metres below ground level, which is 3.1 metres below the deepest part of the excavation. No information is available on the range of periodic fluctuation of groundwater level within the site but it is considered extremely improbable that a rise of 3.1 metres could occur. The ground slopes towards the river, so that surface runoff is likely to account for the major part of incident rainfall and infiltration only a minor part. Drainage of groundwater beneath the site is also likely to be relatively rapid due to the topographic gradient.

As the basements of the proposed hospital will not extend towards the water table, and the building will not extend into the alluvial aquifer, it is considered that the development will have no impact on groundwater flows. Temporary dewatering will not be required during construction, and the water table will be below the base of the permanent structure.

The site is currently undeveloped grazing land, and the development will include substantial areas of roofs and hard surfacing. Although, as noted above, the infiltration rate is likely to be low and the contribution of such recharge to the resources of the alluvial aquifer insignificant, there may be some reduction due to the introduction of impermeable areas of the building.

Water quality in the alluvial aquifer is likely to be controlled by the quality of the river water; however a very minor contribution of seepage flow from the weathered bedrock on the side of the valley means that contamination of groundwater in the bedrock has the potential to affect the quality of the aquifer water. The greatest risk of contamination probably arises during construction, and the most likely form of contaminant is turbidity due to sediment from the earthworks entering runoff water during periods of high rainfall. (Note that the risk to surface water is probably much greater than the risk of groundwater contamination from this source). This risk can be fully mitigated by appropriate construction water management.

Mitigation

No mitigation is required in respect of construction or post-construction impacts on groundwater flow, as the works will not extend below a water table.

A minor reduction in the volume of recharge to the alluvial aquifer is a possible consequence of the reduction of permeable surface area due to roofs and hard surfacing. Sustainable drainage systems can be incorporated into the drainage design of the building such that there is no loss of infiltration to the subsurface.

The risk of groundwater pollution from the construction activities can be fully mitigated by the adoption of control measures such as bunding, settlement ponds and interceptors within the site drainage system.

Conclusions

1. The proposed hospital development is unlikely to impact the local groundwater system.
2. Any risks which arise during construction can be fully mitigated by the adoption of appropriate site water management arrangements.

3. Consideration should be given to the incorporation of sustainable drainage systems in the building design so as to maintain existing rates of surface infiltration.

[1] Letter reference 5307-2012 from Alan Bright (A/Director, Metropolitan & Regional Projects South, Planning & Infrastructure, NSW Government).

[2] Bega Hospital Development, Bulk Earthworks Cut/Fill Plan, Drawing No. 00801_DA231 Revision P2, 20/04/12.

[3] Bega – Mallacoota 1:250 000 Geological Series Sheet, Dept of Mineral Resources, (1995)

[4] Douglas Partners, July 2012. Report on Geotechnical Investigation Proposed South East Regional Hospital 1614 Tathra Road, Bega. Project 78385.00.

[5] http://www.begavalley.nsw.gov.au/environment/Water_Sewerage/water_systems.htm#water-bega

[6] Bega Valley Shire Council. Water restrictions policy Adopted 26 October 2004

DOCUMENT CHECKING (not mandatory for File Note)

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