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12. GEOLOGY AND SOILS

This chapter provides a response to the issues raised in relation to the geology and soils impact assessment for the Traveston Crossing Dam EIS.

Twenty-seven submissions received, approximately half of which were lodged by government agencies or community representative groups, raised issues related to geology and soils. These issues included:

- suitability of geology at the dam wall and perceived potential for leakage;
- suitability of the proposed dam in relation to seismic activity;
- suitability of the proposed dam site in relation to the inundation of fertile land;
- land slip potential and identification of mining/extraction locations within the catchment area; and
- increased erosion and salinity risks within the catchment.

Discussion of these issues is presented in this chapter.

12.1 Impacts within Inundation Area

12.1.1 Suitable foundations, potential leakage

A submission raised the claim that the dam wall is proposed to be built on soft alluvial soil (or other inappropriate rock unit) as a result of there being no satisfactory rock base available. Several submissions contended that very little is known about possible leakage from the dam through fractures in the adjacent landforms.

Extensive investigation of the ground beneath the Project dam wall has been undertaken and bedrock in hard metasediments of the Amamoor Beds has been established at depths from 2 m under the left abutment to 7 m under the right abutment and 15-26 m across the main dam wall. These hard rocks will be the foundation for the dam wall. Section 5.4.1.2 of the EIS outlines the steps necessary to prepare the foundations. This depth to bedrock means that in the central part of the stream valley, about half the dam wall, will be below the surface of the stream alluvium with its base well-founded on solid bedrock.

Aquifer (groundwater) hydraulic testing results at the Project dam wall site indicate that bedrock structures or defects have very low permeability (refer section 6.2.2.6 of the EIS). This means that leakage from the water storage through structures or other defects in the underlying bedrock is expected to be extremely low. The design for the dam also includes a grout curtain that provides a concrete barrier to seepage for a depth of 20 m into the solid rock beneath the foundation of the dam wall. This is specifically to prevent water leakage or seepage in the highly unlikely event that undetected geological structures or defects may exist as potential water conduits.

One submission raised the issue that the Golder Associates (2006) Report referenced in the EIS on page 5-115, was not made available to the public. This reference related to the Initial Advice Statement authored by Golder Associates and has been freely available on the website for the Department of Infrastructure and Planning (http://www.dip.qld.gov.au/projects/water/traveston-crossing-dam.html) since its submission in September 2006.

The results of geotechnical investigations undertaken by Golder Associates in 2006 are available in the Sunwater report of 2006 which describes the findings of Preliminary Borehole Investigations. This report has been available on the QWI website since October 2006 (http://www.qldwi.com.au).

12.1.2 Earthquake Risk

Two submissions claimed that the proposed location of the Project lies at the junction of several lines of seismic activity and that seismic monitoring dates back only to the very near past.

Within section 5.4.3.2 the EIS acknowledges a level of seismic activity in the area, indicating the recording of 71 earthquakes within 50 km of the proposed dam site since 1937. These ranged between 0.1 and 3.6 on the Richter scale, a range indicative of minor adjustments in the earth, and compatible with the geological interpretation of the proposed dam site, 2 km from the edge of a stable tectonic block. This stable geological environment is relevant to today and at least the very recent past (last 20,000-1,000,000 years). The extensive tectonic activity referred to in the EIS as having occurred in the Mary Valley region is a commentary on the geological history of the area over the 200 million years since the Amamoor Beds were deposited on the sea floor. Most of this activity occurred in the distant geological past with little chance of recurrence in the foreseeable future. In the EIS section on Natural Hazards (4.14.6.1) the proposed dam site is identified as being in a low earthquake risk area based on the peak ground acceleration measure in the area (0.01g) being below the Australian average and significantly below such places as Newcastle (0.1g) or Wellington, NZ at 0.5g. Detailed study of the geological structure at the dam site resulting in two independent reports acknowledges the occurrence of shear zones in the basement rock but also explains, providing strong evidence, that these structures are geologically very old and have been solidly fused for probably millions of years. Examination of local features including the south-eastern face of the gravel pit downstream of the dam site allows confidence that no movement has occurred in the last 20,000 years at least. These studies have been incorporated into design of the dam to provide a structure that could withstand ground movement considerably greater than could be expected in the area.

12.1.3 Inundation of Fertile Land

Several submissions raised the claim that the Project will inundate flat grazing and cropping land underlain by fertile soils and that the alluvial plain downstream of the dam will be dehydrated. One submission claimed the mapping of Good Quality Agricultural Land (GQAL) was at too large a scale and thus missed many small patches.

As noted in section 5.4.3.1 (page 5-137) of the EIS, areas classified as having good agricultural soils, GQAL Class A or B within the inundation area, equated to 1.7% of agricultural land within the Mary River catchment currently devoted to grazing, cropping and horticulture. This included 3,408 ha of GQAL Class A and 418ha of Class B land within the operational area of the dam. Section 5.1 Land Use and Tenure provided further detailed analysis on Shire specific impacts on GQAL. In Section 5.4.2.3 of the EIS the authority that has classified agricultural land in Queensland is identified (i.e. Queensland (Department of Local Government and Planning and Department of Primary Industry and Fisheries) so the choice of scale for this classification has been chosen by others. Any tiny plots of GQAL that may have been too small to map would have minimal impact on the relativity of areas in the various classes.

12.1.4 Resource Recovery of Good Soils

One submission raised the issue that the rate of extraction for topsoil recovery is impossible and would be account for approximately 1% of the available soil and that stockpiling of the soil will lead to the death of the soil micro-organisms that make the soil productive.

Section 4.5.12 of the EIS describes resource recovery for the Project stating that valuable soil, sand and gravel resources which will not be used in construction, site rehabilitation, landscaping or other identified needs and opportunities, will be made available to the commercial market for extraction. This only includes sites where these resources are disturbed as part of excavation activities for construction and does not include the recovery of topsoil across the entire inundation area.

The mitigation measures proposed to limit the deterioration in biological activity of the topsoil include the use of the topsoil as soon as practicable and restricting the height of stockpiles to less than two meters.

12.2 Impacts Associated with Extraction Areas

12.2.1 Landslip Risk

The landslip potential in the hills west of the proposed dam was raised as an issue within a submission.

Landslips in the hills west of the proposed inundation area are almost certainly the result of clearing of native vegetation to produce bare slopes unable to maintain their angle of incline due to the nature of the soils involved and the loss of binding agencies namely tree root systems. The Project is not expected to have any impact on this existing landscape process. Operators of the dam however will be obliged to monitor these geomorphic processes with particular reference to any potential landslips that could deliver soft surface soils to the water storage.

12.2.2 Sand Extraction

A submission suggested that Figure 5-45 within the EIS had not identified the gravel pit between Carter’s Ridge and Brooloo (noted in the Australian Mines Atlas adjacent to the inundation area) as a Key Resource Area (KRA) as defined within the Queensland Government’s State Planning Policy 2/07. With respect to this policy the State Government indicates that the only KRAs listed in the Cooloola Shire are Meadvale and Moy Pocket quarries contrary to the suggestion in this submission.

12.3 Impacts within Catchment

12.3.1 Erosion

12.3.1.1 Downstream

Several submissions raised claims that the Project will cause changes to river flow inducing greater erosion of riverbanks and bed downstream and at the end of the spillway. In addition, several submissions claimed that the Project would have severe impacts on the Great Sandy Strait through further degradation of water quality as a result of reduced environmental flow and increased sediment flows from stream bank instability downstream and within impoundment area.

The EIS (Section 5.3.1.3) provides an extensive discussion of stream erosion and sedimentation from historical records, field observations and survey of the existing literature on the subject. The discussion identifies the high susceptibility of soft alluvium stream banks in the catchment to erosion particularly in high flow periods. Removal of riparian vegetation and other practices since arrival of European settlers have been identified as the principal contributing factors to this susceptibility. Construction of the Project would not significantly affect this susceptibility because it is not expected to change the high river flows regime. It is expected that reduced medium flow periods would reduce the potential for erosion posed by those medium energy events.

The EIS explains that effects of the Project on in stream sediment load and bank erosion, while not significant, are expected to be greatest immediately downstream of the dam site with gradual diminution of the effect further downstream. Further details on downstream sedimentation issues are outlined in section 11.1.2 and 11.1.3 of the Supplementary Report.

Design of the spillway from the dam is described in the EIS (Section 4.4.2.5 to 4.4.2.8). This description indicates that a number of design features have been incorporated specifically to avoid scouring or erosion impacts at the downstream end of the spillway. The EIS further indicates that the detailed design of the spillway will include consultation with ecologists to identify how to further reduce risk of physical damage to fauna in large water releases. The EIS does not anticipate any need for bank protection works immediately or further downstream from the stilling basin in the spillway. This will be examined further, to achieve confirmation, during detailed design. Thus, the issue of possible impact on the sand and gravel deposit near the end of the spillway has been considered in the EIS study and will be carried forward into the detailed design phase of the project.

12.3.1.2 Within and Upstream of Inundation Area

A small number of submissions claimed that potential erosion impacts within the inundation area had not been adequately addressed, specifically impacts to properties along the banks of the storage. The submissions' claims related to the chemical combination of Magnesium, Calcium and Sodium within soils at a particular location within the catchment, and their highly erodible nature making these soils prone to dispersion.

Section 5.4.2.4 (Erosion Potential) of the EIS assessed erosion potential and soil erodibility using a revised Universal Soil Loss Equation (USLE) to estimate erosion rates. The susceptibility of the soil types occurring within the operational area to erosion was also evaluated using soil characteristics and properties determined from the soil mapping and laboratory analysis (Pointon and Collins, 2004). Both section 5.4.2.4 and section 5.3.2.2 of the EIS acknowledge and assess potential causes of erosion and provided a range of practical mitigation measures that would minimise these impacts.

It should be noted that the claims raised in relation in dam erosion within the inundation area appear to be driven by current experience elsewhere in the catchment whereby private properties abuts an existing storage. All land surrounding the Project storage will be owned by QWI and thus potential erosion around the storage margins will be managed accordingly and is not expected to have impacts on private land holders.

12.3.2 Salinity Risk

Referring to the National Action Plan for Salinity & Water Quality and the recommendation of the Mary River Catchment requiring an assessment under this Plan, several submissions have raised the issue regarding the possible lowering of water quality through salinisation as a result of reduced flow. Further, some submitters have made comparisons between the Murray River Catchment and what might be expected within the Mary River Catchment.

12.3.2.1 Reduced Flows

In relation to the potential lowering of water quality through salinisation as a result of reduced flow, it is first important to understand the impact to flows within the Mary River. As outlined in Chapter 4 of the Supplementary Report and section 6.1.2.3 of the EIS, whilst greatest impacts on flow are likely to occur immediately downstream of the dam wall, these impacts will dissipate rapidly in the first 25 km downstream of the Project, as the contribution of the dam to overall flows is reduced by inflows from downstream tributaries. As noted on figure 6-14, Dagun Pocket and Amamoor Creek (downstream streamflow gauges located nearest the proposed dam) are expected to register flows of approximately 85% of existing flow. Further the EIS also states that the overall low flows and high flows will remain similar to the current situation while median flows will be most impacted. With this in mind and the relationship between surface water and groundwater flows, as outlined in section 6.2 of the EIS and section 17.3.1 of the Supplementary Report, changes to flow within the Mary River as a result of the dam is likely to have a low risk of increasing salination downstream of the dam.

12.3.2.2 Murray River Comparison

One submission has raised the claim that the Mary River is at risk of developing similar salinity issues as the Murray River if the Project were to go ahead, based on the assumption that the Project will exert a hydraulic head on connected aquifers and thus increase the risk of salinisation. The construction of the dam wall through the alluvial aquifer, the geology at the dam wall foundations and the proposed construction of a grout curtain will disconnect any aquifer connection between upstream and downstream and thus an increased hydraulic head will not be created.

In comparison to the Murray River, it is important to understand that the Mary Valley has considerably higher annual rainfall than the Murray and therefore any comparison is inappropriate in this context. Comparison of annual average rainfall at recording centres shows Albury and Mildura in the Murray Basin at 736 mm and 292 mm, respectively, as opposed to Maleny, Gympie and Maryborough in the Mary River Catchment at 1973 mm, 1138 mm and 1156 mm, respectively. The comparison is even more inappropriate in light of the fact that only 39% of water entering the Murray River catchment flows through to the end of the system whereas 90% flows through the Mary River system to the sea (post-dam) and in view of the numbers of impoundments on the respective rivers – more that 60 on the mainstream Murray compared to 2 currently on the Mary. In the situation where annual average rainfall is low, recharge to downstream aquifers will be predominantly from groundwater moving down slope. However, in the Mary Valley, the major recharge agent (70%) will be rainfall, free of salinity as it enters the aquifer and thus the potential for the proposed dam to create circumstances where groundwater would move laterally away from the stream channel and come to the surface is unlikely.