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Management of Bentonite Slurry during Tunnelling

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Contents

1. Management of Bentonite Slurry during Tunnelling

This note is to address the following questions raised (February 28th 2024) on management of bentonite slurry:

- Use of bentonite slurry
- Assessment of potential for impact on receptors
- Containment, transport and disposal of slurry

A Slurry TBM typically utilises a mix of bentonite and water in order to ensure the correct pressure across the cutting head. Bentonite is blended from naturally occurring materials and is non-hazardous to the receiving environment. As with the slurry itself, very little is left in the ground as it is continuously re-cycled and mixed with fresh slurry as the tunnel is extended (see section 19.6.2.6 of the EIAR).

The bentonite is normally reused within the tunnelling operations, however any bentonite which is no longer required will require separate disposal as a non-hazardous waste and require disposal at an appropriately licensed waste facility.

1.1 Additives to Bentonite

As outlined in Section 5.5.3.1.5 of the EIAR, spoil conditioning additives such as polymers or foam can be added to the bentonite mix. Non-hazardous polymers may be added to improve viscosity and to reduce the clogging (stickiness) of the bentonite.

Foam additives generally consist of a detergent that is mixed with water in foam generators on the backup gantries to produce a thick shaving cream-like foam that can be injected into the chamber in front of the bulkhead. The foam breaks down after a few hours or days.

All materials are non-hazardous and biodegradable with no harmful residual chemicals. Further information on the use of spoil conditioning additives is contained in Appendix A5.14 (TBM Consumables).

1.1.1 Environmental Impact

In relation to any grouting of the surrounding soils/rock, bentonite is almost insoluble and thus has a low mobility in soils. The bentonite grout essentially solidifies within any soil or rock fracture within a short period of time < 1-2 days.

There is no pathway for discharge to surface water (on the contractor compound or through the soil/rock) and therefore there is no source - pathway linkage for impact on any aquatic habitat/aquatic species.

During tunnelling, any residual will readily adsorb within the soil/bedrock. The aquifer through which the proposed Project traverses is classified as a “Poor-Locally Important” aquifer only. Where fracturing occurs, they are poorly connected and no evidence of karstification/fissuring exists i.e. there is no potential for significant migration of bentonite within the aquifer. The aquifer is not used for significant water supply and there is no source - pathway linkage to public or private water supplies. Therefore, there is no potential for pollution impacts on aquifer resources through the use of soil conditioning additives to the bentonite.

1.1.2 Disposal

Appendix A24.1 states the amount of excavated material containing bentonite that is predicted to be generated is approximately 52,450 tonnes. This takes into account losses into the ground and soil during the tunnel boring process. On completion of all tunnelling works, this excavated material containing bentonite would be classified as non-hazardous and require disposal at an appropriately licensed waste facility.

Table 1.1 below summarises the amount and source of Bentonite Waste for licenced disposal.

Table 1.1. Bentonite Waste for Disposal

Source	Assumption	Volume m3	Tonnes
Diaphragm Walls	5% of total excavated material	7,393	17,005
Secant Piles	5% of total excavated material	10,509	24,170
Tunnels	Approximately 20% of the drive will be in slurry mode, approximately 3% bentonite wastage	4,899	11,267
	Total	**22,801**	**52,443**

Transportation of the material from the construction sites to its management option will be transported in sealed containers. This is due to the fluid form of the material in order to avoid spillages.

The waste classification is dependent on the properties of the waste, this includes its physical properties. Bentonite slurry, from a chemical perspective can be considered non-hazardous when in slurry form for example, the EWC code 10 09 14, but possibly inert when in a more solid state. For the purposes of the environmental impact assessment, we have taken a conservative approach and assumed it is all non-hazardous.

Table 24.23 of Chapter 24 of the EIAR summarises the amount of construction waste produced, the indicative classification and the indicative management option, the Bentonite element is shown below.

Waste Type	Indicative Waste Classification	Total Tonnage	Waste recovery rate (%)	Quantity of construction waste reused, recycled, recovered (tonnes)	Quantity of construction waste sent for disposal (tonnes)	Indicative management option(s)
Bentonite waste	Non-hazardous	52,443	0%	0	52,443	The only option for the bentonite waste is disposal

It is important note that the bentonite waste has been identified as non-hazardous waste and its management option is disposal to a licenced landfill as it is not suitable for Article 27 or soil recovery facilities. While some of the material may be able to be further recovered through additional processing, for the purposes of waste impact assessment it is all considered to be landfilled.

Section 24.5.4.2.2 Tunnel Boring Activities states *"that the foam conditioner can be left mixed within the excavated material as it is highly biodegradable and will breakdown by 95% within 28 days, requiring no separate disposal".* We note it is stated in Section 3.24 Bored Tunnels (Appendix A24.1 excavated material management strategy),

that "*it may be necessary to keep the material on site to allow degradation process to occur before removal of the material from site*."

This has now been clarified and it is not required to store onsite for any extended period of time and can be transferred to the licenced waste facility.