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Dear Mr Bruce

Letter title: Specialist Opinion- Queries Raised from Stakeholders
Project Reference: Proposed Water Abstraction, Supply and Storage Infrastructure, Haib
Project Reference No.: 301-906/05

Herewith our response to the stakeholder questions:

1. How will the proposed intake structure impact the morphology of the Orange River?

The right bank riverbed near the proposed intake will reach a new dynamic bed equilibrium with sediment deposition locally upstream of the intake over 150 m distance and about 300 m downstream of the proposed intake. The sediment deposition will not extend beyond the intake into the river, about 30 m from the right bank. The river width during a small 2-year flood is about 200 m wide at the intake site and the proposed right bank side intake will not affect the left bank of the Orange River.

2. Is there a risk of erosion at the river banks at or around the proposed intake works?

Where high flow velocities occur during floods concrete walls will be used such as the intake and flank walls. The right bank upstream of the proposed intake and flank wall will be protected by riprap (dumped rock) with suitable filter layers for erosion protection for the Q100cc flood. The right bank floodplain opposite the flank wall also needs erosion protection by riprap during the Q100cc flood (cc=future climate change impact).

3. It is assumed that a coffer dam would be used during the dry season for construction.

- a) Do you perhaps have any examples (images or descriptions) of a similar type of coffer dam?

For a shallow good quality bedrock scenario such as at the Orange River site, a poor quality concrete curved wall works best as was designed for the Goodenough abstraction works on the Umkhomazi River in KZN in SA (see Figure 3-1 below), which is about 10 m high and will be removed after the construction of the works. In RSA on large rivers the cofferdams are typically designed by the contractor with the annual recurrence interval flood risk specified by the client such as a 5-year flood with freeboard at the cofferdam, and with limited spillage allowed during a 10-year flood without failing.



Figure 3-1: Temporary works coffer dam at the Goodenough River abstraction works on the uMkhomazi River

- a. Is sedimentation / scour expected to occur during construction because of this coffer dam?

Sediment deposition is expected upstream for about 400 m downstream and about 200 m downstream of the centre of the cofferdam, at the right bank side not further than about 40 m from the right bank. No scour is expected since riprap will be used for right bank erosion protection locally upstream of the cofferdam, and the cofferdam is constructed on the bedrock.

- c. Can it be assumed that during operation, sedimentation and scour at the intake location will reach an equilibrium and thus not pose a long-term risk to the structure or downstream users?

Yes

- b) What do we expect to happen to the flank wall during flood events?

It is proposed that the river abstraction works is designed with an intake wall height for the 20-year flood but allowing spillage over the intake structure during larger floods, while continuing to pump during all flood conditions. The pump switchgear should however be above the 100-year flood level. During floods larger than the 20-year flood water will spill over the intake and right bank flank wall. Erosion protection on the right floodplain with riprap opposite and immediately downstream of the right bank flank wall will be required to prevent deep scour.

c) From an impact assessment aspect, what are the risks to the actual river?

In a large river such as the Orange River with relatively large floods, the impact of the proposed intake works will be relatively small, with a new sedimentation equilibrium that would be reached within a single flood season with sediment deposition patterns at the right bank localized as discussed above. The intake zone is self-scouring during floods and do not require mechanical removal of deposited sediment. The low flow impact on low flows was analysed in a water resources study, and the pump rates would be reduced with the variable speed pumps when the river discharge become small to maintain sufficient submergence for the pumps, for example when the river discharge is 4 m³/s only 15% would be abstracted, if the off-channel dam is not full.

d) It is assumed that the intake works will be constructed on bedrock in the river. Do you think that blasting will be required?

For hydraulic structure design and construction, engineers are very cautious to blast the bedrock because it can damage the rock mass in ways that affect stability. A detailed geotechnical investigation is required but blasting will probably not be carried out.

Yours sincerely



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