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Attention: Simon Clarke

1.1 AURECON

Dear Simon

Freshwater Ecological Assessment of proposed Peninsula Formation Monitoring (Core) boreholes in Steenbras.

Three proposed monitoring boreholes, namely H1A8, H5A1 and H5A2 were visited on the 14th November 2018 to:

- Identify any freshwater ecosystems (rivers or wetlands) within close proximity of the proposed sites;
- Evaluate the sensitivity of these habitats to the layout and drilling operations proposed at each site;
- Provide recommendations for the layout and operation of drilling activities, if necessary, to minimise the risk of potential impacts to freshwater ecosystems.

2 General description

Although the footprint of each monitoring borehole is located on existing roads, all three sites are situated in pristine habitats described by Mucina and Rutherford (2006) as Kogelberg Sandstone Fynbos, identified as a critically endangered vegetation type. Rivers and wetlands within this vegetation type are typically nutrient poor (oligotrophic) with low pH (acidic) and a low mineral content as indicated by low Electrical Conductivity of either standing or flowing waters. These ecosystems typically support threatened biota with high levels of endemism and are generally sensitive to anthropogenic disturbance.

3 H1A8: Assessment of sensitivity and risk

This site is situated in a mountainous region on a narrow flat small sandy plain between two mountain peaks where the 5-6 m road is slightly wider than the average width of the track (Figure 1). The existing cul du sac at the southern end of the road will be used as a turning circle for vehicles (Figure 2). While the site is situated within a sandy dryland habitat, a seasonal seep habitat identified by the presence of obligate wetland vegetation (mostly *Ficinia indica*) with a distinct seasonal channel originates immediately downslope of the site on the northern side of the existing road (Figure 2). This system is considered of *High Ecological Importance and Sensitivity* as it supports a high floral diversity and is likely to provide seasonal habitat for aquatic fauna endemic to this region.

Considering that the watercourse and wetland are downslope of the proposed drilling site, there is some risk to runoff from the site entering the habitat, particularly if the borehole is artesian. Depending on the volumes of runoff, aseasonal flows into a seasonal system could result in the creation of an erosion donga. Also, depending on the chemistry of the groundwater, spillage into the watercourse and seep habitat could result in die off of wetland plants that are sensitive to such changes.



Figure 1 H1A8 (immediately behind the vehicle) looking south west.

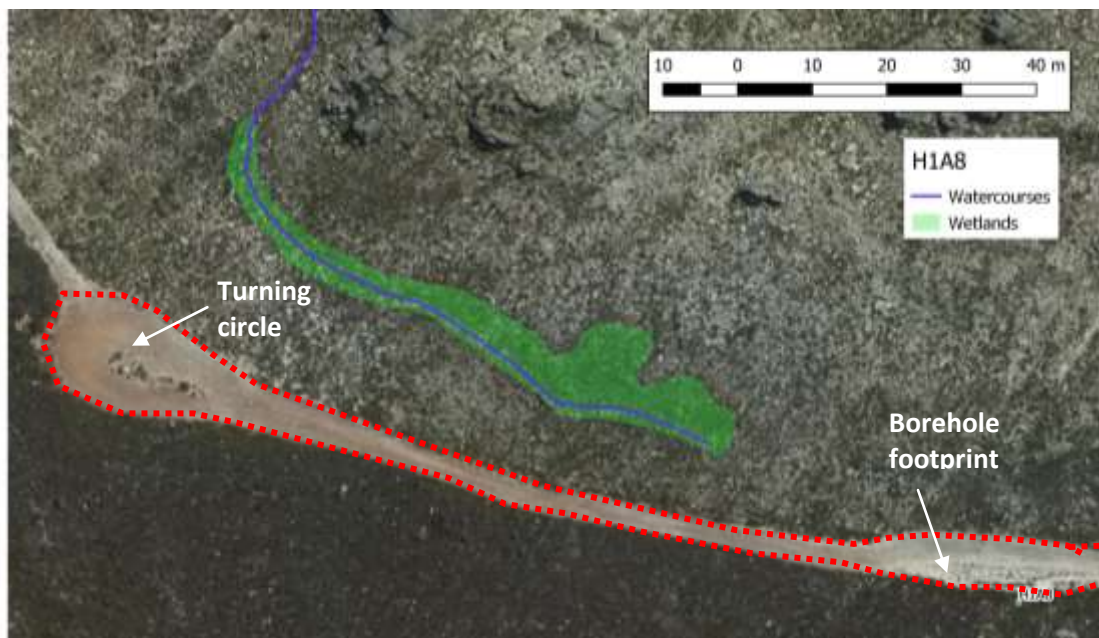


Figure 2 H1A8 is situated immediately upslope of the source of a seasonal seep habitat with a defined channel

Recommendations: Measures to contain any runoff from the site should be implemented prior to the onset of drilling operations. The potential of spillage from the drilling site should be closely monitored by an ECO. If necessary, any

spillage should be directed down the existing road to ensure that runoff does not enter the wetland and watercourse downslope.

4 H5A1: Assessment of sensitivity and risk

H5A1 is situated on a narrow (3 m wide) sandy track that bisects a wetland habitat characterised as a mosaic of seasonally saturated and inundated patches with permanently saturated soils (Figure 3 and Figure 4). The wetland is dominated by restios and ericas with larger shrubs such as *Berzelia lanuginosa* and *Psoralea pinnata* typical of permanently saturated soils existing road (Figure 2). This system is considered of *High Ecological Importance and Sensitivity* as it supports a high floral diversity and is likely to provide habitat for aquatic fauna endemic to this region.

Based on the limited road width and location within a wetland, there is a high risk of disturbance to wetland habitat associated with this core drilling site. It is likely that disturbance will be direct i.e loss of habitat due to the movement of drilling operators, machinery, vehicles etc, as well as indirect through potential spillage of groundwater (should the borehole be artisanal) into a highly sensitivity habitat which could lead to erosion and/or loss of vegetative cover through change in water chemistry and die off of plants.

Recommendations: It is recommended that this borehole be sited elsewhere, beyond the wetland habitat. If this is not possible, measures to contain any runoff from the site should be implemented prior to the onset of drilling operations. The potential of spillage from the drilling site should be closely monitored by an ECO. If necessary, any spillage should be directed down the existing road to ensure that runoff does not enter the wetland and watercourse downslope.

The probability of effectively implementing these measures is however questionable and thus it is likely that siting of this borehole will result in high residual impacts to aquatic ecosystems.



Figure 3 H5A1 looking south towards the river channel

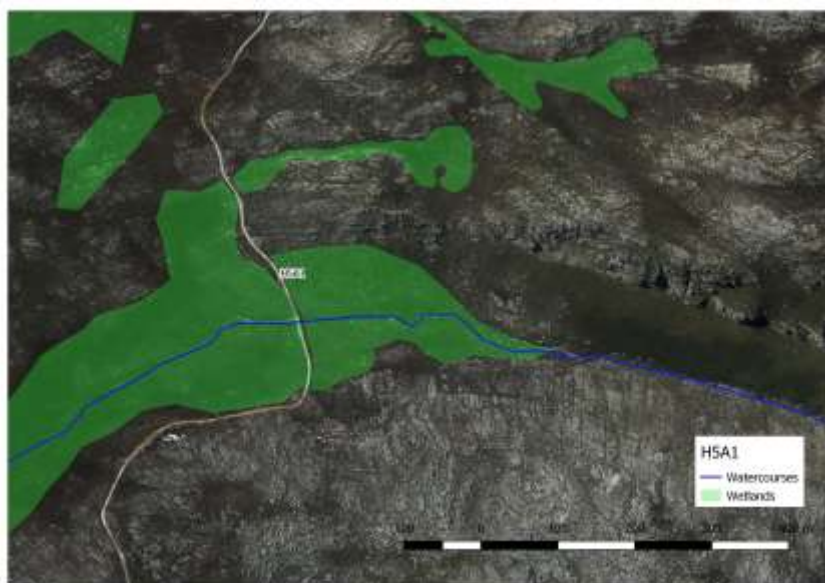


Figure 4 H5A1 is situated on a sandy track that bisects wetland habitat that drains towards a perennial stream

5 H5A2: Assessment of sensitivity and risk

H5A2 is situated on a gravel road (Figure 5) immediately upslope of a perennial stream, flanked by a well-developed riparian fringe dominated by *Berzelia lanuginosa*, *Pteridium aquilinum*, *Psoralea pinnata*, *Restio sp.* and *Osmotopsis asteriscoides*, together with *Mimetes cucullatus* along the drier but seasonally saturated wetland margins (Figure 6) .



Figure 5 H5A2 looking north towards the perennial stream and adjacent riparian vegetation situated downslope from the borehole site



Figure 6 The riparian habitat surrounding the perennial stream

This system is considered of *High Ecological Importance and Sensitivity* as it supports a high floral diversity and is likely to provide habitat for aquatic fauna endemic to this region.

The gravel road on which the borehole footprint is sited is outside but upslope of the river and riparian fringe (Figure 7). If managed effectively, the likelihood of direct loss of wetland habitat associated with the borehole is low. A drainage ditch has been dug immediately north of the gravel road, presumable to ensure drainage of road runoff into the lower lying area to the north of the road as it bends westwards (Figure 7). Considering the limited width of the road, there is a moderate to high risk of runoff entering the ditch and draining northwards eventually entering the wetland. If the borehole is artesian, it is possible that runoff into this area would result in the creation of an erosion donga in this area, thus exacerbating the risk of further die off of sensitive vegetation.

Recommendations: It is recommended that this borehole be sited slightly further south along the road to maximize the distance to aquatic habitats and thereby reduce the potential risk of spillage into this area. Regardless of the siting, it is important that berms to impede flow are placed within the existing drainage ditch such that flows from the borehole site are attenuated as far as possible in case of spillage. Measures to contain any runoff from the site should however be implemented as a first step in the implementation of mitigation, prior to the onset of drilling operations. The potential of spillage from the drilling site should be closely monitored by an ECO.

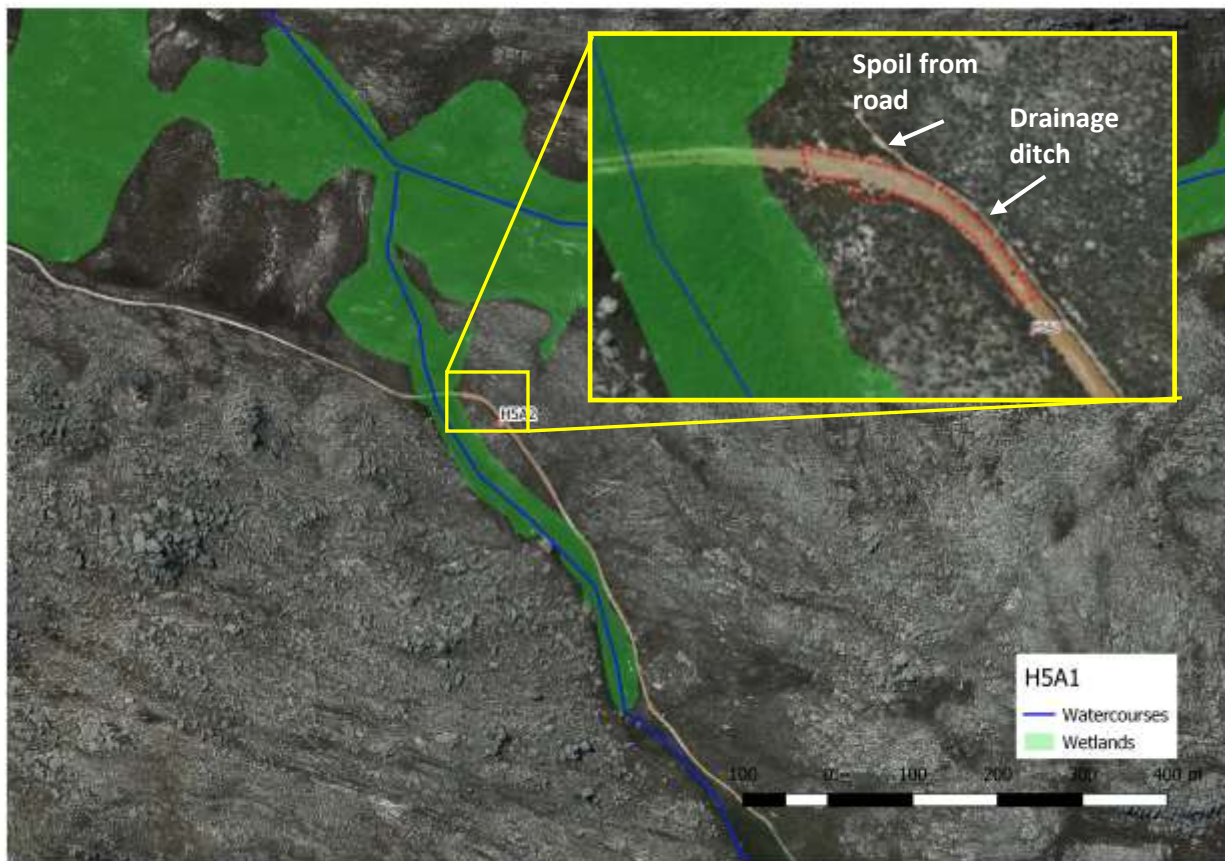


Figure 7 H5A2 is situated on a gravel track upslope of perennial stream with a well developed riparian fringe

6 General comments and recommendations.

Core borehole drilling at all three proposed monitoring sites poses some risk of impact to freshwater ecosystems in close proximity. Of these H5A1 poses the highest risk to pristine wetlands of the region because it is situated on very narrow road within a wetland habitat. If potential runoff from H8A1 and H5A2 is effectively contained and the movement of

drilling staff are limited through the supervision of an ECO, then the impacts to freshwater ecosystems associated with these sites is likely to be low.

Of some concern however is access to and vehicular movement, including the towing of drilling rigs and associated infrastructure to H5A1 and H5A2. While there is an existing road to these sites, numerous wetlands and watercourse are traversed along this route. Should the need arise to upgrade these roads through import of material and further compaction, these impacts will be exacerbated and are likely to result in long term impacts to the functioning of aquatic ecosystems of high ecological importance. It is therefore strongly recommended that due consideration is given to the potential need for further upgrades to the road and the associated implications for the natural environment.

Yours sincerely

A handwritten signature in dark ink, appearing to read 'Justine Ewart-Smith', is written over a light grey rectangular background.

Justine Ewart-Smith