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MEMORANDUM

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Cc:	
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Document Title:	RAS Wetland Field Investigation

Hydro Geochem Group Limited (HGG) conducted a field investigation at the Rise and Shine (RAS) wetlands at the Bendigo Ophir Gold Project (BOGP) from 27th July to 29th July 2026 to characterise their hydrological function. This memo describes the installation of equipment to continuously monitor surface and groundwater levels in the wetland, and a synoptic[1] surface and groundwater measurement survey post-installation. Based on information gathered, preliminary understanding of surface and groundwater movement at the site is described and recommendations for ongoing site investigation are made.

BACKGROUND

Dewatering of BOGP open pits and underground workings has the potential to negatively affect the RAS wetlands through drawdown the water table if they are connected to the groundwater system that will be influenced by pit dewatering. For the Fast-Track Approvals Act (FTAA) BOGP Substantive Application, it had been assumed that the RAS wetlands (also referred to as swamps and marsh) are predominantly surface-water dominated and that stream flow augmentation can be used to mitigate any potential indirect effects of drawdown on the surface water regime (and any associated wetlands). However, it was noted by HGG that this assumption needs verification through characterisation of the surface and groundwater hydrology at the RAS wetlands. The installed monitoring equipment described within this document allows for monitoring of key hydrological variables help interrogate this assumption.

OBJECTIVES

Objectives of the field investigation were to:

- Design and install instrumentation of the shallow groundwater within the wetlands to allow long-term monitoring of the hydrological gradients that exist between shallow groundwater, and surface water.
- Quantify surface water inputs to and within the RAS wetlands.

[1] The use of the term synoptic here implied that field measurements are collected on the same day and representative of the same hydrological conditions.

DESCRIPTION OF WORK

The proposed scope of work was to validate assumptions relating to the hydrological functioning of the RAS wetlands. The area indicated in Figure 1 was chosen for this study as it is between the proposed RAS and SRX pits. Specific field activities included installation of two instrumentation transects (RAS 1 and RAS 2). Each transect consisted of two piezometer pairs, each consisting of one shallow (~30 cm depth) and one deep (~80 cm depth) piezometer. Pressure transducers were installed within each piezometer to provide continuous measurement of groundwater level and thus pressure gradients between the shallow and deep piezometers, and across each transect. Where each transect crosses the Rise and Shine Creek channel, a stilling well and pressure transducer were installed to provide continuous measurement of surface water level. This arrangement will allow assessment of the magnitude and duration of surface-groundwater gradients and allow inference of the controlling factors on wetland hydrology. Synoptic measurement of surface water flows into and within the wetland were also taken to characterise winter flow regime of the wetland.

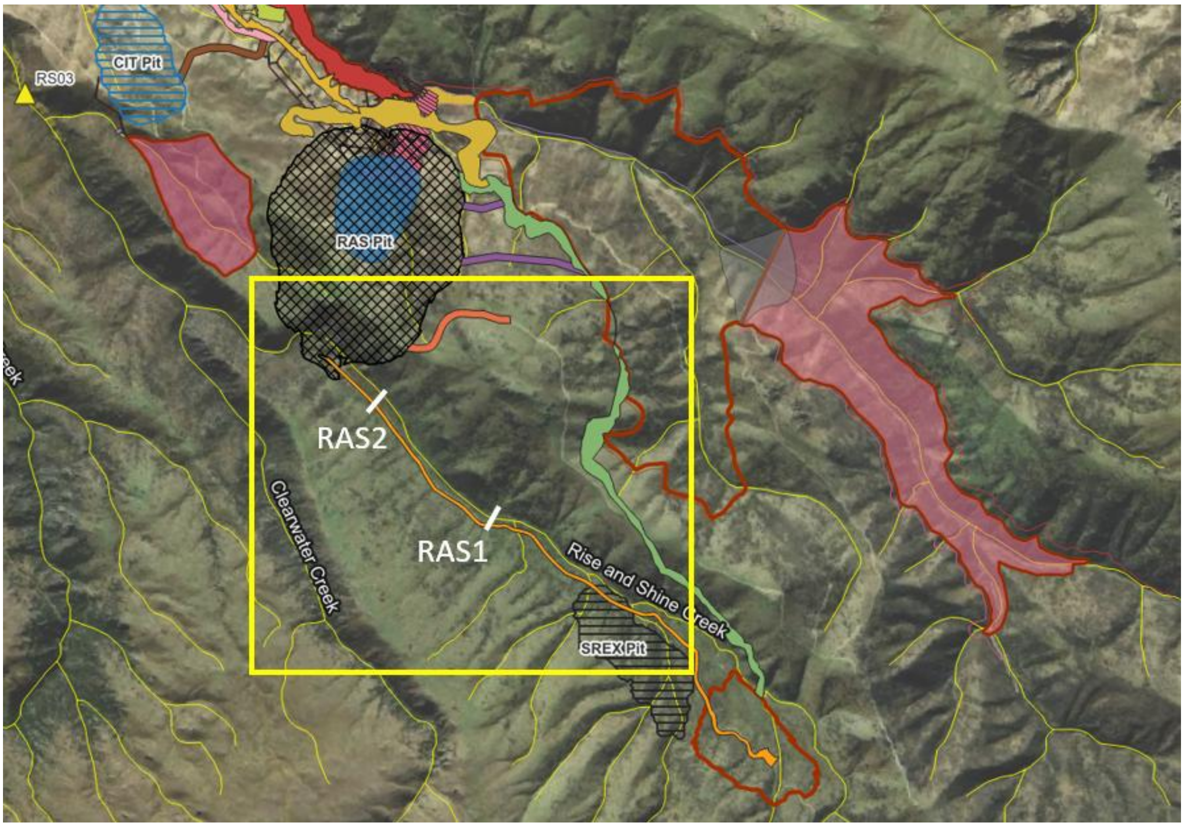

Figure 1: Location of surface and groundwater transects (RAS 1 and RAS 2).

Piezometer Installation

Figure 2 provides a more detailed illustration of the location of installed monitoring equipment. Piezometer transect RAS 1 lies on the upstream side of the studied section of wetland, closest to the proposed SRX Pit. A stilling well was installed, and flow measurements were taken approximately 70 m upstream of the RAS 1 transect, which represents the hydrological input to the studied section.

The downstream piezometer transect RAS 2, lies 0.7 km downstream of transect RAS 1. A surface water gauge was installed, and flow measurements were taken approximately 10 m downstream from the RAS 2 transect and represent the outflow from the studied area. The depth of the piezometers and reference numbers of loggers (Solonist Levelogger 5) are shown in Table 1. The loggers were set to record water levels at 15-minute intervals.

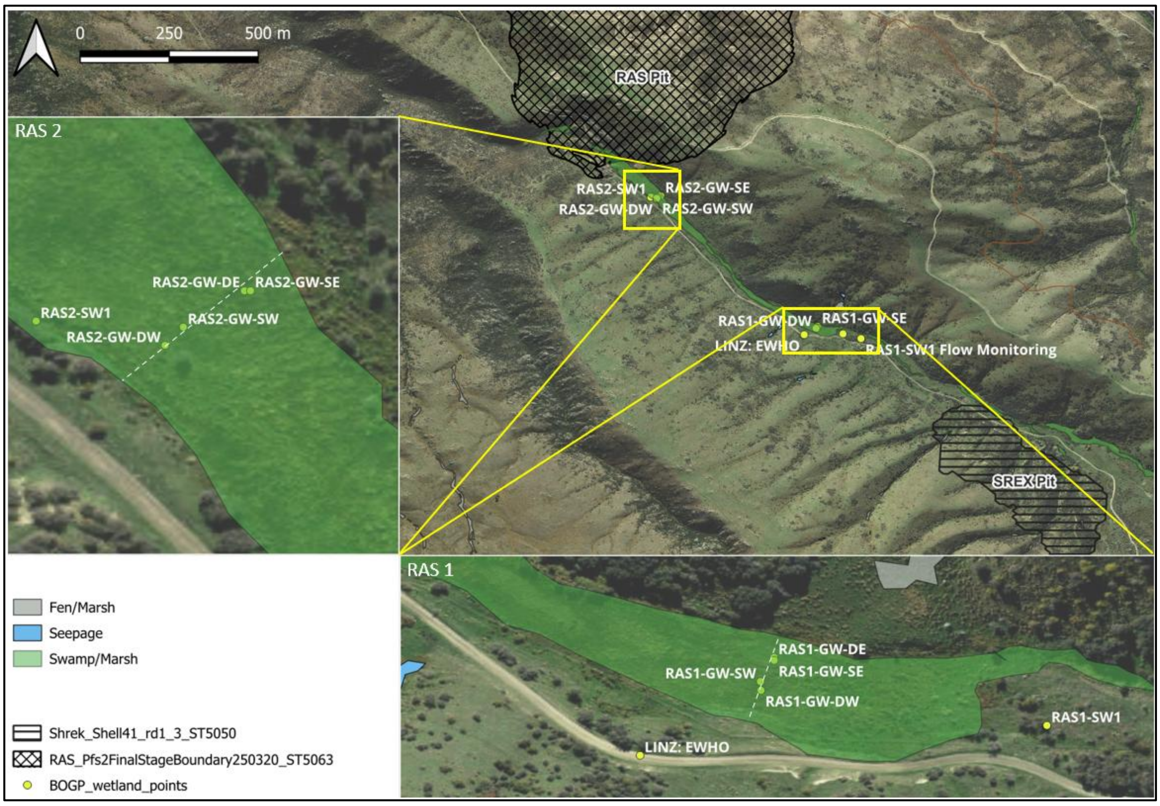

Figure 2: Location of piezometer transects RAS 1 and RAS 2 in relation to RAS and SRX pits.

Table 1: Piezometer logger specifications and location details.

PIEZOMETER ID#	LOGGER REF NO.	PROBE DEPTH (cm bgl)	WATER LEVEL (cm bgl)	X CO-ORD[1]	Y CO-ORD[1]
RAS1-GW-DE	002-2230447	124	80	169.43171	-44.95149
RAS1-GW-SE	002-2230448	57	5	169.43171	-44.9515
RAS1-GW-DW	002-2230440	157	-30*	169.43165	-44.95159
RAS1-GW-SW	002-2230436	56	5	169.43165	-44.95156
RAS2-GW-DW	002-2230438	64	0	169.42599	-44.94691
RAS2-GW-SW	002-2230449	45	0	169.42601	-44.94688
RAS2-GW-DE	002-2230439	60	0	169.42611	-44.94682
RAS2-GW-SW	002-2230441	48	0	169.426019	-44.94688

SW- surface water; GW-ground water; E - east; W - west; D - deep; S - shallow.

[1] *Approximate XY coordinates measured using GPS Tracks app. (accuracy ± 3-5m).*

* *Artesian (above ground level)*

bgl – below ground level

PVC pipes with 30 mm diameter were used to construct piezometers with target depths of 30 cm and 80 cm. Each piezometer had a 20cm screen (slotted-section) at its base. In practice, the depths varied depending on sub-surface conditions found at each location. Shallow piezometers were back-filled with sand and finished with a 5 mm layer of bentonite at the surface. Deeper piezometers were back-filled with sand around the screened section; a bentonite seal; auger cuttings; and a 5 mm layer of bentonite at the ground level to prevent surface water ingress (Figure 3). The shorter length (~30 cm) wells used full-length slotted screen and were back-filled with sand only.

Piezometer installations at RAS 2 were hampered by saturated conditions such that any augured hole immediately filled with water. Whilst sand and subsequently bentonite was poured around the piezometer tubes, it is possible that the holes will need remediation in Spring once saturated conditions have subsided. The deeper piezometers at RAS 2 were installed to just 60-65 cm below ground level (bgl) due to the occurrence of a hard regolith or impenetrable stony layer lying beneath the organic soils (see Appendix A Figure 6).

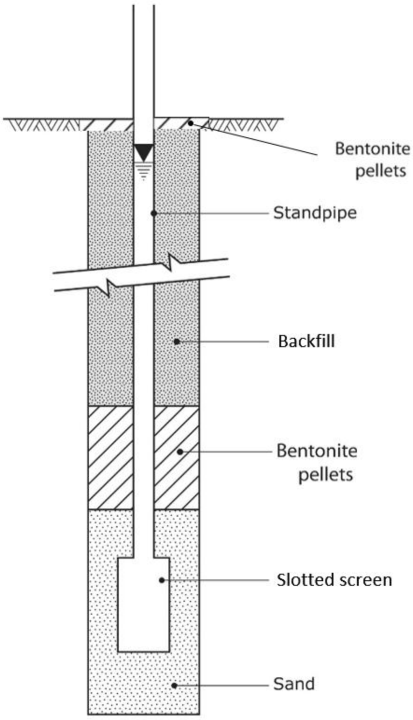

Figure 3: Schematic of deeper monitoring well design used at the RAS wetland.

Surface Water Monitoring

Stream stage boards were installed at location RAS1-SW1 and RAS2-SW1, and stream flow was measured using an impeller type flow meter (Flow-Probe) (see Appendix A Figure 5). A 30-mm diameter perforated pipe was attached to the gauge board post to house a water depth logger (logging at 15-minute intervals).

SYNOPTIC SURVERY RESULTS

Wetland Water Table

The RAS 1 transect location was notable for a drainage convergence zone that lies to the north side of Rise and Shine Creek valley (see Figure 4). The landcover on the northern side of the valley has also been classified as a Fen wetland (RMA Ecology, 2025) and supports seepage wetland higher in the gulley. As a classified wetland, HGG would expect a hydrological connection between the gulley and the Rise and Shine Creek and wetland. Several smaller wetland pockets can also be seen to the south of transect RAS 1 (draining north into Rise and Shine Creek).

RAS 2 is also situated adjacent to a drainage feature on the north side of the Rise and Shine Creek valley. However, there is no record of any springs or seepages in that area. A second large surface water catchment exists between RAS 1 and RAS 2 and is highlighted as it is probably the largest single source of surface water into the wetland corridor within this area (other surface water catchments being much smaller). Perhaps because of surface water convergence and multiple seepages, the RAS 2 is noticeably more saturated than RAS 1, with much of the wetland surface was under up to 20 cm of water.

Initial water levels in the installed piezometers were recorded (Table 1) but should not be considered conclusive of the wetland water-table, as piezometers generally need a few days to equilibrate after installation. However, it was noted that only one day after installation the deep piezometer (157 cm bgl) on the south side of the RAS1 transect (RAS1-GW-DW) was indicating artesian conditions with water having risen to the top of the piezometer pipe (30 cm above ground level). Due to the saturated nature of the ground at RAS 2, it was not possible to obtain a realistic groundwater level as the ground was already saturated to the surface. It is envisaged that as the ground dries in Spring, the water level in the wetland will fall – and this will be recorded by the installed loggers.

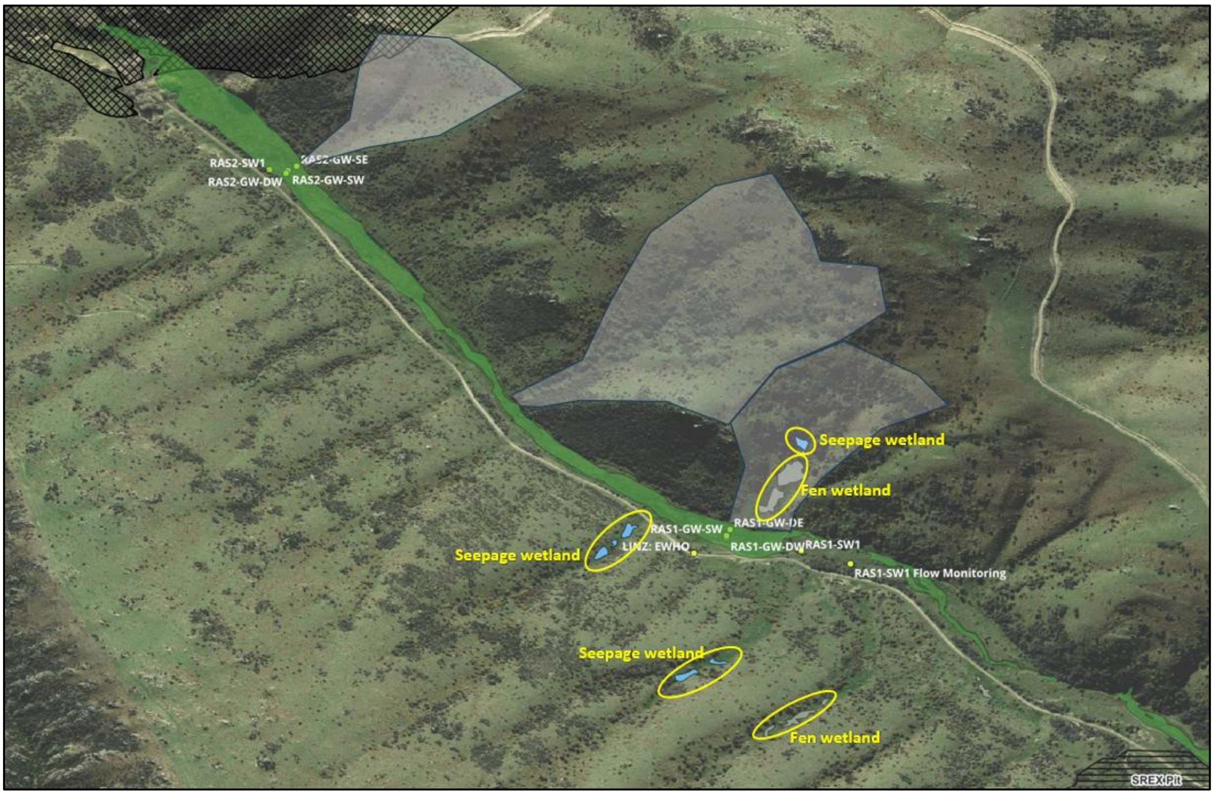

Figure 4: Location of Fen and Seepage wetlands and large surface water catchments likely contributing to wetland hydrology.

Surface Water Flows

Surface water flows into the wetland at RAS 1 were measured on the south side of the wetland. There appeared to be a channel on the north side of the wetland, but this was frozen at the time of visit. It is likely that both north and south channels deliver surface water to the wetland under warmer and wetter conditions. It was noted that water was being diverted out of parts of the south channel and across the wetland in several reaches due to localised freezing of water in the channel. Water depth on the gauge board came to 6.8 cm, and measured flow rate was 10.8 L/s.

Surface water flows at RAS 2 were also measured in a channel to the south of the main wetland. Whilst there was some evidence of occasional surface water flow on the north side of the wetland, there was no water flowing at the time of visit. A flow of 17 L/s was measured on the south side channel. Water level at the installed gauging board was recorded at 12.5 cm. This indicates a slight increase in flow in the downstream direction.

SUMMARY AND RECOMMENDATIONS

In total, eight piezometers were installed and were instrumented to measure water depth at 15-minute intervals. In addition, surface water channels were instrumented to measure water depth at the same interval.

The data collected from the synoptic survey completed following installations are largely inconclusive as to the nature of surface-groundwater interaction at the RAS Wetland when viewed in isolation. Field investigation at the upstream wetland transect (RAS1) indicated a positive groundwater gradient at one of the deeper piezometers (RAS1-GW-DW). However, this was not replicated at any other location. The downstream transect (RAS 2), however, was water-logged at the time of visit. Surface water flow accretion was measured between RAS 1 and RAS 2. Interpretation of synoptic data will become more meaningful over time when combined with the continuous water level data now being recorded, and will provide greater certainty as to the direction and magnitude of surface and groundwater gradients at the site.

Based on observations made during the site visit, and to ensure effective interpretation of the data currently being collected by the installed loggers, the following recommendations are made:

- The site should be visited within one month and data downloaded from all loggers to ensure they are operational and providing preliminary data.
- Data from the installed loggers should be inspected (with simultaneous field observation) to assess the quality of data being produced.
- A detailed geodetic survey of the location and elevation of all the installed piezometers and stream gauges should be made before or during the next site visit. It is noted that a LINZ geometric survey marker (ref: EWHO) is situated near RAS 1 which can be used as reference for this.
- Summer synoptic survey of surface water flow across the wetland is needed to characterise the seasonal variability of water movement within the wetland (i.e., to compare winter saturated conditions with summer conditions).
- Ideally, surveys in Spring and Autumn would also be conducted, especially if the year 2026/2027 is uncharacteristically dry (as defined by annual rainfall at the nearest meteorological station). Additional flow measurements are also needed to inform a rating curve for the stream depth data collected by the loggers.
- Subsequent surface water flow surveys should measure flow on both north and south channel of RAS1 section if water is free flowing in both channels.
- Due to the combination frozen ground around the wetland and highly organic saturated soils within the wetland, it was not possible to retrieve samples for soil particle size analysis. These

samples should be retrieved on the next visit at an appropriate location to be representative of wetland soils and their hydrological properties.

CLOSING REMARKS

Please do not hesitate to contact Jim Griffiths. at [redacted] or [redacted] should you wish to discuss the content of this memo in greater detail.

REFERENCES

RMA Ecology Ltd., 2025. Bendigo-Ophir Gold Project – Wetlands Values Assessment, prepared for Matakanui Gold Ltd, Report No. 2352.

APPENDIX A

Figure 5: Flow gauging at RAS1-SW1 (left) and installed flow gauging board at same location (right).

Figure 6: Auguring at RAS2-GW-DE (left) and inorganic material retrieved from c.60 cm bgl (right).