TECHNICAL MEMORANDUM

PROJECT NO.: WGA260144
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DATE: 8 SEPTEMBER 2026

COMPANY NAME	Oceana Gold (New Zealand) Ltd
ATTENTION	Rod Redden
SUBJECT	Stream Depletion Effects Arising from Golden Point Underground Mine MP4 Extension
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1. INTRODUCTION

OceanaGold (New Zealand) Limited (OGNZL) is planning to apply for resource consents authorising the Macraes Phase Four Project ("MP4" or "the Project") to extend the life of mining operations at the Macraes Operation through to 2036. The project is being pursued under the Fast-track Approvals Act 2024 (FTAA).

Within the wider Macraes Operation, OGNZL is currently operating an underground gold mine, known as Golden Point Underground (GPUG). Specifically, one of the resource consents under which GPUG operations are authorised is RM23.783.03 from the Otago Regional Council. This consent authorises OGNZL:

- *"To take groundwater and operational water from the Golden Point Underground Mine for the purpose of dewatering an underground mining operation and for use in dust suppression and in the mine water management system."*
- *"The maximum rate of take of water from the Golden Point Underground Mine authorised by this consent must not exceed 50 litres per second, or 4,300 cubic metres per day."*

Underground development in GPUG is currently scheduled to wind down from 2028, in the absence of MP4 consents, with production ending in 2030.

OGNZL is applying for consents to authorise further development beyond the already consented GPUG area ("the Extension") as part of MP4. With approval of MP4, and assuming ongoing exploration success, the life of GPUG is expected to extend by up to seven years.

The Extension is located within the catchment of Deepdell Creek, as presented in Figure 1 attached to this memorandum. The underground workings associated with the Extension are planned to locally extend under the bed of Deepdell Creek. The elevation of proposed workings within the currently unconsented area will vary from 440 mRL to -40 mRL (40 m below mean sea level) in the dark grey drilled envelope shown in Figure 1, and between about 220 mRL to -130 mRL for the undrilled envelope, with depth increasing as mining progresses eastwards. These elevations compare to the elevation of Deepdell Creek reach that intersects the expansion envelope, which decreases eastward from 340 mRL to 300 mRL. Overall, the mining operations are to be carried out at depths in excess of 105 m below Deepdell Creek. Additionally, controls on ore extraction are proposed to minimise the risk of ground settlement impacting Deepdell Creek (PSM 2026).

Dewatering of the Extension is expected to be associated with a depletion of flows in Deepdell Creek. An assessment of the effects of the Extension on the surrounding groundwater system and on flows in Deepdell Creek has recently been undertaken (GHD 2026). The information presented in this memorandum with regards stream depletion is sourced from the GHD (2026) report, except where otherwise stated.

This memorandum summarises the findings of an assessment of the effects of the proposed GPUG Extension against Schedule 5a of the Otago Regional Water Plan.

2. REGIONAL PLAN REQUIREMENTS

Policy 6.4.1A of the Regional Plan: Water for Otago (RPW) dated 3 September 2022 states:

"A groundwater take is allocated as:

a. *Surface water, subject to a minimum flow, if the take is from any aquifer in Schedule 2C; or*
b. *Surface water, subject to a minimum flow, if the take is within 100 metres of any connected perennial surface water body; or*
c. *Groundwater and part surface water if the take is 100 metres or more from any connected perennial surface water body, and depletes that water body most affected by at least 5 litres per second as determined by Schedule 5A; or*
d. *Groundwater if (a), (b) and (c) do not apply."*

With respect to Policy 6.4.1A of the RPW:

a. The water inflows to the Extension are not from any aquifer listed in Schedule 2C. Furthermore, the rock mass surrounding the Extension consists of low permeability fractured schist and is not realistically considered to represent an aquifer in the hydrogeological sense.
b. WGA understands from OceanaGold that Deepdell Creek is considered to be a perennial surface water body for the purposes of Policy 6.4.1A. The take applied for relates to underground workings at least 105 m below the ground surface or the bed of Deepdell Creek, with the depth to the workings increasing substantially from west to east. Therefore, the proposed take is more than 100 m from the bed of Deepdell Creek.
c. As determined under the guidelines in Schedule 5A, the projected rate of depletion to flows in Deepdell Creek is 1.5 L/s (GHD 2026). This depletion is characterised by GHD (2026) as a modelled change in groundwater contributions to Deepdell Creek upstream from the surface water quality compliance monitoring point DC08. Deepdell Creek is the surface water body most affected by the proposed Extension. The means of assessment used to calculate this rate of depletion are summarised in Section 3 of this memorandum. The projected rate of depletion is substantially less than the 5 L/s provided for under the RPW.
d. Therefore, the water take from the Extension is a groundwater take for the purposes of Policy 6.4.1A.

3. SCHEDULE 5A REQUIREMENTS

Schedule 5 of the RPW documents a "*Schedule of limits to instantaneous take of groundwater*". Schedule 5A referred to in the Regional Plan presents a "*Schedule of equations to determine stream depletion effects of the take of groundwater"*. The equations presented under Schedule 5A all relate to the depletion effects arising from the taking of water from a bore. They are not applicable to the taking of water from an underground mine. Schedule 5A recognises this by accepting the use of numerical models to evaluate stream depletion effects. Schedule 5A states that:

"*The use of numerical groundwater flow models will be accepted over the equations given above, when an applicant can clearly demonstrate:*

1. *That the numerical method is validated or potentially validated at a generic level against either the Theis Equation or the Jenkins Equation; and*
2. *That the model is in common use for the purpose, and shares a degree of acceptance in such use among groundwater professionals."*

With respect to Requirement 1 above, Schedule 5A recognises that "*the Bekesi and Hodges, or Jenkins equations have situations where they are less valid or have violated their basic assumptions"*. Such situations include:

"*Where the groundwater system:*

a. *Has very low permeability (e.g. schist fractured rock aquifers). Although the low permeability will calculate a very low stream depletion effect in the Jenkins equation, this is not considered in the empirical Bekesi and Hodges equations); or*
b. *Does not influence surface water due to the depth of the bore or well screen".*

Both of the above limitations apply to the use of the stream depletion equations presented in Schedule 5A for assessing stream depletion arising from the Extension. Therefore, these equations are not appropriate for estimating the stream depletion effects from an underground mine developed in low permeability schist rock.

Deepdell Creek is interpreted to be a gaining stream, receiving groundwater discharges supporting stream baseflows along much of its length. GHD (2026) has used 3D groundwater modelling methods to calculate an average groundwater flow to creeks and tributary streams upstream from DC08 of 42.3 L/s under current conditions (Table 1). This calculated rate is consistent with the average groundwater-derived baseflow contribution to Deepdell Creek over the period from 1 January 1991 to 31 December 2015 estimated by WSP Golder (2023) to be approximately 38.2 L/s.

In terms of the assessment methodology, GHD (2026) states: "*To assess the potential effects of dewatering of Innes Mills and GPUG extension to the surrounding creeks, modelled groundwater outflows to surface water under existing conditions were compared with those predicted by the dewatering model*." The groundwater modelling software used for this purpose was Groundwater Vistas, which is an industry standard package that is fit for the intended purpose. The outcomes of the GHD (2026) modelling are summarised in Table 1.

Table 1: Stream Depletion Flows Modelled by GHD (2026)

PARAMETER [1]	UNITS	VALUE
Modelled groundwater flow to creeks and tributary streams - Existing Conditions model	L/s	42.3
Modelled groundwater flow to creeks and tributary streams - Dewatering model	L/s	40.8
Modelled change of groundwater contribution due to dewatering	L/s	1.5
Proportional change in groundwater contribution	%	3.4

Notes:

[1] Sourced from Table 5.1, GHD (2026).

With respect to validation of the 3D groundwater model developed and used by GHD (2026) to assess potential stream depletion, two previous groundwater assessments on the effects of extensions to GPUG have been undertaken independently of the current work.

An assessment was undertaken by WGA (2020) on the effects of the planned GPUG mine. The WGA (2020) report was lodged with ORC in support of the application to develop the GPUG mine in 2020 and was accepted by Council reviewers. The analysis for stream depletion documented by WGA (2020) applied commonly accepted generic groundwater flow equations. The stream depletion flows calculated by WGA were less than 20 m^3/day (0.2 L/s). Although the mine layout evaluated by WGA (2020) incorporated a set-back from Deepdell Creek of 30 m, and is considerably smaller than the current Extension, the calculated depletion rate is consistent with depletion rates derived through later modelling undertaken by WSP (2023).

A comprehensive stream depletion assessment for GPUG was undertaken by WSP (2023). With respect to Requirement 1 above, the model software package MODFLOW USG used by WSP is an industry standard package, widely used and accepted internationally for groundwater flow modelling purposes. In my opinion, there is no doubt that this modelling package is fit for purpose. The model outcomes cover a wide range of scenarios simulated by WSP, including variations in ore extraction percentages, a range of rock mass permeability values and the possible presence of a vertical fault intersecting both Deepdell Creek and the GPUG Extension workings. The expected range of stream depletion (baseflow reduction) documented by WSP (2023) was 0.24 L/s to 0.54 L/s, based on the anticipated range of rainfall recharge, schist hydraulic conductivity and ore extraction percentage. This depletion rate is lower than the depletion rate derived by GHD (2026). However, it should be noted that:

1. WSP (2023) assessed dewatering effects associated with the Golden Point Underground (GPUG) mine in isolation from other existing and proposed mining-related dewatering activities. The modelling was therefore focused solely on the GPUG mining extent and its associated groundwater drawdown effects. In contrast, the GHD modelling includes the effects of the planned dewatering and mining of Innes Mills Pit.
2. The currently proposed Extension to GPUG is considerably larger than that modelled by WSP.

Further independent validation of the WSP (2023) model results was provided by audit notes to the model from GeoSolve (2023) to ORC. These notes state "*The modelled baseflow reduction of 0.24 L/s to 0.54 L/s (for the mining activity and dependent upon recharge case), was manually checked for a representative 2 km reach of Deepdell Creek. Utilising reported hydraulic conductivity for the schist, an estimate of baseflow reduction amounted to 0.24 L/s. Therefore, there is good agreement with the quantum of baseflow reduction arising from the model cases.*"

As each of the above calculations were undertaken independently, this consistency is considered to provide reasonable validation of the stream depletion outcomes documented in the GHD (2026) report (Table 1).

4. CONCLUSIONS

Based on the information summarised in this memorandum, WGA concludes that the dewatering of GPUG Extension should be addressed as a groundwater take rather than a surface water take for the purposes of the Policy 6.4.1A of the RPW.

Should you have any questions regarding the content of this memorandum, please contact the undersigned.

5. REFERENCES

Geosolve 2023. Initial audit by Geosolve: May/June 2023. Review notes produced for Otago Regional Council by Geosolve Ltd.

GHD 2026. Macraes Phase 4 FTA. Surface and Groundwater Assessment. Report produced for OceanaGold (New Zealand) Limited by GHD Limited. Document No: 12682240-REP-REV0.

PSM 2026. Macraes Phase Four Project. Golden Point Underground Extension – Mine Subsidence Assessment. Report produced for OceanaGold (New Zealand) Limited by Pells Sullivan Meynink Pty Ltd. Document No: PSM71-373R, dated 20 August 2026.

WGA 2020. Golden Point Underground Mine Groundwater Assessment. Report produced for OceanaGold (New Zealand) Ltd by WGANZ Pty Ltd. Document No: WGA191328-RP-HG-0001 Rev C, dated 22 April 2020.

WSP Golder 2023. Golden Point Underground Mine (GPUG). GPUG Extension Hydrogeological Assessment. Report produced for OceanaGold (New Zealand) Limited by WSP Australia Pty Ltd. Document No: PS130025-003-R-Rev5, dated 26 April 2023.

Yours Sincerely

[redacted]

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APPENDIX A FIGURES

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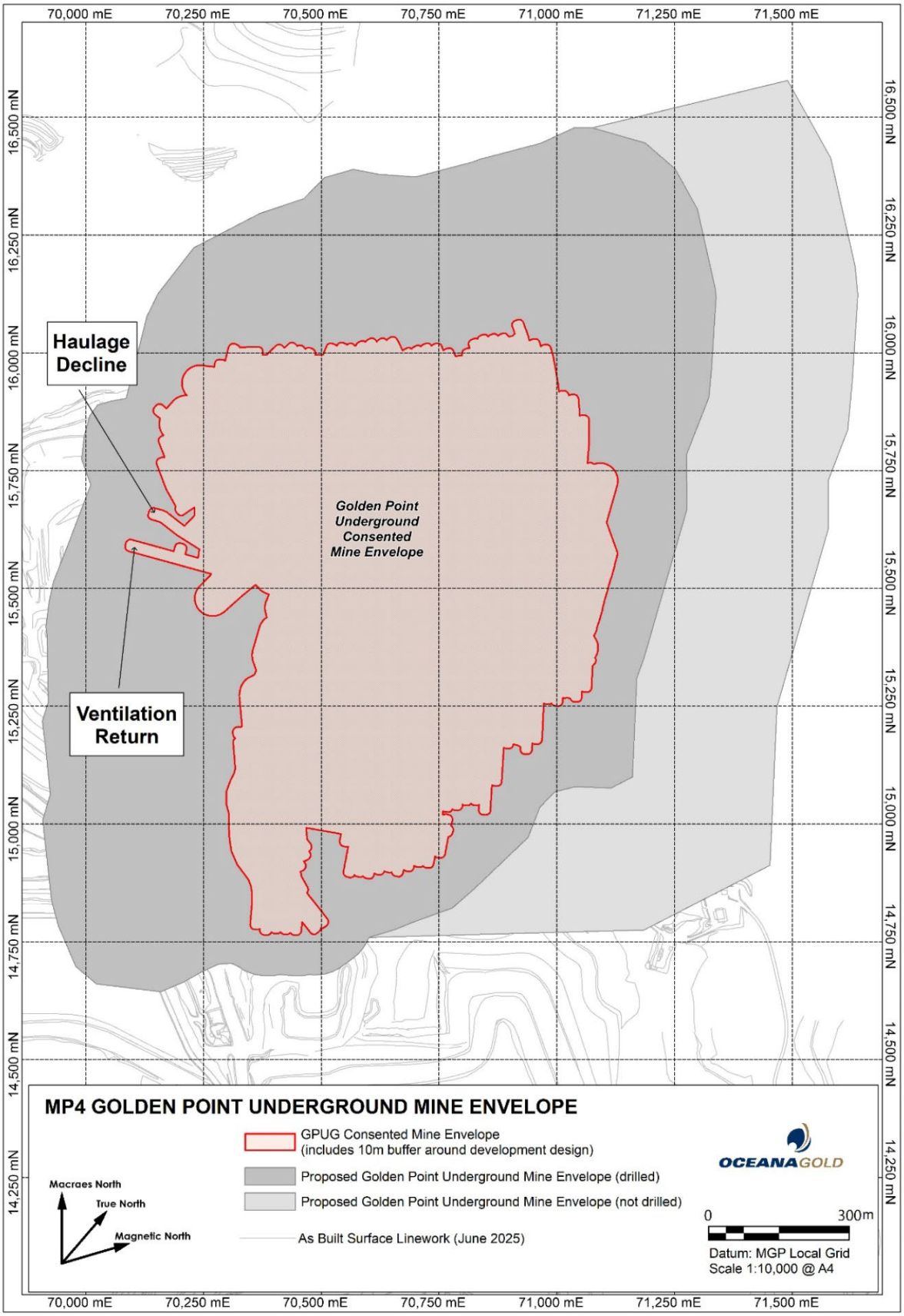

Figure 1: MP4 Golden Point Underground Mine Envelope