



APPENDIX A

Air Quality Letter



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Phil Petersen
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11 March 2020

Attention: Phil Petersen

Dear Phil

Oceana Gold - Deepdell - Response to Request for Further Information

The following information is provided in response to the request for further information (RFI) received by Oceana Gold (New Zealand) Limited (OGNZL) from Otago Regional Council (ORC) with regards to OGNZL's application to discharge contaminants to air from the proposed Deepdell project.

1. *The AEE includes a brief discussion of Respirable Crystalline Silica (RCS) and PM₁₀/PM_{2.5} monitoring undertaken in relation to existing mining activities in 1998 - 2000 but does not provide any specific details. It is noted that considerable advancements have occurred in the state of knowledge regarding the potential effects of RCS over the past 20 years. Please provide further detail in respect of this matter, with reference to:*
 - a. *Measured RCS;*
 - b. *PM₁₀ concentrations;*
 - c. *The separation distance between the monitors and mining activities;*
 - d. *Current accepted guidelines; and*
 - e. *The proximity of sensitive receptors to the proposed Deepdell activities.*

Measured RCS Results

Consent 96785 applied to the discharge of contaminants to air from the Macraes gold mine between 1998 and 2000. The consent did not include a limit on RCS concentrations, but Condition 13 required the monitoring of PM₁₀ and PM_{2.5} at four sites during November through to March inclusive and for the collected particulate to be analysed for respirable quartz. Condition 13 included a clause which allowed for monitoring to cease at any site if all quartz results at that site were below 6 µg/m³ (24-hour average) and all respirable particulate results were below 50 µg/m³ (24-hour average) for two consecutive summers.

OGNZL measured RCS during the summer months at four sites between 1998 and 2000. The monitoring was carried out by the University of Otago Commercial Consulting Group (UoO) and the results were reported annually to the ORC. The original UoO monitoring report and results for 1998 could not be found.

The RCS results were reported by UoO as a range. The UoO reports state that initially the quartz content of the filters was determined by X-ray diffractometry. However, due to the very low levels of quartz in the samples and the precision of the analysis method, an alternative method needed to be developed. The alternative method used the approximate quartz content of the rock mined at Macraes. The upper limit of the quartz content was reported to be 37% but the true percentage of the quartz in the respirable size range was estimated by UoO to be 15%. The range of RCS results reported are based on the upper and lower

estimates of the quartz content of the rock. The UoO reports state that the lower result is the best estimate of the airborne quartz content in the respirable size range.

The monitoring results for RCS for January 1999 to March 2000 are shown in Table 1^{1,2}.

Table 1 – RCS monitoring results ($\mu\text{g}/\text{m}^3$) 24-hour averages

Date	Howards ($\mu\text{g}/\text{m}^3$)	Macraes ($\mu\text{g}/\text{m}^3$)	Suttons ($\mu\text{g}/\text{m}^3$)	Golden Point ($\mu\text{g}/\text{m}^3$)
January 1999	2-6	<1-1	<1-<1	1-2
February 1999	1-1	<1-2	*	*
March 1999	<1-<1	1-1	1-3	2-4
November 1999	1-3	<1-<1	<1-<1	2-4
December 1999	1-2	<1-1	3-5	3-7
January 2000	1-1	2-4	1-2	3-7
February 2000	1-1	0-0	6-15**	-
March 2000	1-2	2-4	3-6	1-3

*data excluded from analysis

**monitor ran for 40 hours instead of 24 hours.

The results shown in Table 1 demonstrate that all of the low range RCS measurements were below the consent trigger value of $6 \mu\text{g}/\text{m}^3$ (24-hour average). Monitoring of RCS ceased at the end of March 2000.

It is noted that the reported RCS results assume that all of the dust sampled by the monitors was derived from rock, whereas in reality the dust will also be generated from other sources at the mine such as soil and overburden excavation and unsealed roads plus background sources, all of which will have a lower crystalline quartz content than the hard rock that is mined. It is therefore considered that the monitoring results for RCS are likely to significantly overestimate actual concentrations.

Measured PM₁₀ Results

OGNZL also measured PM₁₀ concentrations during the summer months at four sites between 1998 and 2000. The monitoring was carried out by UoO and were reported annually to the ORC. The original UoO monitoring report and results for 1998 could not be found.

The monitoring results for PM₁₀ for January 1999 to March 2000 are shown in Table 2^{3,4}.

¹ Fitzharris B.B et al “*Atmospheric Dustfall at Macraes, Otago 1999, the Tenth Year from Opening of the Gold Mine*”, University of Otago, February 2000.

² Fitzharris B.B et al “*Atmospheric Dustfall at Macraes, Otago 2000, the Eleventh Year from Opening of the Gold Mine*”, University of Otago, February 2001.

Table 2 PM₁₀ monitoring results (µg/m³) (24-hour average)

Date	Howards (µg/m ³)	Macraes (µg/m ³)	Suttons (µg/m ³)	Golden Point (µg/m ³)
January 1999	15	3	3	11
February 1999	6	3	13	16
March 1999	1	6	5	10
November 1999	<1	2	1	6
December 1999	7	6	10	17
January 2000	5	15	7	14
February 2000	<1	-	-	-
March 2000	7	16	-	9

All of the PM₁₀ concentrations measured at the four monitoring sites were well below the consent trigger limit of 50 (µg/m³) (24-hour average) and hence monitoring ceased at the end of March 2000.

Separation distances between monitors and mining activities

Figure 1 is a copy of a figure included in the 2000 UoO report which illustrates the locations of the monitoring sites used to measure PM₁₀ and RCS and the locations of the mining activities taking place in 1999 and 2000.

³ Fitzharris B.B et al "Atmospheric Dustfall at Macraes, Otago 1999, the Tenth Year from Opening of the Gold Mine", University of Otago, February 2000.

⁴ Fitzharris B.B et al "Atmospheric Dustfall at Macraes, Otago 2000, the Eleventh Year from Opening of the Gold Mine", University of Otago, February 2001.

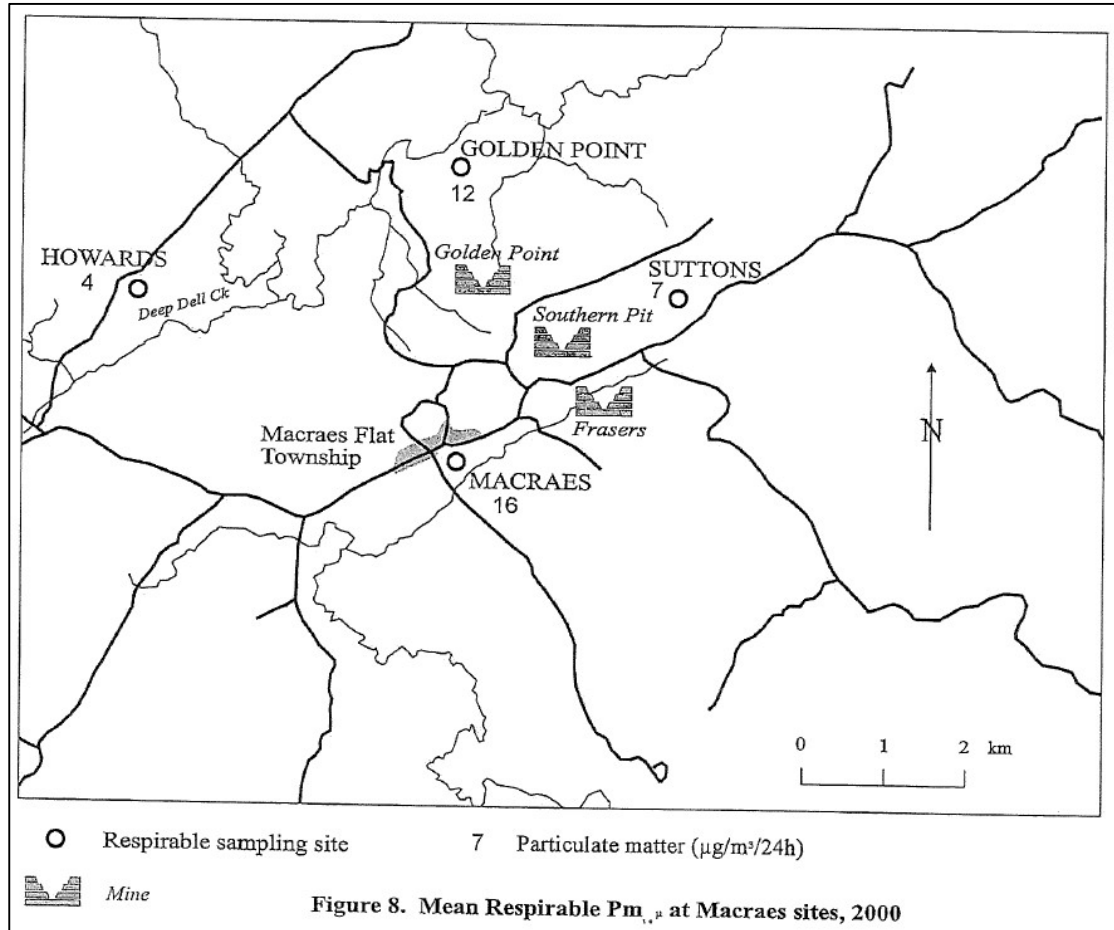


Figure 1 Map showing the location of the PM_{10} monitoring sites and mining activity in 2000 (copied from UoO report for 2000) (note the map is oriented towards true north)

The approximate distances between the closest mining activity and each monitoring site based on Figure 1 are shown in Table 3.

Table 3 Approximate distances between monitoring sites and mining activities in 2000

Monitoring site	Approximate distance to closest mining activity
Howards	3.9 km west of Golden Point
Macraes	1.5 km southwest of Frasers
Suttons	1 km northeast of Southern Pit
Golden Point	1 km north of Golden Point

Current accepted guidelines for PM₁₀ and RCS

PM₁₀

The current accepted guideline for ambient PM₁₀ concentrations is the National Environmental Standard for Air Quality (NESAQ) criteria of 50 µg/m³ (24-hour average).

RCS

There are no New Zealand NESAQ, Ambient Air Quality Guidelines (AAQG) or World Health Organisation (WHO) ambient air quality guidelines for RCS. In the absence of national ambient standards, guidelines or WHO guidelines, the Ministry for the Environment (MfE)⁵ recommends the use of selected international guidelines, including those published by the California Office of Environmental Hazard Assessment.

The California Office of Environmental Hazard Assessment chronic reference exposure limit (REL) for long term exposure to RCS is 3 µg/m³ (annual average). The chronic REL is an airborne level that would pose no significant health risk to individuals indefinitely exposed to the level.

The trigger value included in Condition 13 of Consent 96785 was 6 µg/m³ as a 24-hour average. There is no direct relationship between daily and annual average criteria levels as the acute and chronic effects of contaminants are different. However, based on the relationship between daily and annual average guidelines for PM₁₀, it is expected that the annual average criteria for RCS would be less than 50% of the daily average criteria. Consequently, the daily average criteria value of 6 µg/m³ used in Consent 96785 is approximately equivalent to the annual average REL of 3 µg/m³.

Proximity of sensitive receptors to the proposed Deepdell activities

The distances between the Howard monitoring site, the other nearby residences and the proposed Deepdell project are shown in Figure 2. Figure 2 is copied from Figure 2-2 of the Beca assessment report titled “*Oceana Gold (New Zealand) Ltd – Deepdell North Stage III – Assessment of Effects of Discharges to Air*” (Beca AEE)⁶

⁵ Ministry for the Environment, “*Good Practice Guide for Assessing Discharges to Air from Industry*” November 2016

⁶ Beca Limited, “*Oceana Gold (New Zealand) Ltd – Deepdell North Stage III – Assessment of Effects of Discharges to Air*”, July 2019

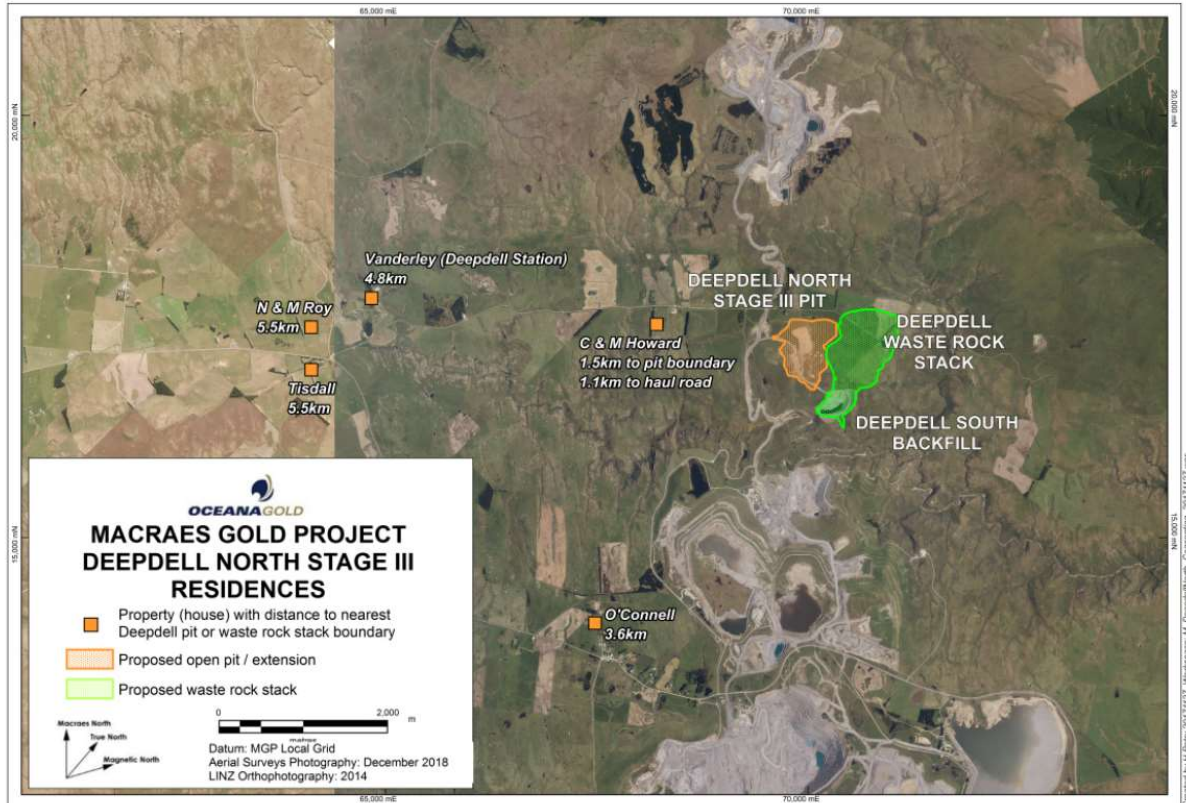


Figure 2 Aerial photograph showing the location of the Deepdell project features and the nearby residences and the distances between them. (copied from Beca AEE) (note the aerial is oriented towards Macraes North)

Figure 2 demonstrates that the Howard residence is located 1.1 km from the proposed Deepdell haul road and 1.5 km from the pit boundary.

2. *Assess the dust effects associated with construction activities, notably construction of the large bund on the eastern side of the haul road that is indicated in the plans. In this assessment consider methods proposed to control potential effects on the Howard residence and property during the construction period.*

The Deepdell project will include noise bunds located on the western side of the proposed haul road (as shown in Figure 3 and it is these that we assume are referred to in question 2). The noise bunds will be located approximately 1.1 km to the northeast of the Howard residence. The Howard residence will be downwind of the bunds in northeasterly winds. Northeasterly winds occur for 12% of the time and northeasterly winds that exceed 5 m/s and which have the potential to entrain dust occur for 0.8% of all hours. Figure 4 is an aerial photograph of the Deepdell project overlaid with a windrose showing the frequency of hourly average wind speeds measured at Golden Point Road, Macraes between 2012 – 2018 (inclusive).

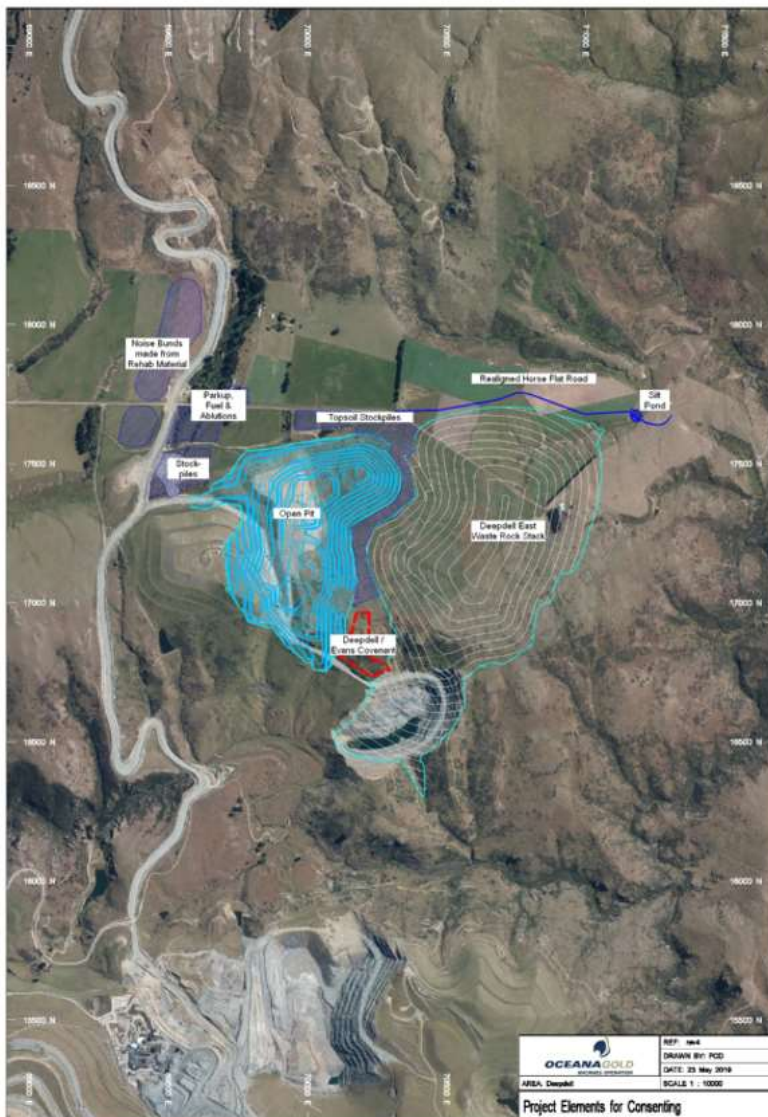


Figure 3 Aerial photograph showing the major project elements for the Deepdell Stage III project (Figure 4-1 of the Beca AEE) (Figure supplied by OGNZL)

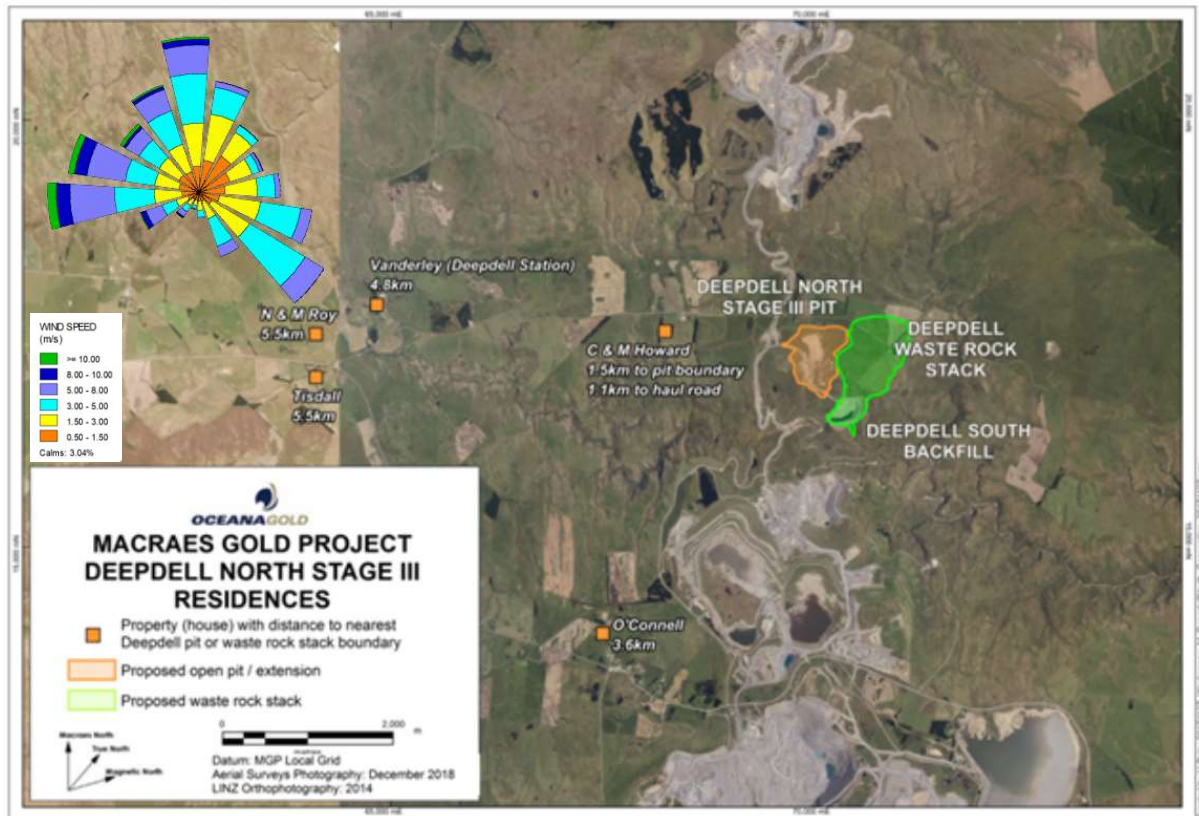


Figure 4 Aerial photograph of project area overlain with the site windrose for 2012-2018 oriented to Macraes north (background image provided by OGNZL)

As noted in Section 7.1.1 of the Beca AEE, as a general rule dust deposition is unlikely to occur to any significant degree beyond an approximate distance of 100 – 200 m from a dust source in most circumstances but that local environmental conditions may influence the potential range of dust deposition. For the Macraes Flat area, which is subject to high wind speeds, with large scale mining activities and elevated dust sources, it is expected that areas within 1- 2 km of mining activities may be potentially affected by dust in worst case weather conditions, if appropriate mitigation measures are not implemented.

The construction of the noise bunds will use the same earthworks and construction techniques that are used in other parts of the mine for constructing structures such as waste rock stacks and will have a similar potential to generate dust. OGNZL proposes to continue to use the same dust control measures that are used effectively elsewhere in the mine when constructing the bunds. These include:

- Limiting vehicle speeds;
- Minimising haul distances as far as practicable;
- Keeping roads and construction surfaces damp with water carts and/or fixed sprinklers when required; and
- Minimising drop heights when loading and unloading materials.

Due to the very low frequency of winds which may blow dust generated from the construction of the bunds towards the Howard residence, the distance between the bunds and the Howard residence and the mitigation

measures that are proposed, the risk of dust generated from the construction of the bunds being offensive or objectionable and causing adverse effects at the Howard residence is considered to be low.

3. *Having specific regard to the location of the Howard residence, assess the merit of employing continuous particulate monitoring methods during the 2-year period of proposed activity at Deepdell. Monitoring should be located between the proposal and the Howard residence and provide 1-hour and 24-hour suspended particulate concentration data with reference to trigger levels that could be used to instigate additional dust control conditions as required.*

As noted above, it is considered that the risk of dust generated by the construction of the bunds causing adverse effects at the Howard residence is low. Section 7 of the Beca AEE assessed the effects of the discharges to air from the project and noted that due to the low frequency of winds which may blow dust towards the Howard residence and the large distance between the residence and the mine it is unlikely that the Howard residence will be adversely affected by dust generated during construction and operation of the mine. Consequently, it is Beca's opinion that the use of continuous instrumental particulate monitoring at the Howard residence is unnecessary and will not provide any useful information on the performance of the dust control methods used at the mine, as for the majority of time, wind will carry any dust generated away from the monitor.

4. *Propose specific consent conditions for the proposed discharge to air permit. In this refer to the specific dust gauges of relevance (DG07 and DG15), the suspended particulate monitoring, reporting proposed and appropriate trigger levels with response actions. When proposing conditions include any changes that may be proposed as a result of questions 1-3 of this letter.*

The current locations of the monitoring sites are shown in Figure 5. As noted in Section 8 of the Beca AEE, the current ambient air monitoring programme includes three sites that are in the vicinity of the proposed Deepdell North Stage III project (DG07, DG17 and DG24). DG07 is located on the Howard property and provides a measure of the effects of dust from the mine at the site. This gauge will continue to be used throughout the project.

The dust levels measured at DG07 are subject to the current consent limit for deposited dust included in the current consents for discharges to air for the mine. The consents require that deposited insoluble dust must not exceed 3 g/m²/30 days above background levels more than twice in any calendar year. It is recommended that this consent trigger limit continues to apply in the consent for the Deepdell project.

DG17 is located approximately 300 m to the north of the proposed Deepdell project on land owned by OGNZL. The dust levels measured at this site are not subject to the consent limit. DG24 is a background site that is located approximately 2.4 km to the north of the proposed project. These dust gauges will also continue to be used.

DG15 is located in Macraes Flat Village some 4 km southeast of Howards and 4.7 km south east of the proposed Deepdell project. DG15 is very unlikely to be affected by the Deepdell project. A deposit gauge, continuous TSP monitor and a climate station are located at this monitoring site. It is recommended that these instruments continue to operate and the TSP consent limit of 120µg/m³ (24-hour average) continues to apply.

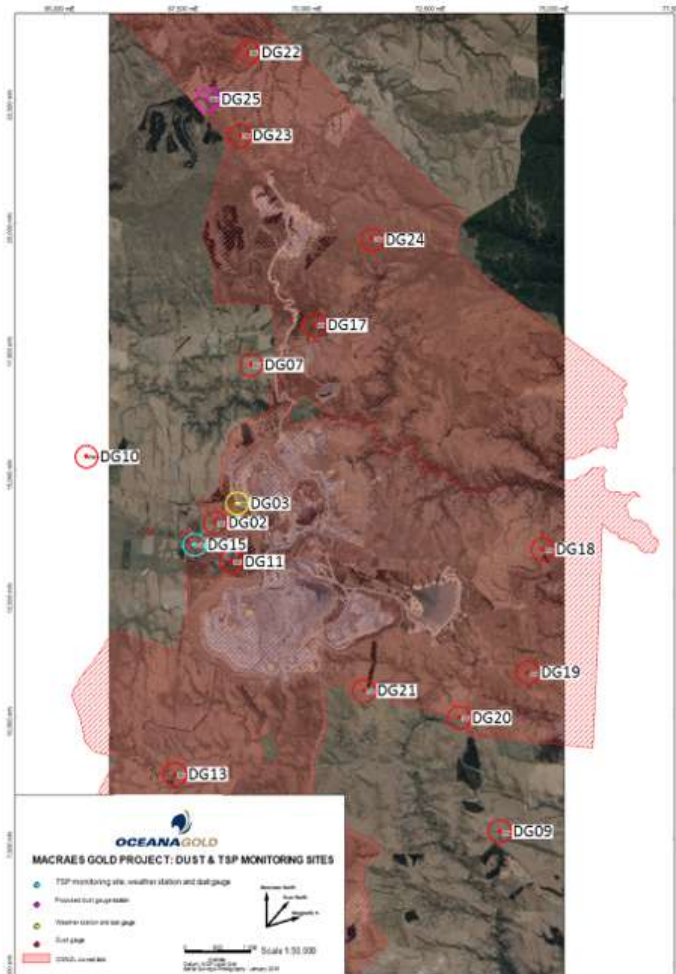


Figure 5 Locations of dust and TSP monitoring sites (image provided by OGNZL)

It is Beca's opinion that the locations of the dust monitoring sites do not need to be altered, or any new sites added to provide adequate monitoring of the effects of dust generated by the Deepdell project. It is also Beca's opinion that the current consent trigger limits and response actions are appropriate and no changes to the consent conditions are necessary.

Yours sincerely

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on behalf of

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