



## Discharge Consent (068/12/2) Reporting

September 2015 to November 2015

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**Appendix A – Presentation of Water Quality Results**

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## 1.0 INTRODUCTION

This report has been prepared by Dalradian Gold Ltd. (DGL) in response to Condition 1.I. of Discharge Consent 068/12/2, which requires quarterly water quality reporting. The consent relates to discharge of site drainage water (at Irish Grid Reference H 5707 8690) arising from the DGL advanced exploration project at Curraghinalt. The site is situated approximately 8 km to the east of the village of Gortin, County Tyrone, Northern Ireland, BT79 7SF.

## 2.0 SUMMARY OF OPERATIONS DURING THE REPORTING PERIOD

DGL are currently progressing advanced exploration at the Curraghinalt site, which includes re-activating historical underground workings and completion of a parallel drilling program. The work is progressing under Planning Permission K/2013/0072/F, and is aimed at collecting information that will support a Feasibility Study and an Environmental Impact Assessment to allow for development of a full mine.

Water discharged via the consent during the reporting period has derived from natural groundwater drainage from the adit entrance, together with runoff water from various components of the site that has resulted from incident rainfall. Following capture and management of these sources, treatment prior to discharge at the consent location has included passage through a settlement tank, oil interceptor, lamella clarifier (for further sediment removal), and a pH adjustment tank.

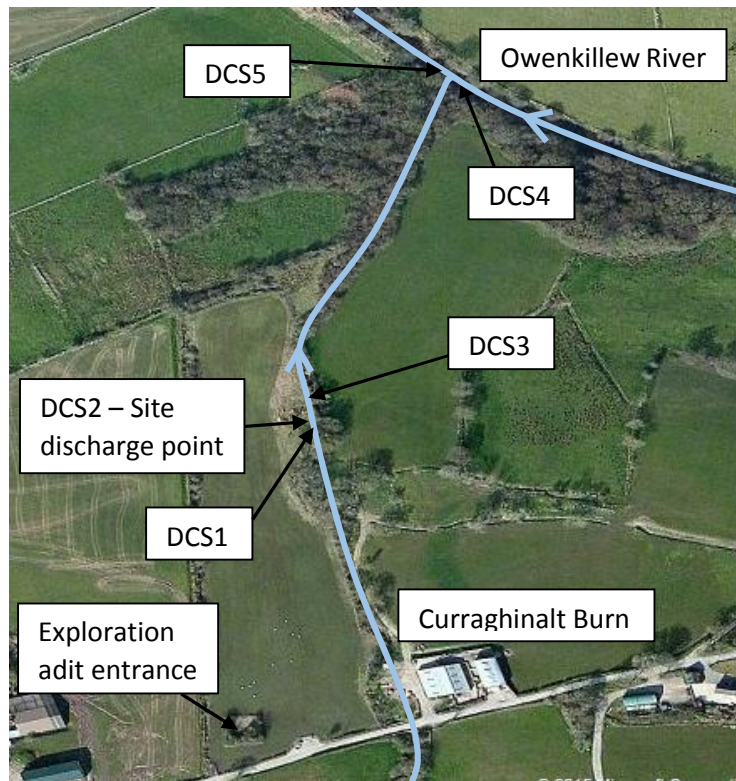
DGL informed the Northern Ireland Environment Agency (NIEA) of the intention to commence the site discharge on 3 December 2014. This document represents the fourth quarterly discharge consent report.

Construction works have now been largely finalised at the site and have included the development of offices, services and parking, a designated storage area for waste rock, and the formal water treatment facility.

## 3.0 SAMPLING LOCATIONS, PROTOCOL AND LABORATORIES

Five surface water sample locations are required to be sampled monthly as part of the Discharge Consent. These have been listed below as Discharge Consent Sample 1 (DCS1) to Discharge Consent Sample 5 (DCS5) and are also presented on Figure 1.

- DCS1 - Immediately upstream of the confluence of the site discharge point and Curraghinalt Burn;
- DCS2 - Site discharge point;
- DCS3 - 5 m downstream of the confluence of the site discharge point and Curraghinalt Burn;
- DCS4 - Immediately upstream of the confluence of Curraghinalt Burn and the Owenkillew River; and
- DCS5 - 5 m downstream of the confluence of the Curraghinalt Burn and the Owenkillew River.



100m – approx. scale

**Figure 1: Site map (Bing Maps) showing discharge consent sample locations**

All surface water samples are collected according to protocols described in the DGL Surface Water Sampling Procedure<sup>1</sup>. To help ensure quality results, care is taken not to disturb stream bed sediments upstream of the sampling point and prior to sampling. Samples are collected at all locations by a DGL Field Technician wearing a fresh pair of nitrile gloves and from the flowing stream of water to minimise any risks of contamination. All sample bottles are laboratory supplied and are filled to capacity at source.

In accordance with best practice field filtration for dissolved parameters is undertaken on site using a syringe and attached 0.45µm filter, and these samples are associated with a nitric acid (HNO<sub>3</sub>) preservative to thereafter stabilise dissolved metals in solution. All laboratory analytical services during the quarter, including supplementary Quality Assurance/Quality Control (QA/QC) testing, have been provided by [REDACTED].

Samples are placed in a cooler with ice, secured with sample packaging and accompanied by a completed Chain of Custody (CoC) Form, and shipped directly to [REDACTED] in [REDACTED] for analysis. [REDACTED] are accredited by the United Kingdom Accreditation Service (UKAS) to 17025 standard, and UKAS monitor and externally audit the laboratory.

DGL have also been working to include the measurement of pH in the field at each sample location. Regular calibration of the instrument used is undertaken on site using both pH 4.01 and pH 7.01 buffer solution and in accordance with DGL MultiParameter Meter Calibration Procedure<sup>2</sup>. During readings, the pH probe is fully immersed at all times in the flowing stream of water and up until stabilisation

<sup>1</sup> Dalradian Gold Ltd. 2013 & 2015. Surface Water Sampling Procedure.

<sup>2</sup> Dalradian Gold Ltd. 2013 & 2015. MultiParameter Meter Calibration Procedure.

occurs<sup>3</sup>. The instrument has not always been available throughout the reporting period and has had some scheduling for maintenance.

## 4.0 RESULTS

During the reporting period DGL have collected a total of 21 water samples from the discharge consent locations. This number of samples exceeds that required by the consent during the period, and amounts to a maximum of five samples from any of the locations described. Sampling was undertaken on 2 September 2015, 28 September 2015, 1 October 2015, 22 October 2015 and 5 November 2015.

QA/QC checks and factual reporting against the consent water quality thresholds for the discharge point are presented in the following sub-sections. Water quality results and thresholds are summarised in Appendix A, and all laboratory certificates are presented in Appendix B.

### 4.1 Quality Assurance/Quality Control

A number of QA/QC measures have been applied to water samples taken at all sites. A factory calibrated certificate for the HANNA HI9828 MultiParameter meter used to measure pH in the field is provided in Appendix C.

#### 4.1.1 Chain of Custody and confirmation of parameter analysis

A CoC form was completed on each day of sampling and on five separate occasions between 2 September 2015 and 5 November 2015. The CoC forms document possession of the samples from the time of sample collection to reception at the lab; provide primary instruction to the lab on the parameters to be analysed; and provide sample information relevant to the lab, such as sample name and sample date and time. Following each sampling event and prior to submission to the lab, the CoC was reviewed and checked for errors. In the events covered within the period there are no issues to report in this respect.

#### 4.1.2 Holding times

In order to ensure holding times were not exceeded, DGL shipped samples directly to the laboratory. Certificates presented in Appendix B demonstrate that all samples were received by [REDACTED] on the next day following sampling on all occasions. Testing is recorded on CoC forms to have been scheduled for a standard 10 day turnaround time on all occasions.

#### 4.1.3 Field Blanks

A total of four field blanks have been collected during the reporting period to assess potential contamination due to the sampling environment (e.g., dust getting into the sample bottle). Analysis of field blanks was undertaken by the laboratory alongside the specified water chemical analysis. Field blank results include total ambient conditions during samplings, but can also potentially incorporate bias due to laboratory methods (e.g., low-level constituents remaining in analytical equipment from a prior highly contaminated sample from another site) that are assessed by laboratory method blanks. The field blanks incorporated deionised water which theoretically should return no measurable values throughout the parameters analysed (with the omission of pH) unless there has been a source of contamination during sampling.

All determinants in two blank samples (1 October 2015 and 5 November 2015) were below laboratory detection limits (Appendix A). The exceptions to this rule are for dissolved cadmium in the blank samples from 9 September and 22 October 2015 (0.08 µg/L and 0.04 µg/L respectively), dissolved lead in the blank samples from 9 September and 22 October 2015 (0.5 µg/L and 1.1 µg/L respectively), and dissolved chromium in the blank sample from 2 September 2015 (0.7 µg/L). All of these 'positive

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<sup>3</sup> Dalradian Gold Ltd. 2013 & 2015. MultiParameter Meter Sampling Procedure.

results' are within five times the reported Limit of Detection (LoD) for each parameter (<0.03 for dissolved cadmium, <0.2 for dissolved chromium, and <0.4 for dissolved lead). These low level detections reported in two of the blank samples are considered to be acceptable.

#### 4.1.4 Duplicate Samples

Three duplicate samples were collected during the reporting period, and all from the discharge point (DCS2). Analysis of all duplicate samples was undertaken by [REDACTED] and therefore alongside the remaining batch.

The measure of the reproducibility or precision of the chemical analysis has been quantified by calculating the Relative Percentage Difference (RPD) between parameter concentrations on the split sample submitted as a blind duplicate. The RPD has been calculated as follows:

$$RPD\% = \frac{|S - D|}{\frac{1}{2}(S + D)} \times 100$$

Where:

RPD = Relative Percentage Difference

S = Sample value of parameter; and

D = Duplicate value of parameter

Theoretically, duplicate samples should have identical chemical concentrations (i.e., RPD = 0). However, due to factors such as sample matrix heterogeneity, natural variations or variations due to sample collection, handling or analysis, a variation in chemical concentration may occur (i.e., RPD greater than 0).

It should be noted that the reproducibility of replicate analyses at concentrations near the method detection limit (MDL) can be poor, resulting in RPD values of greater than the desirable limits. Therefore, for duplicate concentrations greater than five times the detection limit, a relative percent difference value of  $\pm 20\%$  is considered acceptable<sup>4</sup>. Given these considerations, for duplicate concentrations less than five times the detection limit, RPD has not been calculated.

An RPD value greater than the above project objectives suggests variability has been introduced through sample collection, sample handling, or sample analysis. Of the analysis undertaken, dissolved cadmium (22 October 2015) and dissolved iron and lead (5 November 2015) in the discharge point sample (DCS2) fall outside the project objectives for reproducibility. It should be noted that all values are below the consent limit. Discrepancies are considered to most likely be due to small variations in sampling and analytical procedure.

#### 4.1.5 Laboratory internal QA/QC

[REDACTED] report data only if the laboratory is confident that the results are a true reflection of the samples analysed, and data is only reported as accredited when all the requirements of their Quality System have been met. Any failure in the Quality System is fully investigated and documented as deviating samples on certificates issued. If samples are received in a condition inappropriate to the requested analyses, for example if they are dispatched in inappropriate containers or at a temperature not commensurate with the requested analysis, any test results that may be compromised will be highlighted in a deviating samples report.

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<sup>4</sup> Zeiner, S.T. 1994. Realistic Criteria for the Evaluation of Field Duplicate Field Results. Proceedings of Superfund XV, November 29-December 1, 1994. Sheraton Washington Hotel, Washington, D.C.

On all laboratory certificates returned all samples sent for analysis were scheduled upon receipt, and no deviating samples are noted.

#### 4.1.6 Summary

As detailed above, there are no major QA/QC concerns regarding the dataset presented. Duplicate and blank samples collected also indicate a high level of data quality. There were a few minor detections in field blanks that resulted in no apparent bias in the water quality results. These are attributed to conditions during sampling and potentially bias deriving from laboratory procedures.

## 4.2 Factual Presentation of Data

All water quality results are presented in summary form for each location in Appendix A. This includes a comparison of concentrations from the discharge point location (DCS2) against specific threshold values detailed within the consent.

**During the reporting period, all five sample results from DCS2 are below the threshold values presented within the consent for all parameters.**

Excluding any duplicate samples obtained for QA/QC purposes, water quality obtained from the Curraghinalt Burn during the period can be summarised as follows:

- Total suspended solids data varied from a maximum of 32 mg/L upstream of the site to a maximum of 10 mg/L downstream of the site;
- All BOD concentrations are  $\leq 2$  mg/L;
- Laboratory measured pH varies between a minimum of 6.45 pH units (recorded at the downstream location) and a maximum of 7.74 pH units (recorded at the upstream location);
- Low level dissolved mercury was recorded at the downstream location (DCS3) on one occasion. Low level dissolved cadmium was detected on one occasion at both the upstream location (DCS1) and the downstream location (DCS3);
- Oil or grease has not been visible at the sample locations;
- The maximum dissolved iron concentration has been determined at 6.646 mg/L at the upstream location; and
- The maximum total hardness has been recorded as 100 mg/L at the downstream location.

Excluding duplicate samples obtained for QA/QC purposes, water quality obtained from the Owenkillew River during the period can be summarised as follows:

- Total suspended solids data from upstream and downstream are all  $<10$  mg/L during the period;
- All BOD concentrations are  $\leq 2$  mg/L;
- Laboratory measured pH varies between a minimum of 6.45 pH units (recorded at the upstream location) and a maximum of 7.91 pH units (recorded at the downstream location);
- Oil or grease has not been visible at the sample locations;
- The maximum dissolved iron concentration has been determined at 1.938 mg/L at the downstream location; and
- The maximum total hardness has been recorded as 43 mg/L at the downstream location.

**Appendix A**  
**Presentation of Water Quality Results**



**Appendix B**  
**Laboratory Certificates**

**Appendix C**

**Hanna MultiParameter Meter Calibration Certificate**