# *2016 OPERATING CARE & MAINTENANCE ANNUAL REPORT*

## *Denison Mines Inc.*

***Submitted to the***

***Canadian Nuclear Safety Commission***

***March 31, 2017***

Denison Mines Inc.
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March 31, 2017

Dr. Karina Lange, Senior Project Officer
Wastes and Decommissioning Division
Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
Ottawa, Ontario
K1P 5S9

Dear Dr. Lange:

**RE: Denison Mines Inc. 2016 Operating Care and Maintenance Annual Report**

Denison Mines Inc. is pleased to submit one copy of the Denison Mines Inc. Operating Care and Maintenance Annual Report for 2016. This document has been completed in accordance with: UMDL-Minemill-Denison.01/indf; and UMDL-Minemill-Stanrock.02/indf; and CofA No. 4-0067-74-766.

Yours truly,

Denison Mines Inc.

Janet Lowe

General Manager

Enclosure

Distribution

**Elliot Lake Joint Review Group 2016**

| | |
|---|---|
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**Additional Distribution 2016**

| | |
|---|---|
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# 1 ORGANIZATIONAL INFORMATION

Licensee
DENISON MINES INC.
1100-40 University Avenue
Toronto, Ontario
M5G 1T1

## *1.1 Board of Directors*

Table 1.1 lists the names and addresses of the Directors of Denison Mines Inc. as of December 31, 2016.

***Table 1.1 Denison Mines Inc. Directors as of December 31, 2016***

| Name | Office |
|---|---|
| David Cates | Director, President and Chief Executive Officer |
| Gabriel (Mac) McDonald | Director, Chief Financial Officer |
| Amanda Willett | Corporate Secretary |
| Mary Jo Smith | Director, Internal Audit |

## *1.2 List of Officers*

The Denison Mines Inc. officers as of December 31, 2016 are listed below in Table 1.2.

***Table 1.2 Denison Mines Inc. Officers as of December 31, 2016***

| Name | Office |
|---|---|
| David Cates | Director, President and Chief Executive Officer |
| Gabriel (Mac) McDonald | Director and Chief Financial Officer |
| Amanda Willett | Corporate Secretary |
| Mary Jo Smith | Director, Internal Audit |

# 2 FINANCIAL GUARANTEES

Federal and Provincial regulations which apply to the decommissioning programs of Denison Mines Inc. (Denison) in Elliot Lake require mine operators to provide adequate and secure resources to meet current and future responsibilities with respect to mine closure and long-term care and maintenance.

All expenditures are funded through a reclamation trust fund where Denison is required to maintain a balance in the trust equivalent to six years of the estimated current annual costs. Sufficient funds are currently in the reclamation trust to meet all monitoring costs through 2022.

# 3 LICENSE AND MONITORING PROGRAM MODIFICATIONS

Denison Mines Inc. operates under UMDL-Minemill-Denison.01/indf and UMDL-Minemill-Stanrock.02/indf and Certificate of Approval (C of A) No. 4-0067-74-766 in 2016.

There were approved changes/modifications to the Source Area Monitoring Program (SAMP) and the Tailings Operational Monitoring Program (TOMP) in 2015, which are presented in the *Cycle 4 Study Design for the Serpent River Water Management Program (SRWMP), SAMP and TOMP* (Minnow, 2016). A summary of approved changes is provided in Appendix I.

# 4 METHODOLOGY

## *4.1 Health and Safety*

### *4.1.1 Health and Safety Injury Statistics*

During 2016, training and education in matters relating to health and safety continued to be provided at monthly safety meetings and daily line-ups for Denison staff.

### *4.1.2 Gamma Dosimetry*

Denison has continued to voluntarily participate in the gamma dosimetry program. The program applies to employees and contractors whose job involves working in and around the licensed sites which include the tailings management areas. The procedure does not apply to visitors visiting the sites or employees who do not actively work at the licensed sites.

Personal gamma dosimetry continued in 2016 for the Care and Maintenance service provider. Optically Stimulated Luminescence (OSL) dosimeters were issued January 1, 2016 and each quarter going forward. At the end of the wearing period the dosimeters are sent to the Radiation Protection Bureau (RPB) Health Canada for processing. Denison's designate is responsible for reviewing the information and maintaining the company records.

Individual dose estimates for Care and Maintenance workers who are classified as Nuclear Energy Workers for 2016 will be issued to the Canadian Nuclear Safety Commission (CNSC) under separate cover.

### *4.1.3 Radon Progeny Monitoring*

Radon progeny monitoring has continued to occur on a quarterly basis at all Denison facilities in Elliot Lake. It is reported in Working Level (WL) unit.

Radon level is measured by calculating alpha radiation from radon decay products. The sample is first collected on membrane filters with an air sampling pump by walking through the entire ETP over a 5 minute period, simulating a normal work routine. The ETP should be ventilated per routine work practice before the walkthrough. Between forty to ninety minutes after the sample collection, alpha radiation is measured with an alpha counter. WL is then calculated based on the counts, count duration, sampling duration, sampling flow rate, decay factor, filter self-absorption value, background count and efficiency factor.

If any WL value exceeded 0.5, mitigative measures were implemented, such as longer ventilation time before work, to reduce worker exposure to radon gas.

## *4.2 Water Quality Monitoring Program*

### *4.2.1 Program Requirements*

Approved recommendations for modifications to the SAMP and TOMP starting in 2015 are presented in the *Cycle 4 Study Design* for the SWRMP, SAMP and TOMP (Minnow, 2016). A summary of approved changes is provided in Appendix I.

The 2016 SAMP and TOMP followed program requirements (sampling locations, frequencies, parameters and analytical protocols) as recommended and approved in the *Cycle 4 Study Design for the SRWMP, SAMP and TOMP* (Minnow, 2016). Appendix II provides a map of the sampling stations included in the water quality program. Tables in Appendix II provide a brief description of each location, the frequency and parameters monitored as well as non-SAMP and TOMP regulatory drivers.

### *4.2.2 Data Quality Objectives*

Targeted Method Detection Limits (MDLs) for SAMP and TOMP requirements are provided in Table 4.2.2 which were derived from the Cycle 4 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2015). Laboratory data quality assessment is provided in Section 3.1 of the *Serpent River Watershed Monitoring Program (SRWMP) Water Quality Report 2016* (RAL; DMI, 2017).

### *4.2.3 Changes in Analytical Methods*

There were no changes in analytical methodology in 2016.

### *4.2.4 Data Screening and Assessment Conventions*

Data validation was conducted on SAMP and TOMP water quality data throughout the year. The data validation assessment-screening process flags all data points outside a rolling minimum 12 value mean $\pm$ 3 standard deviations.

Detailed surface water and groundwater quality assurance and quality control (QA/QC) results are included in Appendix III of this report. Data quality assessment involves monthly screening of field duplicate and field blank sample data against SAMP and TOMP data quality objectives.

Laboratory analyses are contracted to Canadian Association of Laboratory Accreditation (CALA) certified laboratories. Laboratory QA/QC reports are provided in the *Serpent River Watershed Annual Water Quality Report 2016* (RAL; DMI, 2017).

Flagged data and short-term response plans are then reported monthly to the CNSC, Ministry of the Environment & Climate Change (MOECC) and Environment Canada (EC) in the monthly water quality report. Monthly data validation of flagged data for 2016 can be found in Appendix III.

Field quality assurance and quality control sampling was extended to the groundwater monitoring program in 2006. TOMP data quality objectives are identified in *The Cycle 4 Study Design for the SRWMP, SAMP and TOMP* (Minnow, 2016).

Annual water quality reporting is designed to be concise and focused on the presentation of data in a standardized format with limited interpretation. Detailed statistical evaluation of water quality trends is included in the *Serpent River Watershed Cycle 4 State of the Environment Report (SOE)* (Minnow, 2016). Data validation, as documented in Data Validation Procedures, ensures prompt response to upset conditions or unusual results. Appendix IV includes all 2016 water quality monitoring results with surface water results compared to Table 4.2.2 Assessment Criteria and Data Quality Objectives (ACDQO). Five years of groundwater quality data are also included in Appendix IV. It should be noted that elevation measurements for Denison sites were changed from feet to meters in 2015. Historic data will be updated in the environmental database to reflect this change in 2017.

## *Table 4.2.2 Assessment Criteria and Data Quality Objectives*

| | | Assessement Criteria[1] | Data Quality Objectives [2] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **Receiving Environment Criteria** | **Targeted Detection Limit** | **Minimum Detectable Difference** | **Field Blank Criteria** | **Laboratory Blank Criteria** | **Field Precision** | **Laboratory Precision** | **Laboratory Spikes** | **Laboratory Accuracy (CRM)** |
| **Field Parameters** | | | | | | | | | | |
| Conductivity | µmho/cm | - | 0.1 | 0.05 | - | - | 20% | - | - | - |
| Flow | L/s | - | method | method | - | - | - | - | - | - |
| pH | pH units | | 0.1 | 0.01 or 0.02 | - | - | 20% | - | - | - |
| *Lake* | | 6.5 | | | | | | | | |
| *Wetland/stream* | | 5.2 | | | | | | | | |
| **Laboratory Parameters** | | | | | | | | | | |
| Acidity | mg/L | - | 1.0 | - | 2 | 2 | 20% | 10% | - | 20% |
| Barium | mg/L | 1.0 | 0.005 | - | 0.01 | 0.01 | 20% | 10% | 20% | 20% |
| Cobalt | mg/L | 0.0025 | 0.0005 | - | 0.001 | 0.001 | 20% | 10% | 20% | 20% |
| Iron | mg/L | | | - | 0.04 | 0.04 | 20% | 10% | 20% | 20% |
| *Lake* | | 0.49 | 0.02 | | | | | | | |
| *Wetland/stream* | | 1.69 | 0.02 | | | | | | | |
| Manganese [3] | mg/L | 0.8 | 0.002 | - | 0.004 | 0.004 | 20% | 10% | 20% | 20% |
| Radium | Bq/L | 1.0 | 0.005 | - | 0.01 | 0.01 | 20% | 20% | 20% | - |
| Sulphate [3] | mg/L | 128-429 | 0.1 | - | 0.2 | 0.2 | 20% | 10% | 20% | 20% |
| TSS | mg/L | - | 1 | - | 2 | - | 20% | 10% | - | 20% |
| Uranium | mg/L | 0.0150 | 0.0005 | - | 0.001 | 0.001 | 20% | 10% | 20% | 20% |

**Notes:**
1. Table 4.5 Cycle 4 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2016)
2. Table 5.2 Cycle 4 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2016)
3. Sulphate and manganese criteria taken from Table B.1, Appendix B, Cycle 4 Study Design for the SRWMP, SAMP and TOMP (Minnow, 2016). Parameters are hardness dependent.

# 5 RESULTS AND DISCUSSION

## *5.1 Health and Safety*

### *5.1.1 Health and Safety Injury Statistics*

All care and maintenance workers have Workplace Hazardous Materials Information System (WHMIS), Cardiopulmonary Resuscitation (CPR) and First Aid certification and have completed the Annual Radiation Safety training. There was one medical aid that required 12 stitches due to a laceration between the base of the thumb and wrist in 2015 but there were no lost time accidents reported between 2014 and 2016 at the Elliot Lake sites (Table 5.1.1).

***Table 5.1.1 Health & Safety Injury Statistics***

| *Category* | *2016* | | *2015* | | *2014* | |
|---|---|---|---|---|---|---|
| | *Number* | *Frequency* | *Number* | *Frequency* | *Number* | *Frequency* |
| Medical Aid | 0 | 0.0 | 1 | 3.9 | 0 | 0.0 |
| Lost Time | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **0** | **0.0** | **1** | **3.9** | **0** | **0.0** |
| **Person-Hours Worked** | **50, 417** | | **51,312** | | **50, 237** | |

* Frequency is calculated as: Number / Person-hours Worked * 200,000

### *5.1.2 Gamma Dosimetry*

Dose reports will be provided to the Canadian Nuclear Safety Commission (CNSC) under separate cover.

### *5.1.3 Radon Progeny Monitoring*

There were no radon progeny action level exceedances in 2016. Quarterly values for individual effluent treatment plants are reported below.

#### *5.1.3.1 Denison TMA-1*

Quarterly radon progeny monitoring was conducted at the Denison TMA-1 in accordance with license requirements. Radon progeny monitoring results for the year 2016 confirmed WLs remained well below the action level criteria of 0.10 WL (Table 5.1.3.1).

***Table 5.1.3.1 Denison TMA-1 Radon Progeny Monitoring 2016***

| **Quarter 2016** | **Radon (WL)** |
|---|---|
| 1 | 0.0011 |
| 2 | 0.0138 |
| 3 | 0.0417 |
| 4 | 0.0077 |

### *5.1.3.2 Denison Lower Williams Lake*

Quarterly radon progeny monitoring was conducted at the LW ETP in accordance with license requirements. Radon progeny monitoring results for the year 2016 confirmed WLs remained well below the action level criteria of 0.10 WL (Table 5.1.3.2).

***Table 5.1.3.2 Denison Lower Williams ETP Radon Progeny Monitoring 2016***

| Quarter 2016 | Radon (WL) |
|---|---|
| 1 | 0.0394 |
| 2 | 0.0100 |
| 3 | 0.0272 |
| 4 | 0.0341 |

### *5.1.3.3 Stanrock*

Quarterly radon progeny monitoring was conducted at the Stanrock ETP in accordance with license requirements. Radon progeny monitoring results for the year 2016 confirmed WLs remained well below the action level criteria of 0.10 WL (Table 5.1.3.3).

***Table 5.1.3.3 Stanrock ETP Radon Progeny Monitoring 2016***

| Quarter 2016 | Radon (WL) |
|---|---|
| 1 | 0.0183 |
| 2 | 0.0101 |
| 3 | 0.0251 |
| 4 | 0.0027 |

## *5.2 Water Quality Monitoring Program*

The objective of the annual data review is to identify anomalous data and provide evaluation and short-term annual averages at select locations. Step changes and anomalies are identified by reviewing and compiling the last five years of annual average data for all SAMP and TOMP locations. Unusual individual results are routinely investigated in accordance with the Water Quality Assessment and Response Plan.

### *5.2.1 Surface Water Quality*

Appendix IV contains surface water station-specific annual data reported as monthly averages including annual statistics and comparison to ACDQO, as per *The Cycle 4 Study Design for the*

*SRWMP, SAMP and TOMP* (Minnow, 2016). Surface water quality data are reported monthly to the CNSC, MOECC, and EC.

The field blank Data Quality Objectives (DQOs) were met for all parameters in all samples.

The radium field precision DQO of 20% was exceeded slightly in two of twelve samples at 21% and 26%. The exceedances are consistent with the variability observed in radium concentrations and occurred at relatively low concentrations (<0.043 Bq/L) and do not affect the interpretation of water quality results. The annual average percent difference was 13%.

The barium field precision DQO of 20% was also exceeded slightly in one of 12 samples at 21%. However, the annual average percent difference remained well below the DQO at 7%. All other parameters met field precision DQOs

The 2016 surface water field blank and field precision data summary was presented in Table 5.2.1.

## *Table 5.2.1 2016 Surface Water Field Blank and Field Precision Data Summary*

| | pH | TSS (mg/L) | Hardness (mg/L) | SO4 (mg/L) | Ra(T) Bq/L) | U (mg/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| Field Blank Statistics | | | | | | | | | | |
| Count | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Average | 5.6 | <1 | <0.5 | <0.1 | <0.008 | <0.0005 | <0.005 | <0.0005 | <0.02 | <0.002 |
| Max | 6.6 | <1 | <0.5 | <0.1 | <0.008 | <0.0005 | <0.005 | <0.0005 | 0.03 | <0.002 |
| Min | 5.2 | <1 | <0.5 | <0.1 | <0.008 | <0.0005 | <0.005 | <0.0005 | <0.02 | <0.002 |
| Field Blank Exceedances | | | | | | | | | | |
| Criteria [1] | | 2 | 1.0 | 0.2 | 0.01 | 0.001 | 0.01 | 0.001 | 0.04 | 0.004 |
| # Exceedances | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Field Duplicate Statistics | | | | | | | | | | |
| Count | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Average | 0% | 0% | 2% | 1% | 13% | 2% | 7% | 3% | 4% | 3% |
| Max | 0% | 0% | 5% | 6% | 26% | 10% | 21% | 15% | 17% | 10% |
| Min | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 0% |
| Field Precision Exceedances | | | | | | | | | | |
| Criteria [1] | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| # Exceedances | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |

[1] SAMP and TOMP field blank criteria taken from Table 5.2 of the Cycle 4 Study Design for SRWMP, SAMP and TOMP (Minnow, 2016)

Bold Indicates an exceedance of the Blank Criteria

### *5.2.1.1 Denison TMA-1*

Site-specific water quality monitoring at the Denison TMA-1 facility was completed in accordance with SAMP and TOMP design documents. Water quality results are provided in Appendix IV.

TMA-1 basin performance is monitored at station D-1. Review of the TOMP data set over the last five years (Table 5.2.1.1a), indicates elevated annual average radium concentrations and decreasing sulphate and uranium concentrations. Barium, iron, and manganese concentrations have consistently remained below the ACDQO (Table 4.2.2) while acidity and cobalt remain near or below detection levels.

***Table 5.2.1.1a Annual Average Concentrations ETP Overflow (D-1)***

| DATE | ACID (mg/L) | FLOW (L/s) | pH | SO4 (mg/L) | Ra (Bq/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) | U (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | < 1 | 17.9 | 7.8 | 165.0 | 1.607 | 0.063 | < 0.0005 | 0.12 | 0.024 | 0.0268 |
| 2013 | < 1 | 62.5 | 7.8 | 170.0 | 1.325 | 0.074 | 0.0006 | 0.09 | 0.071 | 0.0274 |
| 2014 | < 1 | 65.7 | 7.4 | 118.5 | 1.204 | 0.068 | < 0.0005 | 0.06 | 0.049 | 0.0172 |
| 2015 | < 1 | 21.7 | 7.6 | 103.0 | 1.331 | 0.095 | < 0.0005 | 0.08 | 0.024 | 0.0157 |
| 2016 | < 1 | 41.7 | 7.5 | 83.0 | 1.622 | 0.047 | 0.0006 | 0.10 | 0.037 | 0.0118 |
| *Annual Summary Statistics* | | | | | | | | | | |
| Average | < 1 | 41.9 | 7.6 | 127.9 | 1.418 | 0.069 | 0.0005 | 0.09 | 0.041 | 0.0198 |
| Maximum | < 1 | 65.73 | 7.8 | 170.0 | 1.622 | 0.095 | 0.0006 | 0.12 | 0.071 | 0.0274 |
| Minimum | < 1 | 17.89 | 7.4 | 83.0 | 1.204 | 0.047 | < 0.0005 | 0.06 | 0.024 | 0.0118 |

Note: Five year annual average, maximum and minimum statistics

TMA-1 Final Discharge is monitored at the Stollery Settling Pond Outlet (D-2). Review of annual average concentrations for SAMP and TOMP parameters for the last five years (Table 5.2.1.1b) indicate generally decreasing sulphate concentrations while annual average radium concentrations consistently remain below the Ministry of Environmental and Energy (MOEE) Provincial Water Quality Objectives (PWQO) of 1.0 Bq/L. The increase in annual average barium concentrations in 2014 and 2016 is consistent with the increased barium chloride addition rates required for radium removal. Uranium concentrations appear to be gradually decreasing while cobalt, iron and manganese concentrations consistently meet ACDQO.

***Table 5.2.1.1b Final Discharge at Stollery Settling Pond Outlet (D-2)***

| DATE | FLOW (L/s) | Haedness (mg/L) | pH | SO4 (mg/L) | TSS (mg/L) | Ra (Bq/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) | U (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 19.6 | 435.4 | 7.2 | 380.9 | 1 | 0.135 | 0.071 | 0.0008 | 0.19 | 0.199 | 0.0685 |
| 2013 | 66.6 | 331.8 | 7.3 | 261.7 | 1 | 0.127 | 0.169 | 0.0008 | 0.20 | 0.241 | 0.0522 |
| 2014 | 68.3 | 259.0 | 7.1 | 215 | 1 | 0.175 | 0.206 | 0.0008 | 0.18 | 0.209 | 0.0367 |
| 2015 | 33.7 | 296.8 | 7.2 | 241.7 | 1 | 0.113 | 0.14 | 0.0006 | 0.18 | 0.212 | 0.0416 |
| 2016 | 42.4 | 287.8 | 7.1 | 227.5 | 1 | 0.153 | 0.206 | 0.0006 | 0.22 | 0.134 | 0.0396 |
| *Annual Summary Statistics* | | | | | | | | | | | |
| Average | 46.1 | 322.2 | 7.2 | 265.4 | 1 | 0.141 | 0.158 | 0.0007 | 0.19 | 0.199 | 0.0477 |
| Maximum | 68.3 | 435.4 | 7.3 | 380.9 | 1 | 0.175 | 0.206 | 0.0008 | 0.22 | 0.241 | 0.0685 |
| Minimum | 19.6 | 259.0 | 7.1 | 215.0 | 1 | 0.113 | 0.071 | 0.0006 | 0.18 | 0.134 | 0.0367 |

Note: Five year annual average, maximum and minimum statistics

### *5.2.1.2 Denison Lower Williams Lake*

Site-specific water quality monitoring at the Denison LW ETP was completed in accordance with SAMP and TOMP requirements and results are provided in Appendix IV.

Seepage from Dam 1 is monitored at the Lower Williams Influent (D-22). Review of annual average concentrations for TOMP parameters indicates relatively stable iron concentrations with near neutral pH and acidity below detection levels. Radium, uranium, barium, and cobalt concentrations consistently remain below the ACDQO in Table 4.2. The 2015 and 2016 annual average manganese concentrations appear to be influenced by seasonal spikes observed during July in both years when flow is generally very low. However, no impact was observed downstream at the final discharge (D-3) where concentrations remain well below ACDQO. There are no other discernible trends in the data set (Table 5.2.1.2a).

***Table 5.2.1.2a Lower Williams ETP Influent (D-22)***

| DATE | ACID (mg/L) | pH | SO4 (mg/L) | Ra (Bq/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) | U (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 2012 | < 1 | 6.9 | 185.0 | 0.733 | 0.055 | 0.0008 | 4.37 | 0.200 | 0.0032 |
| 2013 | < 1 | 6.9 | 95.0 | 0.262 | 0.034 | 0.0005 | 3.51 | 0.444 | 0.0014 |
| 2014 | < 1 | 6.7 | 80.3 | 0.479 | 0.035 | 0.0010 | 3.90 | 0.635 | 0.0017 |
| 2015 | < 1 | 6.7 | 118.8 | 0.449 | 0.047 | 0.0011 | 4.31 | 1.194 | 0.0030 |
| 2016 | < 1 | 6.7 | 109.0 | 0.604 | 0.043 | 0.0009 | 5.43 | 1.603 | 0.0019 |
| *Annual Summary Statistics* | | | | | | | | | |
| Average | < 1 | 6.8 | 117.6 | 0.505 | 0.043 | 0.0009 | 4.30 | 0.815 | 0.0022 |
| Maximum | < 1 | 6.9 | 185.0 | 0.733 | 0.055 | 0.0011 | 5.43 | 1.603 | 0.0032 |
| Minimum | < 1 | 6.7 | 80.3 | 0.262 | 0.034 | 0.0005 | 3.51 | 0.200 | 0.0014 |

Note: Five year annual average, maximum and minimum statistics

The discharge from Lower Williams is monitored at the Final Discharge Point (D-3). Review of annual average concentrations for SAMP and TOMP parameters (Table 5.2.1.2b) indicate that

all parameters have consistently remained well below the ACDQO over the past five years with the exception of cobalt which remains at or below detection levels.

***Table 5.2.1.2b Lower Williams Final Discharge at Denison Access Road (D-3)***

| DATE | FLOW (L/s) | Hardness (mg/L) | pH | SO4 (mg/L) | TSS (mg/L) | Ra (Bq/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) | U (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 5.7 | 163.0 | 7.4 | 109.2 | 1 | 0.106 | 0.183 | < 0.0005 | 0.03 | 0.003 | 0.0112 |
| 2013 | 15.1 | 120.1 | 7.4 | 74.3 | 1 | 0.119 | 0.242 | < 0.0005 | 0.09 | 0.015 | 0.0070 |
| 2014 | 11.8 | 101.6 | 7.1 | 66.8 | 1 | 0.127 | 0.320 | 0.0005 | 0.20 | 0.049 | 0.0039 |
| 2015 | 10.6 | 118.6 | 7.1 | 79.1 | 1 | 0.124 | 0.254 | 0.0006 | 0.24 | 0.063 | 0.0041 |
| 2016 | 6.8 | 122.2 | 7.0 | 82.7 | 1 | 0.101 | 0.211 | < 0.0005 | 0.06 | 0.006 | 0.0031 |
| *Annual Summary Statistics* | | | | | | | | | | | |
| Average | 10.0 | 125.1 | 7.2 | 82.4 | 1 | 0.115 | 0.242 | 0.0005 | 0.12 | 0.027 | 0.0059 |
| Maximum | 15.1 | 163.0 | 7.4 | 109.2 | 1 | 0.127 | 0.320 | 0.0006 | 0.24 | 0.063 | 0.0112 |
| Minimum | 5.7 | 101.6 | 7.0 | 66.8 | 1 | 0.101 | 0.183 | < 0.0005 | 0.03 | 0.003 | 0.0031 |

Note: Five year annual average, maximum and minimum statistics

### *5.2.1.3 Stanrock*

Discharge and runoff from the TMA is monitored at the Stanrock Treatment Plant Influent (DS-2). Based on a review of the last five years of data (Table 5.2.1.3a), annual average radium concentrations appear to be relatively stable and remain consistently below the PWQO of 1.0 Bq/L while annual average barium concentrations remain well below the ACDQO of 1.0 mg/L. There are no other discernible trends in the data set.

***Table 5.2.1.3a Stanrock Influent (DS-2)***

| DATE | ACID (mg/L) | FLOW (L/s) | pH | SO4 (mg/L) | Ra (Bq/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) | U (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 292 | 45.2 | 3.1 | 700.0 | 0.120 | 0.012 | 0.1135 | 60.00 | 2.600 | 0.0372 |
| 2013 | 234 | 70.2 | 3.0 | 584.8 | 0.158 | 0.015 | 0.1000 | 38.72 | 1.857 | 0.0348 |
| 2014 | 156 | 73.1 | 3.0 | 422.5 | 0.188 | 0.028 | 0.0589 | 30.35 | 1.426 | 0.0188 |
| 2015 | 231 | 49.3 | 2.9 | 632.5 | 0.152 | 0.029 | 0.0763 | 46.65 | 1.939 | 0.0220 |
| 2016 | 235 | 45.7 | 2.9 | 580.0 | 0.182 | $0.030 | 0.0786 | 45.40 | 1.724 | 0.0321 |
| *Annual Summary Statistics* | | | | | | | | | | |
| Average | 230 | 56.7 | 3.0 | 584.0 | 0.160 | 0.023 | 0.0855 | 44.22 | 1.909 | 0.0290 |
| Maximum | 292 | 73.1 | 3.1 | 700.0 | 0.188 | $0.030 | 0.1135 | 60.00 | 2.600 | 0.0372 |
| Minimum | 156 | 45.2 | 2.9 | 422.5 | 0.120 | 0.012 | 0.0589 | 30.35 | 1.426 | 0.0188 |

Note: Five year annual average, maximum and minimum statistics

Based on a review of water quality data at the Stanrock Final Point of Control at Orient Lake Outlet (DS-4) for the last five years, annual average sulphate concentrations are gradually decreasing (Table 5.2.1.3b) and all metal concentrations consistently meet SRWMP receiving water quality objectives with cobalt approaching detections levels.

### *Table 5.2.1.3b Orient Lake Outlet Stanrock Final Point of Control (DS-4)*

| DATE | FLOW (L/s) | Hardness (mg/L) | pH | SO4 (mg/L) | TSS (mg/L) | Ra (Bq/L) | Ba (mg/L) | Co (mg/L) | Fe (mg/L) | Mn (mg/L) | U (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2012 | 24.4 | 396.1 | 7.2 | 358.3 | 1 | 0.06 | 0.025 | 0.0008 | 0.11 | 0.053 | 0.0022 |
| 2013 | 54.6 | 383.9 | 7.3 | 355.8 | 1 | 0.045 | 0.033 | 0.0008 | 0.15 | 0.042 | 0.0023 |
| 2014 | 52.7 | 316.1 | 7.1 | 292.5 | 1 | 0.054 | 0.045 | 0.0007 | 0.15 | 0.049 | 0.0016 |
| 2015 | 42.7 | 292.5 | 7.1 | 258.3 | 1 | 0.062 | 0.05 | 0.0006 | 0.13 | 0.067 | 0.0021 |
| 2016 | 27.3 | 300 | 7.1 | 262.5 | 1 | 0.073 | 0.047 | 0.0006 | 0.1 | 0.044 | 0.0043 |
| *Annual Summary Statistics* | | | | | | | | | | | |
| Average | 40.3 | 337.7 | 7.2 | 305.5 | 1 | 0.059 | 0.04 | 0.0007 | 0.13 | 0.051 | 0.0025 |
| Maximum | 54.6 | 396.1 | 7.3 | 358.3 | 1 | 0.073 | 0.05 | 0.0008 | 0.15 | 0.067 | 0.0043 |
| Minimum | 24.4 | 292.5 | 7.1 | 258.3 | 1 | 0.045 | 0.025 | 0.0006 | 0.1 | 0.042 | 0.0016 |

Note: Five year annual average, maximum and minimum statistics

### *5.2.2 Groundwater Quality*

Field quality assurance and quality control sampling was extended to the groundwater monitoring program in 2006.

The Iron field blank Data Quality Objectives of 0.04 mg/L was exceeded in two of 3 samples ranging from 0.37 mg/L to 5.99 mg/L (confirmed). Although there is evidence of slight contamination, both locations indicate high iron concentrations (ranging from 632 mg/L to 1230 mg/L) and these results are consistent with previous values. Therefore, the exceedances do not impact interpretation of iron groundwater quality results.

The field precision DQOs were met for all parameters in all samples in 2016.

The 2016 groundwater field blank and field precision data summary is presented in Table 5.2.2.

### *Table 5.2.2 2016 Groundwater Field Blank and Field Precision Data Summary*

| | pH | SO4 mg/L | Acidity mg/L | Iron mg/L |
|---|---|---|---|---|
| Field Blank Statistics | | | | |
| Count | | 3 | 3 | 3 |
| Average | 6.3 | <0.1 | 1 | 2.13 |
| Max | 6.7 | <0.1 | 2 | 5.99 |
| Min | 5.8 | <0.1 | <1 | <0.02 |
| Field Blank Exceedances | | | | |
| Criteria [1] | | 0.2 | 2 | 0.04 |
| # Exceedances | 0 | 0 | 0 | 2 |
| Field Duplicate Statistics | | | | |
| Count | 3 | 3 | 3 | 3 |
| Average | 1% | 6% | 3% | 8% |
| Max | 2% | 11% | 6% | 18% |
| Min | 0% | 0% | 0% | 0% |
| Field Precision Exceedances | | | | |
| Criteria [1] | 20% | 20% | 20% | 20% |
| # Exceedances | 0 | 0 | 0 | 0 |

1 Field criteria taken from Table 5.2 of the Cycle 4 Study Design for SRWMP, SAMP and TOMP (Minnow, 2016)

Bold Indicates an exceedance of the Blank Criteria

#### *5.2.2.1 Denison TMA-1*

Based on a review of the data for the last five years, porewater and groundwater continue to show variability. Lower pH values measured in 2016 are likely the result of a new pH meter that was used this year and not a change necessarily in water quality. The meter (YSI Pro Plus) reduces oxygen exposure while taking the measurement, and thus yields more accurate results.

Downstream of Dam 1 on the North Ridge (BH91 D9A), review of the data indicates near neutral pH levels over the last five years with moderately elevated but gradually decreasing iron and acidity concentrations. There are no other discernible trends in the data set.

Downstream of Dam 10 (BHDG-4B) groundwater is characterized by slightly depressed pH with iron concentrations (2-11 mg/L) and acidity below detection limits. Iron concentrations appear to have increased in the last two years but are consistent with values prior to 2012. There are no other discernible trends in in the data set.

At the east end of the TMA, downstream of Dam 17 on the North Abutment (BH91 D1), review of the data for the last five years indicates slightly elevated but gradually decreasing iron at depth with acidity levels approaching the detection limit. Near surface, iron remains below ACDQO while acidity levels consistently remain near or below detection limits. pH indicates slightly alkaline conditions, likely due to flushing from historic liming in the area of groundwater influence.

Downstream of Dam 17 in the North Valley (BH91 D3), review of the data indicates gradually improving water quality with near neutral pH and consistently decreasing acidity and iron concentrations in both wells.

#### *5.2.2.2 Denison Lower Williams Lake*

Downstream of Dam 1 on the North Ridge (BH91 D9A), a review of the data indicates near neutral pH levels over the last five years with moderately elevated iron and acidity concentrations. There are no other discernible trends in the data set at Denison Lower Williams Lake.

#### *5.2.2.3 Stanrock*

Lower pH values measured in 2016 are the result of a new pH meter (YSI Pro Plus) that was used this year and not a change necessarily in water quality. The meter reduces oxygen exposure while taking the measurement, and thus yields more accurate results.

Groundwater quality is measured at Stanrock downstream of Dam A (BH91 SG1A); downstream of Dam B (BH98-16A); downstream of Dam C (BH98-15A); and downstream of Dam D (BH91-SG2 and BH91-SG3). Dam A groundwater is characterized by depressed pH with elevated sulphate, acidity and iron concentrations. There have been no discernible trends observed over the past five years. At Dam B, pH is mildly depressed with elevated sulphate, acidity and iron concentrations with no apparent trends. Dam C groundwater indicates near neutral pH with elevated but generally decreasing concentrations of sulphate, acidity and iron. There has been no recharge in most wells at Dam D, with the exception BH91-SG2A, where pH

is near neutral with elevated concentrations of all parameters with no apparent trends over the past five years.

Stanrock porewater, as measured at Dam A (ST3-P3, 5, 6, and 8), is characterized by depressed pH with increasing acidity and iron concentrations near surface (2.64 m). There are no other discernible trends in the data (see Appendix IV).

## *5.3 Site Specific Maintenance and Operations Program*

Site-specific program reports are provided in the following sections in accordance with the SAMP and TOMP Annual Reporting Requirements. Each section provides the following information:

- Summary of tailings management area (TMA) maintenance
- Summary of effluent treatment plant (ETP) operations

### *5.3.1 Denison TMA-1*

#### *5.3.1.1 TMA Maintenance*

Routine inspection and preventative maintenance was performed as required.

In February 2016, the Ministry of Natural Resources and Forestry (MNRF) was granted access to the site due to the presence of elk in the area. A helicopter was used to complete a capture and collar program to assist in tracking the population and to help with management strategies for the local herd.

There was a forest fire on the Denison property below Dam 17 on May 24, 2016. Denison staff responded to a call and met the local fire department to determine the actual location of the fire. Eventually it was determined that the fire was in the jurisdiction of MNRF so MNRF fire crews and a water bomber were quickly brought on scene to extinguish the fire. Denison staff escorted the fire department to the scene and provided support until the fire was under control. The fire crew remained on site for two days to monitor the area to ensure the fire was completely out. The cause of the fire was determined to be the result of trees coming into contact with the hydro line between Dam 17 and Quirke Lake. Hydro One completed the required maintenance at the site to ensure the issue causing the fire was resolved. Denison management later met to review the incident and determine what procedural improvements could be made should a similar event occur. CNSC reported that they were pleased with Denison's emergency response.

In 2016, groundwater and dam instrumentation well elevations were resurveyed as well as dam crest elevations.

#### *5.3.1.2 ETP Operations*

The ETP at the TMA-1 spillway (D-1) operated for 141 days in 2016 at a monthly average flow rate of 108 L/s and the total volume treated was 1,310,000,000 L. An estimated 1,326,000,000 L was discharged from the final point of control at the Stollery Settling Pond Outlet, D-2, over a total of 366 discharge days (Table 7.2.1).

##### 5.3.1.2.1 Operating Summary

The ETP operated as required throughout the year with the use of the siphons, which allowed for a controlled release of water from the TMA to maximize the settling capabilities of the Stollery Lake Settling Pond. Treatment was for radium control only; no addition of sodium

hydroxide was required for pH control in 2016 but a flocculent was used for a brief period in April and May to assist in radium removal.

Due to elevated radium levels at the final point of control in April, flow was reduced and the sodium hydroxide tank was converted into a flocculent (floc) mixing and dispensing station and floc was added to the influent at 3 L/min with the use of a small sandpiper pump. As a result of the mitigation measures taken, the monthly average radium level remained below discharge criteria at 0.339 Bq/L with an annual average concentration of 0.151 Bq/L. Treatment with floc continued until the ETP was shutdown later in May. Once the ETP resumes operation in 2017 it will be determined if the floc system will continue based on initial radium results.

In 2016, there were minor issues with the siphon intake screens plugging up from organic matter while in operation, resulting in the plugged screens shutting the siphons down. Denison fixed the plugged lines by blowing out the lines with the use of a compressor and re-establishing the siphons, within a day in most cases. Due to this plugging continuing throughout 2016, Denison is investigating larger screen sizes to help eliminate plugging issues in 2017.

The ETP operated from the beginning of the year until May 20, 2016 when it was shut down due to low water levels. The plant remained down for the remainder of the year. The use of siphons for TMA drawdown was once again effective, along with the required treatment, to ensure the pond level remained below spillway elevation and maintain a controlled release of water from the TMA.

#### 5.3.1.2.2 Discharge Compliance

In 2016, TMA-1 effluent quality at the final point of control, D-2, was in compliance with the discharge criteria in the license (Tables 5.3.1.2.2a and b).

### *Table 5.3.1.2.2a TMA-1 Effluent Treatment Plant 2016 Flow Rates, Operating Days and Discharge Days*

| ITEM | Unit | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | Y.T.D. 2016 | Y.T.D. 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OPERATIONS | | | | | | | | | | | | | | | |
| Operating Days | | 31 | 29 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 141 | 131 |
| Maximum Daily Plant Flow ( D-1) | L/s | 128 | 108 | 173 | 128 | 161 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 | 186 |
| Minimum Daily Plant Flow (D-1) | L/s | 99 | 82 | 48 | 28 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average Daily Plant Flow (D-1) | L/s | 108 | 99 | 118 | 81 | 144 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 | 61 |
| Total Volume Treated | ML | 289 | 248 | 316 | 209 | 249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1310 | 693 |
| Barium Chloride Consumption | kg/m | 625 | 615 | 734 | 627 | 631 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3232 | 1278 |
| monthly average | mg/L | 2.16 | 2.49 | 2.32 | 3.01 | 2.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.47 | 1.84 |
| Caustic Soda Consumption | kg/m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| monthly average | mg/L | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EFFLUENT | | | | | | | | | | | | | | | |
| Discharge Days | | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 366 | 365 |
| Maximum Daily Discharge Flow (D-2) | L/s | 153 | 81 | 173 | 87 | 126 | 32 | 17 | 9 | 12 | 19 | 17 | 21 | 173 | 133 |
| Minimum Daily Discharge Flow (D-2) | L/s | 75 | 69 | 52 | 36 | 17 | 12 | 9 | 5 | 9 | 17 | 0 | 17 | 0 | 4 |
| Average Daily Discharge Flow (D-2) | L/s | 98 | 74 | 103 | 65 | 66 | 19 | 13 | 8 | 10 | 18 | 12 | 18 | 42 | 33 |
| Total Volume Discharged | ML | 263 | 186 | 276 | 168 | 177 | 49 | 35 | 21 | 25 | 47 | 31 | 48 | 1326 | 1054 |

***Table 5.3.1.2.2b 2016 TMA-1 Compliance with Discharge Limits at Final Point of Control (D-2)***

| Month | Number of Times Discharge Limits Were Exceeded | | | | | | |
|---|---|---|---|---|---|---|---|
| | Samples Required | pH | | TSS mg/L | | Ra(T) Bq/L | |
| | | Limits[1]: Upper 9.5 Lower 5.5 | Limits[2]: Upper 9.5 Lower 6.5 | Limits[1]: Upper 50 | Limits[2]: Upper 25 | Limits[1]: Upper 1.11 | Limits[2]: Upper 0.37 |
| Jan. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Feb. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Mar. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Apr. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| May | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| June | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| July | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Aug. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Sept. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Oct. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Nov. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Dec. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| YTD | 52 | 0 of 52 | 0 of 12 | 0 of 52 | 0 of 12 | 0 of 52 | 0 of 12 |

Limits established in the Licence UMDL-MINEMILL-DENISON.01/indf issued December 15, 2004.

[1]Grab sample limit

[2] Monthly Arithmetic Mean.

### *5.3.2 Denison Lower Williams Lake*

#### *5.3.2.1 TMA Maintenance*

Routine inspection and preventative maintenance were performed as required.

#### *5.3.2.2 Summary of ETP Operations*

The treatment plant, as monitored at station D-22, operated 346 days at an average operating flow rate of 7 L/s, in 2016. An estimated 207,000,000 L was discharged from the final point of control, D-3, over a total of 274 discharge days (Table 7.3.1).

5.3.2.2.1 Operating Summary

The Lower Williams Effluent Treatment Plant (LW ETP) operated throughout 2016 to control radium; neutralization for pH control has not been required since 2002. Water quantity was so low in August that flow to the LW ETP ceased on August 5, 2016, at which time treatment was stopped. The plant remained shut down until August 25, 2016, when flow and subsequent treatment resumed and continued for the remainder of the year.

Routine inspections and preventative maintenance were performed as required. There were no process or design changes to the LWETP in 2016.

#### 5.3.2.2.2 Discharge Compliance

In 2016, Lower Williams effluent quality at the final point of control, D-3, was in compliance with the discharge criteria in the license (Tables 5.3.2.2.2a and b).

### *Table 5.3.2.2.2a Lower Williams ETP 2016 Flow Rates, Operating Days and Discharge Days*

| ITEM | Unit | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | Y.T.D. 2016 | Y.T.D. 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OPERATIONS | | | | | | | | | | | | | | | |
| Operating Days | | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 11 | 30 | 31 | 30 | 31 | 346 | 340 |
| Maximum Daily Plant Flow (D-22) | L/s | 8 | 3 | 46 | 46 | 10 | 4 | 0 | 0 | 0 | 24 | 39 | 9 | 46 | 140 |
| Minimum Daily Plant Flow (D-22) | L/s | 4 | 2 | 3 | 7 | 1 | 1 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 |
| Average Daily Plant Flow (D-22) | L/s | 6 | 3 | 17 | 21 | 5 | 2 | 0 | 0 | 0 | 8 | 13 | 4 | 7 | 12 |
| Total Volume Treated | ML | 15 | 6 | 47 | 53 | 14 | 6 | 0 | 0 | 0 | 20 | 35 | 11 | 207 | 338 |
| Barium Chloride Consumption | kg/m | 73 | 57 | 62 | 56 | 47 | 48 | 48 | 17 | 41 | 56 | 30 | 55 | 590 | 567 |
| monthly average | mg/L | 4.76 | 9.15 | 1.34 | 1.05 | 3.38 | 8.21 | 0.00 | 0.00 | 0.00 | 2.78 | 0.86 | 4.81 | 3 | 2 |
| Caustic Soda Consumption | kg/m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| monthly average | mg/L | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| EFFLUENT | | | | | | | | | | | | | | | |
| Discharge Days | | 31 | 29 | 31 | 30 | 31 | 30 | 0 | 0 | 0 | 31 | 30 | 31 | 274 | 303 |
| Maximum Discharge Flow (D-3) | L/s | 8 | 3 | 46 | 46 | 10 | 4 | 0 | 0 | 0 | 24 | 39 | 9 | 46 | 140 |
| Minimum Discharge Flow (D-3) | L/s | 4 | 2 | 3 | 7 | 1 | 1 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 |
| Average Discharge Flow (D-3) | L/s | 6 | 3 | 17 | 21 | 5 | 2 | 0 | 0 | 0 | 8 | 13 | 4 | 9 | 13 |
| Total Volume Discharged | ML | 15 | 6 | 47 | 53 | 14 | 6 | 0 | 0 | 0 | 20 | 35 | 11 | 207 | 332 |

***Table 5.3.2.2.2b 2016 Lower Williams Compliance with Discharge Limits at Final Point of Control (D-3)***

| Month | Number of Times Discharge Limits Were Exceeded | | | | | | |
|---|---|---|---|---|---|---|---|
| | Samples Required | pH | | TSS mg/L | | Ra(T) Bq/L | |
| | | Limits[1]: Upper 9.5 Lower 5.5 | Limits[2]: Upper 9.5 Lower 6.5 | Limits[1]: Upper 50 | Limits[2]: Upper 25 | Limits[1]: Upper 1.11 | Limits[2]: Upper 0.37 |
| Jan. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Feb. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Mar. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Apr. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| May | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| June | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| July | Zero Discharge | | | | | | |
| Aug. | Zero Discharge | | | | | | |
| Sept. | Zero Discharge | | | | | | |
| Oct. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Nov. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Dec. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| YTD | 39 | 0 of 39 | 0 of 9 | 0 of 39 | 0 of 9 | 0 of 39 | 0 of 9 |

Limits established in the Licence UMDL-MINEMILL-DENISON.01/indf issued December 15, 2004.

[1] Grab sample limit

[2] Monthly Arithmetic Mean.

### *5.3.3 Stanrock TMA*

#### *5.3.3.1 TMA Maintenance*

Routine inspection and preventative maintenance were performed as required.

On May 21, 2015, Denison received a public comment regarding the strange colouration of a pond located near the Stanrock Mine close to the licenced area and in close proximity to Quirke Lake. In response, Denison staff conducted some visual observations of the site and collected samples from the pond (station DSP) on June 15 followed by further monitoring in July and August. Site observation found no evidence of surface water discharge from the pond into Quirke Lake and no apparent evidence of an influent stream feeding the pond from surface water. However, a small amount of upwelling seepage (<1 L/s) was observed below the pond discharging into Quirke Lake.

Following results of the first sampling at DSP, it was evident that the site showed depressed pH and elevated levels of some metals. To better assess water quality and confirm initial results, an interim monitoring program was initiated for one year. The monitoring program was also designed to determine effects with seasonal variability on concentrations and included quarterly monitoring of the pond (DSP), monthly monitoring of the pond seepage (DSP-2) and quarterly monitoring of the outflow area on the edge of Quirke Lake (DSP-3).

On August 31, 2016, Denison submitted a follow-up report to the CNSC. The report provided results of the monitoring program, historical review of the suspected source of the contamination and a proposal to treat the pond in addition to continued monitoring for a period of one more year after treatment to determine the effect on water quality. However, following receipt of the report and continued discussions with CNSC, it was determined that the pond is on crown land and that proper permitting will be required prior to treatment of the pond. It was agreed that Denison would submit a treatment plan to CNSC who would then seek the necessary permits required to allow for treatment to be undertaken. The next step is for Denison to complete the treatment plan. Details of the report along with pond location and monitoring results are provided in Appendix V.

In 2016, groundwater and dam instrumentation well elevations were resurveyed as well as dam crest elevations.

#### *5.3.3.2 Summary of ETP Operations*

The Stanrock ETP, as monitored at DS-3, operated 114 days in 2016 at an average daily flow rate of 128 L/s. An estimated 867,000,000 L was discharged from the final point of control, DS-4, over a total of 366 discharge days (Table 7.4.1).

##### 5.3.3.2.1 Operating Summary

The Stanrock ETP operated periodically throughout the year as required to maintain discharge compliance and control of the Holding Pond water levels. The majority of the operating days were during spring runoff and fall rains (Table 7.4.1).

Approximately 114,306,690 L of water was siphoned from Beaver Lake to Dam G collection Pond and pumped to the Stanrock ETP. This ensured better pH control of Moose Lake and the final discharge water quality.

The Dam G pumps operated throughout the year to ensure the Dam G Seepage Collection Pond level remained well below spillway elevation. An estimated 162,101,628 Litres of water was pumped from the Dam G Collection Pond to the ETP for treatment.

The Dam M Pond pumps operated throughout the year to ensure the Dam M Seepage Collection Pond level remained well below spillway elevation. An estimated 153,849,799 L of water was discharged to the Dam G Seepage Collection Pond.

The Dam G and Dam M pumps experienced several issues in 2016. The pumps experienced both mechanical and electrical failures. Spares were installed, as required, to maintain operation and faulty pumps were sent away for repairs. Investigations are ongoing into the causes of the failures. Although surge and phase loss protection had been installed, issues remained with pumps at these locations throughout the year. Denison is investigating other pumping options going forward to ensure equipment performance objectives are met.

#### 5.3.3.2.2 Discharge Compliance

In 2016, Stanrock TMA effluent quality at the final point of control, DS-4, was in compliance with the discharge criteria in the license (Tables 5.3.3.2.2a and b).

### *Table 5.3.3.2.2a Stanrock ETP 2016 Flow Rates, Operating Days and Discharge Days*

| ITEM | Unit | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | Y.T.D. 2016 | Y.T.D. 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLANT OPERATIONS | | | | | | | | | | | | | | | |
| Operating Days | | 15 | 12 | 26 | 24 | 7 | 3 | 0 | 0 | 0 | 5 | 9 | 13 | 114 | 125 |
| Maximum Daily Plant Flow (DS-2 ) | L/s | 150 | 147 | 192 | 174 | 161 | 122 | 0 | 0 | 0 | 150 | 165 | 151 | 192 | 190 |
| Minimum Daily Plant Flow (DS-2 ) | L/s | 105 | 100 | 104 | 77 | 84 | 73 | 0 | 0 | 0 | 90 | 110 | 96 | 0 | 0 |
| Average Daily Plant Flow (DS-2) | L/s | 127 | 127 | 138 | 121 | 120 | 97 | 0 | 0 | 0 | 120 | 138 | 134 | 128 | 118 |
| Total Volume Treated | ML | 164 | 132 | 310 | 251 | 73 | 25 | 0 | 0 | 0 | 52 | 107 | 151 | 1264 | 1276 |
| Barium Chloride Consumption | kg/m | 75 | 67 | 224 | 135 | 30 | 12 | 0 | 0 | 0 | 19 | 38 | 54 | 653 | 805 |
| monthly average | mg/L | 0.46 | 0.51 | 0.72 | 0.54 | 0.41 | 0.47 | 0.00 | 0.00 | 0.00 | 0.37 | 0.35 | 0.36 | 0.52 | 0.63 |
| Total dry lime consumption | tonnes/m | 10.74 | 10.09 | 28.28 | 24.21 | 6.06 | 3.61 | 0.00 | 0.00 | 0.00 | 5.51 | 12.28 | 16.30 | 117.08 | 127.81 |
| monthly average | g/l | 0.07 | 0.08 | 0.09 | 0.10 | 0.08 | 0.14 | 0.00 | 0.00 | 0.00 | 0.11 | 0.11 | 0.11 | 0.09 | 0.10 |
| NEUTRALIZATION | | | | | | | | | | | | | | | |
| Lime Consumption | | | | | | | | | | | | | | | |
| Beaver Lake total dry | tonnes/m | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 |
| Site total including ETP Operations | tonnes/m | 10.74 | 10.09 | 28.28 | 24.21 | 6.06 | 3.61 | 0.00 | 0.00 | 0.00 | 5.51 | 12.28 | 16.30 | 117.08 | 127.8 |
| EFFLUENT | | | | | | | | | | | | | | | |
| Discharge Days | | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 366 | 365 |
| Maximum Daily Discharge Flow (DS-4) | L/s | 47 | 21 | 191 | 172 | 13 | 13 | 3 | 3 | 35 | 25 | 58 | 35 | 191 | 693 |
| Minimum Daily Discharge Flow (DS-4) | L/s | 17 | 13 | 13 | 78 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 18 | 1 | 1 |
| Average Daily Discharge Flow (DS-4) | L/s | 34 | 16 | 92 | 105 | 7 | 6 | 3 | 3 | 12 | 9 | 15 | 27 | 27 | 42 |
| Total Volume Discharged | ML | 90 | 40 | 245 | 272 | 18 | 15 | 7 | 8 | 30 | 23 | 38 | 73 | 859 | 1315 |

***Table 5.3.3.2.2b 2016 Stanrock Tailings Management Area Compliance with Discharge Limits at Final Point of Control (DS-4)***

| Month | Number of Times Discharge Limits Were Exceeded | | | | | | |
|---|---|---|---|---|---|---|---|
| | Samples Required | pH | | TSS mg/L | | Ra(T) Bq/L | |
| | | Limits[1]: Upper 9.5 Lower 5.5 | Limits[2]: Upper 9.5 Lower 6.5 | Limits[1]: Upper 50 | Limits[2]: Upper 25 | Limits[1]: Upper 1.11 | Limits[2]: Upper 0.37 |
| Jan. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Feb. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Mar. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Apr. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| May | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| June | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| July | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Aug. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Sept. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Oct. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| Nov. | 5 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 | 0 of 5 | 0 of 1 |
| Dec. | 4 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 | 0 of 4 | 0 of 1 |
| YTD | 52 | 0 of 52 | 0 of 12 | 0 of 52 | 0 of 12 | 0 of 52 | 0 of 12 |

Limits established in the Licence UMDL-Minemill-Stanrock.02/indf issued September, 2010.

[1] Grab sample limit

[2] Monthly Arithmetic Mean.

# 6 REFERENCES

Minnow, 2016a. The Cycle 4 Study Design for the SRWMP, SAMP and TOMP. Prepared for Rio Algom Limited and Denison Mines Inc. February 2016.

RAL and DMI. Serpent River Watershed Monitoring Program 2016 Annual Water Quality Report. (Rio Algom Limited and Denison Mines Inc.) March 2017.

Minnow, 2016b. Serpent River Watershed Cycle 4 State of the Environment Report. Prepared for Rio Algom Limited and Denison Mines Inc. March 2016.

# APPENDIX I
# Summary of Cycle 4 Changes

**Table 5.1: Cycle 4 TOMP substances and frequency of data collected (2015 to 2019)**

Denison Mines

| | | | Parameters and Frequencies[a] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TMA | TOMP Stations | Station Type/Purpose | Elevation | Flow | pH | Conductivity | Sulphate | Total Radium-226 | Lime or NaOH Consumption | Barium Chloride Consumption | TSS | Acidity | Iron | SAMP Metals[b] | Change |
| Denison | D-1[g] | Basin performance (primary), ETP operations | W | D | M | | Q | M | M | M | | Q | | Q | Flow W to D; pH D to M |
| | D-22[g] | ETP operations | | | W | | Q | M | | M | | Q | | Q | |
| | D-3[g] | Effluent | | W[c] | W | | M | W | | | W | | | M[c] | Flow D to W |
| | D-2[g] | Effluent | | W[c] | W | | M | W | | | W | | | M[c] | Flow D to W |
| | D-25 | Basin performance (secondary) | | | S | | S | S | | | | S | S | | |
| | BH91-D1A,B, BH91-D3A,B, BH91-DG4B, BH91-D9A | Groundwater | | | A | | A | | | | | A | A | | |
| Stanrock | DS-2[g] | Basin performance (primary), ETP operations | | D | M | | Q | M | M | M | | Q | | Q | pH D to M |
| | DS-3[g] | ETP operations | | | D | | | | | | | | | | |
| | DS-4[g] | Effluent | | W[c] | W | | M | W | | | W | | | M[c] | |
| | DS-1[g] | Additional pH control, radium monitoring | | W | W | | | Q | | | | | | | |
| | DS-6[g] | Additional pH control | | W | W | | | | | | | | | | |
| | DS-5 | Seepages and surface water internal to TMA | | Q | Q | Q | | | | | | | | | |
| | PN-ST3-P3,5,6,8; BH91-SG2A,D | Porewater | | | A | | A | | | | | A | A | | |
| | BH91-SG1A, BH98-16A, BH98-15A, BH91-SG3A,B | Groundwater | | | A | | A | | | | | A | A | | |

[a] D - Work days, W - Weekly, M - Monthly, S - Semi-annually, A - Annually, Q-Quarterly.

[b] SAMP metals are barium, cobalt, iron, manganese and uranium.

[c] Monitoring requirement of SAMP.

[e] Spanish-American.

[f] During the snow-free period (April - November).

[g] Sampled when treatment plant is operating.

## Table 5.2: Cycle 4 SAMP stations, parameters and frequencies (2015 to 2019)

| TMA | Location | Type | Description | Frequency[a] | | | | | | Change |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Flow | pH | Sulphate | Radium-226 | SAMP metals[b] | Toxicity[c] | |
| Denison | D-2[d,e] | Primary | Stollery Lake Outlet | W | W | M | M | M | S | flow D to W |
| | D-3[d,e] | Primary | TMA-2 Effluent at Denison Mine access road | W | W | M | M | M | | flow D to W |
| | D-9 | Seepage | Seepage at Dam 17 | Q | Q | Q | Q | Q | | none |
| | D-16 | Seepage | Seepage at Dam 9 | Q | Q | Q | Q | Q | | none |
| Stanrock | DS-4 | Primary | Orient Lake Outlet (Final Point of Control) | W | W | M | M | M | S | none |
| | DS-16 | Drainage | Quirke Lake Delta | Q | Q | Q | Q | Q | | none |
| Reference | SR-16 | Reference | Fox Creek at Highway 108 | | Q | Q | Q | Q | | |
| | SR-17 | Reference | Unnamed Creek from Lake Three at Highway 108 | | Q | Q | Q | Q | | |

[a] D =daily, W = weekly, M = monthly, Q = quarterly, S = semi-annual (twice per year).

[b] SAMP metals - barium, cobalt, iron, manganese, uranium.

[c] Toxicity includes: acute (*Daphnia magna* and rainbow trout) and sub lethal (*Ceriodaphnia dubia*) testing following Environment Canada (2000 and 2007 a, b) methods.

[d] This station is also TOMP effluent station and requirements have been harmonized to serve both programs.

[e] Sampled when treatment plant is operating.

[f] P-14 will revert to P-36 upon ETP shut down.

[g] Flow is based on influent flow to the ETP at P-13.

March 9, 2016
via e-mail

Karina Lange
Project Officer for Wastes and Decommissioning Division
Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
Ottawa, ON, K1P 5S9

Dear Ms. Lange:

**Re: Serpent River Watershed Cycle 4 State of the Environment Report**

Denison Mines Inc. (DMI) and Rio Algom Limited (RAL) are pleased to submit the Serpent River Cycle 4 State of the Environment (SOE) Report (2010 to 2014). The report presents and integrates the monitoring data obtained through the Elliot Lake closed mines monitoring programs, namely the Serpent River Watershed Monitoring Program (SRWMP), the Source Area Monitoring Program (SAMP) and the TMA Operational Monitoring Program (TOMP). The report covers the period of January 1, 2010 to December 31, 2014 although historical data has been considered for trend analysis.

This report represents the completion of the fourth cycle of the SRWMP. A complete list of all study design and interpretive reports prepared since the start of Cycle 1 is provided in Table 1. This table also summarizes the time frame covered for each cycle and the key changes to each of the monitoring programs over time.

We are also distributing this Cycle 4 State of the Environment Report to the members of the Joint Regulatory Review Group (JRG; distribution attached). We look forward to your review of the report and the opportunity to address and any questions or comments you may have.

Yours very truly,

Denison Mines Inc.

Ian Ludgate,
Manager

Rio Algom Limited

Debbie Berthelot,
Reclamation Manager

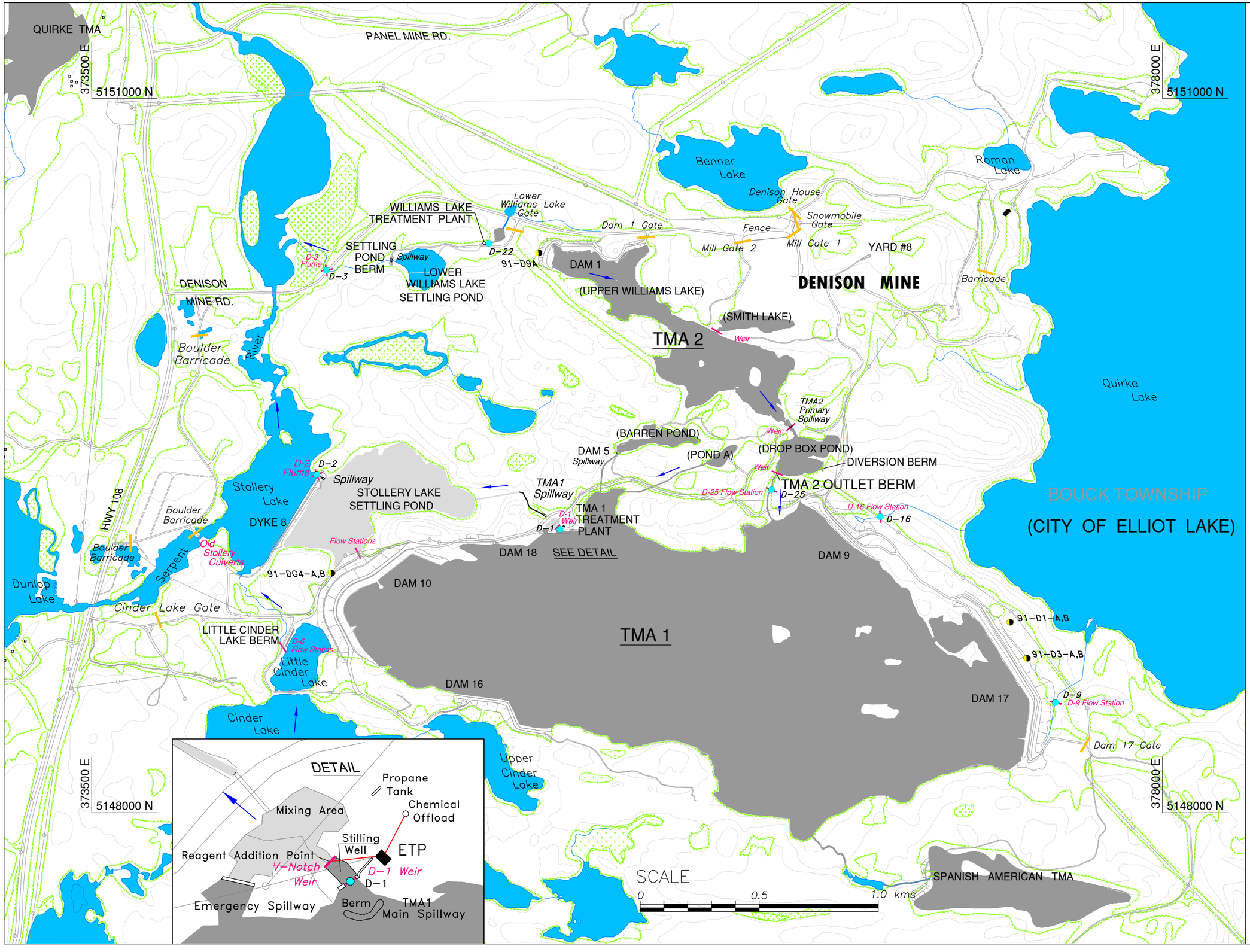
cc: Distribution List

**Table 1: Summary of the Elliot Lake monitoring programs; documents produced and changes to the programs during each cycle.**

| Cycle | Report Title | Year | Period Covered | Description Of Changes To The Monitoring Programs Within Each Cycle |
|---|---|---|---|---|
| **Cycle 1** | Serpent River Watershed Monitoring Program Framework Document. | 1999 | historical monitoring data | SRWMP, IBMP, SAMP and TOMP were developed based on program objectives and existing monitoring data collected over the period of operations and decommissioning. |
| | In-Basin Monitoring Program Report | 1999 | | |
| | Serpent River Watershed and In-Basin Monitoring Program – Implementation Document. | 1999 | | |
| | Serpent River Watershed Monitoring Program -1999 Study | 2001 | 1999 - 2000 | |
| | In-Basin Monitoring Program for the Uranium Tailings Areas - 1999 Study. | 2001 | | |
| **Cycle 2** | Overview of Elliot Lake Monitoring Programs and Source Area Monitoring Program Design. | 2002 | 2000 -2004 | **Changes only SRWMP** most associated with optimization after first cycle of program was complete:<br>- monitoring substances reduced to mine indicator parameters (barium, cobalt, DOC, iron, manganese, Ra-226, selenium, silver, sulphate and uranium),<br>- addition of two lake reference stations (Summers and Semiwite lakes) and 3 stream reference areas (SR-16, SR-17 and SR-18 );<br>- removal of shallow lakes for sediment and benthic sampling (Westner, Grassy, Halfmoom, Upper Cinder and Horne lakes);<br>- removal of some stream sediment and benthic stations (D-15, SC-03 and SR-07);<br>- removal of Depot Lake and Serpent Harbour; addition of May Lake;<br>- the transfer of some SRWMP stations to SAMP or TOMP (N-12, ECA-131, P-11, MPE and Q-23);<br>- fish health assessment eliminated based on performance, fish community assessment added for McCabe Lake and fish tissue monitoring reduced in scope based on performance. |
| | TMA Operational Monitoring Program Design (TOMP). | 2002 | | |
| | Cycle 2 Study Design – Serpent River Watershed and In-Basin Monitoring Programs. | 2004 | | |
| | Serpent River Watershed Monitoring Program: Cycle 2 Interpreative Report | 2005 | | |
| | Serpent River In-Basin Monitoring Program: Cycle 2 Interpretive Report - 2004 Study. | 2005 | | |
| | Serpent River Watershed State of the Environment | 2009 | | |
| **Cycle 3** | Monitoring Framework For Closed Uranium Mines Near Elliot Lake | 2009 | 2005- 2009 | **IBMP** eliminated based on objectives of program being achieved.<br>**SAMP and TOMP:**<br>- removal of silver, selenium based on performance and removal of conductivity based on redundancy with sulphate;<br>- DOC, hardness and flow added at selected stations.<br>**SRWMP:**<br>- removal of selenium and sliver based on performance,<br>- removal of station SR-12, ELO, SR-09, SR-15, SR-02, SR-03, SR-11, P-01, QL-01 and SR-16 and SR-17 based on performance;<br>- monthly monitoring frequency reduced to quarterly;<br>- sediment and benthic monitoring removed from Whiskey, Evans and Cinder Lakes based on redundancy,<br>- depositional streams (Q-20, D-6, SR-06, M-01 and SR-08) based on very high natural variability masking results;<br>- fishing in McCabe Lake and fish tissue monitoring eliminated based on performance. |
| | In Basin Monitoring Program, Cycle 3 Study Design | 2009 | | |
| | Serpent River Watershed Monitoring Program: Cycle 3 Study Design | 2009 | | |
| | Source Area Monitoring Program Revised Study Design. | 2009 | | |
| | Tailing Management Area Monitoring Program (TOMP) Revised Study Design | 2009 | | |
| | Serpent River Watershed State of the Environment Report. | 2011 | | |
| **Cycle 4** | Cycle 4 Study Design For the SRWMP, SAMP and TOMP. | 2014[a] | 2010 - 2014 | Minor changes to SAMP and TOMP.<br>**SRWMP:**<br>- elimination of reference stations SR-05, P-222 and SR-14;<br>- removal of cobalt as substance for monitoring, addition of DOC;<br>- far-field lakes removed from the program (Hough, Pecors and McCarthy);<br>- removal of Rochester Lake as a sediment and benthic reference area;<br>- reduction in benthic and sediment sampling to 1/10 years based on measured deposition rates. |
| | Serpent River Watershed Cycle 4 State of the Environment | 2016 | | |

[a] Study Design was submitted to CNSC and JRG in 2014 but reissued with agency comments in 2016.

# APPENDIX II
# Site Maps, Sampling Requirements




Denison Mines

# Denison Mines Inc.
# Denison
# SAMPLE LOCATION MAP

Rev. 2016-00
March 2016

## Legend

- water covered tailings.
- settling ponds.
- surface water sample location.
- groundwater sample location.
- flow direction.
- roads or trails.
- power line.
- flow station or weir.
- pipeline.
- gate.
- wetlands.

## Notes

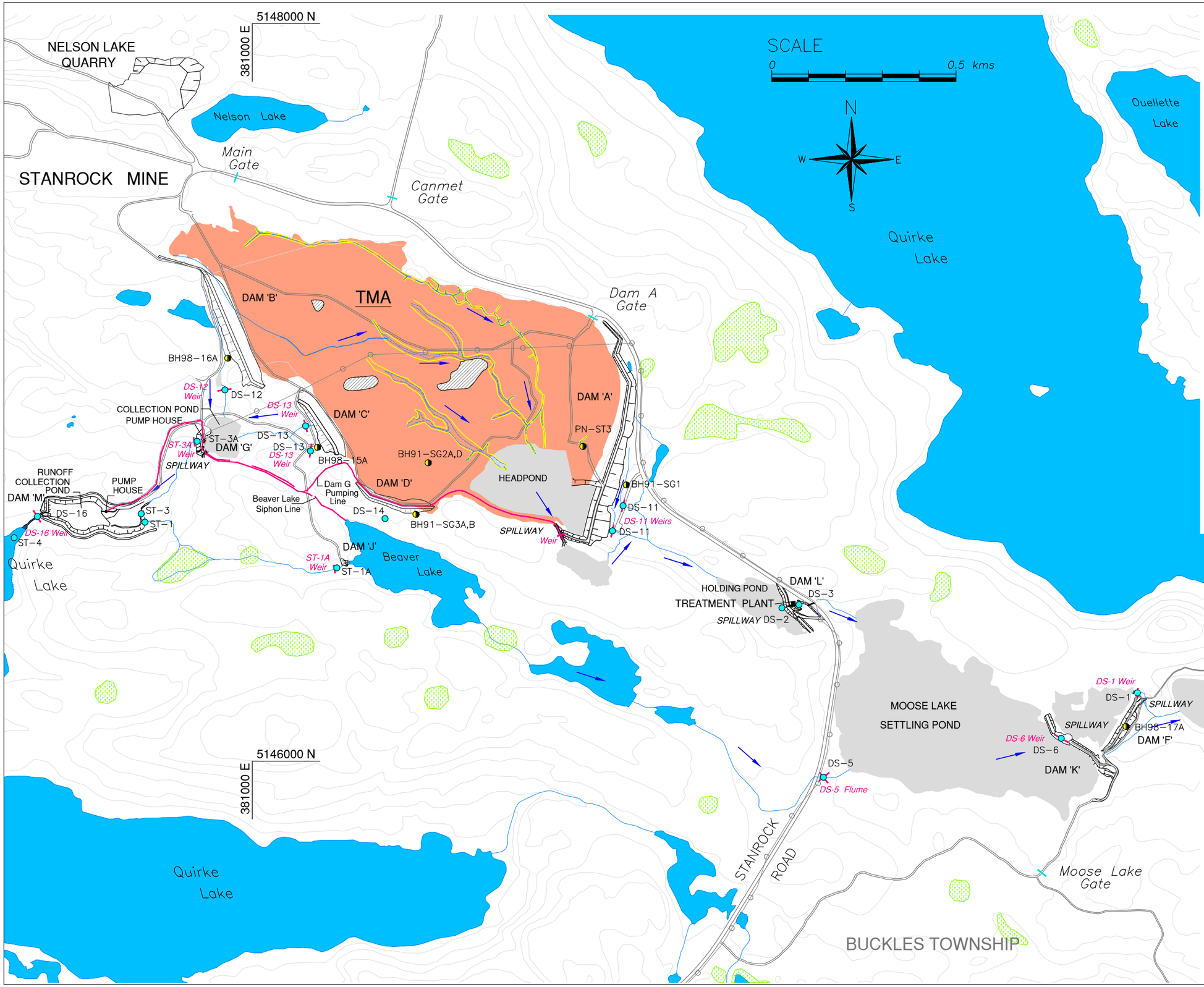
- OBM © Queens Printer for Ontario, 2008.
- Mine structures and property limits were derived from Denison Mines records.
- Mapping export parameters = NAD83 WGS_1984_UTM Zone_17N (Central Meridian = 81°W).
- Contour Interval = 10 metres.
- File 9.3.2 (Sample Location Map).

N
W E
S

Issued on: _____

Issued by: _____

Denison Responsible Authority




Denison Mines

# Denison Mines Inc.
# Stanrock Site
# SAMPLE LOCATION MAP

Rev. 2016-00
March 2016

## Legend

- vegetated tailings.
- collection or settling ponds.
- surface water sample location.
- groundwater sample location.
- flow direction.
- roads or trails.
- power line.
- siphon line.
- pipeline.
- wetlands.
- exposed bedrock

## Notes

- OBM©Queens Printer for Ontario, 2007.
- Mine structures and property limits were derived from Denison Mines records.
- Mapping export parameters = NAD83 WGS_1984_UTM Zone_17N (Central Meridian = 81°W).

Issued on: _____

Issued by: _____

Denison Responsible Authority

***Stanrock C of A***
***Performance Monitoring 2016***

Denison Mines

| Sampling Station | Location / Description | Coordinates | Purpose | Flow | pH | Conductivity | Sulphate | $^{226}$Radium (Total) | Acidity | Alkalinity | Hardness | DOC | Iron | SAMP METALS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Barium | Cobalt | Manganese | Uranium |
| DS-11 | Seepage of Dam A | N 5146624 E 381977<br>N 5146692 E 382006 | MOE | 4 | 4 | 4 | | | | | | | | | | | |
| DS-12 | Seepage of Dam B | N 5147007 E 380926 | MOE | 4 | 4 | 4 | | | | | | | | | | | |
| DS-13 | Seepage of Dam C | N 5146909 E 381145<br>N 5146841 E 381158 | MOE | 4 | 4 | 4 | | | | | | | | | | | |
| DS-14 | Seepage of Dam AD | N 5146658 E 381360 | MOE | 4 | 4 | 4 | | | | | | | | | | | |
| DS-18 | Halfmoon Lake Outlet | N 5145050 E 383761 | MOE | 4 | 4 | | 4 | 4 | | | | | 4 | 4 | 4 | 4 | 4 |
| ST-1 | Downstream of Dam G | N 5146648 E 380709 | MOE | | 4 | 4 | | | | | | | | | | | |
| ST-1A | Dam J at toe of dam | N 5146524 E 381229 | MOE | | 4 | 4 | | | | | | | | | | | |
| ST-3 | Downstream of Dam G | N 5146671 E 380699 | MOE | | 4 | 4 | | | | | | | | | | | |
| ST-3A | Dam G at Toe of Dam | N 5146867 E 380850 | MOE | | 4 | 4 | | | | | | | | | | | |
| ST-4 | Within Quirke Lake Delta | N 5146606 E 380354 | MOE | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

***Denison TOMP/SAMP***
***Surface Water Performance Monitoring 2016***

| Sampling Station | Location / Description | Coordinates | Purpose | Elevation | Flow | pH | Conductivity | Sulphate | $^{226}$Radium (Total) | TSS | Acidity | Hardness | Iron | SAMP METALS | | | | Toxicity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Barium | Cobalt | Manganese | Uranium | Acute *Rainbow Trout* | Acute *Daphnia magna* | Chronic *Ceriodaphnia dubia* |
| D-1 | TMA-1 Overflow | N 5149191 E 375468 | TOMP | 52 | 261 | 12 | | 4 | 12 | | 4 | | 4 | 4 | 4 | 4 | 4 | | | |
| D-2 | TMA-1 Stollery Lake Overflow | N 5149421 E 374446 | TOMP | | 52 | 52 | | | 52 | 52 | | | | | | | | | | |
| D-3 | TMA-2 Effluent | N 5150280 E 374485 | TOMP | | 52 | 52 | | | 52 | 52 | | | | | | | | | | |
| D-22 | TMA-2 ETP Influent | N 5150391 E 375169 | TOMP | | | 52 | | 4 | 12 | | | | 4 | 4 | 4 | 4 | 4 | | | |
| D-25 | TMA-2 Overflow into TMA-1 | N 5149357 E 376357 | TOMP | | | 2 | | 2 | 2 | | 2 | | 2 | | | | | | | |
| DS-1 | Stanrock Moose Lake Outlet to Orient Lake | N 5146185 E 383401 | TOMP | | 52 | 52 | | | 4 | | | | | | | | | | | |
| DS-2 | Stanrock ETP Influent | N 5146416 E 382437 | TOMP | | 261 | 12 | | 4 | 12 | | 4 | | 4 | 4 | 4 | 4 | 4 | | | |
| DS-3 | Stanrock ETP Effluent | N 5146424 E 382483 | TOMP | | | 261 | | | 12 | | | | | | | | | | | |
| DS-4 | Stanrock Final Discharge @ Orient Lake Outlet | N 5146327 E 383888 | TOMP | | 52 | 52 | | | 52 | 52 | | | | | | | | | | |
| DS-5 | Orient Creek Discharge into Moose Lake | N 5145956 E 382549 | TOMP | | 4 | 4 | 4 | | | | | | | | | | | | | |
| DS-6 | Moose Lake Narrows upstream of Dam K | N 5146062 E 383194 | TOMP | | 52 | 52 | | | | | | | | | | | | | | |
| Denison TOMP Sites Sample Subtotal | | | | | 838 | 655 | | 14 | 210 | 156 | 10 | | 14 | 12 | 12 | 12 | 12 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | | | | | | | |
| D-2 | TMA-1 Stollery Lake Overflow | N 5149421 E 374446 | SAMP | | 52 | 52 | | 12 | 12 | | | 12 | 12 | 12 | 12 | 12 | 12 | 2 | 2 | 2 |
| D-3 | TMA-2 Effluent | N 5150280 E 374485 | SAMP | | 52 | 52 | | 12 | 12 | | | 12 | 12 | 12 | 12 | 12 | 12 | | | |
| D-9 | Denison TMA-1; Dam 9 Seepage | N 5148462 E 377550 | SAMP | | 4 | 4 | | 4 | 4 | | | 4 | 4 | 4 | 4 | 4 | 4 | | | |
| D-16 | Denison TMA-1; Dam 17 Seepage | N 5149244 E 376814 | SAMP | | 4 | 4 | | 4 | 4 | | | 4 | 4 | 4 | 4 | 4 | 4 | | | |
| DS-4 | Stanrock Final Discharge @ Orient Lake Outlet | N 5146327 E 383888 | SAMP | | 52 | 52 | | 12 | 12 | | | 12 | 12 | 12 | 12 | 12 | 12 | 2 | 2 | 2 |
| DS-16 | Stanrock TMA; Dam M Seepage; Quirke Lake Delta | N 5146663 E 380417 | SAMP | | 4 | 4 | | 4 | 4 | | | 4 | 4 | 4 | 4 | 4 | 4 | | | |
| Denison SAMP Sites Sample Subtotal | | | | | 168 | 168 | | 48 | 48 | 0 | 0 | | 48 | 48 | 48 | 48 | 48 | 4 | 4 | 4 |
| | | | | | | | | | | | | | | | | | | | | |
| Denison Total Samples | | | | | 1006 | 823 | | 62 | 258 | 156 | 10 | 48 | 62 | 60 | 60 | 60 | 60 | 4 | 4 | 4 |
| | | | | | | | | | | | | | | | | | | | | |
| FB | Field Blank | | | | | | | 12 | 12 | 12 | | 4 | 12 | 12 | 12 | 12 | 12 | | | |
| BS | Blind Sample | | | | | | | 12 | 12 | 12 | | 4 | 12 | 12 | 12 | 12 | 12 | | | |

***Denison Groundwater***
***Performance Monitoring 2016***

| Sampling Station | Location / Description | Coordinates | Type | Purpose | Elevation | Conductivity | pH | Acidity | Iron |
|---|---|---|---|---|---|---|---|---|---|
| BH91-D1 | Dam 17 North Abutment | N 5148801 E 377359 | Groundwater (2 wells) | TOMP | 2 | 2 | 2 | 2 | 2 |
| BH91-D3 | Dam 17 North Valley, Toe | N 5148649 E 377430 | Groundwater (2 wells) | TOMP | 2 | 2 | 2 | 2 | 2 |
| BH91-D9 | Dam 1 North Ridge, Toe | N 5150352 E 375379 | Groundwater (1 well) | TOMP | 1 | 1 | 1 | 1 | 1 |
| BH91-DG4 | Below Dam 10 | N 5149006 E 374508 | Groundwater (1 well) | TOMP | 1 | 1 | 1 | 1 | 1 |
| BH91-SG2 | Upstream of Dam D | N 5146809 E 381477 | Porewater (2 wells) | TOMP | 2 | 2 | 2 | 2 | 2 |
| PN-ST3 | Upstream of Dam A | N 5146853 E 381897 | Porewater (4 wells) | TOMP | 4 | 4 | 4 | 4 | 4 |
| BH91-SG1 | Downstream of Dam A | N 5146749 E 382014 | Groundwater (1 well) | TOMP | 1 | 1 | 1 | 1 | 1 |
| BH91-SG3 | Downstream of Dam D | N 5146669 E 381444 | Groundwater (2 wells) | TOMP | 2 | 2 | 2 | 2 | 2 |
| BH98-15 | Downstream of Dam C | N 5146851 E 381177 | Groundwater (1 well) | TOMP | 1 | 1 | 1 | 1 | 1 |
| BH98-16 | Downstream of Dam B | N 5147093 E 380933 | Groundwater (1 well) | TOMP | 1 | 1 | 1 | 1 | 1 |

# APPENDIX III
# Flagged Data & QA/QC Results

***Denison Mines Inc.***

***SAMP/TOMP Flagged Data***
***2016***

| Location | Analyte | Date | Low | Hi | Result | | Comment |
|---|---|---|---|---|---|---|---|
| D-2 | FLOW | 2016-01-12 | 0 | 109.3 | 153.0 | L/s | Result is above the high flag limit but consistent with previous values and increased precipitation. |
| | Ra | 2016-01-05 | 0 | 0.284 | 0.356 | Bq/L | Result is above the high flag but consistent with previous values at this location; however in response to the elevated result, flow was reduced and barium chloride addition rates were increased. Concentrations decreased to 0.266 Bq/L by the following week. |
| D-1 | FLOW | 2016-03-11 | 0 | 171.8 | 173.0 | L/s | Results above the high flag limit but consistent with previous values and plant start up due to elevated water levels. |
| | | 2016-03-14 | 0 | 171.8 | 173.0 | L/s | |
| | | 2016-03-15 | 0 | 171.8 | 173.0 | L/s | |
| D-2 | FLOW | 2016-03-15 | 0 | 136.9 | 173.0 | L/s | Result is slightly above the high flag limit but consistent with previous values at this location. |
| | Ra | 2016-03-22 | 0 | 0.351 | 0.412 | Bq/L | Result is above the high flag limit, confirmed by repeat analysis. In response, flow was reduced and the BaCl2 addition rate was increased. In addition, supplemental floc addition was initiated to help with precipitation of radium. By April 19, concentrations decreased to 0.301 Bq/L. |
| | | 2016-03-29 | 0 | 0.351 | 0.421 | Bq/L | |

***Denison Mines Inc.***

***SAMP/TOMP Flagged Data***
***2016***

| Location | Analyte | Date | Low | Hi | Result | | Comment |
|---|---|---|---|---|---|---|---|
| DS-1 | pH | 2016-03-21 | 6.3 | 8.4 | 8.9 | | Results are above the high flag limit but consistent with heavy precipitation and increased flow under ice cover. PH levels remained near neutral at 7.5 downstream at the final discharge (DS-4). |
| | | 2016-03-22 | 6.3 | 8.4 | 9.1 | | |
| | | 2016-03-23 | 6.3 | 8.4 | 9.2 | | |
| | | 2016-03-24 | 6.3 | 8.4 | 9.2 | | |
| BSDST | Ba | 2016-04-12 | 0 | 0.418 | 0.589 | mg/L | Result is above the high flag limit but consistent with operational adjustments made in response to elevated radium in the final discharge (D-2). The result is also consistent with the primary sample (D-2). |
| | Ra | 2016-04-12 | 0 | 0.345 | 0.396 | Bq/L | Result is above the high flag limit but consistent with the primary sample (D-2). In response, flow was reduced and the BaCl2 addition rate was increased. In addition, supplemental floc addition was initiated to help with precipitation of radium. By April 19, concentrations decreased to 0.301 Bq/L. |
| D-1 | SO4 | 2016-04-12 | 36.4 | 198.4 | 22.0 | mg/L | Result is a historic low confirmed by repeat analysis, but likely due to heavy precipitation, snowmelt and dilution. Result is indicative of the decreasing trend observed for for this parameter. |

***Denison Mines Inc.***

***SAMP/TOMP Flagged Data***
***2016***

| Location | Analyte | Date | Low | Hi | Result | | Comment |
|---|---|---|---|---|---|---|---|
| D-2 | Ba | 2016-04-12 | 0 | 0.425 | 0.565 | mg/L | Result is above the high flag limit but consistent with operational adjustments made in response to elevated radium. The result is also consistent with the duplicate sample (BSDST). |
| DS-4 | Ba | 2016-04-12 | 0.006 | 0.085 | 0.115 | mg/L | Result is a 19-year high confirmed by repeat analysis but consistent with operational adjustments in response to slightly elevated radium. Concentrations decrease to within expected ranges the following month at 0.058 mg/L. |
| D-2 | TSS | 2016-05-03 | 1 | 1 | 2 | mg/L | Result is slightly above the high flag limit but still consistent with previous values at this location. |
| D-22 | pH | 2016-05-10 | 6.1 | 7.3 | 7.4 | | Result is slightly above the high flag limit but still consistent with previous values at this location. |
| D-22 | Mn | 2016-07-12 | 0 | 3.403 | 6.120 | mg/L | Result is above the high flag confirmed by repeat analysis but consistent with very low flow at the time of sampling. |
| FBDST | Fe | 2016-07-12 | 0.02 | 0.02 | 0.03 | mg/L | Result slightly exceeds the targeted detection limit of <0.02 mg/L, however, it still remains below the laboratory blank criteria of 0.04 mg/L. No further action is required. |

***Denison Mines Inc.***

***SAMP/TOMP Flagged Data***
***2016***

| Location | Analyte | Date | Low | Hi | Result | | Comment |
|---|---|---|---|---|---|---|---|
| D-22 | Ra | 2016-08-30 | 0 | 1.490 | 2.147 | Bq/L | Result is above the high flag limit but consistent with seasonal values during periods of low flow and drier conditions. |
| D-22 | Ra | 2016-09-13 | 0 | 0.874 | 1.576 | Bq/L | Result is above the high flag limit but consistent with seasonal values during dry conditions and low water levels. |
| D-2 | TSS | 2016-10-18 | 1 | 1 | 2 | mg/L | Result is slightly above the high flag limit but still consistent with previous values at this location. |
| DS-4 | U | 2016-10-11 | 0 | 0.0069 | 0.0091 | mg/L | Result is a 15-year high confirmed by repeat analysis but is only slightly above the high flag limit and still consistent with historic values at this location. Will continue to monitor at the current monthly frequency. |
| D-3 | TSS | 2016-11-08 | 1 | 1 | 2 | mg/L | Result is slightly above the high flag limit but still consistent with previous values at this location. |
| DS-4 | U | 2016-11-08 | 0 | 0.0101 | 0.0121 | mg/L | Result is a 17-year high confirmed by repeat analysis but is only slightly above the high flag limit and still consistent with historic values at this location. Will continue to monitor at the current monthly frequency. |

***SAMP and TOMP DATA QUALITY REPORTING***
***Field Blank 2016***
***Revision 2016-01***

***Registry: RC8.5.4-02***



| | Date | pH | TSS mg/L | Hardness mg/L | Uranium mg/L | Sulphate mg/L | Radium Bq/L | Barium mg/L | Cobalt mg/L | Iron mg/L | Manganese mg/L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Blank Criteria | | | | | | | | | | | |
| | SAMP [1] | - | - | 1.0 | 0.001 | 0.2 | 0.01 | 0.01 | 0.001 | 0.04 | 0.004 |
| | TOMP [1] | - | 2 | - | 0.001 | 0.2 | 0.01 | 0.01 | 0.001 | 0.04 | 0.004 |
| FBDST | 2016.01 | 5.3 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.02 | 5.3 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.03 | 5.8 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.04 | 5.3 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.05 | 5.3 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.06 | 5.9 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.07 | 5.2 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | 0.03 | < 0.002 |
| FBDST | 2016.08 | 5.7 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.09 | 5.6 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.10 | 5.8 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.11 | 5.8 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| FBDST | 2016.12 | 6.6 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | < 0.02 | < 0.002 |
| Count | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| # Exceedances | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | | 5.6 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | 0.02 | < 0.002 |
| Max | | 6.6 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | 0.03 | < 0.002 |
| Min | | 5.2 | 1 | < 0.5 | < 0.0005 | < 0.1 | < 0.008 | < 0.005 | < 0.0005 | 0.02 | < 0.002 |

[1] SAMP and TOMP field Precision criteria taken from Table 5.2 of the Cycle 4 Study Design for SRWMP, SAMP and TOMP (Minnow, 2016)

Bold Indicates an exceedance of the Blank Criteria

***SAMP and TOMP DATA QUALITY REPORTING***
***Field Precision 2016***
***Revision 2016-01***

Denison Mines

***Registry: RC8.5.4-02***



| Location | Date | pH | TSS | Hardness | Sulphate | Radium (total) | Uranium | Barium | Cobalt | Iron | Manganese |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/L | mg/L | mg/L | Bq/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| D-2 | 2016.01 | 7.2 | < 1 | 223.0 | 190.0 | 0.266 | 0.0354 | 0.319 | 0.0008 | 0.29 | 0.164 |
| BSDST | | 7.2 | < 1 | 220.0 | 200.0 | 0.255 | 0.0345 | 0.308 | 0.0008 | 0.28 | 0.166 |
| variance | | 0% | 0% | 1% | 5% | 4% | 3% | 4% | 0% | 4% | 1% |
| D-2 | 2016.02 | 7.0 | < 1 | 212.0 | 180.0 | 0.223 | 0.0313 | 0.272 | 0.0006 | 0.37 | 0.141 |
| BSDST | | 7.0 | < 1 | 215.0 | 180.0 | 0.238 | 0.0315 | 0.273 | 0.0007 | 0.37 | 0.141 |
| variance | | 0% | 0% | 1% | 0% | 7% | 1% | 0% | 15% | 0% | 0% |
| D-2 | 2016.03 | 7.0 | < 1 | 247.0 | 180.0 | 0.133 | 0.0310 | 0.289 | 0.0006 | 0.45 | 0.127 |
| BSDST | | 7.0 | < 1 | 258.0 | 180.0 | 0.148 | 0.0311 | 0.282 | 0.0007 | 0.38 | 0.132 |
| variance | | 0% | 0% | 4% | 0% | 11% | 0% | 2% | 15% | 17% | 4% |
| D-2 | 2016.04 | 7.1 | < 1 | 180.0 | 130.0 | 0.402 | 0.0223 | 0.565 | < 0.0005 | 0.34 | 0.111 |
| BSDST | | 7.1 | < 1 | 180.0 | 130.0 | 0.396 | 0.0225 | 0.589 | < 0.0005 | 0.34 | 0.112 |
| variance | | 0% | 0% | 0% | 0% | 2% | 1% | 4% | 0% | 0% | 1% |
| D-2 | 2016.05 | 7.6 | 1 | 237.0 | 150.0 | 0.249 | 0.0251 | 0.376 | 0.0007 | 0.36 | 0.198 |
| BSDST | | 7.6 | 1 | 238.0 | 150.0 | 0.215 | 0.0248 | 0.393 | 0.0007 | 0.36 | 0.200 |
| variance | | 0% | 0% | 0% | 0% | 15% | 1% | 4% | 0% | 0% | 1% |
| D-2 | 2016.06 | 7.0 | 1 | 263.0 | 200.0 | 0.090 | 0.0294 | 0.161 | < 0.0005 | 0.15 | 0.103 |
| BSDST | | 7.0 | 1 | 261.0 | 200.0 | 0.093 | 0.0286 | 0.157 | < 0.0005 | 0.15 | 0.100 |
| variance | | 0% | 0% | 1% | 0% | 3% | 3% | 3% | 0% | 0% | 3% |
| D-2 | 2016.07 | 7.1 | 1 | 289.0 | 220.0 | 0.061 | 0.0370 | 0.103 | < 0.0005 | 0.07 | 0.083 |
| BSDST | | 7.1 | 1 | 287.0 | 230.0 | 0.070 | 0.0364 | 0.106 | < 0.0005 | 0.06 | 0.080 |
| variance | | 0% | 0% | 1% | 4% | 14% | 2% | 3% | 0% | 15% | 4% |
| D-2 | 2016.08 | 7.3 | 1 | 319.0 | 260.0 | 0.033 | 0.0450 | 0.085 | < 0.0005 | 0.06 | 0.076 |
| BSDST | | 7.3 | 1 | 319.0 | 260.0 | 0.043 | 0.0458 | 0.087 | < 0.0005 | 0.06 | 0.072 |
| variance | | 0% | 0% | 0% | 0% | **26%** | 2% | 2% | 0% | 0% | 5% |
| D-2 | 2016.09 | 7.0 | 1 | 350.0 | 280.0 | 0.040 | 0.0504 | 0.075 | < 0.0005 | 0.08 | 0.072 |
| BSDST | | 7.0 | 1 | 367.0 | 280.0 | 0.032 | 0.0524 | 0.065 | < 0.0005 | 0.07 | 0.065 |
| variance | | 0% | 0% | 5% | 0% | **22%** | 4% | 14% | 0% | 13% | 10% |

*Issued by, Environmental Manager*

*Issued on: March 31, 2016*
*Expires on: March 31, 2020*

| Location | Date | pH | TSS | Hardness | Sulphate | Radium (total) | Uranium | Barium | Cobalt | Iron | Manganese |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/L | mg/L | mg/L | Bq/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| D-2 | 2016.10 | 7.3 | < 1 | 379.0 | 300.0 | 0.082 | 0.0518 | 0.070 | < 0.0005 | 0.09 | 0.146 |
| BSDST | | 7.3 | < 1 | 396.0 | 300.0 | 0.070 | 0.0574 | 0.076 | < 0.0005 | 0.09 | 0.150 |
| variance | | 0% | 0% | 4% | 0% | 16% | 10% | 8% | 0% | 0% | 3% |
| D-2 | 2016.11 | 7.1 | 1 | 378.0 | 310.0 | 0.088 | 0.0586 | 0.080 | 0.0006 | 0.12 | 0.152 |
| BSDST | | 7.1 | 1 | 391.0 | 330.0 | 0.072 | 0.0573 | 0.092 | 0.0006 | 0.12 | 0.149 |
| variance | | 0% | 0% | 3% | 6% | **20%** | 2% | 14% | 0% | 0% | 2% |
| D-2 | 2016.12 | 7.2 | < 1 | 377.0 | 330.0 | 0.070 | 0.0579 | 0.079 | 0.0009 | 0.21 | 0.212 |
| BSDST | | 7.2 | 1 | 383.0 | 330.0 | 0.081 | 0.0569 | 0.098 | 0.0010 | 0.22 | 0.210 |
| variance | | 0% | 0% | 2% | 0% | 15% | 2% | **21%** | 11% | 5% | 1% |
| Count | | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| Average | | 0% | 0% | 2% | 1% | 13% | 2% | 7% | 3% | 4% | 3% |
| Max | | 0% | 0% | 5% | 6% | 26% | 10% | 21% | 15% | 17% | 10% |
| Min | | 0% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 0% |
| Criteria[1] | | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| # Exceedances | | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |

[1] SAMP and TOMP field Precision criteria taken from Table 5.2 of the Cycle 4 Study Design for SRWMP, SAMP and TOMP (Minnow, 2016)

Bold Indicates an exceedance of the field precision criteria

## *SAMP and TOMP DATA QUALITY REPORTING*
## *Field Blank*
## *Revision 2016.01*

***Registry: RC8.5.4-03***



| Date | | | Acidity | Sulphate | pHF | Iron |
|---|---|---|---|---|---|---|
| | | | mg/L as CaCO3 | mg/L | | mg/L |
| Blank Criteria | | TOMP [1] | 2 | | | 0.04 |
| 2016.07 | FBD-GW2 | | 1.0 | 0.1 | 6.7 | **0.37** |
| 2016.07 | FBD-GW3 | | < 1.0 | < 0.1 | 5.8 | < 0.02 |
| 2016.07 | FBD-GW4 | | 2.0 | < 0.1 | 6.4 | **5.99** |
| Count | | | 3 | 3 | 3 | 3 |
| # Exceedances | | | 0 | 0 | 0 | 2 |
| Average | | | 1.0 | < 0.1 | 6.3 | 2.13 |
| Max | | | 2.0 | < 0.1 | 6.7 | 5.99 |
| Min | | | < 1.0 | < 0.1 | 5.8 | < 0.02 |

[1] SAMP and TOMP field Precision criteria taken from Table 5.2 of the Cycle 4 Study Design for SRWMP, SAMP and TOMP (Minnow, 2016)

Bold Indicates an exceedance of the Blank Criteria

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*Issued on: March 31, 2016*
*Expires on: March 31, 2020*

***SAMP and TOMP DATA QUALITY REPORTING***
***Groundwater Field Precision***
***Revision 2016.01***

Denison Mines

***Registry: RC8.5.4-04***



| Location | Date | pHF | Sulphate | Acidity | Iron |
|---|---|---|---|---|---|
| | | | mg/L | mg/L | mg/L |
| 98-15A | 2016.07 | 6.0 | 2600.0 | 1130.0 | 626.00 |
| BSD-GW2 | | 6.0 | 2900.0 | 1060.0 | 623.00 |
| variance | | 0% | 11% | 6% | 0% |
| BH91 DG4B | 2016.07 | 6.6 | 700.0 | < 1.0 | 10.40 |
| BSD-GW3 | | 6.7 | 650.0 | < 1.0 | 8.67 |
| variance | | 2% | 7% | 0% | 18% |
| BH91-SG2A | 2016.07 | 6.0 | 4000.0 | 2260.0 | 1160.00 |
| BSD-GW4 | | 6.0 | 4000.0 | 2290.0 | 1230.00 |
| variance | | 0% | 0% | 1% | 6% |
| Count | | 3 | 3 | 3 | 3 |
| Average | | 1% | 6% | 3% | 8% |
| Min | | 2% | 11% | 6% | 18% |
| Max | | 0% | 0% | 0% | 0% |
| Criteria[1] | | 20% | 20% | 20% | 20% |
| # Exceedances | | 0 | 0 | 0 | 0 |

*Issued by, Environmental Manager*

*Issued on: March 31, 2016*
*Expires on: March 31, 2020*

# APPENDIX IV
# Water Quality Results

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### BSDST

| Month | FLOW L/s | pH | SO4 mg/L | TSS mg/L | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 153.00 | 7.2 | 200.0 | <1 | 0.255 | 0.308 | 0.0008 | 0.28 |
| 2016.02 | 72.00 | 7.0 | 180.0 | <1 | 0.238 | 0.273 | 0.0007 | 0.37 |
| 2016.03 | 52.00 | 7.0 | 180.0 | <1 | 0.148 | 0.282 | 0.0007 | 0.38 |
| 2016.04 | 36.00 | 7.1 | 130.0 | <1 | 0.396 | 0.589 | <0.0005 | 0.34 |
| 2016.05 | 126.00 | 7.6 | 150.0 | 1 | 0.215 | 0.393 | 0.0007 | 0.36 |
| 2016.06 | 12.00 | 7.0 | 200.0 | 1 | 0.093 | 0.157 | <0.0005 | 0.15 |
| 2016.07 | 9.00 | 7.1 | 230.0 | 1 | 0.070 | 0.106 | <0.0005 | 0.06 |
| 2016.08 | 5.00 | 7.3 | 260.0 | 1 | 0.043 | 0.087 | <0.0005 | 0.06 |
| 2016.09 | 9.00 | 7.0 | 280.0 | 1 | 0.032 | 0.065 | <0.0005 | 0.07 |
| 2016.10 | 19.00 | 7.3 | 300.0 | <1 | 0.070 | 0.076 | <0.0005 | 0.09 |
| 2016.11 | 17.00 | 7.1 | 330.0 | 1 | 0.072 | 0.092 | 0.0006 | 0.12 |
| 2016.12 | 17.00 | 7.2 | 330.0 | 1 | 0.081 | 0.098 | 0.0010 | 0.22 |
| | | | | | | | | |
| Count | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| High | 153.00 | 7.6 | 330.0 | 1 | 0.396 | 0.589 | 0.0010 | 0.38 |
| Low | 5.00 | 7.0 | 130.0 | <1 | 0.032 | 0.065 | <0.0005 | 0.06 |
| Mean | 43.92 | 7.2 | 230.8 | 1 | 0.143 | 0.210 | 0.0006 | 0.21 |
| | | | | | | | | |
| High Limit | | 8.5 | 128.0 | 10 | 1.000 | 1.000 | 0.0025 | 0.49 |
| Low Limit | | 6.5 | | | | | | |
| Lim Ex | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 100% | 0% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

### BSDST

| Month | Mn mg/L | U mg/L |
|---|---|---|
| 2016.01 | 0.166 | 0.0345 |
| 2016.02 | 0.141 | 0.0315 |
| 2016.03 | 0.132 | 0.0311 |
| 2016.04 | 0.112 | 0.0225 |
| 2016.05 | 0.200 | 0.0248 |
| 2016.06 | 0.100 | 0.0286 |
| 2016.07 | 0.080 | 0.0364 |
| 2016.08 | 0.072 | 0.0458 |
| 2016.09 | 0.065 | 0.0524 |
| 2016.10 | 0.150 | 0.0574 |
| 2016.11 | 0.149 | 0.0573 |
| 2016.12 | 0.210 | 0.0569 |
| | | |
| Count | 12 | 12 |
| High | 0.210 | 0.0574 |
| Low | 0.065 | 0.0225 |
| Mean | 0.131 | 0.0399 |
| | | |
| High Limit | 0.800 | 0.0150 |
| Low Limit | | |
| Lim Ex | 0 | 12 |
| Frequency | 0% | 100% |
| 10x Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-1 – Denison TMA-1 Overflow (Influent and ETP Operations)

| Month | ACID mg/L | BaCl2T kg/month | ELEV m | FLOW L/s | NaOHT kg/month | ODays day | pH | SO4 mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | <1 | 624.70 | 387.15 | 107.75 | 0.00 | 31 | 7.6 | 100.0 |
| 2016.02 | | 615.30 | 387.09 | 98.80 | 0.00 | 29 | 7.6 | |
| 2016.03 | | 733.80 | 387.08 | 117.95 | 0.00 | 31 | 7.4 | |
| 2016.04 | <1 | 627.40 | 387.13 | 80.52 | 0.00 | 30 | 7.1 | 22.0 |
| 2016.05 | | 630.60 | 387.05 | 96.10 | 0.00 | 20 | 8.0 | |
| 2016.06 | | 0.00 | 386.95 | 0.00 | 0.00 | 0 | | |
| 2016.07 | | 0.00 | 386.84 | 0.00 | 0.00 | 0 | | |
| 2016.08 | | 0.00 | 386.73 | 0.00 | 0.00 | 0 | | |
| 2016.09 | | 0.00 | 386.69 | 0.00 | 0.00 | 0 | | |
| 2016.10 | | 0.00 | 386.72 | 0.00 | 0.00 | 0 | | |
| 2016.11 | | 0.00 | 386.83 | 0.00 | 0.00 | 0 | | |
| 2016.12 | | 0.00 | 386.78 | 0.00 | 0.00 | 0 | | 110.0 |
| | | | | | | | | |
| Count | 2 | 12 | 52 | 250 | 12 | 12 | 12 | 3 |
| High | <1 | 733.80 | 387.23 | 173.00 | 0.00 | 31 | 8.0 | 110.0 |
| Low | <1 | 0.00 | 386.66 | 0.00 | 0.00 | 0 | 7.1 | 22.0 |
| Mean | <1 | 269.32 | 386.92 | 41.74 | 0.00 | 12 | 7.5 | 77.3 |
| | | | | | | | | |
| High Limit | | | | | | | 8.5 | 128.0 |
| Low Limit | | | | | | | 6.5 | |
| Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

| Month | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L | Mn mg/L | U mg/L |
|---|---|---|---|---|---|---|
| 2016.01 | 1.526 | 0.060 | <0.0005 | 0.13 | 0.006 | 0.0192 |
| 2016.02 | 1.558 | | | | | |
| 2016.03 | 1.598 | | | | | |
| 2016.04 | 0.951 | 0.033 | 0.0006 | 0.07 | 0.067 | 0.0043 |
| 2016.05 | 1.595 | | | | | |
| 2016.12 | 2.068 | | | | | |
| | | | | | | |
| Count | 6 | 2 | 2 | 2 | 2 | 2 |
| High | 2.068 | 0.060 | 0.0006 | 0.13 | 0.067 | 0.0192 |
| Low | 0.951 | 0.033 | <0.0005 | 0.07 | 0.006 | 0.0043 |
| Mean | 1.549 | 0.047 | 0.0005 | 0.10 | 0.037 | 0.0118 |
| | | | | | | |
| High Limit | 1.000 | 1.000 | 0.0025 | 0.49 | 0.800 | 0.0150 |
| Low Limit | | | | | | |
| Lim Ex | 5 | 0 | 0 | 0 | 0 | 1 |
| Frequency | 83% | 0% | 0% | 0% | 0% | 50% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-16 – Denison TMA-1 Dam 17 Seepage

| Month | FLOW L/s | hard mg/L | pH | SO4 mg/L | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 3.80 | 150.0 | 6.6 | 150.0 | <0.008 | 0.016 | 0.0007 | 0.38 |
| 2016.04 | 1.00 | 155.0 | 6.0 | 150.0 | <0.008 | 0.017 | <0.0005 | 0.27 |
| 2016.07 | 0.25 | 324.0 | 6.5 | 290.0 | 0.042 | 0.040 | 0.0051 | 12.80 |
| 2016.10 | 1.00 | 326.0 | 6.4 | 300.0 | 0.040 | 0.039 | 0.0015 | 6.37 |
| | | | | | | | | |
| Count | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| High | 3.80 | 326.0 | 6.6 | 300.0 | 0.042 | 0.040 | 0.0051 | 12.80 |
| Low | 0.25 | 150.0 | 6.0 | 150.0 | <0.008 | 0.016 | <0.0005 | 0.27 |
| Mean | 1.51 | 238.8 | 6.4 | 222.5 | 0.025 | 0.028 | 0.0019 | 4.96 |
| | | | | | | | | |
| High Limit | | | 8.5 | 128.0 | 1.000 | 1.000 | 0.0025 | 0.49 |
| Low Limit | | | 6.5 | | | | | |
| Lim Ex | 0 | 0 | 2 | 4 | 0 | 0 | 1 | 2 |
| Frequency | 0% | 0% | 50% | 100% | 0% | 0% | 25% | 50% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 50% |

| Month | Mn mg/L | U mg/L |
|---|---|---|
| 2016.01 | 0.301 | <0.0005 |
| 2016.04 | 0.225 | <0.0005 |
| 2016.07 | 4.380 | <0.0005 |
| 2016.10 | 2.050 | <0.0005 |
| | | |
| Count | 4 | 4 |
| High | 4.380 | <0.0005 |
| Low | 0.225 | <0.0005 |
| Mean | 1.739 | <0.0005 |
| | | |
| High Limit | 0.800 | 0.0150 |
| Low Limit | | |
| Lim Ex | 2 | 0 |
| Frequency | 50% | 0% |
| 10x Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-2 – Denison TMA-1 Stollery Lake Settling Pond Outlet (Final Discharge)

| Month | FLOW L/s | hard mg/L | pH | SO4 mg/L | TSS mg/L | TOXCD IC25 | TOXDM % | TOXRT % |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 98.25 | 223.0 | 7.2 | 190.0 | 1 | | | |
| 2016.02 | 74.25 | 212.0 | 7.0 | 180.0 | 1 | | | |
| 2016.03 | 103.00 | 247.0 | 6.8 | 180.0 | 1 | | | |
| 2016.04 | 64.75 | 180.0 | 7.0 | 130.0 | 1 | | | |
| 2016.05 | 66.20 | 237.0 | 7.2 | 150.0 | 1 | 100 | 0 | 0 |
| 2016.06 | 18.75 | 263.0 | 7.0 | 200.0 | 1 | | | |
| 2016.07 | 13.00 | 289.0 | 7.1 | 220.0 | 1 | | | |
| 2016.08 | 7.80 | 319.0 | 7.0 | 260.0 | 1 | | | |
| 2016.09 | 9.75 | 350.0 | 7.2 | 280.0 | 1 | | | |
| 2016.10 | 17.50 | 379.0 | 7.3 | 300.0 | 1 | 100 | 0 | 0 |
| 2016.11 | 12.03 | 378.0 | 7.2 | 310.0 | 1 | | | |
| 2016.12 | 18.00 | 377.0 | 7.1 | 330.0 | 1 | | | |
| Count | 52 | 12 | 52 | 12 | 52 | 2 | 2 | 2 |
| High | 173.00 | 379.0 | 7.6 | 330.0 | 2 | 100 | 0 | 0 |
| Low | 0.16 | 180.0 | 6.6 | 130.0 | <1 | 100 | 0 | 0 |
| Mean | 42.35 | 287.8 | 7.1 | 227.5 | 1 | 100 | 0 | 0 |
| High Limit | | | 8.5 | 128.0 | 10 | | | |
| Low Limit | | | 6.5 | | | | | |
| Lim Ex | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 100% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

### D-2

| Month | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L | Mn mg/L | U mg/L |
|---|---|---|---|---|---|---|
| 2016.01 | 0.272 | 0.319 | 0.0008 | 0.29 | 0.164 | 0.0354 |
| 2016.02 | 0.242 | 0.272 | 0.0006 | 0.37 | 0.141 | 0.0313 |
| 2016.03 | 0.300 | 0.289 | 0.0006 | 0.45 | 0.127 | 0.0310 |
| 2016.04 | 0.339 | 0.565 | <0.0005 | 0.34 | 0.111 | 0.0223 |
| 2016.05 | 0.187 | 0.376 | 0.0007 | 0.36 | 0.198 | 0.0251 |
| 2016.06 | 0.095 | 0.161 | <0.0005 | 0.15 | 0.103 | 0.0294 |
| 2016.07 | 0.056 | 0.103 | <0.0005 | 0.07 | 0.083 | 0.0370 |
| 2016.08 | 0.043 | 0.085 | <0.0005 | 0.06 | 0.076 | 0.0450 |
| 2016.09 | 0.042 | 0.075 | <0.0005 | 0.08 | 0.072 | 0.0504 |
| 2016.10 | 0.073 | 0.070 | <0.0005 | 0.09 | 0.146 | 0.0518 |
| 2016.11 | 0.094 | 0.080 | 0.0006 | 0.12 | 0.152 | 0.0586 |
| 2016.12 | 0.059 | 0.079 | 0.0009 | 0.21 | 0.212 | 0.0579 |
| Count | 52 | 12 | 12 | 12 | 12 | 12 |
| High | 0.421 | 0.565 | 0.0009 | 0.45 | 0.212 | 0.0586 |
| Low | 0.011 | 0.070 | <0.0005 | 0.06 | 0.076 | 0.0223 |
| Mean | 0.151 | 0.206 | 0.0006 | 0.22 | 0.134 | 0.0396 |
| High Limit | 1.000 | 1.000 | 0.0025 | 0.49 | 0.800 | 0.0150 |
| Low Limit | | | | | | |
| Lim Ex | 0 | 0 | 0 | 0 | 0 | 12 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 100% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-22 – Denison TMA-2 ETP (Influent and ETP Operations)

| Month | ACID mg/L | BaCl2T kg/month | ODays day | pH | SO4 mg/L | Ra Bq/L | Ba mg/L | Co mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | <1 | 73.30 | 31 | 6.6 | 63.0 | 0.040 | 0.024 | <0.0005 |
| 2016.02 | | 57.30 | 29 | 6.6 | | 0.142 | | |
| 2016.03 | | 62.30 | 31 | 7.0 | | 0.187 | | |
| 2016.04 | <1 | 56.00 | 30 | 6.6 | 62.0 | 0.056 | 0.019 | <0.0005 |
| 2016.05 | | 47.10 | 31 | 7.4 | | 0.159 | | |
| 2016.06 | | 47.90 | 30 | 6.8 | | 0.582 | | |
| 2016.07 | <1 | 47.50 | 31 | 6.6 | 51.0 | 1.312 | 0.079 | 0.0019 |
| 2016.08 | | 16.70 | 11 | 6.5 | | 2.147 | | |
| 2016.09 | | 41.30 | 30 | 6.5 | | 1.576 | | |
| 2016.10 | <1 | 55.80 | 31 | 6.6 | 260.0 | 0.475 | 0.051 | <0.0005 |
| 2016.11 | | 30.00 | 30 | 6.9 | | 0.345 | | |
| 2016.12 | | 54.70 | 31 | 6.7 | | 0.222 | | |
| Count | 4 | 12 | 12 | 12 | 4 | 12 | 4 | 4 |
| High | <1 | 73.30 | 31 | 7.4 | 260.0 | 2.147 | 0.079 | 0.0019 |
| Low | <1 | 16.70 | 11 | 6.5 | 51.0 | 0.040 | 0.019 | <0.0005 |
| Mean | <1 | 49.16 | 29 | 6.7 | 109.0 | 0.604 | 0.043 | 0.0009 |
| High Limit | | | | 8.5 | 128.0 | 1.000 | 1.000 | 0.0025 |
| Low Limit | | | | 6.5 | | | | |
| Lim Ex | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 25% | 25% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

| Month | Fe mg/L | Mn mg/L | U mg/L |
|---|---|---|---|
| 2016.01 | 0.17 | 0.115 | <0.0005 |
| 2016.04 | 0.09 | 0.028 | <0.0005 |
| 2016.07 | 18.50 | 6.120 | 0.0055 |
| 2016.10 | 2.96 | 0.149 | 0.0009 |
| Count | 4 | 4 | 4 |
| High | 18.50 | 6.120 | 0.0055 |
| Low | 0.09 | 0.028 | <0.0005 |
| Mean | 5.43 | 1.603 | 0.0019 |
| High Limit | 0.49 | 0.800 | 0.0150 |
| Low Limit | | | |
| Lim Ex | 2 | 1 | 0 |
| Frequency | 50% | 25% | 0% |
| 10x Lim Ex | 1 | 0 | 0 |
| Frequency | 25% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-25 – Denison TMA-2 Overflow into TMA-1

| Month | ACID mg/L | pH | SO4 mg/L | Ra Bq/L | Fe mg/L |
|---|---|---|---|---|---|
| 2016.04 | <1 | 7.4 | 73.0 | 0.201 | 0.19 |
| 2016.10 | <1 | 7.2 | 160.0 | 0.342 | 0.19 |
| | | | | | |
| Count | 2 | 2 | 2 | 2 | 2 |
| High | <1 | 7.4 | 160.0 | 0.342 | 0.19 |
| Low | <1 | 7.2 | 73.0 | 0.201 | 0.19 |
| Mean | <1 | 7.3 | 116.5 | 0.272 | 0.19 |
| | | | | | |
| High Limit | | 8.5 | 128.0 | 1.000 | 0.49 |
| Low Limit | | 6.5 | | | |
| Lim Ex | 0 | 0 | 1 | 0 | 0 |
| Frequency | 0% | 0% | 50% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-3 – Denison TMA-2 Effluent (Final Discharge)

| Month | FLOW L/s | pH | SO4 mg/L | TSS mg/L | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 5.75 | 7.0 | 47.0 | <1 | 0.072 | 0.171 | <0.0005 | 0.13 |
| 2016.02 | 2.50 | 7.0 | 60.0 | 1 | 0.072 | 0.174 | <0.0005 | 0.09 |
| 2016.03 | 17.40 | 6.9 | 80.0 | 1 | 0.075 | 0.206 | <0.0005 | 0.12 |
| 2016.04 | 20.50 | 7.0 | 50.0 | <1 | 0.074 | 0.341 | <0.0005 | 0.08 |
| 2016.05 | 5.20 | 7.0 | 68.0 | <1 | 0.116 | 0.250 | <0.0005 | 0.02 |
| 2016.06 | 2.25 | 7.0 | 79.0 | 1 | 0.162 | 0.254 | <0.0005 | 0.03 |
| 2016.07 | 0.00 | | | | | | | |
| 2016.08 | 0.00 | | | | | | | |
| 2016.09 | 0.00 | | | | | | | |
| 2016.10 | 7.50 | 7.3 | 130.0 | 1 | 0.142 | 0.193 | <0.0005 | 0.02 |
| 2016.11 | 13.40 | 7.1 | 120.0 | 1 | 0.114 | 0.174 | <0.0005 | 0.01 |
| 2016.12 | 4.25 | 7.1 | 110.0 | 1 | 0.094 | 0.136 | <0.0005 | 0.03 |
| | | | | | | | | |
| Count | 52 | 52 | 9 | 39 | 39 | 9 | 9 | 9 |
| High | 46.00 | 7.5 | 130.0 | <2 | 0.193 | 0.341 | <0.0005 | 0.13 |
| Low | 0.00 | 6.6 | 47.0 | <1 | 0.052 | 0.136 | <0.0005 | 0.01 |
| Mean | 6.75 | 7.0 | 82.7 | 1 | 0.102 | 0.211 | <0.0005 | 0.06 |
| | | | | | | | | |
| High Limit | | 8.5 | 128.0 | 10 | 1.000 | 1.000 | 0.0025 | 0.49 |
| Low Limit | | 6.5 | | | | | | |
| Lim Ex | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 11% | 0% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

| Month | Mn mg/L | U mg/L |
|---|---|---|
| 2016.01 | 0.004 | 0.0015 |
| 2016.02 | 0.003 | 0.0024 |
| 2016.03 | 0.004 | 0.0041 |
| 2016.04 | 0.020 | 0.0010 |
| 2016.05 | 0.005 | 0.0016 |
| 2016.06 | 0.005 | 0.0025 |
| 2016.10 | 0.005 | 0.0019 |
| 2016.11 | 0.003 | 0.0073 |
| 2016.12 | 0.002 | 0.0058 |
| | | |
| Count | 9 | 9 |
| High | 0.020 | 0.0073 |
| Low | 0.002 | 0.0010 |
| Mean | 0.006 | 0.0031 |
| | | |
| High Limit | 0.800 | 0.0150 |
| Low Limit | | |
| Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |
| 10x Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### D-9 – Denison TMA-1 Dam 9 Seepage

| Month | FLOW L/s | hard mg/L | pH | SO4 mg/L | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 0.67 | 495.0 | 7.0 | 440.0 | <0.008 | 0.015 | 0.0030 | 1.63 |
| 2016.04 | 5.70 | 482.0 | 7.0 | 370.0 | <0.008 | 0.014 | 0.0022 | 0.96 |
| 2016.07 | 1.60 | 910.0 | 6.8 | 830.0 | 0.010 | 0.022 | 0.0062 | 1.41 |
| 2016.10 | 2.30 | 825.0 | 7.0 | 690.0 | <0.008 | 0.019 | 0.0043 | 1.65 |
| | | | | | | | | |
| Count | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| High | 5.70 | 910.0 | 7.0 | 830.0 | 0.010 | 0.022 | 0.0062 | 1.65 |
| Low | 0.67 | 482.0 | 6.8 | 370.0 | <0.008 | 0.014 | 0.0022 | 0.96 |
| Mean | 2.57 | 678.0 | 7.0 | 582.5 | 0.009 | 0.017 | 0.0039 | 1.41 |
| | | | | | | | | |
| High Limit | | | 8.5 | 128.0 | 1.000 | 1.000 | 0.0025 | 0.49 |
| Low Limit | | | 6.5 | | | | | |
| Lim Ex | 0 | 0 | 0 | 4 | 0 | 0 | 3 | 4 |
| Frequency | 0% | 0% | 0% | 100% | 0% | 0% | 75% | 100% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

| Month | Mn mg/L | U mg/L |
|---|---|---|
| 2016.01 | 1.380 | 0.0115 |
| 2016.04 | 0.962 | 0.0090 |
| 2016.07 | 2.670 | 0.0143 |
| 2016.10 | 2.040 | 0.0116 |
| | | |
| Count | 4 | 4 |
| High | 2.670 | 0.0143 |
| Low | 0.962 | 0.0090 |
| Mean | 1.763 | 0.0116 |
| | | |
| High Limit | 0.800 | 0.0150 |
| Low Limit | | |
| Lim Ex | 4 | 0 |
| Frequency | 100% | 0% |
| 10x Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-1 – Stanrock Moose Lake Settling Pond Outlet to Orient Lake Polishing Pond

| Month | FLOW L/s | pH | Ra Bq/L |
|---|---|---|---|
| 2016.01 | 46.75 | 7.5 | 0.021 |
| 2016.02 | 13.75 | 7.2 | |
| 2016.03 | 113.20 | 7.9 | |
| 2016.04 | 144.75 | 8.5 | 0.028 |
| 2016.05 | 6.40 | 7.4 | |
| 2016.06 | 16.75 | 7.4 | |
| 2016.07 | 3.00 | 7.4 | 0.014 |
| 2016.08 | 4.00 | 7.5 | |
| 2016.09 | 18.25 | 7.5 | |
| 2016.10 | 7.00 | 7.5 | 0.023 |
| 2016.11 | 10.20 | 7.2 | |
| 2016.12 | 23.75 | 7.1 | |
| | | | |
| Count | 52 | 52 | 4 |
| High | 212.00 | 9.2 | 0.028 |
| Low | 0.00 | 7.0 | 0.014 |
| Mean | 33.94 | 7.5 | 0.022 |
| | | | |
| High Limit | | 8.5 | 1.000 |
| Low Limit | | 6.5 | |
| Lim Ex | 0 | 4 | 0 |
| Frequency | 0% | 8% | 0% |
| 10x Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-11 – Stanrock Seepage from Dam A

| Month | CONDF µmho/cm | FLOW L/s | pH |
|---|---|---|---|
| 2016.01 | 276.3 | 0.12 | 6.1 |
| 2016.04 | 228.2 | 0.55 | 6.0 |
| 2016.07 | 683.0 | 0.20 | 5.8 |
| 2016.10 | 481.0 | 0.42 | 6.5 |
| | | | |
| Count | 4 | 4 | 4 |
| High | 683.0 | 0.55 | 6.5 |
| Low | 228.2 | 0.12 | 5.8 |
| Mean | 417.1 | 0.32 | 6.1 |
| | | | |
| High Limit | 69.5 | | 8.5 |
| Low Limit | | | 6.5 |
| Lim Ex | 4 | 0 | 3 |
| Frequency | 100% | 0% | 75% |
| 10x Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-12 – Stanrock Seepage from Dam B

| Month | CONDF µmho/cm | FLOW L/s | pH |
|---|---|---|---|
| 2016.01 | 336.2 | | 3.9 |
| 2016.04 | 354.7 | 0.50 | 3.6 |
| 2016.07 | 1003.0 | 0.01 | 4.8 |
| 2016.10 | 467.0 | 0.17 | 6.6 |
| | | | |
| Count | 4 | 4 | 4 |
| High | 1003.0 | 0.50 | 6.6 |
| Low | 336.2 | 0.01 | 3.6 |
| Mean | 540.2 | 0.23 | 4.7 |
| | | | |
| High Limit | 69.5 | | 8.5 |
| Low Limit | | | 6.5 |
| Lim Ex | 4 | 0 | 3 |
| Frequency | 100% | 0% | 75% |
| 10x Lim Ex | 1 | 0 | 0 |
| Frequency | 25% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-13 – Stanrock Seepage from Dam C

| Month | CONDF µmho/cm | FLOW L/s | pH |
|---|---|---|---|
| 2016.01 | | 0.00 | |
| 2016.04 | 428.2 | 0.07 | 6.9 |
| 2016.07 | 1001.0 | 0.03 | 6.7 |
| 2016.10 | 540.0 | 0.04 | 6.9 |
| | | | |
| Count | 4 | 4 | 4 |
| High | 1001.0 | 0.07 | 6.9 |
| Low | 428.2 | 0.00 | 6.7 |
| Mean | 656.4 | 0.04 | 6.8 |
| | | | |
| High Limit | 69.5 | | 8.5 |
| Low Limit | | | 6.5 |
| Lim Ex | 3 | 0 | 0 |
| Frequency | 100% | 0% | 0% |
| 10x Lim Ex | 1 | 0 | 0 |
| Frequency | 33% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-14 – Stanrock Seepage from Dam D

| Month | CONDF µmho/cm | FLOW L/s | pH |
|---|---|---|---|
| 2016.01 | | 0.00 | |
| 2016.04 | | 0.00 | |
| 2016.07 | | 0.00 | |
| 2016.10 | | 0.00 | |
| | | | |
| Count | 4 | 4 | 4 |
| High | | 0.00 | |
| Low | | 0.00 | |
| Mean | | 0.00 | |
| | | | |
| High Limit | 69.5 | | 8.5 |
| Low Limit | | | 6.5 |
| Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-16 – Stanrock TMA, Seepage from Dam M at Quirke Lake Delta

| Month | CONDF µmho/cm | FLOW L/s | hard mg/L | pH | SO4 mg/L | Ra Bq/L | Ba mg/L | Co mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 68.8 | 0.05 | | 6.5 | | | | |
| 2016.02 | | 0.00 | | | | | | |
| 2016.03 | 53.9 | 2.90 | 18.3 | 6.8 | 13.0 | <0.008 | 0.006 | <0.0005 |
| 2016.04 | 63.2 | 0.78 | | 6.8 | | | | |
| 2016.05 | | 0.00 | | | | | | |
| 2016.06 | | 0.00 | | | | | | |
| 2016.07 | 0.0 | 0.00 | | | | | | |
| 2016.08 | | 0.00 | | | | | | |
| 2016.09 | | 0.00 | | | | | | |
| 2016.10 | | 0.00 | | | | | | |
| 2016.11 | 46.5 | 0.08 | | 6.3 | | | | |
| 2016.12 | 69.2 | 0.00 | | 6.6 | | | | |
| Count | 52 | 52 | 1 | 52 | 1 | 1 | 1 | 1 |
| High | 69.2 | 11.30 | 18.3 | 7.3 | 13.0 | <0.008 | 0.006 | <0.0005 |
| Low | 0.0 | 0.00 | 18.3 | 6.3 | 13.0 | <0.008 | 0.006 | <0.0005 |
| Mean | 54.5 | 0.35 | 18.3 | 6.7 | 13.0 | <0.008 | 0.006 | <0.0005 |
| High Limit | 69.5 | | | 8.5 | 128.0 | 1.000 | 1.000 | 0.0025 |
| Low Limit | | | | 6.5 | | | | |
| Lim Ex | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 10% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

| Month | Fe mg/L | Mn mg/L | U mg/L |
|---|---|---|---|
| 2016.03 | 0.03 | 0.005 | <0.0005 |
| Count | 1 | 1 | 1 |
| High | 0.03 | 0.005 | <0.0005 |
| Low | 0.03 | 0.005 | <0.0005 |
| Mean | 0.03 | 0.005 | <0.0005 |
| High Limit | 0.49 | 0.800 | 0.0150 |
| Low Limit | | | |
| Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-2 – Stanrock ETP Influent

| Month | ACID mg/L | FLOW L/s | Freeboard(m) m | pH | SO4 mg/L | Ra Bq/L | Ba mg/L | Co mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 161 | 69.65 | 1.2411 | 3.1 | 380.0 | 0.169 | 0.053 | 0.0670 |
| 2016.02 | | 76.15 | 1.1360 | 3.0 | | 0.143 | | |
| 2016.03 | | 119.05 | 1.1750 | 2.9 | | 0.176 | | |
| 2016.04 | 173 | 98.05 | 1.6229 | 3.1 | 380.0 | 0.166 | 0.027 | 0.0694 |
| 2016.05 | | 40.14 | 1.5558 | 3.1 | | 0.181 | | |
| 2016.06 | | 13.27 | 1.7910 | 2.7 | | 0.211 | | |
| 2016.07 | | 0.00 | 1.8555 | | | | | |
| 2016.08 | | 0.00 | 1.7595 | | | | | |
| 2016.09 | | 0.00 | 1.5571 | | | | | |
| 2016.10 | 372 | 30.00 | 1.5561 | 2.6 | 980.0 | 0.202 | 0.009 | 0.0993 |
| 2016.11 | | 43.84 | 1.5032 | 2.6 | | 0.196 | | |
| 2016.12 | | 56.44 | 1.4212 | 2.7 | | 0.194 | | |
| Count | 3 | 250 | 241 | 13 | 3 | 9 | 3 | 3 |
| High | 372 | 192.00 | 2.4400 | 3.1 | 980.0 | 0.211 | 0.053 | 0.0993 |
| Low | 161 | 0.00 | 0.7700 | 2.6 | 380.0 | 0.143 | 0.009 | 0.0670 |
| Mean | 235 | 45.46 | 1.5442 | 2.9 | 580.0 | 0.182 | 0.030 | 0.0786 |
| High Limit | | | | 8.5 | 128.0 | 1.000 | 1.000 | 0.0025 |
| Low Limit | | | | 6.5 | | | | |
| Lim Ex | 0 | 0 | 0 | 9 | 3 | 0 | 0 | 3 |
| Frequency | 0% | 0% | 0% | 100% | 100% | 0% | 0% | 100% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% |

| Month | Fe mg/L | Mn mg/L | U mg/L |
|---|---|---|---|
| 2016.01 | 39.20 | 0.934 | 0.0328 |
| 2016.04 | 45.30 | 0.998 | 0.0344 |
| 2016.10 | 51.70 | 3.240 | 0.0290 |
| Count | 3 | 3 | 3 |
| High | 51.70 | 3.240 | 0.0344 |
| Low | 39.20 | 0.934 | 0.0290 |
| Mean | 45.40 | 1.724 | 0.0321 |
| High Limit | 0.49 | 0.800 | 0.0150 |
| Low Limit | | | |
| Lim Ex | 3 | 3 | 3 |
| Frequency | 100% | 100% | 100% |
| 10x Lim Ex | 3 | 0 | 0 |
| Frequency | 100% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-3 – Stanrock pH Probe Control (ETP Operations)

| Month | BaCl2T kg/month | CaOT tonnes/mth. | ODays day | pH |
|---|---|---|---|---|
| 2016.01 | 75.30 | 10.70 | 15 | 10.9 |
| 2016.02 | 66.70 | 10.10 | 12 | 10.9 |
| 2016.03 | 224.20 | 28.30 | 26 | 10.8 |
| 2016.04 | 134.70 | 24.20 | 24 | 10.7 |
| 2016.05 | 29.70 | 6.10 | 7 | 10.8 |
| 2016.06 | 11.90 | 3.60 | 3 | 10.8 |
| 2016.07 | 0.00 | 0.00 | 0 | |
| 2016.08 | 0.00 | 0.00 | 0 | |
| 2016.09 | 0.00 | 0.00 | 0 | |
| 2016.10 | 19.30 | 5.50 | 5 | 10.8 |
| 2016.11 | 37.50 | 12.30 | 9 | 10.8 |
| 2016.12 | 54.10 | 16.30 | 13 | 10.7 |
| | | | | |
| Count | 12 | 12 | 12 | 248 |
| High | 224.20 | 28.30 | 26 | 11.3 |
| Low | 0.00 | 0.00 | 0 | 10.2 |
| Mean | 54.45 | 9.76 | 10 | 10.8 |
| | | | | |
| High Limit | | | | 8.5 |
| Low Limit | | | | 6.5 |
| Lim Ex | 0 | 0 | 0 | 90 |
| Frequency | 0% | 0% | 0% | 100% |
| 10x Lim Ex | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-4 – Stanrock Orient Lake Polishing Pond Outlet (Final Discharge)

| Month | FLOW L/s | hard mg/L | pH | SO4 mg/L | TSS mg/L | TOXCD IC25 | TOXDM % | TOXRT % |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 33.75 | 269.0 | 7.0 | 280.0 | 1 | | | |
| 2016.02 | 16.00 | 296.0 | 6.9 | 290.0 | <1 | | | |
| 2016.03 | 91.60 | 352.0 | 7.1 | 290.0 | 1 | | | |
| 2016.04 | 104.75 | 214.0 | 7.4 | 190.0 | 1 | | | |
| 2016.05 | 6.80 | 252.0 | 7.0 | 180.0 | 1 | 100 | 0 | 0 |
| 2016.06 | 5.75 | 286.0 | 7.0 | 230.0 | 1 | | | |
| 2016.07 | 2.50 | 302.0 | 7.0 | 270.0 | 1 | | | |
| 2016.08 | 3.00 | 322.0 | 6.9 | 280.0 | <1 | | | |
| 2016.09 | 11.75 | 328.0 | 7.0 | 290.0 | 1 | | | |
| 2016.10 | 8.50 | 318.0 | 7.3 | 280.0 | 1 | 100 | 0 | 0 |
| 2016.11 | 14.60 | 336.0 | 7.1 | 280.0 | 1 | | | |
| 2016.12 | 27.25 | 325.0 | 7.2 | 290.0 | 1 | | | |
| Count | 52 | 12 | 52 | 12 | 52 | 2 | 2 | 2 |
| High | 191.00 | 352.0 | 7.6 | 290.0 | 1 | 100 | 0 | 0 |
| Low | 1.00 | 214.0 | 6.7 | 180.0 | <1 | 100 | 0 | 0 |
| Mean | 27.33 | 300.0 | 7.1 | 262.5 | 1 | 100 | 0 | 0 |
| High Limit | | | 8.5 | 128.0 | 10 | | | |
| Low Limit | | | 6.5 | | | | | |
| Lim Ex | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 100% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

### DS-4

| Month | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L | Mn mg/L | U mg/L |
|---|---|---|---|---|---|---|
| 2016.01 | 0.037 | 0.040 | 0.0010 | 0.26 | 0.036 | 0.0022 |
| 2016.02 | 0.036 | 0.040 | 0.0008 | 0.12 | 0.035 | 0.0021 |
| 2016.03 | 0.041 | 0.045 | 0.0008 | 0.11 | 0.047 | 0.0022 |
| 2016.04 | 0.040 | 0.115 | 0.0005 | 0.16 | 0.033 | 0.0009 |
| 2016.05 | 0.063 | 0.058 | <0.0005 | 0.06 | 0.039 | 0.0008 |
| 2016.06 | 0.089 | 0.051 | <0.0005 | 0.07 | 0.023 | 0.0032 |
| 2016.07 | 0.111 | 0.048 | <0.0005 | 0.03 | 0.046 | 0.0017 |
| 2016.08 | 0.095 | 0.041 | <0.0005 | 0.03 | 0.088 | 0.0021 |
| 2016.09 | 0.096 | 0.035 | <0.0005 | 0.05 | 0.062 | 0.0043 |
| 2016.10 | 0.095 | 0.032 | <0.0005 | 0.06 | 0.050 | 0.0091 |
| 2016.11 | 0.088 | 0.030 | <0.0005 | 0.07 | 0.040 | 0.0121 |
| 2016.12 | 0.091 | 0.028 | <0.0005 | 0.14 | 0.026 | 0.0115 |
| Count | 52 | 12 | 12 | 12 | 12 | 12 |
| High | 0.121 | 0.115 | 0.0010 | 0.26 | 0.088 | 0.0121 |
| Low | 0.026 | 0.028 | <0.0005 | 0.03 | 0.023 | 0.0008 |
| Mean | 0.073 | 0.047 | 0.0006 | 0.10 | 0.044 | 0.0043 |
| High Limit | 1.000 | 1.000 | 0.0025 | 0.49 | 0.800 | 0.0150 |
| Low Limit | | | | | | |
| Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-5 – Stanrock Orient Creek Discharge into Moose Lake

| Month | CONDF µmho/cm | FLOW L/s | Head(ft) ft | pH |
|---|---|---|---|---|
| 2016.01 | 103.4 | | | 3.9 |
| 2016.04 | 107.6 | 5.00 | | 3.7 |
| 2016.07 | | 0.00 | | |
| 2016.10 | 195.2 | 0.89 | 0.1 | 3.6 |
| | | | | |
| Count | 4 | 4 | 1 | 4 |
| High | 195.2 | 5.00 | 0.1 | 3.9 |
| Low | 103.4 | 0.00 | 0.1 | 3.6 |
| Mean | 135.4 | 1.96 | 0.1 | 3.7 |
| | | | | |
| High Limit | 69.5 | | | 8.5 |
| Low Limit | | | | 6.5 |
| Lim Ex | 3 | 0 | 0 | 3 |
| Frequency | 100% | 0% | 0% | 100% |
| 10x Lim Ex | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### DS-6 – Stanrock Moose Lake Settling Pond Narrows, Upstream of DS-1

| Month | FLOW L/s | pH |
|---|---|---|
| 2016.01 | 80.75 | 8.2 |
| 2016.02 | 6.00 | 7.8 |
| 2016.03 | 114.60 | 7.6 |
| 2016.04 | 141.00 | 8.3 |
| 2016.05 | 11.60 | 8.1 |
| 2016.06 | 0.25 | 7.6 |
| 2016.07 | 0.00 | |
| 2016.08 | 0.00 | |
| 2016.09 | 0.00 | |
| 2016.10 | 0.00 | |
| 2016.11 | 0.00 | |
| 2016.12 | 20.75 | 7.1 |
| | | |
| Count | 52 | 52 |
| High | 232.00 | 9.4 |
| Low | 0.00 | 7.0 |
| Mean | 31.27 | 7.8 |
| | | |
| High Limit | | 8.5 |
| Low Limit | | 6.5 |
| Lim Ex | 0 | 3 |
| Frequency | 0% | 12% |
| 10x Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### FBDST

| Month | pH | SO4 mg/L | TSS mg/L | Ra Bq/L | Ba mg/L | Co mg/L | Fe mg/L | Mn mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.01 | 5.3 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.02 | 5.3 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.03 | 5.8 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.04 | 5.3 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.05 | 5.3 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.06 | 5.9 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.07 | 5.2 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | 0.03 | <0.002 |
| 2016.08 | 5.7 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.09 | 5.6 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.10 | 5.8 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.11 | 5.8 | <0.1 | 1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| 2016.12 | 6.6 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| | | | | | | | | |
| Count | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| High | 6.6 | <0.1 | 1 | <0.008 | <0.005 | <0.0005 | 0.03 | <0.002 |
| Low | 5.2 | <0.1 | <1 | <0.008 | <0.005 | <0.0005 | <0.02 | <0.002 |
| Mean | 5.6 | <0.1 | 1 | <0.008 | <0.005 | <0.0005 | 0.02 | <0.002 |
| | | | | | | | | |
| High Limit | 8.5 | 128.0 | 10 | 1.000 | 1.000 | 0.0025 | 0.49 | 0.800 |
| Low Limit | 6.5 | | | | | | | |
| Lim Ex | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 92% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

### FBDST

| Month | U mg/L |
|---|---|
| 2016.01 | <0.0005 |
| 2016.02 | <0.0005 |
| 2016.03 | <0.0005 |
| 2016.04 | <0.0005 |
| 2016.05 | <0.0005 |
| 2016.06 | <0.0005 |
| 2016.07 | <0.0005 |
| 2016.08 | <0.0005 |
| 2016.09 | <0.0005 |
| 2016.10 | <0.0005 |
| 2016.11 | <0.0005 |
| 2016.12 | <0.0005 |
| | |
| Count | 12 |
| High | <0.0005 |
| Low | <0.0005 |
| Mean | <0.0005 |
| | |
| High Limit | 0.0150 |
| Low Limit | |
| Lim Ex | 0 |
| Frequency | 0% |
| 10x Lim Ex | 0 |
| Frequency | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### ST-1 – Stanrock Downstream of Dam G

| Month | CONDF µmho/cm | pH |
|---|---|---|
| 2016.01 | 94.3 | 4.2 |
| 2016.04 | 65.4 | 4.1 |
| 2016.07 | | |
| 2016.10 | 190.2 | 3.9 |
| | | |
| Count | 4 | 4 |
| High | 190.2 | 4.2 |
| Low | 65.4 | 3.9 |
| Mean | 116.6 | 4.1 |
| | | |
| High Limit | 69.5 | 8.5 |
| Low Limit | | 6.5 |
| Lim Ex | 2 | 3 |
| Frequency | 67% | 100% |
| 10x Lim Ex | 0 | 0 |
| Frequency | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### ST-1A – Stanrock Seepage from Dam J at Toe of Dam

| Month | CONDF µmho/cm | FLOW L/s | pH |
|---|---|---|---|
| 2016.01 | | 0.00 | |
| 2016.04 | | 0.00 | |
| 2016.07 | | 0.00 | |
| 2016.10 | | 0.00 | |
| Count | 4 | 4 | 4 |
| High | | 0.00 | |
| Low | | 0.00 | |
| Mean | | 0.00 | |
| High Limit | 69.5 | | 8.5 |
| Low Limit | | | 6.5 |
| Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### ST-3 – Stanrock Downstream of Sam G

| Month | CONDF µmho/cm | pH |
|---|---|---|
| 2016.01 | 418.7 | 3.6 |
| 2016.04 | 358.8 | 3.5 |
| 2016.07 | 1083.0 | 3.4 |
| 2016.10 | 1004.0 | 3.4 |
| | | |
| Count | 4 | 4 |
| High | 1083.0 | 3.6 |
| Low | 358.8 | 3.4 |
| Mean | 716.1 | 3.5 |
| | | |
| High Limit | 69.5 | 8.5 |
| Low Limit | | 6.5 |
| Lim Ex | 4 | 4 |
| Frequency | 100% | 100% |
| 10x Lim Ex | 2 | 0 |
| Frequency | 50% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### ST-3A – Stanrock Dam G at Toe of Dam

| Month | CONDF µmho/cm | FLOW L/s | pH |
|---|---|---|---|
| 2016.01 | 797.0 | 0.10 | 3.9 |
| 2016.04 | 676.0 | 0.12 | 4.0 |
| 2016.07 | 2063.0 | 0.03 | 5.6 |
| 2016.10 | 1545.0 | 0.06 | 4.5 |
| | | | |
| Count | 4 | 4 | 4 |
| High | 2063.0 | 0.12 | 5.6 |
| Low | 676.0 | 0.03 | 3.9 |
| Mean | 1270.3 | 0.08 | 4.5 |
| | | | |
| High Limit | 69.5 | | 8.5 |
| Low Limit | | | 6.5 |
| Lim Ex | 4 | 0 | 4 |
| Frequency | 100% | 0% | 100% |
| 10x Lim Ex | 3 | 0 | 0 |
| Frequency | 75% | 0% | 0% |

## DENISON Mines Inc.
**2016 Performance Monitoring Results**

### ST-4 – Stanrock within Quirke Lake Delta

| Month | ACID mg/L | ALK mg/L | CONDF µmho/cm | hard mg/L | pH | SO4 mg/L | Ra Bq/L | Ba mg/L |
|---|---|---|---|---|---|---|---|---|
| 2016.02 | <1 | 6.00 | 104.2 | 31.3 | 6.9 | 27.0 | 0.035 | 0.029 |
| 2016.05 | <1 | 6.00 | 98.8 | 47.7 | 7.3 | 32.0 | 0.014 | 0.032 |
| 2016.08 | <1 | 15.00 | 106.9 | 43.7 | 7.1 | 35.0 | 0.031 | 0.038 |
| 2016.11 | <1 | 7.00 | 80.6 | 45.3 | 7.3 | 35.0 | 0.033 | 0.039 |
| | | | | | | | | |
| Count | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| High | <1 | 15.00 | 106.9 | 47.7 | 7.3 | 35.0 | 0.035 | 0.039 |
| Low | <1 | 6.00 | 80.6 | 31.3 | 6.9 | 27.0 | 0.014 | 0.029 |
| Mean | <1 | 8.50 | 97.6 | 42.0 | 7.1 | 32.3 | 0.028 | 0.035 |
| | | | | | | | | |
| High Limit | | | 69.5 | | 8.5 | 128.0 | 1.000 | 1.000 |
| Low Limit | | | | | 6.5 | | | |
| Lim Ex | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 100% | 0% | 0% | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |

| Month | Co mg/L | Fe mg/L | Mn mg/L |
|---|---|---|---|
| 2016.02 | <0.0005 | 0.08 | 0.014 |
| 2016.05 | <0.0005 | <0.02 | 0.006 |
| 2016.08 | <0.0005 | <0.02 | 0.006 |
| 2016.11 | <0.0005 | <0.02 | 0.004 |
| | | | |
| Count | 4 | 4 | 4 |
| High | <0.0005 | 0.08 | 0.014 |
| Low | <0.0005 | <0.02 | 0.004 |
| Mean | <0.0005 | 0.03 | 0.007 |
| | | | |
| High Limit | 0.0025 | 0.49 | 0.800 |
| Low Limit | | | |
| Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |
| 10x Lim Ex | 0 | 0 | 0 |
| Frequency | 0% | 0% | 0% |

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH91 D1A** 218.00 ft

| Year | Elevation [1] (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 9062.72 | 7.6 | 900.0 | 5 | 39.40 |
| 2013 | 9065.10 | 7.3 | 830.0 | <1 | 37.90 |
| 2014 | 9060.10 | 7.2 | 870.0 | <1 | 38.80 |
| 2015 | 359.73 | 7.1 | 980.0 | <1 | 33.30 |
| 2016 | 360.60 | 6.8 | 790.0 | <1 | 32.00 |

**BH91 D1B** 149.20 ft

| Year | Elevation [1] (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 9061.19 | 8.3 | 660.0 | <1 | <0.02 |
| 2013 | 9068.82 | 8.1 | 580.0 | <1 | 0.05 |
| 2014 | 9061.52 | 8.1 | 570.0 | <1 | <0.02 |
| 2015 | 360.16 | 7.7 | 690.0 | 2 | 0.10 |
| 2016 | 360.75 | 7.6 | 570.0 | <1 | 0.02 |

1. 2015 elevation changed from feet to meters.

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH91 D3A** 159.00 ft

| Year | Elevation [1] (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 9058.93 | 7.0 | 1930.0 | 400 | 317.00 |
| 2013 | 9059.95 | 7.0 | 1800.0 | 312 | 301.00 |
| 2014 | 9054.71 | 7.1 | 1800.0 | 266 | 258.00 |
| 2015 | 361.22 | 6.7 | 1800.0 | 278 | 277.00 |
| 2016 | 361.07 | 6.5 | 1800.0 | 223 | 190.00 |

**BH91 D3B** 69.00 ft

| Year | Elevation [1] (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 9088.46 | 7.0 | 1850.0 | 439 | 353.00 |
| 2013 | 9093.37 | 7.1 | 1800.0 | 469 | 344.00 |
| 2014 | 9090.89 | 6.8 | 1800.0 | 405 | 279.00 |
| 2015 | 370.30 | 6.3 | 1500.0 | 277 | 214.00 |
| 2016 | 370.37 | 6.3 | 1300.0 | 245 | 125.00 |

1. 2015 elevation changed from feet to meters.

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH91 D9A** 72.20 ft

| Year | Elevation [1] (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 9177.93 | 6.9 | 1900.0 | 256 | 266.00 |
| 2013 | 9178.19 | 7.1 | 1700.0 | 258 | 295.00 |
| 2014 | 9177.41 | 7.4 | 1700.0 | 262 | 221.00 |
| 2015 | 395.62 | 6.3 | 1700.0 | 256 | 204.00 |
| 2016 | 395.64 | 6.3 | 1800.0 | 224 | 189.00 |

1. 2015 elevation changed from feet to meters.

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH91 DG4B** 35.80 ft

| Year | Elevation [1] (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 9053.89 | 6.6 | 700.0 | <1 | 1.92 |
| 2013 | 9055.29 | 6.2 | 520.0 | <1 | 3.02 |
| 2014 | 9054.58 | 6.6 | 580.0 | <1 | 2.27 |
| 2015 | 358.02 | 6.3 | 710.0 | <1 | 10.50 |
| 2016 | 358.49 | 6.2 | 700.0 | <1 | 10.40 |

1. 2015 elevation changed from feet to meters.

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**Stanrock**
**BH91 SG1A** 5.49 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 388.07 | 4.2 | 5700.0 | 4110 | 1840.00 |
| 2013 | 388.09 | 4.3 | 5700.0 | 4150 | 2320.00 |
| 2014 | 387.89 | 4.5 | 4800.0 | 3400 | 1810.00 |
| 2015 | 387.98 | 4.0 | 6200.0 | 3660 | 2810.00 |
| 2016 | 387.90 | 4.2 | 4600.0 | 3360 | 1440.00 |

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH91 SG2A** 33.31 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 404.17 | 6.2 | 4800.0 | 2190 | 1340.00 |
| 2013 | 401.31 | 6.3 | 4800.0 | 2290 | 1670.00 |
| 2014 | 400.41 | 6.5 | 4600.0 | 2290 | 1400.00 |
| 2015 | 400.78 | 6.5 | 4500.0 | 2200 | 1330.00 |
| 2016 | 400.48 | 6.0 | 4000.0 | 2260 | 1160.00 |

**BH91 SG2D** 4.39 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 404.48 | No sample collected (no recharge) | | | |
| 2013 | 405.19 | No sample collected (no recharge) | | | |
| 2014 | 404.32 | No sample collected (no recharge) | | | |
| 2015 | 404.37 | No sample collected (no recharge) | | | |
| 2016 | 404.52 | No sample collected (no recharge) | | | |

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH91 SG3A** 8.78 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 399.51 | No sample collected (no recharge) | | | |
| 2013 | 399.56 | No sample collected (no recharge) | | | |
| 2014 | 399.77 | No sample collected (no recharge) | | | |
| 2015 | 399.52 | No sample collected (no recharge) | | | |
| 2016 | 399.29 | No sample collected (no recharge) | | | |

**BH91 SG3B** 5.85 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 399.06 | No sample collected (no recharge) | | | |
| 2013 | 399.10 | No sample collected (no recharge) | | | |
| 2014 | 399.45 | No sample collected (no recharge) | | | |
| 2015 | 399.26 | No sample collected (no recharge) | | | |
| 2016 | 398.81 | No sample collected (no recharge) | | | |

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH98 15A** 7.86 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 392.24 | 6.2 | 3100.0 | 1450 | 957.00 |
| 2013 | 392.24 | 6.1 | 2900.0 | 1300 | 935.00 |
| 2014 | 392.24 | 5.9 | 2700.0 | 1240 | 786.00 |
| 2015 | 392.24 | 6.4 | 2700.0 | 1200 | 838.00 |
| 2016 | 392.24 | 6.0 | 2600.0 | 1130 | 626.00 |

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**BH98 16A** 5.49 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 395.60 | 5.8 | 4100.0 | 2180 | 1350.00 |
| 2013 | 396.58 | 5.9 | 6200.0 | 3980 | 2840.00 |
| 2014 | 396.28 | 5.9 | 3900.0 | 2050 | 1430.00 |
| 2015 | 395.96 | 6.1 | 4800.0 | 3200 | 1680.00 |
| 2016 | 396.15 | 5.7 | 3900.0 | 1880 | 1240.00 |

**Denison Mines Inc. Elliot Lake Division**
**2016 Denison Tailings Management Area**
**Environmental Monitoring Results**

**PN ST3 P3** 5.94 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 404.48 | 5.9 | 2200.0 | 864 | 406.00 |
| 2013 | 404.57 | 5.3 | 2500.0 | 980 | 543.00 |
| 2014 | 404.20 | 5.7 | 2300.0 | 954 | 427.00 |
| 2015 | 404.37 | 5.9 | 2500.0 | 1030 | 586.00 |
| 2016 | 404.17 | 5.9 | 2100.0 | 1030 | 589.00 |

**PN ST3 P5** 2.64 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 404.47 | 3.1 | 2800.0 | 1400 | 642.00 |
| 2013 | 404.51 | 3.3 | 3000.0 | 1640 | 853.00 |
| 2014 | 404.25 | 3.5 | 3200.0 | 1950 | 1120.00 |
| 2015 | 404.34 | No sample collected (no recharge) | | | |
| 2016 | 404.18 | 3.6 | 2800.0 | 2200 | 1070.00 |

**PN ST3 P6** 11.58 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 404.32 | 6.3 | 4500.0 | 3070 | 1570.00 |
| 2013 | 404.62 | 5.1 | 4900.0 | 3460 | 2140.00 |
| 2014 | 404.02 | 6.2 | 4300.0 | 3540 | 1640.00 |
| 2015 | 404.29 | 6.3 | 4700.0 | 3560 | 1770.00 |
| 2016 | 404.06 | 6.2 | 5200.0 | 3970 | 2030.00 |

**PN ST3 P8** 20.91 m

| Year | Elevation (m) | Field pH | Sulphate (mg/L) | Acidity (mg/L) | Iron (mg/L) |
|---|---|---|---|---|---|
| 2012 | 402.37 | 5.5 | 11000.0 | 7810 | 5000.00 |
| 2013 | 402.68 | 5.9 | 12000.0 | 9770 | 6130.00 |
| 2014 | 402.00 | 5.6 | 12000.0 | 9560 | 5540.00 |
| 2015 | 402.36 | 4.5 | 12000.0 | 10100 | 7020.00 |
| 2016 | 401.89 | 5.8 | 11000.0 | 9630 | 5810.00 |

# APPENDIX V
# Stanrock Unnamed Pond Report

Denison Mines Inc.
200 – 1 Horne Walk
Elliot Lake ON P5A 2A5

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August 31, 2016

Dr. Karina Lange, Senior Project Officer
Directorate of Nuclear Cycle and Facilities Regulation
Wastes and Decommissioning Division
Canadian Nuclear Safety Commission
280 Slater Street
PO Box 1046, Station B
Ottawa, Ontario
K1P 5S9

Dear Dr. Lange:

**Re: Information request related to Un-named Pond adjacent to Stanrock licenced area**

This letter report is provided as follow-up to your letter dated June 20, 2016, to Denison Mines Inc. (DMI) in which the Canadian Nuclear Safety Commission (CNSC) requested that DMI provide all monitoring results for the Un-named Pond and undertake an assessment of whether the nearby TMA(s) are the source of contamination for this pond. As a result of CNSC requesting that a hydrogeological study be included in the assessment, Denison Environmental Services (DES) went as far as soliciting hydrogeological study proposals from two consulting engineering companies.

At the same time, DES also conducted further desktop file reviews and field investigations of the area. A desktop file review of historical information about the Stanrock Mine site discovered that DMI reported that in June 1964, a decant tower failed and approximately 450,000 tonnes of tailings were released downstream of the Stanrock TMA to Moose Lake and further to Orient Creek. Further review of the Ministry of Natural Resources and Forestry (MNRF) topographic map (Appendix A) shows that flows from such an event could have also reported east and north to a low lying wetland area which eventually reported to the Un-named Pond.

Based on DES's desktop file review and subsequent discussion with CNSC July 15, 2016, the hydrogeological study was not carried out and instead a visual field investigation of the historical tailings spill was undertaken along with the collection of pH and water depth at various locations within Unnamed Pond along with the proposed water quality sampling program at DSP, DSP-2 and DSP-3.

**Background**

On May 21, 2015, Denison received a public comment regarding a strange colouration of a pond located near the Stanrock Mine close to Stanrock's Licenced area. Denison staff conducted some visual observations of the site and collected samples from the pond (named station DSP) on June 15, 2015 followed by further monitoring in July and August. Site observation found no evidence of surface discharge from this site into Quirke Lake and also no visual evidence of an influent stream feeding the

pond from surface water. A small amount of seepage (unmeasurable due to the small amount) was observed below the pond and discharging to Quirke Lake (DSP-2).

Following the results of the first sampling at DSP, it was evident that the site showed depressed pH and elevated levels of some metals. Further sampling at DSP and the seepage location (DSP-2) was performed to better assess the water quality and confirm initial results. These results also show some depressed pH and elevated metal concentrations, so a monitoring program was implemented to determine whether or not there is any appreciable loadings into Quirke Lake at any time in the year and whether any work will be required to address the pond and seepage water quality.

**Monitoring Program**

The monitoring program was developed based on a comparison of the results against the Ministry of the Environment Provincial Water Quality Objectives (PWQO) and Canadian Council of Ministers of the Environment (CCME) guidelines as well as other stations in the Elliot Lake area. The program included monitoring the emergent seepage monthly and the outflow area on the edge of Quirke Lake (DSP-3), as well as the pond itself quarterly for the same parameters as the discharge and downstream areas of the Stanrock treatment plant. The parameter and station sampling frequency is summarized in Table 1 below;

**Table 1 – Proposed Sampling Program**

| Station | Description | Frequency[1] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flow | pH | CONDF | TSS | SO4 | Al | Co | Fe | Mn | U | Ra |
| DSP | Pond | Q | Q | Q | Q | Q | Q | Q | Q | Q | Q | |
| DSP-2 | Pond Seepage | M | M | M | M | M | M | M | M | M | M | 3M[2] |
| DSP-3 | Quirke Lake Outflow Area | Q | Q | Q | Q | Q | Q | Q | Q | Q | Q | |

[1]M=Monthly; Q=Quarterly

[2]Radium values low, will only sample for 3 months

**Results**

Results of the monitoring program are provided in Appendix B. Within the Un-named Pond sampling location (DSP), the average aluminum (4.13 mg.L), cobalt (0.0417 mg/L), iron (0.455 mg/L) and pH (3.9) concentrations did not meet applicable regulatory water quality objectives of 0.015 mg/L, 0.0009 mg/L, 0.3 mg/L and 6.5-9.5, respectively.

At the Un-named Pond seepage sampling location (DSP2), the average aluminum (1.18 mg/L), cobalt (0.0428 mg/L), iron (4.59 mg/L) and pH (4.3) concentrations did not meet applicable regulatory water quality objectives of 0.015 mg/L, 0.0009 mg/L, 0.3 mg/L and 6.5-9.5, respectively. When compared to water quality within the Unnamed Pond DSP location, aluminum was lower, cobalt and pH were similar but iron increased by an order of magnitude at DSP2.

At the Quirke Lake Outflow Area sampling location (DSP3), only aluminum with an average concentration of 0.02 mg/L was slightly above the applicable regulatory water quality objectives of 0.015 mg/L. All other parameters measured met the applicable criteria.

pH measurements were also collected at various locations across the Un-named Pond. pH was measured at surface , 1 metre below surface and at bottom. pH was consistent at 3.7 at all measured locations and depths on that sampling day of July 5, 2016. While doing pH measurements it was noted that the depth within the pond was on average approximately 3 metres.

Flows from the seepage of the Un-named Pond into Quirke Lake were so low this year that they were not measureable and as such are estimated to be less than 1L/s. No surface water flow was observed during this sampling program between Un-named Pond and Quirke Lake.

Based on the results of the water quality monitoring program undertaken between June 2015 and June, 2016 there is no appreciable loadings into Quirke Lake at any time during the year.

**Conclusion**

In that there is no appreciable loadings into Quirke Lake from the Un-named Pond, and impacts to the Un-named Pond appear to be associated with the historical tailings spill that occurred in 1964, DMI proposes to treat the water in the Un-named Pond to increase the pH level prior to the onset of winter 2016. We will continue with the proposed water quality and flow monitor program for a period of 1 more year to assess the effect of treatment on the pond water, the pond seepage and the Quirke Lake outflow area.

Please feel free to call me at 705-848-9191 ext. 229 if you have any questions or concerns regarding the letter report.

Yours very truly,

**DENISON MINES INC.**

Janet Lowe, B.Sc.
General Manager
Denison Environmental Services

cc P. Longo/V. Kilp
Elliot Lake JRG

Attachments
Appendix A – Un-named Pond Figure
Appendix B – Monitoring Program Results

# APPENDIX A

## Un-named Pond Figure

MINISTRY OF NATURAL RESOURCES AND FORESTRY

Make a Topographic Map

# Un-named Pond Local Topography


0 0.2 km

Projection: Web Mercator

N

# APPENDIX B

## Monitoring Program Results

Table 2: Surface Water Quality Results

| Parameter | Units | Water Quality Guidelines | | POND SEEPAGE - DSP2 | | | | | | | | | | | | | | QUIRKE LAKE DSP3 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PWQO | CCME | 23-Jul-15 | 13-Aug-15 | 23-Sep-15 | 26-Oct-15 | 20-Nov-15 | 7-Dec-15 | 19-Jan-16 | 11-Feb-16 | 7-Mar-16 | 5-Apr-16 | 13-May-16 | 16-Jun-16 | 5-Jul-16 | 11-Aug-16 | 13-Aug-15 | 23-Sep-15 | 7-Dec-15 | 7-Mar-16 | 16-Jun-16 |
| TSS | mg/L | | | 1 | 19 | 2 | 1 | <1 | 1 | <1 | 1 | 2 | 1 | <1 | 1 | 2 | 3 | <1 | <1 | <1 | <1 | <1 |
| ACID | mg/L CaCO3 | - | - | <1 | <1 | | | | | | | | | | | | | <1 | | | | |
| Ag | mg/L | 0.0001 | 0.0001 | 0.00001 | 0.000008 | | | | | | | | | | | | | 0.000002 | | | | |
| Al | mg/L | 0.015 | - | | 0.87 | 0.71 | 0.56 | 0.92 | 0.96 | 0.88 | 1.04 | 1.11 | 0.97 | 1.44 | 2.25 | 1.88 | 0.94 | 0.0214 | 0.02 | 0.02 | 0.03 | 0.01 |
| As | mg/L | 0.005 | 0.005 | 0.0004 | 0.0005 | | | | | | | | | | | | | <0.0002 | | | | |
| B | mg/L | 0.2 | 29 | 0.0339 | 0.0323 | | | | | | | | | | | | | 0.0128 | | | | |
| Ba | mg/L | - | - | 0.0442 | 0.0466 | | | | | | | | | | | | | 0.0365 | | | | |
| Be | mg/L | 1.1 | - | 0.000254 | 0.000196 | | | | | | | | | | | | | <0.000007 | | | | |
| Bi | mg/L | - | - | <0.000007 | <0.000014 | | | | | | | | | | | | | <0.000007 | | | | |
| Ca | mg/L | - | - | 57.8 | 61.3 | | | | | | | | | | | | | 15.5 | | | | |
| Cd | mg/L | 0.0002 | 0.00009 | 0.000037 | 0.000046 | | | | | | | | | | | | | 0.000005 | | | | |
| Co | mg/L | 0.0009 | - | 0.0713 | 0.0713 | 0.0633 | 0.0454 | 0.0209 | 0.0214 | 0.0262 | 0.0276 | 0.0281 | 0.0144 | 0.037 | 0.0501 | 0.0558 | 0.0659 | 0.000015 | <0.0005 | <0.0005 | <0.0005 | <0.0005 |
| Cr | mg/L | 0.001 | 0.001 | 0.00038 | 0.00061 | | | | | | | | | | | | | <0.00003 | | | | |
| Cu | mg/L | 0.005 | 0.004 | 0.00048 | 0.00039 | | | | | | | | | | | | | 0.00071 | | | | |
| Fe | mg/L | 0.3 | 0.3 | 11.5 | 15.7 | 10.8 | 8.33 | 0.41 | 0.71 | 1.08 | 1.37 | 1.55 | 0.25 | 0.61 | 1.24 | 4.3 | 6.35 | 0.006 | <0.02 | 0.25 | 0.04 | <0.02 |
| hard | mg/L CaCO3 | - | - | 206 | 220 | | 187 | 128 | 142 | 144 | 161 | 174 | 103 | 168 | 253 | 247 | 267 | 44.2 | | 45.3 | 45.2 | 44.9 |
| K | mg/L | - | - | 2.23 | 2.33 | | | | | | | | | | | | | 1.24 | | | | |
| Li | mg/L | - | - | 0.00506 | 0.00403 | | | | | | | | | | | | | 0.00214 | | | | |
| Mg | mg/L | - | - | 15.1 | 16.2 | | | | | | | | | | | | | 1.4 | | | | |
| Mn | mg/L | - | - | 6.62 | 6.71 | 6.26 | 4.43 | 2.74 | 2.94 | 3.13 | 3.37 | 3.48 | 1.92 | 3.55 | 4.99 | 5.98 | 6.26 | 0.00413 | 0.004 | 0.009 | 0.008 | 0.011 |
| Mo | mg/L | 0.04 | 0.073 | <0.00001 | 0.00063 | | | | | | | | | | | | | 0.00064 | | | | |
| Na | mg/L | - | - | 5.55 | 5.61 | | | | | | | | | | | | | 2.19 | | | | |
| Ni | mg/L | 0.025 | 0.15 | 0.0087 | 0.0074 | | | | | | | | | | | | | 0.0004 | | | | |
| P | mg/L | 0.01 | - | 0.115 | <0.009 | | | | | | | | | | | | | <0.009 | | | | |
| Pb | mg/L | 0.005 | 0.007 | 0.00061 | 0.00033 | | | | | | | | | | | | | <0.00001 | | | | |
| pHF | pH Units | 6.5-8.5 | 6.5-9.5 | 4 | 4.5 | 4.5 | 4.6 | 4.3 | 4.4 | 4.8 | 4.4 | 4.2 | 4.9 | 4.4 | 3.9 | 4.2 | 3.7 | 6.9 | 7.1 | 6.9 | 6.7 | 6.9 |
| Ra | Bq/L | 1 | - | 0.033 | 0.026 | 0.037 | 0.031 | 0.03 | 0.018 | 0.025 | 0.017 | 0.016 | | 0.027 | 0.031 | 0.025 | 0.033 | 0.023 | | | | |
| Sb | mg/L | 0.02 | - | <0.0002 | <0.0002 | | | | | | | | | | | | | <0.0002 | | | | |
| Se | mg/L | 0.1 | 0.001 | 0.00006 | 0.00005 | | | | | | | | | | | | | <0.00009 | | | | |
| Si | mg/L | - | - | 4.95 | 4.5 | | | | | | | | | | | | | 1.03 | | | | |
| Sn | mg/L | - | - | 0.00007 | 0.00008 | | | | | | | | | | | | | 0.00009 | | | | |
| SO4 | mg/L | - | - | 230 | 260 | 280 | 280 | 140 | 150 | 160 | 180 | 180 | 110 | 190 | 270 | 300 | 304 | 34 | 36 | 37 | 33 | 33 |
| Sr | mg/L | - | - | 0.107 | 0.109 | | | | | | | | | | | | | 0.024 | | | | |
| Ti | mg/L | - | - | 0.00022 | 0.00031 | | | | | | | | | | | | | 0.0001 | | | | |
| Tl | mg/L | 0.0003 | 0.0008 | 0.000069 | 0.000097 | | | | | | | | | | | | | 0.000035 | | | | |
| U | mg/L | 0.005 | 0.015 | 0.0001 | 0.0001 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | 0.0013 | 0.0011 | 0.0014 | 0.0012 | 0.0014 |
| V | mg/L | 0.006 | - | 0.00044 | 0.00052 | | | | | | | | | | | | | 0.00018 | | | | |
| Zn | mg/L | 0.02 | 0.03 | 0.02 | 0.016 | | | | | | | | | | | | | <0.002 | | | | |

NOTE:

Results in red do not meet water quality guidelines

PWQO Al: Interim

PWQO As: Interim PWQO for As; PWQO for As is 0.1 mg/L. (Both PWQO and Interim PWQO exist - more stringent objective is presented in the table)

PWQO B: Interim PWQO.

PWQO Be: PWQO for hardness >75 mg/L CaCO3.

PWQO Cd: PWQO for Cd; Interim PWQO for Cd is 0.0005 mg/L for hardness >100 mg/L CaCO3. (Both PWQO and Interim PWQO exist - more stringent objective is presented in the table)

PWQO Cr: PWQO for hexavalent chromium (PWQO is 0.0089 mg/L for trivalent Cr).

PWQO Cu: PWQO fo Cu; Interim PWQO for Cu for hardness >20 mg/L CaCO3 is also 0.005 mg/L. (Both PWQO and Interim PWQO exist)

PWQO Mo: Interim PWQO.

PWQO P: Interim PWQO which is the most stringent objective provided; "A high level of protection agains aesthetic deterioration will be provided by a total phosphorus concentraiton for the ice-free period of 10 ug/L or less. This should apply to all lakes naturally below this value."

PWQO Pb: PWQO fo Pb for alkalinity <20 mg/L CaCO3; Interim PWQO for Pb for hardness >80 mg/L CaCO3 is also 0.005 mg/L. (Both PWQO and Interim PWQO exist)

PWQO Sb: Interim PWQO.

PWQO Tl: Interim PWQO.

PWQO U: Interim PWQO.

PWQO V: Interim PWQO.

PWQO Zn: Interim PWQO for Zn; PWQO for Zn is 0.03 mg/L. (Both PWQO and Interim PWQO exist - more stringent objective is presented in the table)

CCME Cr: CCME limit for hexavalent chromium (CCME limit is 0.0089 mg/L for trivalent Cr).

CCME Cu: CCME limit for Cu is at hardness >180 mg/L CaCO3.

CCME Pb: CCME limit for Pb is at hardness >180 mg/L CaCO3.

CCME Ni: CCME limit for Ni is at hardness >180 mg/L CaCO3.