BEST MANAGEMENT PRACTICES and
STORM WATER MONITORING
2017 ANNUAL REPORT

Hecla Greens Creek Mining Company
March 1, 2018
# Table of Contents

1.0 Introduction ......................................................................................................................... 1

2.0 Comprehensive Site Compliance Inspections/Evaluations, Incidents of Potential Noncompliance and Associated Corrective Actions ........................................................................... 1
   2.1 AK-CESCL Site Compliance Inspections ........................................................................... 1
   2.2 Agency Site Compliance Evaluation Inspections ............................................................... 2
   2.3 HGCMC Monthly Evaluations and Site Inspections ......................................................... 4

3.0 BMP Plan Modifications in 2017 .......................................................................................... 4

4.0 HGCMC 2016 Annual Storm Water Monitoring Report ................................................... 4
   4.1 Storm Water Outfall 003 – Hawk Inlet ........................................................................... 9
   4.2 Storm Water Outfall 004 – Pit 7 ................................................................................... 10
   4.3 Storm Water Outfall 005.2 – Zinc Creek Bridge ............................................................ 10
   4.4 Storm Water Outfall 005.3 – Site E ............................................................................. 10
   4.5 Storm Water Outfall 005.4 – Pit 6 ................................................................................. 11
   4.6 Storm Water Outfall 005.5 – 7.8 Mile B-Road Culvert ................................................... 11
   4.7 Storm Water Outfall 006 – Pond D Overflow ................................................................. 12
   4.8 Storm Water Outfall 007 – Pond C Overflow ................................................................. 12
   4.8 Storm Water Outfall 008 – 960 Site ............................................................................ 12
   4.10 Storm Water Outfall 009 – 1350 Site ......................................................................... 13

5.0 Certification .......................................................................................................................... 14

# Attachments

Photographs
Figures: Storm Water Outfalls and Receiving Water Sampling Sites
1.0 Introduction

This 2017 Best Management Practices (BMP) and Storm Water Report is submitted by Hecla Greens Creek Mining Company (HGCMC) pursuant to Parts 1.3, 1.6.2 and 2.2.6 of Alaska Pollutant Discharge Elimination System (APDES) Permit AK-0043206, effective 1 October 2015. This report summarizes the scope and dates of the comprehensive site compliance inspections/evaluations, major observations related to implementation of the BMP plan, corrective actions taken as a result of the inspections/evaluations, identification of potential incidents of noncompliance as they pertain to the BMP plan, description of the quantity and quality of the storm water discharged, and BMP plan modifications made during the year. The final section of this report contains the required annual certification under Permit Appendix A, Part 1.12.

2.0 Comprehensive Site Compliance Inspections/Evaluations, Incidents of Potential Noncompliance and Associated Corrective Actions

2.1 AK-CESCL Site Compliance Inspections

In March 2017, fourteen HGCMC personnel completed the Alaska Certified Erosion and Sediment Control Lead (AK-CESCL) storm water training program. The training program outlines the key elements of a storm water pollution prevention plan; provides detailed instructions on how to select, install and maintain storm water best management controls; and teaches how to conduct site inspections and monitoring. The class was developed with input from the USACE Alaska district, ADOT, ADEC, ADNR, ARRC, MOA and Alaska construction industry representatives. The AK-CESCL certification is for a period of three years from the date of the training.

Monthly storm water and BMP inspections were completed by certified inspectors, and can be considered site compliance inspections. The results of the inspections conducted in 2017 generally involved the need for maintenance activities to existing BMPs. Records of these inspections are retained onsite and are available upon request. Items noted as deficiencies during the 2017 inspections, as well as the corrective actions taken, included:

- In March, the rubber razor bar above the freight barge ramp was noted as damaged, but still functioning. This BMP was replaced in June, using a more durable rubber strip.
- During the April inspection it was noted that ditches and settling sumps along the B-Road needed maintenance. Surface Operations personnel performed extensive ditch and BMP maintenance, including hydro-seeding, along the road system from April through October.
- Multiple inspections noted the need for sediment removal from sumps and cleaning/replacement of straw wattles in the 3.0-mile bridge area. Surface Operations personnel performed BMP maintenance work during the months of April, May, June and October.
2.2  Agency Site Compliance Evaluation Inspections

Agency personnel performed routine inspections to evaluate compliance with HGCMC operating plans and permits on eleven occasions in 2017. All the inspections were led by personnel from the U.S.D.A. Forest Service. In addition, representatives from the Alaska Department of Fish & Game and the Alaska Department of Natural Resources participated in two inspections each. Action items noted on the Forest Service inspection reports include:

- The need for sediment removal from the ends of the 3.4-mile bridge was noted in February and October.
- The need to reduce turbidity in storm water exiting the sumps and rock filter berms below the 3.2-mile culvert was noted in June and October.
- The need to remove sand bags from Falls Creek below the 3.4-mile bridge was noted in June.
- The need to clean a culvert inlet located on the uphill side of the 3.4-mile bridge was noted in October.
- The need to inspect and maintain the outlet pipe from the sump located at 3.1-mile B-Road was noted in October.

Progress in 2017 included work on corrective and preventive actions from inspections, on continuous improvement projects on the various storm water outfall sites, as well as on improvements to BMPs. The list below summarizes the 2017 work and improvements, as well as plans for 2018. Photographs showing some of this work are included at the end of this report.

- **Hawk Inlet Freight Barge Ramp**
  The rubber razor bar installed above the freight barge ramp in November 2016 functioned well to prevent turbid water from entering Hawk Inlet at this location. However, due to the thickness and rigidity of the rubber belt material, particularly during freezing temperatures, it sustained damage from the heavy forklifts during the winter months. The rubber razor bar was replaced in early June with a thinner, more flexible material that held up well for the remainder of the year and into 2018.

- **B-Road Bridges**
  Mitigation of sediment concerns at the B-Road bridges, located at 3.0-mile, 3.4-mile and 7.4-mile, was a priority for HGCMC in 2017. Maintenance of BMPs, including cleaning the bridge surfaces, was performed multiple times in the spring and fall. In June, a 12-inch extension was added to the splash guards on each bridge, raising their height to 4-feet. In August, the 80-mil HDPE liner and both layers of wood decking were replaced on all bridges. Also, hydroseed was applied beneath the 3.0-mile and 7.4-mile bridges to improve the vegetative cover and soil stabilization. The success of these measures to reduce sediment accumulation beneath the bridges was noted in several of the Forest Service inspection reports.

- **B-Road Maintenance and Improvements**
  Following the spring snow-melt in April, Surface Operations personnel performed cleaning of the ditches, culverts, and sediment sumps along the entire B-Road. The removed sediments were hauled and placed in the tailings disposal facility. Hydro-seed was then applied to establish vegetation in the ditches to stabilize soils and reduce erosion and sedimentation.
From June through December, Surface Operations worked on improvements to the entire B-Road with the goal of reducing erosion and sedimentation. This work involved narrowing the road width and enlarging the interior ditch on approximately five miles of road. Then, through a combination of re-grading and placement of imported road rock, a majority of the road was in-sloped to expedite drainage from the road surface to the interior ditch. Lastly, portions of the road surface were capped with an imported “very hard” aggregate to reduce the rate at which sediment is produced from degradation of the road surface by vehicle traffic. The combination of a narrower and more durable road surface with improved drainage is expected to reduce erosion and sedimentation and increase the effectiveness of BMPs for storm water management.

- **Storm Water Outfall 005.5 7.8-Mile Culvert**
  This storm water outfall has historically contained the highest lead and zinc concentrations during storm event monitoring due to sediment from this section of the road. To mitigate this, drainage improvements were implemented at 7.9-mile to reduce the amount of runoff reporting to the 7.8-mile culvert. In October, the road at 7.9-mile was re-graded and ditches were constructed to convey runoff to Pond D. Water in Pond D is routed to treatment facilities and subsequent discharge through outfall 002. Reduced flow through outfall 005.5 is expected to enable BMPs in the roadside ditch to more effectively retain sediment from the road.

- **Storm Water Outfall 009 Site 1350**
  To improve water quality at Outfall 009, during the summer of 2016 a shallow trench, caisson and pump system were installed to capture runoff from the remaining waste rock at Site 1350. Intercepted water is pumped to the 1350 adit where it enters the mine water system that is routed to treatment facilities. The pump system operated from September through November in 2016 and was then suspended for the winter. This system was operated again in 2017 from June through November. The water quality at outfall 009 continues to show improvement.

- **Ore Pad Drainage Improvements**
  A project was completed in May 2017 to improve drainage from the ore pad and warehouse area and reduce the amount of sediment accumulation in Pond A. A trench and French drain was constructed along the toe of the hillslope on the north side of the ore pad to intercept runoff and prevent it from running onto the ore pad. A new buried culvert was installed across the ore pad, replacing an existing culvert, which routes drainage from the trench and French drain, as well as from the warehouse area, into Pond A.

- **Summary of Plans for 2018**
  - Improvements at Pond C to prevent freezing of pump discharge pipeline.
  - Improve sediment barriers at the ends of B-road bridges.
  - Continue seasonal operation of pump system at Site 1350.
  - Improve BMPs located at 3.1-mile and 3.2-mile on the B-Road.
  - Improve BMPs associated with outfall 003.
2.3 **HGCMC Monthly Evaluations and Site Inspections**

HGCMC environmental staff members conduct weekly, monthly and quarterly visual inspections of a variety of areas within the mine site to identify any potential breaches that may lead to pollutants entering the permitted outfalls, storm water drainage system, or surface waters. The results of the inspections conducted in 2017 generally involve maintenance activities to existing BMPs. Any corrective actions needed to address findings from the inspections are conducted with coordination between the environmental department staff, the maintenance department staff, or the surface operations department staff.

3.0 **BMP Plan Modifications in 2017**

The HGCMC BMP Plan addresses all components and facilities associated with the Greens Creek Mine. The BMP Plan is a “living” document subject to frequent edits and revisions resulting from routine inspections and BMP modifications. The official copy is retained on-site.

Modifications to the Plan in 2017 include:
- Drainage improvements at 7.9-mile to reduce the volume of runoff reporting to Outfall 005.5.
- Including the use of 80-mil HDPE liner and improved splash guards on the B-Road bridges as site-specific BMPs for areas of concern.

4.0 **HGCMC 2017 Annual Storm Water Monitoring Report**

The requirements for storm water monitoring in the reissued APDES permit, effective 1 October 2015, were changed from those of the previous 2005 permit. The current permit requires monitoring of the receiving water directly upstream and downstream of where each storm water outfall enters the receiving water, and for monitoring to be conducted semiannually and at the same time (within three hours) as each associated outfall. Based on this, and the time required to visit all ten storm water outfalls and associated receiving water sites, it is likely that each semiannual monitoring event will occur over multiple days, and potentially during separate storm events.

In the re-issued APDES Permit, numeric effluent limits were not developed for the individual storm water outfalls. As stated in the Permit Fact Sheet, this is due to the difficulty in developing numeric limits for storm water discharges that are extremely variable in flow and pollutant concentrations and the uncertainty regarding the effect of the storm water discharges on the receiving waters. Instead, the permit requires HGCMC to implement corrective action if a storm water discharge exceeds a water quality criterion and results in a statistically significant reduction in receiving water quality.

Statistics can be used to define the statistical uncertainty between sample values collected at different sites (e.g., upstream and downstream receiving waters). Statistics can never prove that a difference between sample values is real, only the probability that one may exist, given the
available data. Statistical tests rely on using estimates of the true mean and true variance of a population, where larger sample populations increase statistical confidence. With the upstream and downstream receiving water monitoring program having been implemented in 2016, there is not yet adequate data to perform valid statistical testing to determine if storm water outfall discharges are causing significant reduction in receiving water quality. For this report, monitoring results are discussed in general terms as well as in relation to Alaska Water Quality Standards.

Table 1, Storm Event Details 2017, summarizes the precipitation and duration data associated with the sampling events that occurred in 2017. HGCMC maintains three meteorological stations at the site; one located at the mill site, one located at the tailings facility, and one located at the Hawk Inlet float plane dock. When possible, the meteorological station in closest proximity to the outfalls being sampled is used as the reference station for the precipitation and duration data.

Table 1: Storm Event Details 2017

<table>
<thead>
<tr>
<th>Date</th>
<th>5/18/2017</th>
<th>6/16/2017</th>
<th>6/17/2017</th>
<th>9/26/2017</th>
<th>9/27/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outfalls Sampled</td>
<td>008, 009</td>
<td>005.3</td>
<td>005.4</td>
<td>005.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outfalls Observed (not sampled)</td>
<td>005.5</td>
<td>004, 005.2</td>
<td>006, 007</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>006, 007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meteorological Station Reference</td>
<td>Mill Site</td>
<td>Mill Site</td>
<td>Hawk Inlet</td>
<td>Mill Site</td>
<td>Tailings</td>
</tr>
<tr>
<td>SAMPLE EVENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration (hours)</td>
<td>5.5</td>
<td>7</td>
<td>12.75</td>
<td>9.75</td>
<td>20.5</td>
</tr>
<tr>
<td>Start Date</td>
<td>5/18/17</td>
<td>6/16/17</td>
<td>6/16/17</td>
<td>9/26/17</td>
<td>9/26/17</td>
</tr>
<tr>
<td>Start Time</td>
<td>9:15</td>
<td>3:00</td>
<td>23:15</td>
<td>2:15</td>
<td>17:00</td>
</tr>
<tr>
<td>Precipitation (inches)</td>
<td>0.05</td>
<td>0.28</td>
<td>0.28</td>
<td>0.4</td>
<td>0.78</td>
</tr>
<tr>
<td>Same Day Precip. (inches)</td>
<td>0.05</td>
<td>0.29</td>
<td>0.26</td>
<td>0.4</td>
<td>0.42</td>
</tr>
<tr>
<td>PRIOR EVENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lapse Between Events (hours)</td>
<td>90.5</td>
<td>4</td>
<td>13.5</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Duration (hours)</td>
<td>51</td>
<td>5.75</td>
<td>5</td>
<td>4.75</td>
<td>9.5</td>
</tr>
<tr>
<td>Start Date</td>
<td>5/12/17</td>
<td>6/15/17</td>
<td>6/16/17</td>
<td>9/24/17</td>
<td>9/26/17</td>
</tr>
<tr>
<td>Start Time</td>
<td>11:45</td>
<td>17:15</td>
<td>4:45</td>
<td>20:30</td>
<td>2:30</td>
</tr>
<tr>
<td>Precipitation (inches)</td>
<td>0.71</td>
<td>0.18</td>
<td>0.35</td>
<td>0.2</td>
<td>0.53</td>
</tr>
</tbody>
</table>

For the spring storm event monitoring, most of the outfalls were not able to be sampled as early in the year as is preferred. April was a relatively dry month with less than one-inch of precipitation recorded at the Hawk Inlet meteorological station. There were a few large rain events during May, but they occurred on weekends when there were no Environmental Department staff available to collect samples. For the one minor rain event in May when
personnel performed monitoring, only two of the outfalls had flow. Consequently, most of the spring storm event monitoring was performed in June.

Table 2, Storm Water Outfall Area and Estimated Total Discharge Volume, presents the estimated total gallons of storm water discharged through the outfalls that were sampled. These discharge estimates were calculated using the rational method equation. Note that with the 2015 update of the BMP Plan, the figures associated with each storm water outfall were revised, and the catchment areas were recalculated based on updated high resolution LiDAR aerial imagery. The actual drainage area acreage for each outfall is lower than the conservative estimates that were provided in previous annual reports, and results in a more accurate estimation of the total discharge gallons during each storm event.

<table>
<thead>
<tr>
<th>Outfall</th>
<th>Date</th>
<th>Catchment Area (acre)</th>
<th>Total Discharge (gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>6/17/2017</td>
<td>0.2</td>
<td>1,056</td>
</tr>
<tr>
<td></td>
<td>9/27/2017</td>
<td>0.2</td>
<td>2,940</td>
</tr>
<tr>
<td>005.2</td>
<td>9/26/2017</td>
<td>0.6</td>
<td>1,936</td>
</tr>
<tr>
<td>005.3</td>
<td>6/16/2017</td>
<td>6.8</td>
<td>25,637</td>
</tr>
<tr>
<td></td>
<td>9/27/2017</td>
<td>6.8</td>
<td>71,328</td>
</tr>
<tr>
<td>005.4</td>
<td>6/16/2017</td>
<td>1.9</td>
<td>5,729</td>
</tr>
<tr>
<td></td>
<td>9/27/2017</td>
<td>1.9</td>
<td>15,941</td>
</tr>
<tr>
<td>005.5</td>
<td>6/16/2017</td>
<td>5.3</td>
<td>11,991</td>
</tr>
<tr>
<td></td>
<td>9/26/2017</td>
<td>5.3</td>
<td>17,117</td>
</tr>
<tr>
<td>008</td>
<td>5/18/2017</td>
<td>0.7</td>
<td>373</td>
</tr>
<tr>
<td></td>
<td>9/26/2017</td>
<td>0.7</td>
<td>3,013</td>
</tr>
<tr>
<td>009</td>
<td>5/18/2017</td>
<td>3.3</td>
<td>1,759</td>
</tr>
<tr>
<td></td>
<td>9/26/2017</td>
<td>3.3</td>
<td>14,210</td>
</tr>
</tbody>
</table>

Table 3, 2017 HGCMC Storm Water Outfall and Receiving Water Results, presents the required monitoring parameters for each outfall and associated receiving water sites. Also provided are the method detection limit (MDL) and method limit (ML) for total recoverable lead, total recoverable zinc, oil and grease, and total suspended solids. As required by Permit Part 1.3.6, if a value is less than the MDL it is reported as less than the numeric value of the MDL, and if a value is less than the ML it is reported as less than the numeric value of the ML.

The results in Table 3 are organized first by the permitted outfall, and then by the date of the sample or observation. The results for the storm water effluent (S) are grouped with the receiving water upstream sites (RU) and downstream sites (RD), as appropriate for each sampling event. Figures showing site locations are included as an attachment to this report. A discussion and evaluation of the results for each outfall and sampling event is provided below.
<table>
<thead>
<tr>
<th>Outfall</th>
<th>Type *</th>
<th>Site</th>
<th>Date</th>
<th>Time</th>
<th>Flow (gpm)</th>
<th>pH</th>
<th>Hardness (mg/L)</th>
<th>Lead-TR (µg/L)</th>
<th>Zinc-TR (µg/L)</th>
<th>Oil &amp; Grease (mg/L)</th>
<th>TSS (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>S</td>
<td>527SW</td>
<td>17-Jun</td>
<td>13:21</td>
<td>0.5</td>
<td>7.24</td>
<td>189</td>
<td>2.4</td>
<td>0.1</td>
<td>40</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>529SW</td>
<td>17-Jun</td>
<td>13:40</td>
<td>8.06</td>
<td>5200</td>
<td>&lt;0.5</td>
<td>0.5</td>
<td>3</td>
<td>&lt;10</td>
<td>&lt;2</td>
</tr>
<tr>
<td>004</td>
<td>S</td>
<td>520SW</td>
<td>17-Jun</td>
<td>10:10</td>
<td>2</td>
<td>7.51</td>
<td>144</td>
<td>302</td>
<td>0.1</td>
<td>580</td>
<td>&lt;1.9</td>
</tr>
<tr>
<td></td>
<td>RG</td>
<td>529SW</td>
<td>17-Jun</td>
<td>13:35</td>
<td>7.79</td>
<td>4480</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>30</td>
<td>&lt;1.9</td>
</tr>
<tr>
<td>005.2</td>
<td>S</td>
<td>539SW</td>
<td>16-Jun</td>
<td>10:25</td>
<td>2</td>
<td>4.3</td>
<td>28</td>
<td>7.5</td>
<td>0.1</td>
<td>44</td>
<td>&lt;1.9</td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>371SW</td>
<td>16-Jun</td>
<td>11:40</td>
<td>7.32</td>
<td>30</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>10</td>
<td>&lt;1.9</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>368SW</td>
<td>16-Jun</td>
<td>11:55</td>
<td>7.48</td>
<td>30</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>9</td>
<td>&lt;1.9</td>
</tr>
<tr>
<td>005.3</td>
<td>S</td>
<td>545SW</td>
<td>16-Jun</td>
<td>13:13</td>
<td>25</td>
<td>7.71</td>
<td>197</td>
<td>7.6</td>
<td>0.1</td>
<td>231</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>595SW</td>
<td>16-Jun</td>
<td>14:36</td>
<td>8.08</td>
<td>52</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>&lt;5</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>591SW</td>
<td>16-Jun</td>
<td>14:20</td>
<td>8.01</td>
<td>51</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>9</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td>005.4</td>
<td>S</td>
<td>547SW</td>
<td>16-Jun</td>
<td>13:39</td>
<td>0.25</td>
<td>7.16</td>
<td>69</td>
<td>1.3</td>
<td>0.1</td>
<td>14</td>
<td>&lt;2</td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>595SW</td>
<td>16-Jun</td>
<td>14:36</td>
<td>8.08</td>
<td>52</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>&lt;5</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>591SW</td>
<td>16-Jun</td>
<td>14:20</td>
<td>8.01</td>
<td>51</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>5</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td>005.5</td>
<td>S</td>
<td>560SW</td>
<td>16-Jun</td>
<td>10:55</td>
<td>11</td>
<td>7.43</td>
<td>212</td>
<td>777</td>
<td>0.1</td>
<td>952</td>
<td>&lt;2</td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>6SW</td>
<td>16-Jun</td>
<td>11:48</td>
<td>7.86</td>
<td>47</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>6</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>590SW</td>
<td>16-Jun</td>
<td>11:19</td>
<td>8.01</td>
<td>47</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>6</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td>005.5</td>
<td>S</td>
<td>560SW</td>
<td>26-Sep</td>
<td>10:30</td>
<td>3</td>
<td>8.2</td>
<td>438</td>
<td>4860</td>
<td>0.1</td>
<td>5490</td>
<td>&lt;1.9</td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>6SW</td>
<td>26-Sep</td>
<td>10:10</td>
<td>7.81</td>
<td>46</td>
<td>&lt;0.5</td>
<td>0.1</td>
<td>5</td>
<td>10</td>
<td>&lt;2.1</td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>590SW</td>
<td>26-Sep</td>
<td>10:50</td>
<td>7.96</td>
<td>53</td>
<td>0.7</td>
<td>0.1</td>
<td>5</td>
<td>9</td>
<td>&lt;1.9</td>
</tr>
</tbody>
</table>

Table 3: 2017 HGCMC Storm Water Outfall and Receiving Water Results

No sample taken due to no discharge.
Table 3: 2017 HGCMC Storm Water Outfall and Receiving Water Results

<table>
<thead>
<tr>
<th>Outfall</th>
<th>Type *</th>
<th>Site</th>
<th>Date</th>
<th>Time</th>
<th>Flow (gpm)</th>
<th>pH</th>
<th>Hardness (mg/L)</th>
<th>Lead-TR (µg/L) MDL ML</th>
<th>Zinc-TR (µg/L) MDL ML</th>
<th>Oil &amp; Grease (mg/L) MDL ML</th>
<th>TSS (mg/L) MDL ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>006</td>
<td>S</td>
<td>562SW</td>
<td>16-Jun</td>
<td>11:40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>007</td>
<td>S</td>
<td>565SW</td>
<td>16-Jun</td>
<td>12:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>008</td>
<td>S</td>
<td>570SW</td>
<td>18-May</td>
<td>12:50</td>
<td>2</td>
<td>7.34</td>
<td>198</td>
<td>&lt;0.1 0.1 0.5 38 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>1SW</td>
<td>18-May</td>
<td>13:30</td>
<td>31,867</td>
<td>7.89</td>
<td>45</td>
<td>&lt;0.5 0.1 0.5 6 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>6SW</td>
<td>18-May</td>
<td>14:05</td>
<td>32,315</td>
<td>7.85</td>
<td>44</td>
<td>&lt;0.1 0.1 0.5 5 2 5</td>
<td>&lt;2 2 9.8</td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td>009</td>
<td>S</td>
<td>580SW</td>
<td>18-May</td>
<td>12:30</td>
<td>1</td>
<td>7.13</td>
<td>88</td>
<td>2 0.1 0.5 864 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>48SW</td>
<td>18-May</td>
<td>13:15</td>
<td>31,867</td>
<td>7.85</td>
<td>42</td>
<td>&lt;0.5 0.1 0.5 &lt;5 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>1SW</td>
<td>18-May</td>
<td>13:30</td>
<td>31,867</td>
<td>7.89</td>
<td>45</td>
<td>&lt;0.5 0.1 0.5 6 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>580SW</td>
<td>26-Sep</td>
<td>9:00</td>
<td>7</td>
<td>7.16</td>
<td>67</td>
<td>&lt;0.5 0.1 0.5 166 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RU</td>
<td>48SW</td>
<td>26-Sep</td>
<td>9:35</td>
<td>27,379</td>
<td>7.81</td>
<td>43</td>
<td>&lt;0.5 0.1 0.5 &lt;5 2 5</td>
<td></td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RD</td>
<td>1SW</td>
<td>26-Sep</td>
<td>9:45</td>
<td>28,187</td>
<td>7.84</td>
<td>51</td>
<td>&lt;0.1 0.1 0.5 10 2 5</td>
<td>&lt;2.1 2.1 10.4</td>
<td>&lt;5 5 20</td>
<td></td>
</tr>
</tbody>
</table>

Note *  
S = Stormwater  
RU = Receiving water upstream  
RD = Receiving water downstream  
No sample taken due to no discharge
4.1 Storm Water Outfall 003 – Hawk Inlet

Outfall 003 is a culvert pipe located adjacent to the North Cannery Building and drains the storm water runoff from a small area approximately 0.2 acres in size. Prior to 2009, this outfall had a larger drainage area encompassing portions of the shift-housing units and included flow from a building foundation drain. The building foundation drain was found to be the primary source of zinc that was historically measured in the storm water monitoring. A shallow caisson and pump system were installed above the culvert inlet to capture the drainage from the housing units and route it to treatment facilities. This resulted in a substantial reduction in the zinc concentration at the storm water outfall.

Outfall 003 discharges directly into Hawk Inlet, and therefore there is only one associated receiving water monitoring site (Site 529). Routine storm water monitoring for 2017 was performed on June 17 and September 27. The total recoverable lead and zinc concentrations in the September 27 sample were measured at 302 µg/L and 580 µg/L, respectively, which are the highest concentrations measured since prior to 2009. The discharge flow rate at the time of sampling was measured at 1.3 gpm. The lead and zinc is attributed to the TSS concentration, measured at 283 mg/L, indicating the need to improve BMPs in that area.

Comparison of monitoring results from 2009 through 2017 shows there is no correlation between the zinc concentrations in the Outfall 003 discharge and those measured in the Hawk Inlet receiving water (see Figure 1). This is attributed to the low discharge rate through the outfall and the immense dilution volume of Hawk Inlet. While the storm water periodically exceeds the Alaska Water Quality Standards for marine water, the zinc concentration in Hawk Inlet is well below the marine chronic aquatic life criteria of 86 µg/L. HGCMC plans to improve BMPs to reduce the potential for contaminated sediments in the storm water discharge.

Figure 1: Zinc, Total Recoverable (µg/l)
4.2 **Storm Water Outfall 004 – Pit 7**

Outfall 004 is located downgradient of a constructed wetlands that receives runoff from Pit 7, which is a former rock quarry and current reclamation material storage pile. Flow has not been observed at this outfall during storm events since 2012, and there was no flow observed during the 2017 storm event monitoring. There was no activity at Pit 7 during 2017, and no signs of erosion from the reclamation material stockpile.

4.3 **Storm Water Outfall 005.2 – Zinc Creek Bridge**

Outfall 005.2 is located near the bottom of the north abutment, upstream side, of the Zinc Creek Bridge located at 3.0-mile on the B-Road. The drainage area for this outfall is approximately 0.6 acres in size, and captures runoff from a short section of road and a portion of the abutment. Receiving water monitoring is performed at Site 371 (upstream) and Site 368 (downstream) in Zinc Creek.

Storm event monitoring for 2017 was performed on September 26. There was no discharge from the outfall when it was observed during the spring storm events. The results in Table 3 show that the storm water effluent is weakly acidic and contains detectable concentrations of lead and zinc. The receiving water samples showed no measureable change in lead concentration and the zinc concentration was lower at the downstream site than at the upstream site. This demonstrates that the low volume of storm water runoff through this outfall is not having an adverse impact on the water quality of Zinc Creek.

4.4 **Storm Water Outfall 005.3 – Site E**

Outfall 005.3 is located in a small drainage that runs between the B-Road and inactive waste rock Site E. The drainage area contributing to the outfall location is approximately 6.8 acres. The drainage flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at Site 595 (upstream) established in 2016, and Site 591 (downstream) that was established in 2005.

Water quality at the outfall is influenced by the Site E waste rock and has exhibited highly variable lead and zinc concentrations throughout its monitoring history. Outfall 005.3 was sampled on June 16 and September 27, with flows estimated at 25 gpm and 75 gpm, respectively. Of the two samples, the lead concentration was higher in June whereas the zinc concentration was higher in September, demonstrating the variability in water quality at this outfall. The receiving water samples showed essentially no change in water quality between the up-gradient and down-gradient sites during the June storm event. There was a slight, but measurable, increase in the lead and zinc concentrations during the September storm event. During both events the concentrations in Greens Creek were below the chronic aquatic-life criteria of 1.32 µg/L for lead and 66.6 µg/L for zinc, based on a hardness of 50 mg/L.
In 2008, HGCMC initiated a program of removing Site E waste rock for co-disposal in the tailings facility. Through 2017, over 121,000 cubic yards of material were removed. It is anticipated that there will be additional waste rock removal in 2018. The water quality at Outfall 005.3 is expected to show gradual improvement as the waste rock removal activities progress.

4.5 **Storm Water Outfall 005.4 – Pit 6**

Outfall 005.4 is the discharge location for runoff from a reclamation material storage area in an old road construction quarry called Pit 6. The catchment area draining to the outfall is approximately 0.9 acres in size. There has been no activity in Pit 6 since 2009 and the area is stabilized and vegetated. Storm water runoff flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at Site 595 (upstream) established in 2016, and Site 591 (downstream) that was established in 2005.

Storm event monitoring for 2017 was performed on June 16 and September 27. Water quality at Outfall 005.4 is excellent, with lead and zinc concentrations consistently below the Alaska Water Quality Standards since 2009.

4.6 **Storm Water Outfall 005.5 – 7.8 Mile B-Road Culvert**

Outfall 005.5 is a culvert that drains a portion of the B-Road surface above mile 7.8. The catchment area draining to the culvert is approximately 5.3 acres, most of which is undisturbed forest on the uphill side of the road. Discharge from the culvert is to a forested hillside, approximately 200 feet from Greens Creek. Flows through the culvert during storm event monitoring have been low and typically less than 10 gpm. As a result, the drainage infiltrates into the forest duff and a point source discharge to Greens Creek has not been observed.

Access to this section of Greens Creek below the culvert is challenging, particularly during storm events. Therefore, the sites for the upstream and downstream receiving water monitoring were chosen to address safety concerns while also satisfying the intent of the Permit. Site 6, which is also sampled on a monthly basis under the Fresh Water Monitoring Program (FWMP), was selected as the upstream receiving water site. Site 590, located below mile 7.6, was selected as the downstream site.

Storm event monitoring for 2017 was performed on June 16 and September 26. As shown in Table 3, the outfall samples contained the highest lead and zinc concentrations of all outfalls sampled due to the road runoff. However, with the low flow rate and infiltration into the forest duff there is minimal influence on Greens Creek water quality. The receiving water samples showed essentially no change in water quality between the up-gradient and down-gradient sites during the June storm event. For the September storm event, the lead concentration was slightly higher at the down-stream site compared to the upstream site, but the zinc concentration was lower. The fact that the storm water outfall contained more zinc than lead, yet the zinc concentration in the receiving water was lower at the down-stream site than at the up-stream site, means it is unlikely that the slight increase in lead at the down-stream site is solely attributable to the storm water
discharge. The lead and zinc concentrations in Greens Creek were well below the chronic aquatic-life criteria during both storm events.

Work was completed in October designed to reduce the volume and improve the quality of storm water runoff at the 7.8-mile culvert. The road surface near 7.9-mile was re-graded and ditches were constructed to direct road runoff from above that point to Pond D. Water in Pond D is pumped to the treatment facility and then discharged at outfall 002. By diverting road runoff from above 7.9-mile, there will be less flow in the roadside ditch between 7.9 and 7.8-mile enabling BMPs to more effectively contain contaminated sediments. This work was completed after the fall storm event monitoring so it will not be known until the spring 2018 storm event monitoring if the project was successful.

4.7 **Storm Water Outfall 006 – Pond D Overflow**

Pump systems maintain a low water level in Pond D and route storm water to treatment facilities or for use in the mill. There were no storm water discharges through Outfall 006 in 2017. If a discharge were to occur, receiving water monitoring in Greens Creek would be performed at Site 6 for the upstream site and at Site 590 for the downstream site.

4.8 **Storm Water Outfall 007 – Pond C Overflow**

Pump systems maintain a low water level in the upper and lower Pond C and route storm water to treatment facilities. There were no storm water discharges through Outfall 007 in 2017. If a discharge were to occur, receiving water monitoring in Greens Creek would be performed at Site 1, located at the 920 weir, for the upstream site and at Site 6 for the downstream site.

4.8 **Storm Water Outfall 008 – 960 Site**

Outfall 008 is the discharge location for runoff from a former waste rock storage pile placed during initial development of the 920 mine portal. The majority of the waste rock was removed in 2005 and only a small quantity remains that is in the road prism for the 1350 Site access road. The catchment area contributing runoff to the outfall is approximately 0.7 acres. Since removal of the waste rock material the water quality at the outfall has consistently met the Alaska Water Quality Standards for lead and zinc.

Storm event monitoring for 2017 was performed on May 18 and September 26. Receiving water monitoring was performed in Greens Creek at Site 1 (upstream) and Site 6 (downstream).
4.10 Storm Water Outfall 009 – 1350 Site

Outfall 009 monitors the runoff quality from an inactive waste rock pile that was placed during the development of the 1350 adit. Between 2005 and 2015, over 80 percent of the waste rock was removed for disposal in the underground mine. The catchment area contributing runoff to the outfall is approximately 3.3 acres in size. Receiving water monitoring is performed in Greens Creek at Site 48 (upstream) and Site 1 (downstream). Site 48, also sampled monthly as part of the FWMP, is located upstream of all mining activity and represents natural background quality for Greens Creek.

Storm event monitoring for 2017 was performed on May 18 and September 26. The zinc concentration in the storm water runoff was elevated in the May sample, with the source of the zinc being the remaining waste rock near the 1350 adit. During the summer of 2016, HGCMC installed a collection trench and pump system to intercept runoff from the waste rock and route it to treatment facilities. The pump system is operated seasonally and was not in use at the time of the May sample. The zinc concentration was substantially lower in the September 26 storm event monitoring when the pump was operational.

Storm event monitoring has been performed at Outfall 009 since 1998. Throughout its history the flows have always been low, making it unlikely that the runoff causes significant degradation of Greens Creek. Though the 2017 storm event monitoring showed a slight increase in the zinc concentration between the up-gradient and down-gradient receiving water sites, loading calculations show that the zinc in the outfall discharge only accounted for approximately one percent of the increased zinc in Greens Creek during each event. The majority of the zinc loading in this section of Greens Creek is naturally occurring. Nonetheless, HGCMC will continue to seasonally collect the runoff from the remaining waste rock at the 1350 Site for as long as necessary to protect the water quality at the storm water outfall.
5.0 Certification

Fulfillment of requirements set forth in Permit AK-0043206 are met with the above report, the inspections and evaluations for 2017, and the BMP plan.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Christopher Wallace
Environmental Affairs Manager
Hecla Greens Creek Mining Company
Photographs

PHOTO 1. 3.0-mile bridge showing 80-mil liner installation and modified splash guards.

PHOTO 2. 7.4-mile bridge showing 80-mil liner installation and modified splash guards.
PHOTO 3. Vegetation for slope stabilization under 7.4-mile bridge.

PHOTO 4. Vegetation established in B-Road drainage ditch.
PHOTO 5. Narrowing and in-sloping B-Road and enlarging drainage ditch.

PHOTO 6. Drainage improvement to capture road runoff at 7.9-mile B-Road.
PHOTO 7. Ore pad drainage improvement project.

PHOTO 8. Modified sediment sump with rock filter berms at 3.2-mile B-Road.
SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 003 HAWK INLET FACILITIES

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 004 - PIT 7 ON 'A' ROAD

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 005.2
ZINC CREEK BRIDGE

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES
APDES OUTFALL 005.3 - SITE E WASTE ROCK

SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 005.3 - SITE E WASTE ROCK

Runoff Area (298,200 sq feet)
APDES Sample Site
Stormwater Site
Effluent Pipeline to WTP
Contact Water Ditch
Contact Flow Direction
Non Contact Flow Direction
Greens Creek
Drainage
Berm
Velocity Break
Spill Response
Sump
Culvert
Contours (10 feet)

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 005.5 - CULVERT AT 7.8 MILE ‘B’ ROAD

- Runoff Area (229,059 square feet)
- APDES Outfall
- Storm Water Site
- Sump
- Road Contact Water Flow Direction
- Road Contact Water Diversion Ditch
- Non Contact Water Flow Direction
- Culvert
- Contours (5 feet)
- Velocity Break

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES

APDES OUTFALL 006 - POND D OVERFLOW

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 008 - 960 WASTE ROCK PILE

Runoff Area (28,965 square feet) Non Contact Water Flow Direction
APDES Outfall Non Contact Water Diversion Ditch
Storm Water Site Berm
Sump Drainage
Culvert Contours (5 feet)

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.
SITE SPECIFIC BEST MANAGEMENT PRACTICES APDES OUTFALL 009 1350 WASTE STOCKPILE

Runoff Area (142,945 square feet)
APDES Outfall
Storm Water Site
Adit Drain
Sump
Berm
Contact Water Flow Direction
Non Contact Water Flow Direction
Drainage
Contours (5 feet)

BMPs are continually maintained, therefore BMP position and quantity are representative and may not be exact to figure location.