



# BGC ENGINEERING INC.

---

## AN APPLIED EARTH SCIENCES COMPANY

1605, 840 – 7 Avenue S.W. , Calgary, Alberta, Canada. T2P 3G2  
Phone (403) 250-5185 Fax (403) 250-5330

---

### PROJECT MEMORANDUM

---

<b>To:</b>	<b>Breakwater Resources</b>	<b>Fax No.:</b>	<b>Via email</b>
<b>Attention:</b>	<b>Bob Carreau</b>	<b>CC:</b>	
<b>From:</b>	<b>Geoff Claypool (Ext. 104)</b>	<b>Date:</b>	<b>July 18, 2008</b>
<b>Subject:</b>	<b>Nanisivik Mine Geotechnical Inspection – July 2008</b>		
<b>No. of Pages (including this page):</b>	<b>8</b>	<b>Project No:</b>	<b>0255-017-02</b>

---

BGC completed the annual geotechnical inspection of reclamation covers at Nanisivik Mine between July 14 and 16, 2008. The significant observations and maintenance recommendations for each site are summarized below.

#### **Oceanview Open Pit**

##### Observations:

- No ponded water observed on cover.
- Upslope water deflection berm appears to be effective in directing surface water away from the cover. Inferred from signs of water flowing along upstream edge of berm.
- Minor surface erosion noted along side slope at south end of cover. It should be noted the erosion was not observed to be more progressed than was observed in 2007.
- Some seepage noted at the toe of the cover.
- Some seepage water noted running onto cover surface at south end of cover
- Some staining observed running on east edge of cover originating from upslope, appears about the same as observed in 2007.
- The thermokarst feature observed in 2007 was backfilled, as recommended in the 2007 inspection report.

##### Recommended Maintenance:

- No maintenance recommended.

---

This communication is intended for the use of the above named recipient. Any unauthorized use, copying, review or disclosure of the contents by other than the recipient is prohibited.

---

K:\Projects\0255 CanZinc\017 2008 work\03 Annual Inspection Report\Report\2008 Annual Geotech Inspection memo.doc

**BGC Project Memorandum**

To: Murray Markle, Nanisivik Mine

From: Geoff Claypool, BGC

Date: July 18, 2008

Subject: 2008 Annual Inspection Summary Memo

Proj. No: 0255-017-02

---

**Oceanview Portal**Observations:

- Settlement observed along west edge of cover near south corner, as was observed in 2006 and 2007.
- No seepage observed at the toe of the cover.

Recommended Maintenance:

- Repair settlement in SW corner of portal cover.

**Oceanview East and West Raises**Observations:

- No erosion or deformation of surface mounds noted.

Recommended Maintenance:

- No maintenance required.

**K Baseline Portal**Observations:

- No surface erosion observed.
- No seepage noted at toe of cover.

Recommended Maintenance:

- No maintenance required.

**Kuhulu Lake Borrow Area**Observations:

- Some minor thermokarst features observed in floor of borrow area, similar condition to what was observed in 2007.
- No ponding observed.

Recommended Maintenance:

- No maintenance required.

**Chris Creek Borrow Area**Observations:

- No significant degradation of floor of borrow area noted.

Recommended Maintenance:

- No maintenance required.

**BGC Project Memorandum**

To: Murray Markle, Nanisivik Mine

From: Geoff Claypool, BGC

Date: July 18, 2008

Subject: 2008 Annual Inspection Summary Memo

Proj. No: 0255-017-02

---

**East Trench**Observations:

- Only minor surface erosion observed near upslope edge of cover where surface water observed running onto surface of cover.
- No seepage observed at toe of cover.

Recommended Maintenance:

- No maintenance required.

**East Open Pit**Observations:

- Some very minor surface erosion noted in upper portion of cover.
- No seepage observed at the toe of the cover.
- Some loosening of rock in remnant highwall observed.

Recommended Maintenance:

- No maintenance required.

**East Adit Treatment Pond Dike**Observations:

- Dike breached in 2006.
- No ponding observed in 2008.
- Some channelization of sediments upstream of breach has occurred.

Recommended Maintenance:

- No maintenance recommended.

**East Adit Retention Pond Dike**Observations:

- Dike breached in 2006.
- Some ponding of water observed in NW corner of area.
- Some channelization of sediments upstream of breach observed.

Recommended Maintenance:

- Improve drainage to prevent ponding. May not be feasible due to ground conditions.

**Shale Hill Quarry**Observations:

- No erosion of regraded slopes noted.
- Minor thermokarsting in quarry floor, no ponding observed.

Recommended Maintenance:

- No maintenance required.

### **Shale Hill Raise**

#### Observations:

- No erosion or deformation of surface mound noted.

#### Recommended Maintenance:

- No maintenance required.

### **17 N Portal**

#### Observations:

- No significant erosion observed.
- Small thermokarst feature observed near upslope edge of cover.
- No seepage observed at toe of cover.
- Surface flow observed along east edge of cover.

#### Recommended Maintenance:

- Backfill thermokarst feature.

### **Upper Dump Pond**

#### Observations:

- No surface erosion observed.
- No seepage observed at toe of cover.

#### Recommended Maintenance:

- No maintenance required.

### **West Open Pit**

#### Observations:

- No erosion of armour surface observed.
- No seepage water observed at toe of cover.
- Some cracking was observed in the West Open Pit crown pillar. This is the same cracking that has been observed in previous inspections and there does not appear to have been additional extension or widening of the cracking, based on visual comparisons.

#### Recommended Maintenance:

- Complete armoring of access road at toe of pit when regular road use no longer required.

### **West Twin Dike**

#### Observations:

- No erosion or settlement of the cover was observed.
- No seepage was noted at the toe of the dike.

#### Recommended Maintenance:

- No maintenance required.

### **Test Cell/ Toe of WT Dike**

#### Observations:

- No erosion of cover observed.
- No ponding on cover observed.
- Cover very undulating along north/south arm of remnant Test Cell dike.
- Outlet of Test Cell armoured to the normal water line.
- Some settlement areas were observed in the cover at the Toe of the West Twin Dike cover.

#### Recommended Maintenance:

- Extend rip rap along the shoreline at the Test Cell outlet below water level to approximately 369.4 m elev.
- Apply additional compactive effort to the north-south arm of remnant Test Cell dike.

### **Surface Cell**

#### Observations:

- Some cracking and settlement of cover in east/west trench, approximately to same degree as observed in 2007.
- Small head pond at spillway inlet observed, maximum depth approximately 20 cm.
- Some thermokarst features noted near south edge of cover (581034N, 8104483E).

#### Recommended Maintenance:

- Backfill thermokarst features.

### **Reservoir Shoreline**

#### Observations:

- No erosion of rip rap observed.
- Additional rip rap stockpiled along shoreline at toe of WT Dike.

#### Recommended Maintenance:

- Spread stockpiled rip rap along shoreline at toe of WT Dike.

### **Reservoir Breaches**

#### Observations:

- The water depth in breaches estimated to be approximately 0.5 m below current water surface. The water level during the inspection was estimated to be about 370.4 m.

#### Recommended Maintenance:

- No maintenance required.

### **West Twin Outlet**

#### Observations:

- No erosion of rip rap observed.
- Water level behind wall was approximately 3 cm below invert elevation of outlet.

#### Recommended Maintenance:

- Continue to monitor water level on polishing pond side of wall to assess seepage losses.

### **Twin Lakes Creek Diversion Berm**

#### Observations:

- No erosion of rip rap observed.

#### Recommended Maintenance:

- No maintenance required.

### **Twin Lakes sand and gravel quarry**

#### Observations:

- Some minor thermokarsting of quarry floor observed, no more than observed in 2007.
- Quarry floor observed to be draining into Reservoir.

#### Recommended Maintenance:

- Construct a surface mound over the Area 14 Raise, if it can be located. (May not be critical given stability over 20 years).

### **Area 14 Waste Rock Cover, Portal Cover and Raise Cover**

#### Observations:

- No erosion of covers noted.
- No surface mound constructed as recommended in 2007 report.

#### Recommended Maintenance:

- Construct surface mound over Area 14 Raise..

### **Area 14 Armour and Shale Quarries**

#### Observations:

- Thermokarsting of shale quarry entrance is continuing.
- Erosion of highwall in shale quarry continues at northeast corner where ephemeral flow occurs into pit.
- No ponding noted in shale quarry floor.
- Some thermokarsting in armour borrow area observed.

#### Recommended Maintenance:

- No maintenance required.

### **Spillway**

#### Observations:

- Small pond at inlet on Surface Cell cover, depth not exceeding 20 cm.
- Some erosion of access ramp occurring on southwest side.
- No debris falling into spillway bottom from diabase area, as has been observed previously.

**BGC Project Memorandum**

To: Murray Markle, Nanisivik Mine

From: Geoff Claypool, BGC

Date: July 18, 2008

Subject: 2008 Annual Inspection Summary Memo

Proj. No: 0255-017-02

---

- One settlement area observed in spillway bottom near outlet.

**Recommended Maintenance:**

- Re-level access road.
- Place additional rockfill in settlement area near spillway outlet.
- Re-grade area near deflection berms.
- Apply additional armour to edge of south side of access ramp.

**Industrial Complex****Observations:**

- Permafrost aggradation cover was constructed as per approved reclamation plan.
- No erosion of the portal plug beneath the Industrial Complex was noted. However, it remains unarmoured.

**Recommended Maintenance:**

- The surface of the Industrial Complex portal plug should be armoured.

**Landfill****Observations:**

- No erosion observed on surface of cover.
- No seepage observed at toe of cover.
- Some shale observed exposed on lower portion of west face of cover.
- Armour on surface of cover loose and un-compact.

**Recommended Maintenance:**

- Complete spreading of armour on west face.
- Apply additional compaction to armour surface.

**Landfill Quarry****Observations:**

- No ponding observed in quarry floor.
- No erosion of surface observed.
- Full reclamation of quarry not complete as quarry is still occasionally in use.

**Recommended Maintenance:**

- Complete re-sloping of quarry walls when use of quarry is complete.

**Mt. Fuji Quarry****Observations:**

- No significant ponding observed in quarry floor.
- Quarry benches beginning to fill in.

**Recommended Maintenance:**

- No maintenance required.

**BGC Project Memorandum**

To: Murray Markle, Nanisivik Mine

From: Geoff Claypool, BGC

Date: July 18, 2008

Subject: 2008 Annual Inspection Summary Memo

Proj. No: 0255-017-02

---

**Instrumentation**

The frost gauges were each examined during the inspection. Some of the frost gauges were observed to be low in methyl blue fluid. Others were observed to be completely drained. It is recommended that FG9 in the Surface Cell and FG's 13 and 14 at the East Open Pit be replaced in 2008. As such, the frost gauges currently installed at the EOP should be removed over the winter months and the PVC pipes should be cleared of fluid and ice. Additionally, the other frost gauges may be topped up with methyl blue in 2008 and re-sealed at the top to permit continued use for monitoring during the closure period. The current practice of swabbing the PVC pipes during reading of the frost gauges should be continued.

The original instrumentation plan included frost gauges and thermistors at the West Open Pit. If a drill can be access from ongoing construction activities in Arctic Bay, it is recommended that these instruments be installed in the West Open Pit cover in 2008. Consideration may also be given to installing instrumentation in the Industrial Complex cover.

**Closure**

We trust the enclosed information is sufficient for your present purposes. Please contact the undersigned should you have any questions or comments.

Respectfully submitted

**BGC Engineering Inc.****per:**

Geoff Claypool, P.Eng.

Geological Engineer