

1998

During the morning of 22 May, 1998 the Alaska Department of Fish & Game (ADF&G) received telephone calls from residents of Nome who were concerned about the appearance of the water in Anvil Creek and they asked what ADF&G was going to do about it. Peter Rob of ADF&G, Commercial Fisheries Management & Development Division (CFM&D) spoke with Mac McLean, ADF&G Habitat Division in Fairbanks, and he suggested sampling the waters of Anvil Creek and measuring the amounts of settleable solids in the samples. He said he would send an Imhoff cone to make the measurements. Peter Rob then obtained an Imhoff cone and 1 liter samples bottles from Bob Russell of the Nome Joint Utility System (NJUS), so that sampling could begin immediately. The Imhoff cone sent from Fairbanks arrived in Nome on 26 May 1998.

All samples were collected and processed according to the settleable solid sampling and analysis protocols (Table 1). All samples were collected from the middle of the stream and at approximately mid-depth.

Table 1. Settleable Solid Sampling and Analysis Protocol

Settleable Solids Sampling Protocol

1. Grab samples shall be collected.
2. Samples shall be collected in sterile one liter polypropylene or glass containers.
3. Samples must be cooled to 4° Celsius (iced), if analysis is not performed immediately.
4. Samples must be analyzed within 48 hours of sample collection.

Settleable Solids Analysis Protocol

1. Fill an Imhoff cone to the liter mark with a thoroughly mixed sample.
2. Settle for 45 minutes, then gently stir the sides of the cone with a rod or by gently spinning the cone
3. Settle for 15 minutes longer, then record the volume of settleable matter in the cone as milliliters per liter. Do not estimate any floating material. The lowest measurable mark on the Imhoff cone is 0.1ml/l. Any settleable material below the 0.1ml/l shall be recorded as trace.

Sampling from Anvil Creek just upstream of the culvert under the Nome-Teller Highway started on 22 May 1998. Snowdrifts on the roads up Anvil Creek prevented vehicle access to the mining areas upstream. Distance, snow conditions and time constraints prevented walking upstream to collect samples. From 22 through 26 May the samples collected had either trace readings or 0.1ml/l settleable solids. The 27 and 28 May readings rose to 0.3 and 0.4 ml/l settleable solids. In the morning of 29 May the reading was 0.2ml/l settleable solids (Table 2). At this time the snow had melted enough to allow vehicle access part of the way up Anvil Creek so Peter Rob walked upstream to see

what was occurring. The first series of settling ponds next to Anvil Creek are part of Bert Pettigrew's operations and all had broken walls and deep eroded channels in their bottoms. The discharge from the outlet of the lowest pond was sampled with a result of 12ml/l settleable solids (Table 3). Peter Rob did not go further upstream than these ponds at this time. He could hear and see equipment operating at Pettigrew's operation next to the Glacier Creek Road above Anvil Creek. On the afternoon of 29 May, Peter Rob returned to sample Pettigrew's ponds again and to photograph the broken ponds. On the way there he met Scott Miller and John Handeland of the Alaska Gold Company. They said that they were going to talk to Bert Pettigrew and also that they wished they had been notified that there was a problem sooner. Peter Rob told them that he had only realized there was a problem a couple of hours before meeting them. He walked up to the ponds and met Scott Miller and Bert Pettigrew there. We looked at the ponds and Bert Pettigrew said he would get some equipment mobilized and would fix the problem right away. After a discussion with Scott Miller about the boundaries of the various Anvil Creek mining operations, Peter Rob continued upstream and collected a sample (0.6ml/l settleable solids) from Anvil Creek above Bert Pettigrew's operations (Table 5). Peter Rob resampled the Pettigrew pond outlet (14ml/l settleable solids) (Table 3), and sampled Anvil Creek next to the old water gauge downstream of all Pettigrew operations (2ml/l settleable solids) and also returned to sample Anvil Creek at the Nome-Teller highway for comparison (1ml/l settleable solids) (Table 2), this reading was five times higher than the morning reading. In retrospect, it seems that the ponds broke open sometime after the last low reading at the Nome-Teller highway on 26 May and the readings dramatically increased as the water flow through the ponds scoured the solids from the pond bottoms. The water entering the ponds from the hillside was not sampled, but it appeared clean. Scott Miller and Mac McLean said that diversion channels had been dug around these ponds last year so that water would not enter them; unfortunately snow and ice build up prevented the diversions from working. After collecting the last sample, Peter Rob drove up Glacier Creek Road to look at the upper operations, there was still a significant amount of snow covering them, and Bert Pettigrew was operating a Cat and beginning to repair the walls of his lowest pond. The Glacier Creek Road was open only as far as Pettigrew's operations.

On 30 May 1998, Kate Persons, ADF&G, Wildlife Conservation Division and Peter Rob returned to sample Anvil Creek. The lowest Pettigrew pond had been repaired and two discharge pipes placed in the dyke. The sample from the outfall was much improved (0.2ml/l settleable solids) (Table 3). Upstream of these ponds the snow and ice along Anvil Creek had melted enough to expose significant runoff from the vicinity of Pettigrew's workings next to Glacier Creek Road – a sample from the largest flow had 1.8ml/l settleable solids (Table 4). They continued upstream and collected a sample from just above Pettigrew's operations (1ml/l settleable solids) (Table 5). The water running from Specimen Gulch was extremely dirty looking. The creek in Specimen Gulch still had significant areas of snow cover and bridging. An operating discharge pipe from a

pond up the gulch was visible and a sample was collected from the flow vortex entering the pipe in the pond (4ml/l settleable solids) (Table 6). The area below the pipe discharge seemed very unstable and Peter Rob did not want to climb down into the gully the water had created there. A sample was also collected from Anvil Creek above Glacier Creek Road (0.2ml/l settleable solids) (Table 7).

On 31 May 1998, Kate Persons and Peter Rob collected samples from all points sampled the previous day, except for Specimen Gulch where the sample was collected at the Glacier Creek Road culvert because of the difficult walking up Specimen Gulch. To sample Specimen Gulch and above Glacier Creek Road they drove to Pettigrew's Glacier Creek Road operations and parked by the first snowdrifts blocking the road, they then walked to the sampling locations. At this time, they observed that the ponds in Pettigrew's Glacier Creek Road operations were broken with deep erosion gullies. The flows from these upper pond breaks were contributing to the flows sampled along Anvil Creek upstream of Pettigrew's ponds but still draining the area of his operations (4ml/l settleable solids on 31 May) (Table 4).

On Monday morning 1 June 1998, Peter Rob spoke with Scot Miller of Alaska Gold and described the weekend activities and findings. Peter Rob again collected samples from all points sampled the previous day. When he parked on Glacier Creek Road, he observed Bert Pettigrew repairing the upper ponds.

On 2 June 1998, Nancy Bauer, ADF&G, CFM&D Division, and Peter Rob collected samples from all points sampled the previous day by. Significant amounts of snow had melted from Specimen Gulch, making access easier, so they returned in the afternoon and discovered that most of the ponds up Specimen Gulch had broken and washed out. A sample was collected above the ponds, near the site of what appears to be last summer's wash operation (2.2ml/l settleable solids). There are signs of significant mining activity above this point. A sample was collected from near the pond outlet sampled on 30 May. The outlet had washed out so the sample was collected from the resulting channel (12ml/l settleable solids) (Table 6).

On 3 June 1998, Nancy Bauer and Peter Rob collected samples from all points sampled the previous day, except for Specimen Gulch at the Glacier Creek Road culvert. Photographs were taken of the Specimen Gulch ponds. The Alaska Department of Transportation (DOT) was beginning to plow snow on Glacier Creek road when we returned to Nome.

On 4 June 1998, Nancy Bauer and Peter Rob collected samples, from all points sampled the previous day, except from next to the wash plant in Upper Specimen Gulch. The Alaska DOT had plowed Glacier Creek Road just beyond the pass between the Anvil and Glacier Creek watersheds, from the height of the land it was apparent that many of the settling ponds in the Anvil Creek drainage above Glacier Creek Road had broken and washed out. Nancy Bauer returned to

photograph the washed out ponds above Glacier Creek Road and she collected one sample (50ml/l settleable solids) (Table 8) from the outflow of the first washed out pond above the road.

On 5 June 1998, Nancy Bauer collected samples from all locations sampled the previous day, except the one from the washed out pond above the Glacier Creek Road. Peter Rob and Nancy Bauer collected that sample (24ml/l settleable solids). An additional sample was collected for the flow from the washed out pond before it reached Anvil Creek (trace of settleable solids) (Table 8). The washed out ponds are far enough away from Anvil Creek and the terrain is flat enough that it appears that most of the washed out settleable solids have been deposited on the tundra, in the willows, and behind snow and road berms.

Table 2. Settleable Solids measured using 1 liter samples taken from Anvil Creek below all recent mining activity and measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
22-May	15:00	trace <0.1 ml	Taken just upstream of Teller Highway culvert
23-May	10:00	trace <0.1 ml	Taken just upstream of Teller Highway culvert
24-May	10:30	0.1 ml	Taken just upstream of Teller Highway culvert
25-May	12:00	0.1 ml	Taken just upstream of Teller Highway culvert
26-May	15:00	trace <0.1 ml	Taken just upstream of Teller Highway culvert
27-May	14:00	0.3 ml	Taken just upstream of Teller Highway culvert
28-May	14:00	0.4 ml	Taken just upstream of Teller Highway culvert
29-May	10:00	0.2 ml	Taken just upstream of Teller Highway culvert
29-May	15:30	1 ml	Taken just upstream of Teller Highway culvert
29-May	14:45	2 ml	Taken next to old water guage
30-May	14:30	1.1 ml	Taken next to old water guage
31-May	14:00	0.9 ml	Taken next to old water guage
1-Jun	12:35	0.9 ml	Taken next to old water guage
2-Jun	10:10	0.4 ml	Taken next to old water guage
3-Jun	11:45	0.4 ml	Taken next to old water guage
4-Jun	9:10	0.4 ml	Taken next to old water guage
5-Jun	9:30	0.8 ml	Taken next to old water guage

Table 3. Settleable Solids measured using 1 liter samples taken from the outfall of the bottom Pettigrew settling ponds and measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
29-May	11:00	12 ml	Extreme turbidity a line noted at 12ml after standard settling time 1 hour.
29-May	11:00	15 ml	After settling 3 hours
29-May	15:00	14 ml	Saw Scott Miller who asked Pettigrew to repair ponds
30-May	14:20	0.2 ml	Dams rebuilt on bottom pond
31-May	11:55	0.1 ml	
1-Jun	12:30	0.1 ml	
2-Jun	10:05	trace	
3-Jun	10:40	trace	
4-Jun	9:10	trace	
5-Jun	9:20	trace	

Table 4. Settleable Solids measured using 1 liter samples taken from flow into Anvil Creek upstream of Pettigrew ponds but still draining the Pettigrew workings and measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
30-May	14:10	1.8 ml	Samples taken above road running up Anvil Creek. Water appears to be coming from Pettigrews recent works where there are more broken ponds
31-May	11:50	4.25 ml	
1-Jun	12:25	1.4 ml	Pettigrew was repairing his upper ponds this morning
2-Jun	10:00	0.8 ml	
3-Jun	10:35	0.8 ml	
4-Jun	9:05	0.2 ml	
5-Jun	13:00	1 ml	

Table 5. Settleable Solids measured using 1 liter samples taken from Anvil Creek just upstream of Pettigrew operations and measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
29-May	15:15	0.6 ml	
30-May	14:00	1 ml	
31-May	11:40	1.1 ml	
1-Jun	12:20	0.8 ml	
2-Jun	9:55	0.8 ml	
3-Jun	10:30	0.8 ml	
4-Jun	9:00	0.9 ml	
5-Jun	9:15	0.9 ml	

Table 6. Settleable Solids measured using 1 liter samples taken from Specimen Gulch measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
30-May	13:30	4 ml	Taken from first pond outlet
31-May	11:30	5.75 ml	Taken at Glacier Creek Road
1-Jun	12:00	4 ml	Taken at Glacier Creek Road
2-Jun	10:30	2.8 ml	Taken at Glacier Creek Road
2-Jun	14:45	2.2 ml	Taken next to old wash plant above ponds
2-Jun	14:35	12 ml	Taken from flow out of first pond
3-Jun	9:05	0.5 ml	Taken next to old wash plant above ponds
3-Jun	9:15	10 ml	Taken from flow out of first pond
4-Jun	8:35	4 ml	Taken from flow out of first pond
5-Jun	9:00	6 ml	Taken from flow out of first pond

Table 7. Settleable Solids measured using 1 liter samples taken from Anvil Creek just upstream of the Glacier Creek Road culvert and measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
30-May	13:45	0.2 ml	
31-May	11:25	0.2 ml	
1-Jun	11:50	0.2 ml	
2-Jun	10:25	0.1 ml	
3-Jun	9:30	trace	
4-Jun	8:45	trace	
5-Jun		trace	

Table 8. Settleable solids measured using 1 liter samples taken from the outflow of the first washed out Walsh pond above the Anvil Creek culvert under Glacier Creek Road.

Date	Sample Time	ml solids/liter	Remarks
4-Jun	14:00	50 ml	Taken from outflow from this pond
5-Jun	9:00	trace	Taken from flow just before it reaches Anvil Creek
5-Jun	11:10	24 ml	Taken just inside pond

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Table 9. Settleable Solids measured using 1 liter samples taken approximately 100 meters upstream of the Taylor Highway culvert and measured in an Imhoff cone.

Date	Sample Time	ml solids/liter	Remarks
27-May	12:30	0.1 ml	
28-May	8:00	0.1 ml	
29-May	8:00	0.3 ml	
30-May	10:30	2.5 ml	
31-May	10:30	1.9 ml	
1-Jun	7:30	1 ml	
2-Jun	7:30	0.5 ml	
3-Jun	7:30	0.3 ml	
4-Jun	7:10	0.2 ml	
5-Jun	7:10	0.4 ml	