2020 Late Winter Snow Survey and Sample Results Summary

Revision 0

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APPENDIX

Appendix A: New Gold Rainy River Mine Snow Sampling Procedure - Draft

1. OBJECTIVES OF 2020 LATE WINTER SNOW SURVEY AND SAMPLE PROGRAM

A snow sampling program was established for New Gold Rainy River Mine (RRM) in 2019 to satisfy Federal Follow Up Monitoring commitment 13.5.2 H which states;

> *As a component of the RRP stormwater management plan, collect and analyze late winter snowpack samples for pH and metals to help determine the effects of dustfall accumulated within the snowpack during spring melt.*

In addition to the collection and analysis of late winter snowpack samples, snow depth and snow water equivalent surveys were conducted to inform the New Gold RRM Site Wide Water Balance. A standard operating procedure, New Gold RRM Snow Sampling Procedure, was prepared from provincial and federal snow survey reference documents (Appendix A), then executed in locations divided by site sub-watershed and ranked by greatest concern for dustfall accumulation in the snowpack, with the addition of reference samples (Figure 1). A previous tailings dusting event in November 2018 was also considered in the planning of snow survey and sampling locations.

Depth of snow on the ground and number of days of snow on the ground were analyzed from the Environment and Climate Change (ECCC) Barwick weather station (Climate ID: 6020559), which reports with an approximate two to three-day delay. Weather conditions were analyzed from the New Gold Barron Site weather station for the duration of the snowpack. The surveys and sample collection were completed with Metric Prairie Snow Samplers.

The first snow survey and sample collection (sample name SNOW04) took place on February 26, 2020 south of the Mine Rock Pond where the ESA boundary juts south (Figure 1). The second snow survey and sample collection (SNOW11) took place on February 28, 2020 in the open area off the road between Teeple and Clark Dams (Figure 1). The third, fourth and fifth snow surveys and sample collection took place on March 2, 2020 in the vicinity of the Water Management Pond (SNOW03), Sediment Pond 1 (SNOW07) and at the North Air Quality Station on Gallinger Road (Figure 1). Additional snow samples were collected in the vicinity of the Stockpile Pond (SNOW09), the former Pinewood Pumphouse (SNOW12) and the South Air Quality Station on McMillan Road (SNOW14) (Figure 1).

2. 2020 SNOW SURVEY RESULTS

New Gold Rainy River snow survey results were summarized and included in the New Gold Rainy River Site Water Balance. The snow water equivalent (SWE) ranged across the five surveyed sites from 7 to 11 cm, averaging approximately 10 cm. Comparison to available regional snow survey data (average SWE 9 cm) was completed to confirm the results obtained from New Gold RRM snow surveys. The summarized snow survey results are provided in Table 1. The selection and ranking of the snow survey location is further detailed in the Snow Sampling Procedure included in Appendix A.

3. 2020 SNOW SAMPLE RESULTS

During the snow surveys conducted, the snow cores were collected and a composite sample for the snow survey location was submitted to ALS Laboratory in Thunder Bay for analysis. The sample results are summarized in Table 2, with metals of concern emboldened. The data has been converted to mg/dm^2/day for comparison to dustfall data. This was accomplished by dividing the mg/L result by

number of days there was snow on the ground before the sample (sample exposure days) to achieve mg/L/day, then further converted to mg/dm²/day, where 1 mg/L is equivalent to 1 mg/dm².

It was determined from the Barwick Weather Station that relevant snowpack dates for our sample data analysis were November 1, 2019 to the date that each sample was collected, referred to as the calculated (sample) exposure period. For purposes of comparison, New Gold RRM Monthly Dustfall results for the period of November 1, 2019 through March 31, 2020 are summarized in Table 3.

A quick analysis of the average daily wind speeds and directions was also completed for the calculated exposure period for the collected snow samples. This data is summarized in Tables 4 and 5. The average daily wind speed was most commonly in the range of 6 to 11 km/hr. The prevailing wind directions for the calculated snowpack exposure period were from the west, southwest and northwest. This information suggests that the snow samples collected to the northeast, east and southeast of site point sources of dust may have increased exposure to dust originating from New Gold RRM. The Barwick precipitation and snow on the ground data and New Gold Barron Site weather station data for the calculated exposure period are also provided in Tables 6 and 7, respectively.

The results for the snow samples collected in the vicinity of the New Gold RRM Air Quality Stations can be directly compared against the dustfall data collected at the New Gold Air Quality Stations. Sample SNOW13 results can be directly compared to the North Air Quality station dustfall results. Sample SNOW14 results can be directly compared to the South Air Quality station dustfall results. It appears that less dust falls out at the SNOW14 sample location than the South Air Quality station, and the opposite appears to be true for the SNOW13 sample location than the North Air Quality station. Snow samples will continue to be collected at New Gold RRM Air Quality Stations for comparison purposes.

4. CONCLUSIONS

The 2020 late winter snow sampling program was successful. The data gathered with regards to the snowpack depth and snow water equivalent distribution around site is important for spring freshet water management planning. Additional snow sample locations added for areas of concern for the 2020 late winter snowpack monitoring program will continue in 2021, a snow survey may or may not be conducted at the same time. The New Gold RRM Snow Sampling Procedure will continue to be refined as the monitoring continues.

Table 1: New Gold Rainy River Mine Snow Survey Results Summary

2020 Snow Survey Area	Watershed	Description	Area (m2)	SWE (cm)	Average Calculated Runoff (m3)	-1 SWE (cm)	+1 SWE (cm)
Offsite							
1	8	Upper West Creek	12,018,749	10	324,506	292,056	356,957
4	5	South of Pit/MRP	4,739,639	**9**	115,173	102,376	127,970
11	14	Teeple/Clark	7,872,637	**11**	233,817	212,561	255,073
Onsite							
2	2,3,4	Lower Loslo Creek	5,344,175	10	187,046	168,342	205,751
3	1d	WMP	1,090,775	**7**	75,591	64,792	86,389
3	1a,b,c	TMA	11,854,094	**7**	555,957	476,535	635,379
5	9	Lower Marr Creek	1,803,297	10	63,115	56,804	69,427
6	13	MRP watershed	5,413,104	**11**	279,857	254,416	305,299
7	7	Sed Pond 1 watershed	1,521,786	**9**	73,959	65,741	82,176
8	6	Sed Pond 2 watershed	1,647,578	10	57,665	51,899	63,432
9	12	Plant Site	1,081,914	10	37,867	34,080	41,654
10	10,11	Open Pit and area	2,993,852	10	89,816	80,834	98,797
				Total	1,420,873	1,253,442	1,588,305
Pinewood Watershed to H1 Hydrometric Station - Pre-Rainy River Mine condition							
12	NA		221,000,000	10	5,967,000	5,370,300	6,563,700

Table 2: New Gold Rainy River Mine Snow Sample Results Summary

November 1, 2019 to	2-Mar-2020	26-Feb-2020	2-Mar-2020	2-Mar-2020	28-Feb-2020	2-Mar-2020	2-Mar-2020	2-Mar-2020
Location	SNOW03	SNOW04	SNOW07	SNOW09	SNOW11	SNOW12	SNOW13	SNOW14
Calculated Exposure Days	123	118	123	123	120	123	123	123
Snow on Ground (cm)	48	44	38	51	51	51	48	51
	mg/dm2/day							
Aluminum (Al)-Total	0.00065	0.01975	0.02732	0.01122	0.01192	0.00012	0.00371	0.01236
Antimony (Sb)-Total	0.0000002	0.0000010	0.0000013	0.0000046	0.0000008	0.0000001	0.0000003	0.0000007
Arsenic (As)-Total	0.0000008	0.0000068	0.0000106	0.0000187	0.0000033	0.0000002	0.0000008	0.0000041
Barium (Ba)-Total	0.0000488	0.0001186	0.0001463	0.0001789	0.0000750	0.0000049	0.0000325	0.0000894
Beryllium (Be)-Total	0.00000002	0.00000026	0.00000038	0.00000028	0.00000017	0.00000000	0.00000009	0.00000023
Bismuth (Bi)-Total	0.00000008	0.00000076	0.00000325	0.00000650	0.00000075	0.00000008	0.00000016	0.00000081
Boron (B)-Total	0.0000041	0.0000042	0.0000041	0.0000041	0.0000042	0.0000041	0.0000041	0.0000041
Cadmium (Cd)-Total	0.0000001	0.0000009	0.0000015	0.0000020	0.0000009	0.00000003	0.0000002	0.0000011
Calcium (Ca)-Total	0.007	0.044	0.047	0.234	0.042	0.002	0.011	0.022
Chromium (Cr)-Total	0.0000016	0.0000178	0.0000252	0.0000065	0.0000125	0.0000003	0.0000049	0.0000138
Cobalt (Co)-Total	0.0000005	0.0000048	0.0000075	0.0000029	0.0000029	0.0000002	0.0000015	0.0000042
Copper (Cu)-Total	0.000007	0.000046	0.000067	0.000089	0.000034	0.000002	0.000012	0.000030
Iron (Fe)-Total	0.00054	0.01568	0.02285	0.00558	0.00942	0.00010	0.00319	0.01057
Lead (Pb)-Total	0.000001	0.000026	0.000029	0.000119	0.000016	0.0000005	0.000004	0.000022
Lithium (Li)-Total	0.000003	0.000034	0.000049	0.000008	0.000017	0.000002	0.000008	0.000016
Magnesium (Mg)-Total	0.0009	0.0101	0.0183	0.0057	0.0083	0.0004	0.0027	0.0066
Manganese (Mn)-Total	0.00008	0.00067	0.00085	0.00307	0.00049	0.00002	0.00016	0.00041
Molybdenum (Mo)-Total	0.00000041	0.00000169	0.00000325	0.00000244	0.00000250	0.00000016	0.00000163	0.00000163
Nickel (Ni)-Total	0.000002	0.000013	0.000020	0.000011	0.000011	0.0000005	0.000004	0.000011
Phosphorus (P)-Total	0.00016	0.00076	0.00065	0.00159	0.00079	0.00004	0.00020	0.00053
Potassium (K)-Total	0.0024	0.0049	0.0097	0.0059	0.0181	0.0006	0.0025	0.0030
Selenium (Se)-Total	0.0000001	0.0000003	0.0000003	0.0000007	0.0000003	0.0000002	0.0000001	0.0000004
Silicon (Si)-Total	0.00002	0.01568	0.02618	0.00911	0.00858	0.00002	0.00002	0.00805
Silver (Ag)-Total	0.0000001	0.0000009	0.0000011	0.0000002	0.0000004	0.00000001	0.0000001	0.0000005
Sodium (Na)-Total	0.0005	0.0024	0.0053	0.0029	0.0013	0.0003	0.0009	0.0040
Strontium (Sr)-Total	0.000020	0.000119	0.000141	0.000320	0.000083	0.000005	0.000029	0.000075
Thallium (Tl)-Total	0.00000004	0.0000002	0.0000002	0.0000002	0.0000002	0.00000004	0.00000004	0.00000016
Tin (Sn)-Total	0.0000007	0.0000017	0.0000016	0.0000049	0.0000033	0.0000007	0.0000008	0.0000008
Titanium (Ti)-Total	0.00002	0.00036	0.00048	0.00003	0.00019	0.00000	0.00009	0.00033
Uranium (U)-Total	0.00000003	0.00000034	0.00000065	0.00000073	0.00000024	0.00000000	0.00000014	0.00000024
Vanadium (V)-Total	0.000002	0.000024	0.000036	0.000007	0.000014	0.000000	0.000006	0.000016
Zinc (Zn)-Total	0.00005	0.00032	0.00039	0.00046	0.00025	0.00002	0.00008	0.00036
pH	6.56	7.15	7.49	8.28	6.99	5.91	6.61	6.91

Table 3: New Gold Rainy River Mine Dustfall Sample Results Summary

Calculated for November 2019 to March 2020		
Location	NORTH	SOUTH
Actual Exposure Days	146	146
Snow on Ground (cm) (Mar-2)	51	51
	mg/dm2/day	
Aluminum (Al)-Total	0.00687	0.00805
Antimony (Sb)-Total	0.0000023	0.0000021
Arsenic (As)-Total	0.0000893	0.0000918
Barium (Ba)-Total	0.0000430	0.0000485
Beryllium (Be)-Total	0.0000113	0.0000105
Bismuth (Bi)-Total	0.000011	0.000011
Boron (B)-Total	0.000228	0.00021
Cadmium (Cd)-Total	0.0000011	0.0000011
Calcium (Ca)-Total	0.010	0.011
Chromium (Cr)-Total	0.00001594	0.0000121
Cobalt (Co)-Total	0.0000030	0.0000025
Copper (Cu)-Total	0.0000318	0.000030
Iron (Fe)-Total	0.005364	0.00588
Lead (Pb)-Total	0.000007	0.000011
Lithium (Li)-Total	0.0001132	0.000105
Magnesium (Mg)-Total	0.0034	0.0038
Manganese (Mn)-Total	0.00018	0.00021
Molybdenum (Mo)-Total	0.00000134	0.000001316
Nickel (Ni)-Total	0.000019	0.00001154
Phosphorus (P)-Total	0.001132	0.00105
Potassium (K)-Total	0.0019	0.0019
Selenium (Se)-Total	0.0000228	0.0000210
Silicon (Si)-Total	0.011236	0.012910
Silver (Ag)-Total	0.0000003	0.0000003
Sodium (Na)-Total	0.0018	0.0016
Strontium (Sr)-Total	0.000038	0.000041
Thallium (Tl)-Total	0.0000023	0.0000021
Tin (Sn)-Total	0.0000026	0.0000021
Titanium (Ti)-Total	0.00029	0.00027
Uranium (U)-Total	0.00000031	0.00000024
Vanadium (V)-Total	0.00002	0.00002
Zinc (Zn)-Total	0.00015	0.00012

Table 4: New Gold Barron Site Daily Average Wind Speed by Beaufort Scale Description For Snowpack Exposure Period (November 1, 2019 to March 31, 2020)

Average Wind Speed (km/hr)	Beaufort Scale Description	Frequency Days (#)	Percent (%)	Cumulative Percent (%)
<1	Calm	0	0	0
1 to 5	Light Air	18	12	12
6 to 11	Light Breeze	100	66	78
12 to 19	Gentle Breeze	33	22	99
20 to 28	Moderate Breeze	1	1	100
29 to 38	Fresh Breeze	0	0	100
Total		152	100	

Table 5: New Gold Barron Site Daily Average Wind Direction by Compass Direction for Snowpack Exposure Period

Average Wind Direction^ (Degrees)	Compass Direction Description	Frequency Days (#)	Percent (%)	Cumulative Percent (%)
45	Northeast	15	10	10
90	East	15	10	20
135	Southeast	17	11	31
180	South	17	11	42
225	Southwest	25	16	59
270	West	33	22	80
315	Northwest	20	13	93
360	North	10	7	100
Total		152	100	
^ Direction is a range +/- 22.5 degrees				

Table 6: Barwick Weather Station (ECCC Climate ID: 6020559) Precipitation and Snow on Ground Data for November 1, 2019 to March 31, 2020.

Date	Wind Speed	Wind Direction	Max Temperature	Min Temperature
	km/hr	° (degrees)	°C	°C
11/1/2019	11.6	268.5	0.48	-2.05
11/2/2019	10.9	285.2	-0.80	-4.25
11/3/2019	6.1	188.1	2.82	-3.98
11/4/2019	11.4	301.9	0.22	-8.41
11/5/2019	11.6	263.5	-7.53	-10.71
11/6/2019	10.4	285.4	-6.28	-11.53
11/7/2019	6.5	244.7	-7.97	-16.23
11/8/2019	8.9	161.2	-3.85	-15.45
11/9/2019	9.5	285.8	-1.65	-6.31
11/10/2019	11.5	323.6	-6.14	-15.05
11/11/2019	9.7	298.1	-12.92	-24.95
11/12/2019	10.6	152.8	-9.09	-28.20
11/13/2019	10.0	251.6	-5.51	-10.17
11/14/2019	12.2	267.7	-2.73	-12.85
11/15/2019	7.2	149.9	-4.49	-16.54
11/16/2019	15.9	169.8	5.59	-5.09
11/17/2019	11.0	275.7	2.21	-3.68
11/18/2019	9.5	157.5	-0.66	-3.85
11/19/2019	5.8	227.5	1.74	-1.07
11/20/2019	4.7	20.8	1.02	-1.61
11/21/2019	13.9	320.1	-1.47	-10.41
11/22/2019	14.1	216.1	0.14	-11.39
11/23/2019	9.6	238.5	2.31	-9.05
11/24/2019	7.6	257.0	6.09	-2.46
11/25/2019	11.9	30.6	1.09	-2.46
11/26/2019	6.6	53.2	-2.25	-5.10
11/27/2019	13.7	24.7	-3.64	-6.68
11/28/2019	7.3	64.4	-6.41	-7.94
11/29/2019	11.3	95.9	-1.20	-7.26
11/30/2019	18.8	70.6	-1.98	-7.13
12/1/2019	8.2	28.3	-2.71	-19.48
12/2/2019	8.8	195.9	-0.86	-20.33
12/3/2019	8.8	251.1	-1.51	-9.52
12/4/2019	10.5	297.9	-0.33	-12.17
12/5/2019	9.4	302.5	-2.18	-11.76
12/6/2019	8.2	226.7	-7.13	-17.53
12/7/2019	9.4	170.5	-0.93	-7.43
12/8/2019	14.7	14.1	-1.00	-16.88
12/9/2019	7.5	337.4	-15.06	-22.41
12/10/2019	11.4	268.1	-18.16	-27.90
12/11/2019	8.4	252.0	-17.86	-29.33
12/12/2019	5.9	74.6	-12.25	-23.79
12/13/2019	7.6	58.8	-8.24	-14.30
12/14/2019	9.7	315.0	-10.98	-32.86

Table 6 cont'd: Barwick Weather Station (ECCC Climate ID: 6020559) Precipitation and Snow on Ground Data for November 1, 2019 to March 31, 2020.

Date	Wind Speed	Wind Direction	Max Temperature	Min Temperature
	km/hr	° (degrees)	°C	°C
12/15/2019	5.2	182.1	-11.39	-35.78
12/16/2019	10.8	243.7	-7.80	-15.80
12/17/2019	11.8	304.3	-7.94	-33.88
12/18/2019	8.8	137.8	-13.79	-35.03
12/19/2019	6.5	87.0	-9.43	-21.05
12/20/2019	10.8	139.4	-4.63	-12.34
12/21/2019	8.3	199.4	1.84	-11.83
12/22/2019	9.8	227.8	6.70	-13.39
12/23/2019	9.9	56.0	-2.86	-14.58
12/24/2019	6.6	192.2	-1.64	-6.48
12/25/2019	9.8	70.0	-0.49	-5.24
12/26/2019	10.7	315.6	-0.20	-6.96
12/27/2019	13.0	227.8	-1.35	-8.65
12/28/2019	6.6	104.7	-2.69	-14.10
12/29/2019	20.9	44.3	-3.71	-8.04
12/30/2019	15.7	2.6	-6.48	-8.28
12/31/2019	7.4	269.7	-7.46	-20.78
1/1/2020	5.0	146.5	-4.86	-14.74
1/2/2020	11.3	280.7	-3.51	-9.56
1/3/2020	6.6	262.5	-3.88	-8.85
1/4/2020	7.3	200.6	-2.59	-5.40
1/5/2020	15.1	249.6	-2.32	-9.46
1/6/2020	9.8	234.6	-1.21	-20.95
1/7/2020	16.4	291.0	-6.18	-23.21
1/8/2020	8.9	94.2	-14.64	-36.56
1/9/2020	11.4	187.0	-8.31	-14.88
1/10/2020	10.9	266.3	-11.97	-32.45
1/11/2020	7.4	77.7	-16.62	-38.50
1/12/2020	13.3	94.9	-11.39	-19.22
1/13/2020	11.4	126.8	-4.63	-11.59
1/14/2020	9.1	286.2	-5.51	-22.81
1/15/2020	8.9	298.1	-17.22	-25.56
1/16/2020	6.5	264.6	-20.48	-33.88
1/17/2020	17.8	118.8	-7.40	-23.69
1/18/2020	12.0	325.0	-6.08	-13.66
1/19/2020	7.1	302.5	-10.65	-27.43
1/20/2020	6.1	186.5	-10.18	-34.35
1/21/2020	14.2	191.0	-4.05	-19.08
1/22/2020	8.0	181.4	-0.24	-7.40
1/23/2020	11.7	71.1	-3.74	-6.75
1/24/2020	5.5	31.5	-3.51	-8.21
1/25/2020	3.9	291.6	-3.61	-6.41
1/26/2020	5.1	4.0	-5.84	-8.55
1/27/2020	6.3	331.6	-8.38	-10.95

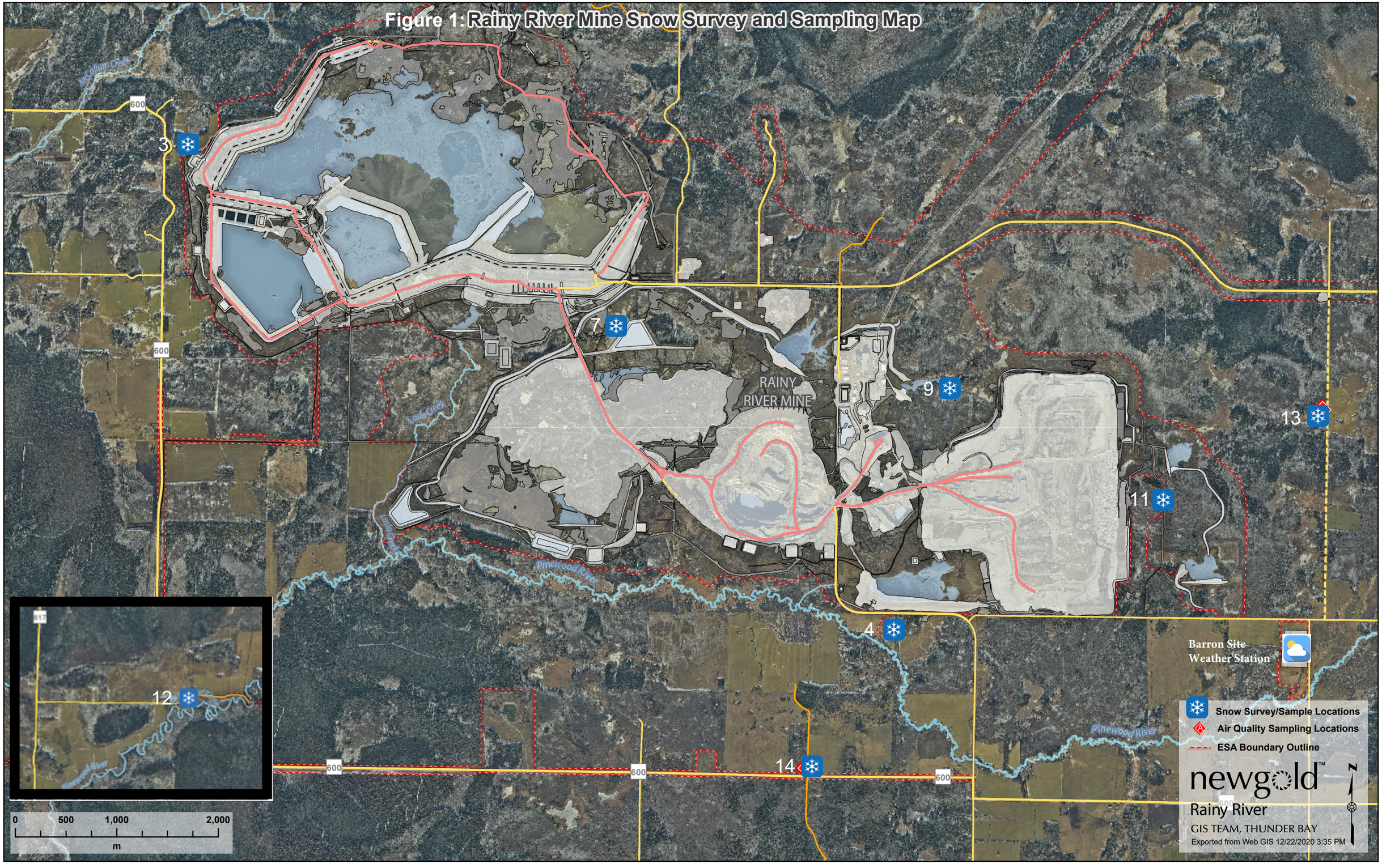
Table 6 cont'd: Barwick Weather Station (ECCC Climate ID: 6020559) Precipitation and Snow on Ground Data for November 1, 2019 to March 31, 2020.

Date	Wind Speed	Wind Direction	Max Temperature	Min Temperature
	km/hr	° (degrees)	°C	°C
1/28/2020	4.5	97.8	-7.61	-11.05
1/29/2020	4.9	119.7	-5.71	-10.17
1/30/2020	5.6	145.3	-4.49	-9.83
1/31/2020	11.9	204.2	-2.12	-14.07
2/1/2020	9.9	213.0	0.58	-9.19
2/2/2020	9.9	291.5	0.35	-6.18
2/3/2020	14.6	295.0	-3.95	-19.15
2/4/2020	7.1	239.7	-11.80	-29.26
2/5/2020	11.0	219.4	-1.35	-25.59
2/6/2020	9.7	56.7	-6.29	-17.42
2/7/2020	7.9	51.8	-13.67	-30.79
2/8/2020	5.1	211.2	-11.39	-31.23
2/9/2020	6.2	264.1	-7.61	-23.22
2/10/2020	10.1	228.2	-3.91	-24.40
2/11/2020	14.2	231.6	-1.21	-15.56
2/12/2020	14.7	327.9	-3.71	-32.18
2/13/2020	7.8	257.2	-18.48	-39.86
2/14/2020	15.1	180.3	-4.56	-35.44
2/15/2020	14.6	263.4	-4.46	-20.91
2/16/2020	4.4	110.3	-9.85	-36.50
2/17/2020	8.1	248.0	-5.85	-13.56
2/18/2020	15.1	290.7	-9.93	-22.95
2/19/2020	7.7	257.2	-15.90	-35.65
2/20/2020	12.5	217.6	-6.15	-35.31
2/21/2020	14.7	232.6	3.42	-9.39
2/22/2020	6.7	209.4	8.33	-14.85
2/23/2020	11.8	265.1	3.19	-15.15
2/24/2020	5.6	311.7	3.52	-17.96
2/25/2020	6.4	345.7	-3.98	-20.68
2/26/2020	4.4	20.2	-8.29	-24.54
2/27/2020	4.2	46.0	-6.10	-27.05
2/28/2020	4.1	351.0	-4.98	-30.65
2/29/2020	8.7	165.9	3.21	-20.47
3/1/2020	16.5	227.0	4.70	-4.42
3/2/2020	17.5	231.0	1.33	-6.68
3/3/2020	15.2	278.3	-0.39	-13.97
3/4/2020	7.5	150.3	1.18	-22.61
3/5/2020	14.1	42.7	-0.81	-17.99
3/6/2020	11.5	148.3	3.12	-23.62
3/7/2020	9.2	150.5	9.53	-2.59
3/8/2020	10.7	51.5	10.75	-4.97
3/9/2020	10.4	304.9	-4.16	-12.85
3/10/2020	5.2	234.6	0.41	-12.07
3/11/2020	7.9	147.5	2.69	-15.56

Table 6 cont'd: Barwick Weather Station (ECCC Climate ID: 6020559) Precipitation and Snow on Ground Data for November 1, 2019 to March 31, 2020.

Date	Wind Speed	Wind Direction	Max Temperature	Min Temperature
	km/hr	° (degrees)	°C	°C
3/12/2020	11.5	286.9	2.04	-7.02
3/13/2020	18.3	299.2	-5.34	-10.74
3/14/2020	6.6	42.0	-2.44	-19.79
3/15/2020	9.4	135.2	0.11	-12.17
3/16/2020	15.8	255.7	-1.91	-10.51
3/17/2020	8.3	278.1	-0.88	-14.33
3/18/2020	9.8	73.9	2.16	-13.52
3/19/2020	13.9	9.3	-1.51	-9.76
3/20/2020	8.8	350.5	-3.29	-21.42
3/21/2020	9.5	118.3	-0.10	-23.62
3/22/2020	10.1	160.2	-0.16	-7.60
3/23/2020	8.5	238.0	6.09	-6.24
3/24/2020	17.2	172.5	7.89	-2.29
3/25/2020	12.1	335.5	3.30	-5.77
3/26/2020	8.2	210.8	4.20	-10.13
3/27/2020	10.3	218.7	7.62	-8.04
3/28/2020	8.9	73.3	9.33	-8.61
3/29/2020	12.6	16.3	12.41	-1.78
3/30/2020	8.6	98.1	11.33	-6.04
3/31/2020	10.1	120.6	12.35	-2.83

Figure 1: Rainy River Mine Snow Survey and Sampling Map



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2020 Late Winter Snow Survey and Sample Results Summary

Appendix A

Snow Survey and Sampling Procedure

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Standard Operating Procedure

Document Title: Snow Survey and Sampling Procedure	**Document Number:** ENV-SOP-0021
Department: Environment	**Owner: Amanda Jacobs**

Version Created	Date	Author	Comments and Updated Sections
Rev 0	February 28, 2019	Amanda Jacobs	
Rev 1	December 20, 2020	Amanda Jacobs	Updates

Approvals

Title	Name	Signature	Date
Environmental Manager	Sylvie St. Jean		

newgold™ Rainy River	**ENV-SOP-0021** **Snow Survey and Sampling Procedure**
Department: Environment	**Status:** Draft
Review Frequency: 3 years	**Date Approved:** Not Approved

1.0 Purpose

This document details the requirements and procedure for snow sampling at New Gold Rainy River Mine (RRM). The intent of snow survey and sampling is to measure snow accumulation, gather snow water content and snow chemistry data to be prepared for spring freshet, manage the site water supply and to fulfil Federal Commitment 13.5.2 H (Follow-up Monitoring Program).

2.0 Scope

This procedure is an outline of the snow survey and sampling activities performed by the RRM Environmental Department.

3.0 Definitions

Snow Water Equivalent (SWE)	The equivalent volume of water contained in a known volume of snow. This information is used for spring freshet and water supply planning, and flood event forecasting.

4.0 Responsibilities

4.1 Environmental Department

- Conduct snow survey and sampling according to this procedure
- Report snow accumulation, snow water content and snow chemistry data, as required
- Communicate snow accumulation, snow water content and snow chemistry data to site stakeholders
- Maintain snow sampling equipment
- Submit snow chemistry samples to external laboratory to fulfil commitments
- Inform Site Water Balance of SWE of site watersheds

5.0 Procedure

5.1 Required Training and Qualifications

Snow survey and sampling will be conducted by RRM Environment Department personnel. Environment Department personnel should be familiar with this procedure as well as the documents referenced in Section 7.

5.2 Identification of Survey Data and Samples

The snow survey and sampling locations were selected based on the Rainy River Mine Snow Survey/Sample Area Location map (Figure 3) included in Appendix A**.**

5.2.1 Snow Survey/Sample Areas

Refer to Figure 3 in Appendix A, snow survey/sample areas are grouped by the watershed area(s) they are collected in. They are listed in order of watershed priority, ranked by risk to the environment (fugitive dust) and site water management objectives;

- Snow Survey/Sample Area 1 - Stockpile and West Creek Ponds and Diversions (Watershed 8)
- Snow Survey/Sample Area 2 - Lower Loslo Creek / Constructed Wetlands (Watersheds 2,3,4)
- Snow Survey/Sample Area 3 - Upper Loslo and Marr Creeks / Tailings Management Area (TMA) (Watersheds 1b and 1c)
- Snow Survey/Sample Area 4 - Area south of Stockpiles and Open Pit (Watershed 5)
- Snow Survey/Sample Area 5 - Lower Marr Creek (Watershed 9)
- Snow Survey/Sample Area 6 - Mine Rock Pond / East Mine Rock Stockpile (Watershed 13)
- Snow Survey/Sample Area 7 - Sediment Pond 1 / Overburden Stockpile (Watershed 7)
- Snow Survey/Sample Area 8 - Sediment Pond 2 / West Mine Rock Stockpile (Watershed 6)
- Snow Survey/Sample Area 9 - Plant Site (Watershed 12)
- Snow Survey/Sample Area 10 - Open Pit perimeter (Watershed 10, 11)

Any specific location of concern can be moved up in priority, as required. This priority list does not require that all watersheds be surveyed. Any number of surveys can be completed within a sample area, and will be differentiated by date, time and UTM coordinates of the stations surveyed.

Two reference locations have been identified, as listed below;

- Snow Survey/Sample Area 11 - Teeple / Clark system (Watershed 14)
- Snow Survey/Sample Area 12 – Pinewood Pumphouse (Site Watershed)

The following snow survey/sample areas have been added to correlate with monthly dustfall sampling,

- Snow Survey/Sample Area 13 – North Air Quality Station (Gallinger)
- Snow Survey/Sample Area 14 – South Air Quality Station (Tait)
- Snow Survey/Sample Area 15 – Northwest Air Quality Station (Seven Bends)

Additional areas may be added as needed, as the snow sampling program continues.

5.3 Survey Data and Sample Naming

Snow survey data will be identified by snow survey/sample area, as listed above. If multiple snow surveys are required in one watershed area, they will be identified as Site 1, Site 2, Site 3, etc., as required for each snow survey/sample area.

Snow samples require further measures to ensure they are easily identifiable, and the data can be managed by our environmental data management program

The following snow sample names have been established for the above snow survey/sample areas, any snow chemistry sample or collected within that watershed will be named as follows;

- Snow Sample 1 (Snow01) – Snow Survey/Sample Area 1
- Snow Sample 2 (Snow02) – Snow Survey/Sample Area 2
- Snow Sample 3 (Snow03) – Snow Survey/Sample Area 3
- Snow Sample 4 (Snow04) – Snow Survey/Sample Area 4
- Snow Sample 5 (Snow05) – Snow Survey/Sample Area 5

- Snow Sample 6 (Snow06) – Snow Survey/Sample Area 6
- Snow Sample 7 (Snow07) – Snow Survey/Sample Area 7
- Snow Sample 8 (Snow08) – Snow Survey/Sample Area 8
- Snow Sample 9 (Snow09) – Snow Survey/Sample Area 9
- Snow Sample 10 (Snow10) – Snow Survey/Sample Area 10
- Snow Sample 11 (Snow11) – Snow Survey/Sample Area 11
- Snow Sample 12 (Snow12) – Snow Survey/Sample Area 12
- Snow Sample 13 (Snow13) – Snow Survey/Sample Area 13
- Snow Sample 14 (Snow14) – Snow Survey/Sample Area 14
- Snow Sample 15 (Snow15) – Snow Survey/Sample Area 15
- Snow Sample 16, 17, 18, etc. (Snow16, Snow17, Snow18) - Any sample outside of the snow survey/sample areas on Figure 3 (Appendix A)
- Snow Sample 100 (Snow100) – Duplicate snow sample
- Snow Sample 00 (Snow00) – Field blank

The information to be recorded on each sample bottle label will include;

- Company name
- Sample location name from above snow sample name list
- Date and Time of sample collection

Multiple samples collected within the same watershed area will be identified by date and time of collection, and the UTM coordinates recorded in your field book, should the samples be collected on the same day. A map will be generated for watersheds with multiple sample locations.

Snow chemistry samples will be shipped to an external laboratory for analysis. The analyses will include pH, total suspended solids and total metals. Other parameters of interest may be analyzed at any time. The samples bottles should be requested from the external laboratory two weeks in advance, unless there is a supply of sample bottles on hand.

5.4 Survey and sample site selection

The success of the snow survey and sampling conducted at RRM will depend on the selection of observation sites that are representative of the surrounding area. The site should be easy to access, not subject to excessive wind drifting, and should be in a location that can be sampled year after year to ensure continuity of snow survey and sampling records.

The ideal site is an opening in a wooded area surrounded by hills for wind protection and sloped to allow water runoff below the snowpack. As these conditions are not likely to be encountered, the survey and sample points should be away from fencing, buildings, trees, and other obstructions which would encourage wind drifting. Boulders, fallen logs, underbrush and shrubs should also be avoided. Site selection will also involve consideration of point sources of fugitive dust emissions.

The survey location should have a 270m baseline to complete the snow survey to allow for 10 stations 30m apart, if this is not possible then select an open area to complete the survey in an alternate method as described in the survey and sample collection section.

The following target locations have been identified for each watershed/air quality station, listed below by watershed in order of survey/sample priority;

- Snow Survey/Sample Area 1 – Near the outlet of the West Creek Pond in a V pattern
- Snow Survey/Sample Area 2 –North side of lower West Creek Diversion for snow depth, Tailings Pipeline Corridor Emergency Dump Pond closest to Cell 1 area for snow chemistry

- Snow Survey/Sample Area 3 – Near the wildlife exclusion fence beyond the current footprint of the North Dam, at least 5 metres from the fence
- Snow Survey/Sample Area 4 – South of Mine Rock Pond where ESA boundary juts south
- Snow Survey/Sample Area 5 – Not able to survey stockpile areas, discrete snow depths/samples may be collected
- Snow Survey/Sample Area 6 – South of the Mine Rock Pond where the ESA boundary juts out
- Snow Survey/Sample Area 7 – Along Georgeson Lane south of the Jack Pine stand, beside the WCD
- Snow Survey/Sample Area 8 – Not able to survey stockpile areas, discrete snow depths/samples may be collected
- Snow Survey/Sample Area 9 – Back side of crusher
- Snow Survey/Sample Area 10- Not able to survey open pit, discrete snow depths/samples may be collected
- Snow Survey/Sample Area 11 (Reference 1) - Open area off of road between Teeple and Clark Dams
- Snow Survey/Sample Area 12 (Reference 2) – Pinewood Pumphouse
- Snow Survey/Sample Area 13 (North AQ Station) – In field near station
- Snow Survey/Sample Area 14 (South AQ Station) – In field near station

Coordinates will be collected after the first snow survey is completed for each area and mapped. Snow surveys will be repeated at the same location, or as close to the same location, each year for data continuity.

5.5 Survey and Sample Collection Methods

It is recommended in several of the reference documents that snow surveys be completed twice a month on the first and 15th of each month, or at minimum on the first of each month. The frequency of snow surveys will be assessed on an annual basis with a minimum of one snow survey in late winter at or near maximum snow depth.

Snow chemistry samples will be collected once per year in late winter at or near maximum snow depth. Additional samples may be needed after a significant fugitive dust emission event, or to confirm sample results.

Equipment Required

- Metric Prairie Snow sampler
- Snow scale and hanger
- Brush or other means to remove the snow stuck in the sampler
- Snow knife for removing suck/packed snow from inside of tubing
- Field book, pencil, calculator
- Snowshoes, snowmobile
- PPE/survival gear appropriate to terrain and conditions
- Camera, GPS
- Meter stick
- 20L pail, clean bags, and permanent marker

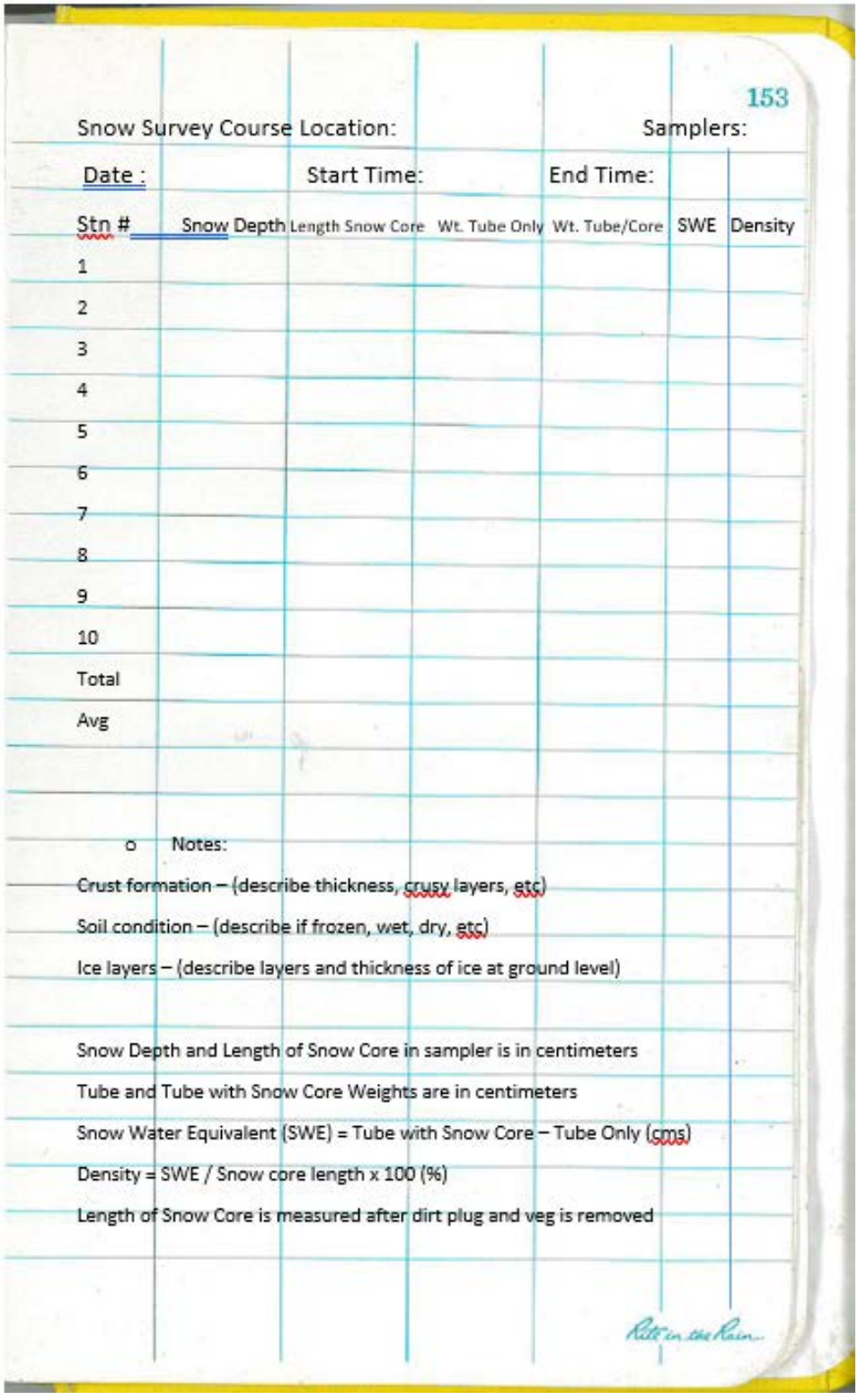
The pail, bags and permanent marker are only required when snow chemistry samples are being collected in conjunction with the snow survey.

Figure 1: Metric Prairie Snow Sampler with Snow Scale and Hangar

(Continued on next page)

It is helpful to have your field book set up in advance, see the example below;

Figure 2: Field Note Book Example



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Snow Survey Course Location: Samplers:

Date : Start Time: End Time:

Stn #	Snow Depth	Length Snow Core	Wt. Tube Only	Wt. Tube/Core	SWE	Density
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Total						
Avg						

- Notes:

Crust formation – (describe thickness, crusy layers, etc)

Soil condition – (describe if frozen, wet, dry, etc)

Ice layers – (describe layers and thickness of ice at ground level)

Snow Depth and Length of Snow Core in sampler is in centimeters

Tube and Tube with Snow Core Weights are in centimeters

Snow Water Equivalent (SWE) = Tube with Snow Core – Tube Only (cms)

Density = SWE / Snow core length x 100 (%)

Length of Snow Core is measured after dirt plug and veg is removed

Rite in the Rain

5.5.1 Survey Method

The snow sampler should remain at the ambient outdoor temperature to prevent snow from sticking to it. Travel to station 1 by snowmobile is permissible however the rest of the course should only be navigated by snowshoe, or by snowmobile at a distance of 5 or more meters from any station.

The snow survey method steps are as follows;

1. Sketch a map of the snow survey course location and stations in your field book. Stations must be 30m apart (+/-1.5m) and be in a straight line, Z, V, + or other linear shape that will not bias the survey.
2. Fill out the headings in your field book as in the example above if not already completed.
3. Locate the station and collected the UTM coordinates using a GPS and record on the sketched map or store location on GPS. Measure the snow depth with a meter stick within 1.5 metres of the station and record.
4. Check to ensure the sample tube is clean. Obtain and record the weight of the tube only before sampling to nearest centimeter on scale.
5. Hold the sample tube vertically with the cutter down and drive straight down to the ground surface, preferably in one continuous motion. Turn the tube clockwise with the handles to cut through any ice layers in the snowpack or at ground surface.
6. Carefully raise the tube to retain the snow core, remove any dirt plug (throw away from station) and record the snow core length. This is recorded to ensure a complete sample of the snow has been obtained, values less than 70% of the total snow depth should be resampled.
7. Weight the tube with snow core to the nearest centimeter and record.
8. If snow chemistry samples are being collected, place the snow core in a large plastic bag if a composite sample is being collected, or individual resealable plastic bags labelled with the snow survey location and station number if grab samples are being collected.
9. Compute the Snow Water Equivalent (SWE) by subtracting the weight of the tube only from the weight of the tube with snow core. For example: 35cm (tube with snow core) – 30cm (tube only) = 5cm SWE. Record this result to the nearest centimeter. This is the actual depth of the water contained in the snowpack.
10. Compute the sample density by dividing the snow water equivalent by the snow depth, multiply by 100 (%). For example: 5cm SWE divided by 25cm snow depth = 0.25 X 100 = 25% density
11. Repeat steps 3 through 10 for the rest of the stations, documenting any deviation from the sketched map.
12. Record comments on crust formation, soil condition and ice layers.
13. Compare station snow water equivalents and densities. The sample densities should not vary more than 5%, stations that fall outside of this variance should be resampled. The overall snowpack density can be as low as 10% for fresh fallen snow and as high as 60% for a late season snowpack. The density of ice is 100%.
14. Check notes and compute the average depths before leaving the survey course.

If there are is an uncertainty in the above snow survey method, refer to any of the referenced documents in Section 7 for clarification.

5.5.2 Snow Chemistry Sample Preparation

If snow cores were collected, allow the snow samples to sit at room temperature in the environment lab until 75% melted, and then refrigerate until completely melted, to meet hold times and maintain the sample at 4°C until it reaches the external laboratory. If the snow cores were collected in individual bags, prepare multiple sample bottles. Label the snow chemistry samples as detailed in Section 5.2.

5.5.3 Snow Chemistry Analysis

Snow chemistry will be analyzed and documented year to year. The parameters of interest are;

- Total and dissolved metals
- Total suspended solids
- pH

Additional parameters may be added, as required. Mass of solids, and total metals by percent, may also be analyzed as required.

6.0 References

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Appendix A

Figure 3: RRM Snow Survey/Sample Area Location Map