



Appendix G.4

Physical Characterization of Watercourses – May 2021
Completed for the Updated 2021 Beaver Dam Mine EIS



DRAFT

**Appendix G.11
Physical Characteristics of
Watercourses and Waterbodies**

**Beaver Dam Mine Project
Environmental Impact Statement Summary
April 2021**

Atlantic Mining NS Inc.

Table G.11-1: Watershed Physical Characteristics within the Beaver Dam Mine Site

Watershed	Size (ha)	Depth (m)	Shoreline Characteristics	Littoral Zone Characteristics	Substrate
Crusher Lake	4.5	4 to 10	Organic peatland surrounds approximately 50% of the lake; moderately sloped mineral soil surrounds the remaining margins of the lake. The majority of the lake is unshaded, with only thin bands of shaded areas present along the margins. Mature, discrete, undisturbed forest surrounds the entire lake. Floating peatlands are present along the margins (Wetlands 8 and 10), particularly along the eastern end. A beaver lodge is also present in the eastern end of the waterbody within WL 8.	Organic substrate is present. Floating peatland extends into the waterbody in the eastern and western edges. These lacustrine wetlands support a community of submergent and emergent wetland vegetation. Near discrete upland habitat, the littoral zone is abrupt and generally lacking vegetation. Littoral zone is shaded by adjacent upland forest. Marsh St. John's Wort, Leatherleaf and a variety of sedges are emergent in both of these wetlands.	Muck and organic, with some gravel and cobble
Mud Lake	4.1	2	Entire shoreline is comprised of wetland habitat (WL17). Adjacent to open water, the wetland consists of low ericaceous shrubs and graminoids, with tall shrubs dominant at the wetland/upland edge. Gentle slopes surround the waterbody.	The littoral zone is gently sloped with some evidence of fluctuating water levels. Littoral zone is unshaded by any forest canopy cover, but some shade is provided by emergent and floating wetland vegetation (primarily Leatherleaf and White Water-lily, respectively).	Muck and organic
Cameron Flowage	11	5	Organic peatland surrounds 25% of the waterbody. Sparsely vegetated cobble and rubble shores encompass approximately 35% of the waterbody's shoreline, while mature, undisturbed forest encompasses approximately 40% of the boundary.	Emergent and floating wetland vegetation is present in the littoral zone adjacent to wetland habitat. White Water-lily is the dominant floating species, but emergent Royal Fern and Leatherleaf are also present. Where the shoreline is dominated by cobble and rubble habitat, emergent vegetation is sparse, and habitat diversity is provided primarily by structural features (i.e., cobble, rubble, small boulders). The littoral zone adjacent to upland forest is shaded, generally lacks emergent vegetation, and is comprised of sand, gravel and cobble substrate.	Majority of the substrate is rubble to small boulder, with some areas dominated by gravel and organic material.

Notes: ha = hectares; m = meter; % = percent; WL = wetland.

Table G.11-2: Beaver Dam Mine Site – Physical Characteristics of Watercourses

Watercourse	Tertiary Watershed	UTM East	UTM North	Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris
1	Tent Lake	522631	4989087	60	L	M-L	45	60	10	20	SB=80 Gr=20	Run=100	20	80	M
2	Cameron Flowage	522050	4990014	70	L	M-L	70	80	15	10	Gr=20 MC=80	Run=100	40	80	H
3	Cameron Flowage	522024	4989866	50	L	M-L	30	30	5	5	Ru=70 Sa=30	Riffle=80 Pool=20	40	80	L
4	Cameron Flowage	521450	4990084	40	L	L	10	80	5	1	Co=80 Gr=20	Flat=100	40	>95	H
5 (top near WL2)	Cameron Flowage	521808	4989574	100	M	M-L	60	75	5	15	Si=20 MC=15 SB=20 Ru=30 Pe=15	Run=40 Flat=60	15	100	M
5 (Lower near WL14)	Cameron Flowage	521555	4990209	266	M	M-L	50-200	100-300	20-60	60	SB=80 Ru=10 Co=10	Run=70 Riffle=30	20	100	H
6	Cameron Flowage	521379	4990527	30	M	M-L	20	30	5	10	Ru=60 Co=20 Pe=20	Run=100	10	100	M
7	Cameron Flowage	521438	4990346	100	L	M-L	40	50	3	20	SB=5 Ru=20 Co=20 Pe=20 Gr=10 MC=15	Riffle=15 Pool=15 Glide=70	25	100	M
8	Cameron Flowage	521343	4990272	30	L	L	50	300	10	250	SB=10 Ru=15 MC=35 Si=40	Glide=100	70	75	L
9	Cameron Flowage	521536	4990206	100	H	H	50	200	8	20	SB=50 Ru=30 Co=10 Pe=3 MC=7	Riffle=15 Pool=25 Glide=50 Cascade=10	30	100	M
10	Kent Lake	521394	1989508	100	L	L	60	70	10	40	Gr=50 Si=50	Run=100	20	70	M
11	Kent Lake	521166	4989752	250	L	L	150	150	40	150	Ru=5 SB=5 MC=90	Run=100	40	70	H
12	Cameron Flowage	522202	4990328	40	M	L	50-400	100-400	10	10	Gr=40 Si=60	Run=100	15	80	L
13	Cameron Flowage	522689	4990224	60	L	L	300	500	10	20	SB=20 Ru=60 Si=20	Riffle=25 Pool=20 Run=55	80	100	L
14	Cameron Flowage	522734	4990027	150	M	M-L	100	120	50	10	Co=60 Gr=40	Run=100	0	100	M
15	Cameron Flowage	5200961	4990506	60	L	L	40	60	10	40	MC=85 SB=15	Run=100	0	60	L

Table G.11-2: Beaver Dam Mine Site – Physical Characteristics of Watercourses (continued)

Watercourse	Tertiary Watershed	UTM East	UTM North	Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris
16	Cameron Flowage	520825	4990602	115	L	L	30	30	15	15	MC=100	Run=100	0	70	L
17	Cameron Flowage	520938	4990711	1433	L	L	30-100	30-100	20	10	MC=90 SB=10	Flat=95 Run=5	5	75	M
18	Cameron Flowage	522896	4989817	200	L	L	20-40	40	20	30	MC= 50 Gr=50	Flat=50 Riffle=50	30	20	M
19	Tent Lake	523301	4988607	300	L	L	75-150	50	30	50	MC=100	Flat=100	60	20	L
20	Cope Brook	520060	4989901	225	L	L	100-200	100-200	40	30	Sa=5	Flat -Glide=30 Run=50 Pool=20	40	70	M
														MC=70 SB=25	
21	Cope Brook	520059	4990173	50	L	L-M	20	20-30	15	40	MC=15 Ru=70 SB=15	Run=80 Pool=20	20	95	L
22	Cope Brook	520133	4989803	973	L	L	100	100	15	30	MC=90 Ru=10	Run=100	10	90	H
23 ¹	Cope Brook	519780	4989577	16453	L	L	300-600	300-600	35	0	MC=85 SB=15	Flat=90 Run=10	55	80	H
24	Cope Brook	520219	4989715	923	L	L	20	20	10	50	MC=60 SB=40	Run=100	0	60	M
25	Cameron Flowage	522421	4990531	393	L	L	75-300	75-300	50	10	MC=100	Run=100	10	40	L
26 ^(a) (Outlet to Killag)	Cameron Flowage	520003	4991349	8033	L	L	50-300	250	70	0	MC=80	Run=100	40	80	L
														SB=20	
27 ^(a) (Outlet to Mud Lake)	Cameron Flowage	521351	4991021	2373	L	L	1500	2500	100	10	MC=100	Flat=100	25	2	L

Notes: ^(a) Watercourses surveyed beyond PA. Potential impact to fish and fish habitat within LAA.

^(b) Physical parameters were assessed along the total length of these watercourse.

^(c) WC-AI does not cross the Haul Road.

Coarse Woody Debris: H: 10+ woody debris per 20 m reach, M: 10-5 woody debris per 20 m reach, L: less than 5 woody debris per 20 m section

Velocity: H: flows at a speed at which the water is visually rough and irregular, creates eddies, M: flows at a speed which creates smooth riffles, L: flows so slowly that the water is smooth and fine sediments are not held in suspension

Substrate: SB: Small Boulder, Ru: Rubble, Co: Cobble, Pe: Pebbles, Gr: Gravel, Sa: Sand, MC: Mud/Clay, Si: Siltation

Gradient: H: >5% slope, M: 2-5% slope, L: <2% slope (estimated only)

Habitat Type: Run: Swiftly flowing water with some surface agitation but no major flow obstructions, coarser substrate (gravel, cobble, and boulders). Riffle: Shallower section with swiftly flowing, turbulent water with some partially exposed substrate (usually cobble or gravel dominated). Flat: Water surface is smooth and substrate is made up of organic matter, sand, mud, and fine gravel. This habitat differs from a pool due to the length, associated with low gradient. This habitat type generally has a flat bottom. Pool: Deeper area comprising full or partial width of stream, due to the depth or width flow velocity is reduced. Pool has rounded surface on bottom. Cascade: Areas of steeper gradient with irregular and rapid flows, often with turbulent white water. Rapids are primarily associated with larger stream sections and rivers. In larger rivers it is recommended that the survey crew not attempt to conduct cross sections in these types of habitat. Glide: Wide, shallow pool flowing smoothly and gently, with low to moderate velocities and little or no surface turbulence. Substrate usually consists of cobble, gravel and sand.

Table G.11-3: Haul Road – Physical Characteristics of Watercourses (Haul Route from Beaver Dam Mine to Touquoy Mine)

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat Associated with Crossing
		UTM East	UTM North													
A	Tent Lake	522628	4988891	26	L	L	20-400	20-400	10-25	1-20	MC=100	Flat= 100	20	65	L	WL120
B	Tent Lake	522705	4988568	40	L	L	20-400	20-400	10-20	1-20	Co=10 MC=90	Glide=80 Riffle=10 Run=10	10	95	M	WL117
C	Tent Lake	522752	4988169	50	L	L	35-80	35-80	5-25	5-40	Ru=10 Co=20 Gr=15 Si=25 MC=30	Flat= 100	10	50	M	WL119, WL118
D	Tent Lake	522828	4987773	25	M	M	25-65	25-80	5-20	5-20	SB=40 Co=50 MC=10	Run=45 Riffle=35 Pocket= 20	0	45	L	WL121
E	Brandon Lake	522907	4987152	75	M	L	25-170	35-180	1-20	10-40	SB=5 Co=50 Pe=30 Gr=15	Run=50 Riffle=5 Glide=30 Pool=15	5	80	H	N/A
F	Brandon Lake	522841	4986566	83	M	L	60-150	70-170	10-30	5-30	Gr=25 MC=75	Run=50 Pool=50	20	70	M	N/A
G	Brandon Lake	522621	4986101	71	L	L	40-350	50-350	5-30	1-10	Co=5 Pe=10 Gr=25 MC=50	Glide=75 Run=25	75	10	M	WL76
H	Brandon Lake	522562	4985938	100	H	M	100-500	120-500	2-40	10-30	SB=30 Ru=30 Co=30 Pe=10	Run=40 Cascade=25 Riffle=10 Pool=25	0	60	M	N/A
I	Brandon Lake	522547	4985881	64	L	L	30-150	30-150	5-15	1-50	SB=15 Ru=20 Co=60 Gr=5	Pool=20 Riffle=40 Run=40	5	65	L	N/A
J	Brandon Lake	522554	4985838	80	M	M	50-200	60-200	5-23	5-50	Co=15 Pe=15 Gr=15 MC=40	Pool=30 Riffle=30 Run=40	0	70	M	N/A
K	Brandon Lake	522306	4984470	55	M	M	30	40	15	10	SB=40 Gr=20 Sa=40	Riffle=60 Pool=40	5	100	L	N/A
L	Brandon Lake	522312	4984339	47	L-M	M	30	50	10-30	10-20	Pe=50 Gr=50	Run=75 Riffle=20 Pool=5	0	90	I	N/A

Table G.11-3: Haul Road – Physical Characteristics of Watercourses (Haul Route from Beaver Dam Mine to Touquoy Mine) (continued)

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat Associated with Crossing
		UTM East	UTM North													
M	Brandon Lake	522234	4984150	50	L	L	35-100	50-110	2-45		Gr=10 MC=90	Run=100	5	95	H	N/A
N- West River Sheet Harbour	Brandon Lake /Rocky Brook Lake	521887	4983922	113	H	M	1200	1200	100	100-200	LB=5 SB=10 Ru=25 Pe=30 Gr=30	Cascade=10 Glide=25 Riffle=25 Run=40	10	40	L	N/A
O	Lake Alma	521193	4983426	30	L	L	40-400	60-430	15	17-23	SB=10 Ru=15 Co=10 MC=65	Riffle=20 Pool=10 Glide=70	7	30	M	WI95 & WL96
O	Lake Alma	521250	4983332	30	L	L	40-400	60-430	15	17-23	SB=10 Ru=15 Co=10 MC=65	Riffle=20 Pool=10 Glide=70	7	30	M	WL111 & WL112
AI ²	Lake Alma	521480	4983395	70	L	L	20	120	10	20	MC=90 Ru=10	Pool=100	0	10	L	WL218
P	Lake Alma	520111	4982977	30	M	M	20-120	20-150	10-35	10-40	LB=10 SB=30 Ru=20 Co=20 Pe=10 Gr=10	Riffle=30 Pocket= 20 Run=50	0	0	L	N/A
Q	Lake Alma	518454	4982878	35	L	L	60-160	60-160	10-20	30	SB=30 Co=30 Gr=35 MC=5	Glide=80 Riffle=20	0	10	M	N/A
R	Lake Alma	518335	4982893	100	L	L	80-150	100-180	15	20-45	SB=5 Co=5 MC=90	Glide=10 Pool=85 Riffle=5	30	50	M	
S	Lake Alma	518117	4983044	68	L	L	100-200	100-200	10-20	20-40	Ru=15 Pe=25 Gr=40 MC=20	Glide=50 Run=25 Riffle=25	0	90	I	N/A
T	Lake Alma	517873	4982824	52	M	L	100-260	100-260	1-19	15-30	MC=20 Gr=10 Pe=20 Co=20 Ru=20 SB=10	Run=85 Riffle=5 Pool=10	N/A	80	m	N/A

Table G.11-3: Haul Road – Physical Characteristics of Watercourses (Haul Route from Beaver Dam Mine to Touquoy Mine) (continued)

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat Associated with Crossing
		UTM East	UTM North													
U	Lake Alma	517441	4982674	56	L-M	L-M	50-100	50-100	6-40	5-30	MC=50 Co=10 Gr=40	Run=70 Riffle=20 Pool=10	0	90	L	N/A
V	Lake Alma	517395	4982554	65	H	M	80-140	130-150	2-17	5-60	Gr=30 LB=20 Co=30 SB=20	Riffle=5 Run=65 Cascades=30	5	90	L	N/A
W	Lake Alma	517500	4982275	44	M	M	20-150	20-200	5-22	5-20	MC=90 Ru=10	Run=79 Pool=20 Riffle=1	0	90	L	N/A
X	Lake Alma	517549	4982187	70	M	M	25-80	30-100	5-45	5-50	MC=60 Co=20 Pe=20	Riffle=40 Flat= 60	0	40	M	WL114
Y	Lake Alma	517595	4982084	70	M	M	25-80	30-100	5-45	5-50	MC=60 Co=20 Pe=20	Riffle=40 Flat=60	0	40	M	WL115
Z	Lake Alma	517675	4981893	90	L	L	30-200 (downstream), 2500 (upstream)	30-200 (downstream), 2500 (upstream)	12->40	2	Gr=65 Pe=5 MC=30	Run=25 Riffle=5 Pool=70	70	30	L	WL9
AA	Eagles Nest	516527	4979693	105	M	L	50-350	50-350	20	5-15	MC=30 Gr=25 Pe=25 Co=15 Ru=5	Run=100	10	80	20	WL5
AB	Eagles Nest	516303	4979597	40	M	M	20	25	10	5	Sa=100	Run=70 Pocket= 30	40	100	L	WL86
AC	Eagles Nest	515091	4979240	60	L	L	50-400	50-600	5-20	5-10	SB=40 Ru=30 Sa=30	Flat=70 Riffle=10 Pool=20	10	50	L	WL76
AD	Eagles Nest	514588	4978868	130	M	L	~1200- 1600	1300-1700	100+	25	Too deep to see substrate; Co, Ru, LB, SB	Run=100	1	10	0	N/A
AE	Rocky Lake	514402	4978588	80	M	L	30-120	50-150	10	20	Gr=40 Pe=40 Co=15 Ru=5	Run=80 Riffle=10 Pool=10	10	50	L	WET2
AF	Rocky Lake	514346	4978527	70	L	L	50-180	50-180	20-30	30-35	Ru=25 Co=45 Gr=30	Pool=40 Flat=50 Riffle=10	40	70	M	WL70

Table G.11-3: Haul Road – Physical Characteristics of Watercourses (Haul Route from Beaver Dam Mine to Touquoy Mine) (continued)

Watercourse	Tertiary Watershed	Crossing Coordinates		Section Length (m)	Velocity	Gradient	Wetted Width (cm)	Bankfull Width (cm)	Average Depth (cm)	Bank Height (cm)	Substrate (%)	Habitat Type (%)	In-stream Vegetation (%)	Overhanging Vegetation (%)	Coarse Woody Debris	Wetland Habitat Associated with Crossing
		UTM East	UTM North													
AG	Rocky Lake	514286	4978468	65	M	L	40-90	40-110	20-45	30-50	SB=30 Ru=40 Co=30	Run=50 Cascade=15 Riffle=35	10	55	M	WL68
AH	Rocky Lake	514249	4978518	100	M	L	200-650	200-700	50-80	60-90	SB=10 Ru=30 Co=40 Gr=20	Riffle=80 Pool=20	30	30	L	N/A

Note: Coarse Woody Debris: H:10+ woody debris per 20 m reach, M: 10-5 woody debris per 20 m reach, L: less than 5 woody debris per 20 m section.

Velocity:

H: flows at a speed at which the water is visually rough and irregular, creates eddies, heavier riffles to light rapids M: flows at a speed which creates smooth to moderate riffles.

L: flows so slowly that the water is smooth and fine sediments are not held in suspension.

Substrate: LB: Large Boulder, SB: Small Boulder, Ru: Rubble, Co: Cobble, Pe: Pebbles, Gr: Gravel, Sa: Sand, MC: Mud/Clay, Si: Siltation.

Gradient: H:>5% slope M: 2-5% slope L: <2% slope (estimated only).

Habitat Type: Run: Swiftly flowing water with some surface agitation but no major flow obstructions, coarser substrate (gravel, cobble, and boulders). Riffle: Shallower section with swiftly flowing, turbulent water with some partially exposed substrate (usually cobble or gravel dominated). Pocket: Turbulence increased greatly by numerous emergent boulders which create eddies or scour holes (pockets) behind the obstructions. Flat: Water surface is smooth and substrate is made up of organic matter, sand, mud, and fine gravel. This habitat differs from a pool due to the length, associated with low gradient. This habitat type generally has a flat bottom. Pool: Deeper area comprising full or partial width of stream, due to the depth or width flow velocity is reduced. Pool has rounded surface on bottom. Cascade: Areas of steeper gradient with irregular and rapid flows, often with turbulent white water. Rapids are primarily associated with larger stream sections and rivers. In larger rivers it is recommended that the survey crew not attempt to conduct cross sections in these types of habitat. Glide: Wide, shallow pool flowing smoothly and gently, with low to moderate velocities and little or no surface turbulence. Substrate usually consists of cobble, gravel and sand.