

December 14, 2023

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Subject: Bow River 10th St Gravel Bar Project: Tree Survey Summary

Background and Introduction

A tree survey was conducted by O2 to count and measure significant trees along the South Slopes and the North Channel. This survey aimed to evaluate the impact of the design interventions associated with the fish channel and the relocation of material from the gravel bar to the south bank.

Methodology

The study area included two sections along the Bow River between the Louise Bridge and the 14th Street Bridge (Figure 1). The southern part of the study area included the South Slopes and extended east towards the Wave Deck, between the pathway and the river. The second portion included the north shore of the Bow River, in the vicinity of the North Channel and below the main multi-use pathway. It also included a portion of the smaller gravel bar near the north shore. The survey took place over three days (November 30th, December 1st, and December 5th, 2023).

Greater than 10cm DBH

Trees were considered significant when they had a diameter at breast height (DBH) of 10 cm or greater. Point locations were recorded with a GPS (Bad Elf – 3m accuracy) and ArcGIS Collector, noting the tree species and any notes on condition or unique features. Photos were included as attachments for tree ID confirmation or to show features, such as beaver damage or growth form. Measurements were taken for each tree in this category that included DBH, height, and canopy width.

DBH

Diameter at breast height was measured directly with large calipers (for trees less than 50cm in diameter) or a DBH tape (for trees greater than 50cm in diameter).

Tree Height

Height was calculated from field measurements of horizontal distance and the angle to the top and bottom of the tree using the formula:

$$\text{height} = (\tan(\text{top angle}) + \tan(\text{bottom angle})) * \text{distance}$$

The horizontal distance from the tree was measured in meters with a transect tape and the angles were taken in degrees using a clinometer.

Canopy Width

Canopy width was determined using multiple methods, as direct field measurement was not always possible due to steep terrain, clusters of trees, and thick shrub cover. Where possible, canopy width was measured in meters with a transect tape. Where trees were too clustered to define a single canopy, a polygon was drawn to capture the entire cluster.

Where the terrain made measurement unsafe or the thick shrub cover impeded measurement, the Calgary Open Data Tree Canopy layer along with a current air photo were used to define the canopy coverage of the trees in the study area. A combination of these three measures was dissolved into a final tree canopy layer for the study area.

Less than 10cm DBH

Trees with a DBH of less than 10 cm were not considered significant and therefore no measurements were taken. In some cases, a point was marked if the tree was near the study area boundary. In other cases, where there was a cluster of small trees a single point was taken noting the cluster, however individual tree measurements were not taken.

Shrubs

The only shrub species of concern was Caragana (*Caragana arborescens*). Where Caragana was observed as a single shrub it was marked with a GPS point, and where it was a cluster of shrubs the intent was to capture a polygon area of its extent. Due to the steep terrain and fencing along the South Slopes, however, it was not possible to do this in the field. Instead, a polygon was created from the tree canopy layer, the observed extent of the Caragana, and the study area extent which approximated the location of the fence line.

Results and Discussion

A total of 188 trees were recorded across the surveyed area (Table 1). Eight different tree species were observed, with one unknown species. Seven trees, noted as uncertain or unknown, require confirmation in the spring and summer when leaves return, as leaves are one of the most distinguishing features. Confirmation is required for two possible Balsam poplars, one Manitoba maple, two unknown poplars, and two unknown species (Figure 1). Balsam poplar (*Populus balsamifera*) was by far the most commonly recorded species at nearly 85% of surveyed trees. All trees with a DBH greater than 50cm were Balsam poplar.

The South Slopes

A total of 90 trees across seven different species were recorded on the South Slopes. Trees were larger on average on the South Slopes, with greater average DBH and heights (47.5 cm and 16.7m, respectively) than the North Channel (22.4cm and 13.2m, respectively). The South Slopes also contained the largest Balsam poplars (Figure 2). Due to the steep terrain and eroded riverbank in some places, not all trees could be measured for DBH and height. For the South Slopes, 39 of 90 trees were missing DBH and height measurements because of access difficulties, 27 of these were Balsam poplar. The average DBH of the Balsam poplar on the South Slopes was 51.6cm and the average height was 17.2m (Table 2). There were only three other trees with a DBH greater than 30cm on the South Slopes; two Spruce and one Manitoba maple. Tree canopy coverage was also greater along the South Slopes than the North Channel (Figure 3).

The North Channel

A total of 97 trees across seven different species were recorded in the North Channel. Trees were smaller on average than the South Slopes (Figure 2). The terrain in the North Channel was more level with the study area largely below the embankment. The major impediments to sampling here were dense shrub cover and two homeless encampments. Only 11 trees could not be measured for DBH and height in this area because of these limitations. Though they were smaller on average, balsam poplar was even more prevalent in the North Channel,

making up 88 of the 97 surveyed trees. Balsam poplars had an average DBH of 22.7cm and average height of 13.3m in the North Channel (Table 2). Only 14 trees in the North Channel have a DBH greater than 30cm and they are all Balsam poplar. With smaller trees on average, the lesser canopy coverage in the North Channel was unsurprising (Figure 3).

Caragana

Caragana was not observed in the North Channel, though it may have been present adjacent to the surveyed area, it was not noticeable at the time of survey. The South Slopes contained the only notable patch of caragana, and this was below the multi-use path between the Louise bridge and the pedestrian entrance at 11 Street SW. Caragana was located mainly on the river side of the fence in a large dense patch (Figure 3 – inset).

Tree Damage

Not all trees were in good health; there was a great deal of beaver damage causing abnormal growth patterns, such as forking near the base of the stem or off shoots from remaining stumps. Some trees appeared to have grown horizontally for a time before upwards, possibly a result of flowing water impacting growth at a young age. There were several trees leaning heavily or growing horizontally out of the riverbank. Damage or abnormal growth form was documented with photographs where possible, but a full condition assessment was not part of the scope of this survey.

Table 1. Summary of species counts by section of tree survey area

Species	Louis Bar	North Channel	South Slopes	Total Count	Percent of Total Count
Balsam Poplar	1	88	70	160	84.57%
Manitoba Maple		2	11	13	6.91%
Spruce species		2	2	4	2.13%
Paper Birch		1	2	3	1.60%
Mountain Ash			3	3	1.60%
Poplar species		2		2	1.06%
Unknown species		1	1	2	1.06%
Elm species		1		1	0.53%
Trembling Aspen			1	1	0.53%
Total Count	1	97	90	188	

Table 2. Summary of Balsam poplar tree size on the South Slopes and the North Channel

	DBH (cm)		Height (m)	
	South Slopes	North Channel	South Slopes	North Channel
Mean	51.6	22.7	17.2	13.3
Minimum	12	10	7.6	6.4
Maximum	97.8	67.3	29.1	23.9

Summary, Conclusions, and Next Steps

- The vast majority of trees surveyed were Balsam poplar, which was expected in this study area
- The most significant trees were the large Balsam poplars, particularly those along the river path on the South Slopes; there were no trees of equivalent size in the North Channel
- Tree health and the expected riparian habitat and biodiversity along a portion of the South Slopes is currently being impacted by caragana
- Not all trees were in good health, an assessment of condition should follow detailed design to fully evaluate the impacts to trees
- The Design team can use this information to avoid damaging or removing trees, where possible

Reinaldo Jordan
Project Manager, O2

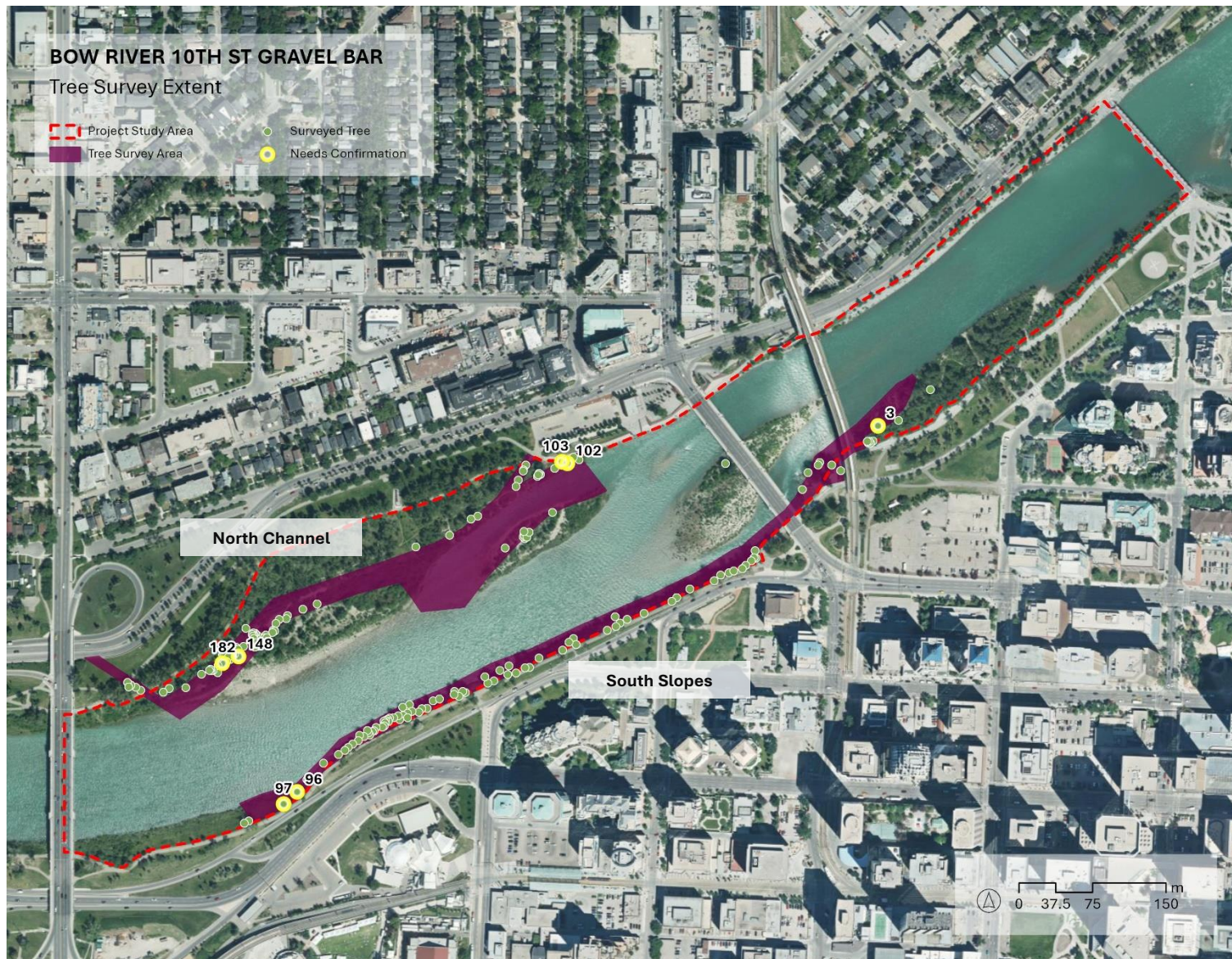


Figure 1. Map of the survey areas, trees surveyed, and trees which need confirmation of species identification

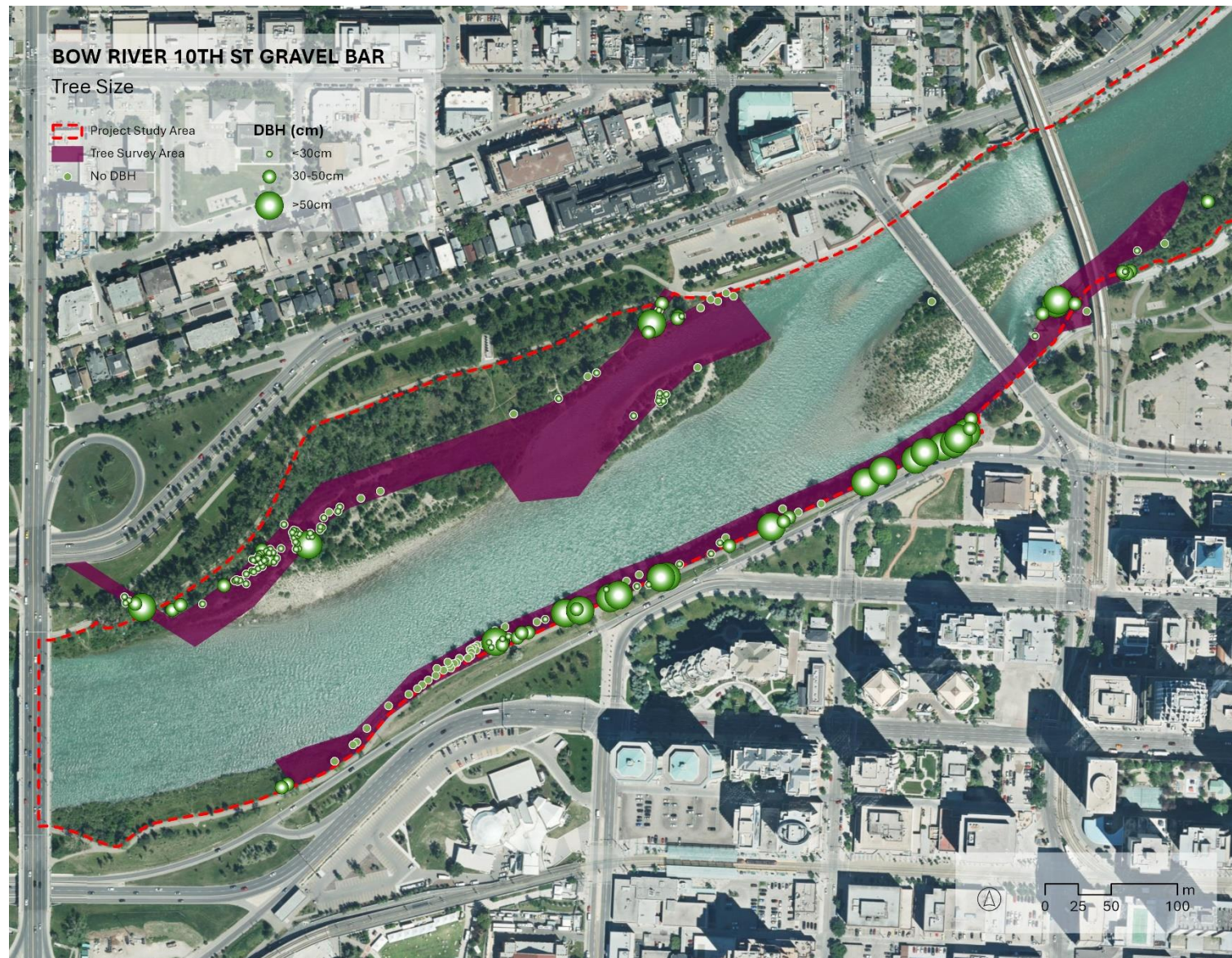


Figure 2. Map of tree diameter at breast height across the surveyed area

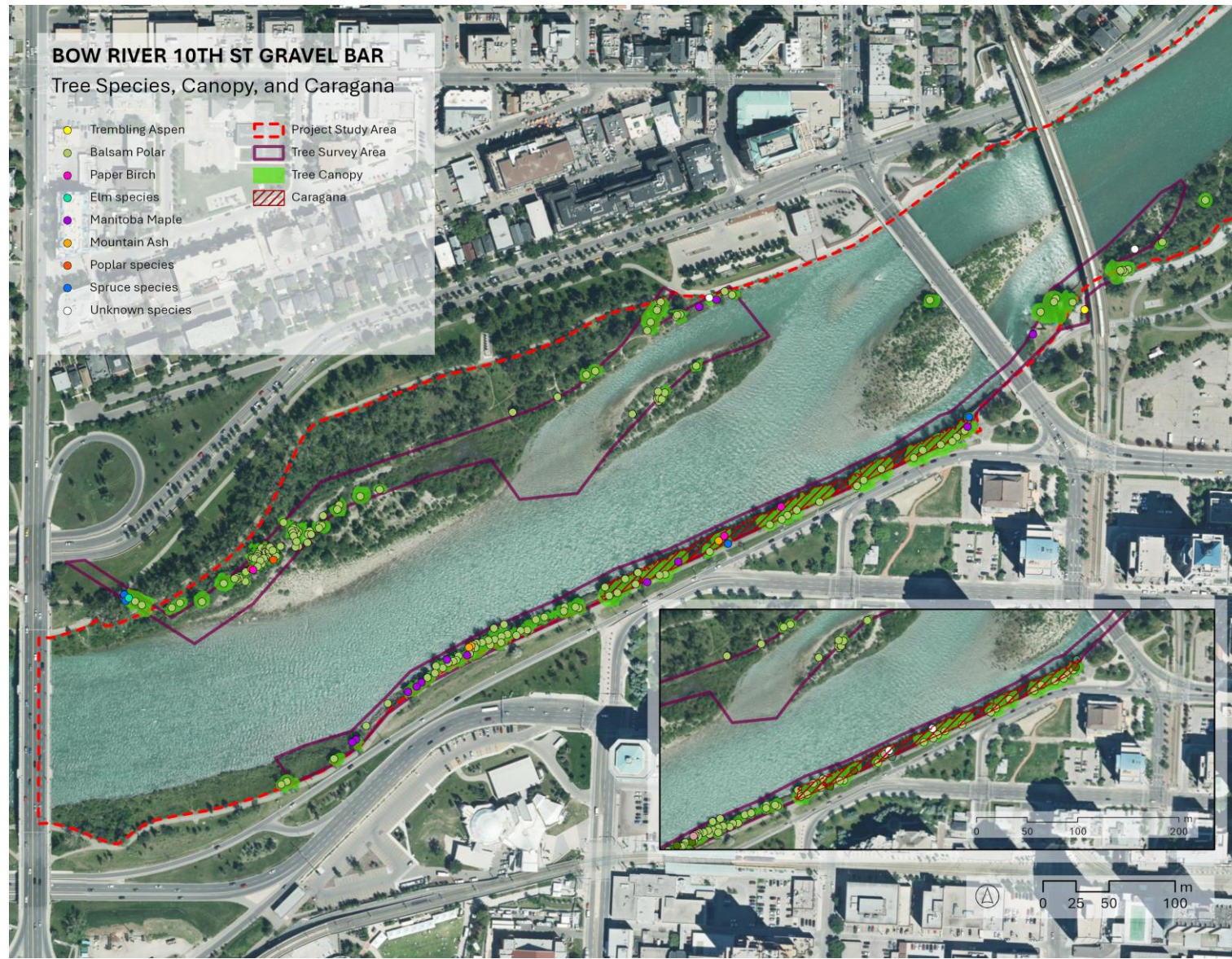


Figure 3. Map of tree species, canopy cover, and caragana extent across the surveyed area

ATTACHMENT:



Large Balsam poplar, main stem dead.



Large Balsam poplar, main stem split at base.



Cluster of Balsam poplars near an encampment.



Large Balsam poplar, main stem split into three – possibly multiple trees but recorded as a single tree.



Balsam poplar growing horizontally out of riverbank.



Possible Narrow-leaved Cottonwood, confirmation needed.

OBJECTID	Species	CanopyHeight_m	CanopyWidth_m	DBH_cm	Notes	Cluster	Attachments	StudyArea	NeedsConfirmation
1	Balsam		11.0	42.0	Cluster of 2. DBH 42, 35.	2	0	Outside	
2	Balsam						0	South Slopes	
3	Unknown	9.6	4.0	15.0	Manitoba maple? Balsam? Confirm species in spring.		0	South Slopes	Yes
4	Balsam	19.1	9.0	48.0			0	South Slopes	
5	Balsam	23.1	9.8	50.0			0	South Slopes	
6	Balsam			40.0	bent over, see polygon		0	South Slopes	
7	Balsam			26.0	see polygon		0	South Slopes	
8	Balsam	26.9		38.0	see polygon		0	South Slopes	
9	Aspen				5 new aspens under 10cm DBH	5	0	South Slopes	
10	Balsam	13.7		44.0			0	South Slopes	
11	Balsam	20.0		58.9	Cluster of 3. DBH 59, 42, 40. See polygon	3	0	South Slopes	
12	Balsam	29.1	17.0	66.0	Cluster of 3. DBH 66, 40, 24.	3	0	South Slopes	
13	Balsam	20.8	14.0	42.0	cluster burned. DBH 50+, 42, 23	3	0	South Slopes	
14	Manitoba Maple		4.0	14.0	in riprap		0	South Slopes	
15	Balsam				significant		0	Louis Bar	
16	Spruce	19.1	7.5	48.0			0	South Slopes	
17	Caragana				starts east of spruce		0	South Slopes	
18	Manitoba Maple			44.0	bent over		0	South Slopes	
19	Balsam	21.9	12.0	87.1			0	South Slopes	
20	Balsam		9.0	72.6			0	South Slopes	
21	Balsam		9.4	73.2			0	South Slopes	
23	Balsam		18.0	75.0			0	South Slopes	
24	Balsam		18.0	75.0			0	South Slopes	
26	Balsam		13.0	70.6			0	South Slopes	
27	Balsam		14.0	75.2			0	South Slopes	
28	Balsam	16.9	16.0	72.4			0	South Slopes	
29	Balsam	23.8	18.0	93.5			0	South Slopes	
30	Balsam		8.0		Cut balsam with growth off side see picture		0	South Slopes	
31	Balsam				Mature		1	South Slopes	
32	Balsam				Dying		1	South Slopes	
33	Balsam	13.2	11.0	50.0			0	South Slopes	
34	Birch				Multi-stem		1	South Slopes	
35	Balsam		8.0	38.0			0	South Slopes	
36	Balsam	21.7	10.0	74.2			0	South Slopes	
37	Birch						1	South Slopes	
38	Spruce	13.4	4.0	31.0			0	South Slopes	
39	Mountain Ash			6.0			1	South Slopes	
40	Balsam	18.5	9.0	29.0	Dying balsam multi (2)	2	0	South Slopes	
41	Manitoba Maple	16.0	5.0	22.0			0	South Slopes	
42	Balsam	14.7	12.0	89.9			0	South Slopes	
43	Balsam	19.2	10.0	51.0	multi dying		0	South Slopes	
44	Manitoba Maple	11.8	6.0	24.0			0	South Slopes	
45	Balsam				below wall		0	South Slopes	
46	Balsam	13.0	6.0	30.0			0	South Slopes	
47	Balsam				below wall		0	South Slopes	
48	Balsam		10.0	79.5	growing off side of cut trunk		0	South Slopes	
49	Balsam	21.5	17.0	97.8			0	South Slopes	
51	Balsam	9.3	2.0	14.0			0	South Slopes	
52	Balsam	17.3		57.2	Cluster of 2	2	0	South Slopes	
53	Balsam	17.3		37.0	Cluster of 2	2	0	South Slopes	
56	Balsam				Young		1	South Slopes	
57	Balsam	22.2	10.0	65.3	Damaged see photo		1	South Slopes	
58	Balsam				Cluster of beaver damaged trees		1	South Slopes	
59	Balsam			17.0	See photo		1	South Slopes	

60	Balsam			44.0	Cluster of 3	3	0	South Slopes	
61	Balsam			31.0	Cluster of 3. Bent over. Split stem. DBH 31, 17.		0	South Slopes	
62	Balsam	15.1		35.0			0	South Slopes	
63	Balsam				Horizontal. See photo		1	South Slopes	
64	Balsam				See photo		1	South Slopes	
65	Balsam	11.5		19.0	Split stem. DBH 19,14. Beaver damage.		1	South Slopes	
66	Balsam	13.3	8.2	30.0			0	South Slopes	
67	Balsam	8.2		75.2	main stem dead see photo		1	South Slopes	
68	Balsam	15.1		36.0	split stem. DBH 36, 32. see photo		1	South Slopes	
69	Balsam	11.4		26.0	split stem big knot		0	South Slopes	
70	Balsam	7.6		12.0	split stem dead		1	South Slopes	
71	Balsam				see photo. too steep after this unsafe to measure trees		1	South Slopes	
72	Balsam						1	South Slopes	
73	Balsam						1	South Slopes	
74	Balsam						1	South Slopes	
75	Mountain Ash						1	South Slopes	
76	Mountain Ash						1	South Slopes	
77	Balsam						1	South Slopes	
78	Balsam						1	South Slopes	
79	Manitoba Maple				See photo		2	South Slopes	
80	Balsam						1	South Slopes	
81	Balsam						1	South Slopes	
82	Balsam						1	South Slopes	
83	Caragana						1	South Slopes	
84	Balsam						1	South Slopes	
85	Manitoba Maple				Unhealthy		1	South Slopes	
86	Balsam						1	South Slopes	
87	Balsam						1	South Slopes	
88	Balsam						1	South Slopes	
89	Balsam				lots of buds in December		3	South Slopes	
90	Manitoba Maple						1	South Slopes	
91	Manitoba Maple						1	South Slopes	
92	Manitoba Maple						1	South Slopes	
93	Balsam						1	South Slopes	
94	Balsam						1	South Slopes	
95	Manitoba Maple						1	South Slopes	
96	Manitoba Maple				Need confirmation in the spring		3	South Slopes	Yes
97	Balsam				Confirm in the spring. Unaccessible. DBH 50+ BIG		1	South Slopes	Yes
98	Balsam	14.7	10.8	38.0			0	South Slopes	
99	Balsam	15.4	8.0	36.0			0	South Slopes	
100	Balsam						1	North Channel	
101	Balsam						1	North Channel	
102	Manitoba Maple				Need confirmation in the spring		3	North Channel	Yes
103	Unknown				Fallen over. Growing out of pit. Shrub form. Confirm species in spring.		1	North Channel	Yes
104	Manitoba Maple				Young tree. Split stem		1	North Channel	
105	Balsam			18.0	leaning over		1	North Channel	
106	Balsam			39.0			1	North Channel	
108	Balsam	23.9		50.0	Cluster of 3	3	1	North Channel	
109	Balsam	17.4		40.0			0	North Channel	
110	Balsam	8.0	12.2	12.0			0	North Channel	
111	Balsam	8.4	4.2				0	North Channel	
112	Balsam	16.5	11.5	53.8			0	North Channel	
113	Balsam	6.4	3.2	13.0			0	North Channel	
114	Balsam	12.2	5.6	15.0	split stem. DBH 15, 13.		1	North Channel	
115	Balsam			20.0			1	North Channel	

116	Balsam			12.0			0	North Channel	
117	Balsam	10.6		18.0			1	North Channel	
118	Balsam			16.0			0	North Channel	
119	Balsam			12.0			0	North Channel	
120	Balsam	9.2	3.6	13.0			1	North Channel	
121	Balsam				Balsam poplar cluster. shrubs too thick to enter	3	1	North Channel	
122	Balsam			31.0	leaning. Cluster	3	1	North Channel	
123	Balsam	10.7	2.5	15.0			1	North Channel	
124	Balsam				Cluster of 2	2	1	North Channel	
125	Balsam	7.8	3.9	13.0			1	North Channel	
126	Balsam				Cluster. encampment nearby could not enter	3	1	North Channel	
127	Balsam				tents nearby		1	North Channel	
128	Balsam				tents nearby		0	North Channel	
129	Balsam	11.2		20.0			0	North Channel	
130	Balsam			13.0	cluster. see photo	3	1	North Channel	
131	Willow						1	North Channel	
132	Balsam			19.0			0	North Channel	
133	Balsam	15.0		18.0		2	0	North Channel	
134	Balsam			20.0		2	0	North Channel	
135	Balsam			19.0			0	North Channel	
136	Balsam	9.6		14.0			0	North Channel	
137	Balsam	15.7		28.0			0	North Channel	
138	Balsam	13.9		22.0			1	North Channel	
139	Balsam	10.0		66.0			0	North Channel	
140	Balsam	10.1		14.0			1	North Channel	
141	Balsam	10.1		17.0			0	North Channel	
142	Balsam	10.5		16.0			0	North Channel	
143	Balsam	10.0		24.0			1	North Channel	
144	Balsam	8.0		11.0			0	North Channel	
145	Balsam	12.4		14.0	cluster		1	North Channel	
146	Balsam	11.4		12.0	cluster of 3	3	1	North Channel	
147	Balsam	11.1		10.0	Cluster of 5 other smaller ones nearby	5	1	North Channel	
148	Poplar	14.7		16.0	Possibly narrow leaf poplar cluster of 3. 2 broken 12 14 DBH. 1	3	2	North Channel	Yes
149	Balsam	11.5	3.4	15.0			0	North Channel	
150	Balsam	12.8		12.0			0	North Channel	
151	Balsam	9.7		13.0			0	North Channel	
152	Balsam	12.8		11.0			0	North Channel	
153	Balsam	12.9		19.0			0	North Channel	
154	Balsam	11.6		18.0			0	North Channel	
155	Balsam	12.2		17.0			0	North Channel	
156	Balsam	17.0		26.0	Really leaning		0	North Channel	
157	Balsam			24.0			0	North Channel	
158	Balsam	12.6		26.0			0	North Channel	
159	Balsam	14.7		24.0			0	North Channel	
160	Balsam	14.9		32.0			0	North Channel	
161	Balsam			18.0	No height because growing sideways		0	North Channel	
162	Balsam			16.0	Leaning a lot		0	North Channel	
163	Balsam	19.5		18.0			0	North Channel	
164	Balsam	14.4		25.0			0	North Channel	
165	Balsam	10.6		18.0	Really close to the tree next to it		1	North Channel	
166	Balsam	10.0		23.0			0	North Channel	
167	Balsam	11.6		26.0	Split at base. Same DBH		0	North Channel	
168	Balsam	17.0		18.0			0	North Channel	
169	Balsam	11.1		24.0			0	North Channel	
170	Balsam	13.8		34.0			0	North Channel	

171	Balsam			16.0			0	North Channel	
172	Balsam	11.5		22.0			0	North Channel	
173	Balsam	11.9	5.5	19.0			0	North Channel	
174	Balsam	8.7		18.0			0	North Channel	
175	Balsam	22.5		33.0			0	North Channel	
176	Balsam	18.7		26.0			0	North Channel	
177	Balsam	23.2		24.0			0	North Channel	
178	Balsam	16.7		12.0			0	North Channel	
179	Balsam	20.4		21.0			0	North Channel	
180	Balsam	11.9		18.0			0	North Channel	
181	Balsam	10.8		24.0			0	North Channel	
182	Poplar	14.1		13.0	Unknown poplar. Possibly narrow leaf poplar		0	North Channel	Yes
183	Birch	15.0		12.0	Paper birch		0	North Channel	
184	Balsam	9.5		12.0			0	North Channel	
185	Balsam	13.2		21.0	Split into 3. DBH 20, 21, 13. Cluster of 5.	5	1	North Channel	
186	Balsam	14.4		22.0			0	North Channel	
187	Balsam	18.3		24.0			0	North Channel	
188	Balsam	13.3		22.0			0	North Channel	
189	Balsam	14.9		26.0			0	North Channel	
190	Balsam	15.5		41.0	Split into 2 at the base. DBH 35, 41		0	North Channel	
191	Balsam	9.9		10.0			0	North Channel	
192	Balsam			36.0			0	North Channel	
193	Balsam			50.0	Split in 3. DBH 40, 40, 50		1	North Channel	
194	Balsam	21.2		67.3			0	North Channel	
195	Balsam	22.7		50.0			0	North Channel	
196	Elm	11.5		28.0	Unknown Elm		1	North Channel	
197	Spruce	9.2		18.0			0	North Channel	
198	Spruce	6.9		16.0			0	North Channel	