Columbia River Project Water Use Plan

KINBASKET AND ARROW LAKES RESERVOIRS

Reference: CLBMON-11A

Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir

Cooper Beauchesne and Associates Ltd.
Head Office
Box 646, 1799 Swayne Road
Errington, BC

CLBMON 11A: Wildlife Effectiveness Monitoring of Revegetation in Kinbasket Reservoir

Data Summary Report – Year 4 (2011)

A.J. MacInnis, V. Prigmore, R.A. Gill, and J.M. Cooper

Cooper Beauchesne and Associates Ltd.
Head Office
Box 646, 1799 Swayne Road
Errington, BC V0R 1V0
Tel: 250 954-1822
Contact: John Cooper
jcooper@cooperbeauchesne.com

Report prepared for:
BC Hydro
Water Licence Requirements
1410 10th Avenue
Golden, BC V0A 1H0

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Cover photo: Site 84, Bush Arm, Kinbasket Reservoir. Photo © V. Prigmore, Cooper Beauchesne and Associates Ltd

EXECUTIVE SUMMARY

An 11-year wildlife effectiveness monitoring study of revegetation enhancements in the drawdown zone of Kinbasket Reservoir was initiated in 2008 (Year 1). The program is intended to assess the effectiveness of enhancing habitat to increase utilization of the drawdown zone by wildlife. In 2011 (Year 4), the ungulate pellet group counts were completed. No monitoring was originally scheduled to occur in Year 4. However, it was recommended following completion of Year 3 that the pellet counts be completed on an annual basis to ensure the plots were cleared and the data collected was from a single year.

The pellet counts were completed on July 8–14, 2011 at the same sites sampled in Year 3 and following the same methods. Due to rising reservoir levels, some transects had already flooded and were not possible to survey.

There were 45 ungulate pellet groups observed in 417 stations. The number of pellet groups detected was lower than in the three previous years of the project. There were more ungulate pellet groups detected in Canoe Reach than in Bush Arm. Deer and moose pellets were only found in Canoe Reach and elk pellet groups were only observed in Bush Arm. The highest relative abundance of all species was on local reference transects, above the drawdown zone.

It is not yet possible to make any determination regarding the effectiveness of the revegetation program in increasing ungulate use of drawdown habitats. This is partly a result of the timing of the revegetation program in relation to the wildlife effectiveness monitoring program.

It is recommended that the ungulate pellet group surveys continue to be completed on an annual basis for continuity of the data set and to ensure pellet detections are from a single year. The other major recommendation is for close coordination with the revegetation program to maintain existing monitoring sites and identify if any previously sampled sites should be included again.

ACKNOWLEDGEMENTS

Doug Adama of BC Hydro administered this project and has provided technical support and data throughout all phases. The project was managed by Andrew MacInnis. Andrew MacInnis coordinated field implementation, logistics, and reporting phases of the project. The field sampling for Year 4 was completed by Andrew MacInnis and Vicki Prigmore. Ryan Gill provided the mapping and GIS analysis.

This report was prepared by Andrew MacInnis, Vicki Prigmore, and Ryan Gill. The draft report was reviewed by John Cooper.

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1 INTRODUCTION

The CLBMON-11A project is an 11-year monitoring program designed to determine the effectiveness of the revegetation program (CLBWORKS-1) in improving wildlife habitat and increasing wildlife use of the Kinbasket Reservoir drawdown zone. Additional detail on the background and intent of the CLBMON-11A wildlife effectiveness monitoring program is provided in CBA (2011a), the Year 3 technical report. Sampling in Year 4 of the project was not included in the original terms of reference (BC Hydro 2008). However, following the completion of Year 3, it was recommended that the ungulate pellet counts be completed on an annual basis (CBA 2011a). This is due to the need to clear the plots annually to ensure that any ungulate detections are from only a single year.

This report presents the results from the pellet counts completed in Year 4 (2011) of the CLBMON-11A monitoring program. This report focuses on ungulate data collected in Year 4 of the project, with some comparisons made to previous years, where feasible. The results and discussion primarily focuses the control and treatment transects as this directly addresses the project objectives.

2 MONITORING OBJECTIVES AND HYPOTHESES

The monitoring objectives and hypotheses for CLBMON-11A were stated in the Terms of Reference for the project (BC Hydro 2008). In association with the revegetation program (CLBWORKS-1), the primary management question to be addressed by this monitoring program is:

- How effective is the revegetation program at enhancing and increasing the utilization of habitat in the drawdown zone by wildlife?

Specific management questions related to the monitoring of ungulates include:

- Are revegetation efforts negatively impacting wildlife in the drawdown zone?
- Which methods of revegetation are the most effective at enhancing and increasing utilization of the drawdown zone by wildlife?

Based on these management question and objectives, the effectiveness monitoring program was designed to test the following management hypotheses stated in the Terms of Reference:

Ungulates

H_{02}: Revegetation does not increase the utilization of habitat by ungulates in the drawdown zone.

H_{02A}: Revegetation does not increase the seasonal abundance (winter/spring) of ungulates in the drawdown zone.

H_{02B}: Revegetation does not increase the abundance (tonnes/hectare) of ungulate forage in the drawdown zone.

H_{02C}: Revegetation does not increase the amount of ungulate habitat in the drawdown zone.

H_{03}: Revegetation does not increase the area of extent of high value wildlife habitat for ungulates in the drawdown zone.

This report provides continuity in data on ungulate habitat use and relative abundance. The differences between revegetation treatments, untreated controls and reference locations above the drawdown zone will be tested using spring/summer pellet counts. Specifically, the data collected can be used for addressing null hypotheses 2 and 2A.

3 METHODS

The project followed the same study design as in 2010 (CBA 2011a). The overall objective of the project is to monitor the effectiveness of revegetation treatments in enhancing wildlife habitat in the drawdown zone of the reservoir. The monitoring program was developed using a stratified random design to test the responses of the indicator species groups to revegetation treatments. Ungulate relative abundance is one of the indicators identified in the Terms of Reference (BC Hydro 2008).

3.1 Study Area

The study area for the project is the Kinbasket Reservoir in eastern British Columbia (Figure 3-1). Specifically, effectiveness monitoring under CLBMON-11A is being conducted in the Canoe Reach and Bush Arm regions of the reservoir. For additional information on the study areas refer to CBA (2011a).

3.2 Study Sites

Sampling occurred at the same sites as in 2010 (sites 2, 8, 12, 15, and 25 in Canoe Reach and sites 83, 84, 87, 88, and 121 in Bush Arm) (Figure 3-2). With the exception of Site 121, these sites have been sampled in all years of the wildlife effectiveness monitoring program to date. Site 121 was added in 2010 at the request of BC Hydro so that sampling from a naturally revegetated area was included in the project. For additional information on the study sites and the rationale for their selection refer to CBA (2011a).

3.2.1 Transect Location and Layout

The transect locations and layout were identical to those used in 2010 (CBA 2011a). Sampling stations were permanently marked in 2010 with painted spikes and washers and the coordinates of each station were recorded using submeter resolution GPS (SX Blue II). Sampling stations were relocated using the same GPS unit and visual searches for the station marker. It was not possible to locate all station markers, as some appeared to have been completely buried under sediment or debris (Figure 3-3). Other station markers were difficult to locate due to heavy growth of vegetation (Figure 3-4). If a marker was not found, the plot center was located using submeter GPS and confirmed by measurement from located markers.

As in 2009 and 2010, the transects sampled at each site included a treatment transect located in an area of the drawdown zone that received a revegetation treatment, a control transect in an area of the drawdown zone that did not receive a vegetation treatment, and a local reference transect located immediately above the drawdown zone. For additional details on transect selection and definition, refer to CBA (2011a, 2011b). Maps of the transects sampled in 2011 are provided in Appendix 1.

Each 140-m transect had 15 sampling stations located at intervals of 10 m. Ungulate pellet counts were conducted at all 15 sampling stations on each transect (except for stations that had already flooded).

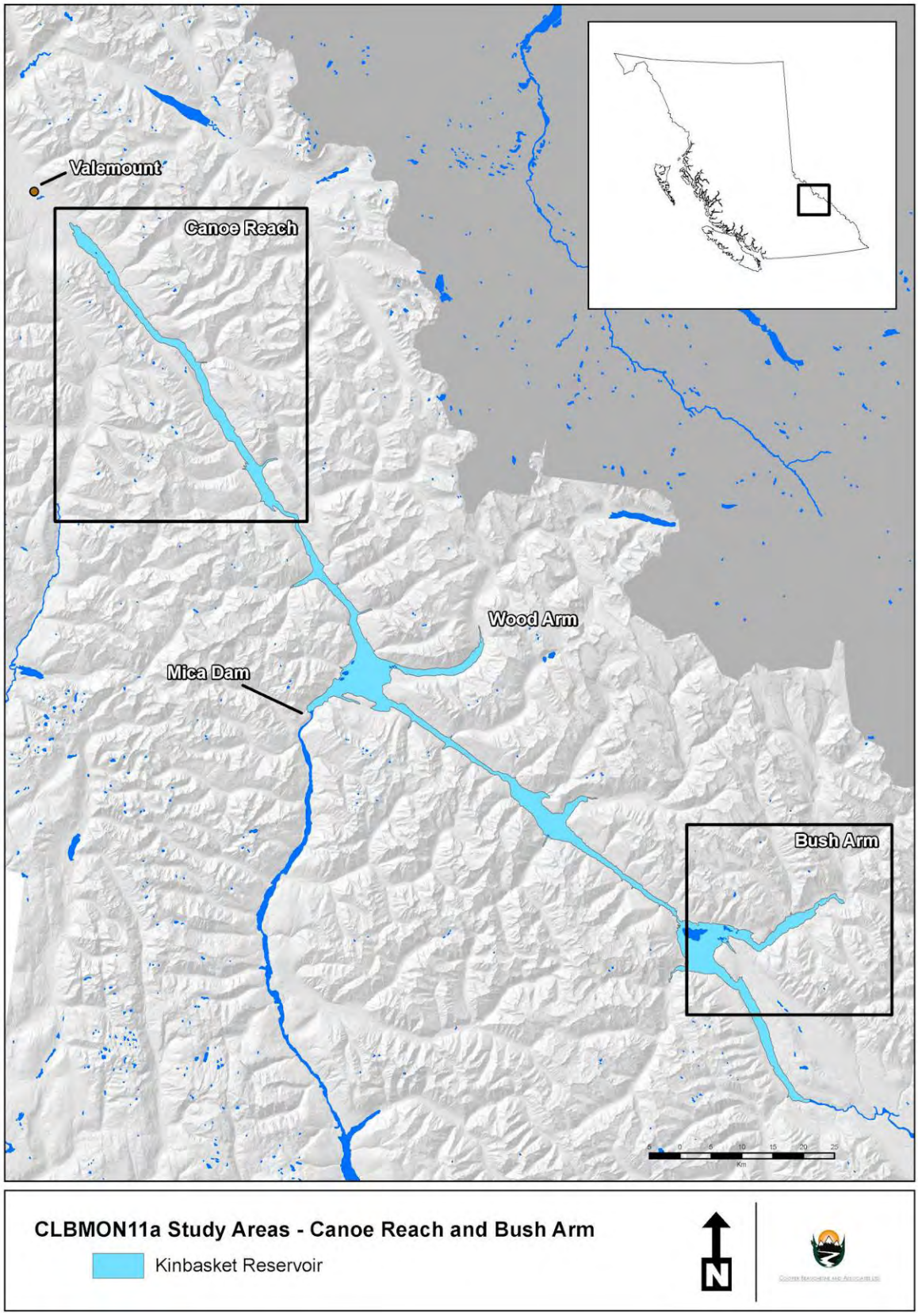

Figure 3-1: Kinbasket Reservoir overview

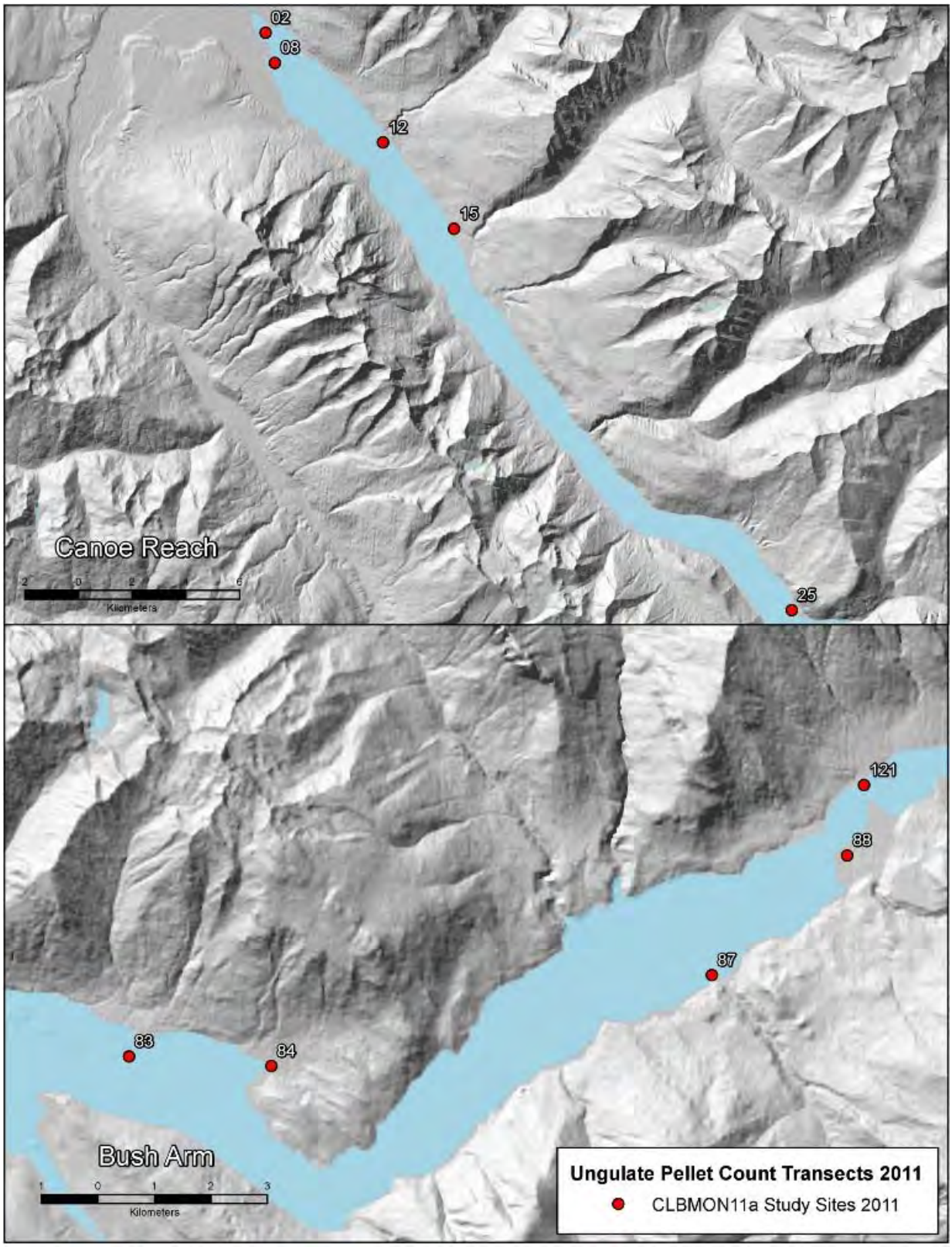

Figure 3-2: Location of study sites in Bush Arm and Canoe Reach of Kinbasket Reservoir

Figure 3-3: Partially buried station marker

Figure 3-4: Dense vegetation on the control transect at site 25. Vegetation height is 70-80 cm.

3.3 Pellet Group Counts

A single replicate of a systematic fecal pellet group count survey (Neff 1968) was conducted at 9 sites in Kinbasket Reservoir (Site 83 in Bush Arm was inaccessible due to reservoir levels). Protocols were consistent with provincial standards (Resources Inventory Committee 1998). A circular 3.99-m radius (50 m^2) plot was surveyed at 15 permanent sampling stations on each transect.

Pellet groups were defined as 10 or more pellets in close proximity. Each pellet group was identified, recorded and cleared from the plot. Both white-tailed deer and mule deer are known to occur in the study area. Since it is virtually impossible to differentiate between deer species by their pellets (Shackleton 1999), all deer pellet groups were classified as “deer”. Scat from other species were also recorded when they could be reliably identified (e.g., bear, grouse). Total pellet group counts were summarized by transect type, site and region to identify differential use of the drawdown zone by ungulates.

4 RESULTS

Ungulate pellet group counts were completed from July 8 - 14, 2011 (Table 4-1). A total of 46 ungulate (moose, deer, elk) fecal pellet groups were counted in 417 survey plots, with a total survey area of 19,552.5 m^2. Surveys totalled 10,795 m^2 and 8,152.5 m^2 in Canoe Reach and Bush Arm, respectively. A summary of the data is provided in Appendix 2.

Flooding due to rising reservoir levels prevented surveys from being completed at 78 of the 495 plots and reduced the area it was possible to survey at 14 additional plots. The survey area for an additional ten plots in Bush Arm was reduced due to surface disturbance. For partially flooded stations, only the dry portion was included as pellet groups in the flooded portion may have been disturbed by wave action. The exposed area of partially flooded or disturbed plots was estimated.

In Canoe Reach, the control and treatment transects at site 12 had already flooded when the surveys were initiated. One treatment transect at site 15 was partially flooded with six sampling stations completely submerged and five that were partially flooded. In Bush Arm, site 83 was not accessible due to the high reservoir levels. The control transect at site 84 was partially flooded with nine stations completely flooded and the remaining six stations were partially flooded. Two plots on the B transect at site 121 were completely flooded and an additional 4 transects were partially flooded. At site 88 it was not possible to survey parts of the control transect as the plots had been disturbed by planting of live stakes with an excavator (Figure 4-1). Additionally, most of the plots on the site 88 treatment transect were covered with woody debris deposited at full pool in the previous season (Figure 4-2). Ten of the fifteen plots were completely covered with debris, four were partly covered (20-80%) and one did not have any woody debris.

The number of pellet groups detected was low and more pellets were detected in Canoe Reach than Bush Arm (Table 4-2). In Bush Arm, only elk pellets were observed (Table 4-2).

In Canoe Reach, deer were the most commonly detected species, accounting for 22 of 26 pellet group detections. Moose pellet groups made up the remaining pellet groups; no elk pellet groups were recorded (Table 4-2).

Elk pellet groups were the only ungulate species observed in Bush Arm in 2011 and were observed at two of the four sites sampled in 2011 (Figure 4-3). Site 83 was inaccessible due to reservoir levels but elk pellet groups were observed at this site in 2009 (CBA 2010). Elk pellet groups were recorded on all transects at site 88 and from both transects at site 121 (Figure 4-3).

In Canoe Reach, the only pellet group recorded in the drawdown zone was on the control transect at site 15 (Figure 4-3). The remaining pellet groups in Canoe Reach were only recorded from local reference transects. No ungulate pellet groups were recorded from the treatment transects. No pellet groups were observed at Site 12 and the local reference transect at Site 8 had the highest number of pellet group observations (Figure 4-3).

Table 4-1: Ungulate pellet group survey dates

Region	Site	Survey Date
Canoe Reach	2	July 10-11, 2011
	8	July 9, 2011
	12	July 8, 2011
	15	July 10, 2011
	25	July 8, 2011
Bush Arm	83[a]	July 12, 2011
	84	July 12, 2011
	87	July 13, 2011
	88	July 13, 2011
	121	July 12, 2011

[a] – unable to access due to reservoir levels

Table 4-2: Total ungulate fecal pellets by transect types and ungulate species, in Bush Arm and Canoe Reach

Ungulate Species	Bush Arm				Canoe Reach		
	Control	Treatment	Local Reference	Reference	Control	Treatment	Local Reference
Deer	0	0	0	0	1	0	22
Elk	4	1	12	2	0	0	0
Moose	0	0	0	0	0	0	4
Total	4	1	12	2	1	0	26

Figure 4-1: Disturbance on the site 88 control transect due to live stake planting in spring 2011.

Figure 4-2: Debris deposited on the treatment transect at site 88 at full pool in fall 2010.

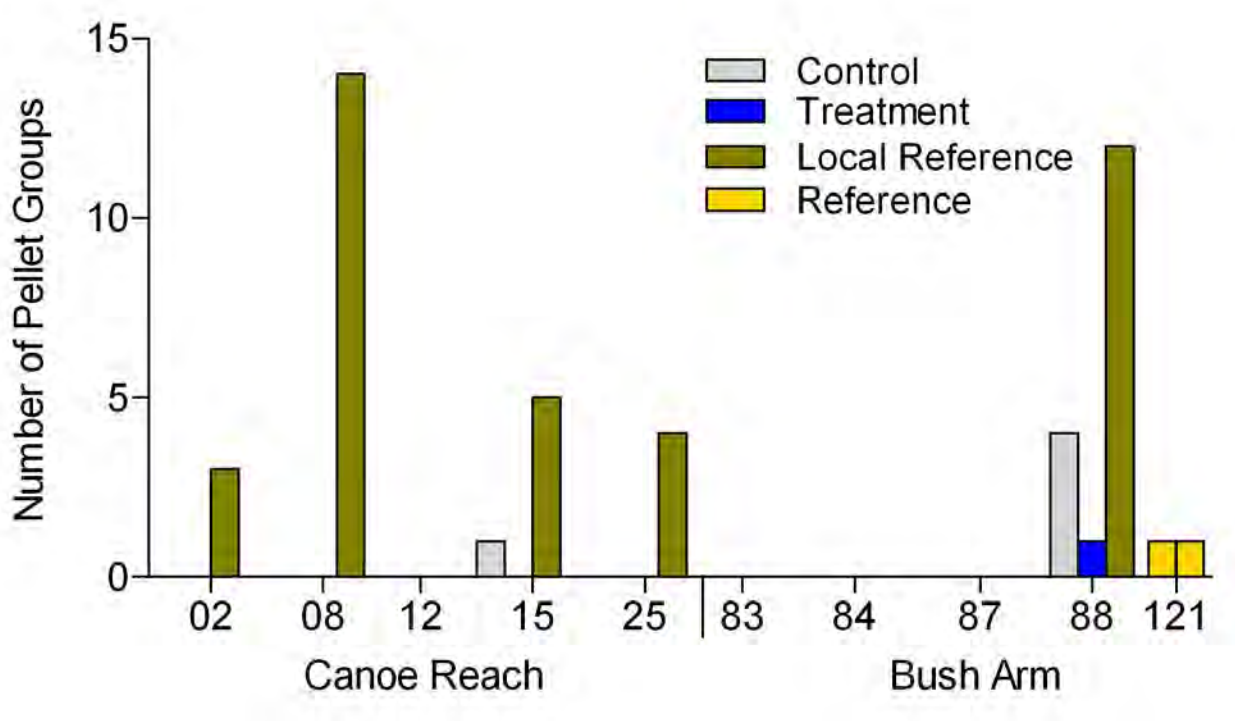

Figure 4-3: Number of pellet groups for all ungulate species by transect and site.

5 DISCUSSION

Ungulates select resources based on forage and mobility requirements, while minimizing predation risk (Kittle et al. 2008). A number of factors, including quality and quantity of forage, snow depth, and thermal and security cover, influence resource selection patterns by different ungulate species to varying degrees (Kittle et al. 2008, Hansen et al. 2009). Vegetation communities are the limiting influence for these factors and ultimately for the survival of ungulate populations.

The systematic ungulate pellet group surveys used in this project are a non-invasive, cost effective means of obtaining an index of ungulate relative abundance (Neff 1968, Collins and Urness 1981, Resources Inventory Committee 1998). The annual pellet group surveys are complemented by periodic aerial winter ungulate surveys along the entire drawdown zone. In the context of the CLBMON-11A wildlife effectiveness monitoring program, these surveys provide information on the relative use of areas in and above the drawdown zone by ungulates and their distribution around the reservoir. The pellet count data will be used to test the following management hypotheses:

H_{O2}: Revegetation does not increase the utilization of habitats by ungulates in the drawdown zone.

H_{02A}: Revegetation does not increase the seasonal abundance (winter/spring) of ungulates in the drawdown zone.

In 2011, the frequency of pellet groups (45 in 417 plots) was lower than in previous years (2008: 136 in 360 plots, 2009: 335 in 630 plots, 2010: 692 in 495 plots) (CBA 2009, 2010, 2011a). The higher number of pellet groups recorded in 2009 and 2010 was primarily the result of large numbers of elk pellt groups encountered at some Bush Arm sites. In contrast to previous years, more ungulate pellet groups were recorded in Canoe Reach than in Bush Arm. The overall distribution of pellet groups in 2011 was also different than in previous years with few pellet groups being recorded from the drawdown zone in either Bush Arm or Canoe Reach. Additionally, deer and moose were not detected in Bush Arm in 2011.

The reason for the notably fewer ungulate detections in the 2011 surveys is likely due to the relatively deep late winter snowpack observed during the March 2011 aerial surveys (CBA 2011a). The low numbers of elk pellet groups in Bush Arm does correspond to the results from the winter aerial surveys in early January and late March 2011 where no or few elk were observed in the drawdown zone (CBA 2011a). No elk were observed during the January surveys. During the March survey, the only elk tracks detected were along the forest edge to the east of the Bush Arm causeway and only a few foraging craters were observed (CBA 2011a). Factors such as snow depth and the annual inundation level should be reviewed following completion of the Year 5 monitoring to determine if either factor has an influence on ungulate use of the drawdown zone.

A number of other factors may have also contributed to the low detections of pellet groups. Weather conditions in the spring and early summer were wetter than normal resulting in dense vegetation growth on some of the drawdown zone transects, especially in Canoe Reach (Figure 3-4). This resulted in difficult search conditions so it is possible that some pellet groups may have been missed due to the dense vegetation. Both transects at site 121 were affected by an extended period of high water levels in the

Bush River that resulted in the deposition of at least 2 – 3 cm of silt and clay over all of the plots at this site. The deposited sediment may have covered some pellet groups. However, a few elk pellet groups were observed in areas adjacent to transect B suggesting that this may not have affected the detection of pellet groups. The number of pellet groups detected on the control transect at site 88 was reduced as due to disturbance on the transect from revegetation treatments. A portion of this transect was planted with live stakes using an excavator. This resulted in a loss of any pellets that were present where sod was removed for planting the stake and where the overturned sod was placed adjacent to the planted stake. The operation of the excavator also resulted in some disturbance that may have affected the number of pellet groups observed. Use of the site 88 treatment transect by ungulates was likely affected by the extensive coverage of woody debris during full pool in fall 2010. The presence of woody debris would have reduced access to forage and resulted in poor footing, effectively excluding elk from this transect.

A discussion of the habitat requirements of moose, elk and deer and what outcomes of revegetation program would be expected to increase the use of drawdown zone habitats by these species is provided in CBA (2011a).

The revegetation treatments are still in the early stages of establishment, so it is still too early to draw conclusions about the success of revegetation in increasing habitat use and relative seasonal abundance of ungulates in the drawdown zone. Measurable increases in herb cover (sedge and grass treatments) and shrub cover (live stake and deciduous plug treatments) will likely have to occur before differences in ungulate use of the drawdown zone are observed. However, the ability to detect measurable increases in herb and shrub cover is dependent on the success of revegetation treatments. Some revegetation treatments completed to date have had poor or no success (Keefer et al. 2011). The combination of pellet counts and winter surveys over the 11-year duration of the project is expected to address management questions related to the potential for revegetation to increase ungulate habitat use in the drawdown zone.

The Year 4 pellet count data provide continuity in the ungulate data going into Year 5 of the wildlife effectiveness monitoring program and for the detailed technical report from the first five years of the program. The results from Year 3 provided some indication that the revegetation program may be producing positive results for ungulates (CBA 2011a). However, it was considered too early to make any conclusions regarding the effectiveness of the monitoring program. The low numbers of pellet groups observed in 2011 confirms that additional years of monitoring on successfully revegetated sites will be required to determine the effectiveness of the revegetation treatments in increasing ungulate use of drawdown zone habitats.

As discussed in (CBA 2011a), the revegetation treatments were completed either just prior to or during the wildlife effectiveness monitoring program. Additionally, the success of the revegetation treatments was variable, with either complete failure in some locations (e.g., live stake treatment at Site 85 in Bush Arm), poor establishment of the revegetation treatment, or losses due to erosion and deposition in other locations (Keefer et al. 2011). Coordination with the revegetation program (CLBWORKS-1) about future planting locations and replanting plans will be required before the next effectiveness monitoring is initiated in Year 5 to avoid conflicts between the two studies and to confirm monitoring locations.

5.1 Recommendations

The ungulate pellet counts were completed during Year 4 of CLBMON-11A, to address one of the recommendations in CBA (2011a). Based on the results and observations during Year 4, the following recommendations should be addressed in future years of the effectiveness monitoring program:

- Coordination with the revegetation program will be crucial for the success of the wildlife effectiveness monitoring program in future years to ensure that appropriate controls are maintained and for coordination of sampling sites. The number of sites with high potential for revegetation is limited and as additional revegetation treatments have been completed it is becoming difficult to maintain effective control transects for wildlife monitoring at some of the sites. Crowding has occurred at sites 15, 84, 87, and 88 due to the large areas treated at these sites. This has affected transect placement, particularly for locating control transects.

- Ungulate pellet count data should continue to be collected every year, as the plots need to be cleared of pellets annually to ensure that pellets detected are only from a single year.

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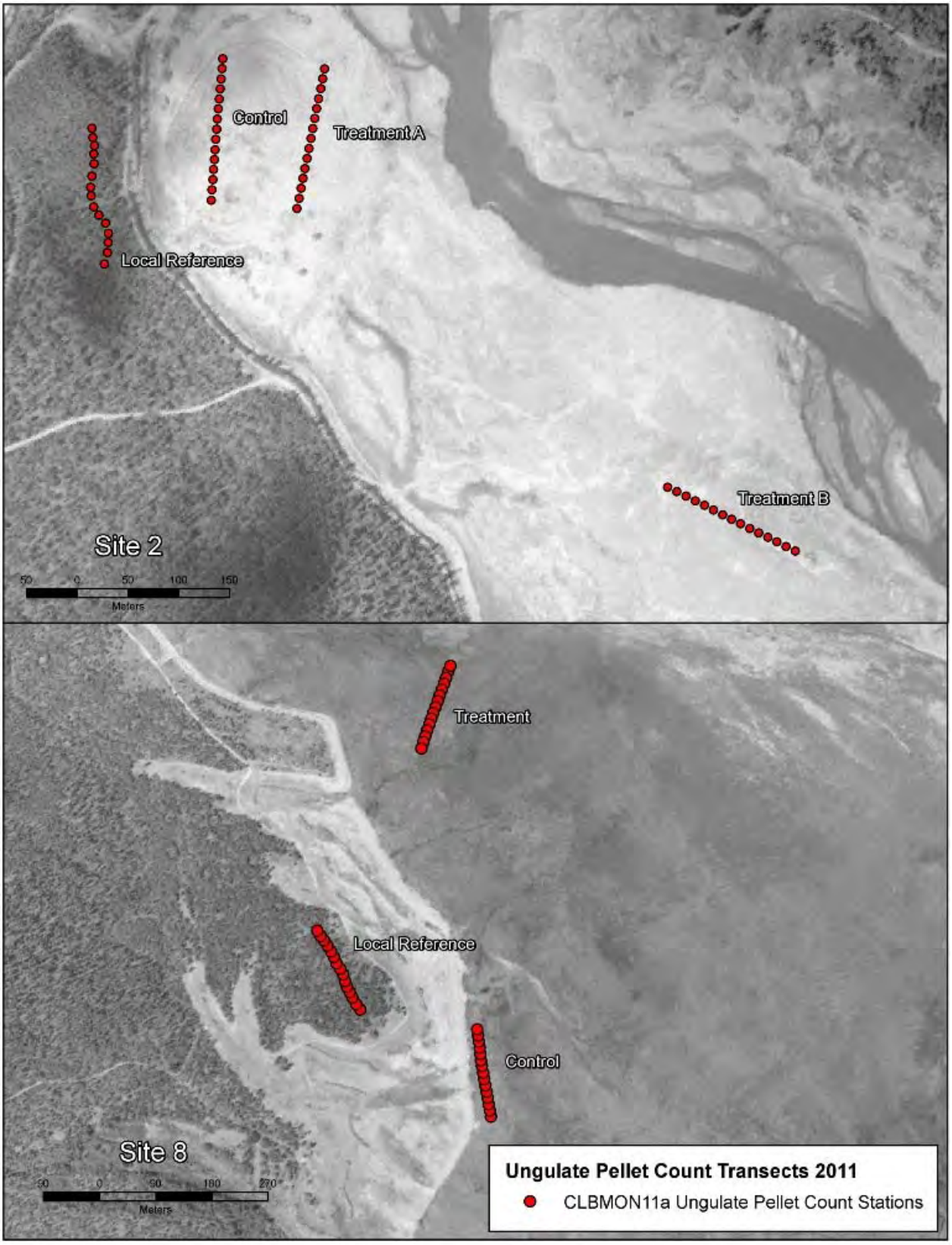
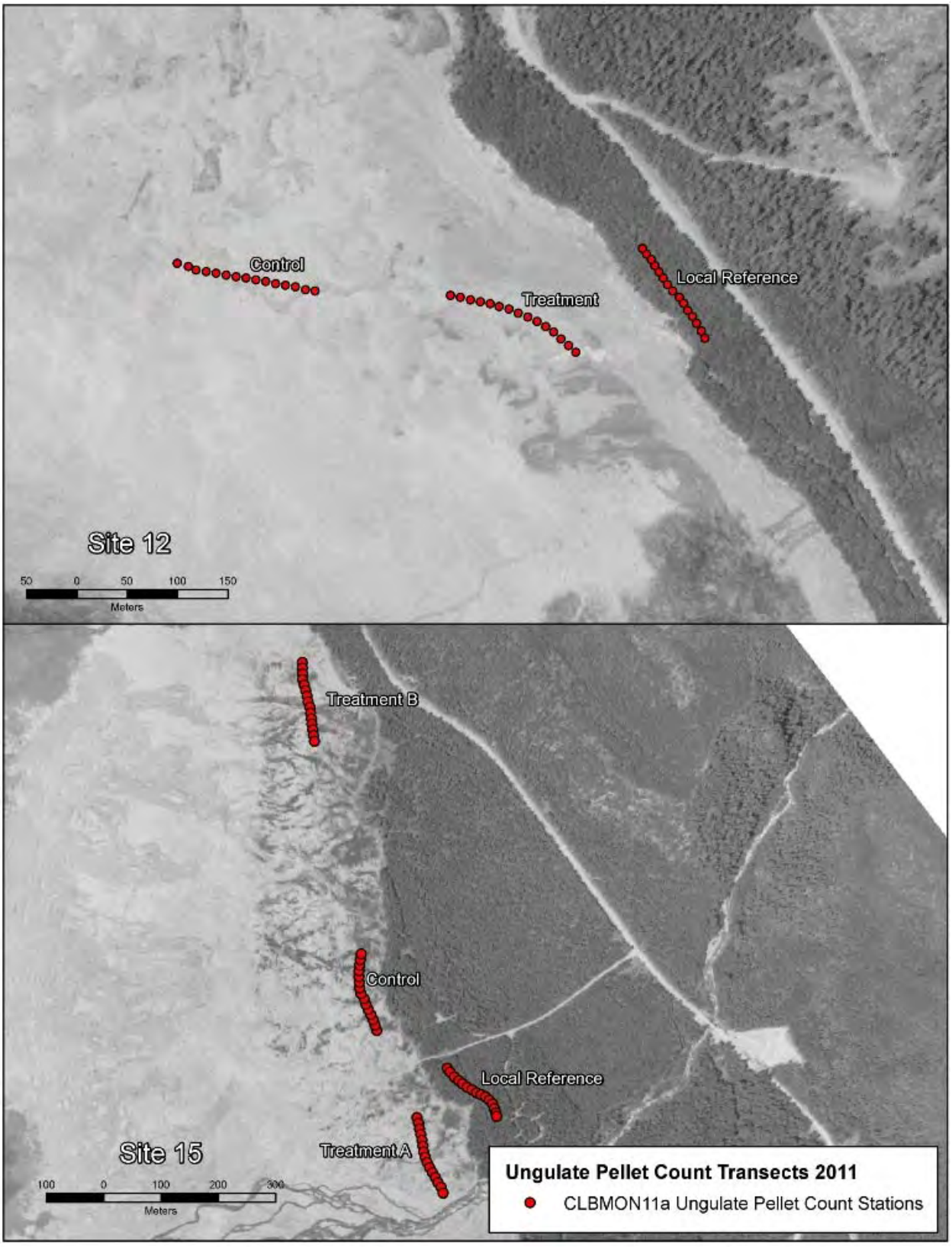
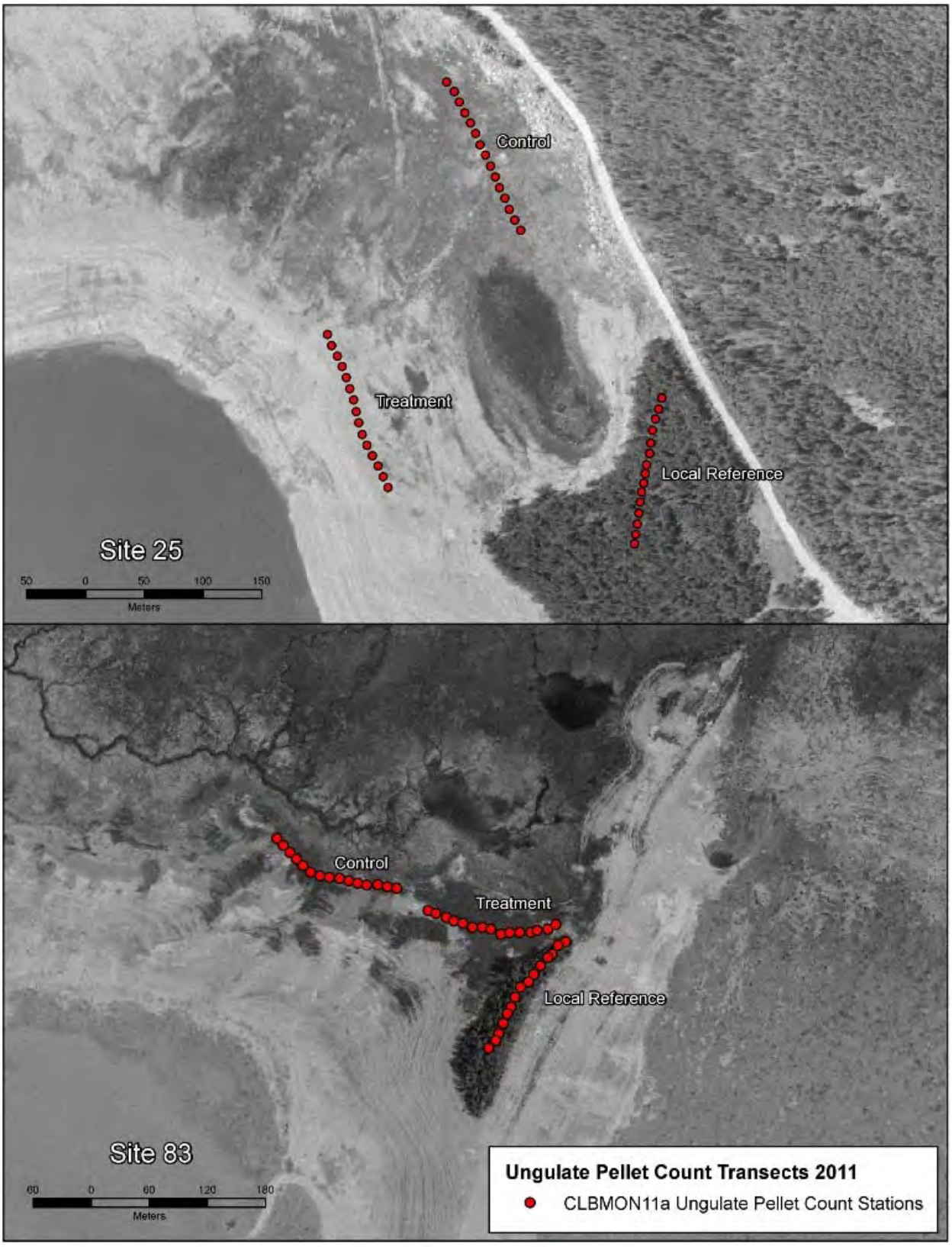
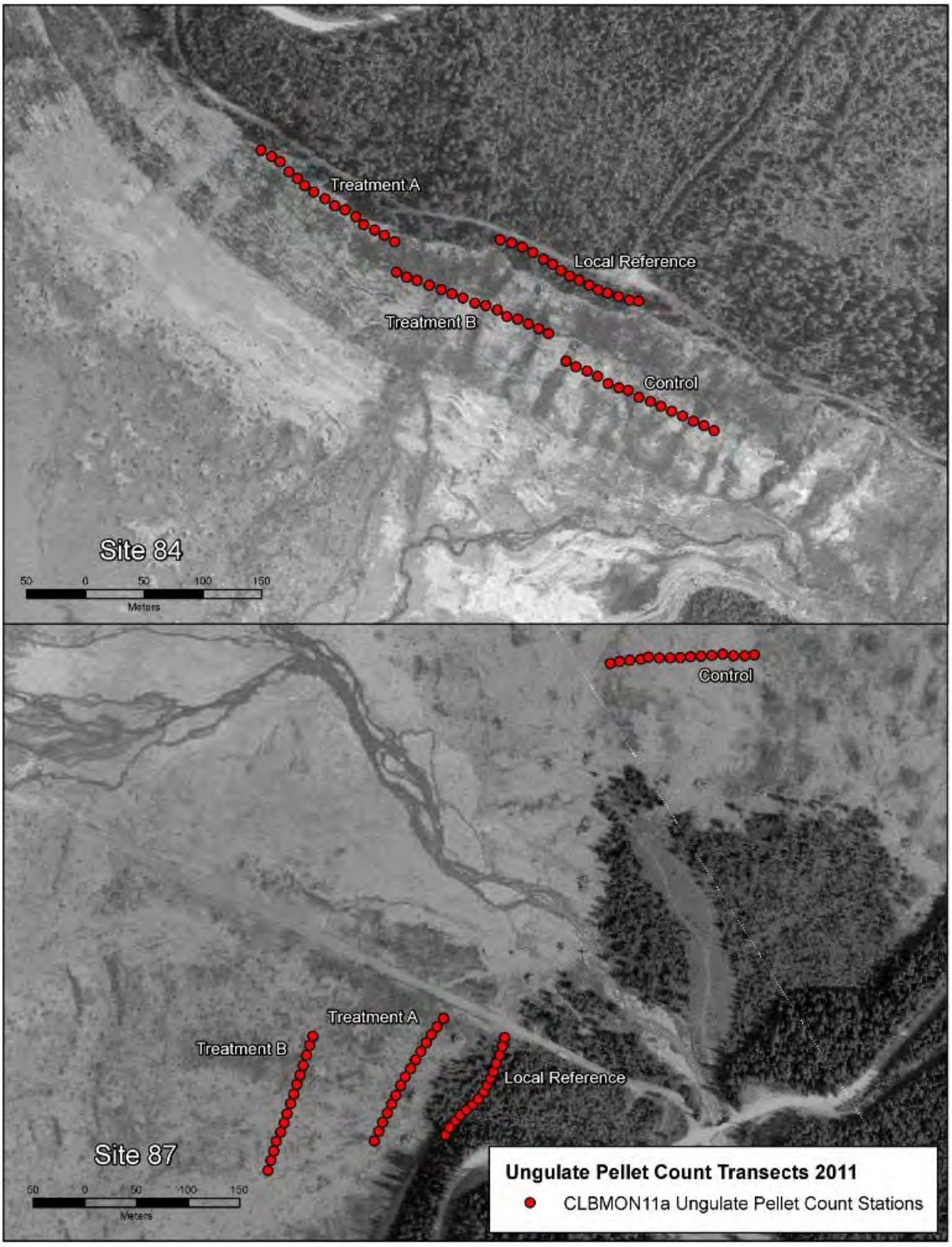
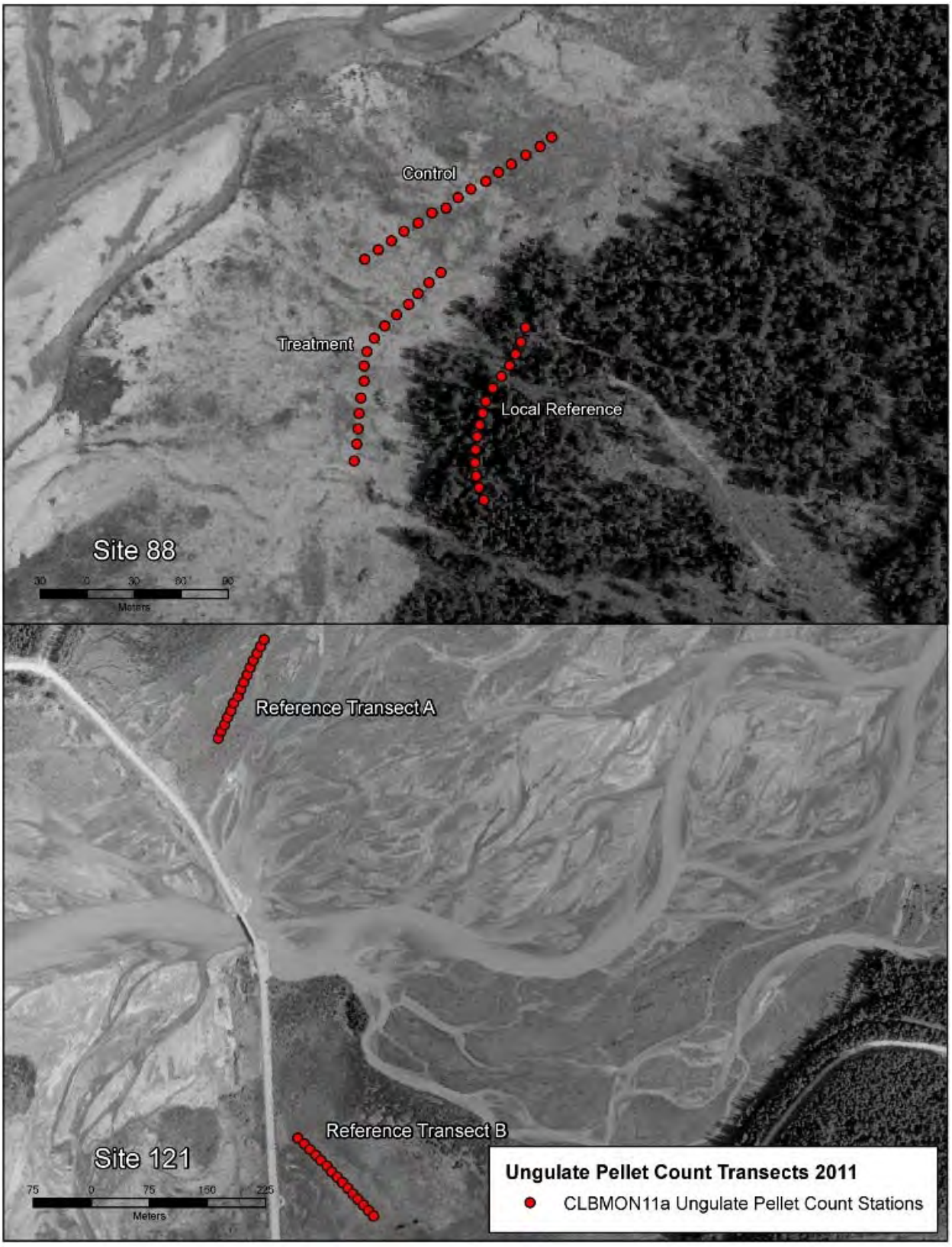
Appendix 1. Sampling location maps.


Control
Treatment A
Local Reference
Treatment B
Site 2
50 0 50 100 150
Meters
Treatment
Local Reference
Control
Site 8
90 0 90 180 270
Meters
Ungulate Pellet Count Transects 2011
CLBMON11a Ungulate Pellet Count Stations


Control
Treatment
Local Reference
Site 12
50 0 50 100 150
Meters
Treatment B
Control
Local Reference
Treatment A
Site 15
100 0 100 200 300
Meters
Ungulate Pellet Count Transects 2011
CLBMON11a Ungulate Pellet Count Stations


Control
Treatment
Local Reference
Site 25
50 0 50 100 150
Meters
Control
Treatment
Local Reference
Site 83
60 0 60 120 180
Meters
Ungulate Pellet Count Transects 2011
CLBMON11a Ungulate Pellet Count Stations


Treatment A
Local Reference
Treatment B
Control
Site 84
50 0 50 100 150
Meters
Control
Treatment A
Treatment B
Local Reference
Site 87
50 0 50 100 150
Meters
Ungulate Pellet Count Transects 2011
CLBMON11a Ungulate Pellet Count Stations


Control
Treatment
Local Reference
Site 88
30 0 30 60 90
Meters
Reference Transect A
Reference Transect B
Site 121
75 0 75 150 225
Meters
Ungulate Pellet Count Transects 2011
CLBMON11a Ungulate Pellet Count Stations

Appendix 2: Summary of ungulate pellet group count data, 2011

Region	Site	Transect	Deer	Moose	Elk	Total
Canoe Reach	2	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Reference	3	0	0	3
	8	Control	0	0	0	0
		Treatment	0	0	0	0
		Reference	14	0	0	14
	12	Control[a]	-	-	-	-
		Treatment[a]	-	-	-	-
		Reference	0	0	0	0
	15	Control	1	0	0	1
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Reference	5	0	0	5
	25	Control	0	0	0	0
		Treatment	0	0	0	0
		Reference	0	4	0	4
Bush Arm	83[b]	Control	-	-	-	-
		Treatment	-	-	-	-
		Reference	-	-	-	-
	84	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Reference	0	0	0	0
	87	Control	0	0	0	0
		Treatment A	0	0	0	0
		Treatment B	0	0	0	0
		Reference	0	0	0	0
	88	Control	0	0	4	4
		Treatment	0	0	1	1
		Reference	0	0	12	12
	121	A	0	0	0	0
		B	0	0	1	1

[a] – Transects flooded.
[b] – Site not accessible due to high reservoir levels.