

THE REGIONAL DISTRICT OF EAST KOOTENAY
MOSQUITO CONTROL PROGRAM
WASA/TA TA CREEK/SKOOKUMCHUCK MOSQUITO CONTROL EXTENDED SERVICE
AREA

SEASON END REPORT
NOVEMBER 2014

PROGRAM STAFF:

Mark Vaandering
Kendra Lewis

Project Manager
Program Coordinator/Mosquito Control Technician

CONTAINING:

Summary of 2014 Season Activities

Morrow BioScience Ltd.

SUMMARY OF ACTIVITIES

As with the previous three seasons, 2014 was busy one for mosquito control and the Wasa, Ta Ta Creek and Skookumchuck area. While the snow levels in the basins feeding this floodplain were higher than average, weather conditions were favorable to a relatively slow melt and lower than expected river levels.

The first treatment took place on May 23. Ground treatments continued through July 24.

On May 25 the river peaked at 3.98m (as measured at station 08NG065 – Kootenay River at Fort Steele). This high water resulted in an increase in larval activity of a very large area. At this point ground crews could no longer access many of the areas requiring treatment and a helicopter was brought in to conduct a large-scale treatment.

The first aerial treatment took place on June 3 as a result of the highest peak of the season.

The water levels were sustained at a relatively high level from late May until early July. This sustained water level resulted in increased seepage areas. A second aerial was conducted on June 25 to address these concerns.

This season a total of 1,189 hectares were treated, well above the 700 hectares included in the base contract.

Morrow BioScience Ltd (MBL) employees received no complaint calls concerning adult mosquito annoyance in this program this season.

SNOW AND RIVER LEVELS

Snow accumulations throughout the East Kootenay region (fig. 1-3) began this season above average. The melt through the end of May was relatively quick, resulting in a significant peak on May 25. The river level was maintained at a level that resulted in water table pressure and resulting seepage water through much of June. Most of the low and mid-elevation snow came out during May, reducing the risk of a freshet induced flood event.

By the end of June all of the significant snow was out of the system, all but eliminating the risk of subsequent flooding. (fig. 4)

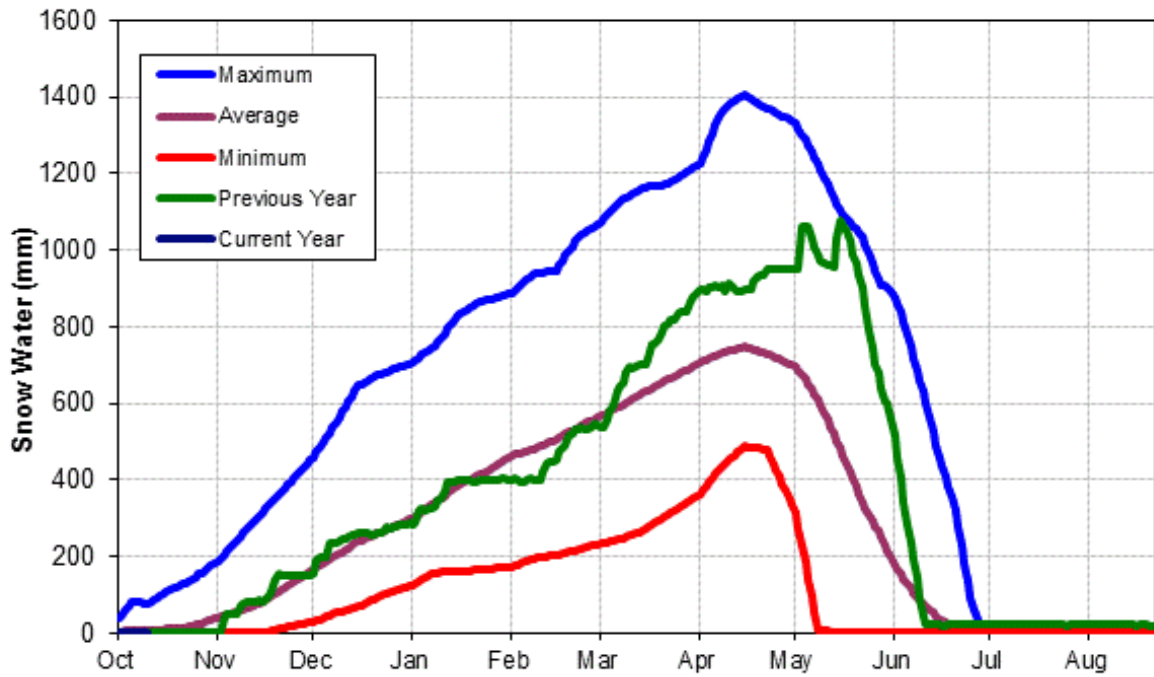


Figure 1. Snow pillow for Morrissey Ridge (2C09Q). The green line represents the accumulated snow levels for the 2014 season.

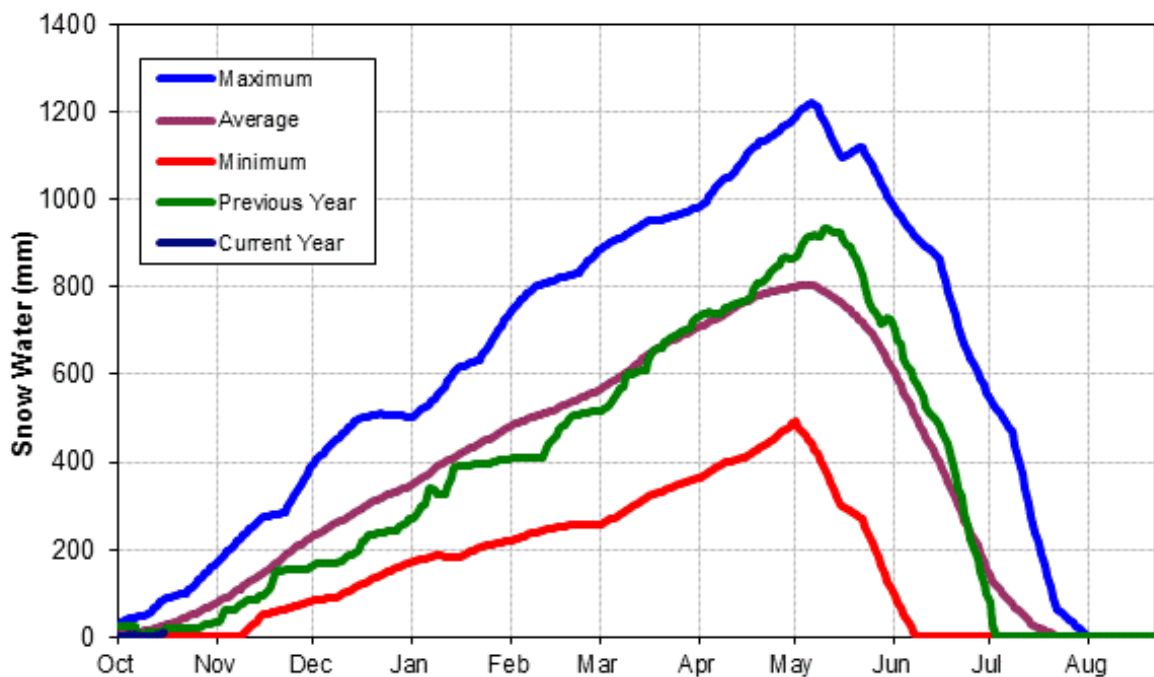


Figure 2. Snow pillow for Floe Lake (2C14P). The green line represents the accumulated snow levels for the 2014 season.

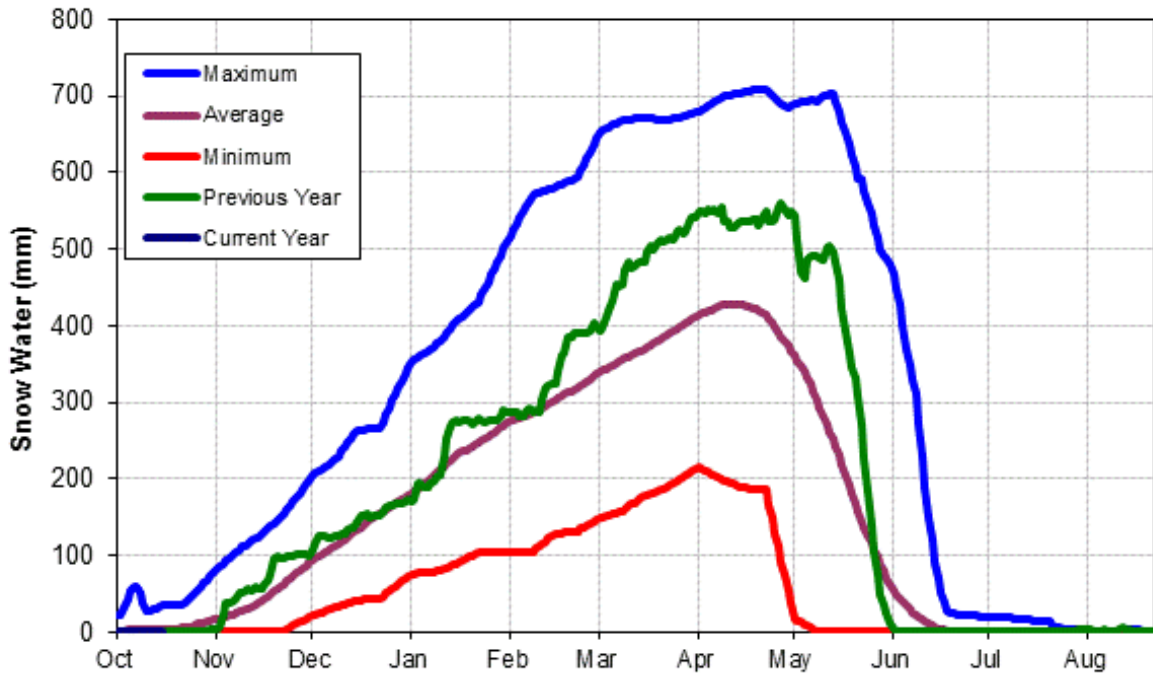


Figure 3. Snow pillow for Moyie Mountain (2C10P). The Green line represents the accumulated snow levels for the 2014 season.

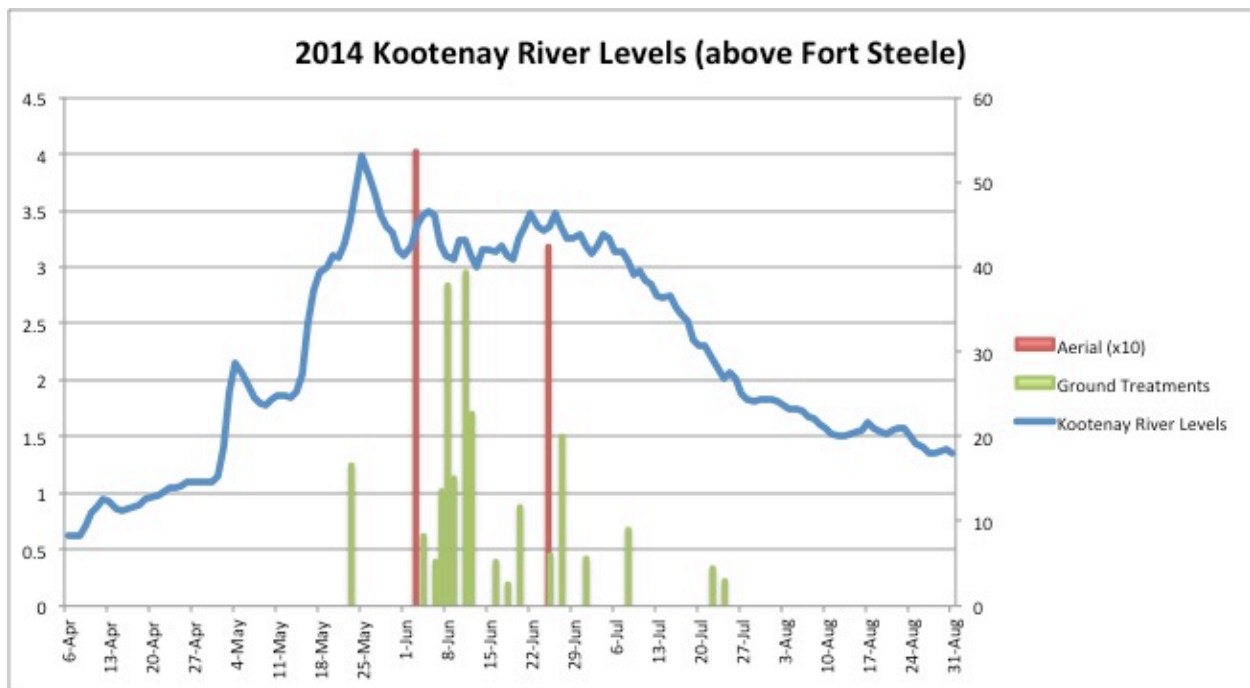


Figure 4 Note the increase in river level in early May. The green lines represent ground treatments and the red lines represent the one aerial (x10 to determine hectares treated).

MONITORING METHODOLOGY

The RDEK mosquito control program involves monitoring historically recognized mosquito development sites within the floodplain surrounding Wasa Lake, Tata Creek, and Skookumchuck. Although the monitoring area is relatively small, new sites are continually detected especially in high water years. High water means that the potential for seepage site development is also high. As there are numerous low-lying farms and benches throughout the floodplain, these areas are at a greater risk for the development of seepage from the Kootenay River. When new sites are found they are entered into a GIS database and monitored on the same schedule as are the historical sites.

In April and early May, the sites are visited at least once a week with the exception of the snowmelt-influenced sites, which are visited twice because they typically become active early. From mid-May through mid-August, each site is visited at least twice a week.

Aedes mosquitoes are the most common nuisance mosquitoes within the program. As opposed to other mosquitoes (i.e., *Culex*, *Culisetta*, *Anopholes*), *Aedes* lay their eggs on damp substrate in areas with a high flooding potential; they are often called 'floodwater' mosquitoes for this very reason. If the water flooding the eggs is sufficiently warm, contains a low enough dissolved oxygen (DO) content, and is organically rich (which contributes to a decreased DO content), hatching will commence (Gjullin et al. 1950).

The mosquito eggs hatch into larvae, which then go through 5 stages on their way to adulthood. The stages include 4 larval instars (or stages) and one pupal stage. These mosquitoes can hatch with densities recorded at levels up to 80 million per hectare, feeding many vertebrates and invertebrates for a few weeks each year before leaving the aquatic system.

Larval counts are made upon each visit and counts are distinguished between early instar (1st and 2nd) and late (3rd and 4th). Also at each visit, notes are made regarding pupae counts, which aid in distinguishing whether or not a treatment has been missed at a particular site. MBL treatment protocol dictates that field technicians target the late 3rd instar and early 4th instar stages in order to leave more biomass in the water for predators who depend on larvae as a food source.

LARVAL TREATMENT

Larval mosquitoes are treated with Aquabac®. Aquabac® is considered a microbial larvicide, meaning that the active ingredient is a soil-borne bacteria. In this case, the bacteria is *Bacillus thuringiensis* var. *israelensis* (Bti). The mode of action for Bti is relatively simple and with a rather high degree of species specificity. Receptors within the midgut region of the mosquito larvae are specific to the toxin proteins that are produced alongside each bacterial spore. After the mosquito larvae ingest the toxin protein, disruption of the larval midgut cells occurs as a result of cleavage of the protoxins by midgut proteases. An osmotic imbalance across the midgut epithelial cell membranes occurs due to this binding, which causes considerable damage to the wall of the gut and quickly leads to larval death (Boisvert and Boisvert, 2000). Bti has four specific endotoxins (Beaty and Marquardt, 1996).

Due to the specificity of the mosquito larval midgut receptors to the Bti endotoxins, Bti is a relatively safe treatment option. Besides mosquitoes, Bti also has an effect on black fly larvae. A commonly voiced concern is whether or not Bti has effects on salmonids. There is a large body of evidence that suggests Bti does not directly affect salmonids. Numerous studies have demonstrated the general safety of exposing fish to Bti (Brown et al. 1998, Brown et al. 2002, Brown et al. 2004). Hurst et al. (2007) subjected the crimson-spotted rainbowfish (*Melanotaenia duboulayi*) to 10 times the effective field concentration of Bs, Bti, and s-methoprene and reported no effects on their swimming performance. Sternberg et al. (2012) subjected juvenile coho salmon (*Oncorhynchus kisutch*) to the maximum recommended amount of a Bti product in two separate standard static toxicity tests (USEPA, 1996). No overt effects were observed on behavior or detected in fish weight. Therefore, amounts of Bti applied in field treatments are highly unlikely to cause direct hazard to juvenile salmonids.

MONITORING AND TREATMENT SUMMARY

Table 1 Each entry in the table indicates a monitoring and/or treatment event. In the event that there is no treatment indicated in column 5, then the event is considered a "monitoring only event".

Site	Date	Larvae/dip	Method	Hectares
RDEK-001	13-May	0		0.000
RDEK-003	13-May	0		0.000
RDEK-005	13-May	0		0.000
RDEK-006	13-May	0		0.000
RDEK-023	13-May	0		0.000
RDEK-028	13-May	0		0.000
RDEK-048	13-May	0		0.000
RDEK-050	13-May	0		0.000
RDEK-001	20-May	0		0.000
RDEK-003	20-May	0		0.000
RDEK-005	20-May	0		0.000
RDEK-006	20-May	0		0.000
RDEK-022	20-May	0		0.000
RDEK-023	20-May	0		0.000
RDEK-024	20-May	0		0.000
RDEK-045	20-May	0		0.000
RDEK-048	20-May	75		0.000
RDEK-050	20-May	50		0.000
RDEK-050	23-May	50	Blower	12.133
RDEK-048	23-May	75	Blower	4.550
RDEK-028	23-May	0		0.000
RDEK-008	23-May	0		0.000
RDEK-007	23-May	0		0.000

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RDEK-001	29-May	1000		0.000
RDEK-002	29-May	2000		0.000
RDEK-003	29-May	500		0.000
RDEK-006	29-May	100		0.000
RDEK-007	29-May	150		0.000
RDEK-008	29-May	200		0.000
RDEK-028	29-May	300		0.000
RDEK-029	29-May	300		0.000
RDEK-005	29-May	75		0.000
RDEK-014	31-May	100		0.000
RDEK-015	31-May	100		0.000
RDEK-016	31-May	150		0.000
RDEK-042	31-May	150		0.000
RDEK-043	31-May	50		0.000
RDEK-044	31-May	40		0.000
RDEK-045	31-May	20		0.000
RDEK-052	31-May	30		0.000
RDEK-018	31-May	30		0.000
RDEK-001	03-Jun	500	Aerial	30.333
RDEK-002	03-Jun	500	Aerial	30.333
RDEK-003	03-Jun	500	Aerial	15.167
RDEK-004	03-Jun	500	Aerial	3.033
RDEK-005	03-Jun	500	Aerial	6.067
RDEK-006	03-Jun	500	Aerial	15.167
RDEK-007	03-Jun	500	Aerial	12.133
RDEK-008	03-Jun	500	Aerial	18.200
RDEK-011	03-Jun	500	Aerial	9.100
RDEK-012	03-Jun	500	Aerial	6.067
RDEK-013	03-Jun	500	Aerial	6.067
RDEK-014	03-Jun	500	Aerial	18.200
RDEK-015	03-Jun	500	Aerial	33.367
RDEK-016	03-Jun	500	Aerial	36.400
RDEK-018	03-Jun	500	Aerial	3.033
RDEK-022	03-Jun	500	Aerial	3.033
RDEK-027	03-Jun	500	Aerial	3.033
RDEK-028	03-Jun	500	Aerial	36.400
RDEK-029	03-Jun	500	Aerial	18.200
RDEK-030	03-Jun	500	Aerial	9.100
RDEK-035	03-Jun	500	Aerial	6.067

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RDEK-036	03-Jun	500	Aerial	6.067
RDEK-037	03-Jun	500	Aerial	6.067
RDEK-038	03-Jun	500	Aerial	6.067
RDEK-039	03-Jun	500	Aerial	6.067
RDEK-040	03-Jun	500	Aerial	6.067
RDEK-042	03-Jun	500	Aerial	24.267
RDEK-043	03-Jun	500	Aerial	12.133
RDEK-044	03-Jun	500	Aerial	9.100
RDEK-045	03-Jun	500	Aerial	6.067
RDEK-047	03-Jun	500	Aerial	3.033
RDEK-048	03-Jun	500	Aerial	12.133
RDEK-049	03-Jun	500	Aerial	6.067
RDEK-050	03-Jun	500	Aerial	60.667
RDEK-052	03-Jun	500	Aerial	6.067
RDEK-054	03-Jun	500	Aerial	18.200
RDEK-055	03-Jun	500	Aerial	18.200
RDEK-056	03-Jun	500	Aerial	12.133
RDEK-005	04-Jun	200	Blower	0.758
RDEK-028	04-Jun	20	Blower	0.758
RDEK-004	04-Jun	10	Blower	0.758
RDEK-006	04-Jun	30	Blower	0.758
RDEK-001	04-Jun	200	Blower	4.550
RDEK-025	04-Jun	10	Blower	0.758
RDEK-010	06-Jun	10	Blower	2.275
RDEK-022	06-Jun	5	Blower	0.758
RDEK-026	06-Jun	15	Blower	0.758
RDEK-027	06-Jun	20	Blower	0.758
RDEK-020	06-Jun	0		0.000
RDEK-021	06-Jun	0		0.000
RDEK-023	06-Jun	0		0.000
RDEK-024	06-Jun	25	Blower	0.758
RDEK-015	06-Jun	0		0.000
RDEK-017	06-Jun	0		0.000
RDEK-016	06-Jun	0		0.000
RDEK-023	07-Jun	20	Blower	0.758
RDEK-006	07-Jun	100	Blower	2.275
RDEK-008	07-Jun	100	Blower	6.067
RDEK-014	07-Jun	300	Blower	2.275
RDEK-003	07-Jun	60	Blower	2.275

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RDEK-004	08-Jun	30	Blower	2.275
RDEK-001	08-Jun	100	Blower	2.275
RDEK-002	08-Jun	500	Blower	15.167
RDEK-005	08-Jun	20	Blower	3.033
RDEK-028	08-Jun	200	Blower	7.583
RDEK-029	08-Jun	200	Blower	7.583
RDEK-015	08-Jun	0		0.000
RDEK-047	09-Jun	50	Blower	3.033
RDEK-048	09-Jun	75	Blower	3.033
RDEK-050	09-Jun	75	Blower	9.100
RDEK-046	09-Jun	0		0.000
RDEK-028	11-Jun	200	Blower	9.100
RDEK-029	11-Jun	200	Blower	3.792
RDEK-042	11-Jun	50	Blower	15.167
RDEK-027	11-Jun	20	Blower	5.308
RDEK-026	11-Jun	10	Blower	0.758
RDEK-018	11-Jun	25	Blower	3.033
RDEK-023	11-Jun	10	Blower	0.758
RDEK-022	11-Jun	15	Blower	0.758
RDEK-025	11-Jun	15	Blower	0.379
RDEK-020	11-Jun	15	Blower	0.379
RDEK-021	11-Jun	0		0.000
RDEK-042	12-Jun	50	Blower	3.033
RDEK-043	12-Jun	30	Blower	6.067
RDEK-024	12-Jun	15	Blower	3.033
RDEK-015	12-Jun	0		0.000
RDEK-016	12-Jun	0		0.000
RDEK-005	12-Jun	25	Blower	3.033
RDEK-003	12-Jun	20	Blower	0.758
RDEK-002	12-Jun	100	Blower	1.517
RDEK-001	12-Jun	100	Blower	1.517
RDEK-045	12-Jun	10	Blower	0.758
RDEK-004	12-Jun	50	Blower	3.033
RDEK-025	16-Jun	15	Blower	0.379
RDEK-026	16-Jun	10	Blower	0.379
RDEK-020	16-Jun	20	Blower	0.379
RDEK-021	16-Jun	20	Blower	0.379
RDEK-027	16-Jun	50	Blower	0.758
RDEK-022	16-Jun	30	Blower	0.758

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RDEK-001	16-Jun	200	Blower	0.758
RDEK-003	16-Jun	75	Blower	0.379
RDEK-004	16-Jun	50	Blower	0.758
RDEK-005	16-Jun	50	Blower	0.379
RDEK-001	18-Jun	0		0.000
RDEK-008	18-Jun	100	Blower	1.517
RDEK-023	18-Jun	15	Blower	0.379
RDEK-024	18-Jun	50	Blower	0.758
RDEK-047	18-Jun	0		0.000
RDEK-048	18-Jun	0		0.000
RDEK-050	18-Jun	0		0.000
RDEK-014	19-Jun	0		0.000
RDEK-015	19-Jun	0		0.000
RDEK-016	19-Jun	0		0.000
RDEK-017	19-Jun	0		0.000
RDEK-042	19-Jun	0		0.000
RDEK-043	19-Jun	0		0.000
RDEK-044	19-Jun	0		0.000
RDEK-045	19-Jun	0		0.000
RDEK-028	20-Jun	100	Blower	4.550
RDEK-029	20-Jun	100	Blower	2.275
RDEK-022	20-Jun	30	Blower	0.758
RDEK-026	20-Jun	10	Blower	0.379
RDEK-020	20-Jun	20	Blower	0.379
RDEK-021	20-Jun	20	Blower	0.379
RDEK-023	20-Jun	15	Blower	0.379
RDEK-024	20-Jun	30	Blower	0.758
RDEK-018	20-Jun	10	Blower	0.379
RDEK-027	20-Jun	50	Blower	1.517
RDEK-001	24-Jun	50		0.000
RDEK-002	24-Jun	50		0.000
RDEK-003	24-Jun	50		0.000
RDEK-004	24-Jun	50		0.000
RDEK-005	24-Jun	50		0.000
RDEK-006	24-Jun	50		0.000
RDEK-007	24-Jun	50		0.000
RDEK-008	24-Jun	50		0.000
RDEK-011	24-Jun	50		0.000
RDEK-012	24-Jun	50		0.000

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RDEK-014	24-Jun	50		0.000
RDEK-015	24-Jun	50		0.000
RDEK-016	24-Jun	50		0.000
RDEK-018	24-Jun	50		0.000
RDEK-022	24-Jun	50		0.000
RDEK-023	24-Jun	50		0.000
RDEK-024	24-Jun	50		0.000
RDEK-027	24-Jun	50		0.000
RDEK-028	24-Jun	50		0.000
RDEK-029	24-Jun	50		0.000
RDEK-042	24-Jun	50		0.000
RDEK-043	24-Jun	50		0.000
RDEK-045	24-Jun	50		0.000
RDEK-048	24-Jun	50		0.000
RDEK-050	24-Jun	50		0.000
RDEK-001	25-Jun	50	Aerial	12.133
RDEK-002	25-Jun	50	Aerial	12.133
RDEK-003	25-Jun	50	Aerial	12.133
RDEK-004	25-Jun	50	Aerial	15.167
RDEK-005	25-Jun	50	Aerial	9.100
RDEK-006	25-Jun	50	Aerial	12.133
RDEK-007	25-Jun	50	Aerial	6.067
RDEK-008	25-Jun	50	Aerial	30.333
RDEK-009	25-Jun	50	Aerial	15.167
RDEK-010	25-Jun	50	Aerial	15.167
RDEK-011	25-Jun	50	Aerial	15.167
RDEK-013	25-Jun	50	Aerial	15.167
RDEK-014	25-Jun	50	Aerial	12.133
RDEK-015	25-Jun	50	Aerial	9.100
RDEK-016	25-Jun	50	Aerial	9.100
RDEK-017	25-Jun	50	Aerial	15.167
RDEK-018	25-Jun	50	Aerial	6.067
RDEK-022	25-Jun	50	Aerial	9.100
RDEK-023	25-Jun	50	Aerial	3.033
RDEK-024	25-Jun	50	Aerial	6.067
RDEK-027	25-Jun	50	Aerial	12.133
RDEK-028	25-Jun	50	Aerial	6.067
RDEK-029	25-Jun	50	Aerial	9.100
RDEK-030	25-Jun	50	Aerial	9.100

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RDEK-033	25-Jun	50	Aerial	6.067
RDEK-042	25-Jun	50	Aerial	15.167
RDEK-043	25-Jun	50	Aerial	15.167
RDEK-045	25-Jun	50	Aerial	6.067
RDEK-047	25-Jun	50	Aerial	9.100
RDEK-048	25-Jun	50	Aerial	6.067
RDEK-049	25-Jun	50	Aerial	9.100
RDEK-050	25-Jun	50	Aerial	15.167
RDEK-051	25-Jun	50	Aerial	6.067
RDEK-052	25-Jun	50	Aerial	15.167
RDEK-053	25-Jun	50	Aerial	12.133
RDEK-054	25-Jun	50	Aerial	15.167
RDEK-055	25-Jun	50	Aerial	15.167
RDEK-056	25-Jun	50	Aerial	3.033
RDEK-042	25-Jun	30	Blower	1.517
RDEK-043	25-Jun	30	Blower	3.033
RDEK-045	25-Jun	20	Blower	0.758
RDEK-005	25-Jun	15	Blower	0.758
RDEK-006	27-Jun	50	Blower	2.275
RDEK-008	27-Jun	50	Blower	3.033
RDEK-009	27-Jun	50	Blower	2.275
RDEK-010	27-Jun	50	Blower	3.033
RDEK-011	27-Jun	50	Blower	1.517
RDEK-028	27-Jun	30	Blower	2.275
RDEK-025	27-Jun	5	Blower	0.379
RDEK-020	27-Jun	5	Blower	0.379
RDEK-021	27-Jun	5	Blower	0.379
RDEK-022	27-Jun	20	Blower	0.758
RDEK-027	27-Jun	0		0.000
RDEK-016	27-Jun	0		0.000
RDEK-015	27-Jun	20	Blower	0.758
RDEK-003	27-Jun	75	Blower	3.033
RDEK-023	01-Jul	0		0.000
RDEK-024	01-Jul	20	Blower	0.758
RDEK-027	01-Jul	30	Blower	1.517
RDEK-018	01-Jul	15	Blower	1.517
RDEK-020	01-Jul	5	Blower	0.379
RDEK-021	01-Jul	5	Blower	0.379
RDEK-022	01-Jul	20	Blower	0.758

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RDEK-025	01-Jul	5	Blower	0.379
RDEK-026	01-Jul	0		0.000
RDEK-028	01-Jul	0		0.000
RDEK-029	01-Jul	0		0.000
RDEK-006	08-Jul	10	Blower	4.929
RDEK-020	08-Jul	10	Blower	0.379
RDEK-021	08-Jul	10	Blower	0.379
RDEK-025	08-Jul	5	Blower	0.379
RDEK-005	08-Jul	20	Blower	0.758
RDEK-027	08-Jul	25	Blower	1.517
RDEK-024	08-Jul	25	Blower	0.758
RDEK-001	10-Jul	1		0.000
RDEK-002	10-Jul	0		0.000
RDEK-003	10-Jul	0		0.000
RDEK-004	10-Jul	2		0.000
RDEK-005	10-Jul	0		0.000
RDEK-006	10-Jul	0		0.000
RDEK-008	10-Jul	0		0.000
RDEK-015	10-Jul	0		0.000
RDEK-018	10-Jul	0		0.000
RDEK-020	10-Jul	0		0.000
RDEK-021	10-Jul	0		0.000
RDEK-022	10-Jul	0		0.000
RDEK-023	10-Jul	0		0.000
RDEK-024	10-Jul	0		0.000
RDEK-025	10-Jul	0		0.000
RDEK-027	10-Jul	0		0.000
RDEK-028	10-Jul	2		0.000
RDEK-029	10-Jul	2		0.000
RDEK-042	10-Jul	3		0.000
RDEK-047	10-Jul	0		0.000
RDEK-001	22-Jul	0		0.000
RDEK-002	22-Jul	0		0.000
RDEK-003	22-Jul	0		0.000
RDEK-004	22-Jul	15	Blower	1.517
RDEK-005	22-Jul	15	Blower	3.033
RDEK-015	22-Jul	0		0.000
RDEK-016	22-Jul	0		0.000
RDEK-018	22-Jul	0		0.000

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RDEK-020	24-Jul	5	Blower	0.379
RDEK-021	24-Jul	5	Blower	0.379
RDEK-023	24-Jul	0		0.000
RDEK-024	24-Jul	0		0.000
RDEK-025	24-Jul	5	Blower	0.758
RDEK-027	24-Jul	10	Blower	0.758
RDEK-022	24-Jul	5	Blower	0.758
RDEK-001	28-Jul	0		0.000
RDEK-002	28-Jul	2		0.000
RDEK-003	28-Jul	0		0.000
RDEK-004	28-Jul	0		0.000
RDEK-005	28-Jul	0		0.000
RDEK-006	28-Jul	3		0.000
RDEK-008	28-Jul	1		0.000
RDEK-018	28-Jul	1		0.000
RDEK-020	28-Jul	0		0.000
RDEK-021	28-Jul	0		0.000
RDEK-025	28-Jul	0		0.000
RDEK-028	28-Jul	1		0.000
RDEK-029	28-Jul	0		0.000
RDEK042	28-Jul	1		0.000
RDEK-001	07-Aug	0		0.000
RDEK-006	07-Aug	0		0.000
RDEK-020	07-Aug	0		0.000
RDEK-028	07-Aug	1		0.000
RDEK-001	13-Aug	0		0.000
RDEK-006	13-Aug	0		0.000
RDEK-028	13-Aug	0		0.000
RDEK-020	13-Aug	0		0.000
RDEK-042	25-Aug	0		0.000
RDEK-006	25-Aug	0		0.000
RDEK-001	25-Aug	0		0.000
RDEK-020	25-Aug	0		0.000
RDEK-028	25-Aug	0		0.000

SEASON TOTALS

	QUANTITY APPLIED (kg)	AREA (ha)	APPLICATION MODE
Grand Total	5,773.4	961.6	Aerial
	1,367.0	227.5	Blower/Hand
	7,140.4	1,189.1	

DISCUSSION

In an effort to assist all areas in broadcasting a uniform message regarding mosquito control and WNV, Morrow BioScience Ltd. operates a comprehensive website. This site can be found at www.morrowbioscience.com. MBL would encourage people to utilize this resource to help answer any questions they may have. MBL would also encourage the RDEK to provide a link to this website from their municipal site for easy access to local residents. It is planned to revamp/update the website prior to the 2015 season in order to further improve its content and presentation.

A total of 7,140.4kg of larvicide or approximately 392.3 bags (18.2kg/bag) were applied to 1,189.1ha during the season.

Plans for Mosquito Control Program Improvements – Future Seasons

- To effectively treat the service area we will need a higher budget/ more product.
- Start planning our budget based on a flood year. (By having more product available we will keep the inventory current by using the first in first out method).
- Continue to work with “Ducks unlimited” and “Natures Trust” on direction to be taken with “Bummers Flats”.
- Contact Parks Canada for trail upkeep around the lake
- Ensure we actively pursue the ongoing beaver dam problems
- Work on Thunderhoof culvert and dyke.
- Put culvert or dyke on north side of Thunderhoof

If you have any questions regarding this summary report, please do not hesitate to give me a call at 604-986-1168.



Mark Vaandering, P.Eng.
President
MORROW BIOSCIENCE LTD.