Driving Ecological Solutions
for a Better Living

2017 FINAL REPORT

BIOLOGICAL CONTROL OF BITING INSECTS

Labrador City

Table of Content

1 Introduction

Labrador City, located in the West of Labrador, is home to one of the world's largest iron mining operations. Surrounding Labrador City are vast lands of forest with peaks and valleys dotted and scoured by lakes and rivers. Given its surrounding topography and hydrology, this area is an ideal breeding ground for black flies and mosquitoes.

Labrador City has mandated GDG Environnement to undertake the control of black flies and mosquitoes using the biological larvicide *Bacillus thuringiensis israelensis* (Bti).

The program's objective is to reduce adult populations of black flies by 90% within the boundaries of Labrador City, Wabush and the Tamarack Golf Club from May 1st to September 1st.

In order to achieve 90% reduction of biting fly population, every mosquito breeding site up to 2.5 km from the protection area were treated and, for black flies, within 8 to 10 km. More than 90% nuisance reduction was achieved in 2017.

2 Highlights of 2017 operations

HISTORY

Since 2010, GDG Environment has been contracted by Labrador City to reduce nuisance caused by black flies. Originally, the program offered a 90% reduction of black fly nuisance from May to September. In 2013, mosquito control was added to the mandate.

TREATED AREAS

The program consists of 2 types of treatments, one for mosquito control and the other for black fly control. The protection area is shown in Figure 1.1. This is where a 90% reduction in mosquitoes and black flies is guaranteed.

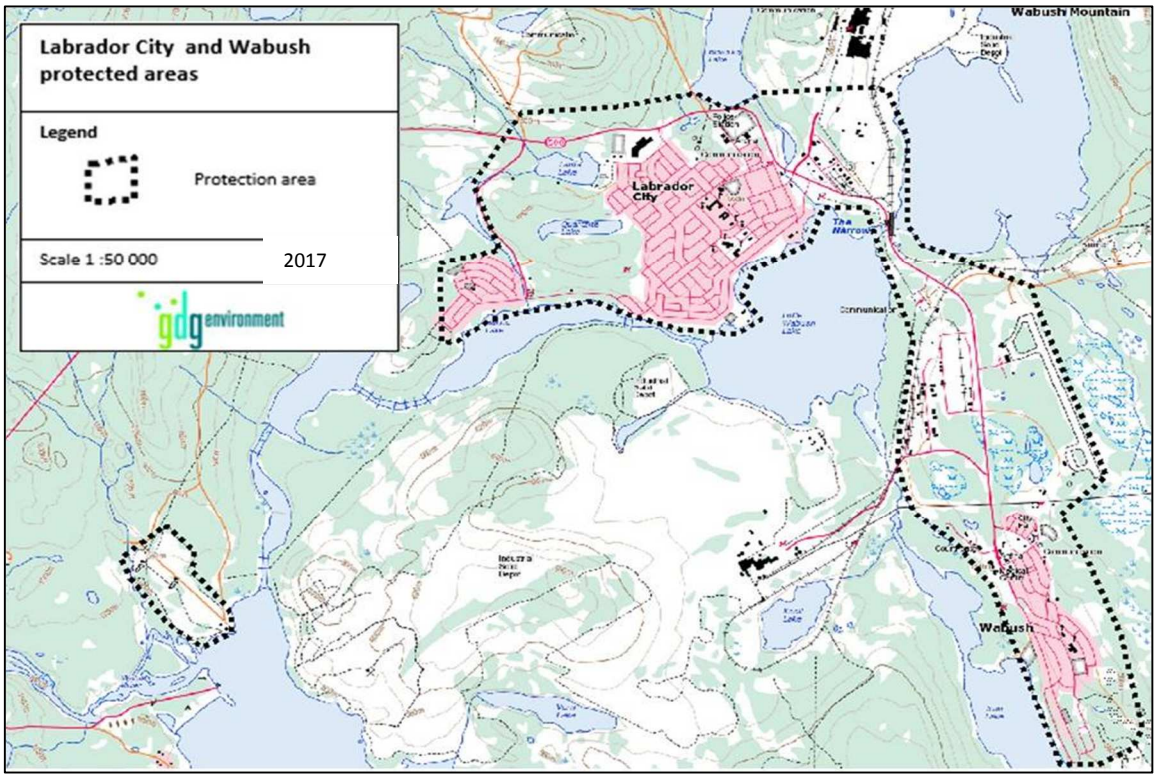


Figure 1.1. Labrador City biting fly protection area

In order to reach a 90% reduction, treatment of all the possible mosquito and black fly development sites is necessary. Figure 1.2 shows the areas that were monitored and treated for the control of mosquitoes in 2017. Figure 1.3 shows the areas that were monitored and treated with a biological larvicide for the control of black flies.

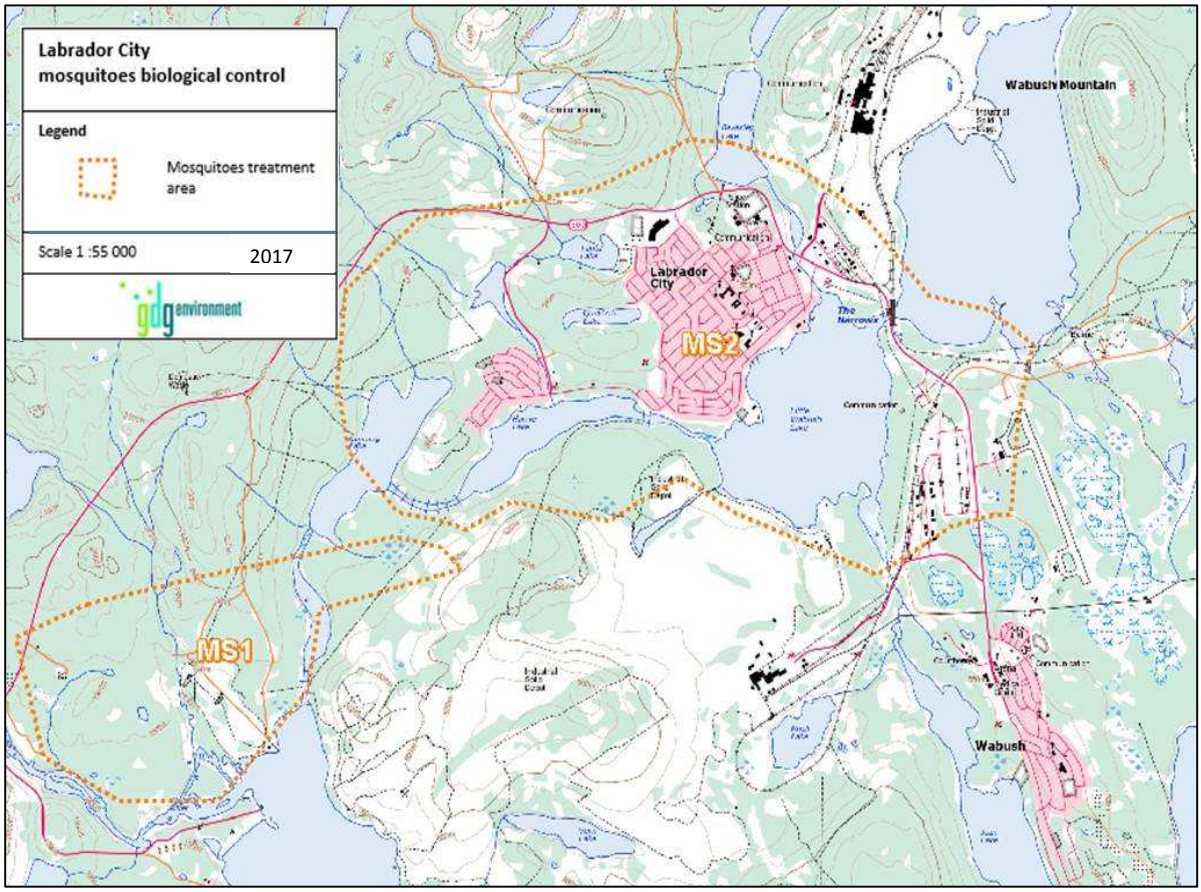


Figure 1.2. Areas monitored and treated for the control of mosquito populations

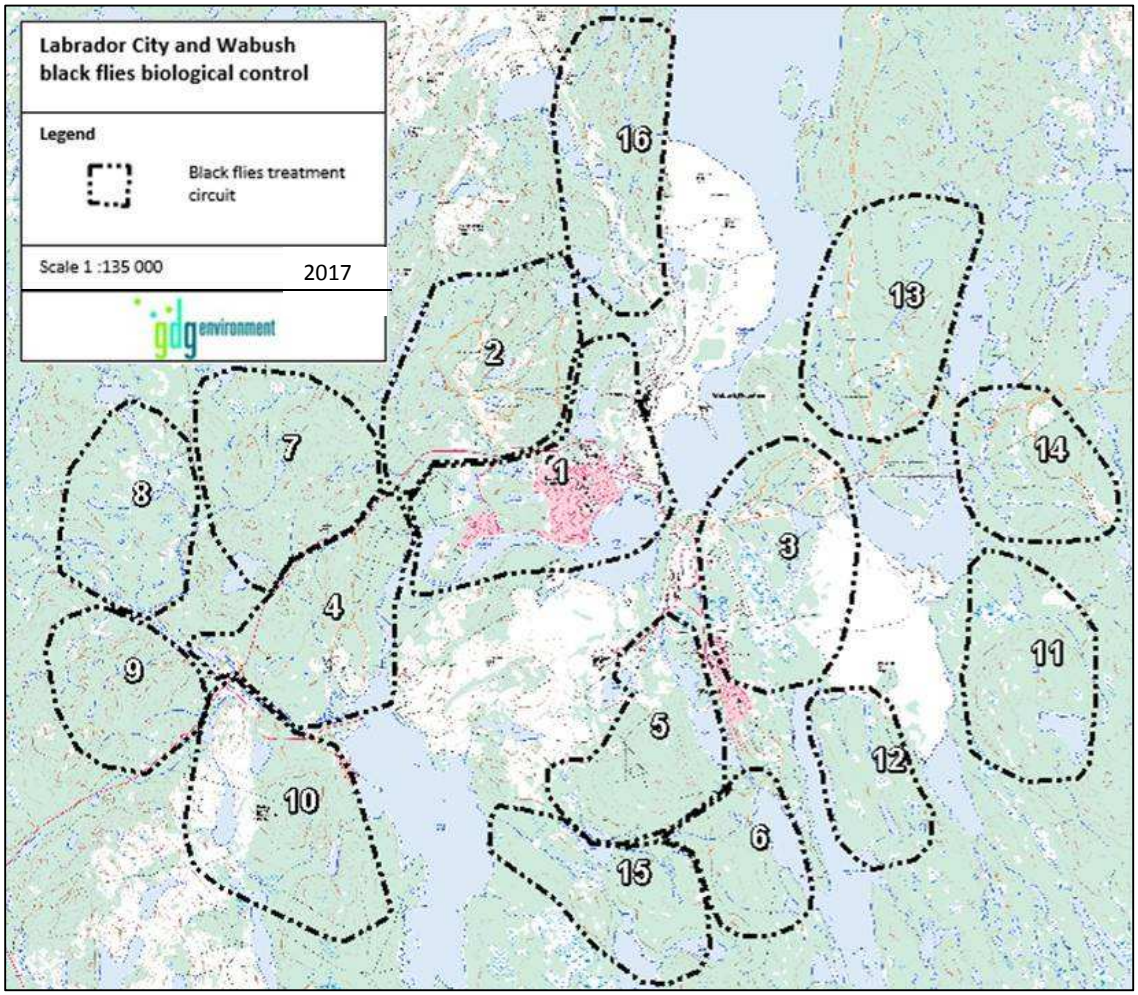


Figure 1.3 Black fly treatment areas for the Labrador City program

3 Operational highlights

- A public notice, announcing the start of the season, was published in *The Labradorian* on May 8, as requested by the Pesticides Control Section.

- The coordinator and his assistant were on site in May to prepare the 2017 operations. Other members joined the permanent team later on for the spring treatment.

- The team followed the conditions outlined in the Pesticides Operator Licence issued by the Government of Newfoundland and Labrador.

- A total of 506 liters of VectoBac was used for the control of black flies and mosquitoes and a total of 217 kg of VectoBac 200G (granular) was used for the control of mosquitoes.

3.1 Summary of treatments

The team was comprised of 3 full-time employees. The team stayed in Labrador City and was available at all times.

3.1.1 Mosquito control

The monitoring started upon arrival. The nuisance caused by mosquitoes normally starts between the first and the third week of June. As soon as the team arrives, they follow-up on the development of mosquito larvae. This activity, called monitoring, is essential to ensure the success of the operations and to maintain optimal results. Larval surveillance was conducted on a weekly basis and treatments were performed when required.

All mosquito development sites are treated within a radius of 2.5 km outside the protected area. Our ground crew performs a systematic ground search on humid territories. Development sites can be peat-bogs, flooded forests, swamps, ruts, overflowing streams or ditches of any kind.

- The Spring treatment was completed between May 27 and June 16.
- Aerial treatments were conducted by GDG Environnement's helicopter in the week of June 12th.

3.1.2 Black fly control

Although there was still a lot of snow and ice, the monitoring started upon the team's arrival.

The nuisance caused by black flies normally starts in the first weeks of June. As soon as the team arrives, they follow-up on the development of black fly larvae.

In general, the number of treatments depends on the amount of precipitation received. Generally, the biggest treatment occurs in the spring. As the season progresses, development sites normally dry up, requiring less resources. Application of larvicides may be done by aircraft, by boat or on the ground, depending on the type of vegetation and/or accessibility of the site. A visit, 24-48 hours after the application of Bti, allow us to evaluate the efficacy of the treatment, and to apply corrective measures if necessary.

- The first sequence of treatments was conducted from May 27 to June 16.
- The second sequence began on June 17 and ended by June 29.
- The third black fly treatment began on July 1 and lasted until July 15.
- The fourth treatment began on July 18 and ended on August 5 and the team.
- The fifth treatment began on August 3 and finished on August 11.

Table 3.1 Summary of 2017 black fly treatments

Number of treatment	Date of beginning (dd-mm-yy)	Date of end (dd-mm-yy)
1	27-05-17	16-06-17
2	17-06-17	29-06-17
3	01-07-17	15-07-17
4	18-07-17	05-08-17
5	03-08-17	11-08-17

3.2 Weather

GDG compiled weather data to better track biting insect development trends in Labrador City. Mosquito and black fly population size and species composition has been shown to be influenced by weather conditions such as rainfall and temperature. Based on our analysis of the weather data from Wabush airport weather station, the 2017 season (April to September) can be summarized below.

The months of April and May were a little cooler than the historical average. Temperatures quickly changed in the month of June with above normal temperatures and, in July, August and September temperatures were around the long-term normals.

Table 3.2 illustrates the monthly average temperatures experienced over the season along with the monthly precipitation amounts. When looking at the table, it appears that temperatures were never very hot, and that precipitations were lower than the mean average except for the months of July and August.

Table 3.2 Mean temperature April-September (Wabush airport weather station)

Month	Temperature (in °C)		Rainfall (mm)	
	2017	Mean temperature (1981-2010)	2017	Mean rainfall (1981-2010)
April	-7	-4,3	28	48,8
May	5	4	25	53,5
June	12	10,3	69	82,7
July	13	13,8	129	113,9
August	12	12,5	187	103,5
September	7	7,6	61	96,5

3.3 Objective of the biological biting fly control program

It is important to remember that the objective of the program is not to completely eradicate the populations of biting insects, but to control their population so as to reduce the observable nuisance at a tolerable level. In this context, we can confirm that all the necessary resources were put in place to achieve this objective and that our results demonstrate the met objective. However, there still remains some problematic areas on the base and suggestions will be further discussed in our recommendations.

3.4 Larval mortality

Post-treatment monitoring was conducted in approximately 40% of all sites treated. The larval mortality for the majority of these sites were at 100%, some areas require touch-up treatments to ensure 100% mortality. Subsequent verification demonstrated that retreated sites achieved 100% larval mortality.

3.5 Sweep net test results

Three series of nuisance tests were conducted in the protected area over the course of the summer. Three series were also done in the unprotected zone. In the former, capture varies between 0 and 1 compared to captures between 62 and 940 biting flies.

Table 3.3 Sweep net test results

Date	Hour	Protected Zone	Quantity*	Hour	Unprotected Zone	Quantity*	Efficiency
11-07-2017	18:14	Parc Centennial Labrador City	0	18:59	Golf	62	100,00%
	18:31	Menihek High School	0	18:59	Golf	62	100,00%
20-07-2017	19:00	Parc Centennial Labrador City	1	19:00	20 km west of Fermont	940	99,89%
			0		**Season average:**	501	**99,96%**

* Quantity of biting flies captured in a 5 minute test

4 Methodology

The GDG method is based on a strategy for a fully integrated pest management control program for biting insects. The goal is to reduce the negative impacts of nuisance in an effective, economical and ecological way. The objective is to lower the biting insect population at an acceptable level for the base residents and users without eradicating the population and with minimal impact on to the environment.

The following are the major characteristics of an integrated pest management program:

- Prevention
- Species identification and their biology
- Detection
- Establishing thresholds for triggering actions
- Control methods
- Treatment log
- Follow-up and re-evaluation

Since 1984, GDG has worked in the control of mosquitoes and black flies. The methodology presented is used in over forty municipalities across Quebec, Ontario and Newfoundland and Labrador. Our team executes the control programs using a structured approach promoting continuing improvement. The major phases of our programs are as follows:

1. Preparation

A) Planning

The success of all control programs rely on a rigorous plan for the intervention required to meet the objective. Each phase is followed by a quality verification unique to GDG Environment.

The milestones are the following

- MEC permit request must be sent no later than February 15
- Pre-start meeting upon arrival
- Public notification on May 8 in *The Labradorian*
- May launch of larval surveillance activities
- Launch of treatment operations triggered by larval surveillance results
- Final report submitted in November

The application of larvicides to standing water sites are performed from 6:00 am to 6:00 pm.
Bti ground treatments are performed during daylight hours in ditches, water management ponds and other natural development sites.
All larval control procedures are performed according to the requirements listed in Pesticide Operator license issued by the Newfoundland and Labrador Ministry of Environment and conservation.

B) Permits from Ministry of Environment and Conservation

When our firm is awarded a mandate we proceed immediately with the request for permits from the Ministry of Environment and Conservation (MEC). As well, authorizations Water Management Division for the application of pesticides near and around public water supply areas is requested at the beginning of March. GDG has made several requests to both MEC as well as local authorities. The delays and procedures are completely understood and integrated in our operations. When all the necessary permits and authorizations will have been received, the operations will be launched. We have extensive experience in permit requests for a biological control program.

C) Training of personnel

The hiring of locally available personnel is favored by GDG when possible. As soon as the mandate is awarded, the assignation of resources for field technicians begins and the hiring process is launched. Generally, our staff assigned in Labrador are English speaking, however a large percentage are bilingual. All hired resources will undergo a week long extensive training program and will receive certification for pesticide application. The training program is designed to fulfill all requirements and provides supervision to support any challenges which could arise.

D) Logistics

Our field team is based in Labrador City for the duration of the contract. The team is responsible for the monitoring of breeding sites and evaluation of larval densities, coordinating treatments, performing ground treatments, evaluating the efficacy, and setting-up corrective measures, if necessary. All vehicles and personnel will always be clearly identified. The territory to be treated will be divided in sections and assigned to certified and trained field technicians, supervised by a certified coordinator. Pesticide storage will follow the requirements of the Pesticide Operator licence.

2. Biting insect control method

A) Mapping

The analysis of historical data and update of operational maps will be performed. GDG already has historical data which will be assembled in order to plan out the ground and aerial maps for this program. Excluded zones and Environmentally Sensitive Areas (ESAs) will be defined. The goal of this step is to have the most precise information in order to be most effective when applying the biopesticide dosage through the treatment areas. Generally, the inhabited areas of the zone to be protected are prioritized. This process outputs a detailed planning schedule customized for the control program for biting flies including the resources, equipment, mapping, safety measures and public information.

Photo 1. Spring mosquito breeding ground

B) GIS and treatment analysis

We produce and update maps locating biting fly development sites using aerial photographs and topographical maps (see below). Then, we perform a field survey which is aimed at locating precisely and characterizing the mosquito and black fly breeding sites on the territory. Through ground inspections and prospecting on foot, larval samples are taken as well as notes on the breeding sites, their potential of production and additional useful information. Sampling is done in order to identify the main species of mosquitoes and black flies, to measure their larval densities and to locate the main sources. A computer-based GIS system is used to locate breeding sites on field maps. The information is then computerized into a database system. Using this information and the field data, biting fly larvae production sites can be precisely located on computerized maps. The maps are outlined by using a priority process in order to facilitate the decision making. In turn, these maps illustrate the treatment sites with a sequential route, enabling the field technician to respond efficiently. Moreover, our programs are designed using existing historical data.

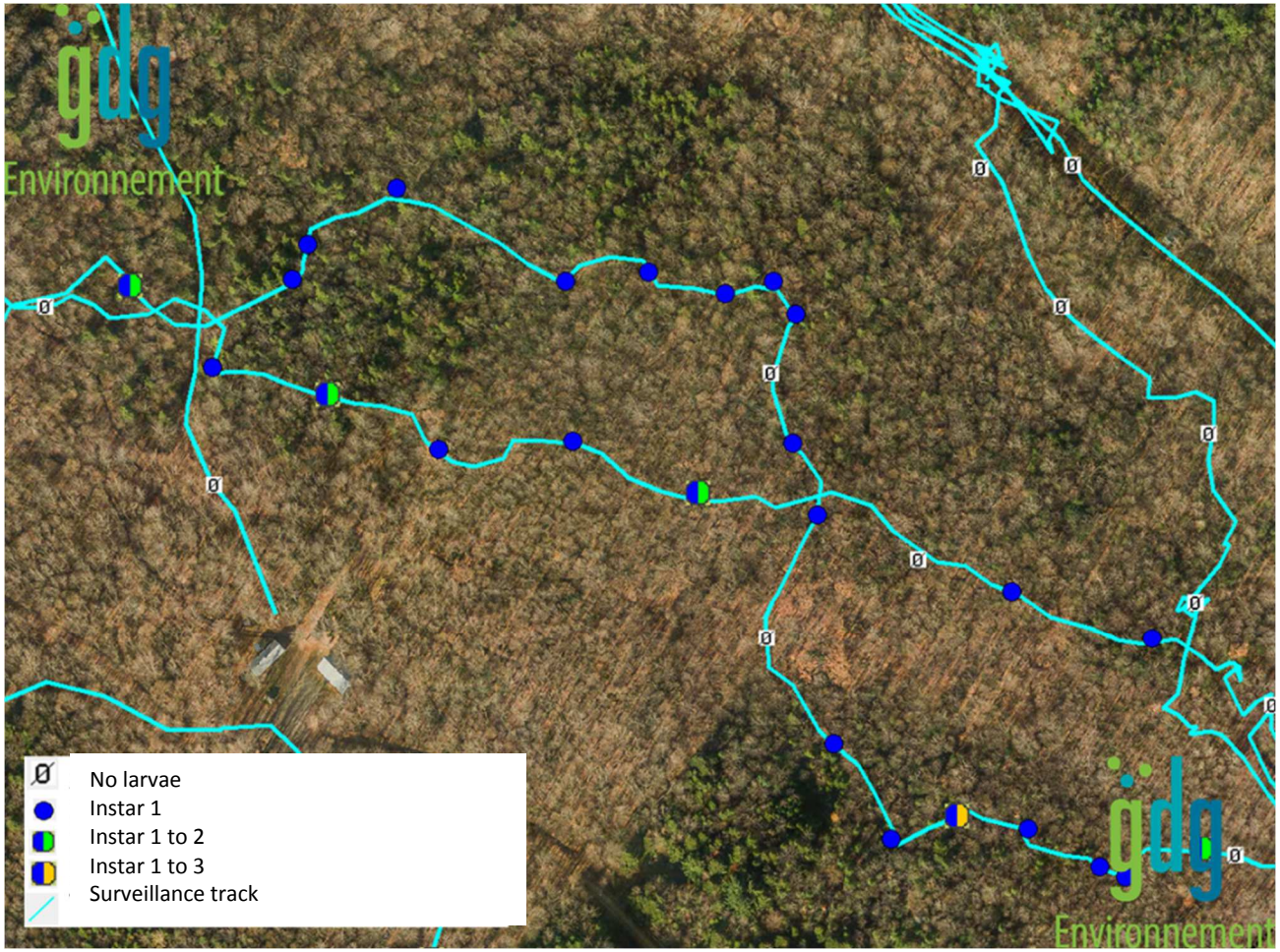
All monitoring and treatment data from prior years are analyzed to plan future treatment interventions.

C) Bioassays of Larvicides

Larvicide quality is verified by bioassays in our laboratory when required. These bioassays can support and can optimize our methodologies in the field allowing us to obtain a mortality of 100%. GDG is the only company willing to perform laboratory bioassays on its products prior to the start of operations. Following all governing guidelines and norms, our bioassays provide information to the program coordinator and indicate the optimal dosage to be used to assure the efficiency of the field work.

D) Larval monitoring

We produce and update maps locating biting fly development sites using aerial photographs and topographical maps. Then, we perform a field survey which is aimed at locating precisely and characterizing the mosquito and black fly breeding sites on the territory. Through ground inspections and monitoring on foot, larval samples are taken as well as notes on the breeding sites, their potential of production and additional useful information. Sampling is done in order to identify the main species of mosquitoes and black flies, to measure their larval densities and to locate the main sources. All surveillance information is geo-referenced and updated into our GIS system for planning of treatments.



Example of a surveillance track displayed in our GIS system

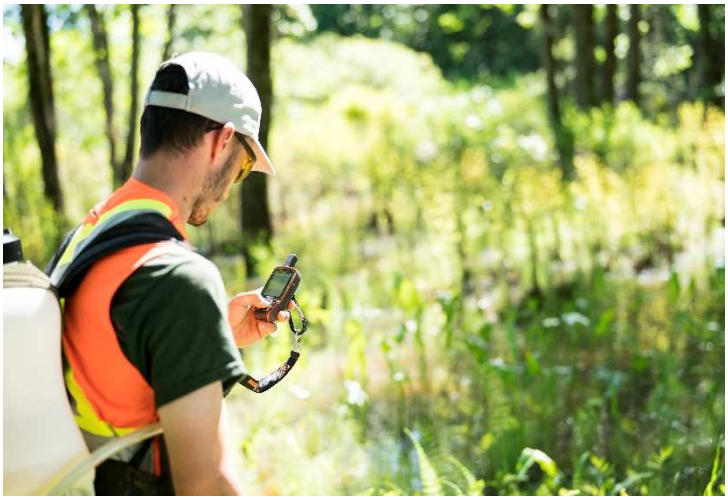
E) Treatments

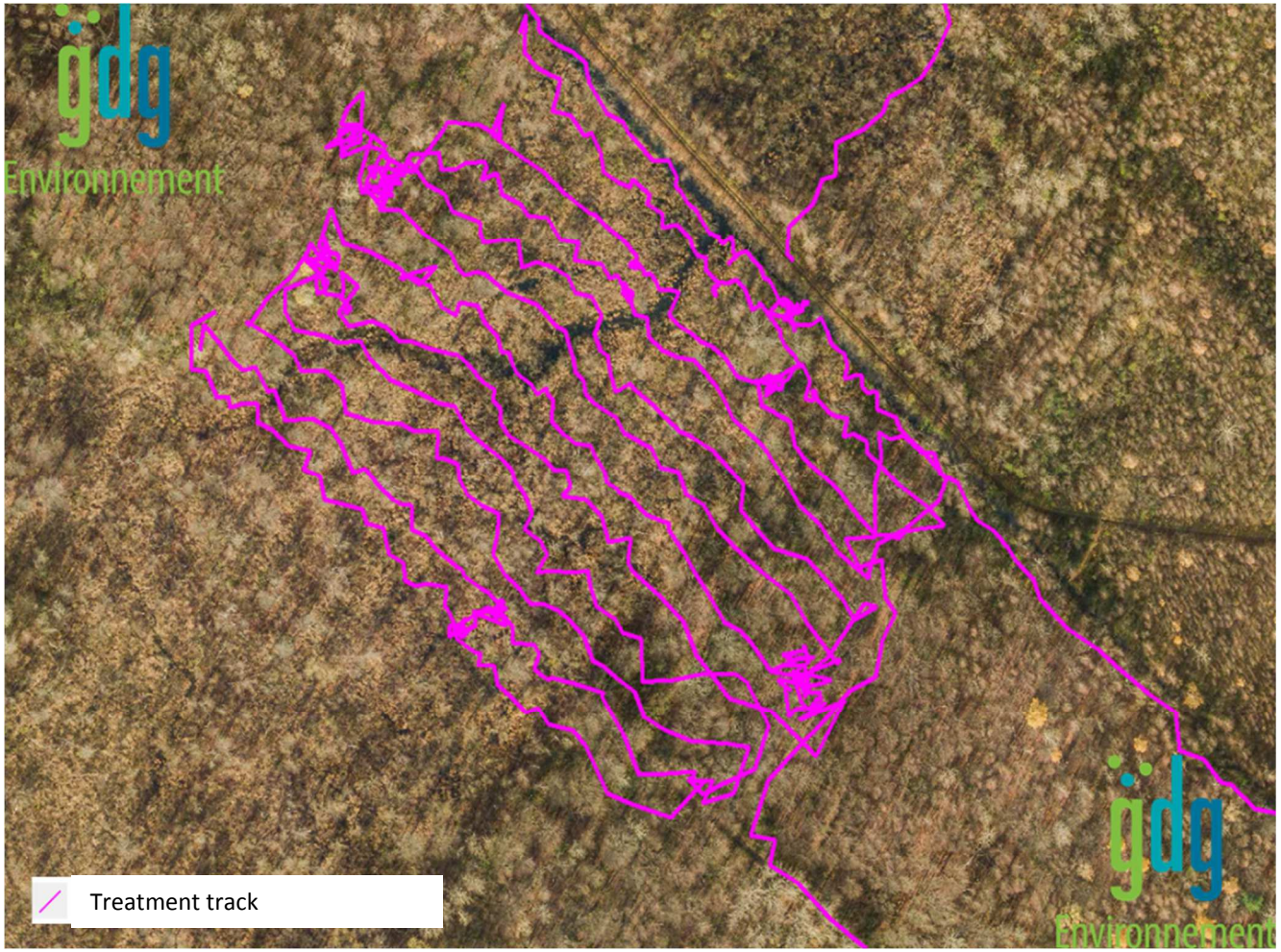
In general, the number of treatments depends on the amount of precipitations received in one season. Thus, the number of treatments can vary from year to year. Generally, the biggest treatment is the first spring treatment. As the season progresses, development sites are normally controlled and can dry up, requiring less resources to control biting fly development sites. Treatments are administered in consequence to rainfall and monitoring results. Furthermore, application of larvicides may be done by aircraft or terrestrially; this depends on the dimensions of the development sites as well as the type of vegetation and accessibility to the site. Treatment of larvae will depend on their stage of development.

F) Terrestrial application of larvicdes

Terrestrial application is required in a 50 to 60-meter buffer zone around residential areas. This buffer zone is required by legislation, as to protect residential zones from aerial treatments. Also treated terrestrially are development sites smaller than 5 ha. Bti is a biological larvicide which acts upon biting fly larvae. It is the larvicide of choice for mosquito and black fly control because of its specificity: *Bti* is only effective against actively feeding larvae and does not affect pupae or adults. *Bti* breaks down quickly in the environment and needs to be reapplied when new biting fly generations emerge. In order to obtain a sustained nuisance control, regular monitoring is required. The liquid form of Bti (VectoBac 1200L - PMRA Reg. No. 21062) is used for ground treatments and applied with a backpack sprayer after dilution in water. Its application is very discrete and can be performed in densely inhabited areas without inconvenience to the residents. The dosage will be between 0.25 and 1 litre per hectare, as recommended by the manufacturer.

- For the control of mosquito larvae, standing water sites within a 3 km buffer zone of the Air base are monitored and treated when larvae reach 2nd and 3rd instar levels of maturity. Development sites may require additional treatments throughout the season based on the weather conditions and precipitation amounts.
- For the control of black fly larvae, running streams, creeks, rivers and lake outflows within a 10 to 15 km buffer zone from the air base are monitored closely and treated when larvae have reached late instar stages as to ensure egg hatch has been completed. Some streams eventually dry out as the season progresses, however new generations of larvae will emerge bi-weekly and therefore require close monitoring as to determine when to apply the product at the right time.





Example of a geo-referenced treatment track

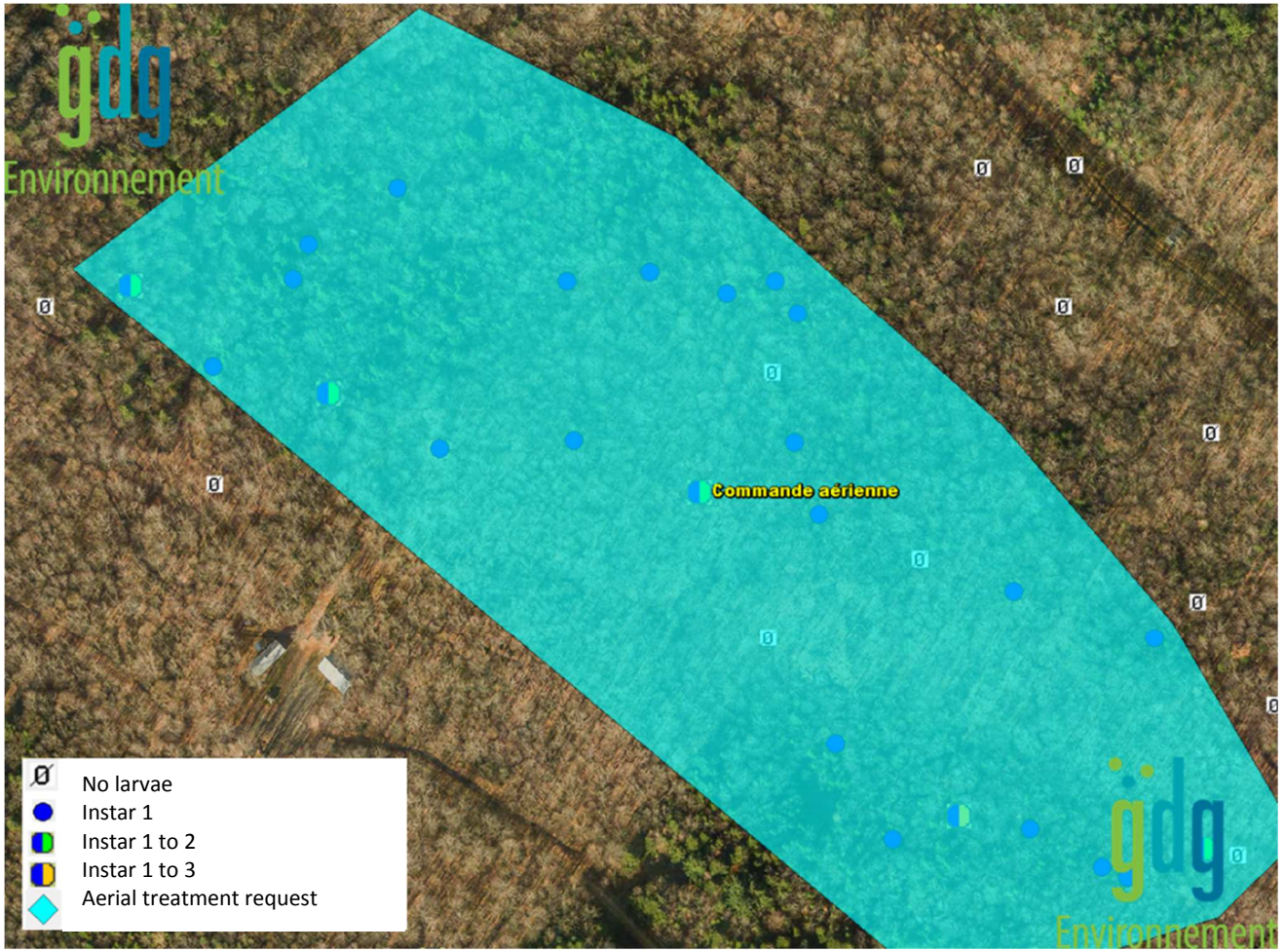
G) Aerial application

Aerial applications will be performed for sites greater than 5 ha, for sites considered inaccessible, or sites where ground treatments could disturb fauna such as nesting turtles. The granular form of Bti (VectoBac 200G- PMRA Reg. No. 18158) is made of ground corn, on which Bti is absorbed, and it is used to do treatments in dense vegetation areas where the granules will penetrate vegetation and reach the stagnant water. The dosage is between 3 and 7 kg/ha. Aerial treatments are usually performed during normal daylight hours which are between 7am and 5pm in order not to disturb nearby residents. The granular form of larvicide is preferred for the aerial treatment because of its advantages over the liquid formulation (proven and observed in the field). The granular formulations ensure a higher quality of aerial treatment:

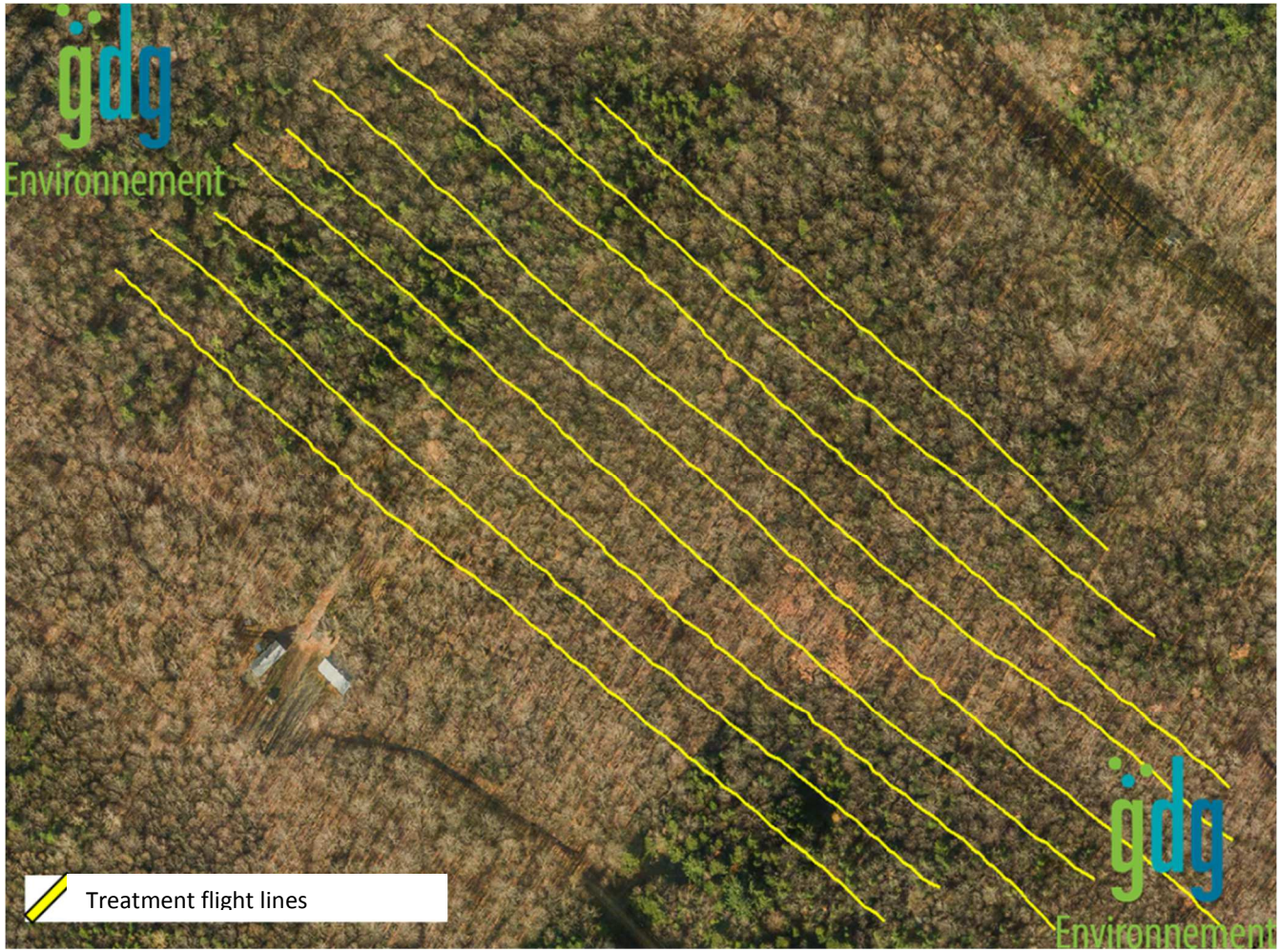
- Better penetration into vegetation, particularly in evergreen habitats;
- Lower risk of product drifts;
- Easier calibration;
- Easier quality control (extent of treatments) because we can see the granules.

Aerial treatments are launched based on an aerial treatment request sent by the field team. All aerial treatment requests are analysed with the observed larval surveillance data to ensure the treatment is performed at the optimal time.

All aircraft have an AgNav navigation system that guides the pilot along prescribed flight lines. Everytime the pilot activates the pesticide applicator, the geographical position is tracked to produce application flight lines. Below, you will find an example of such flight lines. These flight lines are analysed by the field coordinator, which determines post-treatment monitoring locations based on the spacing of the lines.



Example of an aerial treatment request



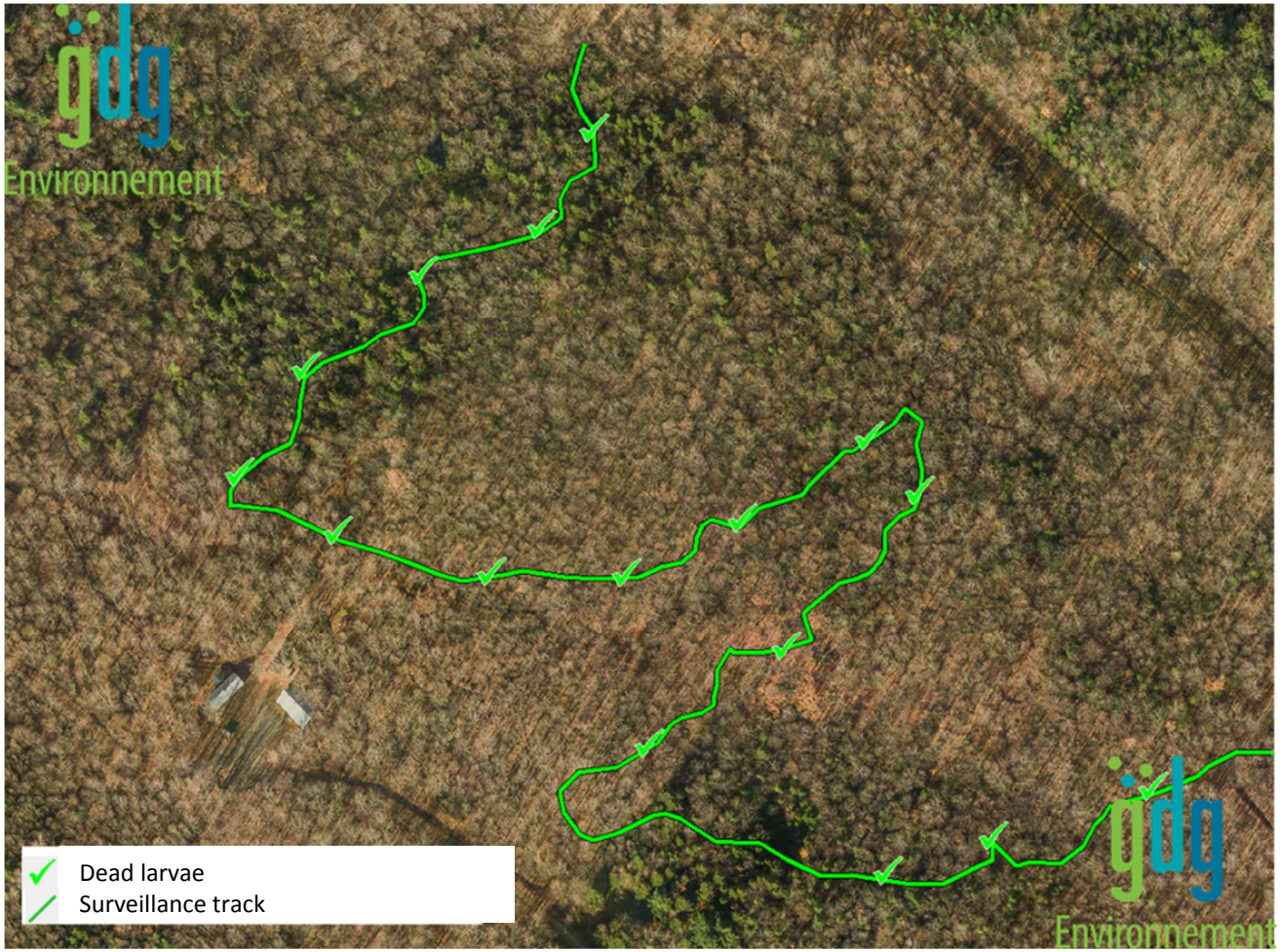
Example of aerial treatment flight lines

3. Quality control of operations

The success of our program is governed by the careful preparation and planning of the operations to be completed in order to achieve our goals. The quality control in our program is addressed with the methodologies and protocols of best practices to ensure the quality of work that has been executed. Many of these factors are found in the technical approach to our methodologies and the logistical planning of resources which we structure. Processing ground data and aerial data directly impacts the success of a biological nuisance program. Our track record demonstrates our efficiency when we guarantee a nuisance reduction of at least 90% caused by biting flies. In all respect, our methodology and mechanisms substantially exceed all levels of required compliances. Furthermore, the guarantee of success in our biological control programs are based upon, dedicated and knowledgeable personnel, premium quality product and state-of-the-art equipment.

Post-treatment follow-up will make it possible to verify the effectiveness of applications and make any needed corrections.

Nuisance tests performed weekly during the timeframe of the project provide insight on the success of the program and in determining the sources of residual nuisance.



Example of post-treatment monitoring

A) Reporting

GDG uses primarily Microsoft Excel and Microsoft Access software for data management. Information collected from the field, such as larval monitoring, treatment information and private citizen requests are all electronically recorded on a daily basis. Outputs, such as graphs and maps, are generated and used for consultation with our clients.

Outputs generated from our database serve as decision tools for determining treatment windows and for prioritizing the treatment of standing water sites.

Our IT department will set up and manage a password-protected web server page which will provide a secure and confidential access to information, such as dates of aerial treatments, progress reports and weekly reports for the treatment of standing water sites.

B) IT Capabilities

GDG uses primarily specialized data management software programs and QGIS for data management. Information collected from the field, such as larval monitoring, treatment information and private citizen requests are all electronically recorded on a daily basis by GPS. Outputs, such as graphs and maps, are generated and used for consultation with our clients.

Outputs generated from our database serve as decision tools for determining treatment windows and for prioritizing the treatment of standing water sites.

5 The Bti products used and their exceptional qualities

To control biting flies, GDG uses a biological insecticide called *Bacillus thuringiensis subsp. israelensis* (Bti). This bacteria is unique in that it is toxic only to the larval stages of dipteran insects such as mosquitoes and blackflies. It has no impact on other types of insects, amphibians, fish or wildlife. The active ingredient in Bti is a small diamond shaped protein crystal that is produced by the fermentation of the bacterium. This bacterium occurs naturally in the soil and is not the result of genetic manipulation.

Mosquito and black fly larvae are known as filter feeders, and when the larvae filter water to find food, the Bti is ingested. These crystal shaped proteins become toxic only when the Bti enters the insect's gut. At this point, the Bti crystals react in the high pH level of the gut and the gut wall is perforated. The contents of the gut spills into the body cavity and death occurs rapidly, usually within a few hours.

The Bti formulations used in our biological control programs are manufactured by Valent BioSciences. It comes in two forms; a water based liquid and a granular product that uses corn cob granules as a carrier. The liquid VectoBac® formulation is used to control mosquito larvae in many circumstances and it can also be used to control black flies when it is applied to small streams where the larvae develop. The granular formulation of VectoBac® is applied to standing water; it floats for a short while, releasing the Bti product dose to the mosquito larvae which feed near the surface.

Most applications are made from the ground with trained and licensed field technicians equipped with backpack sprayers. Larger areas or harder to reach sites are more efficiently treated by our aerial support team. VectoBac® formulations may be applied several times during the spring and summer to control successive generations and species of mosquitoes as they emerge at various periods throughout the year, from early spring until first frost.

6 GDG knowledge

G.D.G. Environnement has 34 years of continuous operation on surveillance and control technologies for biting flies. The company was founded in 1980 focusing on the biological control of mosquitoes and black flies. GDG pioneered the concept of biological control of biting flies in Canada to improve the quality of life for millions of Canadian citizens. The initial biological "nuisance control" business segment has expanded to the point where GDG now operates over 50 successful municipal nuisance control programs annually, representing 780 executed contracts.

Establishing Best Practices protocols through the years has enabled GDG to stand out as the Canadian leader in this field. We operate in municipalities across Quebec, New Brunswick, Labrador and Ontario. GDG is also intensely involved in the surveillance and prevention of West Nile virus (WNv) both in Quebec and Ontario. Overall, all operational decisions are to be taken by the GDG experts supervising every biting fly program and research projects. Our Turnkey Service capabilities sets us apart from our competition as we own and can supply all the resources required to support our activities, including entomological knowledge, surveillance, aerial application, and laboratory services. GDG does not rely upon external subcontractors to deliver our expertise and services to Labrador City. This means that we are able to respond quickly and effectively. The following are some of the key components to our turnkey service for this contract.

6.1 Ressources for this mandate

Réjean Bergevin, F. Eng. M. Sc. a.
Réjean Bergevin has been senior project manager for all of our Labrador programs for the last 20 years. These programs include CFB 5 Wing Goose Bay, Labrador City, Wabush and Churchill Falls. He has been responsible for maintaining client relationship and ensuring that all client expectations are met. He is a forestry engineer specialized in entomology, holds a Master Degree in Applied Sciences from Laval University. Since 1980, Mr. Bergevin has been working as a professional forester in a number of fields: biological control of biting flies, feasibility studies, impact assessments and sustainable development projects. All work performed for the Labrador CIty biological control program is reported back to Mr. Bergevin.

Claude Cossette, Project Manager
Mr. Cossette has an extensive background in the planning and execution of biting fly control operations. He has been project manager for all of our Laurentian programs since 1998 and has managed the Labrador prorams since 2013, these include: Labrador City, Wabush, Churchill Falls and CFB 5 Wing Goose Bay. He is also in charge of more than a dozen mandates (Upper Laurentians and the Cote Nord region of Quebec).

Mr. Cossette has a broad knowledge of GPS and geomatics tools. His role is to ensure all staff and equipment resources are ready for the delivery of the program.

Operational team (coordinator and technicians): The team coordinates and delivers the biting fly control service and is available full time. Its principal mandate is to manage the operational schedule established by the project manager and the regional supervisor. The local team also performs larval samplings and treatments. All of the personnel speak English and are certified (Mosquito/biting flies). They also received training in WHIMS, safe work practices, safe work procedures and first aid.

GDG has other contracts in Labrador: technicians could quickly move to Labrador City when needed. This allows to have as much as four workers on site during the Spring operations and to have experienced staff available at all times.

The field coordinator for 2017 was Sebastien Gauthier (licence no. 2799). He was in Labrador City from May to August.

Operational Support/Specialists

Mark Ardis (B.Sc. Wildlife Biology) was project manager for the Labrador programs from 2011 to 2013. He is currently project manager for all of our Ontario operations. Mark has an extensive background in the implementation of Health and Safety policies, he played an integral role in obtaining the COR certification from the NLCSA. Mark's role and responsibility to the Labrador City program is advisor for Health and Safety procedures.

Mosquito identification
Marie-Laure Escudero, Director of the Laboratory has overseen the installation of the laboratory facility and maintains responsibility for overall quality control. She and other members of her team are professionals in the fields of adult and larval mosquito identification, viral testing and PCR technology. A team of 10 experienced taxonomists work 7 days a week to support our field teams.

GIS technologies
Mathieu Boily, Director, geomatics has worked for GDG for 6 years. He will be responsible for the updating of maps and interpretation of geometric information.

Data analysis and reports
Dominic Grandmont is in charge of networking and data systems. Operational and laboratory data are computed and analyzed in real-time, and a regular progress report is produced.

Aerial treatment
Christian Brousseau (M.Sc. Env.) is the Director of Technical and Scientific Services, including the coordination of aerial treatments (technical, legal and operational aspects). He is also involved with R&D projects. He will be available throughout the project term.

6.2 GDG Aviation

G.D.G. Aviation was founded in 1997. It was created with the ultimate goal to have its fleet fully dedicated to support the ground operations of a nuisance program. G.D.G. Aviation has a fleet of 5 aircraft composed of 3 helicopters and 2 airplanes. They are responsible in supplying every component required in an aerial application for a biological mosquito control program. Our well experience pilots provide precision applications during our aerial application. Our aerial support team is completely mobile and licensed to operate in all Canadian provinces. The support team are responsible for the following activities:

- Data monitoring
- Daily quantities of product applied
- Mapping of treatments
- Flight path data
- Equipment calibration

All aircraft are equipped with a specialized and highly precise AG-NAV GPS navigation system. Our aircraft are also equipped with a calibrated dispersal system specialized for the application of the larvicides required for biological control programs of biting flies.

7 Recommendations

The following recommendations are meant to improve the quality of the program and further lower the observe nuisance caused by biting insects in certain areas of the base.

- Continue with the current program structure for the 2018 season
- Increase the number of nuisance tests conducted over the course of the season, and provide a City official to supervise the tests

8 Conclusion

The biological nuisance mosquito control program had the advantage of reducing the intensity and the duration of mosquito and black fly nuisance in the protected area while doing no harm to the environment. The mandate of GDG was to control biting insect populations for a reduction of 90%. Our team was proud to deliver biting fly control program to Labrador City.

The entire GDG Environment team thanks you for your trust and understanding gives you their sincerest regards.

Réjean Bergevin, F. Eng. M.Sc.
Project Manager