
Regional District of Nanaimo

2022 Biosolids Management Summary and Compliance Report

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1 PROGRAM OVERVIEW

The Regional District of Nanaimo (RDN) operates two wastewater treatment plants that produce municipal biosolids:

1. Greater Nanaimo Pollution Control Centre (GNPCC) - Class B biosolids
2. French Creek Pollution Control Centre (FCPCC) - Class A biosolids

In 2022, RDN biosolids were managed at three sites in the Nanaimo area: private forest lands off Nanaimo River Road (“Blackjack”) and on Weigles Road (“TimberWest Properties”) both managed by Mosaic Forest Management (Mosaic), and at the Nanaimo Forest Products Harmac Mill (Harmac).

At the TimberWest Properties, Class B GNPCC biosolids were used by SYLVIS in a forest fertilization program. RDN biosolids have been managed at this site since 2003. The objectives of biosolids forest fertilization were to increase soil quality and tree growth. 2022 was the final year of operations at the TimberWest Properties, the biosolids management program was transitioned to the new Blackjack site in 2022.

At Blackjack, Class B GNPCC biosolids were used by SYLVIS in a forest fertilization and reclamation program. The objectives of biosolids forest fertilization were to increase soil quality and tree growth, and for reclamation to return application trails to productive forest and habitat.

RDN biosolids were also managed in soil fabrication projects at the Harmac Nanaimo Pulp Mill. Class A FCPCC biosolids were managed by Harmac in a biosolids growing medium (BGM) under supervision of SYLVIS. While no Class B / GNPCC biosolids were delivered to the Harmac site in 2022, reclamation growing medium (RGM) containing Class B biosolids which were delivered in 2021 were used in landfill closure.

A total of 7,188 wet tonnes (wt) of RDN biosolids were produced in 2022: 5,897 wt from the GNPCC and 1,291 wt from the FCPCC (Table 1). Of the 7,188 wt produced, 5,095 wt (71% of annual production in 2022) were delivered to Blackjack, 802 wt (11%) were delivered to the TimberWest Properties, and 1,291 wt (18%) were delivered to Harmac (Table 2). Total RDN biosolids production in 2022 is greater than the five-year average annual production though consistent with the increased production following the implementation of secondary treatment operations at the GNPCC (Table 1).

2 REGULATORY AUTHORIZATION

RDN biosolids were managed at Blackjack under the *2021 Blackjack – Forest Fertilization Land Application Plan* (SYLVIS Document #1516-22) associated with Authorization #110732 valid May 16, 2021 to April 23, 2022 and under the *2022 Blackjack – Forest Fertilization & Reclamation Land Application Plan* (SYLVIS document #1525-22) associated with Authorization #111152 valid April 24, 2022 to April 23, 2023.

RDN biosolids were managed at the TimberWest Properties under the *2021 TimberWest Properties (Weigles Road) Reclamation & Forest Fertilization Land Application Plan* (SYLVIS

Document #1439-21) associated with Authorization #110825 valid August 5, 2021 to August 4, 2022.

GNPCC biosolids used to fabricate RGM at Harmac were managed under the *2022 Nanaimo Forest Products Harmac Mill - Reclamation Growing Medium for Landfill Closure Land Application Plan* (SYLVIS Document # 1463-21) associated with Authorization #111016. Class A FCPCC biosolids used in production of BGM were managed according to regulatory requirements in the Organic Matter Recycling Regulation (OMRR) and do not require a land application plan (LAP) or Authorization.

3 2022 BIOSOLIDS MANAGEMENT

This document contains information on the management of RDN biosolids in 2022 including a summary of contractual requirements for the forest fertilization and reclamation programs (Table 3, Table 4, Table 5), a biosolids program management summary (Table 2, Figure 1, Figure 2, and Figure 3), a biosolids quality summary (Table 6), a summary of historical management (Table 2), a map of areas applied in 2022 at Blackjack (Figure 4) and the TimberWest Properties (Figure 5) and, and photographs from the biosolids management projects (Photographs 1 to 3).

3.1 BIOSOLIDS MANAGEMENT SUMMARY

RDN biosolids were managed at the TimberWest Properties on Weigles Road in Nanaimo, BC for a portion of 2022 to complete the 2021-2022 extension contract between the RDN and SYLVIS as well as contingency management under the 2021-2026 contract. Contractual tasks completed under the 2021-2022 extension contract relating to biosolids quality monitoring, biosolids delivery coordination, biosolids beneficial use, site safety, environmental monitoring, public engagement, reporting, coordination with the Nanaimo Mountain Bike Club, and adherence to the conditions of site use under the RDN land-use agreement with TimberWest in 2022 are summarized in Table 3. The biosolids management program was transitioned from the TimberWest Properties to Blackjack in 2022. The TimberWest Properties remain available as a contingency storage site.

In 2022, the majority of GNPCC biosolids were managed at Blackjack, on Nanaimo River Road in Nanaimo, BC. Contractual tasks under the 2021-2026 contract relating to biosolids quality monitoring, biosolids delivery coordination, site safety, environmental monitoring, public engagement, First Nations communications, sustainability activities, and reporting were completed in 2022 are summarized in Table 4.

RDN biosolids delivered to Harmac were managed by Harmac for production and use of reclamation growing medium (RGM) in landfill closure and production of biosolids growing medium (BGM) (Table 5). SYLVIS provided qualified professional oversight under contract to the RDN.

3.2 BIOSOLIDS TRANSPORTATION

In 2022, 5,095 wt of RDN biosolids (all from GNPCC) were transported by DBL Disposal to Blackjack (Table 2). Monthly tonnage delivered to this site in 2022 is shown in Figure 1.

In 2022, 802 wt of RDN biosolids (all from GNPCC) were transported by DBL Disposal to the TimberWest Properties (Table 2). Monthly tonnage delivered to this site in 2022 is shown in Figure 2.

In 2022, 1,291 wt of RDN biosolids (all from FCPCC) were transported by DBL Disposal to Harmac (Table 2). Monthly tonnage delivered to this site in 2022 is shown in Figure 3.

3.3 BIOSOLIDS STORAGE

One large storage area exists at Blackjack and four storage areas exist at the TimberWest Properties and each consisting of an asphalt base with lock blocks delineating three sides of the stockpiles (Photograph 1 and 2). All five storage areas were utilized for biosolids stockpiling in 2022. Biosolids storage conformed to OMRR requirements for Vancouver Island where biosolids are required to be covered from October 1 to March 31 of every year. Following the transition of the biosolids management program from TimberWest Properties to Blackjack, one TimberWest Properties storage facility was decommissioned by Mosaic. Three remain available for contingency storage.

Harmac is not required to cover the stored biosolids when biosolids are incorporated into a fabricated soil medium (BGM or RGM) within 2 weeks of deliveries. Details of RGM storage are discussed in the Harmac Compliance Report. BGM is not subject to regulatory storage requirements in the OMRR.

3.4 2022 PRE-APPLICATION MEASURES

At Blackjack and the TimberWest Properties, site inspections were carried out by a SYLVIS Qualified Professional or designate prior to biosolids forest fertilization and reclamation. During site inspections, water features and other sensitive site features were identified, mapped, and appropriate setback distances were determined. Pre-application soil samples were collected in order to determine an appropriate agronomic rate of biosolids application. Groundwater depth was assessed using a soil auger or visually in road cuts and was confirmed to be in excess of 1 metre (m) prior to commencing biosolids applications.

At Harmac, a site inspection was carried out prior to initiating soil fabrication operations to confirm the suitability of the storage facility, mixing methodology, and soil storage area. Landfill areas to be reclaimed using RGM were assessed prior to applications to ensure suitability for applications. Details of site inspections for the RGM project are detailed in the Harmac Compliance Report. Currently stockpiled BGM and pre-BGM (material that has not undergone final mixing or certification by SYLVIS) is the product of Class A biosolids deliveries starting in June 2022.

3.5 BIOSOLIDS LAND APPLICATION

In 2022, 5,262 wt of RDN biosolids (all from GNPCC) were applied as a fertilizer and soil amendment at Blackjack (Table 2, Figure 1, Figure 4). Biosolids were land-applied to 51 hectares (ha) of forested lands for forest fertilization. Application rates were specific to the individual fertilization units based on pre-application soil sampling and nutrient requirements of the trees, understory vegetation, and soils. The biosolids application rate for forested land averaged 20.6 dry tonnes per ha (dt/ha) which does not exceed the maximum application rate specified in the

LAP for forest land (38 dry tonnes per ha). 2.8 hectares of disturbed land were applied with biosolids for reclamation at Blackjack. The average application rate for reclamation was 50.7 dt/ha which does not exceed the maximum application rate specified in the LAP for reclamation (52 dt/ha). At the end of 2022, 150 wt (all from GNPCC) remained in storage facilities at Blackjack in preparation for fertilization in 2023 (Table 4).

In 2022, 1,602 wt of RDN biosolids (all from GNPCC) were applied as a fertilizer and soil amendment to the TimberWest Properties (Table 2, Figure 2, Figure 5). Biosolids were land-applied to 33 hectares (ha) of forested lands for forest fertilization at the TimberWest Properties at application rates specific to the individual fertilization units based on their history of previous biosolids land applications. Across the site, the biosolids application rate was an average of 9.9 dt/ha which does not exceed the maximum application rate specified in the LAP (23 dt/ha). At the end of 2022, no biosolids remained in storage facilities at the TimberWest Properties (Table 2).

Biosolids were land-applied in forested and reclamation areas using a side-discharge spreader equipped with a hydraulic fan which propels the biosolids up to 30 m into forest stands or across a reclamation area. All biosolids applications adhered to a 30-m setback distance from permanent water features and identified ephemeral water features. Biosolids land applications occurred throughout 2022 except during periods of extreme weather (i.e., snowfall, heavy rainfall, heat waves) or when the ground was snow-covered; land application operations were suspended during these times. For example, biosolids land applications did not occur in weeks of November and December when periods of snowfall or snow cover occurred.

Biosolids incorporated into RGM were land-applied at the Harmac landfill as a topsoil cover during landfill closure operations. In 2022, 5,107 m³ RGM containing approximately 1,386 wt of biosolids were used as landfill closure on 1.8 ha of land (Table 2, Figure 3). Volumes of RGM produced and land-applied at Harmac are detailed in the Harmac Compliance Report.

In May 2022 approximately 3,000 m³ of BGM containing 640 tonnes of RDN FCPCC biosolids was distributed offsite, as indicated by Harmac staff. As of the data of this report, approximately 8,500 m³ of BGM and loosely mixed soil remain on site comprised of approximately 1,850 tonnes of FCPCC biosolids.

3.6 BIOSOLIDS QUALITY

The OMRR requires that a set of seven discrete samples be collected for fecal coliform analysis and one sample for trace elements for every 1,000 dry tonnes of biosolids or annually, whichever comes first.

Biosolids quality was characterized throughout 2022 to ensure biosolids met quality requirements for trace element concentrations, foreign matter, and pathogen reduction set forth in the OMRR.

In 2022, 440 dry tonnes (dt) of biosolids were produced by the FCPCC and 1,205 dt by the GNPCC. Three composite samples, each composed of eight equal-volume subsamples, were collected by SYLVIS at each the FCPCC and the GNPCC for a total of six samples. Composite samples were analyzed for physical parameters, nutrients, and trace elements (Table 6). All RDN biosolids samples collected in 2022 met the respective OMRR Class A and B criteria for trace elements.

The fecal coliform density of the eight samples collected by SYLVIS from the FCPCC in 2022 was <10 MPN/g in all samples (Table 6). For Class A biosolids each individual sample must meet the Class A criterion of 1,000 most probable number per gram (MPN/g).

SYLVIS collected 19 fecal samples from the GNPCC, the geometric mean of the sampling sets was 88,300 MPN/g (Table 6). For Class B biosolids the geometric mean of each set must meet the Class B criterion of 2,000,000 MPN/g.

3.7 SOIL MONITORING

Soil monitoring was conducted in potential reclamation areas at Blackjack in 2022. Soil samples, each comprised of 10 sub-samples from the top 0-30 cm, were collected by SYLVIS. Soil trace element concentrations were below applicable OMRR soil criteria for this site. Further details on soil sampling and nutrient concentrations can be found in the LAP.

RGM quality at Harmac is discussed in the Harmac Compliance Report.

3.8 REGULATORY COMPLIANCE

Biosolids management activities at Blackjack were carried out under Authorizations #110732 and #111152, and in accordance with the LAP applicable at the time of applications (SYLVIS Documents #1516-22 and #1525-22).

Biosolids management activities at the TimberWest Properties were carried out under Authorization #110825, and in accordance with the LAP applicable at the time of applications (SYLVIS Document #1439-21).

Regulatory requirements of the OMRR and specifications of the LAP were met including the requirements for rainy season storage, groundwater level during application, water feature buffers, biosolids quality, agronomic application rates, pre-application and predicted post-application soil concentration limits, and signage with the exception of the agronomic application rate for reclamation applications. Declarations of Land Application Compliance was provided to the RDN for biosolids applied at the TimberWest Properties and to Mosaic for biosolids applied at Blackjack.

Details of regulatory compliance of biosolids land applications as part of RGM at Harmac are detailed in the Harmac Compliance Report.

3.9 CARBON ACCOUNTING RELATED TO BIOSOLIDS MANAGEMENT

+55 t CO₂e of GHG emissions are asserted for transport of GNPCC biosolids to the Woodlot and Blackjack during 2022 under the 2021-2022 extension and the 2021-2026 contracts, while the management of 6,864 bt GNPCC biosolids at these sites in 2022 resulted in -1,662 t/CO₂e of net emissions (emissions and emissions removals).

This carbon emissions estimate does not include transport of biosolids delivered in 2021 that were stored for applications in 2022 at the TimberWest Properties or Blackjack as this was presented in the 2021 report. This carbon emissions estimate considers biosolids storage, land application, and soil carbon sequestration; carbon sequestration related to tree growth is accounted for

separately by Mosaic and vehicle (i.e., pickup truck) emissions related to project operations are accounted for externally by SYLVIS.

4 SUMMARY AND INTERPRETATION OF THE EFFECTS OF BIOSOLIDS DISCHARGES ON THE RECEIVING ENVIRONMENT

The objectives of biosolids forest fertilization at the TimberWest Properties are to increase soil quality and tree growth while remaining compliant with the OMRR. Biosolids fertilization has increased surface horizon organic matter content and available nutrients (e.g., phosphorus). These enriched soils store more carbon and enable accelerated tree growth, which has been documented at this site and other biosolids forest fertilization sites. Trace element concentrations in the soil have increased as a result of additions from biosolids. It has been observed¹ at this site that deer browse of trees is increased in biosolids-fertilized areas, underlining a finding from many biosolids sites that increases in vegetation biomass can lead to increases in animal populations that consume or inhabit the vegetation.

The objectives of biosolids forest fertilization at Blackjack were similar to those at the TimberWest Properties. In addition, the objectives of reclamation activities at Blackjack were to return disturbed lands, including landings and camps, to productive forest.

Confirmation of beneficial use of the RDN's biosolids is provided in the Qualified Professional Certification of Compliance reports following the completion of an Authorization and on monthly invoices sent to the RDN.

The fabrication of growing media (BGM and RGM) at Harmac produces a material that can be used for landfill closure (RGM) or in projects on and off site that require topsoil (BGM). These growing media provide a fertile substrate upon which vegetation can grow to achieve site objectives such as protection of underlying landfill layers or site restoration. Like other organic amendments, their use sequesters carbon in the soil and eliminates the need to import soil from other sites.

5 REVIEW OF BIOSOLIDS TECHNOLOGY IMPROVEMENTS & ALTERNATIVE MANAGEMENT

The RDN requested a review of advancements in biosolids technologies and Canadian biosolids management. Below are the updates during 2022:

Advancements in Canadian Biosolids Policy and Technology

- Biochar carbon quantification methodology:
 - o Verra's Verified Carbon Standard Program developed a methodology for quantifying carbon emission reductions from the production (pyrolysis, gasification, biomass boilers) and use of biochar, which includes biosolids as a feedstock. This lays the groundwork for acquisition of verifiable carbon credits from biosolids thermal treatment processes.

¹ Danjou, B. 2014. Effect of Biosolid on Vegetation Development Within Two Douglas-fir Plantations: Third Year Progress Report - DRAFT. Vancouver Island University, Nanaimo, B.C.

- Renewable natural gas expansion:
 - o Net Zero Waste Abbotsford's organic waste composting facility plans to add anaerobic digestion and biogas production capacity to the facility – the biogas will be sold to FortisBC.
- Composting facility expansion:
 - o TransAqua looks to expand its Moncton biosolids composting operation.
- Wastewater treatment plant upgrade:
 - o Anaergia was contracted to upgrade a Petawawa, ON, wastewater treatment plant to accept organics with biosolids and produce biogas, which will fuel a combined heat and power system to power the treatment plant.
- Biosolids dewatering facility:
 - o Construction of the new Iona WWTP dewatering facility was completed. This is one of the first steps in the Iona plant upgrades that will eventually produce dried biosolids pellets.
- Treatment plant upgrade:
 - o The City of Winnipeg received funding towards the Phase 2 upgrade of its largest sewage treatment plant which will allow it to produce biosolids.
- Decentralized wastewater treatment and biosolids production:
 - o Proteus Waters is bringing its decentralized wastewater treatment solution to Canada, capable of serving 250 people per day (2-4 sea-cans) to 3,500 people per day (10-15 sea-cans). The technology uses a membrane bioreactor to produce clean water and biosolids that can be converted into fertilizer or biodiesel.

Changes to Canadian Biosolids Management Programs

- Site-greening initiative on biosolids-amended marginal land:
 - o Algoma steel partnered with Sault College, planting trees in a wind berm along the St. Mary's River on land where biosolids had been previously applied.
- Guelph Biosolids Master Plan:
 - o The City of Guelph, ON, developed a new Biosolids Master Plan, emphasizing consideration of new technologies to manage biogas and recover energy (combined heat and power) and enhanced filtration (disk filters) to improve tertiary treatment (phosphorus removal) capacity (currently, sand filtration is used).

6 CONCLUSION

RDN biosolids were managed at Blackjack, TimberWest Properties, and at Harmac in 2022. 5,095 wt (71% of annual production in 2022) were delivered to Blackjack, 802 wt (18%) were delivered to TimberWest Properties, and 1,291 wt (11%) were delivered to Harmac (Table 2).

All biosolids land application activities at the TimberWest Properties occurred as specified in the applicable LAP and according to management requirements under the OMRR. The TimberWest Properties accepted over 52,000 wt of biosolids from 2007 to 2022 (Table 1). The biosolids management program was transitioned to Blackjack in 2022. In its first full year as a beneficial use site, over 5,000 wt of biosolids were managed at Blackjack as per the applicable LAPs and the site is being set up to become a successful long-term management site. Biosolids management at Harmac was completed through the fabrication of RGM and BGM.

SYLVIS looks forward to continuing this productive relationship and providing biosolids management services and support to the RDN throughout 2023.

APPENDIX ONE – TABLES

Table 1: Historical management of Regional District of Nanaimo biosolids at the TimberWest Properties, Harmac Landfill, and Blackjack from 2013 to 2022.

Year	TimberWest Properties	Harmac	Blackjack	Total Production
2013	3,930 wt	-	-	3,930 wt
2014	4,812 wt	-	-	4,812 wt
2015	4,383 wt	-	-	4,383 wt
2016	4,263 wt	-	-	4,263 wt
2017	3,662 wt	797 wt	-	4,459 wt
2018	4,802 wt	164 wt	-	4,966 wt
2019	4,871 wt	719 wt	-	5,590 wt
2020	3,773 wt	1,850 wt	-	5,623 wt
2021	5,060 wt	2,194 wt	317 wt	7,571 wt
2022	802 wt	1,291 wt	5,095 wt	7,188 wt
Total	52,048 wt	7,015 wt	5,412 wt	64,475 wt

Table 2: Regional District of Nanaimo biosolids management summary - 2022.

Site	TimberWest Properties	Blackjack	Harmac BGM ^a	Harmac RGM ^b	Total
WWTP	GNPCC	GNPCC	FCPCC	GNPCC	
Class	B	B	A	B	
Storage from 2021	800	317	1,308	1,312 ^d	3,737
Delivered	802	5,095	1,291	0	7,188
Land applied at site	1,602	5,262	0	1,386 ^d	8,250
Distributed offsite	0	0	640	0	640
Storage to 2023	0	150	1,959 ^c	0	2,109

Note: All values in units of wet tonnes.

a FCPCC biosolids are used at the Nanaimo Forest Products Harmac Mill as a feedstock in the production of a biosolids growing medium (BGM). No GNPCC biosolids were used to produce BGM.

b GNPCC biosolids are used at the Nanaimo Forest Products Harmac Mill as a feedstock in the production of a reclamation growing medium (RGM) used for landfill closure.

c FCPCC Class A biosolids as a component of BGM remained stored at the Harmac site at the end of 2022.

d Tonnages are estimates based on soil volumes managed since 2017, leading to a difference of 74 wt which is indicative of the variability of the estimation and not indicative of material left on site. All RGM and Class B biosolids were land applied as of the end of 2022.

Table 3: Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2021-2022 extension contract for GNPCC biosolids management.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality monitoring was completed through the 2021-2026 contract detailed in Table 4 below.
Biosolids Quantity	No biosolids were delivered in 2022 under this contract. 800 tonnes of biosolids remaining onsite at the end of 2021 were land-applied in 2022. No biosolids remained stored at the TimberWest Properties at the end of 2022.
Biosolids Transportation and Delivery Coordination	No biosolids were delivered in 2022 under this contract.
Access Maintenance	Road quality status was monitored, no road maintenance on internal roads at the TimberWest Properties was required in 2022.
Contingency	No contingency biosolids management was required under this contract.
Storage of Biosolids	Biosolids were stored in four storage facilities at the TimberWest Properties and covered with tarps from October 1 st to March 31 st as per OMRR requirements. SYLVIS managed storage facilities throughout 2022. No repairs were completed on storage facilities in 2022 and decommissioning work was not required when the program was completed at TimberWest Properties.
Invoicing	Biosolids were invoiced on a monthly basis.
Environmental Incidents	No environmental incidents occurred in 2022 at the biosolids management site (TimberWest Properties).
Site Safety	No near-miss or safety incidents occurred at the biosolids management site (TimberWest Properties) in 2022. SYLVIS maintained COR and BC Forest SAFE safety accreditations in 2022.
Complaints Management	There were no complaints received about the biosolids forest fertilization program at the TimberWest Properties in 2022.
Annual Reporting	A Qualified Professional Certification of Compliance report, fulfilling the regulatory requirement for written certification under OMRR Section 5(3), was provided to the RDN for land applications at the TimberWest Properties.
Application Planning	SYLVIS mapped, planned, and notified all fertilized areas in 2022.
Nanaimo Mountain Bike Club Land Use Coordination	The Nanaimo Mountain Bike Club was notified of the completion of the biosolids management program at the TimberWest Properties.
Biosolids Beneficial Use	A Land Application Plan (Authorization #110207) was submitted on August 05, 2021. Under this contract 800 wt biosolids were land applied to fertilize forests (16.5 ha) to increase tree growth, soil development, and understory growth.

Table 3 (continued): Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2021-2022 extension contract for GNPCC biosolids management.

Record-Keeping	SYLVIS kept detailed records of all fertilization activities and environmental monitoring in 2022.
TimberWest Rules	SYLVIS maintained its BC Forest SAFE accreditation in 2022.
Construction	No works were constructed by SYLVIS at the TimberWest Properties in 2022. It was agreed upon between Mosaic and the RDN that constructed works were not required to be removed from the TimberWest Properties and ownership was transferred to Mosaic following completion of the program at the site.
Fires	SYLVIS followed a fire prevention protocol throughout 2022.
Hazardous Substance	No hazardous substances were introduced by SYLVIS to the TimberWest Properties in 2022.
Condition of TimberWest Lands	SYLVIS maintained the condition of the TimberWest Properties in 2022.
Equipment Storage	Except for temporary storage of heavy equipment during fertilization activities, SYLVIS did not store any equipment at the TimberWest Properties in 2022.

Table 4: Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2021-2026 Agreement for GNPCC biosolids management.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality was monitored throughout 2022 through the collection of three full suite samples and 19 fecal coliform samples.
Biosolids Quantity	<p>317 tonnes of GNPCC biosolids were delivered in December 2021 with the intent of applications in spring 2022. 5,095 tonnes of GNPCC biosolids were transported to the Blackjack site by DBL Disposal in 2022. 5,262 tonnes of GNPCC biosolids were land-applied in 2022. 150 tonnes of GNPCC biosolids remained stored at Blackjack at the end of 2022.</p> <p>802 tonnes of GNPCC biosolids were delivered and applied at the TimberWest Properties in March and April 2022.</p>
Biosolids Transportation and Delivery Coordination	The RDN coordinated biosolids deliveries with DBL and SYLVIS throughout 2022.
Contingency Plan and Management	<p>A Contingency Plan was written for the 2021-2026 biosolids management contract and the following contingency sites were available for use in 2022: TimberWest Properties, Harmac, Hamm Road, 155-A Pit, and Haslam Pit.</p> <p>802 tonnes of GNPCC biosolids were delivered and applied at the TimberWest Properties in March and April under the existing site authorization. No biosolids remain stockpiled onsite.</p>
Storage of Biosolids	<p>Biosolids were stored at the main storage area at Blackjack and covered with tarps from October 1st to March 31st as per OMRR requirements.</p> <p>During contingency management at the TimberWest Properties, biosolids were stored in two storage facilities at the TimberWest Properties and covered with tarps until March 31st as per OMRR requirements.</p>
Invoicing	Biosolids deliveries were invoiced on a monthly basis.
Environmental Incidents	No environmental incidents occurred in 2022.
Site Safety	No safety incidents occurred at active management sites (Blackjack and TimberWest Properties) in 2022. SYLVIS maintained COR and BC Forest SAFE safety accreditations in 2022.
Complaints Management	There were no complaints received about the biosolids forest fertilization program in 2022.
Odour Management Plan	The program Odour Management Plan was adhered to in 2022.

Table 4 (continued): Summary of SYLVIS 2021 deliverables as outlined in the RDN-SYLVIS 2021-2026 Agreement for GNPCC biosolids management.

Task or Activity	Description
Communications Plan & Engagement	<p>The program Communications Plan was adhered to in 2022.</p> <p>Four inquires were received from the public regarding biosolids quality, the program timeline for transitioning the biosolids management program from the TimberWest Properties to Blackjack, application rates and illegal dumping at the TimberWest Properties, and potential impacts to wild game and plant harvesting. The RDN was included on all stakeholder responses.</p> <p>First Nations engagement was carried out with the Snuneymuxw First Nation for the Blackjack site through Mosaic during 2022. No questions or concerns were raised by the Snuneymuxw First Nation or other First Nations in 2022.</p>
Annual Reporting	<p>Qualified Professional Certification of Compliance reports, fulfilling the regulatory requirement for written certification under OMRR Section 5(3), were provided to the RDN for land applications at the TimberWest Properties and to Mosaic for land applications at Blackjack.</p>
Biosolids Beneficial Use	<p>Two biosolids Land Application Plans for Authorizations #110732 and #111152 were submitted on April 22, 2022 and May 6, 2022 for Blackjack. 5,262 tonnes of biosolids were land-applied to 51 ha of forest and 2.8 ha of disturbed land.</p> <p>Under this contract, 802 wt biosolids were land applied to fertilize forests (16.5 ha) at the TimberWest Properties under the existing Authorization and LAP to increase tree growth, soil development, and understory growth.</p>

Table 5: Summary of SYLVIS 2022 deliverables as outlined in the RDN-SYLVIS 2022 contract for BGM and RGM production using FCPCC biosolids.

Task or Activity	Description
Biosolids Quality	RDN biosolids quality monitoring was completed throughout 2022. FCPCC biosolids continued to meet OMRR Class A criteria.
Biosolids Quantity	1,291 tonnes of RDN FCPCC Class A biosolids were transported to the Harmac site by DBL Disposal in 2022 for use as a feedstock in BGM production. 640 tonnes of biosolids (as a component of BGM) were removed from the site in 2022. ~1,850 tonnes (as a component of BGM) remained stored at the Harmac site at the end of 2022.
	No GNPCC biosolids were transported to the Harmac site in 2022. 1,386 tonnes of biosolids (as a component of RGM) were land-applied in 2022. All Class B biosolids and RGM were used in 2022 and none remained in storage at the end of 2022.
BGM Certification	BGM quality certification was issued by SYLVIS for the batch of BGM including deliveries up to May 2022.
Annual Reporting	The Harmac Compliance Report fulfills the regulatory requirement for written certification under OMRR Section 5(3).

Table 6: Regional District of Nanaimo biosolids quality summary - 2022.

Parameter	FCPCC	GNPCC	Regulatory Criteria		Units
	Class A	Class B	Class A ^a	Class B ^b	
# of samples	3	3	-	-	
Available Nutrients, Physical Properties, Acidity					
Total Nitrogen - TKN	45,894	59,997	-	-	µg/g
Ammonia + Ammonium- N (available)	2,797	5,100	-	-	µg/g
Nitrate - N	4	6	-	-	µg/g
Phosphorus (available)	563	1,287	-	-	µg/g
Potassium (available)	718	757	-	-	µg/g
Organic Matter	65.0	66.0	-	-	%
Total Solids	34.1	20.4	-	-	%
pH	6.6	6.9	-	-	pH
Electrical Conductivity	5.3	2.3	-	-	dS/m
Trace Elements					
Arsenic	1.2	2.4	75	75	µg/g
Cadmium	1.5	1.4	20	20	µg/g
Chromium	40	37	-	1,060	µg/g
Cobalt	2.0	2.9	150	150	µg/g
Copper	603	587	-	2,200	µg/g
Lead	15	24	500	500	µg/g
Mercury	0.58	0.55	5	15	µg/g
Molybdenum	4.6	8.3	20	20	µg/g
Nickel	11	15	180	180	µg/g
Selenium	1.4	2.3	14	14	µg/g
Zinc	1080	867	1,850	1,850	µg/g
Microbiological Analysis - Fecal Coliforms					
Fecal Coliforms	10 ^c	88,300 ^d	1,000	2,000,000	MPN/g

Note: All analyses based on dry weight.

- a Class A trace element criteria specified in Trade Memorandum T-4-93, Standards for Metals in Fertilizers and Supplements as of August 2017, and microbiological criteria specified in Schedule 3 of the BC *Organic Matter Recycling Regulation*.
- b Class B trace element criteria specified in Schedule 4 and microbiological criteria in Schedule 3 of the BC *Organic Matter Recycling Regulation*.
- c Value is the maximum of eight samples collected by SYLVIS throughout 2022.
- d Value is the geometric mean of 19 samples collected by SYLVIS throughout 2022.

APPENDIX TWO – FIGURES

Figure 1: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) dewatered biosolids delivered and applied at Blackjack by month in 2022.

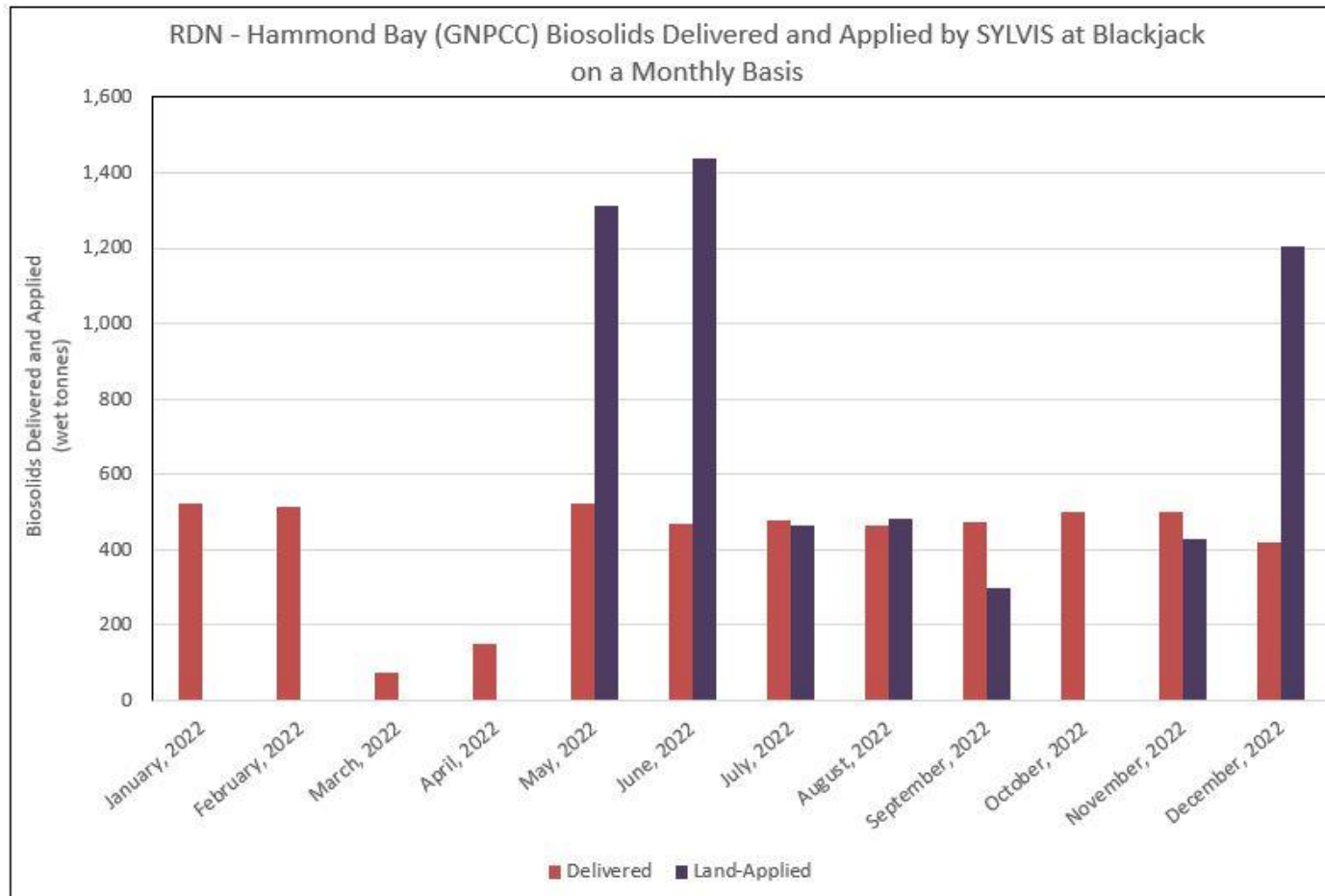
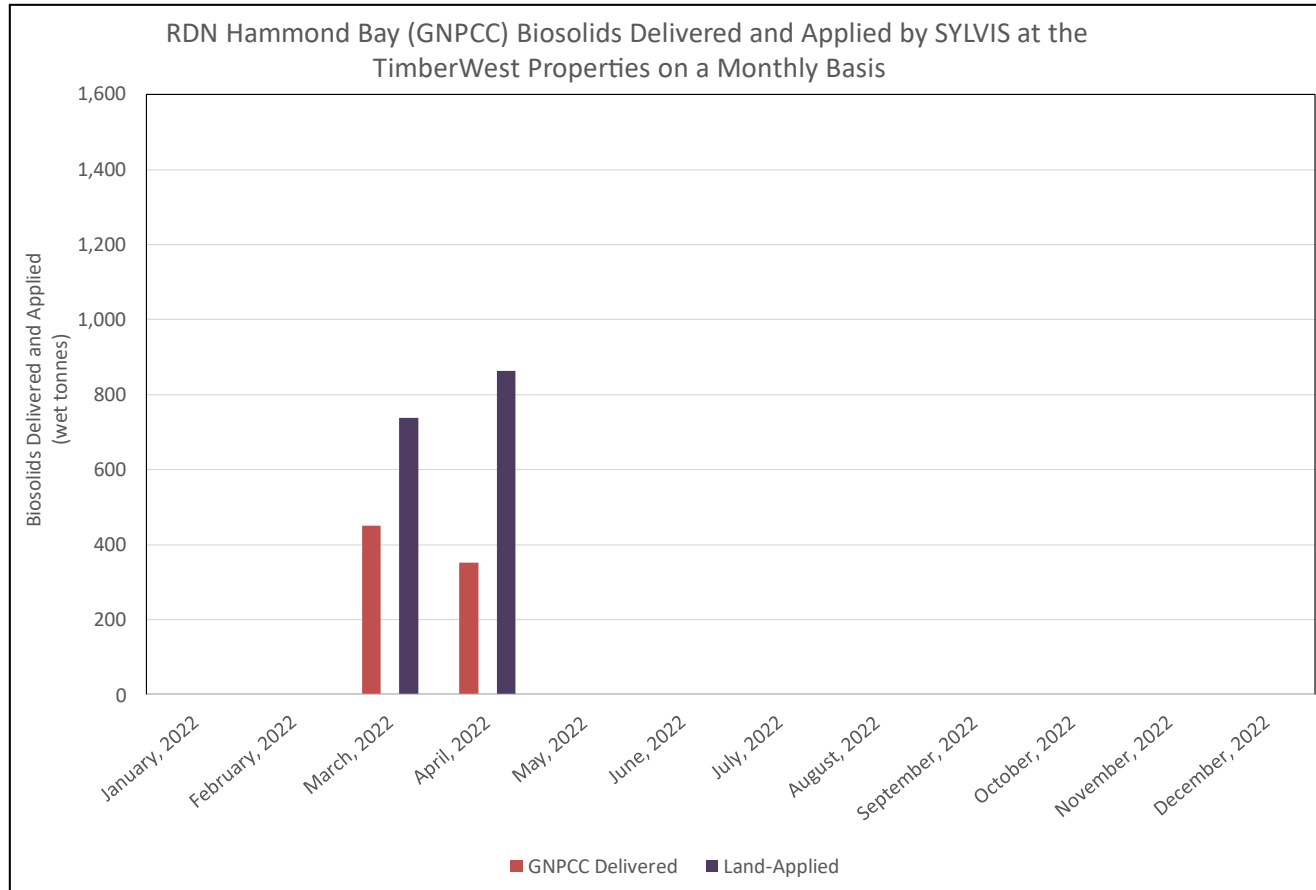
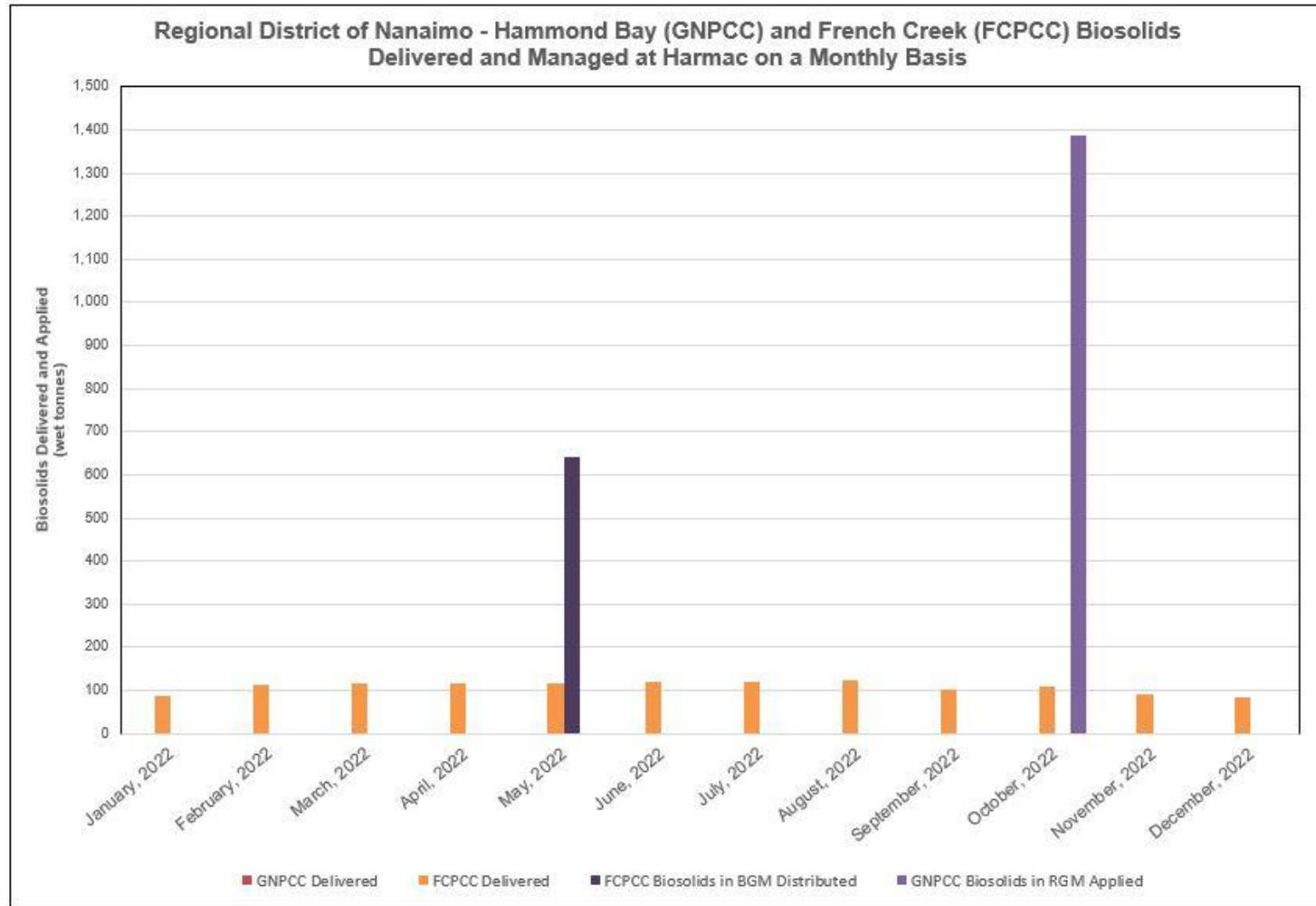


Figure 2: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) dewatered biosolids delivered and applied at the TimberWest Properties by month in 2022.



Note: 800 tonnes of GNPCC biosolids were stored from 2021 in anticipation of 2022 forest fertilization applications.

Figure 3: Tonnage of Regional District of Nanaimo – Greater Nanaimo Pollution Control Centre (GNPCC) and French Creek Pollution Control Centre (FCPCC) dewatered biosolids delivered and managed at Harmac by month in 2022.



Note: The tonnages of biosolids applied/distributed are based on the volume of BGM and RGM distributed as indicated by Harmac.

Figure 4: Blackjack application areas fertilized with Regional District of Nanaimo biosolids in 2022.

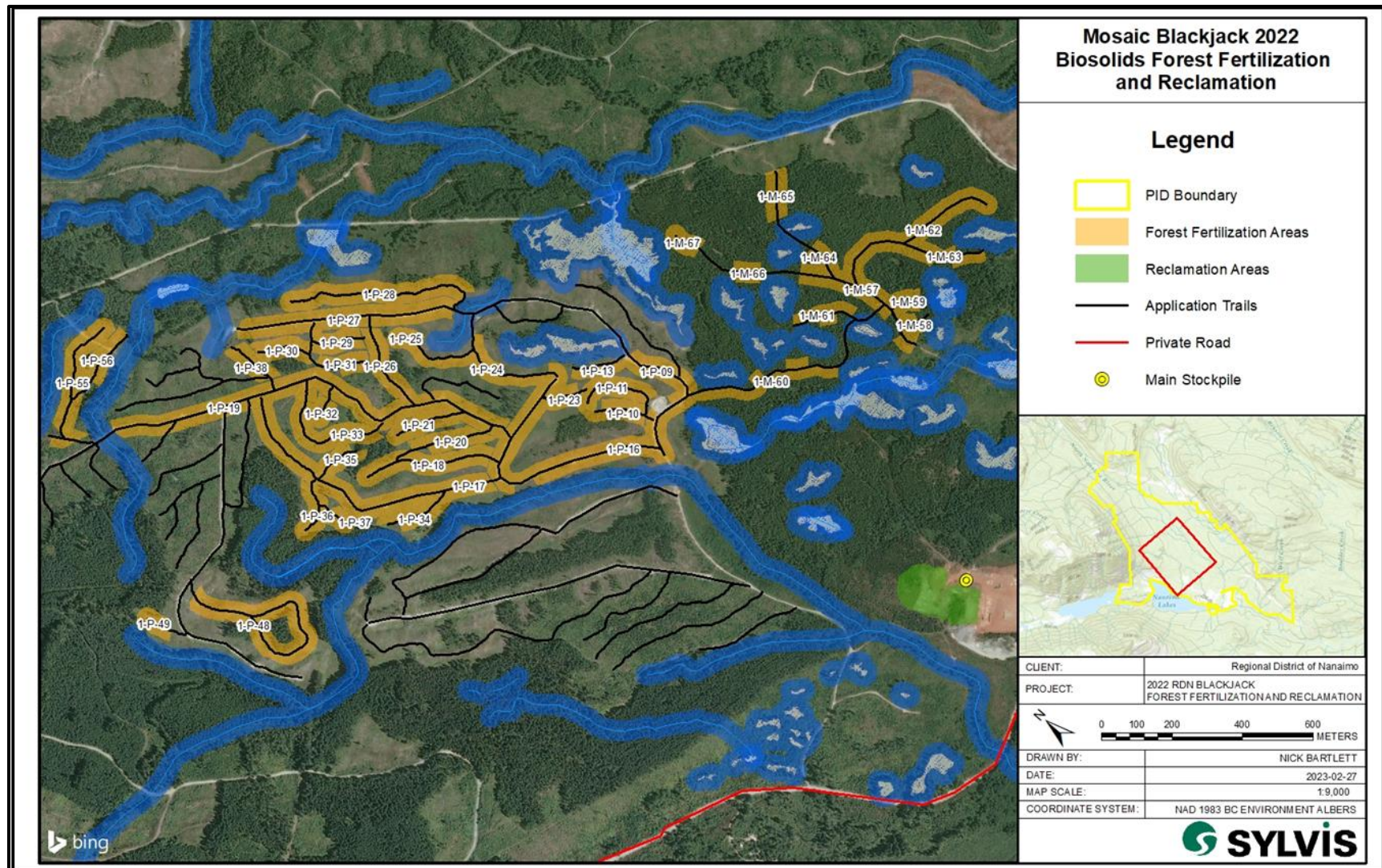
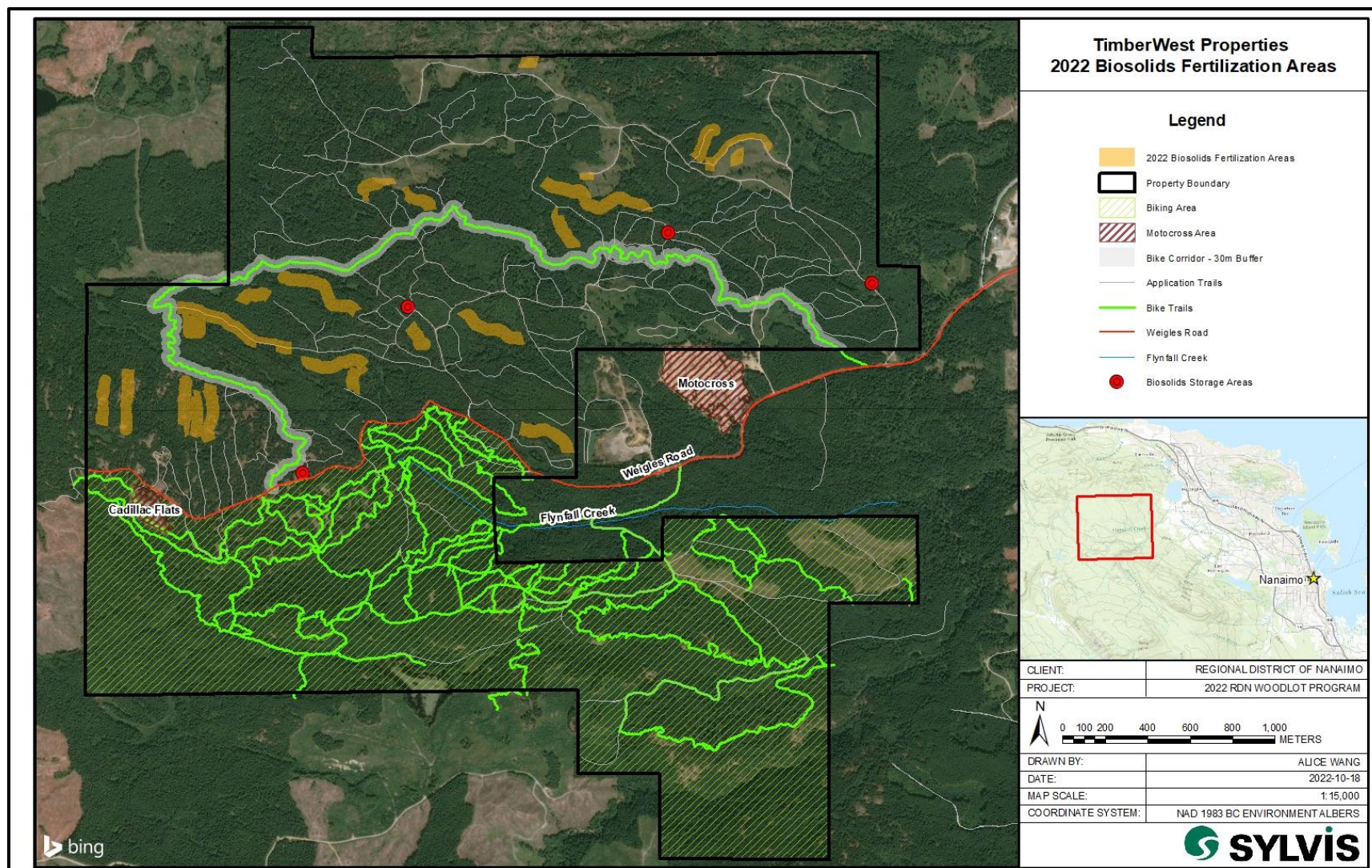


Figure 5: TimberWest Properties application areas fertilized with Regional District of Nanaimo biosolids in 2022.



APPENDIX THREE – PHOTOGRAPHS



Photograph 1: Storage area at the TimberWest Properties following completion of biosolids program. (June 2022)



Photograph 2: Main biosolids storage area at Blackjack. (September 2022)



Photograph 3: Forest fertilization using biosolids onto a mature forest block. (July 2022)

