625 Fisgard St.,
Victoria, BC V8W 1R7

Capital Regional District

Notice of Meeting and Meeting Agenda
Saanich Peninsula Wastewater Commission

Thursday, May 15, 2025 **9:35 AM** **Sidney Community Safety Building**
2245 Oakville Ave., Sidney, BC

Members of the public can view the live meeting via MS Teams link: **Click here**

D. Kelbert (Chair), M. Doehnel (Vice Chair), E. Diller, D. Halldorson, P. Jones, Z. King,
C. McNeil-Smith, R. Novek, S. Shrivastava, R. Windsor

The Capital Regional District strives to be a place where inclusion is paramount and all people are treated with dignity. We pledge to make our meetings a place where all feel welcome and respected.

1. Territorial Acknowledgement

2. Approval of Agenda

3. Adoption of Minutes

3.1. 25-0524 Minutes of the Saanich Peninsula Wastewater Commission Meeting of March 20, 2025

Recommendation: That the minutes of the Saanich Peninsula Wastewater Commission meeting of March 20, 2025 be adopted as circulated.

Attachments: Minutes - March 20, 2025

4. Chair's Remarks

5. Presentations/Delegations

The public are welcome to attend CRD meetings in-person.

Delegations will have the option to participate electronically. Please complete the online application at www.crd.ca/address no later than 4:30 pm two days before the meeting and staff will respond with details.

Alternatively, you may email your comments on an agenda item to the Commission at legserv@crd.bc.ca.

6. Commission Business

6.1. 25-0453 General Manager's Verbal Update - May

Recommendation: There is no recommendation. This verbal update is for information only.

6.2. 25-0503 Residual Treatment Facility Saanich Peninsula Solids Processing

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: RTF Saanich Peninsula Solids Processing

Appendix A: Bylaw No. 4414

6.3. 25-0504 Core Area Biosolids Beneficial Use Strategy

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Core Area Biosolids Beneficial Use Strategy

Appendix A: Letter to Ministry - Long-Term Biosolids Strategy

Appendix B: Minister's Acknowledgement of Biosolids Strategy

Appendix C: Updated Review of Biosolids Land Application – Dr. Kennedy

Presentation: Long-Term Biosolids Management Strategy

7. Notice(s) of Motion

8. New Business

9. Adjournment

The next meeting is July 17, 2025.

To ensure quorum, please advise Megan MacDonald (mmmacdonald@crd.bc.ca) if you or your alternate cannot attend.

Meeting Minutes

Saanich Peninsula Wastewater Commission

Thursday, March 20, 2025	9:35 AM	Sidney Community Safety Building 2245 Oakville Ave., Sidney, BC

PRESENT
Commissioners: M. Doehnel (Vice Chair), E. Diller (EP), D. Halldorson, C. McNeil-Smith, R. Novek, S. Riddel (for R. Windsor) (EP), S. Shrivastava (EP)

Staff: A. Fraser, General Manager, Infrastructure and Water Services (IWS); J. Dales, Senior Manager, Wastewater Infrastructure Operations; D. Dionne, Manager, IWS Business Support Services; P. Kickham, Manager, Environmental Regulations; D. Robson, Manager, Saanich Peninsula Gulf Island Operations; M. Lagoa, Deputy Corporate Officer; M. MacDonald, Legislative Services Coordinator (Recorder)

EP - Electronic Participation

Regrets: Commissioner(s) P. Jones, D. Kelbert (Chair), Z. King, R. Windsor

The meeting was called to order at 9:30 am

1. Territorial Acknowledgement

A Territorial Acknowledgement was provided in the preceding meeting.

2. Approval of Agenda

MOVED by Commissioner McNeil-Smith, SECONDED by Commissioner Halldorson, That the agenda for the Saanich Peninsula Wastewater Commission meeting of March 20, 2025 be approved as circulated.
CARRIED

3. Adoption of Minutes

3.1. 25-0301 Minutes of the Saanich Peninsula Wastewater Commission Meeting of January 16, 2025

MOVED by Commissioner Novek, SECONDED by Commissioner McNeil-Smith, That the minutes of the Saanich Peninsula Wastewater Commission meeting of January 16, 2025 be adopted as circulated.
CARRIED

4. Chair’s Remarks

Vice Chair Doehnel encouraged Commissioners to be informed about the business of the Capital Regional District Board, as well as other committees.

5. Presentations/Delegations

There were no presentations or delegations.

6. Commission Business

6.1. 25-0339 General Manager's Verbal Update

A. Fraser presented Item 6.1. for information and provided the following updates:
- Commissioners will receive an invitation to a tour of the Saanich Peninsula Wastewater Treatment Plant, which will be scheduled sometime during the week of April 14, 2025
- a report on the management of biosolids will be on the next agenda

6.2. 25-0302 Saanich Peninsula Wastewater Treatment Plant Process

D. Robson presented item 6.2. for information.

Discussion ensued regarding:
- monitoring of storm water and marine outflow locations
- methane capture at the landfill and use of captured gas
- ongoing odour control system improvements
- the potential for the use of biosolids as a fuel source and related regulations

7. Notice(s) of Motion

There were no notice(s) of motion.

8. New Business

There was no new business.

9. Adjournment

**MOVED by Commissioner Novek, SECONDED by Commissioner McNeil-Smith,
That the Saanich Peninsula Wastewater Commission meeting of March 20, 2025 be adjourned at 10:26 am.
CARRIED**

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CHAIR

____

RECORDER

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EEI 25-18

REPORT TO SAANICH PENINSULA WASTEWATER COMMISSION
MEETING OF THURSDAY, MAY 15, 2025

SUBJECT **Residual Treatment Facility Saanich Peninsula Solids Processing**

ISSUE SUMMARY

To provide an update on beneficial use of wastewater residuals from the Saanich Peninsula Wastewater Treatment Plant (SPWWTP) through the Core Area Residuals Treatment Facility (RTF).

BACKGROUND

The Saanich Peninsula Liquid Waste Management Plan (LWMP) committed the Capital Regional District (CRD) and participating member municipalities to:

- *Set as an objective the beneficial use of SPWWTP biosolids, and application to peninsula farmland as the primary option for beneficial use.*

This commitment was initially met via the production of Class A biosolids, which were beneficially used in accordance with the provincial Organic Matter Recycling Regulation (OMRR) as a soil amendment under various land application scenarios.

On July 13, 2011, the CRD Board passed a resolution banning the production of biosolids at CRD regional facilities, including the SPWWTP, and the land application of biosolids within the capital region.

The SPWWTP ceased production of Class A biosolids by the end of 2011 and, since then, has disposed of all residual solids as controlled waste at the Hartland Landfill (approximately 4,000 tonnes in 2024). At that time, July 2012, the CRD contacted the BC Ministry of Environment and Climate Change Strategy (ENV) proposing an amendment to the LWMP that would allow for the interim disposal of all SPWWTP wastewater residuals at Hartland Landfill while continuing to look for alternative beneficial reuse opportunities and to consider harmonization with the CRD's Core Area Wastewater Treatment Project biosolids management strategy.

The Core Area Wastewater Treatment Project included the construction of the RTF located adjacent to the Hartland Landfill. Primarily, the RTF was built to produce Class A biosolids from wastewater residuals generated at the new McLoughlin Point Wastewater Treatment Plant. The RTF facility's design also included the capacity to accept wastewater residuals from the SPWWTP along with other sub-regional or municipal wastewater treatment plants within the capital region through a receiving station for Other Municipal Residual Solids (OMRS). Delivery of OMRS loads to the RTF has been delayed due to a protracted dispute with the private partner responsible for design, construction and operation of the RTF, however, staff are hopeful that a resolution to the dispute is imminent, which will allow for residual solids from the SPWWTP to be beneficially used starting in 2025.

In preparation for the completion of the Core Area Wastewater Treatment Project, and beneficial use of OMRS via the core area's infrastructure, in 2021 CRD Bylaw No. 4414 (Appendix A) was passed to enable tipping fees for OMRS deliveries to the RTF. Fees were structured on a cost recovery basis reflecting the region's need to meet regulatory requirements for wastewater management. The rates were set at $225/wet tonne for dewatered residuals and $45/wet tonne for pumpable slurries.

IMPLICATIONS

Intergovernmental Implications

Wastewater residuals in British Columbia must be beneficially used in accordance with commitments in the LWMP and OMRR. Commissioning and operation of the OMRS equipment will allow residuals from the SPWWTP to be beneficially used in accordance with provincial and federal requirements. Staff have initiated a Technical Advisory Committee to review and make recommendations for updating commitments in the Saanich Peninsula LWMP, including management of wastewater residuals, and planning for future capital projects.

Financial Implications

Currently, the Saanich Peninsula wastewater service is billed $165/wet tonne for biosolids disposal at Hartland Landfill. Should the CRD reach an agreement with its partner, the higher tipping fee at the RTF will result in an approximate $250,000 annual increase in fees for treatment and beneficial reuse. In 2020, the Saanich Peninsula Wastewater Commission directed staff to prepare the 2021 budget to account for the increase in tipping fees associated with beneficial reuse, however, to date these costs have not been realized due to the ongoing dispute. Should the dispute be resolved:

a) there are sufficient operating reserve funds to accommodate the increased tipping fee for the remainder of 2025;
b) a budget amendment will be prepared for this commission and CRD Board approval; and
c) budget planning for 2026 will incorporate the RTF fee structure.

CONCLUSION

Due to the 2011 Capital Regional District (CRD) Board motion banning production of biosolids at CRD facilities and the land application of biosolids within the capital region, residual solids from the Saanich Peninsula Wastewater Treatment Plant have been landfilled contrary to provincial regulatory requirements. Completion of the Core Area Wastewater Treatment Project included the capacity to process and beneficially use residual solids from other wastewater treatment plants in the capital region, however this component of the project has been delayed by an ongoing dispute with the private operator of the RTF. Staff anticipate imminent resolution of the dispute, which will allow for immediate beneficial use of SPWWTP residuals, which will result in increased tipping fees for the Saanich Peninsula wastewater service, which can be accommodated by operating reserve funds.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Rory Tooke, Ph.D., Senior Manager, Environmental Innovation
Concurrence:	Luisa Jones, MBA, General Manager, Parks, Recreation & Environmental Services
Concurrence:	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer, GM Finance & IT
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Bylaw No. 4414, "A bylaw to provide for fees and charges for tipping wastewater solids from other municipalities at the residual solids treatment facility"

CAPITAL REGIONAL DISTRICT

BYLAW NO. 4414

* *

A BYLAW TO PROVIDE FOR FEES AND CHARGES FOR TIPPING WASTEWATER SOLIDS FROM OTHER MUNICIPALITIES AT THE RESIDUAL SOLIDS TREATMENT FACILITY

* *

WHEREAS:

A. Pursuant to section 397 of the *Local Government Act*, the Board may, by bylaw, impose a fee or charge payable in respect of all or part of a service of the regional district, or the use of regional district property.

B. The Capital Regional District established wastewater services and facilities to collect, convey, treat and dispose of sewage within the Core Area for participating municipalities of Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria and View Royal, under *Liquid Waste Management Core Area and Western Communities Service Establishment Bylaw No. 1*, 1995 (Bylaw No. 2312), and constructed a Residual Solids Treatment Facility.

C. The Board wishes to authorize and impose the fees and charges payable for the tipping of wastewater solids generated at other facilities in the capital region at the Residuals Solids Treatment Facility.

NOW THEREFORE, the Board of the Capital Regional District, in open meeting assembled, enacts as follows:

Tipping Fees

1. The Board hereby authorizes and imposes fees and charges for the tipping of wastewater solids at the Residuals Solids Treatment Facility from other Municipal sources, as set out in the attached Schedule "A" – Other Municipal Solids Tipping Fees.

Conditions of Access and Use

2. No party shall dispose of wastewater solids at the Residuals Solids Treatment Receiving Facility except in accordance with this Bylaw.

3. The Residuals Solids Treatment Receiving Facility is located at 280 Willis Point Road. Wastewater solids are defined as described in Schedule "A", Table 1.

4. All deliveries made by covered and secure trucks to prevent spillage and unnecessary odours.

5. All trucks must enter and exit through the Hartland north road access unless otherwise directed.

6. All trucks must weigh in and weigh out.

7. Every party depositing wastewater solids at the Residuals Solids Treatment Receiving Facility shall pay to the Capital Regional District the applicable fees in the amounts as set out in the attached Schedule "A".

8. **Credit.** Parties depositing liquid waste at the liquid waste site on a regular basis may apply to the Regional District for credit. If the Treasurer is satisfied of the credit worthiness of the party, credit may be granted to that party, in which case payment of the charge imposed under this bylaw shall be made and credit extended on the following conditions:

    i) The party receiving credit shall pay to the Regional District all fees in full within thirty (30) days of the last day of the month for which an invoice has been submitted. The Regional District will invoice monthly for liquid waste delivered during the preceding month. The invoice amount will be based on the total quantity of the waste delivered during the month, and the posted rates in effect at the time of delivery.

    ii) Late payment(s) will be subject to an interest penalty of 1 1/2 % per month.

    iii) The Regional District reserves the night to cancel, upon five (5) days' notice, the credit offered herein for late payment, non-payment or other justified cause as judged solely by the Regional District.

9. The fees and charges established under this Bylaw shall come into effect on the date of adoption of this bylaw.

10. A failure to comply with a condition of site access set out in ss. 2 to 7, or on conditions of use set out in section 7, is an offence.

11. This Bylaw may be cited as "Other Municipal Solids Tipping Fees and Charges Bylaw No.1, 2021".

READ A FIRST TIME THIS	8th	day of	September,	2021
READ A SECOND TIME THIS	8th	day of	September,	2021
READ A THIRD TIME THIS	8th	day of	September,	2021
ADOPTED THIS	8th	day of	September,	2021

Chair

Corporate Officer

Schedule “A”

Other Municipal Solids Tipping Fees and Charges

Table 1:

Wastewater Solids	**Description**	**Tipping fee**
Pumpable Residuals	Low solid content (less than 10%) residuals solids are pumped to either the Residual Storage Tank or directly into the Residuals Treatment Facility Digester	$45 / wet tonne
Dewatered Residuals	High solids content (equal to or greater than 10%) residuals are loaded into the Other Municipal Solids Reception Hopper and then directed into to the main dewatered sludge hopper	$225 / wet tonne

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EEI 25-17

REPORT TO SAANICH PENINSULA WASTEWATER COMMISSION
MEETING OF THURSDAY, MAY 15, 2025

SUBJECT **Core Area Biosolids Beneficial Use Strategy**

ISSUE SUMMARY

To provide background information on the Core Area biosolids beneficial use strategy.

BACKGROUND

In 2011, the Capital Regional District (CRD) Board passed a resolution to ban the land application of biosolids from CRD facilities due to concerns about the accumulation and dispersal of contaminants and based on the precautionary principle; that lack of scientific certainty should not be a reason to postpone preventative measures.

With the commissioning of the core area wastewater treatment project in 2020, the CRD became responsible for management of the Class A biosolids produced from the Residuals Treatment Facility (RTF) located at Hartland Landfill. This new function required a management plan that demonstrates the beneficial use of CRD-produced biosolids to the provincial regulator. The core area consists of Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, View Royal, and the Esquimalt and Songhees Nations.

In 2019, in anticipation of biosolids production, the CRD developed a short-term Biosolids Beneficial Use Strategy (2020-2025). Under this strategy, biosolids were to be transported to Richmond, BC for use as an alternative fuel in a cement kiln. The Minister of Environment and Climate Change Strategy (now referred to as the Minister of Environment and Parks) approved the short-term strategy with the condition that a long-term strategy be implemented by January 1, 2025, and that an options analysis and consultation process be completed in support of this strategy.

In 2023, given operational and logistical challenges with the short-term plan, the CRD Board amended its position to allow limited non-agricultural land application of biosolids as a contingency option. The CRD then began supplying biosolids to an industrial land reclamation project at a quarry near Cassidy, BC.

In preparation to meet the provincial requirements, the CRD prepared a biosolids management options analysis report. This report included an options analysis, an updated review of international biosolids management practices and a summary and evaluation of the advanced thermal (gasification and pyrolysis) pilots completed in 2022 (Appendix A).

The CRD conducted First Nations and public engagement in early 2024 on the various biosolids management options. The process included an interactive website that solicited and posted email questions, media releases, print ads, online and representative surveys, and a virtual open house. The CRD also convened a Technical and Community Advisory Committee (TCAC) to provide consultation advice and input regarding biosolids management and beneficial use. Respondents indicated that the most important consideration was reducing environmental impacts.

After options analysis and public consultation, the CRD developed a Long-Term Biosolids Management Strategy. The strategy calls for a portfolio of options in alignment with the technical assessment and utilizing each option under a prioritization structure. The strategy was endorsed by the CRD Board in June 2024 and acknowledged by the Province in March 2025. The Long-Term Biosolids Management Strategy is included in Appendix A and is summarized below. The response from the Minister of Environment and Parks is attached as Appendix B.

Tier 1: Advanced thermal option

The preferred solution for biosolids beneficial use management under the long-term strategy is advanced thermal treatment. Using advanced thermal technology (pyrolysis or gasification) biosolids are heated under reduced oxygen conditions to form a biochar and a synthetic gas (syngas). This process reduces the concentrations of many contaminants, including Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS). The exclusion of oxygen from the thermal process helps prevent the formation of air pollutants like nitrogen and sulphur oxides. Biochar sequesters carbon, and has a range of potential uses, including as a soil amendment. The syngas can subsequently be burned for energy as a renewable fuel.

In support of the preferred Tier 1 option, the CRD issued a Request for Proposals (RFP) on July 10, 2024, for an advanced thermal demonstration plant. The RFP is closed and the CRD Board is in the process of deciding next steps.

Tier 2: Out-of-region compliance options

The second tier of options under the long-term strategy constitute measures that the CRD will use to meet its obligation for the beneficial use of biosolids while the Tier 1 thermal processing options are being developed or otherwise unavailable. These are (in priority order):

(i) Continue alternative fuel combustion in the cement manufacturing facility in Richmond, BC
(ii) Industrial land reclamation, such as mine and quarry sites
(iii) Forest fertilization
(iv) Production of biosolids growing medium and/or feedstock in soil production
(v) Partnerships with established biosolids programs
(vi) Explore partnerships with additional industrial partners interested in combustion

The CRD currently has three contracts for the beneficial use of biosolids in alignment with the Tier 2 options above: combustion at a cement kiln, industrial land reclamation at a gravel quarry, and growing medium production at a nursery in the Fraser Valley. CRD staff coordinate the daily management of biosolids across its portfolio of Tier 2 beneficial use options and the CRD has maintained an open procurement for additional Tier 2 options to encourage the market to come forward with cost-effective options to add to the CRD's portfolio.

Tier 3: In-region contingency options

The third tier options constitute contingency options of last resort to ensure compliance with regulatory requirements for the beneficial use of biosolids. The CRD would implement Tier 3 options on a contingency basis, only when options within the Tier 2 portfolio are unavailable and only after receiving explicit consent from the CRD Board and consulting and engaging with any affected First Nations, should the need for Tier 3 arise.

On August 9, 2023, the CRD Board directed staff to commission a literature review by an independent academic researcher to examine the human health and environmental risks and benefits of biosolids land application. Based on recent research, the review concluded that Contaminants Of Emerging Concern (COEC's) present in CRD biosolids pose a negligible to low risk to human health and the environment. However, it also identified significant sources of uncertainty in this risk assessment. To address this uncertainty, the review recommended an adaptive management framework that includes exercising caution and exploring emerging technologies. The CRD's long-term strategy aligns with these conclusions by prioritizing the development of an advanced thermal facility and excluding agricultural land application from consideration. Staff will continue to monitor evolving science and have initiated enhanced monitoring of COEC's in biosolids semi-annually to inform future decision-making. The literature review was prepared by Dr. Christopher J. Kennedy and is attached as Appendix C.

IMPLICATIONS

Financial Implications

Annual biosolids beneficial use management costs are in the range of $2.2M to $2.5M based on current options and trends.

On March 12, 2025, the Board gave final approval of the CRD 2025 financial plan, inclusive of the Liquid Waste Management Plan Core Area and Western Communities Service five-year (2025-2029) capital plan. As is the case each year following plan approval, staff prepare necessary loan authorization bylaws and security issuing bylaws. The Liquid Waste Management Plan Core Area and Western Communities Service capital plan includes planned infrastructure and improvements totalling $10 million, which requires borrowing of $9 million. These capital projects include a Biosolids Advanced Thermal Demonstration Plant construction.

The financial plan includes a $10 million budget for the advanced thermal demonstration plant. Actual costs are yet to be determined and will depend on vendor proposals and contract negotiations with the preferred proponent, pending direction from the CRD Board on a decision anticipated in 2025.

Biosolids beneficial use management and the development of technology options are funded through the Core Area Liquid Waste Management budget.

CONCLUSION

The CRD manages the beneficial use of Class A biosolids produced through the Core Area wastewater treatment system, to meet its regulatory obligations under the provincially approved Liquid Waste Management Plan. The beneficial use of biosolids is informed through the Long-Term Biosolids Management Strategy that currently consists of a portfolio of out-of-region non-agricultural beneficial use options while actively exploring the preferred option of advanced thermal technology solutions.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Rory Tooke, Ph.D., Senior Manager, Environmental Innovation
Concurrence:	Luisa Jones, MBA, General Manager, Parks, Recreation & Environmental Services
Concurrence	Alicia Fraser, P. Eng., General Manager, Infrastructure and Water Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer, GM Finance & IT
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENTS

Appendix A: Long-Term Biosolids Management Strategy – Letter to the Ministry of Environment and Climate Change Strategy (June 18, 2024)
Appendix B: Acknowledgement of Receipt of the Long-Term Biosolids Management Strategy – Letter from the Minister of Environment and Parks (March 19, 2025)
Appendix C: Biosolids Land Application – An Updated Review of Human Health and Environmental Risks by Dr. Christopher J. Kennedy (December 12, 2024)

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June 18, 2024

File: 0220-20
Correspondence
5200-30
Biosolids

Cassandra Caunce, Director, South Authorizations
Regional Operations Branch
Environmental Protection Division
Ministry of Environment and Climate Change Strategy
Via email: Authorizations.South@gov.bc.ca

Dear Cassandra Caunce:

RE: LONG-TERM BIOSOLIDS MANAGEMENT STRATEGY - CAPITAL REGIONAL DISTRICT

I am writing on behalf of the Capital Regional District (CRD) Board regarding biosolids management in the capital region. As per direction in your letter dated September 25, 2020, please find attached our Long-term Biosolids Management Strategy, which was due to you by June 18, 2024.

The basis of the strategy is supported by a technical assessment prepared by the CRD's consultant, GHD, who were commissioned to provide us with a draft long-term biosolids beneficial use strategy (see Attachment 1). GHD assessed all available beneficial use options and provided an options analysis report, which was presented publicly in August 2023. GHD recommended that the CRD pursue a portfolio of biosolids management options to ensure that the beneficial use of biosolids is resilient and sustainable into the future. This is consistent with the CRD's experience to date with options that are not continuously available or reliable, as well as a review of the experiences of other jurisdictions.

Based on the GHD recommendation, current regulatory requirements and all consultation feedback, the CRD Board, at its June 12, 2024 meeting (see Attachment 2), proposed the following Long-term Biosolids Management Strategy as a portfolio of options that utilizes each option under the following prioritization structure:

(a) **Tier 1**: **Advanced thermal option:** Constitutes the preferred long-term solution and will be pursued concurrently with options in other tiers. Current projects include:
   (i) Development of a demonstration facility (pilot) for advanced thermal processing. Outcomes from the demonstration project will serve as the basis for a scaled, long-term solution.

(b) **Tier 2**: **Out-of-region compliance options:** Constitute measures that the CRD will utilize to ensure regulatory compliance is continuously achieved while the Tier 1 thermal processing option is being implemented and when options in Tier 1 are unable to process the totality of biosolids produced in the region. These are (in priority order):

(i) Industrial land reclamation, such as mine and quarry sites
(ii) Forest fertilization
(iii) Production of biosolids growing medium and/or feedstock in soil production
(iv) Partnerships with established biosolids programs
(v) Continue alternative fuel combustion in the cement manufacturing facility in Richmond, BC. Prioritize this option, when available.
(vi) Explore partnerships with additional industrial partners interested in combustion

(c) **Tier 3: In-region contingency options**: Constitute contingency options to ensure compliance with regulatory requirements. The CRD would implement Tier 3 options on a contingency basis, only when options within the Tier 2 portfolio are unavailable and only after receiving explicit consent from the Board and consulting and engaging with any affected First Nations, should the need for Tier 3 arise. These include (in priority order):
(i) Industrial land reclamation, such as mine and quarry sites
(ii) Forest fertilization
(iii) Maintain the option of biosolids application in engineered cover systems and biocell at Hartland Landfill to act as an emergency support option, subject to space availability and cover needs of the landfill

The CRD will continue to explore beneficial use opportunities with First Nations that express interest both in-region and out-of-region. The CRD will also listen to any concerns Nations may have regarding the beneficial use options and is committed to working with individual Nations to address their concerns.

The Strategy focuses on pursuing the in-region thermal management of biosolids, utilizing advanced thermal treatment technology to produce biochar and synthetic fuels, while the tiered approach balances the CRD Board's direction on land application and meeting regulatory requirements. As previously reported, given that it is anticipated to take 2-3 years to design, permit, construct, commission and pilot a thermal demonstration plant, and longer for a full-scale facility, Tier 2 and potentially Tier 3 options in the portfolio will be necessary to pursue in the 2025-2035 time period. Direct agricultural application is excluded from consideration at this time but reclamation of industrial lands where the end use is pasture lands may be considered.

Engagement Considerations

First Nations, public and technical consultation involved review of the above-mentioned options analysis developed by the consultant that ultimately was incorporated into the proposed Strategy, a draft of which was endorsed by the CRD Board on May 8, 2024. An additional 21-day comment period was subsequently provided to allow for input on the draft Strategy itself. Details about all consultation findings are attached in various reports.

First Nations Engagement

First Nations engagement on the Long-term Biosolids Management Strategy is ongoing. The CRD commissioned the design and facilitation of the initial outreach to 50th Parallel Public Relations ("50th Parallel"). Nineteen First Nations were provided with the following opportunities for input over the last several months:

- attending separate in-person and virtual open houses
- participation in an online survey
- open invitation to meet with staff at any time regarding biosolids management planning.

Staff had discussions on the topic of biosolids management with representatives from the Pacheedaht, T'Souke and Pauquachin Nations. CRD staff provided a brief presentation and overview of the wastewater treatment project and resulting requirement to beneficially use biosolids. Staff also presented the full suite of available options for biosolids management, including various land application scenarios, incineration and advanced thermal treatment. Staff also highlighted the concern raised by several groups regarding land application of biosolids.

The 50th Parallel report summarizing the First Nations engagement is found in Attachment 3. The overarching themes expressed by the First Nations included:

- a clear expectation of the CRD to engage further with the Nations on any land application projects across the region
- questions regarding scenarios relevant to their traditional territories
- general questions regarding available options

Following approval of the Long-term Strategy, further engagement with First Nations will be pivotal in the development of specific land application projects located on their traditional territories. The CRD reached out to all First Nations from the initial engagement period to invite submissions on the draft Strategy that the Board endorsed on May 8. Staff received correspondence from two First Nations, Malahat and Tsartlip (see Attachment 4); themes included request for more information on the thermal processing project, implications of land application and where the biosolids may be applied under tiers 2 and 3. The CRD is working with each Nation individually, addressing their concerns, and will continue to engage more specifically if land application options under Tier 3 (in-region, contingency options) are required.

Public Consultation

Public engagement on the Long-term Biosolids Management Strategy options analysis occurred from January 11 to March 6, 2024. Despite the CRD Board's 2011 resolution banning the land application of biosolids, several land application options were included for public consideration, in accordance with provincial direction. The consultation process was commissioned to the Tavola Strategy Group ("Tavola") for design and implementation. Tavola followed a comprehensive approach to encourage broad public participation and capture their feedback. The process included:

- A project engagement page on the CRD's website with detailed background information, including context on provincial regulatory requirements and the Board's direction on land application
- An online survey ("CRD Survey") hosted on the CRD's project engagement page. The CRD Survey rendered 569 responses.
- A representative survey ("Ipsos Survey") of 516 residents across the region, designed and facilitated by market research and public opinion specialist, Ipsos
- A virtual open house on February 20, 2024, which included presentations from CRD staff and the technical consultant, as well as a moderated question-and-answer period. Approximately 59 participants attended the virtual event.
- Various avenues to submit comments, pose questions and receive answers

- A subscription service to allow receipt of information added to the site as the engagement period progressed

Tavola's Summary Consultation Report summarizing the public engagement is found in Attachment 5. Key themes heard from the public during the public engagement are:

- Respondents to both the Ipsos representative survey and the CRD survey indicated that *Environmental Impacts [air, water and soil contaminants]* were the most important consideration when planning for the beneficial use of biosolids. Costs, climate/greenhouse gas emissions and community impacts (truck traffic, odour and noise emission, dust) were less important.

- The two surveys solicited very different results when it came to support for long-term biosolids management options.
  - The Ipsos survey indicates the broader general public is supportive of all options, while respondents to the CRD survey have substantial levels of opposition to most options other than Advanced Thermal, with the least support for bagged fertilizer for residential use and agricultural fertilizer.
  - For this research, Ipsos conducted an online panel survey of 516 adult (18+ years) capital region residents. The final data has been weighted to ensure that the gender/age and regional distribution reflects that of the actual population in the capital region according to 2021 Census data. The precision of Ipsos online polls is measured using a credibility interval. In this case, the poll is accurate to within ±4.9 percentage points, 19 times out of 20, of what the results would have been had all adult capital region residents been polled.

The tiered format of the long-term strategy was posted to the CRD's website for a final review period between May 13 and June 4, 2024, and the CRD received 190 comments, which are included in the Engagement Summary (see Attachment 6).

Technical and Community Advisory Committee Consultation

In September 2023, staff reconvened the Technical and Community Advisory Committee (TCAC) to advise on several liquid waste management issues, including biosolids management. The minutes from the May 22, 2024 TCAC meeting are found in Attachment 7. The TCAC assessed and ranked all beneficial use options. All options had support, with the following order of preference (highest to lowest): industrial land reclamation, forest fertilization, wholesale distribution, residential use, advanced thermal, combustion/incineration and agricultural. While some comments and concerns were raised about land application contaminant risks, the TCAC generally thought that the nutritive value in biosolids outweighed the contaminant risks; agricultural land application had the lowest level of TCAC support due to these contaminant concerns. In addition, concerns were raised about the greenhouse gas implications, cost/benefit and feasibility of the advanced thermal option. Greenhouse gas concerns were also raised for the combustion/incineration option.

Conclusion and Next Steps

CRD Directors and members of the public continue to express significant concern regarding potential human health and environmental risks posed by land application of biosolids, specifically regarding contaminants of emerging concern (e.g., PFAS, pharmaceuticals, microplastics, etc.), many of which are currently not regulated or monitored. Given that the Ministry of Environment and Climate Change Strategy ("the Ministry") considers land application in accordance with the organic matter recycling regulation to be a safe practice, we respectfully request that the Ministry provide updated public information that biosolids land application does not pose a risk to public health or the environment, taking into consideration emerging contaminants of concern and other contaminants that are present in municipal wastewater and biosolids.

Staff are currently preparing a Request for Proposals for vendors interested in providing the Tier 1 advanced thermal pilot facility for a 15-month trial. We are working with staff from the Ministry to ensure this pilot facility is properly authorized and meets all regulatory requirements. Shortly, staff also intend to issue a Request for Expressions of Interest for partners for Tier 2 options to ensure both short and long-term resiliency of the CRD's biosolids management plan, and to ensure biosolids are consistently and reliably beneficially used in accordance with provincial direction. Staff plan to enable Tier 2 options as soon as these become viable, as we await Ministry's review of the Long-term Strategy.

We are confident that our Long-term Biosolids Management Strategy meets your expectations for beneficial reuse. Upon your approval, the CRD's intent is to have sufficient options in place for the plan to be implemented.

Sincerely,

Luisa Jones, MBA
General Manager
Parks, Recreation & Environmental Services

Attachments: 7

cc: Ted Robbins, Chief Administrative Officer, CRD
Glenn Harris, Senior Manager, Environmental Protection, CRD

ATTACHMENT 1

Long-Term Biosolids Management Strategy

April 23, 2024

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Appendices

1. Introduction

Under the Capital Regional District's (CRD) provincially approved Core Area Liquid Waste Management Plan (CALWMP) and its amendments, the CRD is obliged to manage wastewater treatment and biosolids in a beneficial manner. As part of the CALWMP, the CRD is required to submit a Long-Term Biosolids Management Strategy to the BC Ministry of Environment and Climate Change Strategy (ENV) by June 18, 2024 and have it implemented January 1, 2025. This technical memorandum is intended to meet the submission requirement.

This Long-Term Biosolids Management Strategy considers the full spectrum of available biosolids beneficial use options to inform biosolids management within the region for the next 5 to 20-years. This strategy includes a portfolio of biosolids beneficial use options for implementation by the CRD to ensure redundancy and resiliency of the management program.

2. Background

In 2011, the CRD Board of Directors passed a motion to restrict the land application of biosolids, the residual, treated solids resulting from typical wastewater treatment processes. In the following year, 2012, the CRD began planning for upgraded wastewater treatment within the region, as federal regulations had been introduced to require a minimum of secondary treatment for wastewater by the end of the decade.

The McLoughlin Point Wastewater Treatment Plant (WWTP) was implemented in 2020 to serve the CRD's core area municipalities, as well as the Esquimalt and Songhees Nations. Residual solids from the WWTP are conveyed by pipe, for further treatment and dewatering, to the Residuals Treatment Facility (RTF), which is located north of Hartland Landfill. The RTF uses mesophilic anaerobic digestion and fluidized bed drying to further treat and dewater the wastewater residual solids from the WWTP into approximately 3,500 tonnes of dried, pelletized Class A biosolids per year (approximately 10 tonnes per day).

The Class A biosolids produced by the RTF were intended to be managed through the CRD's *Biosolids Beneficial Use Strategy (Definitive Plan)* (2019) through 2020 to 2025, which involved the transport of Class A biosolids to a cement manufacturing facility in Richmond, BC, where the Class A biosolids could be beneficially used via thermal processing as an alternative fuel for combustion in the facility's cement kilns.

The ENV had conditionally approved the Definitive Plan on the basis that the CRD develop this Long-Term Biosolids Management Strategy (extended past 2025) that considers the full spectrum of biosolids management options available to the CRD and adheres to the beneficial use guidelines as defined in the *Canada-Wide Approach for the Management of Wastewater Biosolids* (2012) by the Canadian Council of Ministers of the Environment (CCME).

Beginning with the implementation of the Definitive Plan in 2020 to the present day, the CRD had executed several key initiatives to support the development of this Long-Term Biosolids Management Strategy.

These initiatives included but were not limited to:

- Conducting advanced thermal biosolids processing pilot trials with technology vendors
- Development of the *Long-Term Biosolids Beneficial Use Option Analysis* (2023)
- Forming and consulting with a Technical and Community Advisory Committee (TCAC)
- Engaging and consulting with the public and First Nations

Between January and March 2024, the CRD consulted with the public and TCAC, and solicited their feedback on the types of biosolids management options available for inclusion into this Long-Term Biosolids Management strategy. A separate engagement process with First Nations was also carried out, and reporting on public and First Nations engagement processes is included under separate cover.

2.1 Long-Term Biosolids Beneficial Use Options Analysis Report

On July 5, 2023, the CRD completed development of the *Long-Term Biosolids Beneficial Use Option Analysis* report (included as Appendix A). The report was presented at a CRD Board of Directors meeting on August 9, 2023 and has since been used as informational material in the CRD's engagement processes and the overall development of this Long-Term Biosolids Management Strategy.

The *Long-Term Biosolids Beneficial Use Option Analysis* report presents a full account of the regulatory requirements and historical background influencing this Long-Term Biosolids Management Strategy, a jurisdictional scan of biosolids management options used worldwide, an assessment of the advanced thermal pilot trials, an evaluation of long-term of biosolids management options available to the CRD, and potential risks of operational interruptions to biosolids management options as well as recommendations to mitigate them.

2.2 Existing Biosolids Management Plans

Existing biosolids management plans implemented by the CRD to date include the following:

- **Definitive Plan (enacted in 2020):** Alternative fuel for cement manufacturing combustion
- **Contingency Plan (enacted in 2020):** Biosolids Growing Medium (BGM) production for application in engineered cover systems at the Hartland Landfill
- **Short-Term Contingency Plan (enacted in 2023):** Mixing with sand for BGM production for future quarry reclamation

The historical background and details for these plans are discussed in further detail below.

As previously mentioned, upon the commissioning of the RTF, CRD's biosolids were originally intended to be managed under the Definitive Plan, which involved the transport and beneficial use of biosolids through thermal processing (i.e., combustion) at a cement manufacturing facility in Richmond, BC.

In addition, biosolids produced by the RTF were intended to be supplementally managed through the CRD's provincially approved *Contingency Plan* (2019). Under the Contingency Plan, whenever the cement manufacturing facility could not receive biosolids, the biosolids would be mixed with sand and ground wood to produce up to 38 m^3 of BGM for each tonne of biosolids to be beneficially used as final cover material at the Hartland Landfill. The amount of biosolids to be managed under the Contingency Plan was constrained up to 350 tonnes of biosolids per year due to space and storage limitations at the Hartland Landfill as well as only being able to apply BGM when final cover was required.

Due to prolonged, unforeseen operational interruptions at the cement manufacturing facility and malfunctions with the load-out systems at the RTF throughout the course of 2022 and 2023, the CRD could not manage their biosolids through the Definitive Plan and had exhausted the amount of biosolids which could be used under the Contingency Plan. This left the CRD with one remaining emergency option, which was to directly dispose the biosolids at Hartland Landfill until additional short-term management contingencies could be identified, developed, and approved. The landfilling of biosolids failed to utilize the inherent nutrients and energy potential within biosolids and did not meet the beneficial use requirements stipulated by the ENV.

In February 2023, to offset the landfilling of biosolids while the Definitive Plan and Contingency Plan were not available, the CRD Board of Directors amended its previous land-application restriction policy to the allow out-of-region, non-agricultural land application of biosolids as a short-term contingency management alternative.

Following this amendment, an additional Short-Term Contingency Plan was operationalized. The plan involved the mixing of CRD's biosolids with sand and transporting the mixture to a quarry in Cassidy, BC for temporary storage. Owners of the quarry planned to use the biosolids/sand mixture to produce BGM for future land application on closed sections of the quarry. Closed sections of the quarry were to be reclaimed under a provincial Mines Act permit. However, like the original Contingency Plan, only a portion of CRD's biosolids could be managed under the Short-Term Contingency Plan due to restrictions related to space and storage at the quarry. The remaining biosolids not managed under the Short-Term Contingency Plan were landfilled.

The CRD's experience with operational interruptions and limitations in the execution of the Definitive Plan, Contingency Plan, and Short-Term Contingency Plan demonstrated that this Long-Term Biosolids Management Plan requires a portfolio of management options, irrespective of the type of option selected. Through portfolios, when one option is interrupted, the beneficial use of biosolids can be managed under the next option, and if the next option is interrupted, another backup option will support. In addition, having a diversified portfolio of beneficial use options would further mitigate the potential of future interruption. The redundancy of a diversified portfolio-based strategy would ensure the resilient long-term beneficial use of CRD's biosolids.

3. Methodology

The methodology to developing this Long-Term Biosolids Management Strategy follows the same approach as outlined in the *Long-Term Biosolids Beneficial Use Option Analysis* report which is summarized below:

1. Identify all management options available to the CRD
2. Screen the management options against regulatory requirements
3. Curate portfolios of management options for resiliency
4. Future test the portfolios against potential risks of interruption
5. Select the most resilient portfolio that is consistent with feedback from the public, TCAC, and First Nations groups.

Figure 3.1 below presents a graphical summary of the recommended development approach.

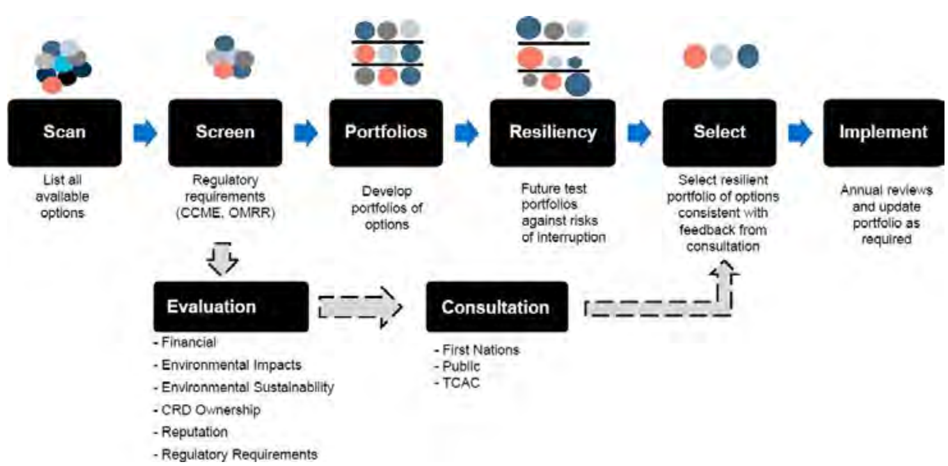

Figure 3.1 ***Outline of the Long-Term Biosolids Management Strategy Development Approach***

4. Recommended Portfolio Framework

Given the management options currently available to the CRD which also meet the definition of beneficial use and regulatory requirements, GHD recommends that the CRD pursue the following portfolio as part of the Long-Term Biosolids Management Strategy:

– Maintain the option of biosolids thermal processing via alternative fuel combustion at the cement manufacturing facility in Richmond BC under the Definitive Plan, for as long as this option is available whenever the facility is operational.
– Procure multiple (ideally at least three) land-application options to act as additional biosolids management alternatives. These options must comply with the Organic Matter Recycling Regulation and should consider guaranteed minimum tonnages and proximity to the RTF to minimize transport distances and consequent greenhouse gas emissions.
– Maintain the option of biosolids application in engineered cover systems at Hartland Landfill under the Contingency Plan to act as an emergency support option; subject to space availability and cover needs of the Hartland Landfill.
– Continued monitoring of the market for potential market driven interruptions and additional available options for consideration to include in the portfolio. Routinely review and update the portfolio as needed.
– Develop a demonstration facility for the advanced thermal processing of biosolids on-site at Hartland Landfill. The implementation of an advanced thermal processing facility at Hartland would add to the robustness and diversification of this proposed portfolio. However, at this time, advanced thermal biosolids processing technologies such as gasification and pyrolysis are considered innovative and have yet to be commercially demonstrated in North America. Further, the expected timeframe to implement such a facility may take up to 7-10-years. As such, this option is not currently available to the CRD but should be explored in the future.

  As noted in the *Long-Term Biosolids Beneficial Use Option Analysis* report, to de-risk the significant capital investment required for such a facility, it is recommended that the CRD first explore the advanced thermal technological feasibility by implementing a smaller-scale demonstration facility before a making a decision to procure a permanent commercial facility.

  If biosolids processing from the demonstration plant proves successful in the future years, advanced thermal processing has the potential to be another important option for the beneficial use of CRD's biosolids. However, it would still be recommended to pursue a portfolio of management options, given the potential risks of interruption when operating major processing facilities due to down time for maintenance, or other operational or market driven interruptions.

Appendix A

Long-Term Biosolids Beneficial Use Option Analysis Report

Long-Term Biosolids Beneficial Use Option Analysis

Capital Regional District

05 July 2023

→ **The Power of Commitment**

[redacted]		TA - Biosolids and Resource Recovery					
[redacted]		Long-Term Biosolids Beneficial Use Option Analysis					
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[redacted]		12590255 - Task 2 - Long-Term Biosolids Beneficial Use Strategy Report - Working Draft (May 31 2023).docx - Long-Term Biosolids Beneficial Option Analysis					
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]		
			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
S3	01	Abram Robiso, Parvin Donyanavard	Jason Wilson		Deacon Liddy		June 23, 2023
S4	00	Abram Robiso, Parvin Donyanavard	Jason Wilson		Deacon Liddy		July 5, 2023

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Executive Summary

GHD has prepared this Long-Term Biosolids Beneficial Use Strategy report for the Capital Regional District (CRD) to support public and First Nations consultation regarding the beneficial long-term use of Class A biosolids produced by the Residual Treatment Facility (RTF) located adjacent to the Hartland Landfill.

The main purpose of this report is to identify and evaluate the full spectrum of beneficial biosolids management options potentially available to the CRD in preparation for consultation with the public and First Nations groups. To accomplish this, GHD evaluated land-application and thermal biosolids management options, conducted a jurisdictional scan of options used worldwide, evaluated ongoing CRD thermal technology pilot trials, as well as identified, screened, and evaluated all long-term options currently available to the CRD. With this information, GHD then generated long-term strategy portfolios for CRD's consideration which are recommended to provide necessary resilience and redundancy to ensure long term consistent biosolids beneficial use. This report also proposes an evaluation criteria and risk matrix to assist the CRD in implementing a step-by step long-term biosolids beneficial use strategy following the reception of feedback from public and First Nations engagement.

This report concluded the following:

Development and Evaluation of Land Application Options – There are various beneficial use land application methods which meet the Canadian Council Ministers of the Environment (CCME) beneficial use criteria in the form of mine/quarry reclamation, forest fertilization, land improvement, direct land application, biosolids growing medium (BGM), compost, and soil product production. There are various out-of-region land application programs available. There are currently no in-region land application options available at this time due to the long standing CRD policy banning land application. However, this policy was recently expanded to allow for non-agricultural land application as a contingency or emergency option. As such, a number of in-region land application options could be investigated for inclusion in potential long term management portfolios.

Evaluation of Thermal Options – Thermal biosolids management technologies are generally classified as pyrolysis, gasification, or incineration. Among the thermal technologies, incineration is the most commercially proven and widely used thermal treatment process for biosolids. However, incineration is energy intensive and does not result in the beneficial use of ash and as such may not be considered a beneficial use option by the CCME. Pyrolysis and gasification technologies are both still emerging in the biosolids processing space with slightly more pyrolysis facilities anticipated to move into operations in North America over the next few years.

Thermal technologies have the added benefits of generating potential revenue through biochar, syngas, heat recovery as well as the potential to co-process other mixed waste streams. However, there are challenges in thermal co-processing technologies, as mixing biosolids with other waste streams may increase maintenance and operational costs due to the added complexity of handling/treating mixed waste streams. Co-processing also presents challenges in meeting CCME criteria for the beneficial re-use of 25% of ash.

Contaminants of Emerging Concern - Community concerns around the land application of biosolids and its potential impacts to soil quality, surface water, and groundwater are largely based on the presence, or suspected presence, of unregulated CEC's. These potential impacts are the subject of ongoing scientific research. CCME's guidelines note that many CECs are found in low concentrations in biosolids, and that detection does not necessarily mean there is a risk to human health or the environment. Generally, risk assessments for each individual CEC have not been completed, but ecotoxicological testing, used to assess the toxicology of residuals holistically, did not detect significant negative impacts. The CCME is supportive of source control measures as an effective way to improve the quality of biosolids. CRD's biosolids have been treated to Class A standards as per the Organic Matter Recycling Regulation (OMRR).

The Canadian Food Inspection Agency (CFIA) proposed an interim standard for per - and polyfluoroalkyl substances (PFAS) in biosolids used in Canada as fertilizers at 50 ppb PFOS (one type of PFAS). The proposed standard aims to protect human health by preventing the small proportion of biosolids products that are heavily impacted by industrial inputs from being applied to agricultural land in Canada. The concentration of PFOS in CRD's biosolids is under the proposed standard at approximately 6 ppb (based on two samples).

The fate of CECs in advanced thermal processing of biosolids is still under investigation. While CECs appear to be reduced in biochar products, some can still be found in syngas and bio-oil products, but the concentrations and environmental fate still need to be confirmed.

Jurisdictional Scan – Globally, biosolids, are beneficially used primarily through land application or thermal treatment methods. The majority of countries assessed in the jurisdictional scan primarily land-apply their biosolids for beneficial use, except for Japan, who relies on incineration due to its high population density and limited areas for land application.

Across the world, the decision to beneficially use biosolids through land application or thermal processes is influenced by a range of factors: regulatory requirements, local infrastructure/resources, public perception, as well as the goals and priorities of local municipalities. Identifying and evaluating these factors are key to the implementation of an effective, long-term biosolids management strategy.

Evaluation of Thermal Pilots – In the evaluation of the Biosolids Thermal Pilot technologies/studies explored by the CRD, valuable insight was gained into the discrete operation of each of these technologies. However, the current pilot results alone may not be sufficient to confirm the feasibility of on-site thermal processing of CRD biosolids nor the potential for integration/beneficial use of by-products into other systems at Hartland at this time.

For the upcoming on-site thermal trial, GHD suggests that the CRD capture key operational criteria such as process reliability, operational costs, maintenance requirements, co-processing feasibility, residual product quality, biochar markets, carbon sequestration benefits, and long-term synergies at Hartland.

Long-Term Options & Portfolio Generation – A long-list of biosolids management options available to the CRD was identified and screened against CCME beneficial use criteria.

GHD recommends that the CRD develop of a combination of multiple options within a diverse portfolio to ensure resiliency in the form of strategy redundancy. In the unexpected event that a biosolids management option is interrupted, the inclusion of additional options within a portfolio will allow CRD's biosolids to still be beneficially used in the interim until the interruption is resolved.

General portfolios were generated using the long-list of options available to the CRD. A risk evaluation identified notable potential risk of interruption factors such as contingency option availability and facility ownership changes to consider in the development of the long-term biosolids beneficial use strategy. The risk evaluation also indicated that some form of land-application is likely required in all proposed portfolios to ensure resiliency.

Next Steps – Following public and First Nations consultation, the CRD may further refine the general portfolios outlined in this report. From the list of options approved by the public and First Nations groups, the CRD may develop portfolios using specific options and vendors and future test these portfolios for resiliency using the risk matrix outlined in Section 7. The risk analysis will help inform the selection of a resilient long-term portfolio for the long-term beneficial use of CRD's biosolids.

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1. Introduction

The Capital Regional District's (CRD) Core Area Wastewater Treatment Project included construction of a Residuals Treatment Facility (RTF) located north of Hartland landfill, which processes wastewater residual solids into approximately 3,650 tonnes of dried pelletized Class A biosolids per year using mesophilic anaerobic digestion and a fluidized bed dryer. The CRD has a provincially approved short-term (2021-2025) Biosolids Beneficial Use Strategy (Definitive Plan) that involves the transport of biosolids to the Lafarge cement manufacturing facility (Lafarge) in Richmond, BC where the biosolids are used as an alternative fuel in the plant's combustion processes. The CRD also has an approved Contingency Plan to manage biosolids when Lafarge has planned or unplanned shutdowns and cannot receive the biosolids, which was anticipated to be approximately 35-days per year. That plan involves the production of Biosolids Growing Medium (BGM), which is then beneficially used in final cover materials at the Hartland Landfill.

Over the course of 2022, disposal of biosolids at Lafarge was unavailable for approximately 10-months, due to both planned shutdowns and unplanned operational issues. As a result, CRD managed approximately 2,700 tonnes of biosolids at Hartland Landfill, 600 tonnes of which were used to produce BGM under the Contingency Plan and the remainder were landfilled. In 2022 the biosolids contingency management consumed more than two-years of the five-year Contingency Plan for beneficial use at Hartland Landfill as BGM, and a significant volume of landfill airspace that should be utilized for non-divertible solid waste. The Contingency Plan must also be aligned with landfill operations such as receiving and storing. Producing future biosolids needs to consider space constraints for temporary storage and application of BGM until final cover areas are ready. This constrains how much material can be used for BGM production in any given year. Given the challenges with biosolids management under the Definitive and Contingency Plans, the CRD is interested in investigating and developing alternative strategies for the short-term and long-term beneficial use of Class A biosolids generated through the RTF.

Under a separate cover 'Alternative Short-Term Contingency Biosolids Beneficial Use Options', GHD assessed responses from industry which were obtained during a previous RFEOI (No.40.20.01-02) issued by the CRD and followed up with various vendors to assess their interest, and ability to manage CRD biosolids in accordance with provincial requirements. GHD also assessed information obtained by CRD in their 2022 outreach to industry to identify additional Short-Term contingency options.

Following this report, the CRD will engage with the public and First Nations groups with regards to the biosolids beneficial use options available to the CRD and outlined in this report. Based on feedback from this consultation, the CRD will develop a strategy which will outline the steps required to implement a resilient portfolio for the beneficial use of biosolids.

1.1 Purpose of this Report

The purpose of this report is to identify and evaluate options to support consultation efforts for the beneficial long-term use of Class A biosolids produced by the RTF at the Hartland Landfill. The key objectives are to:

- Assess potential land application and thermal technology options.
- Conduct a jurisdictional scan of biosolids management options currently used worldwide.
- Evaluate and summarize the results from thermal technology pilots commissioned by the CRD.
- Evaluate the full spectrum of long-term options known to be available to the CRD that are permitted by Provincial regulations.
- Present proposed screening, evaluation, and resiliency criteria as well as methodology to be used to evaluate options and portfolios following the results of public and First Nations consultation.

1.2 Scope and Limitations

This technical memorandum has been prepared by GHD for the Capital Regional District. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose. It is not intended for circulation or incorporation into other documents. The matters discussed in this memorandum are limited to those specifically detailed in the memorandum and are subject to any limitations or assumptions specially set out.

2. Background

The CRD submitted Amendment No.11 to their Core Area Liquid Waste Management Plan (CALWMP) to the BC Ministry of Environment and Climate Change Strategy (ENV) in September 2016, committing to the determination of a long-term management option for the beneficial use of biosolids generated at the RTF. On November 18, 2016, ENV conditionally approved Amendment No.11, with the stipulation that the CRD must first develop a short-term Definitive Plan for utilization of CRD's biosolids which was to be submitted by June 30th, 2019. The Definitive Plan was also required to not include disposal or multi-year storage options at Hartland landfill. Additionally, ENV stipulated that the CRD develop a long-term management beneficial use strategy plan which considers and evaluates the entire spectrum of potential management options with a jurisdictional review of how different municipalities manage their biosolids. This letter of conditional approval can be found in Appendix A.

As of 2023, the RTF produces approximately 10 tonnes of dried biosolids per day, or 3,650 tonnes per year. Biosolids produced by the RTF are currently managed through the following options:

1. Transport to LaFarge for use as alternative cement kiln fuel under the approved Definitive Plan
2. Mix with sand and ground wood to produce BGM for use as a final cover at Hartland Landfill under the approved Contingency Plan
3. Blend with soil and directly landfill (not approved)

As indicated above, these biosolids are primarily transported to Lafarge under the approved Definitive Plan. When Lafarge is unable to accept biosolids, the biosolids are blended with sand and ground wood at a volumetric ratio of 1:5:13 to produce 38 m^3 of BGM for each tonne of biosolids, using up to an approved 350 tonnes of biosolids per year under the Contingency Plan. If the 350 tonnes of biosolids per year used to produce BGM has been exhausted and Lafarge is still unable to take biosolids, the CRD currently has only one remaining emergency option available, which is to blend the biosolids with soil and directly landfill. This process has no beneficial use, is not an approved Canadian Council of Ministers of the Environment (CCME) option and consumes landfill airspace.

The biosolids from the RTF are characterized as Class A, under the BC Organic Matter Recycling Regulation (OMMR). Accordingly, Class A biosolids must have undergone pathogen reduction treatment, vector attraction reduction, and specific sampling protocols. Class A biosolids also have specific limits on their heavy metal and coliform concentrations. The criteria and treatment protocols for Class A designation are outlined in Section 3.2.6. of the OMMR, which regulates the production and land application of compost and biosolids.

BGM must adhere to certain quality criteria outlined in Section 3.4.10 of the OMRR. Schedule 11 of the OMRR stipulates that BGM must be derived from either Class A or Class B biosolids.

The CCME provides guidelines on the beneficial management of biosolids from wastewater treatment plants.

In addition to the above, the CRD's Board currently restricts the land application of biosolids beyond contingency/emergency use at the Hartland Landfill and, more recently, for non-agricultural land application.

Additional information on OMRR requirements, CCME guidelines, CRD Board direction, CRD biosolid characteristics, and thermal processing pilot trials are described in more detail below.

2.1 OMRR Requirements

The production, distribution, storage, sale, and usage of biosolids are regulated under OMRR. OMRR also sets the minimum standards for biosolid product quality criteria in terms of pathogen reduction, vector attraction reduction, pathogen limits, and heavy metals limits.

An official plan must be prepared by a qualified professional for the land application of biosolids. Section 3.1.5 of the OMRR outlines all the requirements for a land application plan. The plan must designate each site where organic matter will be applied, and each scheduled occurrence of application. After each occurrence, the discharger must obtain written certification from a qualified professional that the application was done in accordance with the land application plan.

In terms of distribution requirements, Class A biosolids may only be distributed as follows:

a. In volumes that do not exceed 5 m^3 per vehicle per day.
b. In sealed bags for retail purposes, each not to exceed 5 m^3, with no restrictions on the number of bags distributed per vehicle per day.
c. In volumes greater than 5 m^3 to composting facilities or biosolids growing medium (BGM) facilities.

BGM application does not require a land application plan and may be distributed without volume restrictions as it is considered retail-grade organic matter.

2.2 CCME Beneficial Use Criteria Application

One of ENV's conditions of approval to the CRD's CALWMP was that the proposed long-term management plan for the biosolids generated at the RTF must comply with the requirements for beneficial use specified in the *Canada-Wide Approach for the Management of Wastewater Biosolids* (2012) by the CCME.

According to the CCME, beneficial use of biosolids is based on sound management that includes:

– Consideration of the utility and resource value (product performance).
– Strategies to minimize potential risks to the environment and health.
– Strategies to minimize greenhouse gas emissions and.
– Adherence to federal, provincial, territorial, and municipal standards and regulations.

The policy stated above is upheld by the following principles:

1. Municipal biosolids contain valuable nutrients and organic matter that can be recycled or recovered as energy.
2. Adequate source reduction and treatment of municipal sludge and septage should effectively reduce pathogens, trace metals, vector attraction, odours, and other substances of concern.
3. The beneficial use of municipal biosolids, municipal sludge, and treated septage should minimize the net GHG emissions.
4. Beneficial uses and sound management practices of municipal biosolids, municipal sludge, and treated septage must adhere to all applicable safety, quality, and management standards, requirements, and guidelines.

More details and examples of the beneficial use of biosolids are provided in the CCME supporting document, *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* (2012). There are opportunities for the beneficial use of biosolids through land application, value-added product development, energy recovery, and combustion. Landfilling is not considered a beneficial use option by the CCME since it results in the loss of nutrients and emits greenhouse gases. Any biosolids management option must be evaluated in accordance with the regulations stated in the OMRR, as well as supported by CCME guidelines and principles.

The CCME guidance document promotes the land application of Class A biosolids in support of its beneficial use guiding principles. In alignment with principle 1, the nutrient-rich concentration of biosolids allows direct land application to be a beneficial use option when properly managed as it enhances soil fertility, soil structure, and plant growth. Furthermore, land application supports principle 3 by reducing the need for energy intensive synthetic fertilizer production as well as increasing carbon storage into the soil, hence minimizing net GHG emissions.

Biosolids may also be thermally treated and pelletized to be used for land application or as a biofuel feedstock for combustion. However, for biofuel combustion to be considered as a beneficial use, per the CCME guidance document there are three requirements:

1. The net energy balance must show that the energy recovered exceeds the energy required to combust with dry matter composing >30% of the biosolids to allow for auto combustion and exothermic reaction.
2. >25% of ash or phosphorus generated from the combustion of biosolids must be recovered.
3. The process must emit low levels of nitrous oxides through continuous temperature monitoring with a minimal combustion temperature >880°C.

2.3 CRD Board Resolution on Land Application of Biosolids

On July 13, 2011 the CRD's Board moved to restrict the land application of biosolids within the CRD. These minutes can be found in Appendix B and the motion referenced below.

"*Be it so moved that the CRD will harmonize current and long-term practices at all CRD-owned regional facilities and parks with the approved policies of the regional treatment strategy, including ending the production, storage, and distribution of biosolids for land application at all CRD facilities and parks; and*

Be it further moved that the CRD does not support the application of biosolids on farmland in the CRD under any circumstances, and let this policy be reflected in the upcoming Regional Sustainability Strategy."

The provincial government conditionally approved the Definitive Plan with the condition that the CRD prepare beneficial use options, for use during Lafarge shutdowns, that did not include landfilling or long-term storage. To comply with these regulatory requirements, the CRD Board moved to partially rescind its land application restriction on February 12, 2020. The motion is referenced below.

"*That the Capital Regional District Board partially rescind its policy to prohibit land application as a beneficial use of biosolids at Hartland landfill only; and 2. That land application of biosolids be approved as a contingency plan for beneficial use at Hartland landfill."*

On February 8, 2023, the CRD board amended its policy to allow non-agricultural land application of biosolids as a short-term contingency alternative. These minutes can be found in Appendix C and the motion referenced below.

"*That the Capital Regional District (CRD) Board amend its policy to allow non-agricultural land application of biosolids as a short-term contingency alternative; and 2. That staff be directed to update the CRD's short-term biosolids contingency plan correspondingly*."

2.4 Short Term Memorandum

A short-term alternative contingency plan was developed to address the immediate challenges with biosolids management under the current Definitive and Contingency Plans.

In 2022, GHD prepared a memorandum which identified and evaluated additional contingency options for the beneficial short-term use of Class A biosolids produced by the RTF. These options included both non-land application and land application options which have the potential to be implemented within two-years. The memorandum concluded the following:

- There is no option currently available that meets the CCME criteria for beneficial use, meets OMRR criteria and meets the CRD Board restriction on land application other than Lafarge and BGM.
- Non-land application options could be developed in 24-months or greater that could partially meet the CCME criteria for beneficial use and CRD Board restriction on land application are presented below:
  - Off-Site Thermal Options – Thermal options in addition to Lafarge are possible in 24-months or greater working with existing facilities such as Envirogreen in Princeton, Lehigh Cement Plant, or the Metro Vancouver WTEF. Changes to ENV permits/approvals, consultation with stakeholders may be needed and biosolids receiving, handling and dust mitigation procedures and potentially equipment would need to be developed. The off-Site thermal options do not beneficially use the ash from the biosolids, and as such may not meet CCME guidelines.
  - On-Site Thermal Options – A pilot pyrolysis or gasification facility could be established at Hartland. This would require construction of the pilot facility, and an approval from ENV to operate the facility, which would require 24-months or greater to develop. During the pilot stage the syngas would be flared, and the pilot would be used to characterize the quantity and quality of the syngas to provide information towards the long-term beneficial use (e.g., as a fuel). The quality of the biochar produced would be evaluated and ultimately marketed as a biochar product if feasible. Fulsome GHG implications would also be determined.
- Land application options exist that meet CCME criteria and are used by other jurisdictions in many cases to cost effectively manage biosolids. If the CRD Board limitation on the land application of biosolids was beyond contingency use at the land fill and for non-agricultural land application, then these options could likely be implemented within 1 to 2-years, with some options being available immediately, and without additional infrastructure.

2.5 Biosolids Characteristics

A Safety Data Sheet (SDS) for the CRD's Class A biosolids can be found in Appendix E.

2.6 Thermal Processing Pilot Trials

In July 2020 the CRD issued a Request for Expressions of Interest (RFEOI) (No.40.20.01-02) as part of the CRD's long term plan to determine avenues for the beneficial use of Class A biosolids produced by the RTF. The intent of the RFEOI was twofold:

a. Understanding what technologies were available to beneficially use biosolids
b. Determine interest from proponents willing to undertake pilot trials

An evaluation of the results from the selected pilot trials has been summarized in Section 5.

Following the pilot trials, on March 29, 2023, the CRD board moved to initiate a Request for Proposals (RFP) for the development of a thermal processing trial on-site. These minutes can be found in Appendix D and the motion referenced below:

"Staff concurrently initiate a Request for Proposals process for a biosolids advanced thermal site trial; and that the RFP be scoped broadly to include potential for co-processing of municipal solids waste streams, and that submission be welcomed from both domestic and international vendors."

The RFP process was initiated June 16, 2023, with a response closing date of July 14, 2023.

3. Biosolids Management Options

The beneficial use of biosolids includes various methods of both land application and thermal treatment, which are discussed in further detail below.

3.1 Land Application Options

Biosolids are rich in nutrients such as phosphorus and nitrogen and as a result can be directly applied to lands at an agronomic rate to promote vegetation growth. The land application of biosolids involves spreading biosolids on the soil surface or incorporating biosolids into the soil as soil amendment and fertilizer. Land application is the most common and cost-effective way to beneficially use biosolids and has been widely practiced for decades. Prior to land application, wastewater solids are required to undergo a stabilization process to minimize odour generation, destroy pathogens (disease causing organisms), and reduce vector attraction potential (potential to attract organisms capable of spreading the material) . Wastewater solids can be converted to stabilized biosolids through several methods including adjustment of pH (lime or alkaline stabilization), aerobic digestion, anaerobic digestion, composting, and heat drying.

The following sections outline the most common land application options for biosolids.

3.1.1 BGM, Compost, and Soil Products

Biosolids can be mixed with mineral feedstocks (typically sand or topsoil) to produce BGM, a nutrient rich soil with similar properties to other fabricated soils with respects to aesthetics, odour, consistency, and performance. BGM can promote vegetation growth when applied to lands. Currently, CRD’s Class A biosolids are used to produce BGM under the approved Contingency Plan for use as final cover at Hartland Landfill.

Biosolids are a commonly used feedstock at many compost facilities. Biosolids can be combined with wood chips or green materials as bulk agents to produce a high-quality compost suitable for various land applications. However, composting generally requires a long residence time resulting in increased costs for this option. Wood waste can be mixed with biosolids and cured over time to create a Class A Compost, a nutrient-rich soil amendment which can be regularly tested to ensure it meets both OMRR and the Canadian Food Inspection Agency (CFIA) requirements for land application.

3.1.2 Agricultural Land

Biosolids can be recycled and used as a soil amendment or fertilizer on agricultural land to improve soil productivity, stimulate plant growth, and potentially reduce chemical fertilizer application. Biosolids have been widely applied on agricultural lands due to the cost-effectiveness of this option and its ease of use. Using biosolids on agricultural land has the potential for significant benefits in both the environment and the farming industry.

3.1.3 Forest Fertilization

Forest fertilization is another cost-effective and environmentally safe way to recycle biosolids. Forest soil is usually acidic and deficient in nutrients, thereby applying biosolids can significantly increase the forest lands fertility, total tree production, and build soil foundation for productive forest ecosystems, including wildlife habitat. Furthermore, forestry application can increase vegetation and result in healthier forest soils to improve soil tilth and reduce soil erosion into lakes and streams.

3.1.4 Mine/Quarry Reclamation

Damaged soils impacted by activities such as mining or quarrying can be reclaimed by applying biosolids. Mine/quarry reclamation involves the application of large quantities of biosolids at singular to infrequent periods. Biosolids are often mixed with other materials like wood waste and sand or mixed with stockpiled soil removed from a site prior to disturbance.

Biosolids can be effective in restoring former mines by improving soil conditions, revegetating extensive areas of piled rock and mine tailings and stabilizing slopes. Following biosolids application, the soil is more aerated and lighter, which increases the water infiltration to reduce soil erosion. Unlike nutrients in commercial fertilizers, nutrients added in the biosolids will stay in the topsoil over time and the restored ecosystem will continue to prosper.

The process of mine/quarry reclamation and closure is often required by government to ensure sustainable practices and minimize the long-term effects of mining/quarry operations on the surrounding ecosystems and communities. Ongoing monitoring and maintenance may be required to ensure the success of the reclamation efforts and the long-term stability of the reclaimed site.

3.1.5 Landfill Cover

Biosolids can be beneficially used as an amendment to final cover at landfills acting as a biofilter and mitigating greenhouse gas emissions. Landfills can also benefit from the application of BGM as a topsoil to improve vegetation and prevent erosion on temporarily or permanent closed landfill cells.

3.1.6 Biodiesel and Fuel Crop Production

Biodiesel is an environmentally friendly diesel fuel and renewable alternative to fossil fuels. It is produced from vegetable oils or animal fats through an esterification reaction. High oil seed crops (fuel crops) such as soy and canola and high biomass plants such as willow are considered as suitable feedstock for biodiesel production. Biosolids can be used as fertilizer in growing biodiesel crops and willow plants, in which the biodiesel produced can be beneficially used as fuel for vehicle fleets and farming equipment.

3.2 Knowledge Gaps and Limitations in Land Application

When considering the land application of Class A biosolids, it is important to recognize that knowledge gaps, as well as limitations and barriers to implementation exist. Some of these knowledge gaps and limitations are outlined below.

Nutrient Management: Effective nutrient management is crucial to prevent overapplication or imbalances in soil nutrient levels. Understanding the nutrient content and availability of biosolids is important for determining appropriate application rates and timing. Research can help optimize nutrient management strategies and guidelines specific to biosolids with consideration for the application site soil conditions.

Pathogen and Contaminant Monitoring: Assessing and monitoring the presence of pathogens, heavy metals, pharmaceuticals, and other contaminants of concern in biosolids is essential for reducing risks to public and environmental safety. The presence of ‘per’ and polyfluoroalkyl substances (PFAS) within biosolids has led to public concern regarding land application methods. The potential for groundwater contamination following land application of biosolids and subsequent leaching of PFAS through soil is one of several potential impacts that have generated discussions on banning land application methods. This risk is attributed to how PFAS does not easily decompose. Thermal treatment and destruction technologies at commercial scales are currently limited. Adhering to land application plans can reduce risk of broad environmental contamination.

Public Perception and Acceptance: Public acceptance and understanding of the land application of biosolids play a significant role in its successful implementation. Addressing concerns related to odour, visual appearance, and potential health risks through educational initiatives and public outreach can help foster acceptance and support for this practice.

Logistics and Operational Considerations: Conducting pilot programs and field trials can provide valuable insights into the logistical aspects of land application, such as transportation, storage, application methods, and equipment requirements. These pilot programs can help identify any challenges, evaluate the feasibility of large-scale implementation, and assess the associated costs.

Regulatory Framework and Compliance: Understanding and complying with the existing regulatory framework governing the land application of biosolids is crucial. Identifying any regulatory gaps or barriers can help inform policy development and ensure that appropriate guidelines and standards are in place to regulate the practice effectively.

3.3 Thermal Options

With an increasingly global focus on environmental responsibility, and contaminants of emerging concern (such as microplastics and PFAS), interest in the efficient, safe, and effective thermal processing of biosolids is growing. Employing thermal treatment technologies can produce renewable energy, reduce emissions associated with the transport of biosolids, and result in a higher-value final product.

The thermal management of biosolids refers to application of heat to reduce the volume, reduce contaminants, and utilize the calorific energy of biosolids as heat, steam, electrical power, or combustible material. There are many types of thermal conversion technologies available from many technology providers, however they generally fall into three broad categories: gasification, pyrolysis, and combustion/incineration. Combustion/incineration is the most widely used and commercially proven thermal treatment process for biosolids. Gasification and pyrolysis are innovative technologies gaining interest due to the potential of producing value added products such as syngas and biochar, however, they have limited commercial experience with biosolids as a sole feedstock.

3.3.1 Gasification

Gasification is a thermal treatment technology where any carbon-containing raw material, such as biosolids, can be converted into fuel gas (also known as synthesis gas or syngas) under conditions of high temperature and a highly controlled supply of partial oxygen and/or steam. Gasification can be used to significantly reduce the biosolids volume and produce syngas as a renewable source of energy. Gasification by-products (ash and biochar) can be applied as soil amendments or landfilled. Contaminant reduction also takes place, although the ultimate fate and level of reduction of various classes of organic contaminants is still under investigation.

Syngas can either be utilized as a low calorific gaseous fuel such as in an internal combustion engine (ICE) for cogeneration or can be thermally oxidized to produce heat for beneficial use. Gasification of biosolids typically requires dried biosolids (80% to 90%) as feed, which the RTF already produces. The thermal oxidation of syngas produces heat which can be used to dry biosolids and pre-condition them for gasification.

Close coupled drying with gasification, as shown in Figure 3.1, is an emerging commercial trend for biosolids thermal treatment. Conditioning of syngas for use as fuel in a cogeneration system such as an ICE is still under development. Cleaning of syngas to produce Renewable Natural Gas (RNG) is another avenue of energy recovery which is being explored, however the feasibility of this is still under development.

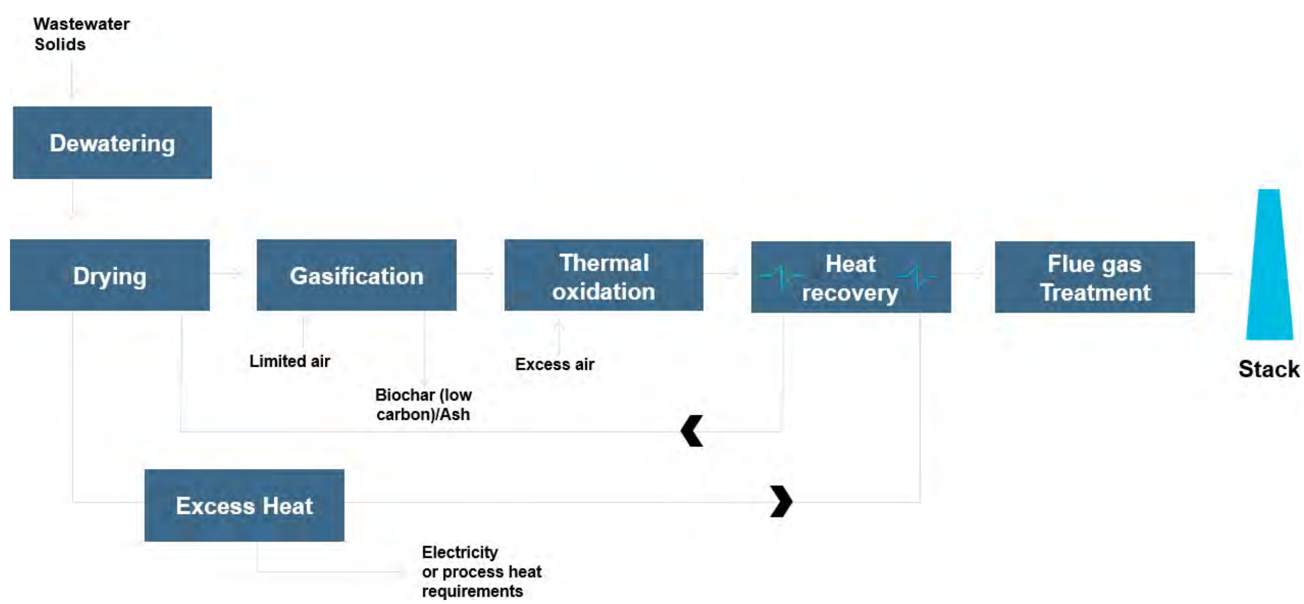


Figure 3.1 Close-Coupled Gasification Process Flow Diagram

3.3.2 Pyrolysis

Pyrolysis is a similar thermal treatment technology to gasification; however, it requires a lower temperature and is carried out without the presence of oxygen under an inert atmosphere (e.g., nitrogen or argon). Like gasification, pyrolysis can decompose and covert biosolids to useful products (syngas, bio-oil, and biochar) while minimizing air emissions and reducing pathogens/contaminants. Like gasification, some contaminant reduction does occur during pyrolysis. However, the contaminant partitioning between the biosolids feedstock and the residual pyrolysis products is yet to be fully understood, and more research is ongoing.

Depending on the temperature and heating rate, pyrolysis can be classified into slow and fast pyrolysis. In slow pyrolysis, known as carbonization, material is pyrolyzed at low to moderate temperatures (around 300 °C) and low heating rates or long reaction times (several hours). The goal of carbonization is to maximize charcoal product (biochar) and generate lower yields of bio-oil and syngas. Fast pyrolysis, carried out at intermediate temperatures (around 500 °C) and short reaction times (a few seconds), produces higher yields of bio-oil in addition to biochar and syngas.

The majority of pyrolysis technologies utilize a close-coupled configuration as shown in Figure 3.2. Syngas produced during pyrolysis is oxidized (combusted) in a thermal oxidizer, and the heat released from thermal oxidation of syngas is recovered and used for biosolids drying. Pyrolysis of biosolids typically requires dried biosolids (80%-90%) as feedstock, which the RTF already produces. A portion of thermal energy is recycled to the pyrolyzer to sustain pyrolysis, and the rest can be recycled to the dryer for beneficial use. Some of the newer pyrolysis technologies do not require continuous heat for their bio-drying process.

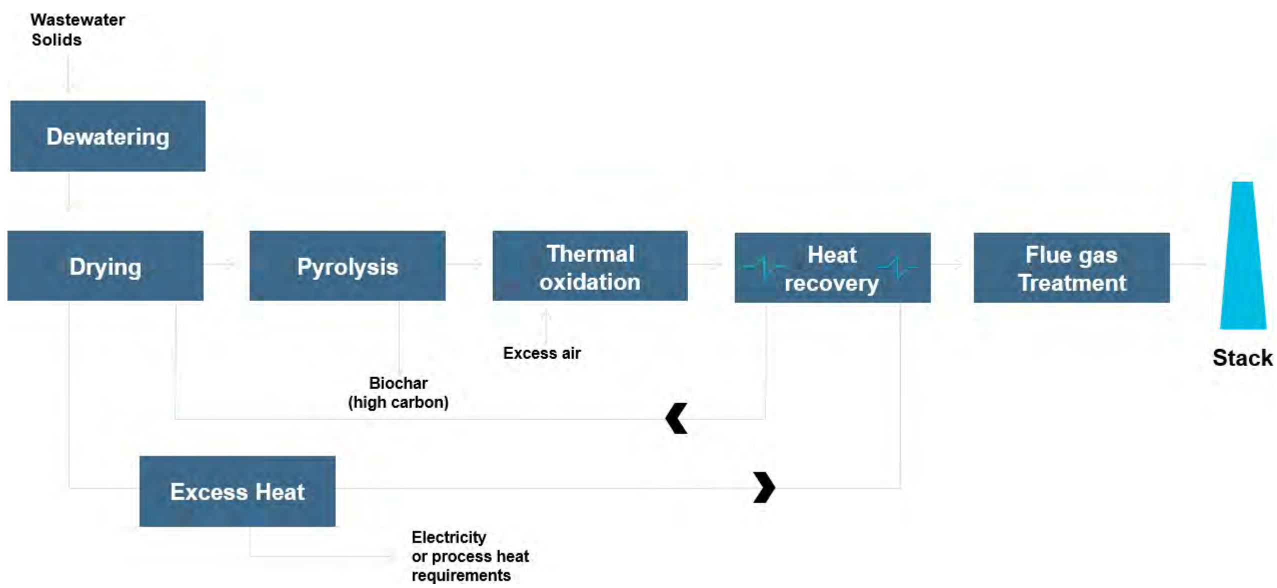


Figure 3.2 Closed Coupled Pyrolysis Process Flow Diagram

3.3.3 Combustion/Incineration

Combustion is a controlled reaction under high temperatures between a fuel and an oxidant that generates carbon dioxide, heat, and water. Incineration is another form of combustion which uses waste as the feedstock fuel material. The primary objective of incineration is feedstock volume reduction and energy recovery. Combustion/incineration residues generally consist of small quantities of HCl, S, volatile compounds, and ash which are typically landfilled. Some biosolids management options utilize biosolids as an alternative fuel for combustion in manufacturing processes such as cement kilns.

Using biosolids as a renewable fuel for combustion/incineration can offset the use of non-renewable fuels and reduce overall GHG emissions. Combustion/incineration without the production of value derived products or energy recovery is commonly not considered an environmentally friendly technology as it is energy intensive and generates a significant amount of greenhouse gas emissions. However, there is ongoing research and development in modern engineering and advanced air pollution control technologies to mitigate the environmental impacts and increase the energy efficiency of the process.

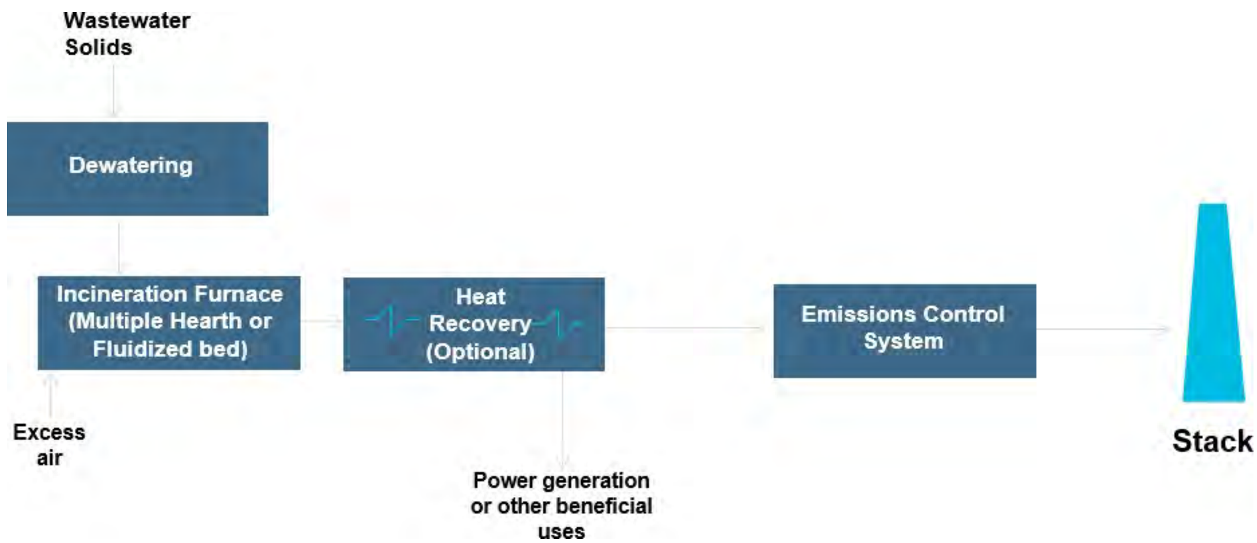


Figure 3.3 Incineration Process Flow Diagram

3.4 Thermal Processing Technologies Summary

Table 3.1 below highlights a few of the key characteristics of the three thermal processing technologies discussed above.

Table 3.1 Thermal Processing Technologies

Technology	Technology Description / Major Differentiators	Benefits	Challenges	End Products & Utilization
Gasification	– Limited/controlled quantity of oxygen/air required – Temperature Range: 600-1000 °C	– Simplicity – Efficient process – Biochar production to be used as contaminant adsorbent or soil amendment – Can be autogenous – Significant volume reduction	– Syngas refinement for fuel generation is challenging – Gas treatment system usually involves scrubbing, which typically requires media that needs to be disposed of as hazardous waste – GHGs are emitted as part of process – Presence of particulate and tars in the produced gas – Low fixed carbon, high ash – Contaminant fate and destruction effectiveness still not fully understood	– Steam which can be converted to electricity – Syngas which can be used in boilers, gas turbines, internal combustion engines to generate electricity – Fly ash which would be disposed as hazardous waste residue – Biochar which may be beneficially used as a soil amendment, compost, biofilter, or as livestock bedding – Slag which may have to be disposed as hazardous waste residue
Pyrolysis	– Complete absence of oxygen required – Temperature Range: 600-1000 °C	– More energy placed into creating final char product – Lower temperature required than other thermal treatments – High fixed carbon, low ash – Significant volume reduction – Low operation energy consumption – Biochar production to be used as contaminant adsorbent or soil amendment	– Technical difficulties ranging from an inability to scale up to largescale production, and relatively poor heat transfer – Requires a constant supply of fuel – Gas treatment system usually involves scrubbing, which typically requires media that needs to be disposed of as hazardous waste – GHGs are emitted as part of process – Contaminant fate and destruction effectiveness still not fully understood	– Syngas which can be used in boilers, gas turbines, internal combustion engines to generate electricity – Biochar which may be beneficially used as a soil amendment, compost, biofilter, or as livestock bedding – Pyrolysis oil (bio-Oil) which can be used as fuel for engines and boilers, or used to produce electricity/heat via combined heat and power plants – Ash which will be disposed as residue, potentially as hazardous waste
Combustion/ Incineration	– Excess oxygen/air required for combustion of waste	– Significant volume reduction – Proven technology at commercial scale	– Poor public perception from historical plants (strict environmental regulations for	– Steam which can be converted to electricity – Heat which can be used for general heating, hot water supply, etc.

Technology	Technology Description / Major Differentiators	Benefits	Challenges	End Products & Utilization
	– Temperature Range: 800-1200 °C	– Greater contaminant reduction at higher temperatures	emissions and combustion control) – Energy-intensive if process does not recover/recycle energy – Gas treatment system usually involves scrubbing, which typically requires media that needs to be disposed of as hazardous waste – GHGs are emitted as part of process – Mixing biosolids with wood chips was found to be necessary to prevent fouling and meet emission requirements – Requires emissions treatment systems to capture pollutants	– Bottom ash which will be disposed as hazardous waste residue

3.5 Thermal Co-Processing

Co-processing biosolids with other types of waste through thermal treatment, particularly in municipal waste-to-energy facilities has potential added benefits of reduced capital costs and increased efficiency in resource recovery. However mixing biosolids with other waste streams may also increase maintenance and operational costs due to the complexity of handling and treating mixed waste streams and their end products. In addition, co-processing presents challenges in meeting the requirement set by CCME for the beneficial re-use of 25% of ash.

A few examples of facilities that process, or have processed, biosolids with other types of waste are noted below:

- The Anaergia's Rialto Bioenergy Facility in California will use pyrolysis to process combination of food waste extracted from municipal waste streams, liquid waste, and municipal biosolids to produce carbon-negative RNG. The facility is currently under construction[1].
- The Covanta Huntsville WTE Facility in Huntsville, Alabama, uses incineration to process solid waste and sewage sludge, producing steam and ash. The facility is currently operational.
- The City of Lebanon, Tennessee, operates a gasification plant that utilized biosolids and wood waste as feedstock to produce syngas and biochar in the past. The facility is operational, however, currently only utilizes wood waste as feedstock.

3.6 Biochar Beneficial Use

Biochar is a type of charcoal produced from the pyrolysis or thermal decomposition of organic biomass materials, such as biosolids, agricultural waste, wood chips, or crop residues. Biochar has demonstrated potential to be used as a soil amendment to improve soil fertility, sequester carbon, and mitigate soil erosion.

Below is a summary of the potential beneficial use options for biochar:

- **Soil Amendment**: Biochar may be directly incorporated into the soil to improve its physical, chemical, and biological properties. Some cases have shown to enhance soil water retention, increase nutrient availability, and promote microbial activity, and consequently improve crop productivity.
- **Carbon Sequestration:** Research demonstrates that the use of biochar as a soil amendment has the added benefit of sequestering carbon for up to a mean residence time of 2,000 years. Biochar sequestration can remove carbon dioxide directly from the atmosphere through carbon uptake by plants, allowing, in principle, a reduction of atmospheric carbon dioxide levels[2].
- **Composting**: Biochar can be mixed with organic waste materials for composting. This can enhance the compost's nutrient content, reduce greenhouse gas emissions, and improve its stability. The resulting compost enriched with biochar can be used as a soil amendment or a growing medium in horticulture and landscaping.
- **Livestock Bedding**: Biochar can be used as bedding material in livestock operations. Its high absorbency helps in moisture management, odour control, and the reduction of pathogen build-up. Used biochar bedding can be further recycled as a soil amendment or added to composting systems.
- **Erosion Control**: Biochar can be applied to erosion-prone areas, such as slopes or mine reclamation sites, to stabilize the soil and prevent erosion. Its porous structure and high water-holding capacity can help retain moisture and promote plant establishment, making it beneficial for land reclamation projects.
- **Stormwater Filtration:** Biochar can be used in permeable reactive barriers or biofiltration systems to treat stormwater runoff. It can act as a filter medium, adsorbing and retaining contaminants such as heavy metals and organic pollutants, thereby improving water quality.

1 Rialto Bioenergy Facility | Anaergia
2 Biochar is carbon negative | Nature Geoscience

– **Activated Carbon Production**: Biochar can be upgraded to produce activated carbon via physical and chemical alteration. Biochar can be physically activated through heating under an oxidant environment in the temperature range of 700–900 °C. To chemically activate, biochar is subjected to activating agents such as $ZnCl_2$, H_3PO_4, NaOH, KOH and treated with heat between 300–500 °C.[3] Activated carbon can be utilized as an adsorbent, as it acts as a porous material to capture and retain various pollutants/contaminants in its structure. Its high surface area and porosity make it effective for adsorbing contaminants from water, air, and soil, offering potential environmental remediation, odour control, and purification applications. It is also intended for adsorption applications like gas masks and fixed-bed adsorbers.

Despite the many potential benefits of biochar, research related to the adverse effects of biochar on soil ecosystems and chemistry is still under investigation. There are growing concerns related to the effects of applied biochar soil physiochemical properties, interactions between biochar and other chemicals within the soil, contaminant accumulation, and its potential impact on soil organisms. A 2021 review of 259 studies related to biochar application to soil concluded that the findings on the effects of biochar soil application are often mixed[4]. Studies indicate that these effects, whether net negative, neutral, or beneficial, are dependent on factors such as feedstock, production process, application rate, soil type, environmental/climactic conditions, and therefore cannot be generalised.

Site-specific assessments and research are essential to determine the appropriate application methods and optimize the benefits of biochar in different contexts. It is crucial to assess the quality and safety of the biochar as well as its effect on the soil's microbiological properties and biota prior to application. Adequate testing and quality standards are important to verify that the biochar is free from contaminants (particularly metals) and meets the desired criteria for its intended use. Research and knowledge sharing in this field is currently ongoing to better understand biochar's potential and optimize its use in diverse agricultural and environmental settings.

3.7 Knowledge Gaps and Limitations in Thermal Treatment Technologies

Similar to the land application of biosolids, it is important to recognize that knowledge gaps and limitations exist in regards to biosolids thermal treatment technologies. Some of these gaps/limitations are outlined below:

Technical Limitations: Specific technical limitations can vary depending on the thermal treatment method employed. For example, incineration may have limitations related to the control of emissions and the need for air pollution control equipment. Pyrolysis and gasification may have limitations related to process efficiency, feedstock characteristics, and the quality of the end products.

Environmental Impacts: While thermal treatment can help reduce the volume of biosolids and recover energy, there may be environmental concerns associated with the process. These can include emissions of greenhouse gases, air pollutants, and the potential for the release of harmful compounds during the treatment process. An environmental impact assessment of any employed thermal treatment method is crucial.

Residuals Management: Thermal treatment processes typically generate residues such as ash or char. The management of these residuals can present challenges in regard to their safe disposal or beneficial reuse. Depending on the residue characteristics, there may be potential for contaminant leaching into the environment. Robust handling and storage protocols need to be established in consideration of the end-use of the residues.

Energy Efficiency: While thermal treatment can produce energy in the form of heat or electricity, the overall energy efficiency of the process is an important consideration. Achieving optimal energy recovery and maximizing the net energy output from the treatment process is a crucial consideration for its economic viability and environmental sustainability. Ensuring there is an end-user of the energy output is also critical to ensure beneficial reuse expectations are achieved.

3 Process Intensification: Activated Carbon Production from Biochar Produced by Gasification - technology.matthey.com
4 https://www.sciencedirect.com/science/article/pii/S0048969721038286

Impact on Nutrient Content: Thermal treatment methods can alter the chemical composition of biosolids, potentially affecting the availability and quality of nutrients. For example, high-temperature processes like incineration can result in the loss of certain nutrients, limiting their potential for use as fertilizer or soil amendment.

Cost Considerations: The economics of thermal treatment processes, including capital costs, operational costs, maintenance costs, and residual disposal costs can significantly impact their feasibility and implementation. Understanding the financial implications and comparing them to alternative treatment methods is important for the decision to invest in thermal treatment processes.

3.8 Contaminants of Emerging Concern

The CRD introduced a ban on the land application of biosolids produced at CRD facilities in 2011 based on the precautionary principle and concerns from the community. Community concerns around the land application of biosolids are largely based on the presence, or suspected presence, of unregulated organic chemical compounds, commonly referred to as “contaminants of emerging concern” (CEC’s), or persistent organic pollutants” (POPs). CECs include Volatile and Semi-Volatile Organic Compounds (VOCs & SVOCs), PFAS, polybrominated flame retardants (PBDE), dioxins, pharmaceuticals and personal care products (PPCPs) and microplastics. There is concern that biosolids with detectable levels of unregulated CEC’s could impact soil quality, surface water or groundwater.

In 2011, the CRD retained Stantec to undertake a literature review titled *Land Application of Wastewater Bio-solids, Concise Literature Review of Issues for CRD* on the risks of the land application of biosolids. The literature review assessed heavy metals, pathogens, and legal liability arising from the land application of biosolids. The review concluded “there is no scientific evidence indicating that the risks of environmental damage or public health concerns for either Class A or B bio-solids land application would be high”.

This risk assessment was updated by Golder in 2014 in their report *Biosolids Risk Assessment and Literature Review Update*. The intent of the report was to re-evaluate the previous analysis using recent information and case studies. The review found that Stantec “oversimplifies the risk and concerns associated with the land application of biosolids” and found that the current state of scientific knowledge does not allow us to fully quantify all risks. Despite this finding, the authors conclude that “no risks have been identified for emerging substances that presently warrant imposition of a land application ban”.

The CCME considered CEC’s when developing the beneficial use guidelines. The document notes that many CECs are found in low concentrations in biosolids, and that detection does not necessarily mean there is a risk to human health or the environment. Generally, risk assessments for each individual compound have not been completed, but ecotoxicological testing, used to assess the toxicology of residuals holistically, did not detect significant negative impacts. The CCME is supportive of source control measures as an effective way to improve the quality of biosolids.

In 2017, Metro Vancouver commissioned a risk assessment for their land application based biosolids management plans in a report titled *Biosolids Risk Assessment for Metro Vancouver*. The report looked at 11 different types of pharmaceuticals or organic compounds and concluded ”the results of this risk assessment indicate that the presence of these eleven CECs in biosolids is highly unlikely to result in adverse health effects for the four Metro Vancouver biosolids use exposure scenarios evaluated.”

In recent years, there has been an increased interest in PFAS and their effects on human and environmental health. PFAS are a class of over 4,700 substances that do not occur naturally. PFAS make products non-stick, water repellent and fire resistant, and are found in a wide range of consumer and industrial products, including cookware, food packaging, clothing, and firefighting foams. PFAS are sometimes referred to as “forever chemicals” because the molecules are characterized by a chain of strong fluorine-carbon bonds which result in highly stable and long persisting chemicals. Exposure to PFAS is associated with an increased risk of cancer, increased cholesterol levels, and can affect the immune system.

In June 2022, the ENV released the *Organic Matter Recycling Regulation Project Update*, which contained some discussion of CECs. “Due to advances in analytical chemistry, the ability to measure CECs has generally outpaced the ability to understand the impacts of CECs on human health and the environment. For this reason, the impacts of CECs in biosolids and wastewater treatment discharges is the subject of on-going scientific research." The ENV intends to add the authority for a director to require the testing of biosolids for CECs but does not intend to regulate the concentration of CEC's in biosolids. The ENV advocates for a prevention first approach to reducing CECs in biosolids, by implementing source control measures to discourage the discharge of certain wastes to the system. Regulatory amendments are targeted for 2023.

On May 19, 2023, The Canadian Food Inspection Agency (CFIA) proposed an interim standard for PFAS in biosolids used in Canada as fertilizers. The CFIA worked with Environment and Climate Change Canada, Health Canada and provincial partners to assess an appropriate standard for PFAS. The proposed standard will protect human health by preventing the small proportion of biosolids products that are heavily impacted by industrial inputs from being applied to agricultural land in Canada. The proposed standard is 50 ppb PFOS (one type of PFAS). The concentration of PFOS in CRD biosolids is under the proposed standard at approximately 6 ppb (based on two samples). For comparison, a 2020 study, found that the PFOS concentration in household dust was 100 ppb (100ng/g).[5]

3.9 Land Application vs Thermal Process Trends

Land application is a well-established practice in British Columbia and many other parts of the world. However, there has been a varied perception and increased regulation towards this practice due to growing concerns over potential environmental and public health risks, including the risk of pathogen regrowth, odours, heavy metals, and CEC's. Scientific literature indicates that when biosolids are properly treated, monitored, and applied in accordance with regulations, the risks associated with contaminants and pathogens are typically low[6]. Land application remains a widely used and accepted approach in many jurisdictions, particularly in areas with access to agricultural land and a demand for fertilizer. Research indicates an increasing trend in the use of biosolids as a soil amendment to support sustainable agriculture and carbon sequestration goals.

Since 2017, there has been a trend towards increased use of thermal processes for biosolids management, particularly in areas where land application is restricted, challenging, or cost prohibitive. However, further research and investment are needed to optimize these technologies and ensure their long-term sustainability.

Overall, the choice between land application and thermal processes for biosolids management will depend on a range of factors, including regulatory requirements, local infrastructure and resources, public perception and acceptance, the need for end-use redundancy, and the specific goals and priorities of the community or organization managing the biosolids.

4. Biosolids Jurisdictional Review Update

Globally, biosolids are primarily managed in three ways, land application, incineration or landfilling. The decision to landfill biosolids rather than using them for beneficial purposes is influenced by several factors, such as:

– **Regulatory Constraints**: Some governments impose restrictions to the land application of biosolids due to concerns over potential environmental and public health risk.
– **Public Perception:** The acceptance of biosolid management options varies widely. In some communities, there persists public resistance to the beneficial use of biosolids based on concerns primarily regarding potential health, environment, and nuisance impacts.
– **Costs and Logistics:** <u>Local circumstances such as land availability, transportation distances, regulatory compliance, and the proximity of technology providers may make landfilling a more logistical and cost-effective option as compared to beneficial reuse.</u>

5 Per- and polyfluoroalkyl substances (PFAS) in dust collected from residential homes and fire stations in North America - PMC (nih.gov)
6 https://www.academia.edu/34682659/Chapter_6_The_environmental_impact_of_biosolids_land_application

The section below presents findings from literature on the reported biosolids management options used in jurisdictions across the globe. It should be noted that the examples presented are not an exhaustive list of all global biosolids management cases as the review is limited to data that is readily available.

4.1 Literature Review

4.1.1 Canada

In Canada, more than 660,000 dry tonnes of stabilized biosolids are produced annually. According to the CCME, land application and landfilling are the most common methods of biosolids management in Canada where approximately 50% of biosolids are applied to land, 41% landfilled and the remainder incinerated (9%) (CCME, 2012a).

In British Columbia, 38,000 dry tonnes of biosolids are produced every year, of which around 94% is beneficially applied to land to support forestry, agriculture, land reclamation and landfill cover, and approximately 6% is landfilled.[7]

In Quebec 49% and 34% of biosolids are incinerated and land applied respectively annually. In Ontario, 44% and 48% of biosolids are incinerated and land applied respectively annually. Both provinces are among the leading provinces in the beneficial use of biosolids[8].

Table 4.1 below summarizes biosolids management in some Canadian provinces in the year 2016. Since then, there has been a lack of available information regarding the current status of Canada's involvement in biosolids beneficial use.

Table 4.1 Biosolids Management in Canada (2016)[2]

Jurisdiction	Land Application	Incineration	Landfill	Percent Beneficial use
British Columbia	94%	0%	6%	94%
Manitoba	75%	0%	25%	75%
Ontario	48%	44%	8%	92%
Alberta	95%	0%	5%	95%
Quebec	34%	49%	17%	83%
Newfoundland/Labrador	0%	0%	100%	0%

4.1.1.1 Examples of Land Application Options in Canada

The CCME Guidance document provides several instances of municipalities across Canada that have beneficially used biosolids through land application. Some examples are:

– The JAMES wastewater plant in Abbotsford, British Columbia, holds a contract with a third party to use municipal biosolids resulting from wastewater treatment as a feedstock addition in the production of fabricated topsoil. The end product is marketed as Val-E-Gro™ and is used as a fertilizer for land application.

– The Lansdowne Wastewater Treatment Plant in Prince George, British Columbia and various treatment plants in the Regional District of Nanaimo, BC have used their biosolids for the fertilization of forests. The fertilization of forests through biosolids is of significant interest to the forest industry, as biosolids allow a slower release of nutrients (>5-years) as compared to the fast action of chemical alternatives (2-3-years). Further, biosolids applied to temporary roads and landings within forests can return these degraded areas into productive land bases quickly, thus resulting in a larger growing area and greater cutting allowance.

7 Biosolids-10 (gov.bc.ca)
8 biosolid_world_map.pdf (gov.bc.ca)

- The Halifax Regional Municipality has treated municipal biosolids with an alkaline stabilization process named N-ViroTM to produce class A biosolids for land application since 2008. The process recycles cement kiln dust as a second residual stream to provide alkalinity for the process. 100% of the biosolids produced have been beneficially used to fertilize sod and agricultural crops such as corn, soybeans, cereals, and forages.
- Locally generated municipal biosolids in Sechelt, British Columbia have been directly applied to barren soils at the Lehigh Materials mine. The community has been supportive of the successful program, and the mine was awarded for its achievements with the 2010 British Columbia Jake McDonald Mine Reclamation Award.

Table 4.2 below summarizes cases of land application of biosolids across Canada:

Table 4.2 Summary of Land Application in Biosolids Management in Canada

Jurisdiction	Product Name	Technology	Program Initiation	Beneficial Reuse of Biosolids
City of Kelowna, BC	Natures Gold	Aerobic composting	Undisclosed	Gardens and lawns fertilization, commercial landscaping and gardening (as mulch)
Metro Vancouver Regional District	Nutrifor	Thermophilic anaerobic digestion	1991	Mine reclamation, landfill closure and reclamation, regional reclamation projects, regional landscaping projects, forest fertilization, and ranch land fertilization
City of Kelowna/City of Vernon	Ogogrow	Aerated static pile composting	1995- 2006	Commercial landscaping, residential gardening, nurseries, orchards, and landfill closure.
Comox/Strathcona Regional District	SkyRocket	Aerated static pile composting	2007	Commercial landscaping, residential, gardening, nurseries and orchards, slope stabilization project, and local reclamation projects.
Regional District of Nanaimo	N/A	Mesophilic and Thermophilic anaerobic digestion	1991	Forest fertilization.
CRD	PenGrow	RDF lime- Pasteurization	2008-2011	Residential gardening and landscaping.
City of Edmonton, AB	N/A	Co-composting with residential organic waste	2002	Horticulture, agriculture, nurseries, commercial landscaping, residential gardening, city reclamation and enhancement projects.
Niagara Region, ON	Niagara N-Rich	N-Viro alkaline stabilization	2007	Agricultural fertilizer.
City of Toronto, ON	N/A	Thermal drying N-Viro alkaline stabilization	2007	Agricultural fertilizer, and mine reclamation.
Greater Moncton, NB	Gardener’s Gold	Composting- Gore Cover system	2008	Commercial landscaping, municipal parks and horticultural activities, and residential gardening.
City of Halifax, NS	Halifax N-Rich	N-Viro alkaline stabilization	2007	Agricultural fertilizer, and municipal horticultural activities.

4.1.2 United States

In the US, based on 2018 data, approximately 54% of all biosolids were land applied, 15% were incinerated and 30% disposed of in landfills (excluding the use as daily cover which is considered a beneficial use option)[9]. According to reports from the US EPA in 2021, about 4.5 million dry metric tons of biosolids generated in the United States, of which approximately 43% were land applied, 14% incinerated, and 42% landfilled, which suggests a trend of decreasing land application and increasing landfilling in US over the past few years. This percentage may vary between state and region. For example, land application of biosolids is more common in the Mid-Atlantic and Northeast regions than in other parts of the country[10]. Figure 4.1 shows the latest status of biosolids management in the US.

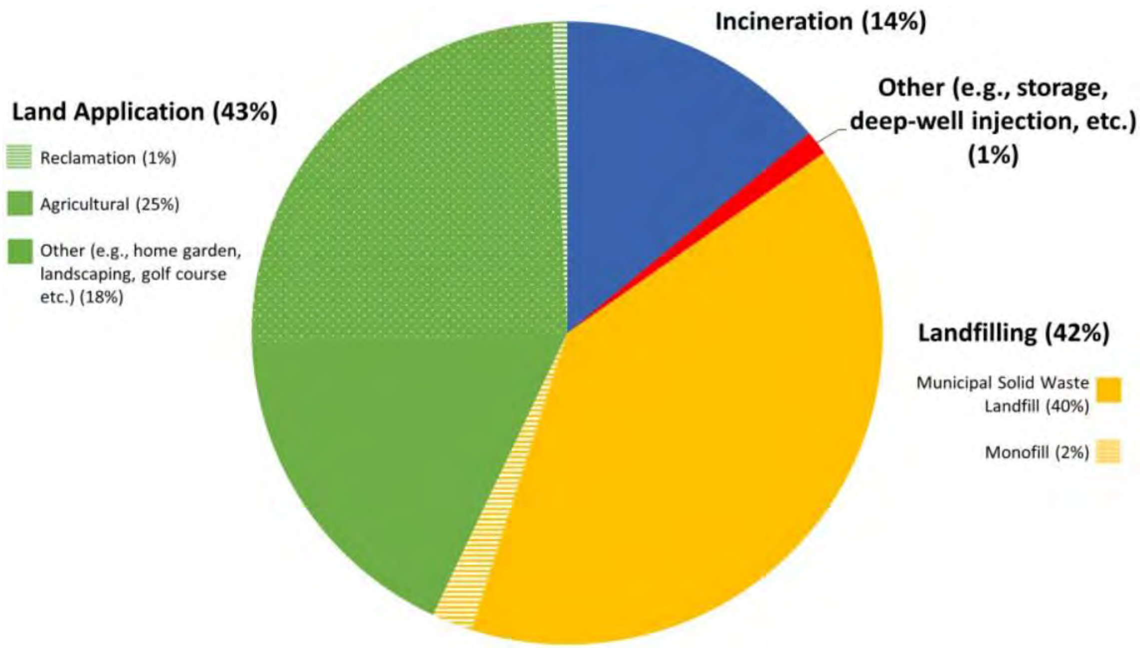


Figure 4.1 2021 Biosolids Management in the US[4]

4.1.3 Europe

In Europe there are rules around the use of sewage sludge as a fertilizer, the sampling and analysis of the sludge, record keeping and the type of treatments and end usages, similar to OMRR in BC. The European Union (EU) developed a Sewage Sludge Directive which aimed to increase the sewage sludge used in agriculture while ensuring heavy metals in soils and sewage sludge did not exceed set limits (also developed as part of the Directive). The Directive would ban the use of sewage sludge on agricultural soils if the concentration of metals in the soil exceeded pre-approved limits. In 2014, it was found that the Directive achieved is objective by increasing the amount of sewage sludge used in agriculture while reducing environmental harm. However, since then, a study was launched in 2020 to evaluate the effectiveness, efficiency, relevance, and coherence of the Directive in all EU countries. The study aimed to complement the results of the initial Directive and better understand the areas where the Directive was successful or challenged[11].

Figure 4.2 below illustrates the proportions of sewage sludge management technologies used by various EU countries:

9 National Summary — National Biosolids Data Project
10 Basic Information about Biosolids | US EPA
11 https://environment.ec.europa.eu/topics/waste-and-recycling/sewage-sludge_en

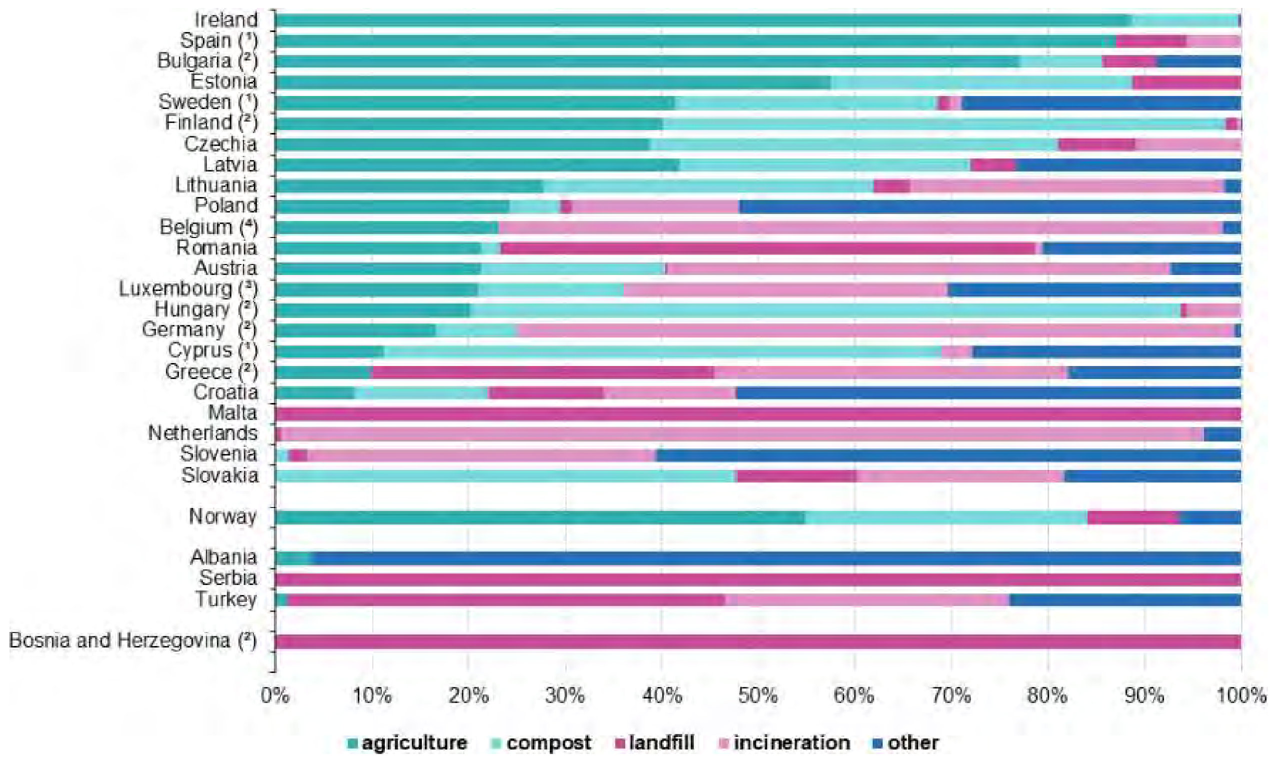


Figure 4.2 ***2020 European Sewage Sludge Disposal***[7]

In Europe, land application of biosolids still constitutes the main method for biosolids management for many countries. In general, 50% of biosolids are land applied on agricultural land (marking an increase from 37% in 2017), 28% incinerated, and 18% landfilled. The remaining fraction is disposed through other methods such as pyrolysis, storage, reuse in green areas and forestry, and landfill cover. The percentage of biosolids managed through each practice may vary depending on factors such as location, available infrastructure, and local regulations. In countries such as Netherlands and Germany, incineration is the primary beneficial use for biosolids due to the low availability of land available for biosolids application. In the Netherlands (96%), Belgium (75%), Germany (74%) [12,13] the majority of biosolids are incinerated.

In France, 44% of biosolids are directly land applied, 29% are composted, 18% are incinerated and 9% are landfilled. In the United Kingdom (UK), approximately 3.6 million tonnes of biosolids are land applied for agricultural use annually and the UK has developed an Biosolids Assurance Scheme (BAS) to provide reassurance that certified biosolids can be safely used in agriculture. According to the UK's BAS, around 3-4 million tonnes of biosolids are applied annually to agricultural land in the UK, representing around 75% of sewage sludge production[14]. In Denmark, based on the 2010 data, 64% of biosolids were land applied, 29% incinerated and 2% of biosolids ended up in landfills. In Portugal, as per 2016 data, 5% of biosolids were disposed in landfills while the rest were used for land application and other uses including agriculture and composting. In Italy (2010), from all the biosolids produced, 34% are land applied, 4% are incinerated, and 49% are landfilled[6].

Europe has been at the forefront of research and development of new thermal technologies for biosolids treatment, such as pyrolysis and gasification. Despite this, many European countries still primarily use land application as the most beneficial method for biosolids utilization. It is noteworthy that there are various approaches to managing PFAS across Europe, both in terms of the presence of regulations and how these regulations are established. Denmark, Germany, the Netherlands, and Sweden established national limits for PFAS in soil, while Germany also set a limit for PFAS in fertilizer, which also applies to biosolids used as fertilizer. As of September 2020, no European countries,

12 https://www.mdpi.com/2071-1050/11/21/6015/htm
13 Water statistics - Statistics Explained (europa.eu)
14 Biosolids-Agric-Good-Practice-Guidance-January-2019.pdf (assuredbiosolids.co.uk)

except for several German states, had implemented specific rules or limitations regarding PFAS concentrations in biosolids for land application [15].

The EU has long been promoting the use of thermal technologies for waste management, including biosolids. The Waste Framework Directive (2008) recommends thermal treatment as a preferred method for waste management. While there are gasification and pyrolysis plants in Europe, they mainly process municipal solid waste. The Netherlands and Germany have the largest sewage sludge incineration capacity among European countries. In Finland, the Helsinki Regional Environmental Services Authority (HSY) implemented a sludge pyrolysis pilot plant with the capacity equivalent to treating wastewater sludge generated by a population of approximately 30,000 people during 2020. In August 2004, a fluidized-bed gasification plant, manufactured by Kopf was constructed at a WWTP in Balingen Germany for processing the digested biosolids and recovering energy. The Balingen plant processes about 230 kg of sewage sludge per hour[16].

4.1.4 Australia

In Australia, approximately 83% of biosolids were beneficially applied to land in 2021, with 72% of that being on agricultural land, which represents an 8% increase compared to the data from 2017. The remaining fraction was disposed of in landfills. Australia is making significant efforts to combat carbon emissions by pledging to reduce them by 43% from 2005 levels by 2030. A step towards this goal has been taken with the opening of Australia's first biosolids gasification plant at the Loganholme Wastewater Treatment Plant in Logan City, Queensland. To further explore the potential applications of the biochar product, the Logan City Council is collaborating with scientists from the Queensland University of Technology to uncover future possibilities for utilizing the biochar product in various ways[17].

4.1.5 New Zealand

In New Zealand, the total percentage of biosolids sent to landfill was 33% in 2021 (down from 38% in 2019). 43% of biosolids were used for land reclamation, 3% of biosolids were used for agricultural purposes, and 2% of biosolids were incinerated. The remaining fraction of biosolids were land applied for forestry, vermicomposting, landfill capping, stockpiling, and other uses.

4.1.6 Japan

Japan heavily relies on thermal processing methods for the management of biosolids. In particular, incineration is commonly used in Japan due to its high population density and limited opportunities for biosolids land application. Sewage sludge in Japan is treated according to regulations that require the removal of harmful substances and pathogens. The treated sludge or biosolids are then typically incinerated or applied to farmland as fertilizer. In 2016, 68% of were biosolids incinerated, 11% were land applied and the rest landfilled[18].

Literature also indicates an increasing trend in the gasification of biosolids in Japan as a means to reduce landfilling. The Kiyose Water Reclamation Center started using a gasification system in 2010 to treat 100 tonnes of dewatered sewage sludge each day[19]. A waste-to-hydrogen facility, located at the Sunamachi Water Reclamation Center near Tokyo Bay, is capable of processing 1 tonne of dried sewage sludge per day to generate 40-50 kg of hydrogen per day[20]. Japan Blue Energy Co., Ltd. (JBEC) has developed an Advanced Gasification Module (AGM), which is a small-scale 1 dry ton per day plant with a goal of producing between 20 and 50 kg of hydrogen per day depending on the system configuration and feedstock quality[21].

15 PFAS in biosolids: A review of international regulations (awa.asn.au)
16 Technology Assessment Report Aqueous Sludge Gasification Technologies (epa.gov)
17 Logan City Biosolids Gasification Project - Australian Renewable Energy Agency (ARENA)
18 biosolid_world_map.pdf (gov.bc.ca)
19 Kiyose Water Reclamation Center Starts Using Gasification System to Treat Sewage Sludge - Bureau of Sewerage Tokyo Metropolitan Government
20 Ways2H Shareholder Japan Blue Energy Launches Tokyo Waste-to-Hydrogen Facility - Hydrogen Central (hydrogen-central.com)
21 Japan Blue Energy – Renewable Hydrogen Production Technology (wipo.int)

4.2 Thermal Processing Facilities Scan

Table 4.3 below outlines some of the biosolids thermal processing facilities globally, the technology implemented, and the stage of the project.

Table 4.3 Thermal Processing Facilities

Location	Facility Name	Technology	End Products	Project Stage
Linden, New Jersey, USA	Aries Linden Biosolids Gasification Facility	Gasification	Syngas, Biochar	Commissioning
Sanford, Florida, USA	Fluidized Bed Biosolids Disposal Gasification Facility	Gasification	Thermal energy	Decommissioned
Kearny, New Jersey, USA	Aries Kearny Biochar Production Facility	Gasification	Biochar	Development
Taunton, Massachusetts, USA	Aries Taunton Biosolids Gasification Facility	Gasification	Biochar	Development
Edmonds, Washington, USA	Edmonds Wastewater Treatment Plant	Gasification	Ash Slurry[22]	Commissioning
Morrisville, Pennsylvania, USA	Ecoremedy Sludge Gasification Pilot Plant	Gasification	Biochar	a three-year pilot project (Decommissioned)
Derry Township, Pennsylvania, USA	Clearwater Road Wastewater Treatment Facility	Gasification	Renewable Thermal Energy, Biochar	Development
Silicon Valley Clean Water (SVCW), California, USA	SVCW Plant	Pyrolysis	Biochar	Operational
Rialto, California, USA	Rialto Bioenergy Facility	Pyrolysis	Biochar	Under construction
Ephrata, Pennsylvania, USA	Ephrata Bioforcetech Pyrolysis Facility	Pyrolysis	Energy, Biochar	Under construction
Niagara Falls, Ontario, Canada	CHAR Technologies' high temperature pyrolysis plant	High Temperature Pyrolysis (HTP)	Syngas, Biocarbon	Development (relocation from London Ontario)
Saint-Félicien, Quebec, Canada	Biomass Power Plant	High Temperature Pyrolysis (HTP)	RNG, Biocarbon	Development
Cuyahoga Heights, Ohio, USA	Southerly Wastewater Treatment Plant (WWTP)	Incineration	Heat and Steam to Energy, Ash	Operational
Los Angeles, California, USA	Biosolids Recovery Plant	Incineration	Steam, Ash	Operational
Pickering, Ontario, Canada	Duffin Creek Water Pollution Control Plant	Fluidized bed incineration	Heat and Steam to Energy, Ash	Operational
London, Ontario, Canada	Greenway Wastewater Treatment plant	Fluidized bed incineration	Heat to energy, Ash	Operational
Mississauga, Ontario, Canada	G.E. Boot Wastewater Treatment Plant	Incineration	Steam, Ash	Operational

22 FlexChar™ has properties similar to activated carbon and can be used as an alternative renewable fuel or a soil amendment.

Location	Facility Name	Technology	End Products	Project Stage
Pickering, Ontario, Canada	Duffin Creek Water Pollution Control Plant	Fluidized bed incineration	Steam, Ash	Development
Espoo, Finland	Pyrolysis Pilot Plant	Pyrolysis	Biochar	Pilot Program
Balingen, Germany	Kopf fluidized-bed Gasification Plant	Gasification	Syngas	Operational
Logan City, Australia	Loganholme Wastewater Treatment Plant	Gasification	Biochar	Operational
Tokyo, Japan	The Kiyose Water Reclamation Center	Gasification	Heat and Electricity	Operational
Tokyo, Japan	Sunamachi Water Reclamation Center	Gasification	Hydrogen	Operational
Japan	Blue Energy Advanced Gasification Module	Gasification	Hydrogen	Operational
Lesna, Poland	Budimex Drying and Incineration Plant	Incineration	Thermal Energy, Ash	Operational

It is important to note that information about advanced thermal facilities in Europe and Asia is limited. There is a lack of available data regarding the status of these facilities, technology providers, and if these providers sell their technology in North America.

In North America, pyrolysis is slightly ahead of gasification in terms of technological readiness with slightly more pyrolysis facilities in operation. Both technologies however are considered innovative and are still emerging in the biosolids processing space.

4.3 Global Trend Summary

Since 2017, the choice of biosolids beneficial reuse has varied across different countries and regions. In Canada, there has been a gradual increase in beneficial reuse, with a focus on land application, composting, and energy recovery. The United States has demonstrated a decrease in land application and an increase in landfilling over the since 2017. However, this trend may vary by state and region. Europe has established well-regulated and advanced biosolids management systems, utilizing land application, composting, and incineration. Australia and New Zealand have actively promoted land application, especially in agriculture, while complying with environmental regulations. In Japan, thermal processing methods such as incineration have been relied upon due to limited land availability stemming from high population density, although efforts are being made to explore alternative reuse options.

The most prevalent biosolid management option in many regions of the world, including North America, is land application (BCWWA 2016, EPA 2017).

The CCME has developed a comprehensive framework for managing wastewater biosolids, including the *Canada-Wide Approach for the Management of Wastewater Biosolids* (CCME, 2012a) and *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* (CCME, 2012b). This guidance covers biosolids quality, application rates, methods, setbacks, and monitoring. Quality standards are in place to ensure biosolids meet specific criteria, including limits on contaminants like heavy metals and pathogens to protect the environment and human health. Risk assessments are conducted before application to evaluate potential impacts on soil, water, and crops, determining appropriate rates and precautions. Biosolids are recognized for their benefits in improving soil fertility, organic matter, and crop productivity. Best management practices, such as proper storage, transportation, and application methods, are encouraged to ensure safe and effective land application. Compliance with setback distances from sensitive areas is also emphasized. Regular monitoring and reporting are required to assess the efficacy of biosolids management, including soil and crop testing, tracking application rates, and locations. These measures aim to ensure compliance with regulations and promote responsible biosolids land application.

Regulations for wastewater residuals, including biosolids, are implemented at the provincial and territorial levels with varying mechanisms to ensure environmental and public health protection. In Newfoundland and Labrador, the land application of biosolids is not permitted. In New Brunswick, only biosolids meeting Category A requirements outlined in the *Guidelines for Compost Quality* (2005) can be applied to land. Quebec prohibits the land application of biosolids for fruit, vegetables, pastureland, and home gardens unless certified by the Bureau de normalization du Quebec (BNQ). Alberta, British Columbia, Ontario, and Nova Scotia permit the land application of Class A and B biosolids and compost in accordance with regulations. Quebec imposes a green tax on sewage sludge/biosolids landfilled or incinerated, while Nova Scotia prohibits landfilling of organic material. Increasing landfill fees and recognition of the resource value in biosolids are reducing the acceptance of biosolids landfill disposal in Canada (CCME, 2012b).

The EPA and the National Academy of Sciences recognize the value of biosolids as a safe resource for soil conditioning and land reclamation. The EPA regulates biosolids under the Part 503 Biosolids Rule. In the US, approximately 43% of biosolids are land applied, 14% are incinerated and 42% are disposed of in landfills. Land application is supported at the federal level but faces restrictions in some counties. In Northern California, a significant portion of biosolids is used as alternative daily cover or disposed of in landfills due to local weather conditions and waste diversion requirements. Legal cases have upheld state regulations allowing land application over local regulations that try to limit land application in states such as California, Pennsylvania, Virginia, North Carolina, and Maryland. Legal cases in California, Pennsylvania, and Virginia have reinforced the safety and acceptance of land application of biosolids as a crucial recycling practice. In Kern County, California, a court ruling deemed the county's biosolids ban unconstitutional after a two-week trial which provided valuable resources for defending land application practices. The Pennsylvania Supreme Court also upheld the protection of biosolids farming under the state's Right to Farm Act, dismissing claims brought by plaintiffs in a long-running litigation. Additionally, the Richmond, Virginia, Circuit Court upheld regulations for land application, rejecting claims of insufficient protection and excessive phosphorus loading. (USEPA, 2017 and Slaughter, 2017)[23].

In Europe, the main method of reusing biosolids in recent years has been application on agricultural land. According to the European Commission, biosolids can be safely used as fertilizer on agricultural soils if they do not pose any environmental or health risks. However, there are variations in the regulations across member states, deviating from the European Commission directive. To improve policy decisions, actions such as sludge minimization, enhancing biosolids reuse, comprehensive monitoring, proper sludge characterization, and effective planning have been recommended. These measures will help ensure the quality of biosolids, protect the environment, and safeguard public health in sludge management practices.

Currently, within the 28 countries which form the European Union, the primary method of sewage sludge recovery is through land application. Approximately 50% of sewage sludge are spread on agricultural soils, 28% are incinerated, and 18% are disposed of in landfills. The decision-making regarding the alternative routes of sludge recovery/disposal, particularly land spreading, is greatly influenced by population density and the availability of agricultural lands. In regions with limited available land for biosolid spreading, northern European countries like the Netherlands and Germany have opted for incineration as the main recovery method. Additionally, despite the potential to apply all produced sludge to less than 5% of agricultural areas in most European Union Member States, the restricted use of biosolids in agriculture is attributed to low acceptance by farmers and the public. This factor also impacts policy decisions regarding sludge management, resulting in the implementation of national regulations by each Member State.

In Australia, approximately 83% of biosolids were beneficially applied to land in 2021, with 72% of that amount being utilized on agricultural land. In New Zealand, land reclamation accounted for 43% of biosolids utilization, while agricultural purposes comprised 3% of usage. Additionally, 2% of biosolids were subjected to incineration. The remaining portion of biosolids was allocated for forestry, vermicomposting, landfill capping, stockpiling, and various other applications.

On the other hand, Japan heavily relies on thermal processing methods, particularly incineration, for biosolids management. In 2016, 68% of were biosolids incinerated, 11% were land applied and the rest landfilled. Due to its

23 https://www.accesswater.org/publications/proceedings/-279639/biosolids-on-trial---recent-litigation-wins-for-land-application

dense population and limited opportunities for land application, Japan has prioritized the generation of energy as a beneficial use of biosolids processing.

5. Evaluation of Biosolids Thermal Pilots

In July 2020, the CRD issued a RFEOI to understand the advanced thermal technologies available and determine interest from the market to undertake pilot trials. The CRD evaluated the proponent submissions on the basis of adherence to CRD policy, beneficial use, project synergies, reputation/track-record, scalability, and the completeness of information in the proponents' responses. The CRD opted to select one pilot from each type of advanced thermal technology to better understand the respective process and by-product characteristics.

A description and the results to date of each selected pilot trial are outlined below.

5.1 Waste Management

Waste Management (WM) collaborated with the CRD to explore the management of CRD biosolids using pyrolysis technology. WM, through their partner BioForceTech (BFT) have a pyrolysis facility located at the Silicon Valley Clean Water Authority in Redwood, California. The BFT pyrolysis system includes three bio-dryers, a pyrolysis kiln, and a thermal oxidizer. This system dries biosolids, pyrolyzes into a pyrolysis gas and biochar, and oxidizes the pyrolysis gas, recovering heat for use in the pyrolysis kiln and biodryers.

The initial step in this pilot program was a desktop data review, to take advantage of results from previous trials at the facility, as well as other published research. WM engaged two external consultants, Northern Tilth and Brown & Caldwell to assist in this work. Northern Tilth gathered and analyzed relevant data sets from previously pyrolyzed biosolids and compared the quality characteristics to CRD biosolids. Brown & Caldwell conducted a literature review on biosolids pyrolysis air emissions, and reviewed air emission data available from the BFT facility.

Based on the review, which compared CRD biosolids against two North American biosolids samples, WM concluded the following:

- CRD biosolids are similar in quality to other anaerobically digested and thermally dried biosolids from similarly sized municipal wastewater treatment facilities in terms of commonly tested parameters such as nutrients and metals. Thus, the resulting biochar from CRD biosolids is also expected to be similar.
- CRD lacks baseline data on non-regulated compounds of concern, including PFAS, VOCs, SVOCs, pharmaceuticals, and personal care products. WM recommended that the CRD test its dried biosolids for these parameters, so that they can be compared to other biosolids. Samples were submitted to an analytical lab, and the analysis will be updated when results are received.
- A WM pyrolysis trial in 2019, and data from other trials globally, found that the concentration of compounds of concern, including PFAS, within the biosolids used in the trial (of similar quality to CRD biosolids) were significantly reduced in the biochar produced from pyrolysis.
- There is limited data on the fate of PFAS in pyrolysis gas before and after combustion. Bench scale testing has demonstrated that pyrolysis can remove specific PFAS compounds to below detection limits in pyrolysis gas, however, the transformation of PFOS (one type of PFAS) into a different type of PFAS was observed. More research, and the confirmation of bench-scale results in a commercial system is needed.
- The BFT Pyrolysis facility meets the requirements of its air permit. Available data suggests that coupling pyrolysis with appropriate emissions technology can lead to air emissions that comply with BC regulations.
- Currently, there is only one full-scale pyrolysis facility for dried biosolids operating in North America, and available air emissions data from that facility is limited to a few regulated parameters of concern, including NO_X and metals. Full-scale air emissions testing at an operational facility is needed to comprehensively understand the fate of both regulated parameters and compounds of concern, such as PFAS, in air emissions.

The second stage of this pilot project was to conduct additional testing, based on knowledge gaps identified during the first stage. The planned testing included participation in a comprehensive study backed by Water Environment Federation which aims to quantify the extent to which PFAS compounds are destroyed pyrolysis by analysing all inputs and outputs to the system, including the pyrolysis gas. All additional testing has been postponed until mid-2024, while the pyrolysis kiln is upgraded.

5.2 Char Technology

In February 2022, CHAR Technologies (CHAR) completed bench-scale laboratory testing of CRD biosolids. Afterward, they collaborated with the CRD to carry out a pilot-scale high temperature pyrolysis (HTP) test of 800 kilograms of CRD biosolids at CHAR's pilot facility in London, Ontario over two days in October 2022. The results of the pilot test were reported to CRD on March 3, 2023.

CRD provided biosolids for the pilot that had a moisture content of 5.3%, total solids (TS) content of 94.7%, and a particle size of approximately 1 mm. Two tests were performed using 398 kg of biosolids with identical operating conditions, in a HTP pilot test, at 850°C. The feed rate was 50 kg/h and the solids residence time was 1-hour, aimed at optimizing the destruction of PFAS components. Biochar was collected 1-hour after the first batch of biosolids entered the kiln.

CHAR used internally developed and proprietary modelling to predict HTP product yields based on previous test results. According to the results, HTP of biosolids at 850°C yielded 28% biochar, 60% syngas, and 12% condensate, a total solids mass reduction of 72%. The CRD biosolids had a carbon content of 8.26%, volatile matter of 62.35%, and ash of 19.55%. After HTP, volatile matter decreased and fixed carbon and ash increased, resulting in biochar with a fixed carbon content of 23.60%. This high fixed carbon content made the biochar eligible for carbon credits, with each tonne generating 0.7 credits according to Puro.earth, a voluntary market which determined carbon credits that can be allocated per tonne of biochar.

Pyrolysis typically increases the concentration of inorganic matter (including metals) due to the loss of volatile matter at high temperatures. As a result, concentrations of Molybdenum and Zinc in the resulting biochar exceeded limits set by the Fertilizer Act of Canada and BC Class A Biosolids standards. Further analysis is needed to determine how the biochar can be used, which may involve methods such as ash washing or compost blending. Phosphorous and potassium were present in the produced biochar in high concentrations of 54,000 mg/kg and 1,910 mg/kg respectively, making it a potentially valuable fertilizer. Nitrogen was detected in the form of nitrate and nitrite in the feedstock. This was an expected result, as volatile forms of nitrogen were lost during the pyrolysis process while phosphorous and potassium were concentrated in the resulting biochar.

Tests and analysis demonstrated that CHAR's HTP Technology was successful in removing PFAS components from the solid phase of CRD's biosolids feedstock at 850°C. The resulting biochar had PFAS components that were below detection limits and met Canada's Agricultural Use standards.

However, PFAS was detected in the dirty syngas, both pre- and post- oxidizer. The samples were not taken simultaneously, thus leading to non-identical process conditions. The oxidizer operated at 850°C with a minimum residence time of 2-seconds. Volumetric flow rates of syngas could not be measured at the sampling locations, so only concentration data was provided. PFAS tests were conducted on the syngas and gas results for O_2, CO_2, CO, CH_4, N2, and H2 were provided for both pre- and post- oxidizer/combustor. The presence of oxygen in both pre- and post-oxidizer gas was identified and indicated air intrusion. Analysis of the syngas particulate matter suggested that more attention is needed when designing the oxidizer to ensure that the particulate matter emissions do not exceed the stack limits and sufficient destruction of any contaminants that are partitioned to the syngas like PFAS. Higher oxidizing temperatures may be necessary. Based on the presence of sulfur and nitrogen in the dirty syngas, the formation of NOx and SO_2 was anticipated.

The process of contaminant partitioning from biosolids feedstock to end products including biochar and syngas (post-oxidizer) is currently under investigation for a variety of organic and inorganic contaminants of concern. While the conversion process may lead to a reduction in contaminant levels, complete destruction of contaminants is still under investigation. Furthermore, careful consideration of the end-use of syngas is necessary to ensure potential risks are mitigated.

Overall, additional analysis is necessary to fully comprehend the properties of the syngas generated, as there were concerns that air intrusion may have adversely affected results. To obtain precise gas data and establish reliable emissions control for a commercial-scale system, CharTech suggested installation of an on-site HTP demonstration system with syngas cleaning at a CRD location for further testing.

5.3 CEM

The CRD discussed the opportunity to pelletize and combust biosolids with CEM. The objective was to have CEM complete a lab analysis on a sample of biosolids and provide a professional opinion of the combustion proprieties of the biosolids and comment on the opportunity to bind biosolids with wood waste for use as fuel in a boiler.

CEM retained a lab in Europe to test different mixtures of dried biosolids and wet Hartland Landfill woodchips at four different ratios:

- 100% biosolids
- 20% biosolids and 80% wood chips
- 10% biosolids and 90% wood chips
- 5% biosolids and 95% woodchips

The lab conducted a “BASIC” analysis on all four samples.

Results showed that the in the 100% biosolids test, the Ash Deformation Temperature (ADT) was at 1,000-1,100 ˚C, which was significantly higher than the minimum requirement of 800 ˚C based on the Best Demonstrated Practice (BDP). ADT refers to the temperature at which ash in a combustion chamber begins to soften and deform. This temperature is a critical parameter for combustion operations, as a low ADT can lead to slagging and fouling in the combustion chamber, reducing the efficiency and reliability of the process.

Since the biosolids had high ADT, they may be burned in a biomass boiler as-is using a fines burner or travelling grate. However, the biosolids contained a considerable amount of ash, approximately 24% on a dry basis. Also, burning biosolids produces high levels of NO_X, SO_X, and strong acids such as HCl and HF. NO_X and SO_X emissions may be reduced with Best Available Control Technology (BACT). Burning biosolids can also cause corrosion due to the production of strong acids, but this may be prevented by maintaining a flue gas temperature above 150˚C. As per BACT, mixing biosolids with wood chips was found to be necessary to prevent fouling and meet emission requirements. A mixture of 85% wood chips and 15% biosolids was recommended by CEM to avoid fouling and reduce NOX/SOX emissions significantly, and to meet the BACT emission levels. CEM believed that this was an inefficient utilization of the biosolids. Additionally, the pellets produced would not be appropriate for pellet boilers intended for commercial or residential use as they would contain elevated levels of sulphur and chlorine.

The pelletization of biosolids was found to be unnecessary for their combustion due to their high ADT. The biosolids could be burned directly in a dedicated "fines" burner with wood chips or above the travelling grate along with the wood chips. This was a positive result because it simplified the combustion process and reduced the cost and complexity of preparing the fuel for combustion.

If 15% of the mix is biosolids at a rate of 3,600 tonnes per year and 85% is wood at 20,400 tonnes per year, the weighted average calorific value of the biosolids wood chip mixture would be 4,800 Btu/lb. The as-is calorific value of the biosolids is 17,250 kJ/kg and the as-is calorific value of the wood is 10,080 kJ/kg. The combustion of approximately 24,000 tonnes of the 15%/85% biosolids wood chip mixture would produce around 2,600 tonnes of ash per year, which could then be collected and utilized either in asphalt or land application.

CEM recommended that the CRD perform further proximate and ultimate analyses on their different types of wood chips, including the coastal-like, dirty, and Construction/Demolition (C&D) Waste wood chips, as well as any other sources of biomass they may have. It was recommended that the CRD prioritized assessing the ash content, chlorine, and fluorine levels in their wood chips to establish a hierarchy of fuel types based on their cleanliness, with the least contaminants of concern being the most favourable option.

CRD was advised to initiate discussions with Natural Resources Canada through their CanmetENERGY laboratory to explore the feasibility of conducting preliminary tests/work on pelletizing a fraction of their biosolids. In addition, it was suggested that CRD conduct an incremental cost/benefit analysis of pelletizing their biosolids (and wood chips) to assess if the additional CAPEX and OPEX involved in this process are worthwhile, considering that alternative, less expensive options may also be available.

Due to the ash content of the fines, CEM recommended the CRD seek out burner OEMs who have the capacity to burn biosolid fines. The OEMs should provide a summary of the advantages and disadvantages of the fines burner option compared to mixing the biosolids and wood chips together and burning them on a grate.

CEM suggested that the ideal location for a biosolids/wood chip combustor would be a thermal-intensive customer within CRD who has a consistent demand for steam, hot water, or hot oil and is interested in reducing their carbon footprint. A biomass combustion system can operate for 8,000-hours per year on 3 tonnes/hour of biosolids/wood chip mixture, resulting in 31.7 mmBtu per hour of heat and 27 mmBtu per hour of useful energy. Assuming an 85% high heat value (HHV) efficiency, this could result in a CO_2 savings of 11,000 tonnes CO_2 equivalent per year. Based on the amount of biosolids available and the recommended blend ratio of 15% biosolids to 85% wood chips, the host site/customer should have a thermal load of around 250,000 mmBtu per year (i.e., equivalent to 10,000 - 11,000 tonnes per year of CO_2 equivalent).

CEM identified at least five fossil fuel users on Vancouver Island with over 10,000 tonnes of CO2 emissions per year who could potentially use all of CRD's biosolids for heat and/or power. It is likely that these operations would require modifications to their systems before pelletized biosolids could be used.

5.4 Aries Clean Technologies

Aries Clean Technologies (Aries) is a US based company which uses Fluidized Bed Gasification technology and is commissioning a new facility in Linden, New Jersey which will operate solely on biosolids. CRD intended to collaborate with Aries to conduct a pilot gasification program of biosolids. However, due to commissioning issues at this new facility, Aries indicated that their facility will not be operational and unable to undergo performance testing until the last quarter of 2023. As such, the pilot trial has been delayed. Staff are currently maintaining communication with Aries Clean Technologies and will make efforts to carry out the pilot study when the facility becomes operational.

5.5 Summary of Thermal Pilot Results

The advanced thermal pilot outcomes/results to date have provided valuable insights into the discrete operation of these technologies and the quality of products that can be obtained from CRD's biosolids. However, the pilots were all completed over a discrete period of time and therefore may not be representative of the long-term day to day operating conditions of the various systems/technologies. In addition, the trials only allowed for limited data to be collected on the characteristics of by-products such as biochar, syngas and wastewater. As such, the current pilot results alone are insufficient to confirm the feasibility of on-site advanced thermal processing of CRD biosolids and the potential for integration/beneficial use of by-products into other systems at Hartland.

5.6 Thermal Pilot Next Steps

Following the pilot trials, on March 29, 2023, the CRD board moved to initiate a request for proposals (RFP) process for an advanced thermal processing trial on-site at Hartland.

GHD recommends the following key objectives for consideration as part of the on-site thermal processing trial:

– Confirm equipment/process reliability
– Determine operating costs and short- and long-term maintenance requirements

- Evaluating the magnitude and quality of flue gases from the process
- Confirm the quantity and quality of syngas, biochar, and liquids
- Identify opportunities for process optimization
- Evaluate the potential for co-processing of other materials arriving at the landfill and assess the effects of co-processing on the quantity and quality of products and waste streams
- Identify and develop local markets for biochar
- Assess carbon sequestration benefits
- Evaluate contaminant partitioning and fate
- Evaluate GHG implications of any oxidized syngas
- Assess potential long-term synergies at Hartland

As noted above, the RFP process was initiated June 16, 2023, with a response closing date of July 14, 2023.

6. Long Term Options

The following section outlines the long-term biosolids beneficial use management options currently available to the CRD at the time this report was developed, along with proposed screening and evaluation criteria used to differentiate between the various options.

6.1 Long-Term Options

As per provincial regulatory direction from ENV, the proposed long-term management plan for biosolids generated at the RTF must comply with the requirements for beneficial use specified by the CCME.

In the context of the CCME beneficial use criteria, the below Table 6.1 screens all known biosolids long-term options available to the CRD:

Table 6.1 Potential Biosolid Options available to the CRD

Type of Operation	Potential Options	Adheres to CCME Beneficial Use?
Land Application		
Mine/Quarry Reclamation	Three potential options: – Two options for quarry reclamation near Nanaimo, BC. – An option for mine reclamation on the mainland.	Yes
Forest Fertilization	Three potential options: – Options for forest fertilization within the CRD and near Nanaimo, BC.	Yes
Land Improvement	One potential option: – An option to land apply biosolids to promote grass growth, help manage invasive species, and develop the potential for land grazing near Courtenay, BC.	Yes

Type of Operation	Potential Options	Adheres to CCME Beneficial Use?
Land Application		
Direct Land Application	One potential option: – Biosolids could be bagged and distributed as a fertilizer product in packages of less than 5 m^3. A pilot project would be required to assess feasibility.	Yes
BGM/Composting/Soil-Product	Multiple potential options with several vendors: – Biosolids could be mixed into BGM and land applied. – Biosolids could be composted with other municipal organic waste and land applied.	Yes
Thermal		
Fuel for Combustion/Incineration	Four potential options: – Co-combustion at two lower mainland cement kilns – As fuel in biomass boilers, either directly or mixed/pelletized with wood. Although possible, a market does not currently exist for use of biosolids as fuel. Changes to air permits would be required, potentially with additional stack testing requirements. Use in traditional residential/commercial units is not recommended as per results of thermal pilot trials. A specially designed "fines" boiler, with emissions control technology, would be required. – Incineration at an off-site waste-to-energy facility. Material handling at the facility would need to be developed.	Potentially – not all options beneficially re-use ash.
Pyrolysis	Two potential options: – On-Site pilot facility - Pyrolysis gas would not be beneficially used in the pilot. – On-Site long-term facility	Partial – Pilot option may not capture energy. Biochar and bio-oil from pyrolysis may not be suitable for land application or combustion, respectively.
Gasification	Two potential options: – On-Site pilot facility - Syngas would not be beneficially used in the pilot. – On-Site long-term facility	Partial – Pilot option may not capture energy. Biochar from gasification may not be suitable for land application.

Options outlined in Table 6.1 may also benefit from the development of additional material handling and storage procedures which may result in increased flexibility for transportation and transportation logistics. Table 6.2 illustrates available materials handling and storage options which could be coupled with options in Table 6.1 above to provide increased flexibility for the CRD.

Table 6.2 Materials, Handling, and Storage Options

Material Handling & Storage	
Materials Handling	Two potential options: – Manually bag biosolids into bulk bags with bag liners for storage and transport. – Bagging for distribution- Class A biosolids can be distributed freely bagged in quantities of less than 5 m^3.
Storage	Two potential options: – Hartland Silo – construct additional silo(s) at Hartland. – Stockpile - stockpiling of biosolids will require blending 1:1 with sand to safely store. Blended biosolids will no longer be suitable for combustion. Stockpiled biosolids must meet OMRR storage requirements. Biosolids could be stockpiled at Hartland landfill or at land application site.

6.2 Proposed Evaluation Criteria

The following table describes a proposed evaluation criteria which could be used to distinguish and identify the benefits and challenges with each of the biosolid beneficial use options outlined above.

Table 6.3 Proposed Evaluation Criteria

Evaluation Criteria	Description
Economic	– Estimated CAPEX and OPEX e.g., cost of capital investment for additional infrastructure and cost of processing – Potential for revenue generation e.g., biochar, biofuel – Estimated cost per tonne e.g., CAPEX and OPEX to process tonne of biosolids; estimated based on information available at the time of this report
Environmental Impacts	– Odour – Noise – Truck Traffic – Air emissions and dust – Contaminant mass balance
Environmental Sustainability	– Production of value derived products e.g., biochar, biocrude, etc. Diversified beneficial use and marketability of products recovered – GHG Emission Implications – Potential to recover energy and reduce dependence on electric grid and natural gas – Potential to co-process additional waste streams – Soil/groundwater impacts
CRD Owned	Yes or no
Reputation	Type of application (thermal treatment, land reclamation, agricultural fertilizer etc.)
Regulatory	New permit requirements and impacts to existing operating permits

6.3 Options Evaluation

The results of the options evaluations using the proposed evaluation criteria are summarized in Table 6.4 below:

Table 6.4 General Option Pathway Evaluation Results

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil Product	Fuel for Combustion/Incineration (Off Site)	Pyrolysis (On Site)	Gasification (On-Site)
Economic	CAPEX and OPEX	Low CAPEX given no investment for additional infrastructure. Medium OPEX due to labour, transport, materials handling, maintenance, storage, public outreach, etc.			Low CAPEX given no investment for additional infrastructure. Higher OPEX due to increased costs from bagging protocol and materials.	Low CAPEX given no investment for additional infrastructure. Medium OPEX due to labour, transport, materials handling, maintenance, storage, public outreach, etc.	Low to medium CAPEX depending on contract agreement. Some vendors may require investment for additional feedstock storage infrastructure. Medium OPEX due to labour, transport, materials handling, maintenance, storage, etc.	High CAPEX due to capital investment for on-site facility. OPEX induced from labour, utility demands (natural gas, electricity, and water), and the transport of biochar. In comparison to off-site alternatives, OPEX will be low in the long-term due to lack of tip-fees for biosolids. However, OPEX may be higher during the early commercial facility commissioning stage until the process becomes optimized.	
	Potential for revenue generation	Low potential for revenue generation as there are no residual products from this process.			Potential for revenue generation through the distribution of bagged biosolids fertilizer product to partially offset processing costs.	Low potential for revenue generation as CRD may not own the rights to the BGM/composting/soil-products.	Low potential for revenue generation as CRD may not own the rights to the value derived products (electricity, cement, heat, etc.).	Potential for revenue from value derived products (biochar, bio-oil) to partially off-set processing costs.	Potential for revenue from value derived product (biochar) to partially off-set processing costs.
	Estimated cost per tonne (CAPEX and OPEX estimate based on information available at the time of this report)	<$250/tonne	<$400/tonne	<$500/tonne	<$500/tonne	<$500/tonne	<$500/tonne	$500-4,500/tonne[1]	
Environmental Impacts	Odour	Potential for nuisance odour emissions at application site(s). May be mitigated via biosolids stabilization and mixing with soil. Application sites are generally far from population centres.					Minimal odour due to installation of an odour abatement system at the facility.		
	Noise	Noise emitted from land application equipment. However, mines/quarries are generally located far from population centres.			Noise potentially emitted from bagging equipment. However, site is located far from population centres	Noise emitted from land application equipment. However, application sites are generally	Minimal noise due to installation of noise abatement system at the facility.		

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On Site)	Gasification (On-Site)
Environmental Sustainability					and a noise abatement system would be designed as the bagging protocol is developed.	located far from population centres.			
	Estimated Truck Traffic	Truck traffic associated with transport of biosolids from site: Approximately one truck every three days (122 trucks each year)						Truck traffic associated with transport of biochar from site: – Approximately one truck every nine days (41 trucks each year)	
	Air Emissions and Dust	Generally low potential for particulate air emissions/dust.					Minimal air emissions/dust due to installation of advanced capture and treatment systems at facility, though residues from these capture and treatment systems need to be disposed of.		
	Contaminant mass balance	Potential accumulation of contaminants. However, class A biosolids have undergone contaminant reduction processes as per OMRR quality standards.					Contaminants have shown to be reduced through thermal processing. However, the level of reduction and ultimate environmental fate are still under investigation.		
	Production of value derived products e.g., biochar, biocrude, etc.	Biosolids may be considered a fertilizer product derived from a waste stream in the context of land-application, with the added benefit of reducing the need for energy-intensive synthetic fertilizer production.				Produces BGM, compost, soil-products which may be beneficially re-used in various applications and reduces the need for energy-intensive synthetic fertilizer production.	Produces energy which may be beneficially re-used for electricity/heating applications assuming nearby end-users.	Produces steam, syngas, , and bio-oil, which can be beneficially re-used in various applications such as heating, electricity, etc. Also produces biochar, however the potential beneficial applications of this product as a soil amendment are still under investigation.	Produces steam, syngas, and which can be beneficially re-used in various applications such as heating, electricity, etc. Also produces biochar, however the potential beneficial applications of this product as a soil amendment are still under investigation.
	GHG Emission Implications[2]	In comparison to landfilling, GHG emissions are significantly reduced due to lesser methane/nitrous-oxide emissions, carbon sequestration into soil, and an offset usage of synthetic fertilizers. In comparison to alternative beneficial use options, biosolids application to degraded areas (mines, quarries, forests, lands, etc.) presents the lowest potential for GHG emission reduction. Any off-site option will have higher GHG emission implications due to the transport distances and trucking frequency associated with the transport of			In comparison to landfilling, GHG emissions are significantly reduced due to lesser methane/nitrous-oxide emissions, carbon sequestration into soil, and offset usage of synthetic fertilizers. In comparison to alternative beneficial use options, the production and sale of biosolids as a soil fertilizer product through bagging, compost, or BGM, presents medium potential for GHG emission reduction, assuming it has greater potential to offset the usage of synthetic fertilizers.		In comparison to landfilling, GHG emissions are significantly reduced (lesser methane/nitrous-oxide emissions, non-renewable fuel usage offsets). Thermal processing options will have increased GHG implications from the oxidization of any gases produced.	In comparison to landfilling, GHG emissions are significantly reduced (lesser methane/nitrous-oxide emissions, non-renewable fuel usage offsets). Advanced thermal processing options will have increased GHG implications from the oxidization of any gases produced. Like combustion/incineration, pyrolysis and gasification present high potential for GHG emission reduction, if biosolids-derived energy (heat, syngas, or bio-oil from	

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On Site)	Gasification (On-Site)
		biosolids, resulting in increased non-renewable fuel usage.			Any off-site option will have higher GHG emission implications due to the transport distances and trucking frequency associated with the transport of biosolids, resulting in increased non-renewable fuel usage.		In comparison to land application options, utilizing biosolids as renewable fuel for cement combustion or energy production via incineration presents high potential for GHG emission reduction, assuming it offsets the usage of non-renewable fuel sources. Any off-site option will have higher GHG emission implications due to the transport distances and trucking frequency associated with the transport of biosolids, resulting in increased fuel usage.	pyrolysis) is beneficially used to offset the usage of non-renewable fuel sources. Depending on process design, this derived energy may not be reused or recycled, and may result in lower GHG emission reductions. On-site options will have lesser GHG emissions associated with transport, as the trucking frequency of hauling biochar will be less than that required of biosolids.	
	Potential to recover energy and reduce dependence on electric grid and natural gas	No potential to recover energy.					High potential to recover energy from products (steam, heat) to offset dependence on electric grid and natural gas. Fulsome energy recovery would depend on presence of nearby end-users.	High potential to recover energy from products (syngas, steam, heat) to offset dependence on electric grid and natural gas onsite. Fulsome energy recovery would depend on presence of nearby end-users.	
	Potential to co-process additional waste streams	No potential for co-processing.				Potential for co-processing via blending of biosolids with compost generated from organic waste streams.	Low potential to co-process mixed waste streams as CRD would not have control over off-site facility operations.	Potential to co-process mixed waste streams. However, co-processing may increase maintenance/operational costs due to added complexity of feedstock.	
	Soil/groundwater impacts	Supplementing soil cover and improving soil health via biosolids application reduces erosion into lakes and streams. Potential negative impact to soil/groundwater if application plan is not followed correctly as per OMRR.			Bagging process presents minimal impacts to soil/groundwater. End-use of the bagged product may present potential negative impact to soil/groundwater if applied in quantities greater than one bag ($5m^3$) per parcel of land. OMRR does not require a land application plan for application quantities less than or equal to $5m^3$ per parcel of land.	End-use of the products may present potential negative impact to soil/groundwater if application plan is not followed correctly as per OMRR.	Process presents minimal impact to soil/groundwater. End-use of the products (biochar, bio-oil, ash) may present potential negative impact to air/soil/groundwater if proper consideration not taken.		

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On Site)	Gasification (On-Site)
CRD Owned	Yes or no	No. Biosolids would be sent to vendors who would own risk and land application responsibility.			Yes.	No. Biosolids would be sent to vendors who would own risk and responsibility.	No. Biosolids would be sent to off-site facility.	Yes.	
Experience and Reputation	Type of application	Mines/quarries are required by the government to eventually reclaim and close to minimize the long-term environmental effects of operations. Biosolids have shown to be an effective measure in the restoration of former mines/quarries by adding nutrients to promote vegetation growth in their barren soils. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	Biosolids have shown to be an effective measure in the fertilization of forests to increase tree production, reduce soil erosion, and improve soil health. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	Land application has demonstrated commercial success and is one of the commonly used management options worldwide. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	It is unclear if there is a local market for bagged biosolids fertilizer product. A pilot trial would be required to assess demand and feasibility. Biosolids as a bagged product is allowed under OMRR in packages of <5m^3. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	Land application has demonstrated commercial success and is one of the commonly used management options worldwide. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	High technological readiness as combustion/incineration is a commercially proven and widely used biosolids management process. However, the market for biosolids as fuel does not currently exist. Additionally, public acceptance of waste incinerators varies due to concerns regarding intensive energy usage and potential for air pollutant emissions.	Reputation of pyrolysis is gaining interest as an innovative technology which produces value added products from waste streams, however it has demonstrated low technological readiness as there are a limited number of operational facilities which use biosolids as a sole feedstock. In North America, pyrolysis is ahead of gasification with regards to technological readiness based on the number of operational facilities.	Reputation of gasification is gaining interest as an innovative technology which produces value added products from waste streams, however it has demonstrated low technological readiness as there are a limited number of operational facilities which use biosolids as a sole feedstock. In North America, gasification is below pyrolysis with regards to technological readiness based on the number of operational facilities.

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On Site)	Gasification (On-Site)
Regulatory	New permitting requirements and impacts to existing permits	May require approvals from: - ENV to ensure land application is carried out safely and does not pose a risk to human health or the environment.					Changes to boiler air mass permits may be required. May require approval from Environmental Management Act Air Quality Permit for any emissions associated with thermal process.	May require approval from Environmental Management Act Air Quality Permit for any emissions associated with thermal process.	

1. Due to pyrolysis and gasification being considered emerging technologies in the biosolids industry there are a number of unknown risks associated with these technologies which have the potential of increasing both CPAEX and OPEX associated these types of projects.
2. GHG Emission Implications are based on the 2022 BEAM Model developed by the Northeast Biosolids and Residuals Association, Northwest Biosolids, Northern Tilth LLC.

6.4 General Option Pathways

The available option types outlined in Table 6.4 fall under four general pathways for CRD's consideration in the long-term:

- **On-Site Thermal:** The CRD invests in an on-site advanced thermal technology to process their biosolids. These processes would yield value-added products such as syngas, biochar, bio-oil, or energy that can be converted into heat/electricity. There is also potential to co-process other waste streams in addition to biosolids, such as municipal solid waste.
- **Off-Site Thermal:** Similar to on-site thermal, the CRD transports biosolids from Hartland to a different facility to process the biosolids via an advanced thermal technology. However, in this scenario there is no need to invest in additional infrastructure.
- **Cement Manufacturing:** The CRD transports biosolids from Hartland to off-site facilities for beneficial use as alternative fuel in cement kilns.
- **Land Application:** The CRD would utilize the biosolids for non-agricultural land-application purposes such as mine/quarry reclamation, forest fertilization, land improvement, direct land application, or the production of BGM/compost/soil-product.

7. Long-Term Portfolios

Irrespective of the type of management option selected for the long-term strategy, GHD recommends that the CRD develop a combination of multiple options within a diverse strategy portfolio to ensure resiliency and further protect the CRD against risks of interruption such as future market forces, regulatory changes, facility shutdowns, or other unplanned circumstances. In the unexpected event that a management option is interrupted due to these risks, the added benefit of strategy diversification in following the portfolio approach will allow CRD's biosolids to still be beneficially used in the interim until the interruption is resolved.

The following sections outline the process for developing biosolids beneficial use portfolios and provide a few general portfolios based on the four general pathways described in the previous section.

A portfolio may be made up of three of more biosolids beneficial use options in order to increase resiliency. These three options may be categorized as follows:

1. **Preferred Option** – This refers to the primary management option. For an option to be categorized as preferred, it should be able to accommodate all biosolids produced by the RTF. A preferred option may be made up of several smaller preferred options in order to meet this requirement.
2. **Support Option** – This refers to a secondary option which would be available to beneficial use biosolids if one or all the preferred options were not available. This option does not have to be capable of accommodating all biosolids produced by the RTF and as such may be seasonal and/or have minimum tonnages associated with it.
3. **Contingency Options** – This refers to options which would serve as back-up options for the beneficial use of biosolids in the unexpected event that the preferred and support options are not available. Contingency may not be as economically or environmentally attractive as the preferred of support options however would be available to accept biosolids on short notice.

7.1 General Portfolios

As noted above, portfolios made consist of the following general biosolids beneficial use option pathways:

- **On-Site Thermal**
- **Off-Site Thermal**

– **Cement Manufacturing**
– **Land Application**

Table 7.1 below outlines a few potential general portfolios. It is important to note that this is not an exhaustive list of all potential portfolios and that there may be additional possible combinations. Following consultation, the portfolios may be further refined to include the specific options approved by the public and First Nations groups.

Table 7.1 General Portfolios

Option Categories	Existing Scenario Portfolio	Short Term Portfolio	On-Site Thermal Portfolio	Off-Site Thermal Portfolio	Land Application Portfolio
Preferred Option	Cement Manufacturing	Cement Manufacturing	Thermal/Fuel (on-site)	Thermal/Fuel (off-site)	Land Application
Support Option	N/A	Land Application	Land Application	Land Application	Land Application
Contingency Option	On-Site BGM	On-Site BGM	Cement Manufacturing (off-site)	Cement Manufacturing (off-site)	Cement Manufacturing (off-site)

7.1.1 General Portfolio Narratives

Existing Scenario Portfolio:

– This portfolio illustrates CRD's existing biosolids management strategy, in which the biosolids are transported off-site for use alternative fuel in cement manufacturing. As a contingency, 350 tonnes of biosolids are used to produce BGM under the Definitive Plan. This portfolio lacks a support option, and consequently does not have appropriate redundancy. This has led to significant operational challenges as off-site cement manufacturing has been interrupted. Although temporary, this portfolio is included as a comparison to the proposed portfolios.

Short-Term Portfolio:

– This portfolio depicts CRD's current short-term strategy, in which potential land-application options are being investigated to serve as additional support to the existing scenario for added resiliency.

On-Site Thermal Portfolio:

– This portfolio includes the investment and construction of an advanced thermal facility at Hartland Landfill. The potential to construct an on-site pilot facility is currently being investigated with pyrolysis and gasification technologies. Depending on the results and operations of the pilot, the on-site facility may be able to process and beneficially use CRD's biosolids for the long-term.
– During periods of planned shutdown, a portion of the biosolids could be transported to various land application programs. There are several potential land application options being explored by the CRD in the areas of mine/quarry reclamation, forest fertilization, land improvement, and BGM/composting/soil-product.
– In the unlikely event that both preferred and support options are interrupted, the CRD may send biosolids for use as alternative fuel in cement manufacturing. There are two off-site cement manufacturing options known to be available to the CRD which meet beneficial use criteria.

Off-Site Thermal Portfolio:

- This portfolio also considers the processing of biosolids via an advanced thermal treatment technology. However, in this scenario the biosolids would be transported to an off-site facility rather than investing in the construction of an on-site facility. Currently, there is one potential off-site thermal option available to the CRD in the form of incineration at a waste-to-energy facility.
- During periods of planned shutdown, a portion of the biosolids could be transported to various land application programs. There are multiple potential land application options being explored by the CRD.
- In the unlikely event that both preferred and support options are interrupted, the CRD may send biosolids for use as alternative fuel in cement manufacturing. There are two off-site cement manufacturing options known to be available to the CRD which meet beneficial use criteria.

Land Application Portfolio:

- This portfolio considers the transport of biosolids to one of the various potentially available land application programs.
- In the unlikely event that both preferred and support options are interrupted, the CRD may send biosolids for use as alternative fuel in cement manufacturing. There are two off-site cement manufacturing options known to be available to the CRD which meet beneficial use criteria.

7.2 Resiliency Evaluation

The following criteria in Table 7.2 was prepared to identify and evaluate the risk of interruption of potential portfolios:

Table 7.2 Resiliency Criteria and Factors

Resiliency Criteria	Factors
Preferred Option Sufficient Capital for Start-Up/ Operating/Refurbishment	Insufficient capital leading to potential shutdown or service interruptions.
Preferred Option Change in Ownership	New owner does not honour existing contracts (increase in tipping fees exponentially over short period of time).
Preferred Option Market for End-Product	Lack of market for end-product causes facility to turn away biosolids.
Preferred Option New OMRR Requirements	Updated OMRR with standards that current facility does not meet.
Preferred Option Short-term Shutdown	Short term shutdowns for various reasons - feedstock interruption, highway closure, wildfire, etc.
Preferred Option Facility Reputation	CRD being associated with a facility a causing a nuisance (haul route, odour, noise, etc.)
Preferred Option Facility Non-Compliance	Facility is not in compliance with permits or regulations.
Support Option Seasonality	Support option cannot accept biosolids on-demand due to winter, rain, etc.
Support Option Minimum Tonnage	CRD cannot produce/store enough biosolids to meet support or contingency option minimum tonnage requirements during periods of interruption of preferred option.
Contingency Option Unavailable	Support/Contingency option is unavailable (no longer open, at maximum capacity, etc.).

Each proposed portfolio was evaluated against the criteria noted in Table 7.2 using a risk-matrix per the following steps:

1. The probability of each criteria factor occurring was evaluated on a scale of rare (<3%), unlikely (3-10%), moderate (11-50%), likely (51-90%), to certain (>90%).
2. The consequence severity of the criteria factor occurring was evaluated on a scale of insignificant (easily mitigated by day-to-day process), minor (schedule delays up to 10% and CAPEX/OPEX increase up to 10%), moderate (schedule delays up to 50% and CAPEX/OPEX increase up to 50%), major (schedule delays up to 100% and CAPEX/OPEX increase up to 100%), to catastrophic (need to abandon the project).
3. The probability and consequence severity ratings for each criteria factor were correlated to find a risk of interruption value on a scale of negligible (level 1), low (levels 2-4), moderate (levels 5-10), high (levels 11-24), to extreme (level 25) using the risk matrix depicted in Table 7.3 below.
4. The resulting risk of interruption values for each criteria factor were averaged to generate a weighted risk of interruption rating and risk level for the overall portfolio.

Table 7.3 Risk Matrix

	Probability				
Consequence Severity	Rare (<3%)	Unlikely (3-10%)	Moderate (11-50%)	Likely (51-90%)	Certain (>90%)
Insignificant	Negligible (1)	Low (2)	Low (3)	Low (4)	Moderate (5)
Minor	Low (2)	Low (4)	Moderate (6)	Moderate (8)	Moderate (10)
Moderate	Low (3)	Moderate (6)	Moderate (9)	High (12)	High (15)
Major	Low (4)	Moderate (8)	High (12)	High (16)	High (20)
Catastrophic	Moderate (5)	Moderate (10)	High (15)	High (20)	Extreme (25)

The resulting risk of interruption and risk level for each portfolio is summarized in Table 7.4 below:

Table 7.4 Risk Resiliency Evaluation

General Portfolio	Average Portfolio Risk of Interruption Value Rating	Average Portfolio Risk Level	Comments
Existing Scenario	High	11	– Results in a high average portfolio risk of interruption rating (11) as the existing scenario portfolio does not include a support option for redundancy. – Preferred option availability (cement manufacturing) identified as a notable potential risk factor as this option has historically demonstrated operational challenges. – Contingency option availability (on-site BGM) identified as a notable potential risk factor as space for BGM cover at Hartland is limited and may eventually reach maximum capacity.
Short Term	Moderate	9	– CRD is exploring land-application programs in the short-term to serve as a support option to the existing scenario. This has decreased the average portfolio risk of interruption rating from high (11) to low (9). – Contingency option availability (on-site BGM) identified as a notable potential risk factor as space for BGM cover at Hartland is limited and may eventually reach maximum capacity.

General Portfolio	Average Portfolio Risk of Interruption Value Rating	Average Portfolio Risk Level	Comments
On-Site Thermal	Moderate	7	– CRD ownership of preferred option (on-site thermal facility) decreases potential risk in multiple criteria factors: change in ownership, market for biosolids in-take, facility reputation, and facility non-compliance. – Contingency option availability (cement manufacturing) identified as a notable potential risk factor as this option has historically demonstrated operational challenges.
Off-Site Thermal	Moderate	8	– Contingency option availability (cement manufacturing) identified as a notable potential risk factor as this option has historically demonstrated operational challenges.
Land Application	Moderate	8	– Contingency option availability (cement manufacturing) identified as a notable potential risk factor as this option has historically demonstrated operational challenges.

It was found that the inclusion of some form of land-application reduced the overall risk of interruption within the generated portfolios due to the diversification of option types resulting in increased resiliency.

Based on feedback from the public and First Nations groups, the CRD may further refine the portfolios and conduct a similar risk matrix exercise on alternative portfolios. This will help the CRD identify notable potential risks of interruption and incorporate mitigation plans accordingly. Further, the risk evaluation will assist the CRD in selecting a single, resilient portfolio for the long-term beneficial use of biosolids.

8. Conclusions & Next Steps

8.1 Conclusions

Development and Evaluation of Land Application Options – There are various beneficial use land application methods which meet CCME beneficial use criteria in the form of mine/quarry reclamation, forest fertilization, land improvement, direct land application, BGM, compost, and soil product production. There are various out-of-region land application programs available. There are currently no in-region land application options available at this time due to the long standing CRD policy banning land application. However, this policy was recently expanded to allow for non-agricultural land application as a contingency or emergency option. As such, a number of in-region land application options could be investigated for inclusion in potential long term management portfolios.

Evaluation of Thermal Options – Thermal biosolids management technologies are generally classified as pyrolysis, gasification, or incineration. Among the thermal technologies, incineration is the most commercially proven and widely used thermal treatment process for biosolids. However, incineration is energy intensive and does not result in the beneficial use of ash and as such may not be considered a beneficial use option by the CCME. Pyrolysis and gasification technologies are both still emerging in the biosolids processing space with slightly more pyrolysis facilities anticipated to move into operations in North America over the next few years.

Thermal technologies have the added benefits of generating potential revenue through biochar, syngas, heat recovery as well as the potential to co-process other mixed waste streams. However, there are challenges in thermal co-processing technologies, as mixing biosolids with other waste streams may increase maintenance and operational costs due to the added complexity of handling/treating mixed waste streams. Co-processing also presents challenges in meeting CCME criteria for the beneficial re-use of 25% of ash.

Contaminants of Emerging Concern - Community concerns around the land application of biosolids and its potential impacts to soil quality, surface water, and groundwater are largely based on the presence, or suspected presence, of unregulated CEC's. These potential impacts are the subject of ongoing scientific research. CCME's guidelines note that many CECs are found in low concentrations in biosolids, and that detection does not necessarily mean there is a risk to human health or the environment. Generally, risk assessments for each individual CEC have not been completed, but ecotoxicological testing, used to assess the toxicology of residuals holistically, did not detect significant negative impacts. The CCME is supportive of source control measures as an effective way to improve the quality of biosolids. CRD's biosolids have been treated to Class A standards as per OMRR.

The CFIA proposed an interim standard for PFAS in biosolids used in Canada as fertilizers at 50 ppb PFOS (one type of PFAS). The proposed standard aims to protect human health by preventing the small proportion of biosolids products that are heavily impacted by industrial inputs from being applied to agricultural land in Canada. The concentration of PFOS in CRD's biosolids is under the proposed standard at approximately 6 ppb (based on two samples).

The fate of CECs in advanced thermal processing of biosolids is still under investigation. While CECs appear to be reduced in biochar products, some can still be found in syngas and bio-oil products, but the concentrations and environmental fate still need to be confirmed.

Jurisdictional Scan – Globally, biosolids, are beneficially used primarily through land application or thermal treatment methods. The majority of countries assessed in the jurisdictional scan primarily land-apply their biosolids for beneficial use, except for Japan, who relies on incineration due to its high population density and limited areas for land application.

Across the world, the decision to beneficially use biosolids through land application or thermal processes is influenced by a range of factors: regulatory requirements, local infrastructure/resources, public perception, as well as the goals and priorities of local municipalities. Identifying and evaluating these factors are key to the implementation of an effective, long-term biosolids management strategy.

Evaluation of Thermal Pilots – In the evaluation of the Biosolids Thermal Pilot technologies/studies explored by the CRD, valuable insight was gained into the discrete operation of each of these technologies. However, the current pilot results alone may not be sufficient to confirm the feasibility of on-site thermal processing of CRD biosolids or the potential for integration/beneficial use of by-products into other systems at Hartland at this time.

For the upcoming on-site thermal trial, GHD suggests that the CRD capture key operational criteria such as process reliability, operational costs, maintenance requirements, co-processing feasibility, residual product quality, biochar markets, carbon sequestration benefits, and long-term synergies at Hartland.

Long-Term Options & Portfolio Generation – A long-list of biosolids management options available to the CRD was identified and screened against CCME beneficial use criteria.

GHD recommends that the CRD develop of a combination of multiple options within a diverse portfolio to ensure resiliency in the form of strategy redundancy. In the unexpected event that a biosolids management option is interrupted, the inclusion of additional options within a portfolio will allow CRD's biosolids to still be beneficially used in the interim until the interruption is resolved.

General portfolios were generated using the long-list of options available to the CRD. A risk evaluation identified notable potential risk of interruption factors such as contingency option availability and facility ownership changes to consider in the development of the long-term biosolids beneficial use strategy. The risk evaluation also indicated that some form of land-application is likely required in all proposed portfolios to ensure resiliency.

8.2 Next Steps

Following public and First Nations consultation, the CRD may further refine the general portfolios outlined in this report. From the list of options approved by the public and First Nations groups, the CRD may develop portfolios using specific options and vendors and future test these portfolios for resiliency using the risk matrix outlined in Section 7. The risk analysis will help inform the selection of a resilient long-term portfolio for the long-term beneficial use of CRD's biosolids.

Appendices

Appendix A

Provincial Conditional Approval Letter

BRITISH
COLUMBIA

Reference: 305517

November 18, 2016

Jane Bird
Chair, Core Area Wastewater Treatment Project Board
Capital Regional District
PO Box 1000, 625 Fisgard Street
Victoria BC V8W 2S6

Dear Ms. Bird:

Thank you for your letter of November 17, 2016, regarding my conditional approval of Amendment No. 11 to the Core Area Liquid Waste Management Plan (CALWMP). As requested in your letter, I will clarify my conditional approval of Amendment No. 11 to the CALWMP and have also considered your request to modify my condition for Integrated Resource Management.

To address your concerns, I am revising my September 30, 2016, Conditional Approval of Amendment No. 11. This revised Conditional Approval of Amendment No. I I supersedes my September 30, 2016, decision.

To clarify, Amendment No. 11 includes, but is not limited to, the following:

1. A single 108 megalitre/day wastewater treatment plant located at McLaughlin Point within the Township of Esquimalt capable of tertiary treatment for flows up to 2 times Average Dry Weather Flow (ADWF) for the Core Area up to 2040. For flows that are greater than 2 times ADWF but not more than 3 times ADWF for the Clover Point catchment and up to 4 times ADWF for the Macaulay catchment, primary treatment will be guaranteed. Construction of the wastewater treatment plant will be completed by December 31, 2020.
2. Commitment to advance studies for a wastewater treatment proposal in Colwood, including up to $2 million to complete the required technical studies and environmental impact assessments.
3. Conveyance of sewage sludge to the Hartland landfill for processing into Class A biosolids, as defined under the Organic Matter Recycling Regulation, for beneficial use and optimization for potential opportunities for integrated resource management.

... 2

Ministry of Environment

Office of the Minister

Mailing Address:
Parliament Buildings
Victoria BC V8V 1X4

Telephone: 250 387-1187
Facsimile: 250 387-1356

As a condition of my approval and in accordance with Section 24 (5) of the *Environmental Management Act,* I require the Capital Regional District (CRD) develop a definitive plan for the beneficial reuse ofbiosolids that does not incorporate multi-year storage of biosolids within a biocell. The Ministry of Environment understands that the plan may need to include short-term storage and/or management options as part of implementing the beneficial reuse plan, but the CRD is strongly encouraged to minimize the need for this. Further, I am amending the deadline for submission of the plan from December 31, 2017, to June 30, 2019, under the condition that the CRD submit, by May 31, 2017, a plan that outlines the procedural steps and schedule it will implement to achieve the definitive plan.

The CRD must ensure that the definitive plan for beneficial reuse of biosolids is supported by an assessment of the full spectrum of beneficial uses and integrated resource management options available for the proposed Class A biosolids produced at the Hartland Landfill, and incorporates a jurisdictional review of how similar-sized and larger municipalities within British Columbia, North America and further abroad, successfully and beneficially reuse biosolids. Ministry staff will assist as necessary and can share the ministry's jurisdictional review of how other similar-sized and larger municipalities reuse biosolids.

The beneficial reuse option selected for treated biosolids must meet the requirements for beneficial use specified in the Canadian Council of Ministers of the Environment *Canada-Wide Approach for the Management of Wastewater Biosolids* (October 11, 2012) and be based on scientific evidence. This definitive plan for the beneficial reuse of biosolids will replace the current proposal to use a biocell for storage.

Please continue to work with staff in the Environmental Protection Division of the Ministry of Environment to ensure that the proposed wastewater treatment facility is registered under the Municipal Wastewater Regulation prior to operation of the plant. Please also inform ministry staff of all beneficial uses of biosolids being considered, in order to ensure all necessary forms of authorization are obtained in advance of discharge.

Additionally, the CRD should continue to engage First Nations and the public on all aspects of theCALWMP.

Be advised that the ministry intends to publically post any reports or other documents received by the CRD on the ministry website related to this conditional approval, the CALWMP and this activity regulated under the *Environmental Management Act.*

...3

Approval of Amendment No.11 to the CALWMP does not authorize entry upon, crossing over or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the local government. This amendment is approved pursuant to the provisions of the *Environmental Management Act,* which asserts it is an offence to discharge waste without proper authorization. It is also the regional district's responsibility to ensure that all activities conducted under this plan amendment are carried out with regard to the rights of third parties and comply with other applicable legislation that may be in force.

Sincerely,

11/cd_,

Mary Polak
Minister

cc: Honourable Peter Fassbender, Minister of Community, Sport and Cultural Development
AJ Downie, Director, Environmental Protection Division, Ministry of Environment
Robert Lapham, Chief Administrative Officer, Capital Regional District
Larisa Hutcheson, Interim Project Director, Core Area Wastewater Treatment Project, Capital Regional District
Sharon Singh, Associate, Bennett Jones Vancouver

Appendix B

CRD Board Minutes Land Application Restrictions July 13, 2011

Making a difference...together

MINUTES OF THE MEETING OF THE CAPITAL REGIONAL DISTRICT BOARD,
<u>held Wednesday, July 13, 2011 in the Board Room, 625 Fisgard Street, Victoria, BC</u>

PRESENT: **Directors:** G. Young (Chair), S. Brice, J. Brownoff, C. Causton, L. Cross, V. Derman, B. Desjardins, J. Evans, D. Fortin, C. Green (for A. Finall), K. Hancock, G. Hendren, M. Hicks (3:30 p.m.), G. Hill, P. Lucas, F. Leonard (2:37 p.m.), J. Mar, J. Mendum, J. Ranns (2:37 p.m.), D. Saunders, L. Seaton (for D. Blackwell), C. Thornton-Joe and L. Wergeland
Staff: K. Daniels, J. Hull, L. Hutcheson, B. Lapham, L. Rushton, S. Santarossa and N. More (Recorder)
Also Present: Kathryn Stuart, Staples McDannold Stewart, Board Solicitor

ABSENT: J. Brownoff, L. Cross and B. Desjardins,

The Chair called the meeting to order at 2:34 p.m.

1 APPROVAL OF THE AGENDA

MOVED by Director Lucas, **SECONDED** by Director Derman,
That the agenda and supplementary agenda be approved; and

That a Notice of Motion to be presented by Director Derman be added to the agenda under item 8 (New Business).

CARRIED

MOVED by Director Derman, **SECONDED** by Alternate Director Green,
That the late request to speak by C. Bannister (#19) be approved.

DEFEATED
Evans OPPOSED

2 ADOPTION OF MINUTES OF THE MEETING OF JUNE 15, 2011

MOVED by Lucas, **SECONDED** by Director Hancock,
That the minutes of the meeting of June 15, 2011 be adopted.

CARRIED

3 REPORT OF THE CHAIR

Chair Young acknowledged the passing of former Capital Regional District (CRD) Alternate Director Allan Cassidy, highlighting his service to the CRD Board from 1999–2002 and 2007, his role as a Royal and McPherson Theatre Society Board member, 2000–2004, and his involvement with the restoration of the Royal Theatre.

Directors Leonard and Ranns entered the meeting at 2:37 p.m.

4 PRESENTATIONS/DELEGATIONS

a) Canadian Association of Municipal Administrators (CAMA) 2011 Education Award – Bill Holtby

Bill Holtby, CAMA Board representative, recognized the CRD for its leadership in the education of its municipal employees because of the custom training program called iLead, developed in association with Royal Roads University (RRU), and presented the CRD with the 2011 National Municipal Education Award in the form of a plaque. Chair Young expressed appreciation on behalf of the CRD Board and thanked RRU for assisting in designing and implementing the iLead program.

b) Victoria Airport Authority 2010 Report to Nominators – Colin Smith, CRD Nominee and Geoff Dickson, President & CEO

Mr. Smith reported on the 2010 activities of the Victoria Airport Authority, using a PowerPoint presentation to illustrate main points, with the assistance of Mr. Dickson. He also provided an overview of the 2011 Capital Program.

c) Supplementary delegates

1. Ruby Commandeur re Item 5.3.1 – Director Lucas Motion re Biosolids—spoke in favour of the motion because of the toxicity of contaminants in biosolids, the pressures on the food supply due to climate change, how farmland is managed and the difficulty in regulating the use of biosolids on farmland. She urged the Board to think carefully on decisions about land use application of biosolids.
2. Marcie Zemluk re Item 5.3.1 – Director Lucas Motion re Biosolids—spoke about the legal liabilities in American case law and current cases before the Canadian courts on the issue of biosolids land application. She noted the importance of understanding the potential for contaminated sites, ongoing regulatory responsibility and liability for the Province and the CRD, and the hardship that an error in regulation or monitoring can have on farmland in the region.
3. Chloe Donatelli re Item 5.3.1 – Director Lucas Motion re Biosolids—Did not appear to speak when called.

Directors Cross and Mendum left the meeting at 3:10 p.m.

Director Mar excused himself from the meeting at 3:13 p.m., noting that he cannot be present to receive further input on the Peninsula Co-op development proposal as the public hearing has been held.

4. David Lawson re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the Central Saanich Official Community Plan (OCP) and the Regional Growth Strategy (RGS).

Director Desjardins left the meeting at 3:15 p.m.

5. Mike Achtem re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because of economic impacts of concern related to the development proposal.
6. Jennifer Kay re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the OCP and the RGS.
7. Don & Shelly Bottrell re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the OCP.
8. Alexander Marr re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the RGS.

Director Hicks entered the meeting at 3:30 p.m.

9. David Wilson re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the OCP.
10. Tom Hall re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—Did not appear to speak when called.
11. Michelle Passmore re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—Did not appear to speak when called.
12. Hanne Kohout re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the RGS.
13. Carol Pickup re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—withdrawn from agenda prior to the meeting.
14. Constance Christiansen re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—Did not appear to speak when called.
15. Ryan Windsor re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in favour of the response because the development proposal is inconsistent with the OCP and the RGS, and due to the importance of maintaining the integrity of the OCP and RGS.
16. Frances Pugh re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke in appreciation of the RGS and the response.
17. Jack Thornburg re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke of the interests of the larger community and the legacy to future generations in the thoughtful stewardship of land, air and water.
18. John Hannam re Item 5.8.1 – Response to Central Saanich Referral re Peninsula Co-op—spoke of stormwater management issues and inconsistencies with the OCP and the RGS.

Director Mar returned to the meeting at 3:45 p.m.
Directors Brownoff and Mendum left the meeting at 3:45 p.m.

5 REPORTS OF COMMITTEES

5.1 CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE – June 29, 2011

1. Core Area Infrastructure Upgrade Projects for 2011

MOVED by Director Brice, **SECONDED** by Director Leonard,
That the CRD Board authorize proceeding with the infrastructure upgrading projects identified in Appendix A of the staff report, that costs be shared as outlined in Appendix B of the staff report, and that funding be provided by the trunk sewer reserve fund in the amount of $530,000.

CARRIED

5.2 ELECTORAL AREA SERVICES COMMITTEE – June 1, 2011

1. Galiano Island Community Use Building Service Establishment And Loan Authorization Bylaws

MOVED by Director Hancock, **SECONDED** by Director Hicks,
That a second referendum be held concurrently with the November 2011 BC civic election in order to confirm the proposed service area's position regarding the updated service establishment and loan authorization bylaws.

CARRIED

MOVED by Director Hancock, **SECONDED** by Director Hicks,
That Bylaw No. 3792, cited as "Galiano Island Community Use Building Service Establishment Bylaw No. 2, 2011", be introduced and read a first time and second time.

CARRIED

MOVED by Director Hancock, **SECONDED** by Director Hicks,
That Bylaw No. 3792 be read a third time.

CARRIED

Director Mendum returned to the meeting at 3:47 p.m.

MOVED by Director Hancock, **SECONDED** by Director Hicks,
That Bylaw No. 3793, cited as "Galiano Island Community Use Building Loan Authorization Bylaw No. 2, 2011", be introduced and read a first and second time.

CARRIED

MOVED by Director Hancock, **SECONDED** by Director Hicks,
That Bylaw No. 3793 be read a third time.

CARRIED

2. Grants-In-Aid

MOVED by Director Hancock, **SECONDED** by Director Hicks,
That the following grants-in-aid applications be approved for payment:

1. Juan de Fuca Grants-in-Aid as approved by Director Hicks
   a) Shirley Community Association $4,800
2. Salt Spring Island Grants-in-Aid as approved by Director Hendren
   a) Canadian Red Cross $5,014
3. Southern Gulf Islands Grants-in-Aid as approved by Director Hancock
   a) Mayne Island Integrated Water Systems Society $3,607
   b) Pender Community Transition Society $2,000
   c) Saturna Heritage Committee $2,000

CARRIED

5.3 ENVIRONMENTAL SUSTAINABILITY COMMITTEE – May 25, 2011

1. Motion to Protect Local Farmland and to Harmonize Sewage Treatment Strategies within the CRD – Director Lucas

MOVED by Director Lucas, **SECONDED** by Director Derman,
Whereas the CRD is committed to developing regional sewage treatment strategies that have the lowest impact on both the environment and public health, and the highest resource recovery potential;

And Whereas the Core Area Liquid Waste Management Committee has passed a motion banning the land application of biosolids in order to address legitimate public health and environmental concerns about the accumulation and dispersal of Polycyclic Aromatic Hydrocarbons, heavy metals, pharmaceuticals, and other Emerging Compounds of Concern (ECCs) on our land, in our food, and in the regional water table;

And Whereas protecting the "integrity of rural communities" and "regional green and blue spaces", and managing "natural resources and environmental sustainability" are important and explicit goals and responsibilities of the CRD as outlined in the Regional Growth Strategy (http://tinyurl.com/65wdd8p), and "improving population health and regional food security" are noted as Priority Actions in the Capital Region Food and Health Action Plan (http://tinyurl.com/4xetqbz);

Be it so moved that the CRD will harmonize current and long-term practices at all CRD-owned regional facilities and parks with the approved policies of the regional treatment strategy, including ending the production, storage and distribution of biosolids for land application at all CRD facilities and parks; and

Be it further moved that the CRD does not support the application of biosolids on farmland in the CRD under any circumstances, and let this policy be reflected in the upcoming Regional Sustainability Strategy.

MOVED by Director Hendren, **SECONDED** by Director Hancock,
That the motion **be amended** by adding the following:
"That it be further moved that the pasteurized, lime-stabilized Class A biosolids material produced at the Saanich Peninsula Wastewater Treatment Plant may be beneficially used by Hartland Landfill operations to replace chemical fertilizers as the soil amendment blended with soil and compost for use as the final cover material in the closure of Phase 2 Cell 1, in full compliance with all environmental and health regulations."

Concerns were raised that the amendment creates an exception and that other exemptions may need to be considered.

MOVED by Director Evans, **SECONDED** by Director Hill,
That the **amendment be referred** to the Environmental Sustainability Committee for consideration.

CARRIED

MOVED by Director Hendren, **SECONDED** by Director Hill,
That consideration of the main motion be postponed until the Environmental Sustainability Committee reports on exemptions.

DEFEATED
Hicks, Ranns, Evans, Seaton, Young, Brice, Causton and Wergeland IN FAVOUR

The question on the main motion was called. **CARRIED**
Evans, Seaton, Causton OPPOSED

Director Saunders left the meeting at 4:17 p.m.

5.4 ENVIRONMENTAL SUSTAINABILITY COMMITTEE – June 22, 2011

1. **#EEP 11-44 Millstream Meadows 2011 Work Plan – Award of Project Management Consulting Contract**

Director Causton and Alternate Director Green left the meeting at 4:19 p.m.

MOVED by Director Ranns, **SECONDED** by Director Derman,
That staff be directed to:
1) award a project management consulting contract to Golder Associates Ltd. at a cost of $265,000 excluding HST to implement the Stage 1 work;
2) undertake the design and tendering for the Stage 1 work; and
3) report to the Committee following completion of Stage 1 work.

CARRIED
Director Evans OPPOSED

5.5 FINANCE AND CORPORATE SERVICES COMMITTEE – July 6, 2011

1. Recreation Services and Facilities Fees and Charges 2011/2012

Director Causton and Alternate Director Green returned to the meeting at 4:20 p.m.

MOVED by Director Mar, **SECONDED** by Director Evans,
That Bylaw No. 3794, cited as "Capital Regional District Recreation Services and Facilities Fees and Charges Bylaw No. 1, 2009, Amendment Bylaw No. 2, 2011", be introduced and read a first and second time.

MOVED by Director Evans, **SECONDED** by Director Mar,
That consideration of Bylaw No. 3794, cited as "Capital Regional District Recreation Services and Facilities Fees and Charges Bylaw No. 1, 2009, Amendment Bylaw No. 2, 2011", **be postponed** until the SEAPARC Recreation Commission has reviewed the proposed fee changes.

CARRIED

2. Budget Direction for the Year 2012

MOVED by Director Causton, **SECONDED** by Director Evans,
That staff prepare the draft 2012 financial plan within the following guidelines:
1) no increase in service levels for existing services
2) new services only as previously approved by the Board
3) staff continue to explore innovative practices to absorb inflationary costs, benefits and utility/fuel costs within existing budgets as much as possible
4) the draft budget recognize provisions for new initiatives directly related to the Board's strategic priorities.

Staff noted that an interim budget report will be forwarded to the committee in October.

The question on the motion was called. **CARRIED**

5.6 JUAN DE FUCA LAND USE COMMITTEE – VOTING BLOCK A – June 21, 2011

1. Development Permit with Variance – DP-09-11 – Lot A, Section 74, Renfrew District, Plan VIP71883 (Lynge – 11237 West Coast Road)

MOVED by Director Hicks, **SECONDED** by Director Evans,
That the steep slopes, foreshore and marine shoreline and watercourses, wetlands and riparian areas development permit (DP-09-11) for Lot A, Section 74, Renfrew District, Plan VIP71883 and the request for:

a. Relaxation of the rear yard setback from 15m to 7.5m for the existing deck; and
b. Exemption from floodplain setback regulations of Part 5 of Bylaw No. 2040, as shown in Appendices 1 and 2, be approved subject to the following conditions:
    i. that the proposed development comply with the Steep Slope, Foreshore and Marine Shoreline and Watercourses, Wetlands and Riparian Areas Development Permit Guidelines outlined in the Shirley/Jordan River Official Community Plan, Bylaw No. 3352;

ii. that the driveway proposed to be constructed prior to subdivision comply with CRD Residential Driveway standards;
iii. that the proposed development comply with the recommendations outlined in the environmental report prepared by Brian Wilkes & Associates dated November 18, 2010; and
iv. that the geotechnical report prepared by Ryzuk Geotechnical dated December 15, 2010, as shown in Appendix 4, be recommended to be secured by the Approving Officer as a restrictive covenant as part of the subdivision process.

CARRIED

5.7 JUAN DE FUCA LAND USE COMMITTEE – VOTING BLOCK B – June 21, 2011

1. Development Permit with Variance – DP-08-11 – Block 352, Malahat District, Except Part in VIP84067 and Block 399 Malahat District (Isis Land Corporation/Hawes)

MOVED by Director Hicks, **SECONDED** by Director Mar,
That the steep slope and foreshore, wetland and riparian development permit (DP-08-11) for Block 352, Malahat District, Except Part in VIP84067 and Block 399 Malahat District District, and the request for an exemption of Section 944 of the Local Government Act to relax the requirement that the minimum frontage of a lot shall be one tenth of the perimeter of the lot that fronts on the highway, for the purposes of permitting a 86-lot subdivision, be approved subject to the following conditions:

a. That the proposed subdivision and development comply with the Development Permit Guidelines in the Malahat Official Community Plan, Bylaw No. 3228; and
b. That the geological reports prepared by Thurber Engineering Ltd. dated October 18, 2010, and April 18, 2011 as shown in Appendix 3, be secured by restrictive covenant as part of the building permit process; and
c. That the report prepared by PA Harder and Associates Ltd. dated March 31, 2011, be secured by restrictive covenant as part of the building permit process; and
d. That the applicant register a Statutory Right of Way to provide access to Regional Parks for access to and construction of the portion Trans Canada Trail through the property as shown on Appendix 2.

CARRIED
Leonard and Mendum OPPOSED

5.8 PLANNING, TRANSPORTATION AND PROTECTIVE SERVICES COMMITTEE – June 22, 2011

Director Hicks left the meeting at 4:45 p.m.

Staff reported on legal opinion about the potential for conflict of interest in regard to Directors and Co-op membership. Upon advice to Directors to seek legal advice or make their own decision on whether they have a conflict, it was determined there would not be quorum to hear the item.

MOVED by Director Fortin, **SECONDED** by Director Lucas,
That consideration of the agenda item "Response to Central Saanich Referral re Peninsula Co-op" be postponed until the next meeting to give Directors that are members of the Peninsula Co-op an opportunity to determine whether they have a conflict of interest.

CARRIED

Staff was requested to circulate the legal opinion prepared by Staples McDannold Stewart.

Staff was asked to close the item to further delegations, since it was a postponement on procedural grounds rather than for the addition of new information.

5.9 REGIONAL PARKS COMMITTEE – June 15, 2011

1. E&N Rail Trail Project – Intersection Improvements Esquimalt Road to Admirals/Colville

MOVED by Director Causton, **SECONDED** by Director Hill,
That the single source procurement of rail infrastructure improvements be approved for five intersections and one pedestrian crossing in the amount of $1,672,200 (not including HST) as per the letters from SVI dated May 17, 2011.

CARRIED

MOVED by Director Causton, **SECONDED** by Director Mar,
That commencement of the expenditure is conditional upon confirmation by the provincial and federal governments that they will financially support active use of the E&N rail line.

CARRIED

MOVED by Director Causton, **SECONDED** by Director Evans,
That this motion be included in the Board Chair's letters to the Minister of Transportation and Infrastructure and the federal government regarding rail investment.

CARRIED

2. Elk/Beaver Lake Recreational Use Advisory Group Revised Terms of Reference

MOVED by Director Evans, **SECONDED** by Director Lucas,
That the revised Terms of Reference for the Elk/Beaver Lake Recreational Use Advisory Group be approved.

CARRIED

6 ADMINISTRATION REPORTS

6.1 2011 GENERAL LOCAL ELECTION – APPOINTMENT OF CHIEF ELECTION OFFICER AND DEPUTY CHIEF ELECTION OFFICER – ELECTORAL AREA DIRECTORS

MOVED by Director Evans, **SECONDED** by Director Lucas,

1) That pursuant to Section 41 of the Local Government Act, Thomas F. Moore be appointed Chief Election Officer with the power to appoint such other assistance as may be required for the administration and conduct of the 2011 General Local Election of the Capital Regional District Electoral Area Directors; and

2) That Sonia Santarossa, Sheila Norton, Kerry Fedosenko, Mary Cooper and Anthony Kennedy be appointed Deputy Chief Election Officers

CARRIED

6.2 EXTENSION TO THE CONTRACT WITH LANGFORD FOR CALL RELAY SERVICES

MOVED by Director Seaton, **SECONDED** by Director Evans,
That an extension of the Call Relay Contract with the City of Langford from August 1, 2011 to May 31, 2012 in the amount of $364,574 be approved.

CARRIED

7 BYLAWS AND RESOLUTIONS

7.1 BYLAW NO. 3784, "SOUTHERN GULF ISLANDS ELECTORAL AREA FALSE ALARM REDUCTION BYLAW NO. 1, 2011"

MOVED by Director Hancock, **SECONDED** by Director Evans,
That Bylaw No. 3784 "Southern Gulf Islands Electoral Area False Alarm Reduction Bylaw No. 1, 2011" be adopted.

CARRIED

7.2 BYLAW NO. 3785, "ANIMAL REGULATION AND IMPOUNDING BYLAW NO. 1, 1986, AMENDMENT BYLAW NO. 8, 2011"

MOVED by Director Hancock, **SECONDED** by Director Evans,
That Bylaw No. 3785 "Animal Regulation and Impounding Bylaw No. 1, 1986, Amendment Bylaw No. 8, 2011" be adopted.

CARRIED

8 NEW BUSINESS

8.1 2011 GENERAL LOCAL ELECTION – APPOINTMENT OF CHIEF ELECTION OFFICER AND DEPUTY CHIEF ELECTION OFFICER (ISLANDS TRUST) & ISLANDS TRUST 2011 ELECTION SERVICES AGREEMENT

MOVED by Director Evans, **SECONDED** by Director Leonard,

a) That the Islands Trust 2011 Election Services Agreement between the CRD and the Islands Trust Council be approved and authorized for execution; and
b) That pursuant to Section 41 of the Local Government Act, Thomas F. Moore be appointed Chief Election Officer with the power to appoint such other assistance as may be required for the administration and conduct of the 2011 General Local Election of Island Trustees; and
c) That Sonia Santarossa, Sheila Norton, Kerry Fedosenko, Mary Cooper and Anthony Kennedy be appointed Deputy Chief Election Officers.

CARRIED

8.2 NOTICE OF MOTION – VIC DERMAN – MARINE TRAIL HOLDINGS

Director Derman gave notice of his intention to propose the following motion at the August Board meeting:

That the Board of the Capital Regional District determines that the Marine Trail Holdings Ltd. Rezoning application to build 257cabins, 6 caretaker residences, a resort lodge and two recreation centres in the Juan de Fuca Rural Resource lands is inconsistent with the Regional Growth Strategy and therefore shall not be permitted to proceed.

9 MOTION TO MOVE IN CAMERA

MOVED by Director Hill, **SECONDED** by Director Derman,
That the Board close the meeting and move in camera in accordance with the Community Charter, Part 4, Division 3, 90(1)(a) personal information about an identifiable individual who is being considered for a position appointed by the Board; (i) the receipt of advice that is subject to solicitor-client privilege, including communications necessary for that purpose.

CARRIED

The Board convened the in camera portion of the meeting at 5:00 p.m. and resumed in open meeting at 5:32 p.m. to rise and report.

10 RISE AND REPORT

- **Water Treatment Upgrade Project**
  That payment is authorized to Ridgeline Mechanical Ltd. in the amount of $190,000 from the Highland and Fernwood Water Treatment Upgrade Project funds to settle a claim related to CRD Contract No. 09-1645.

- **Appointment to Juan de Fuca Economic Development Commission**
  Ken Douch was appointed.

- **Appointment to Port Renfrew Utility Services Committee**
  Dorothy Hunt was appointed.

11 ADJOURNMENT

MOVED by Director Hill, **SECONDED** by Director Derman,
That the meeting be adjourned at 5:35 p.m.

CARRIED

CERTIFIED CORRECT:

______________________________ ______________________________

CHAIR **CORPORATE OFFICER**

Appendix C

CRD Board Minutes Land Application

February 15, 2023

Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Notice of Meeting and Meeting Agenda
Environmental Services Committee

Wednesday, February 15, 2023 | **1:30 PM** | **6th Floor Boardroom, 625 Fisgard St., Victoria, BC V8W 1R7**

B. Desjardins (Chair), S. Tobias (Vice Chair), J. Brownoff, J. Caradonna, G. Holman, D. Kobayashi, D. Murdock, M. Tait, D. Thompson, A. Wickheim, C. Plant (Board Chair, ex-officio)

The Capital Regional District strives to be a place where inclusion is paramount and all people are treated with dignity. We pledge to make our meetings a place where all feel welcome and respected.

1. Territorial Acknowledgement

2. Approval of Agenda

3. Adoption of Minutes

3.1. 23-156 Minutes of the January 18, 2023 Environmental Services Committee Meeting

Recommendation: That the minutes of the Environmental Services Committee meeting of January 18, 2023 be adopted as circulated.

Attachments: Minutes - January 18, 2023

4. Chair’s Remarks

5. Presentations/Delegations

The public are welcome to attend CRD Board meetings in-person.

Delegations will have the option to participate electronically. Please complete the online application at www.crd.bc.ca/address no later than 4:30 pm two days before the meeting and staff will respond with details.

Alternatively, you may email your comments on an agenda item to the CRD Board at crdboard@crd.bc.ca.

5.1. 23-166 Delegation - Dave Cowen; Representing Peninsula Biosolids Coalition: Re: Agenda Item 7.1.: Motion with Notice: Healthy Waters Project for Tod Creek on the Saanich Peninsula (Director Caradonna)

6. Committee Business

6.1. 23-103 2022 Solid Waste Stream Composition Study Results

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: 2022 Solid Waste Stream Composition Study Results

Appendix A: CRD 2022 Solid Waste Stream Composition Study - Tetra Tech

6.2. 23-130 Recycle BC - Packaging and Printed Paper Product, Extended Producer Responsibility - Draft Program Plan

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Recycle BC - Packaging & Paper, EPR - Draft Program Plan

Appendix A: Cont'd Participation in EA Depot Recycling - SR - Feb 7/18

Appendix B: Depot Impacts Analysis

Appendix C: Consultation Feedback Ltr to Recycle BC from CRD (Jan 3/23)

6.3. 23-131 Central Saanich Request for CRD Carbon-based Budget Policy

Recommendation: The Environmental Services Committee recommends to the Capital Regional District Board:
That the CRD not adopt a policy of carbon budgeting as part of its budget cycle but continue to monitor progress in carbon budget methodologies and implications on CRD financial planning processes and share learnings with local governments through the CRD Inter-Municipal Working Group and Task Force, as appropriate.

Attachments: Staff Report: Central Saanich Request for CRD Carbon-based Budget Policy

Appendix A: Central Saanich Letter to CRD Board - November 8, 2022

Appendix B: Summary and History of Carbon Budgeting

6.4. 23-138 Bylaw No. 2922 - Sewer Use Bylaw Amendments

Recommendation: The Environmental Services Committee recommends to the Capital Regional District Board:
1. That Bylaw No. 4530, "Capital Regional District Sewer Use Bylaw No. 5, 2001, Amendment Bylaw No. 7, 2023", be introduced and read a first, second, and third time; and
2. That Bylaw No. 4530 be adopted.
3. That Bylaw No. 4531, "Capital Regional District Ticket Information Authorization Bylaw 1990, Amendment Bylaw No. 75, 2023", be introduced and read a first, second, and third time; and
4. That Bylaw No. 4531 be adopted.

Attachments: Staff Report: Bylaw No. 2922 - Sewer Use Bylaw Amendments

Appendix A: Bylaw No. 2922 - Unofficial Consolidated Bylaw with Amendments

Appendix B: Bylaw No. 4530

Appendix C: Bylaw No. 4531

7. Motions with Notice

7.1. 23-154 Motion with Notice: Healthy Waters Project for Tod Creek on the Saanich Peninsula (Director Caradonna)

Recommendation: That the Healthy Waters project proposal for Tod Creek watershed be referred to staff to report back, by end of March or within the span of two committee meetings, on project implications including resources, service mandate, and regulatory framework.

Attachments: Motion with Notice: Healthy Waters Project for Tod Creek

8. New Business

9. Adjournment

The next meeting is March 29, 2023 at 9:30 am (Special).

To ensure quorum, please advise Jessica Dorman (jdorman@crd.bc.ca) if you or your alternate cannot attend.

Capital Regional District

625 Fisgard St.,
Victoria, BC V8W 1R7

Meeting Minutes

Environmental Services Committee

Wednesday, January 18, 2023 **1:30 PM** **6th Floor Boardroom 625 Fisgard St. Victoria, BC V8W 1R7**

PRESENT
Directors: B. Desjardins (Chair), S. Tobias (Vice Chair), J. Brownoff, J. Caradonna, G. Holman (EP), D. Kobayashi, D. Murdock, M. Tait, D. Thompson

Staff: T. Robbins, Chief Administrative Officer; L. Hutcheson, General Manager, Parks and Environmental Services; G. Harris, Senior Manager, Environmental Protection; S. May, Senior Manager, Environmental Engineering; M. Lagoa, Deputy Corporate Officer; J. Dorman, Committee Clerk (Recorder)

EP - Electronic Participation

Regrets: Director(s) C. Plant, A. Wickheim

The meeting was called to order at 1:30 pm.

1. Territorial Acknowledgement

Vice Chair Tobias provided a Territorial Acknowledgement.

2. Approval of Agenda

MOVED by Director Caradonna, SECONDED by Director Kobayashi,
That the agenda for the January 18, 2023 Environmental Services Committee meeting be approved.
CARRIED

3. Adoption of Minutes

3.1. 23-065 Minutes of the June 15, 2022 and the minutes of the September 28, 2022 Environmental Services Committee Meeting.

MOVED by Director Tait, SECONDED by Director Murdock,
That the minutes of the Environmental Services Committee meeting of June 15, 2022 and September 28, 2022 be adopted as circulated.
CARRIED

4. Chair's Remarks

I am pleased to continue as the Chair of the Environmental Services Committee and looking forward to working with all of the committee members. We are in exciting times within the mandate and work of the Environmental Services Committee, we are on critical paths towards solutions for solid resources whether they be biosolids, wood solid, or organic resources. We are also coming through the pandemic time, where Hartland received a significant per capita increase, and that adds more pressure to make good decisions and set direction going forward. We need some good decision making for critical movement forward for our climate and solid waste targets.

5. Presentations/Delegations

There were no presentations.

5.1. 23-068 Delegation - Daniel Kenway; Representing Willis Point Community Association: Re: Agenda Item 6.3.: Evaluation of Passing Lane on Willis Point Road

D. Kenway spoke to item 6.3.

5.2. 23-071 Delegation - Philippe Lucas; Representing Biosolid Free BC: Re: Agenda Item 6.2.: Biosolids Short-term Contingency Beneficial Use Plan

P. Lucas spoke to Item 6.2.

5.3. 23-072 Delegation - Hugh Stephens; Representing Peninsula Biosolids Coalition: Re: Agenda Item 6.2.: Biosolids Short-term Contingency Beneficial Use Plan

H. Stephens spoke to Item 6.2.

6. Committee Business

6.1. 23-044 2023 Environmental Services Committee Terms of Reference

L. Hutcheson presented 6.1. for information.

Discussion ensued on clarification of corporate and community climate action.

There is no recommendation. This report is for information only.

6.2. 23-052 Biosolids Short-term Contingency Beneficial Use Plan

G. Harris spoke to Item 6.2.

Discussion ensued on the following:
- water quality testing and monitoring
- thermal process pilot studies and established programs
- consultation and engagement processes
- chemicals and contaminants testing
- contingency planning related to operational changes
- shipping and additional costs
- associated risks of the service
- land application in other jurisdictions
- regulatory process
- gasification or composting possibilities

MOVED by Director Holman, SECONDED by Director Tait,
That the Environmental Services Committee recommends to the Capital Regional District Board:
1. That the Capital Regional District (CRD) Board amend its policy to allow non-agricultural land application of biosolids as a short-term contingency alternative;
and
2. That staff be directed to update the CRD's short-term biosolids contingency plan correspondingly.
DEFEATED
OPPOSED: Caradonna, Desjardins, Kobayashi, Thompson, Tobias

MOVED by Director Caradonna, SECONDED by Director Thompson,
That we move to direct staff to look at alternative options and maintain the status quo for now.
CARRIED
OPPOSED: Brownoff, Holman, Murdock, Tait

6.3. 23-009 Evaluation of Passing Lane on Willis Point Road

S. May presented Item 6.3. for information.

Discussion ensued on the following:
- existing turn lanes off of Willis Point road
- jurisdiction and authority of road
- cost of passing lane

There is no recommendation. This report is for information only.

7. Notice(s) of Motion

Appendix D

CRD Board Minutes On-Site Thermal RFP

March 29, 2023

Meeting Minutes

Environmental Services Committee

Wednesday, March 29, 2023	**9:30 AM**	**6th Floor Boardroom 625 Fisgard St. Victoria, BC V8W 1R7**

Special Meeting

PRESENT
Directors: B. Desjardins (Chair), S. Tobias (Vice Chair), J. Brownoff, J. Caradonna, G. Holman (9:33 am) (EP), D. Kobayashi (EP), D. Murdock, M. Tait (9:43 am) (EP), D. Thompson (9:51 am) (EP), A. Wickheim, C. Plant (Board Chair, ex-officio)

Staff: T. Robbins, Chief Administrative Officer; L. Hutcheson, General Manager, Parks and Environmental Services; G. Harris, Senior Manager, Environmental Protection; R. Smith, Senior Manager, Environmental Resource Management; N. Elliott, Climate Action Program Coordinator, Environmental Protection; L. Ferris, Manager, Policy & Planning, Environmental Resource Management; M. Lagoa, Deputy Corporate Officer; J. Dorman, Committee Clerk (Recorder)

EP - Electronic Participation

The meeting was called to order at 9:30 am.

1. Territorial Acknowledgement

Vice Chair Tobias provided a Territorial Acknowledgement.

2. Approval of Agenda

MOVED by Director Caradonna, SECONDED by Director Wickheim,
That the agenda for the March 29, 2023 Environmental Services Committee meeting be approved.
CARRIED

3. Presentations/Delegations

3.1. 23-258 Delegation - Philippe Lucas; Representing Biosolid Free BC: Re: Agenda Item 4.1.: Long-term Biosolids Planning and Biosolids Thermal Plan Updates

P. Lucas spoke to Item 4.1.

3.2. 23-259 Delegation - Jonathan O'Riordan; Representing Peninsula Biosolids Coalition: Re: Agenda Item 4.1.: Long-term Biosolids Planning and Biosolids Thermal Plan Updates

J. O'Riordan spoke to Item 4.1.

4. Special Meeting Matters

4.1. 23-253 Long-term Biosolids Planning and Biosolids Thermal Plan Updates

L. Hutcheson spoke to Item 4.1.

Discussion ensued on the following:
- gasification and thermal processing of biosolids in North America
- international participation in RFP
- co-processing of municipal waste streams
- pyrolysis pilot study in Kelowna and pilot study in Esquimalt
- resource recovery and potential innovation grants
- funding for thermal processing pilot studies
- potential collaboration with other regional districts
- air quality and differentiating technologies
- timelines for consolidation, proposal call, and long term plan

Director Tait joined the meeting at 9:43 am.

Director Thompson joined the meeting at 9:51 am.

Director Murdock left the meeting at 9:53 am.

MOVED by Director Caradonna, SECONDED by Director Tobias,
The Environmental Services Committee recommends to the Capital Regional District Board:

1. That staff develop a consultation plan for long-term biosolids management for the July Environmental Services Committee meeting, to be implemented in the fall of 2023; and
2. That staff concurrently initiate a Request for Proposals process for a biosolids advanced thermal site trial.

Director Murdock returned to the meeting at 10:05 am.

Director Tait left the meeting at 10:16 am.

MOVED by Director Caradonna, SECONDED by Director Plant,
That the following words be added following" site trial"; "and that the RFP be scoped broadly to include potential for co-processing of municipal solid waste streams, and that submissions be welcomed from both domestic and international vendors".
CARRIED

The question was called on the main motion as amended.
The Environmental Services Committee recommends to the Capital Regional District Board:
1. That staff develop a consultation plan for long-term biosolids management for the July Environmental Services Committee meeting, to be implemented in the fall of 2023; and
2. That staff concurrently initiate a Request for Proposals process for a biosolids advanced thermal site trial; and that the RFP be scoped broadly to include potential for co-processing of municipal solid waste streams, and that submissions be welcomed from both domestic and international vendors.
CARRIED

4.2. [23-239] Capital Regional District Climate Action Inter-Municipal Task Force

N. Elliott spoke to Item 4.2.

MOVED by Director Brownoff, SECONDED by Director Caradonna,
The Environmental Services Committee recommends to the Capital Regional District Board:
That the Terms of Reference for the Climate Action Inter-Municipal Task force, attached as Appendix A, be approved.
CARRIED

4.3. [23-131] Central Saanich Request for CRD Carbon-based Budget Policy

N. Elliott spoke to Item 4.3

Discussion ensued on the participants and outcomes of the workshop.

Motion Arising:
MOVED by Director Caradonna, SECONDED by Director Plant,
The Environmental Services Committee recommends to the Capital Regional District Board:
That CRD staff host a workshop on the concept of carbon budgeting with municipal and electoral area staff and elected officials.
CARRIED
OPPOSED: Holman

4.4. [23-236] Solid Waste Advisory Committee Motions of March 3, 2023

R. Smith presented Item 4.4. for information.

Discussion ensued on the following:
- organics processing and composting within the region
- current mandates on collection
- waste composition study
- Compost Education Centre

MOVED by Director Plant, SECONDED by Director Caradonna,
The Environmental Services Committee recommends to the Capital Regional District Board:
That staff be directed to explore mandatory curbside organics collection from the municipalities around the region.
CARRIED

4.5. [23-241] Previous Minutes of Other CRD Committees and Commissions for Information

The following minutes were received for information:
a) Climate Action Inter-Municipal Task Force - March 2, 2023
b) Solid Waste Advisory Committee Minutes - February 3 and March 3, 2023

5. Adjournment

MOVED by Director Murdock, SECONDED by Director Tobias,
That the March 29, 2023 Environmental Services Committee meeting be adjourned at 10:58 am.
CARRIED

____
CHAIR

____
RECORDER

Appendix E

CRD Class A Biosolids SDS

SAFETY DATA SHEET
Dried, Pelletized, Class A biosolids
(From the CRD Residuals Treatment Facility)

SECTION 1 IDENTIFICATION

Material Name:	Biosolids from wastewater treatment
Other Designations:	RTF Biosolids, Class A Biosolids
Source:	CRD Residuals Treatment Facility, Saanich, BC
Product Use:	RTF biosolids are currently used at Hartland as a soil amendment (fertilizer) product after mixing with other carbon and nitrogen sources (wood waste/sand/soil). Off site, biosolids are used as an alternative fuel.

SECTION 2 HAZARD IDENTIFICATION

DANGER: Biosolids may pose a flammability/explosion risk if handled contrary to safety procedures. See Section 16.

Hazard Statements:	Combustible solid – do not expose to moisture/precipitation (exothermic reaction) Combustible dust – dust dispersed in sufficient concentrations in confined spaces, or enclosed areas, may create an explosion hazard in the presence of ignition sources May cause respiratory irritation (dust) May cause eye irritation (dust) Symptoms may be delayed
Precautionary Statements:	No smoking, open flame, sources of heat or ignition. Do not expose to water/moisture unless the material is being blended/mixed with inert material. Do not store as a raw product in large piles for longer than 24 hours. Prompt mixing with inert material recommended.
Other Hazards:	Lung/eye irritant (dust)

SECTION 3 COMPOSITION

Wastewater biosolids are regulated for use under the BC Organic Matter Recycling Regulation. At Hartland, biosolids are blended with sand, soil and wood waste into a biosolids growing medium (BGM) product and applied as a soil amendment for closure areas, or further blended and applied to open areas for landfill gas mitigation.

Biosolids are a brown/grey granular solids consisting of dried wastewater residuals from the CRD's tertiary wastewater treatment plant (McLoughlin Point). Please refer to Appendix 1 for lab results.

SECTION 4 FIRST AID MEASURES

Inhalation:	Remove to fresh air. Check for clear airway, breathing, and presence of pulse. Provide cardiopulmonary resuscitation for person without pulse or respirations. Remove victim to fresh air, if safe to do so. Keep at rest and comfortably warm. Seek medical attention.
Skin Contact:	Wash with soap and water
Eye Contact:	Dust may cause eye irritation. Relocate to fresh air and flush with clean water.
Ingestion:	Not an expected route of exposure. If necessary, consult with a physician.

SECTION 5 FIRE FIGHTING MEASURES

Call fire department immediately and follow site-specific fire safety/response procedures. Do not attempt to extinguish fire.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Avoid exposure to dust. Reload material into containment vessel/bin. Do not allow product to enter surface watercourses.

SECTION 7 HANDLING AND STORAGE

Safe Storage:	Short-term (<24 hours) Store in cool, well-ventilated place. Do not store raw biosolids in ambient air, or expose to precipitation for more than 24 hours. For longer-term storage, store under controlled conditions in oxygen- reduced/free environment with inert gas (e.g. nitrogen or carbon dioxide blanket).
Safe Handling:	Wear full- or half-face respiratory (P100) protection when disturbing material. Avoid dust generation in enclosed areas/buildings.

SECTION 8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Permissible Exposure Limits:	WorkSafeBC limit for Particles (Insoluble or Poorly Soluble) Not Otherwise Classified (PNOC) – 10 mg/m^3 8-hour average for total dust; and 3 mg/m^3 8-hour average for the respirable portion.
PPE:	Always wear chemical-/liquid-resistant gloves (butyl rubber, natural latex, nitrile rubber) and protective eyewear (goggles) when working around biosolids. Standard protective clothing is required at the landfill (follow all site PPE requirements – high visibility gear, steel-toed boots).
Respiratory Protection:	Use half- or full-face respirator equipped with P100 particulate filter when working in areas that have the potential to exceed WorkSafeBC thresholds.

Ensure adequate ventilation when disturbing the material.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Physical State	solid (<10% total moisture)
Appearance	granular/pelletized, soil-like
Colour	brown
Odour	earthy, musty, compost
Odour Threshold	not applicable
Combustion/Explosion	See Section 10

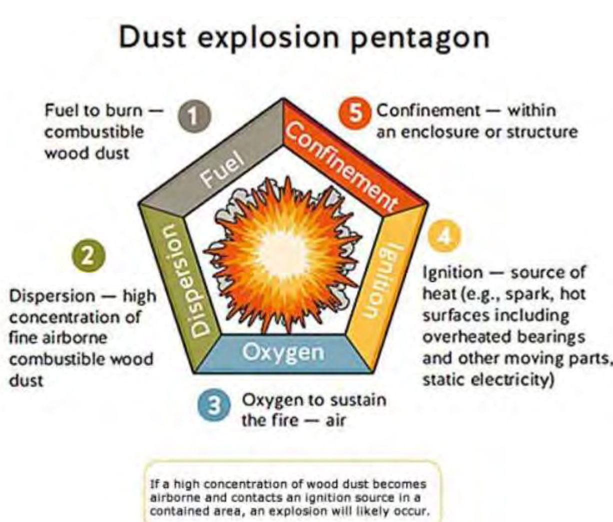
SECTION 10 STABILITY AND REACTIVITY

Combustion:	Dried biosolids undergo slow exothermic oxidation in the presence of oxygen and water/moisture and can undergo combustion. Avoid prolonged exposure to ambient air and moisture in raw form.
Explosivity:	Explosibility testing was completed for the biosolids and results are provided below. At moisture contents less than 10%, the material is explosive as a dust cloud. This is similar to other operations that manage materials that create dust (e.g., flour/grain processing, sawmills, etc.).

Sample	Moisture content (wt.%)	Concentration (g/m^3)	Explosible
Biosolid dust	5.0	1000	Yes
Biosolid dust	10.0	1000	Yes
Biosolid dust	15.0	2000	No
Biosolid dust	20.0	2000	No

WorkSafeBC indicates: “many dusts are combustible, which means they can catch fire and burn. When fine dust particles catch fire while they’re suspended in the air, known as deflagration, fire can spread rapidly and sometimes leads to an explosion”.

When dust is exposed to enough heat or even a spark, it can ignite. When airborne dust is near a fire, it often results in an explosion. For an explosion to occur, the following five factors must be present.



SECTION 11 TOXILOGICAL INFORMATION

Routes Of Exposure:	Inhalation, ingestion, skin and eye contact
Immediate Effects:	May cause irritation to skin or mucous membranes
Toxicity:	No acute toxicity

SECTION 12 ECOLOGICAL INFORMATION

Aquatic Toxicity:	No additional information on aquatic toxicity available.
Additional Ecological Information:	Do not allow biosolids to enter watercourses. Product will cause harm to aquatic organisms (suspended solids/asphyxiation).

SECTION 13 DISPOSAL CONSIDERATIONS

Do not landfill material (prohibited under provincially approved management plan).

SECTION 14 TRANSPORT INFORMATION

UN Classification:	Non-regulated material
Other Transport Considerations:	Loads transported long distances (outside of Hartland) require a nitrogen or non-reactive gas blanket (oxygen free).

SECTION 15 REGULATORY INFORMATION

BC Hazardous Waste Regulation:	Not a Hazardous Waste
Other Regulations:	Management and use of product is regulated under the BC Organic Matter Recycling Regulation.

SECTION 16 OTHER INFORMATION

None.

APPENDIX 1 BIOSOLIDS LAB DATA

Summary statistics: RTF biosolids, February 3 to April 26, 2021.

Substance	OMRR Limit * (mg/kg)	Biosolids Samples **		
		Avg ***	Min	Max
Arsenic (As)	75	2.4	1.7	3.7
Cadmium (Cd)	20	1.4	1.1	1.9
Chromium (Cr)	1060	33.2	26.4	45.2
Cobalt (Co)	151	3.0	2.3	3.9
Copper (Cu)	757	744	591	880
Mercury (Hg)	5	0.6	0.4	1.0
Molybdenum (Mo)	20	6.2	4.8	7.7
Nickel (Ni)	181	17.6	13.0	28.7
Lead (Pb)	505	31.5	25.0	39.0
Selenium (Se)	14	3.6	2.0	4.6
Thallium (Tl)	5	0.08	0.0	<0.5
Vanadium (V)	656	20.7	13.3	33.0
Zinc (Zn)	1868	713	576	826

Solids	n/a	96.9%	94.4%	98.4%
Chlorine	n/a	0.066%	0.061%	0.072%
Iron (Fe)	n/a	29363	23000	35100
Fecal Coliforms	n/a	1.9 MPN/g	<3.0 MPN/g	3.5 MPN/g
Acidity	n/a	5.7 pH	5.6 pH	5.8 pH

Note:
- Mercury: 11 samples.
- Arsenic, Cadmium, Chromium, Cobalt, Copper, Molybdenum, Nickel, Lead, Selenium, Thallium, Vanadium and Zinc: 10 samples.
- Solids and Iron: 8 samples.
- Fecal coliforms: 5 samples.
- Chlorine and pH: 2 samples.
** Based on a 4,400 kg/ha/year application rate.*
*** Values in mg/kg unless otherwise noted. Samples taken from February 3 to April 26, 2021.*
**** Values below the detection limit were replaced with values half the detection limit.*

ATTACHMENT 2

Making a difference...together

EHQ 24-33

REPORT TO CAPITAL REGIONAL DISTRICT BOARD
MEETING OF WEDNESDAY, JUNE 12, 2024

SUBJECT **Long-Term Biosolids Management Strategy**

ISSUE SUMMARY

The Capital Regional District (CRD) is required to submit a long-term biosolids management strategy to the BC Ministry of Environment and Climate Change Strategy (ENV) by June 18, 2024 as a requirement of the CRD's commitments under the Core Area Liquid Waste Management Plan (CALWMP).

BACKGROUND

Regulatory and Technical Considerations

Since the commissioning of the core area wastewater treatment project in 2020, the Capital Regional District (CRD) has been responsible for management of the Class A biosolids produced from the Residuals Treatment Facility (RTF). This new function requires a management plan that demonstrates beneficial use to the provincial regulator. In 2019, the Minister of Environment and Climate Change Strategy approved the short-term CRD Biosolids Beneficial Use Strategy, forming part of the CALWMP (Amendment 11) with the following conditions:

(a) The CRD must include land application in the options analysis and conduct consultation for the long-term biosolids strategy that is intended to be implemented by January 1, 2025.
(b) Options considered should include a range of beneficial uses including, but not limited to: forestry (for example: fertilizer/soil conditioner), reclamation (for example: mines), landfill closure and agriculture.
(c) The consultation process must include citizens, local government and Indigenous communities within the CRD.

In preparation to meet the provincial requirement, the CRD retained a technical consultant who provided a long-term biosolids management options analysis report, which was presented to the Environmental Services Committee in July 2023. In addition to including the options analysis, the report contained an updated review of international biosolids management practices and a summary and evaluation of the advanced thermal (gasification and pyrolysis) pilots procured in 2022.

First Nation Consultation

The CRD undertook a First Nations engagement process that began in February of this year and will continue beyond the submission of the long-term strategy. Nineteen First Nations were included in the established contact list. The engagement sessions were followed up with an invitation to meet directly with individual nations and to continue open dialogue and discussion moving forward at any time. The Board received an update on May 8 and will continue to be updated as these conversations occur.

As directed by the Board, the CRD continues to explore beneficial use opportunities with those Nations that express interest both in-region and out-of-region. The CRD continues to listen to any concerns Nations may have regarding the beneficial use options and is committed to working with individual Nations to address their concerns.

Public Consultation
The formal public consultation period began January 11, 2024. The process included an interactive website that solicited and posted email questions, media releases, print ads, online and representative surveys, and a Virtual Open House The CRD also convened a Technical and Community Advisory Committee (TCAC), starting in October 2023, to provide consultation advice and input regarding biosolids management and beneficial use. A detailed account of what we heard was presented at the May 8 Board meeting.

Proposed Strategy
Based on:

- the Minister of Environment and Climate Change Strategy's direction and provincial requirements
- the CRD Board's ban of the land application of biosolids in the CRD
- the feedback received in the various public engagement processes detailed above
- the technical recommendations provided by GHD in order to develop a robust program that is flexible and provides redundancy in order to minimize operational and compliance risks
- the CRD's goal to have a strategy that:
  - utilizes the existing RTF infrastructure and Class A biosolids already being produced but also prioritizes implementing advanced thermal technology infrastructure
  - minimizes negative impacts on the natural environment
  - protects the health and safety of the public and workers involved in biosolids operations
  - is cost effective, while balancing all of the above considerations

the Long Term Biosolids Management Strategy proposes procuring a portfolio of options in alignment with the technical assessment and utilizing each option under a prioritization structure, summarized as follows:

- **Tier 1**: **Advanced thermal option**
  Constitutes the preferred long-term solution and will be pursued concurrently with options in other tiers.
- **Tier 2**: **Out-of-region compliance options**
  Constitute measures that the CRD will utilize to ensure regulatory compliance is continuously achieved while the Tier 1 thermal processing options are being implemented and when options in Tier 1 are unable to process the totality of biosolids produced in the region.
- **Tier 3: In-region contingency options**
  Constitute contingency options to ensure compliance with regulatory requirements. The CRD would implement Tier 3 options on a contingency basis, only when options within the Tier 2 portfolio are unavailable.

CONSULTATION UPDATES

Opportunities for feedback on the proposed Long-Term Biosolids Management Strategy were provided to the public, First Nations and the Technical and Community Advisory Committee (TCAC). Results are summarized below.

First Nations Consultation Summary
The CRD reached out to all First Nations from the initial engagement period to invite submissions on the draft Strategy that the Board endorsed on May 8 and that had been referred out for comment. Staff received correspondence from two First Nations, themes included request for more information on the thermal processing project, implications of land application and where the biosolids may be applied under tiers 2 and 3. Staff are working with each nation individually, addressing their concerns and will continue to engage more specifically if land application options under Tier 3 (in-region, contingency options) become feasible.

As directed by the Board on May 8, staff will continue to explore beneficial use opportunities with those Nations that express interest both in-region and out-of-region. The CRD will also listen to any concerns Nations may have regarding the beneficial use options and is committed to working with individual Nations to address their concerns.

Public Consultation Summary
The Draft Long-term Biosolids Management Strategy and portfolio of options were available for public review and comment from May 13 to June 3 on the CRD digital engagement platform GetInvolved.crd.bc.ca/biosolids. The CRD used a media release, newsletters and social media to inform the public about the draft strategy and how to share their feedback.

Comments were collected and reviewed to ensure that personal information could be redacted. A total of 232 comments were received and common themes were identified. 18 comments indicated a preference for land application. 190 comments indicated a preference for thermal options or opposition to land application. 101 comments received followed a similar format.

The Engagement Summary Report outlining the process and complete list of comments is attached as Appendix A.

Technical and Community Advisory Committee Consultation Summary
The Technical and Community Advisory Committee (TCAC) met on May 22, 2024 to discuss the draft Long-Term Biosolids Beneficial Use Strategy and resultant Board motions. In general, the TCAC had no significant comments or concerns with the proposed strategy.

Based on the above, staff are not recommending changes to the strategy be made, and that the plan be submitted to province as per the tiered portfolio of options endorsed by the Board on May 8, 2024.

ALTERNATIVES

Alternative 1
That the CRD Board:

1. Approve the Long Term Biosolids Management Strategy as a portfolio of options (in alignment with the Long-Term Biosolids Management Strategy prepared by GHD, April 2024), that utilizes each option under a prioritization structure, as follows:

   (a) **Tier 1**: **Advanced thermal option:** Constitutes the preferred long-term solution and will be pursued concurrently with options in other tiers. Current projects include:

      (i) Develop a demonstration facility for advanced thermal processing, as planned. Outcomes from the demonstration project will serve as the basis for a scaled, long-term solution.

(b) **Tier 2**: **Out-of-region compliance options:** Constitute measures that the CRD will utilize to ensure regulatory compliance is continuously achieved while the Tier 1 thermal processing option is being implemented and when options in Tier 1 are unable to process the totality of biosolids produced in the region. These are (in priority order):
   (i) Industrial land reclamation, such as mine and quarry sites (acknowledging that some reclaimed sites may eventually have a pasture land end use)
   (ii) Forest fertilization
   (iii) Production of biosolids growing medium and/or feedstock in soil production
   (iv) Partnerships with established biosolids programs
   (v) Continue alternative fuel combustion in the cement manufacturing facility in Richmond, BC. Prioritize this option when available.
   (vi) Explore partnerships with additional industrial partners interested in combustion.

(c) **Tier 3: In-region contingency options**: Constitute contingency options to ensure compliance with regulatory requirements. The CRD would implement Tier 3 options on a contingency basis, only when options within the Tier 2 portfolio are unavailable and only after receiving explicit consent from the Board and consulting and engaging with any affected First Nations, should the need for Tier 3 arise.

   These include (in priority order):
   (i) Industrial land reclamation, such as mine and quarry sites (acknowledging that some reclaimed sites may eventually have a pasture land end use)
   (ii) Forest fertilization
   (iii) Maintain the option of biosolids application in engineered cover systems and biocell at Hartland Landfill to act as an emergency support option, subject to space availability and cover needs of the Landfill;

2. Direct staff to submit the Long-Term Biosolids Management Strategy to the BC Ministry of Environment and Climate Change Strategy;
3. Direct staff to continue to explore biosolids beneficial use opportunities with those First Nations that express interest both in-region and out-of-region, and to address any concerns First Nations may have regarding the beneficial use options; and
4. Refer the staff report with the Long-Term Biosolids Management Strategy to the Core Area Liquid Waste Management Committee for information.

Alternative 2
That the CRD Board provide alternative direction to staff regarding the Long-Term Biosolids Management Strategy

IMPLICATIONS

Climate Action Implications

All beneficial reuse long-term biosolids management options have potential greenhouse gas (GHG) emission implications. Land application options have higher emissions the further away the land application sites are, due to transportation requirements. However, these could be offset by the enhanced GHG sequestration within the soils following land application. Thermal and advanced thermal options result in direct GHG emissions to the atmosphere, in addition to transportation-related emissions. Advanced thermal options partially mitigate GHG emissions with sequestration in biochar. Respondents to both the Ipsos representative survey and the CRD survey indicated that “Environmental Impacts (air, water and soil contaminants)” were the most important consideration when planning for the beneficial use of biosolids. Costs, climate/GHG emissions and community impacts (truck traffic, odour and noise emission, dust) were less important.

Environmental Implications

Under the Canadian governance framework, provincial and federal regulators and agencies are responsible to ensure that biosolids reuse options are safe for the intended purposes and protective of human health and the environment when produced and used in accordance with regulations. Agencies assess the risks and benefits associated with specific resources and products and recommend policies that are incorporated into regulatory frameworks, which are evaluated on a regular and ongoing basis. Current regulations support the beneficial use of biosolids, including all of the options considered by the technical consultant.

All options have some level of risks and benefits. Advanced thermal technologies with biosolids feedstock are not yet commercially proven in Canada or the United States. Thermal options have the benefit of reduced (but not eliminated) contaminant levels in end-products. Despite concerns about risks associated with contaminants for land application options, the most significant land application risks are associated with over fertilization (too many nutrients). Both sets of risks can be mitigated by following properly-designed land application plans and complying with the OMRR. Land application options have the benefit of recycling nutrients, enhancing plant growth and offsetting use of commercial GHG-intensive fertilizers.

Community concerns around the land application of biosolids are largely based on the presence, or suspected presence, of unregulated organic chemical compounds, commonly referred to as “contaminants of emerging concern” (CECs). CECs include Volatile and Semi-Volatile Organic Compounds (VOC & SVOC), Per and Polyfluoroalkyl substances (PFAS), Polybrominated flame retardants (PBDE), dioxins, pharmaceuticals and personal care products (PPCP) and microplastics. There is concern that biosolids with detectable levels of unregulated CECs could impact soil quality, surface water or groundwater.

In recent years, there has been an increased interest in PFAS and their effects on human and environmental health. PFAS are a class of over 4,700 substances that do not occur naturally. PFAS make products non-stick, water repellent and fire resistant, and are found in a wide range of consumer and industrial products, including cookware, food packaging, clothing and firefighting foams. PFAS are sometimes referred to as “forever chemicals” because the molecules are characterized by a chain of strong fluorine-carbon bonds, which result in highly stable and long-persisting chemicals. Exposure to sufficient concentrations of PFAS is associated with an increased risk of cancer, increased cholesterol levels, and can affect the immune system.

In June 2022, ENV released the Organic Matter Recycling Regulation Project Update, which contained some discussion of CECs. “Due to advances in analytical chemistry, the ability to measure CECs has generally outpaced the ability to understand the impacts of CECs on human health and the environment. For this reason, the impacts of CECs in biosolids and wastewater treatment discharges is the subject of ongoing scientific research.” The ENV intends to add the authority for a director to require the testing of biosolids for CECs but does not intend to regulate the concentration of CECs in biosolids. ENV advocates for a prevention-first approach to reducing CECs in biosolids by implementing source control measures to discourage the discharge of certain wastes to the system.

On May 19, 2023, the Canadian Food Inspection Agency (CFIA) proposed an interim standard for PFAS in biosolids used in Canada as fertilizers. The CFIA worked with Environment and Climate Change Canada, Health Canada and provincial partners to assess an appropriate standard for PFAS. The proposed standard will protect human health by preventing the small proportion of biosolids products that are heavily impacted by industrial inputs from being applied to agricultural land in Canada. The proposed standard is 50 ppb PFOS (one type of PFAS). The concentration of PFOS in CRD biosolids is under the proposed standard at approximately 6 ppb (ng/g) (based on two samples). For comparison, a 2020 study found that the PFOS concentration in household dust was 100 ppb (100ng/g).

Financial Implications

The proposed portfolio includes options with a range of costs per tonne. Land application and conventional thermal options are approximately the same, at less than $500 per tonne. Advanced thermal options are more expensive at up to $4,500 per tonne; there is significant uncertainty regarding capital and operating costs for a permanent advanced thermal facility at this time, as well as the potential for revenue generation from advanced thermal synthetic gas, bio-oil and biochar end-products and a current lack of demonstrated facilities for cost comparisons. However, this information will be ascertained through the development of the demonstration plant initiative.

Service Delivery Implications

A portfolio of options is required to ensure redundancy and resiliency of the biosolids management strategy. Previous experience with the CRD, as well as a jurisdictional review, has indicated that relying on a single or very few options and single contingency is not suitable to maintain service delivery and regulatory compliance. Based on the consultation feedback, as well as concerns raised previously by the Board, a portfolio of beneficial use options that includes reclamation of industrial lands and forest fertilization, but excludes direct application to agricultural lands is considered prudent. Use of biosolids as an alternative fuel in the current short-term plan will also be carried over as an option in the long-term strategy.

Although the long-term strategy is to address biosolids produced by the Core Area wastewater service, the RTF was designed to receive and process residual solids from the Saanich Peninsula, Sooke and Gulf Island wastewater treatment plants. Once the RTF receiving station is operational, staff will work with the Saanich Peninsula Wastewater Commission to update the Saanich Peninsula Liquid Waste Management Plan accordingly.

Alignment with Board and Corporate Priorities

The recommended Long-Term Biosolids Management Strategy aligns with the 2023-2026 CRD Corporate Plan goal of *Management of wastewater and treatment residuals,* and the initiative to *Develop and implement a long-term Biosolids Management Plan*. The Strategy also supports the initiative under this goal to *Update the Liquid Waste Management Plans for the Saanich Peninsula and Core Area* with regards to complying with the commitment to beneficially use the biosolids generated from the wastewater treatment plants.

First Nations Implications

First Nations are seeking a more respectful, reciprocal government-to-government relationship with the CRD related to service delivery and service delivery impacts in their traditional territories.

As described above, First Nations consultation on the Long-Term Biosolids Management Strategy is ongoing. The CRD will continue to explore beneficial use opportunities with those Nations that express interest. The CRD will also listen to any concerns Nations may have regarding the beneficial use options and is committed to working with individual Nations to address their concerns.

Intergovernmental Implications

Due to the nature of some of the beneficial use options and in order to have a portfolio of options that ensures redundancy and flexibility, it is not unusual for local governments to have biosolids management programs that extend beyond the jurisdictional boundaries of the local government in terms of processing and end use, particularly in areas that are more urban and those that produce larger volumes of biosolids.

Social Implications

Based on all public and TCAC engagement, there is majority support for prioritizing a range of beneficial use options, including advanced and conventional thermal options and land application options. Both the representative survey and TCAC recommendations were in close alignment, with industrial land reclamation and forest fertilization having the strongest support. However, the voluntary survey showed more support for advanced thermal options, although some forms of land application still had support. The differences between the representative and voluntary survey results were likely due to the advocacy and efforts of a few special interest groups that are known to be opposed to land application options. Moving forward, additional public and stakeholder consultation, as required by the provincial regulator on a project-by-project basis, will be conducted.

<u>CONCLUSION</u>

The CRD is required to submit a Long-Term Biosolids Management Strategy to the provincial regulator by June 18, 2024, as part of the CRD’s commitments under the Core Area Liquid Waste Management Plan.

The Long-Term Biosolids Management Strategy consists of a portfolio of options that seeks to ensure continuous regulatory compliance (that reliably avoids landfilling) while actively seeking innovative solutions to execute the Board’s vision of eliminating all forms of land application. The tiered approach considers First Nations and public input and proposes an optimal approach to utilizing options currently available in the biosolids management market.

<u>RECOMMENDATION</u>

That the Capital Regional District Board:

1. Approve the Long Term Biosolids Management Strategy as a portfolio of options (in alignment with the Long-Term Biosolids Management Strategy prepared by GHD, April 2024), that utilizes each option under a prioritization structure, as follows:

   (a) **Tier 1**: **Advanced thermal option:** Constitutes the preferred long-term solution and will be pursued concurrently with options in other tiers. Current projects include:

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   (iii) Maintain the option of biosolids application in engineered cover systems and biocell at Hartland Landfill to act as an emergency support option, subject to space availability and cover needs of the Landfill;

2. Direct staff to submit the Long-Term Biosolids Management Strategy to the BC Ministry of Environment and Climate Change Strategy;
3. Direct staff to continue to explore biosolids beneficial use opportunities with those First Nations that express interest both in-region and out-of-region, and to address any concerns First Nations may have regarding the beneficial use options; and
4. Refer the staff report with the Long-Term Biosolids Management Strategy to the Core Area Liquid Waste Management Committee for information.

Submitted by:	Luisa Jones, MBA, General Manager, Parks, Recreation & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: CRD Engagement Summary – Draft Long-term Biosolids Management Strategy (June 2024)

ATTACHMENT 3

CRD

Making a difference...together

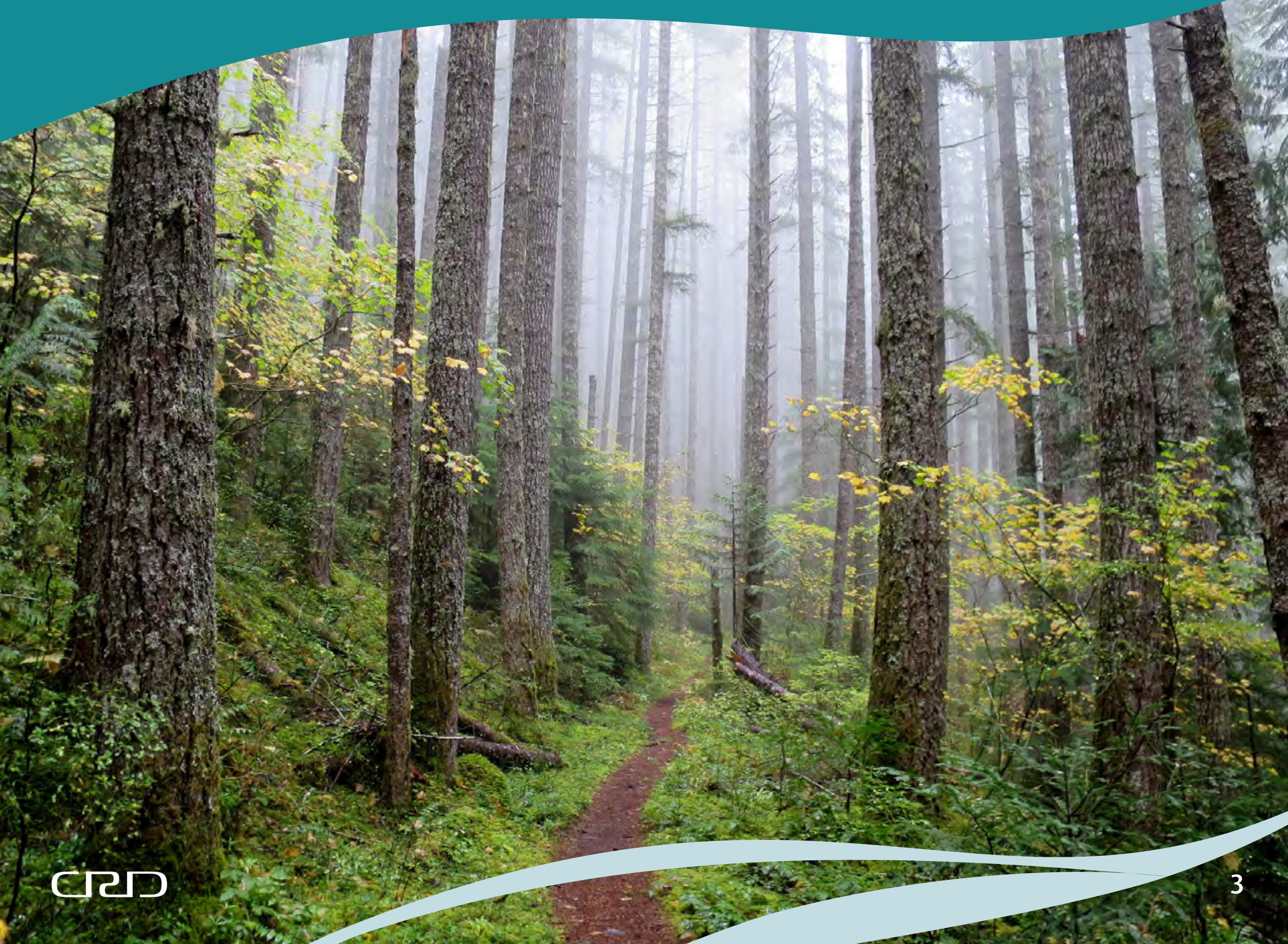
Long-Term Biosolids Management Plan

First Nations Engagement What We Heard Report

Table of Contents

Territorial Acknowledgement

The Capital Regional District conducts its business within the traditional territories of many First Nations, including but not limited to BOḰEĆEN (Pauquachin), MÁLEXEȽ (Malahat), Paaʔčiidʔatx̣ (Pacheedaht), Pune’laxutth’ (Penelekut), Sc’ianew (Beecher Bay), Songhees, SȾÁUTW̱ (Tsawout), T’Sou-ke, W̱JOȽEȽP (Tsartlip), W̱SIKEM (Tseycum) and xʷsepsəm (Esquimalt), all of whom have a long standing relationship with the land and waters from time immemorial that continues to this day.



Executive Summary

The Capital Regional District (CRD) is exploring options and technologies to harness the benefits of biosolids, the by-product of wastewater treatment. Short-term plans regarding biosolids management were put in place when the CRD first introduced wastewater treatment in 2020. However, despite best efforts, the region's biosolids are largely being landfilled under emergency measures.

The Province of BC requires the CRD to submit a *Long-Term Biosolids Management Plan* by **June 2024**. This plan must consider a wide variety of management options, including various land application scenarios in addition to incineration and advanced thermal options. The long-term beneficial use options under consideration include: fertilizer for agriculture; industrial land reclamation; forest fertilization; wholesale fertilizer for landscaping; bagged fertilizer for residential use; fuel for incineration/combustion; and pyrolysis or gasification technology to create biochar/gas.

The purpose of this phase of the engagement process is to effectively communicate and engage with First Nations whose traditional territories span portions of the region in the development of a definitive (long-term) biosolids management plan for the Capital Regional District. From **February 28, 2024, to April 19, 2024**, the CRD sought feedback from First Nations leadership on the direction of which long-term uses of biosolids would best serve their Nation.

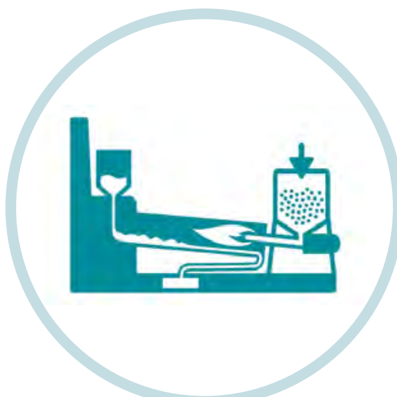
Introduction

Biosolids are the by-product of wastewater treatment, containing nutrients, such as nitrogen, phosphorus, calcium, sulphur and iron, energy and organic matter that can be recycled and used in various ways. The most common use of this material is as fertilizer to promote tree and plant growth and as a soil additive to restore degraded industrial lands. However, there are other options, such as harnessing energy through thermal (heating) processes to use as an alternative fuel.

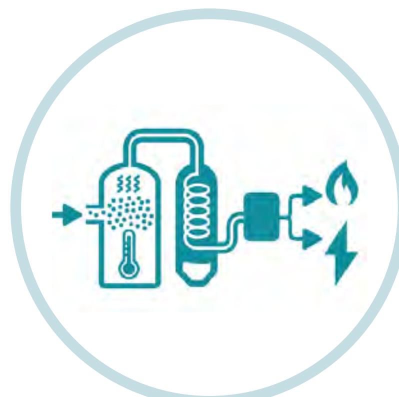
During the treatment process, the liquids and solids are separated, and the solids are then treated to produce a dark coloured, dry granular pellet. Biosolids produced by the CRD surpass standards set out in the Organic Matter Recycling Regulation, due to the high quality of sewage treatment and robust source control programs aimed at preventing metals and other contaminants from entering the wastewater system.

Biosolids can be used as:

A nutrient-rich fertilizer. This organic material improves soil conditions, promotes plant growth, increases crop yields and improves water retention.



An alternative fuel source through burning biosolids to supply heat energy at incineration to facilities to reduce reliance on fossil fuels.



An alternative energy source through pyrolysis and gasification technologies, that creates biochar/synthetic gas, which is then burned to produce heat or electricity.

The CRD has been responsible for the beneficial use of Class A biosolids produced at the Residuals Treatment Facility since the commissioning of the core area wastewater treatment project in 2020.

Currently, the CRD is operating under a Short-term Biosolids Management Plan (2020-2025), with the primary beneficial use options being incineration as an alternative fuel in a cement manufacturing plant in Richmond, BC, and integration with landfill cover systems as contingencies. When neither of these options are available, landfilling biosolids at Hartland Landfill has been the only alternative.

In 2011, the CRD Board passed a resolution to ban the land application of biosolids from CRD facilities; however, in 2023, given the operational and logistical challenges with the short-term plan, the CRD Board amended its position to allow limited non-agricultural land application of biosolids as a contingency option. The CRD has secured the use of biosolids for industrial land reclamation at a quarry near Cassidy, BC, and continues to seek additional short-term beneficial use contingency options, in order to limit or avoid landfilling of biosolids when the other options are not available.

To support transportation, the CRD partnered with the W̱SÁNEĆ Leadership Council in the creation of K'ENES Transportation, a First Nation-owned and operated trucking company. However, regular shipments of biosolids to the cement plant have been challenged by a wide variety of logistical and operational issues.

Purpose of Engagement

This engagement process intends to gather feedback from local First Nations and ensure they are well-informed about the potential long-term uses of biosolids.

The responses received during this phase will inform the development of the *Long-Term Biosolids Management Plan* that will outline the CRD's approach to managing biosolids in the future. This report summarizes insights gained through an online survey and virtual engagement session with First Nation representatives.

Engagement Process and Activities

Committed to gathering diverse feedback, the CRD's objectives were as follows:

Gather feedback from First Nations with territory within the region to help inform the *Long-Term Biosolids Management Plan.*

Ensure that First Nations and all residents within the CRD are well-informed about the potential long-term uses of biosolids.

Seek to identify a long-term biosolids option that maximizes benefits for the communities in the CRD.

A number of resources were developed to support outreach and engagement.

A handout was created, providing frequently asked questions on one side and a description of the seven long-term use options on the other. Throughout the document, useful resources were accessible through a QR code, such as regulatory requirements, biosolids in BC and the CRD's Biosolids Beneficial Use Strategy. An online survey was also developed, asking respondents for their feedback about the use of biosolids in the region and how they want to see them utilized.

Long-term options for biosolid use in the CRD

Scan the QR code to view the biosolids fact sheet.

Fertilizer for Agriculture

The nutrient-rich organic material can improve soil conditions to promote plant growth and increase crop yields. It can also improve water retention to reduce water usage as well as reduce reliance on synthetic fertilizers.

Timeline: Immediate

Cost: Less than $500/tonne

Industrial Land Reclamation

Biosolids can be applied to disturbed and degraded soils to replenish organic matter and essential nutrients, improving soil fertility, soil structure and increasing water retention. They can be applied directly or blended with compost, soil or wood chips.

Timeline: Immediate

Cost: Less than $250/tonne

Forest Fertilization

Biosolids can help improve soil fertility, prevent erosion and accelerate plant and tree growth. After a wildfire, biosolids can help forests regenerate, increasing water retention and providing essential nutrients and organic matter to promote plant and tree growth.

Timeline: Immediate

Cost: Less than $400/tonne

Wholesale Fertilizer for Landscaping

The nutrient-rich organic material can improve soil conditions to promote lawn and plant growth. Uses include lawns, boulevards, golf courses.

Timeline: Immediate

Cost: Less than $500/tonne

Bagged Fertilizer for Residential Use

The nutrient-rich organic material is bagged and distributed as fertilizer or blended with soil, compost or wood chips and made available for residential use.

Timeline: Immediate

Cost: Less than $500/tonne

Fuel for Incineration/Combustion

Biosolids are burned or used as an alternative fuel to power facilities, such as cement kilns and pulp mills, reducing reliance on other non-renewable sources like coal or natural gas.

Timeline: CRD currently utilizes this technology in Richmond. In-region options not available.

Cost: Less than $500/tonne

Pyrolysis or Gasification Technology to Create Biochar/Gas

Biosolids are heated to make a gas or "biochar," which can be used to produce heat or electricity. Biochar is a type of charcoal that is made from organic material. It can be used as a soil additive to improve soil fertility and enhance water retention.

Timeline: 7-10 years for permitting, siting and construction of a permanent facility.

Cost: $500-$4500/tonne

What are Biosolids?

Biosolids are the nutrient-rich by-product of wastewater treatment and can benefit the community. They contain nutrients, energy and organic matter that can be recycled and used in various ways. The most common use is as fertilizer to promote tree and plant growth and as a soil additive to restore degraded industrial lands. Other emerging options may include harnessing energy contained in biosolids through thermal (heating) processes to use as an alternative fuel.

How are biosolids being managed currently?

Timed with wastewater treatment being introduced in the core area in 2020, the CRD implemented a short-term plan to use biosolids as an alternative to fossil fuel combustion at a Lower Mainland cement factory. There have been operational challenges and the majority of biosolids produced have been landfilled. Given the recent challenges, the CRD arranged to have some biosolids sent to a gravel quarry in Cassidy, to be used for industrial land reclamation, one form of land application, under a provincial Mines Act permit. Landfilling biosolids has been used as an emergency measure. It wastes valuable space in the landfill and does not meet provincial requirements for beneficial use of biosolids. It is not being considered as a long-term option.

Scan the QR code to read more about the CRD Biosolids Beneficial Use Strategy

What are the benefits of biosolids?

Biosolids contain important nutrients such as nitrogen, phosphorus, calcium, sulphur and iron. The benefits of biosolids include:

- Adds organic matter and plant nutrients to enrich soil
- A natural alternative to synthetic (chemical) fertilizers
- Stores carbon in soil and decrease greenhouse gas emissions
- Increases soil water retention
- Can be mixed with wood chips or yard waste to create compost

Scan the QR code to learn more about biosolids in BC

Do biosolids pose a risk to human health or the environment?

The BC Ministry of Environment and Climate Change Strategy and federal Environment and Climate Change Canada set the standards for the protection of human health and the environment for wastewater treatment, including biosolids production and use. Biosolids do not pose a risk to human health or the environment when they are produced, ...ributed, stored, sold or used in accordance with all of ...requirements in the Organic Matter Recycling Regulation ...RR). Mismanagement of any product or material can ...to adverse effects on the environment and risk to ...n health. OMRR guidelines are designed to ensure the ...per management of biosolids as well as reduce risk. Class A biosolids that the CRD produces exceed provincial OMRR requirements.

Scan the QR code to read the OMRR

How will public input be used in decision-making?

Your feedback will be used to inform the development of a Long-Term Biosolids Management Plan that will outline the CRD's approach to managing biosolids going forward. Upon completion of this public engagement process a What We Heard consultation summary report will be produced. It will be shared with the CRD Board, Technical and Community Advisory Committee and available on the CRD website as part of the draft plan review process before submission to the province under the CRD's Core Area Liquid Waste Management Plan commitments. Public input, current technical information and First Nations engagement each inform the development of a Long-Term Biosolids Management Plan.

Scan the QR code with your phone to fill out the survey online

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The CRD scheduled two engagement sessions to hear feedback: an in-person gathering on **March 25, 2024**, in Victoria, and virtually on **March 27, 2024**.

An invitation to these sessions was distributed to an established contact list of people in leadership roles at 19 First Nations on **February 28, 2024**.

The contact list included:

- BOḰEĆEN (Pauquachin) First Nation
- MÁLEXEȽ (Malahat) Nation
- Paaʔčiidʔatx̣ (Pacheedaht) First Nation
- SȾÁUTW̱ (Tsawout) First Nation
- Scia'new (Beecher Bay) First Nation
- Songhees Nation
- Spune'luxutth (Penelakut) Tribe
- T'Sou-ke Nation
- W̱JOȽEȽP (Tsartlip) First Nation
- W̱SIḴEM (Tseycum) First Nation
- Xʷsepsum (Esquimalt) Nation
- Cowichan Tribes
- Halalt First Nation
- Lyackson First Nation
- sc̓əwaθən məsteyəxʷ (Tsawwassen) First Nation
- Semiahmoo First Nation
- Stz'uminus (Chemainus) First Nation
- Ts'uubaa-asatx Nation

There were no responses to the initial invitation so, on **March 19, 2024**, a personalized follow-up email was sent to each contact, inviting them to attend one of the two engagement sessions. The CRD then reached out by phone to each First Nation on the contact list to ensure they had received the invitation and to create an RSVP list for the in-person and online engagement sessions. There was some interest expressed, but no confirmations for the RSVP list.

On **March 25, 2024**, the CRD sent out a third email to the contact list as a reminder of the in-person engagement session that evening, as well as the virtual session two days later. An online survey was also linked in the email to invite feedback not only from those on the contact list, but also from their colleagues and those they might share it with. There were no participants in either session, despite initial interest in attending the virtual engagement session.

However, Paaʔčiidʔatx̣ (Pacheedaht) First Nation and T'Sou-ke Nation expressed interest in providing feedback to the CRD in the near future.

A final follow-up email was distributed to the First Nation contact list on **April 12, 2024**. In this email, the CRD provided the link to the online survey as well as a link to the district's "Get Involved" landing page that details the information about the long-term options for biosolid use.

It also noted the **April 19, 2024**, deadline to have feedback included in the report to the Province of BC.

What We Heard

From February 28, 2024, to April 19, 2024, the CRD sought feedback from First Nations leadership on the direction of which long term uses of biosolids would best serve their Nation.

The CRD reached out to 19 First Nations, through email and phone calls, as well as provided an online survey as an alternative way to provide their comments or questions. The district hosted three virtual formal consultation meetings, with BOḰEĆEN (Pauquachin) First Nation, Paaʔčiidʔatx̣ (Pacheedaht) First Nation and T'Sou ke First Nations staff, regarding the beneficial use of biosolids. Pacheedaht First Nation encouraged the CRD to continue consultation regarding the forestry fertilization management option and T'Sou ke Nation would like to be consulted on the specific details on any project under consideration within its territory.

Summary

The CRD is exploring options and technologies to harness the benefits of biosolids, the by product of wastewater treatment and sought the insight of First Nation leadership on the potential long term uses available to the region.

The feedback gathered from this group would help to inform a Long Term Biosolids Management Plan to fulfill provincial requirements. Over the course of two months, the CRD would take part in outreach to 19 First Nations that span portions of the region. While the CRD is required to submit a plan to the provincial government by June, the district will continue to receive feedback from First Nation leadership and will provide an update to the plan at a later date.

Appendix

Survey

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Long-Term Biosolids Management Plan Survey

The Capital Regional District (CRD) is exploring options and technologies to harness the benefits of biosolids and we are eager to hear your Nation's insights. Your participation in this survey will inform a Long-Term Biosolids Management Plan that will outline the CRD's approach to managing biosolids in the future. Upon completion of the First Nations engagement process, a What We Heard summary report will be produced. It will be shared with the CRD Board and available on the district's website. We look forward to your Nation's input for the long-term options for managing biosolids within the district.

Where do you live?

____

What is your age range?

- ☐ <29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ Elder

Do you own or rent your home?

- ☐ Own
- ☐ Rent

Do you own a business in the capital region?

- ☐ Yes
- ☐ No

If so, where is your business located?

____

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How familiar are you with the following topics?

CRD wastewater treatment system

- ☐ Very unfamiliar
- ☐ Unfamiliar
- ☐ Somewhat familiar
- ☐ Familiar
- ☐ Very familiar

Biosolids

- ☐ Very unfamiliar
- ☐ Unfamiliar
- ☐ Somewhat familiar
- ☐ Familiar
- ☐ Very familiar

How important is it to you how biosolids are maximized for community benefit?

- ☐ Not at all important
- ☐ Unimportant
- ☐ Neutral
- ☐ Important
- ☐ Very important

Please explain why you chose that level of importance.

____

____

____

When planning for the beneficial uses of biosolids, how important are the following considerations to you? Please rank in order of importance
(1 being most important – 4 being least important).

______ Costs
______ Environmental impacts (air, water and soil contaminants)
______ Climate/greenhouse gas emissions
______ Community impacts (truck traffic, odour and noise emissions, dust, etc.)

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Please indicate your level of support for the following potential uses.

Scan the QR code with your phone's camera and select the link to see more information about these potential uses.

Agriculture fertilizer

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Forest fertilizer

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Industrial land reclamation

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Wholesale fertilizer for landscaping

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Fuel for incineration/combustion

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Bagged fertilizer or low-cost residential use

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Advanced thermal (gasification/pyrolysis technology)

- ☐ Strongly oppose
- ☐ Somewhat oppose
- ☐ Neutral
- ☐ Somewhat support
- ☐ Strongly support

Making a difference...togeth

What specifically interests you about the potential benefits biosolids can offer?

____

____

____

Do you have any specific concerns about the beneficial use of biosolids?

____

____

____

What is the best way to keep you informed about this topic in future? Check all that apply.

- ☐ Email
- ☐ Phone
- ☐ Printed mail out
- ☐ Social media
- ☐ Newspaper
- ☐ Radio
- ☐ TV news
- ☐ Website

Is there anything more you wish you knew about biosolids and the options being considered?

____

____

____

Is there anything else you would like to add?

____

____

____

Handout

What are Biosolids?

Biosolids are the nutrient-rich by-product of wastewater treatment and can benefit the community. They contain nutrients, energy and organic matter that can be recycled and used in various ways. The most common use is as fertilizer to promote tree and plant growth and as a soil additive to restore degraded industrial lands. Other emerging options may include harnessing energy contained in biosolids through thermal (heating) processes to use as an alternative fuel.

How are biosolids being managed currently?

Timed with wastewater treatment being introduced in the core area in 2020, the CRD implemented a short-term plan to use biosolids as an alternative to fossil fuel combustion at a Lower Mainland cement factory. There have been operational challenges and the majority of biosolids produced have been landfilled. Given the recent challenges, the CRD arranged to have some biosolids sent to a gravel quarry in Cassidy, to be used for industrial land reclamation, one form of land application, under a provincial Mines Act permit. Landfilling biosolids has been used as an emergency measure. It wastes valuable space in the landfill and does not meet provincial requirements for beneficial use of biosolids. It is not being considered as a long-term option.

Scan the QR code to read more about the CRD Biosolids Beneficial Use Strategy

What are the benefits of biosolids?

Biosolids contain important nutrients such as nitrogen, phosphorus, calcium, sulphur and iron. The benefits of biosolids include:

- Adds organic matter and plant nutrients to enrich soil
- A natural alternative to synthetic (chemical) fertilizers
- Stores carbon in soil and decrease greenhouse gas emissions
- Increases soil water retention
- Can be mixed with wood chips or yard waste to create compost

Scan the QR code to learn more about biosolids in BC

Do biosolids pose a risk to human health or the environment?

The BC Ministry of Environment and Climate Change Strategy and federal Environment and Climate Change Canada set the standards for the protection of human health and the environment for wastewater treatment, including biosolids production and use. Biosolids do not pose a risk to human health or the environment when they are produced, distributed, stored, sold or used in accordance with all of the requirements in the Organic Matter Recycling Regulation (OMRR). Mismanagement of any product or material can lead to adverse effects on the environment and risk to human health. OMRR guidelines are designed to ensure the proper management of biosolids as well as reduce risk. Class A biosolids that the CRD produces exceed provincial OMRR requirements.

Scan the QR code to read the OMRR

How will public input be used in decision-making?

Your feedback will be used to inform the development of a Long-Term Biosolids Management Plan that will outline the CRD's approach to managing biosolids going forward. Upon completion of this public engagement process a What We Heard consultation summary report will be produced. It will be shared with the CRD Board, Technical and Community Advisory Committee and available on the CRD website as part of the draft plan review process before submission to the province under the CRD's Core Area Liquid Waste Management Plan commitments. Public input, current technical information and First Nations engagement each inform the development of a Long-Term Biosolids Management Plan.

Scan the QR code with your phone to fill out the survey online

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Long-term options for biosolid use in the CRD

Scan the QR code to view the biosolids fact sheet.

Fertilizer for Agriculture

The nutrient-rich organic material can improve soil conditions to promote plant growth and increase crop yields. It can also improve water retention to reduce water usage as well as reduce reliance on synthetic fertilizers.

Timeline: Immediate

Cost: Less than $500/tonne

Industrial Land Reclamation

Biosolids can be applied to disturbed and degraded soils to replenish organic matter and essential nutrients, improving soil fertility, soil structure and increasing water retention. They can be applied directly or blended with compost, soil or wood chips.

Timeline: Immediate

Cost: Less than $250/tonne

Forest Fertilization

Biosolids can help improve soil fertility, prevent erosion and accelerate plant and tree growth. After a wildfire, biosolids can help forests regenerate, increasing water retention and providing essential nutrients and organic matter to promote plant and tree growth.

Timeline: Immediate

Cost: Less than $400/tonne

Wholesale Fertilizer for Landscaping

The nutrient-rich organic material can improve soil conditions to promote lawn and plant growth. Uses include lawns, boulevards, golf courses.

Timeline: Immediate

Cost: Less than $500/tonne

Bagged Fertilizer for Residential Use

The nutrient-rich organic material is bagged and distributed as fertilizer or blended with soil, compost or wood chips and made available for residential use.

Timeline: Immediate

Cost: Less than $500/tonne

Fuel for Incineration/Combustion

Biosolids are burned or used as an alternative fuel to power facilities, such as cement kilns and pulp mills, reducing reliance on other non-renewable sources like coal or natural gas.

Timeline: CRD currently utilizes this technology in Richmond, In-region options not available.

Cost: Less than $500/tonne

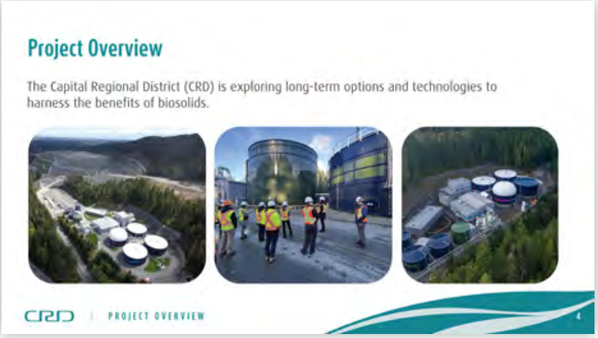
Pyrolysis or Gasification Technology to Create Biochar/Gas

Biosolids are heated to make a gas or "biochar," which can be used to produce heat or electricity. Biochar is a type of charcoal that is made from organic material. It can be used as a soil additive to improve soil fertility and enhance water retention.

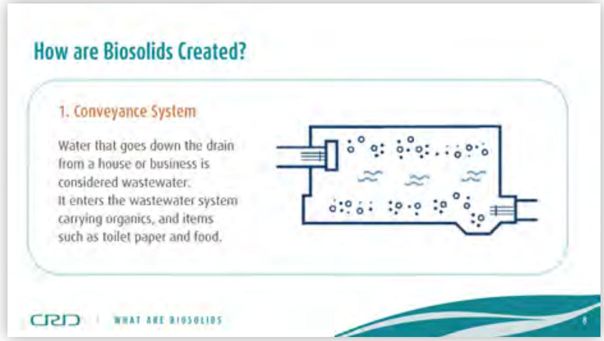
Timeline: 7-10 years for permitting, siting and construction of a permanent facility.

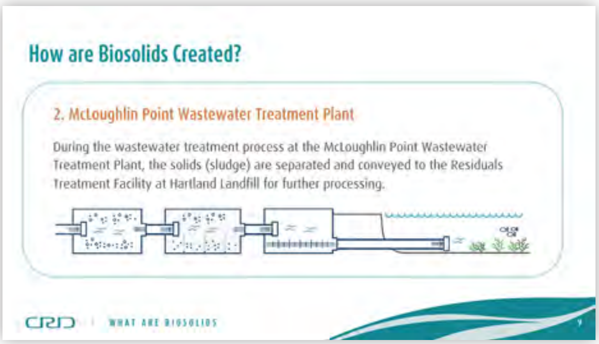
Cost: $500-$4500/tonne

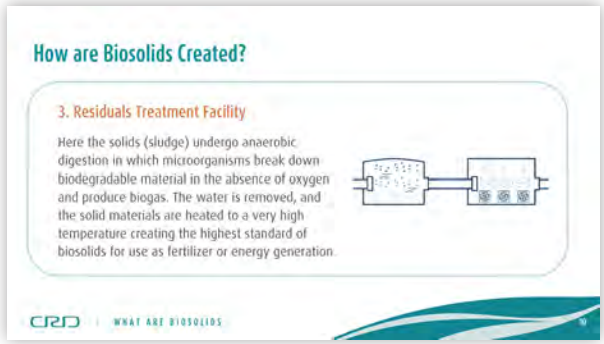
Presentation

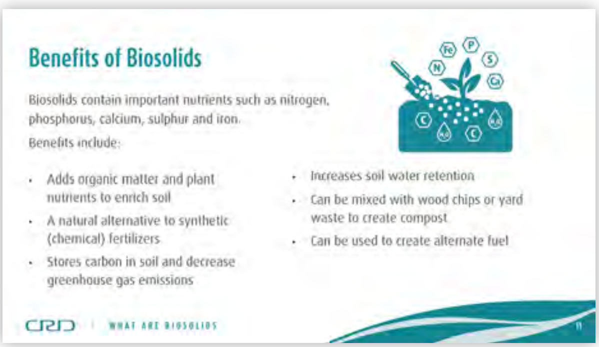



What Are They?
Biosolids are the nutrient-rich by-product of wastewater treatment. They contain nutrients, energy and organic matter that can be recycled and used in various ways. Common uses include:
Commercial and residential fertilizer
Land reclamation
Alternative fuels
WHAT ARE BIOSOLIDS


How are Biosolids Created?
1. Conveyance System
Water that goes down the drain from a house or business is considered wastewater.
It enters the wastewater system carrying organics, and items such as toilet paper and food.
WHAT ARE BIOSOLIDS


How are Biosolids Created?
2. McLoughlin Point Wastewater Treatment Plant
During the wastewater treatment process at the McLoughlin Point Wastewater Treatment Plant, the solids (sludge) are separated and conveyed to the Residuals Treatment Facility at Hartland Landfill for further processing.
WHAT ARE BIOSOLIDS


How are Biosolids Created?
3. Residuals Treatment Facility
Here the solids (sludge) undergo anaerobic digestion in which microorganisms break down biodegradable material in the absence of oxygen and produce biogas. The water is removed, and the solid materials are heated to a very high temperature creating the highest standard of biosolids for use as fertilizer or energy generation.
WHAT ARE BIOSOLIDS


Benefits of Biosolids
Biosolids contain important nutrients such as nitrogen, phosphorus, calcium, sulphur and iron.
Benefits include:
• Adds organic matter and plant nutrients to enrich soil
• A natural alternative to synthetic (chemical) fertilizers
• Stores carbon in soil and decrease greenhouse gas emissions
• Increases soil water retention
• Can be mixed with wood chips or yard waste to create compost
• Can be used to create alternate fuel
WHAT ARE BIOSOLIDS


Do biosolids pose a risk to human health or the environment?
Biosolids do not pose a risk to human health or the environment when they are produced, distributed, stored, sold or used in accordance with all of the requirements in the Organic Matter Recycling Regulation.
WHAT ARE BIOSOLIDS


What is the Organic Matter Recycling Regulation?
The Organic Matter Recycling Regulation (OMRR) regulates the production and land application of compost and biosolids.
Class A biosolids that the CRD produces exceed provincial OMRR requirements.
WHAT ARE BIOSOLIDS


Short-Term Biosolids Beneficial Use Strategy

Definitive Plan

- Developed in early 2019, before wastewater treatment began.
- Strategy consistent with the CRD policy restricting land application of biosolids.
- Planned to ship biosolids to a cement plant in Richmond, BC, to be incinerated in their cement process.
- Conditionally approved by the Ministry of Environment in October 2019.

CRD | SHORT-TERM BIOSOLIDS BENEFICIAL USE STRATEGY 15

- The CRD partnered with W̱SÁNEĆ Leadership Council in the creation of K'ENES Transportation, a new First Nation-owned and operated trucking company.
- K'ENES Transportation transports all of the CRD's biosolids to their destinations.
- Regular shipments of biosolids has been challenging.

CRD | SHORT-TERM BIOSOLIDS BENEFICIAL USE STRATEGY 16

Contingency Plan

- Staff recommended, and the Board approved, the use of biosolids at Hartland Landfill, being mixed with sand and wood chips and applied to closed areas of the landfill to support vegetation regrowth and reduce methane emissions.
- All available space was used in 2022.

CRD | SHORT-TERM BIOSOLIDS BENEFICIAL USE STRATEGY 17

Alternative Contingency Plan and Landfilling

- A new contingency plan was adopted to use biosolids at a gravel quarry near Nanaimo to re-establish vegetation on closed parts of the quarry.
- The quarry's immediate needs were met in 2023, but they will continue to accept biosolids in the future as new areas of the quarry are reclaimed.
- An emergency plan was implemented, landfilling biosolids.
- Landfilling is not a beneficial use and has been prohibited by the province.

CRD | SHORT-TERM BIOSOLIDS BENEFICIAL USE STRATEGY 18

Timeline

- 2011 – CRD Policy—no land application
- 2020 – Short-term Biosolids Management plan developed in 2020; Sewage treatment introduced in 2020
- 2021
- 2022 – Technical review of long-term options from 2022 to 2023
- 2023 – Public engagement from December 2023 to March 2024
- 2024 – Draft long-term Biosolids Management Plan in June 2024

19

Long-term Use Options

Land Based

20

Fertilizer for Agriculture

The nutrient-rich organic material can improve soil conditions to promote plant growth and increase crop yields. It can also improve water retention to reduce water usage as well as reduce reliance on synthetic fertilizers.

Timeline:	Cost:
Immediate	Less than $500/tonne

CRD | LAND BASED LONG-TERM USE OPTIONS 21

Industrial Land Reclamation

Biosolids can be applied to disturbed and degraded soils to replenish organic matter and essential nutrients, improving soil fertility, soil structure and increasing water retention. They can be applied directly or blended with compost, soil or wood chips.

Timeline:	Cost:
Immediate	Less than $250/tonne

CRD | LAND BASED LONG-TERM USE OPTIONS 22

Forest Fertilization

Biosolids can help improve soil fertility, prevent erosion and accelerate plant and tree growth. After a wildfire, biosolids can help forests regenerate, increasing water retention and providing essential nutrients and organic matter to promote plant and tree growth.

Timeline:
Immediate

Cost:
Less than $400/tonne

CRD | LAND BASED LONG-TERM USE OPTIONS

Wholesale Fertilizer for Landscaping

The nutrient-rich organic material can improve soil conditions to promote lawn and plant growth. Uses include lawns, boulevards, golf courses. It can also improve water retention to reduce water usage as well as reduce reliance on synthetic fertilizers.

Timeline:
Immediate

Cost:
Less than $500/tonne

CRD | LAND BASED LONG-TERM USE OPTIONS

Bagged Fertilizer for Residential Use

The nutrient-rich organic material is bagged and distributed as fertilizer or blended with soil, compost or wood chips and made available for residential use. Biosolids can also be blended with soil, compost or wood chips and made available for residential use.

Timeline:
Immediate

Cost:
Less than $500/tonne

CRD | LAND BASED LONG-TERM USE OPTIONS

Long-term Use Options

Thermal Based

Fuel for Incineration/Combustion

Biosolids are burned or used as an alternative fuel to power facilities, such as cement kilns and pulp mills, reducing reliance on other non-renewable sources like coal or natural gas.

Timeline:
Limited facilities available with no in-region options. The CRD currently utilizes this technology at a plant in Richmond.

Cost:
Less than $500/tonne

CRD | THERMAL BASED LONG-TERM USE OPTIONS

Pyrolysis or Gasification Technology to Create Biochar/Gas

Biosolids are heated to make a gas or "biochar," which can be used to produce heat or electricity. Biochar is a type of charcoal that is made from organic material. It can be used as a soil additive to improve soil fertility and enhance water retention.

Timeline:
7-10 years for permitting, siting and construction of a permanent facility. Advanced thermal technology is not currently used for processing biosolids in Canada.

Cost:
$500-$4,500/tonne

CRD | THERMAL BASED LONG-TERM USE OPTIONS

How will public input be used in decision-making?

Your feedback will be used to inform:

- The development of a Long-Term Biosolids Management Plan
- A What We Heard consultation summary report

CRD | HOW YOUR INPUT IS USED

Are there any questions?

Additional Engagement Meeting Notes

Pacheedaht Meeting Notes

April 11, 2024

Kristine Pearson, Pacheedaht First Nation
Erin Bildfell, CRD
Glenn Harris, CRD
Peter Kickham, CRD
Hannah Keene, 50th Parallel PR

CRD staff met with a representative of the Pacheedaht First Nation and provided a brief presentation and overview of the wastewater treatment project and resulting requirement to beneficially use biosolids. Staff presented the full suite of available options for biosolids management including various land application scenarios, incineration, and advanced thermal treatment. Staff also highlighted the concern raised by several groups regarding land application of biosolids.

The Pacheedaht representative asked several questions, including:

- the CRD's current practices under the Short-term Biosolids Beneficial Use Strategy, and why the CRD has not been able to ship any significant amount of product to the cement kiln,
- How biosolids are used in mine/quarry reclamation projects,
- Whether wastewater residuals from Port Renfrew would or could be incorporated under the long-term strategy, and whether there is an opportunity to work with the CRD regarding wastewater treatment infrastructure upgrades.

The Pacheedaht representative also suggested the CRD approach their private forestry partner to discuss using biosolids for forest fertilization, however highlighted a need to explore this potential carefully. Concerns from members of the nation would have to be carefully considered, with an explanation of potential risk factors from working with biosolids in comparison to the synthetic fertilizer products currently in use.

T'Sou-ke Nation

T'Sou-ke Meeting Notes

April 26, 2024

Sam Coggins, T'Souke Nation
Erin Bildfell, CRD
Peter Kickham, CRD
Stephanie Hagenaars, 50th Parallel PR

CRD staff met with a representative of the T'Souke First Nation and provided a brief presentation and overview of the wastewater treatment project and resulting requirement to beneficially use biosolids. Staff presented the full suite of available options for biosolids management including various land application scenarios, incineration, and advanced thermal treatment. Staff also highlighted the concern raised by several groups regarding land application of biosolids.

The T'Souke representative asked several questions, including:

- What is the contaminant profile for CRD biosolids,
- Industrial inputs to the CRD wastewater system (e.g., biomedical waste from hospitals),
- Potential sites within the T'Souke traditional territory where the CRD is considering land application,
- How to manage potential overland flow and impact to aquatic receiving environment,
- Scenario of a motor vehicle accident resulting in a spill of biosolids into a creek,
- Availability of CRD monitoring reports on biosolids,
- How biosolids are managed in other jurisdictions, and where to find monitoring information from other regional districts.

The T'Souke representative did not have formal comments beyond setting an expectation that the T'Souke Nation be engaged further in the event the CRD considers land application (be it a pilot or full scale) of biosolids anywhere in their traditional territory.

Pauquachin First Nation Meeting Notes

April 29, 2024

Octavio Cruz, Pauquachin First Nation
Peter Kickham, CRD
Stephanie Hagenaars, 50th Parallel PR

CRD staff met with a representative of the Pauquachin First Nation and provided a brief presentation and overview of the wastewater treatment project and resulting requirement to beneficially use biosolids. Staff presented the full suite of available options for biosolids management including various land application scenarios, incineration, and advanced thermal treatment. Staff also highlighted the concern raised by several groups regarding land application of biosolids.

The Pauquachin representative asked several questions, including:

- Whether the CRD had received comments or feedback from other First Nations,
- Whether the CRD had considered export options out of the region or province (e.g., to an area where there is high agricultural output and need for fertilizer).

The Pauquachin representative stressed the importance of engagement on any specific (future) land application projects the CRD considers in the territory of the Pauquachin Nation. The concern is not only environmental, but also cultural, as potential impact to harvesting of traditional plants for food or medicinal use is of the utmost importance. They also recognized that potential application of biosolids is only one of many activities that may impact traditional harvesting activities.

250 360 3090

biosolids@crd.bc.ca

getinvolved.crd.bc.ca/biosolids

ATTACHMENT 4

T'SOU-KE NATION

PO Box 307, Sooke B.C., V9Z 1G1
Ph.: 250 642-3957 Fax: 250 642-7808

24 May 2024

RE: 2024 05 22 CRD Biosolids Letter Update & Invitation for Feedback Combined

File: 0220-20

Dear Glen Harris,

Thank you for providing the letter with information about biosolids and applications that are being considered. We provide several concerns and questions below:

1) Tier 1 considers thermal processing. Based on the limited information provided in the letter, T'Sou-ke Nation prefers this option over Tier's 2 and 3. However, we have several questions:
    - How long will a thermal processing facility take to construct?
    - When would the CRD expect such a facility to be operational?
    - What is the budget for the facility as proposed?
    - Bearing in mind the cost to construct a demonstration facility, how can the CRD expect to construct a demonstration facility without then continuing to full-term operations?
    - What will the CRD do with the biosolids that are being produced while the construction of the facility is completed and until the facility is operational?
    - What might happen to biosolids if the thermal processing trial is not continued?

2) Tier's 2 and 3 contemplate land applications of biosolids. This approach is of serious concern to T'Sou-ke Nation. We need to know that the full extent of impacts have been considered and understood. See comments below.

In addition, relevant to Tier 2 and 3 T'Sou-ke Nation needs to understand:

- Whether there are sites in the Capital Regional District on which biosolids may be applied.
- There is reference to a cement manufacturing facility in Richmond. Has the CRD considered any other local facilities or those located in Washington state?

Last, it is very disappointing to receive a letter on May 22, 2024 and to be told that feedback is expected to be received by June 3, with subsequent consideration and decision on June 12. The term "consideration" limits the ability of T'Sou-ke First Nation to effectively govern our lands. Also, the letter provided lacks details about each of the options. Furthermore, the lack of capacity support by the CRD

T'SOU-KE NATION

PO Box 307, Sooke B.C., V9Z 1G1
Ph.: 250 642-3957 Fax: 250 642-7808

prevents T'Sou-ke Nation from making an informed decision about the application and impacts of biosolids on our territory. This directly contravenes parts of the *Declaration on the Rights of Indigenous People's Act* (see article 26.2) and those articles related to Free Prior and Informed Consent.

T'Sou-ke Nation does not support the land application of biosolids until a fulsome independent and unbiased review is completed by an agency or expert or company is independent of the CRD. The chosen reviewer must have specific expertise in biosolids application. For example, West Coast Environmental Law may be an ideal candidate for this work. The review should include, but not be limited to:

- An assessment of impacts from land applications in other parts of Canada, North America, Australia, and Europe.
- A legal assessment of liabilities and case law regarding land application of biosolids from the jurisdictions named in the bullet above.
- How biosolids are used elsewhere in British Columbia, Canada, and the jurisdictions mentioned above.
- Fulsome consultation with First Nations in the Capital Regional District to gather input.

Furthermore T'Sou-ke Nation would be interested to take part in a scoping exercise for the biosolids review and in the choice of an independent agency or company to undertake the review.

T'Sou-ke Nation expects a response from the CRD to the questions and comments provided in this letter. Should you have any comments or questions following this review please correspond with the Lands Manager at landsmanager@tsoukenation.com or at 250-642-3957 ext. 227.

Sincerely,

Sam Coggins, PhD RPF
A/Lands Manager, T'Sou-ke First Nation
250-642-3957; landsmanager@tsoukenation.com

Cc:
Michelle Thut, Administrator, T'Sou-ke First Nation
Larry Underwood, Forestry and Environment Manager

Malahat Nation
110 Thunder Road | Mill Bay, BC | V0R 2P4
Tel: (250) 743-3231 | Fax: (250) 743-3251
Malahat info@malahatnation.com | www.malahatnation.com

June 3rd, 2024

Malahat Referral No: R24096

Glenn Harris
Senior Manager, Environmental Protection

Via email: biosolids@crd.bc.ca

RE: Malahat Nation Response to Long-Term Biosolids Management Planning – Update & Invitation for Feedback

Dear,

Thank you for your consultation request dated May 22nd, 2024, regarding the Long-term Biosolids management planning for the Capital Regional District located in Malahat Nation's traditional territory.

Malahat Nation notes that the proposed activity falls on the edge of Malahat Nation's core traditional territory, and as such we acknowledge and respect the local First Nations' opportunity to act as primary correspondents in this case. However, in the event they do not, or are unable to respond we reserve our right to consultation and engagement and continue to require disclosure on an ongoing basis regarding this project.

Malahat Nation has many exciting sustainable economic development projects underway as the Nation takes a leadership role on Southern Vancouver Island. In support of upholding Malahat Nation's Title and Rights the Nation aims to build relationships and opportunities with surrounding communities, businesses, and government agencies. Malahat Nation looks forward to further communications and updates related to the biosolid management planning.

Thank you for your time and consideration.

Sincerely,

Kate Richey

Kate Richey
Referrals Lead
Malahat Nation

ATTACHMENT 5

TAVOLA STRATEGY GROUP

CAPITAL REGIONAL DISTRICT SUMMARY CONSULTATION REPORT

Long-Term Options for the Beneficial Use of Biosolids January – March 2024

Submitted by:
Katie Hamilton, Principal
Tavola Strategy Group Ltd.
tavolagroup.com

March 2024

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PROJECT OVERVIEW

The purpose of the public consultation process was to engage the public in the development of a long-term biosolids management plan for the Capital Regional District.

The end by-product of the sewage treatment process, biosolids are a nutrient-rich resource that can benefit the community in several different ways. The Province of BC's Organic Matter Recycling Regulation sets the requirements for production of high-quality biosolids, and subsequent beneficial uses related to land application and composting. The CRD produces 3,300 tonnes annually of Class A biosolids, the highest quality category of biosolids.

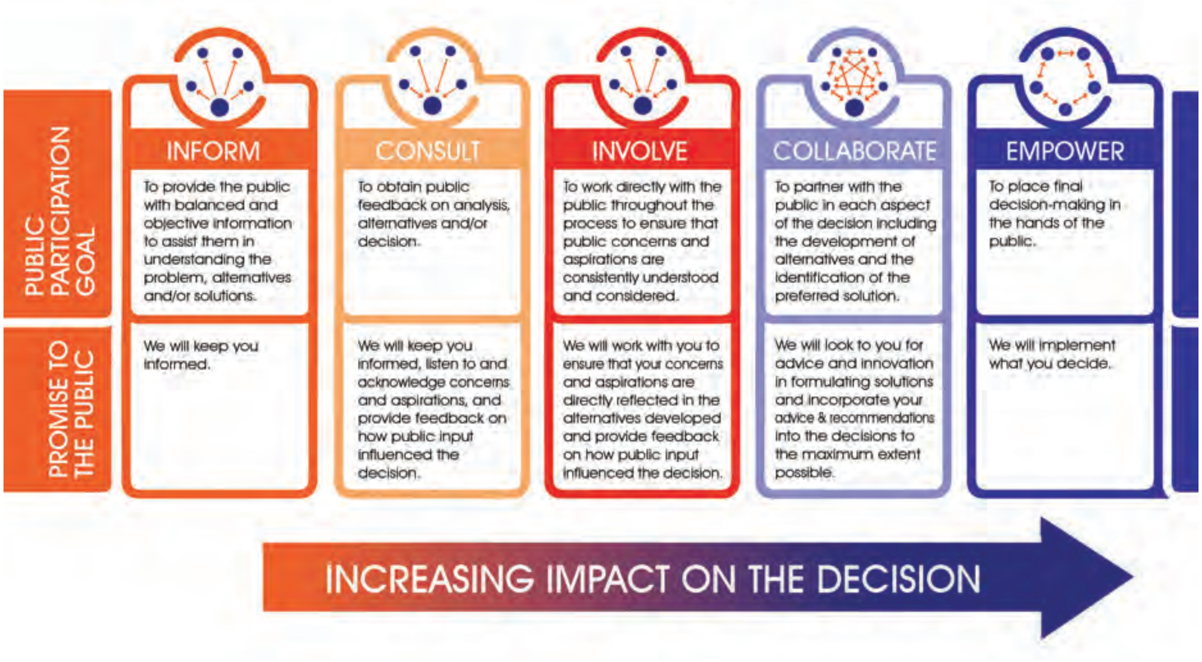
A Long-Term Biosolids Management plan must be submitted to the Province by June 2024. The Ministry of Environment and Climate Strategy requires that the long-term plan consider all potential beneficial uses, including land application. The Capital Regional District has had a policy banning land application in place since 2011. Broad public engagement about the long-term management of biosolids has not occurred in the Capital Region until now.

Seven biosolid management options were presented to the public for feedback.

The broad public engagement process occurred from January 11 to March 6, 2024. A representative sample survey of Capital Region adult residents was fielded by Ipsos from March 1 – March 11, 2024. The Ipsos data is weighted to ensure it reflects the gender/age and regional distribution of the CRD population according to the 2021 census data.

PUBLIC PARTICIPATION APPROACH

The consultation process was designed in alignment with the International Association of Public Participation (IAP2) spectrum and core values.



Communication & Engagement Objectives

1. ***Raise awareness of the need to develop a long-term biosolids management plan that outlines how the Capital Regional District will utilize the benefits of biosolids in-region.***
2. ***Provide multiple channels and opportunities for the community to learn more and provide input into the development of the definitive biosolids management plan.***
3. ***Seek to understand public awareness, perceptions, concerns and top of mind considerations for how biosolids should be managed in the Capital Region.***

Promise To The Public

The public consultation plan aimed to engage at the level of “consult”. The promise to the public is “we will keep you informed, listen to, and acknowledge concerns and provide feedback on how public input influenced the decision.” The Technical and Community Advisory Committee were engaged at the level of “involve”.

Public Consultation Process

On Thursday, January 11, 2024, the Capital Regional District launched the public consultation process to raise awareness of the need and opportunities for the community to provide input into the development of the definitive biosolids management plan. Greater understanding of public awareness, perceptions, concerns and top of mind considerations for how biosolids should be managed in the CRD will help inform options for CRD Board consideration.

The public consultation process ran in parallel to a separate First Nations engagement process led by other consultants.

Information was shared through a variety of channels to provide background on how biosolids have been managed since wastewater treatment was introduced in 2020, the options available to the CRD, including land application [as required by the Ministry of Environment and Climate Strategy], and the technical analysis and considerations associated with various options.

Consultation Activities & Timeline

- A detailed Long-Term Biosolids Management project webpage was developed on **www.GetInvolved.crd.bc.ca**
- Questions were submitted through the website and answers were posted for all web visitors
- Media releases was distributed on January 11 and February 7, 2024.
- Updates were emailed to project page subscribers.
- Several social media posts were shared on CRD social media channels: Facebook, Twitter, and Instagram throughout the process.
- Print ads appeared in the Times Colonist and BlackPress newspapers.
- Letters were sent to a variety of groups and organizations.
- Input was invited by email at **biosolids@crd.bc.ca**
- An online open house was hosted on Tuesday, February 20, 2024 where attendees could pose questions to Capital Regional District staff and GHD technical consultants.
- An online survey was hosted on the CRD's website.
- A statistically representative sample survey of Capital Region residents was conducted by Ipsos from March – March 11, 2024.

A Technical and Community Advisory Committee (LWMP Core Area) was reconstituted to inform the development of the long-term biosolids management plan. They held their first meeting in October 2023 and were presented the public consultation plan for feedback. The committee toured the Residual Treatment Facility in December and met several times in 2024.

Engagement by the numbers

569
Online survey participants

516
Representative survey of Capital Region residents

3,300
Unique web visitors

12
Questions and answers via website

56
Open house attendees

12
Subscribers to project updates

7
Emails to biosolids@crd.bc.ca

WHAT WE HEARD

Over-Arching Themes

- Respondents to both the Ipsos representative survey and the CRD survey indicated that "Environmental Impacts [air, water and soil contaminants]" were the most important consideration when planning for the beneficial use of biosolids. Costs, climate/ greenhouse gas emissions and community impacts (truck traffic, odour and noise emission, dust) were less important.
- The two surveys solicited very different results when it came to support for long-term biosolid management options.
    - *The Ipsos representative survey indicates strong majority support and low levels of opposition to all beneficial uses presented. Support is highest for forest fertilizer and industrial land reclamation. Respondents to the CRD survey indicate substantial levels of opposition to most options other than Advanced Thermal, with the least support for bagged fertilizer for residential use and agricultural fertilizer.*
    - *The most popular option (Advanced Thermal) in the CRD survey was the least popular for the broader general public in the Ipsos survey. The level of opposition to all options is much higher in the CRD survey.*

Comparison of survey results regarding options:

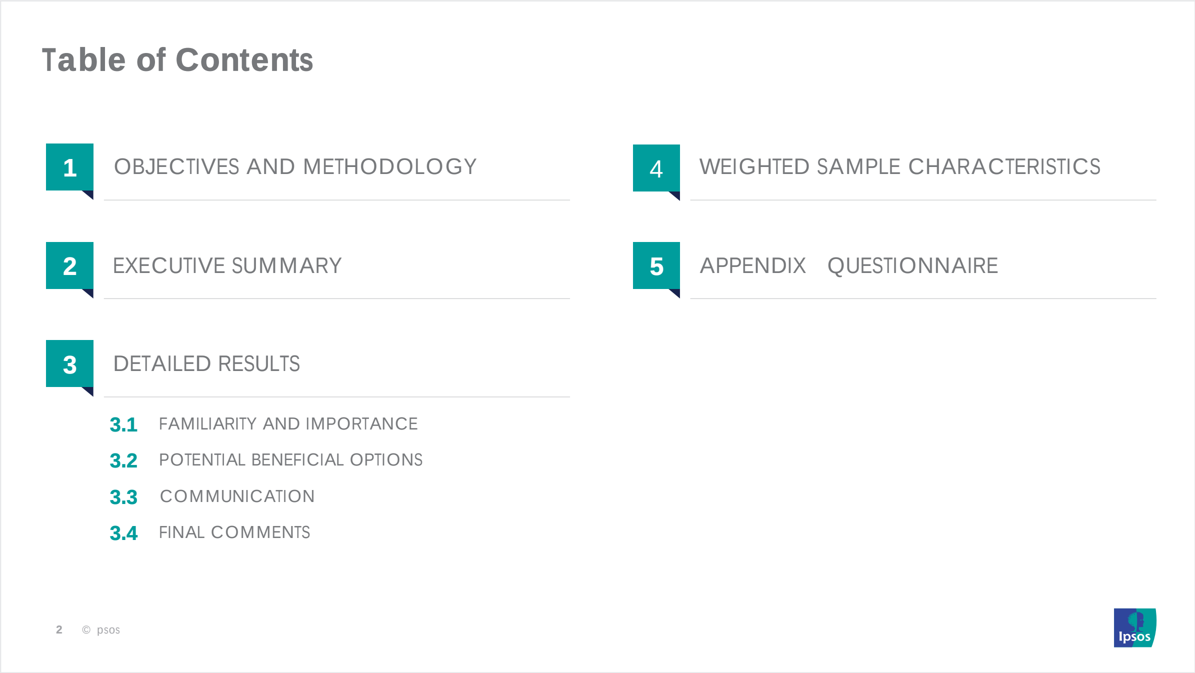
	IPSOS		CRD	
LONG-TERM BIOSOLIDS USE OPTION	***Support***	***Oppose***	***Support***	***Oppose***
Forest fertilizer	85%	4%	41%	51%
Industrial land reclamation (e.g. mine/quarry)	83%	6%	43%	45%
Wholesale fertilizer for landscaping	79%	5%	37%	54%
Agriculture fertilizer	78%	7%	34%	60%
Bagged fertilizer for low-cost residential use	77%	7%	33%	56%
Fuel for incineration/ combustion	66%	9%	49%	38%
Advanced thermal (gasification/pyrolysis technology)	56%	11%	66%	19%

**Numbers may not add to 100% due to summary reporting and rounding.*

- The concerns associated with various options varied depending on the survey. The level of opposition to all options and associated concerns were much greater in the voluntary CRD survey, than in the Ipsos representative survey. Many respondents to the CRD survey expressed concerns related to potential contaminants [e.g. toxicity, PFAS's] and health and environmental risks of land application and many indicated biochar is the only beneficial use.
- Many respondents in the CRD survey felt land application options are not a "beneficial-use" due to potential risks and advanced thermal/biochar options are the most-effective method to reduce risks of biosolids.
- Many respondents who submitted correspondence, attended the open house, and participated in the CRD survey would like more detail about plans, progress, and timelines towards piloting advanced thermal options, and more information about the testing, scientific research and risks associated with land applying biosolids. Some would also like to better understand the cost benefit analysis of options and the experience, feasibility, and case studies of various options in other jurisdictions.

IPSOS Representative Survey

516 people participated in a representative survey of Capital Region residents conducted by Ipsos between March 1 and March 11, 2024. The data is weighted to ensure it reflects the gender/age and regional distribution of the CRD population according to the 2021 census data.



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Ipsos

Objectives and Methodology

These are the findings of an Ipsos survey conducted on behalf of the Capital Regional District.

The main objective of the survey is to obtain a representative sampling of residents' opinions about how to harness the benefits of biosolids from wastewater treatment. The results of the research will be used to inform the CRD's long-term plan outlining the beneficial use of biosolids.

For this research, Ipsos conducted an online panel survey of 516 adult (18+ years) CRD residents.

The survey was fielded from March 1 to 11, 2024.

The final data has been weighted to ensure that the gender/age and regional distribution reflects that of the actual population in the CRD according to 2021 Census data.

The precision of Ipsos online polls is measured using a credibility interval. In this case, the poll is accurate to within ±4.9 percentage points, 19 times out of 20, of what the results would have been had all adult CRD residents been polled. The credibility interval will be wider among subsets of the population.

Notes to Reader

The Core Region is defined as Victoria, Saanich, Esquimalt, Oak Bay, Colwood, Langford and View Royal.

Prior to answering the questions, respondents were presented with a brief overview of the topic and invited to learn more by watching a short video and reading a list of Frequently Asked Questions. A copy of the survey questionnaire can be found in the report Appendix.

Some totals in the report may not add to 100%. Some summary statistics (e.g., total familiar) may not match their component parts. The numbers are correct, and the apparent errors are due to rounding.

The CRD also hosted a non-representative online survey on its website, the results of which have been reported separately.

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EXECUTIVE SUMMARY

1. **Many residents are not familiar with the topics** of the CRD wastewater treatment system and biosolids. Overall, just less than four-in ten residents say they are extremely familiar or moderately familiar with these topics.

2. **The topic is relevant to residents**, with six in ten saying it is "very important" or important" to them how biosolids are maximized for community benefit.

3. When planning for the beneficial uses of biosolids, residents place the **greatest priority on environmental impacts** (air, water and soil contaminants) ahead of considerations like cost, climate/ greenhouse gas emissions and community impacts (truck traffic, odour and noise emission, dust).

4. There is **strong majority support and low levels of opposition to all tested potential uses** of biosolids. Support is highest for forest fertilizer and industrial land reclamation. Support is lower for advanced thermal and fuel for incineration/combustion.

5. Residents say that that **TV news is the best way to keep them informed** on this topic, but many residents also want information via webpage, newspaper, CRD social media and radio.

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DETAILED
RESULTS
3
WATER PUMP
HOUSE
7 © psos
Ipsos


FAMILIARITY
AND
IMPORTANCE
3.1
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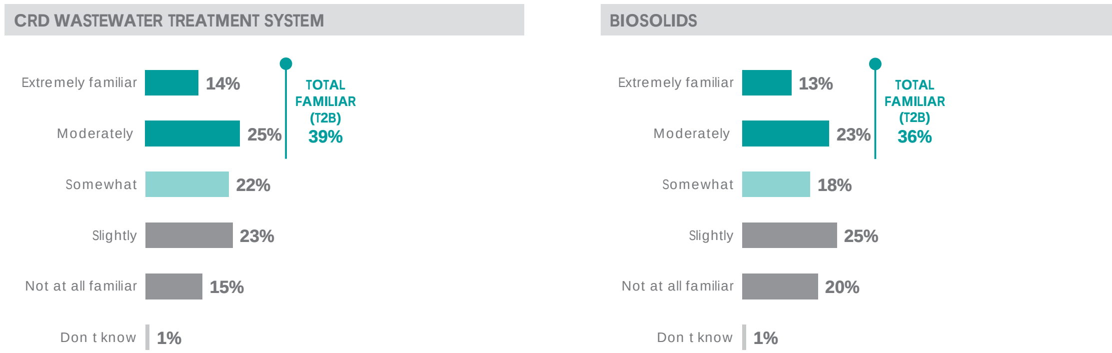
Familiarity with Topics

- C ose to four in ten residents say they are at least moderate y familiar with the topics of the CRD wastewater treatment system and biosolids.



Base: A respondents (n=516)
Q1. How famil ar are you with the following topics?

Ipsos

Familiarity with Topics (by Demos)

- Claimed famil arity with these topics is lower among older residents and women.

Total Important (Extremely + Moderately)

	Total	Region		Age			Sex	
		Core	Other	18 34	35 54	55+	Male	Female
Samp e Size	516	408	108	99	171	246	237	276
CRD wastewater treatment system	39%	36%	45%	47%	43%	31%	52%	27%
Bioso ids	36%	33%	43%	45%	40%	27%	49%	25%

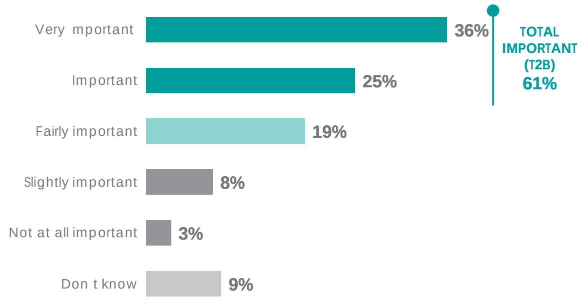
Statistically higher Statistically lower

Base: A respondents (n=516)
Q1. How famil ar are you with the following topics?

Ipsos

Importance of Maximizing Biosolids for Community Benefit

- Six in ten residents say it is important to them how biosolids are maximized for community benefit.



Base: A respondents (n=516)
Q2. How mportant s t to you how b osol ds are maxim zed for commun ty benef t?

Importance of Maximizing Biosolids for Community Benefit (by Demos)

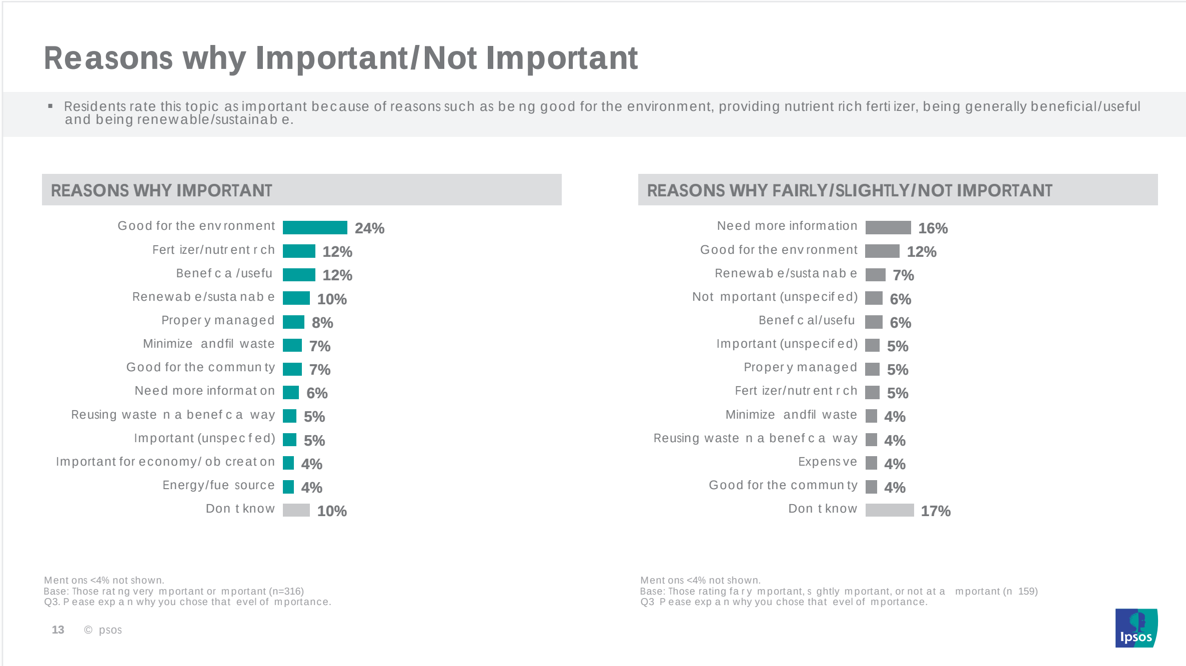
- Older residents are more l kely to place importance on how biosol ds are maximized for community benef t.

Total Important (Very Important + Important)

	Total	Region		Age			Sex	
		Core	Other	18 34	35 54	55+	Male	Female
Samp e Size	516	408	108	99	171	246	237	276
Total mportant	61%	61%	59%	61%	49%	68%	63%	59%

Statistically higher Statistically lower

Base: A respondents (n=516)
Q2. How mportant s t to you how b osol ds are maxim zed for commun ty benef t?


Reasons why Important/Not Important
Residents rate this topic as important because of reasons such as be ng good for the environment, providing nutrient rich ferti izer, being generally beneficial/useful and being renewable/sustainab e.
REASONS WHY IMPORTANT
Good for the env ronment 24%
Fert izer/nutr ent r ch 12%
Benef c a /usefu 12%
Renewab e/susta nab e 10%
Proper y managed 8%
Minimize andfil waste 7%
Good for the commun ty 7%
Need more informat on 6%
Reusing waste n a benef c a way 5%
Important (unspec f ed) 5%
Important for economy/ ob creat on 4%
Energy/fue source 4%
Don t know 10%
REASONS WHY FAIRLY/SLIGHTLY/NOT IMPORTANT
Need more information 16%
Good for the env ronment 12%
Renewab e/susta nab e 7%
Not mportant (unspecif ed) 6%
Benef c al/usefu 6%
Important (unspecif ed) 5%
Proper y managed 5%
Fert izer/nutr ent r ch 5%
Minimize andfil waste 4%
Reusing waste n a benef c a way 4%
Expens ve 4%
Good for the commun ty 4%
Don t know 17%
Ment ons <4% not shown.
Base: Those rat ng very mportant or mportant (n=316)
Q3. P ease exp a n why you chose that evel of mportance.
Ment ons <4% not shown.
Base: Those rating fa r y mportant, s ghtly mportant, or not at a mportant (n 159)
Q3 P ease exp a n why you chose that evel of mportance.
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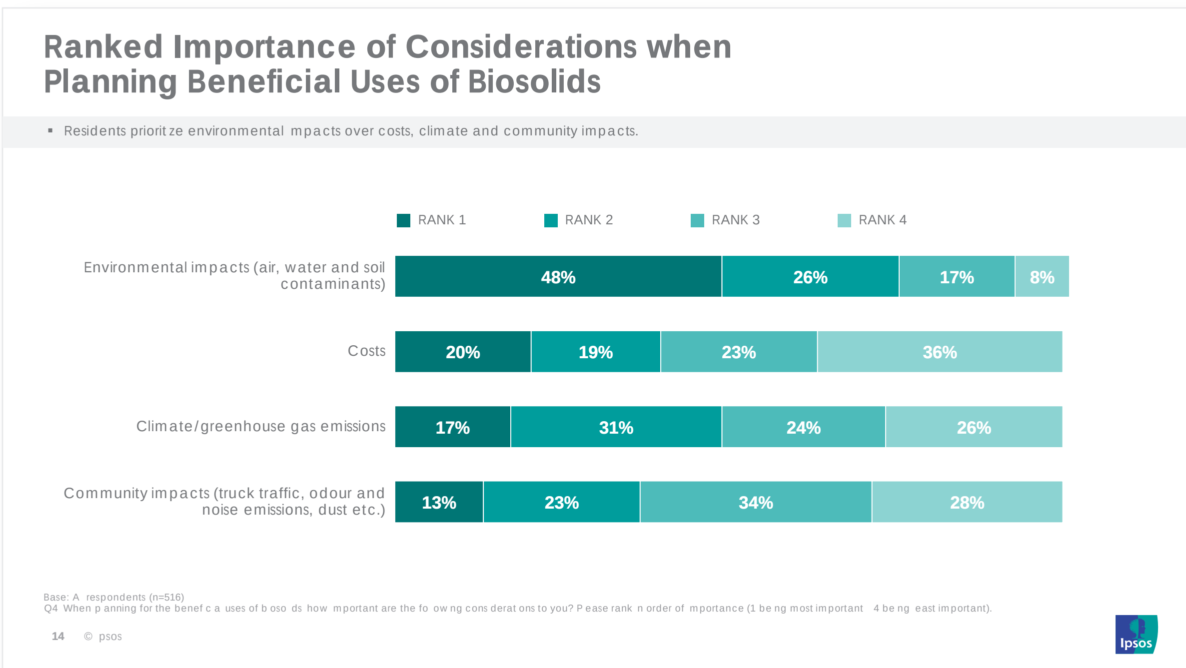
Ipsos


Ranked Importance of Considerations when Planning Beneficial Uses of Biosolids
Residents priorit ze environmental mpacts over costs, climate and community impacts.
RANK 1
RANK 2
RANK 3
RANK 4
Environmental impacts (air, water and soil contaminants) 48% 26% 17% 8%
Costs 20% 19% 23% 36%
Climate/greenhouse gas emissions 17% 31% 24% 26%
Community impacts (truck traffic, odour and noise emissions, dust etc.) 13% 23% 34% 28%
Base: A respondents (n=516)
Q4 When p anning for the benef c a uses of b oso ds how mportant are the fo ow ng cons derat ons to you? P ease rank n order of mportance (1 be ng most important 4 be ng east important).
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Ranked Importance of Considerations when Planning Beneficial Uses of Biosolids (by Demos)

- Older residents are more l kely to prioritize environmental impacts and costs. Younger residents are more likely to prioritize community impacts and less likely to prioritize costs.
- Women are more likely to prioritize environmental impacts.

Ranked First (Most Important)

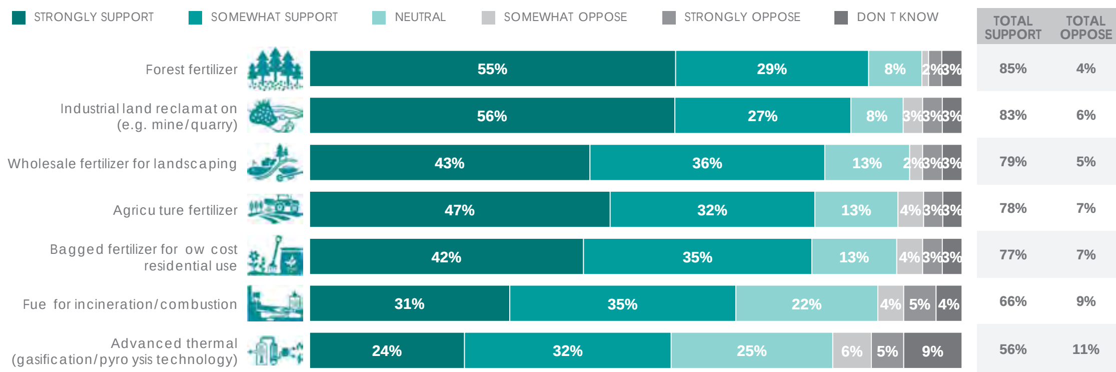
	Total	Region		Age			Sex	
		Core	Other	18 34	35 54	55+	Male	Female
Samp e Size	516	408	108	99	171	246	237	276
Environmental impacts (air, water and so l contam nants)	48%	48%	50%	40%	45%	55%	43%	52%
Costs	20%	22%	16%	9%	22%	25%	21%	19%
C imate/greenhouse gas emissions	17%	18%	16%	24%	19%	12%	19%	16%
Community impacts (truck traffic, odour and no se em ssions, dust etc.)	13%	12%	18%	25%	12%	7%	16%	11%

Statistically higher Statistically lower

Base: A respondents (n=516)
Q4 When p anning for the benef c a uses of b oso ds how mportant are the fo ow ng cons derat ons to you? P ease rank n order of mportance (1 be ng most important 4 be ng east important).

Support for Options

- There is majority support and ow eve s of opposition to a tested options. The greatest support is for forest fertilizer and industrial land reclamation. There is lower support for advanced thermal.



Data abe s <2% not shown.
Base: A respondents (n=516)
Q5 Q11 P ease ind cate your evel of support for...?

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Support for Options (by Demos)

- Older residents are more support ve of using biosolids for wholesale fertilizer for landscaping and agricultural ferti izer. They are less supportive of advanced thermal.
- Residents aged 35 54 years are less supportive of using biosolids for wholesale fertilizer for landscaping and for bagged ferti izer for low cost residential use.
- Younger residents are more support ve of using biosolids for advanced thermal.

Total Support (Strongly + Somewhat)

	Total	Region		Age			Sex	
		Core	Other	18 34	35 54	55+	Male	Female
Samp e Size	516	408	108	99	171	246	237	276
Forest fertilizer	85%	87%	80%	81%	83%	88%	84%	86%
Industrial land reclamat on (e.g. mine/quarry)	83%	82%	84%	79%	83%	85%	85%	81%
Wholesale fertilizer for landscaping	79%	78%	82%	76%	73%	84%	79%	79%
Agricu ture fertilizer	78%	79%	77%	74%	73%	84%	74%	82%
Bagged fertilizer for ow cost residential use	77%	76%	81%	81%	69%	81%	76%	79%
Fue for incineration/combustion	66%	66%	66%	67%	65%	66%	67%	65%
Advanced thermal (gasification/pyrolysis techno ogy)	56%	56%	56%	70%	55%	48%	56%	55%

Statistically higher Statistically lower

Data abe s <2% not shown.
Base: A respondents (n=516)
Q5 Q11 P ease ind cate your evel of support for...?

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Ipsos

Reasons Oppose Use of Biosolids for Forest Fertilizer
(verbatim comments)

- Verbatim comments provided by those opposed to the use of biosolids for **forest fertilizer** can be found below.

Pets.

Potential contamination of ground water.

The thought of animals eating the fertil zer.

Don t believe it is the safest procedure.

Toxicity.

Tox c s udge is not good for trees.

If bioso ids are so good for the environment why was the ocean release not continued? Given the huge water exchange in Victoria's locat on on Juan de Fuca, and the lack of any deleterious effect, the decision to surround ourselves on land with our waste makes no sense at all.

Base: Samp ng of those opposed
Q6A What s the ma n reason why you oppose this use of b oso ds?

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Reasons Oppose Use of Biosolids for Industrial Land Reclamation
(verbatim comments)

- Verbatim comments provided by those opposed to the use of biosolids for **industrial land reclamation** can be found below.

I think that the use of biosolids in bad areas can affect the environment and eco systems.

Cost to me.

Are better th ngs.

I don t be ieve it to be safe enough.

Toxic sludge is not appropriate for this use.

To save land.

Sounds ke it wil be bad for soil for vegetable growth.

I do not trust the treatment that is given.

Environment.

I worry that there will be health concerns to using biosolids.

Toxicity.

It is bad for cl mate change.

Expens ve.

I m unsure of the long term effects on the and and the water. We won't know the long term impacts on the environment for at least 10 years or so and by then it m ght be too late for intervention on the environment and we won't be able to make the necessary adjustments in time for our planet. I m just very concerned about the world my son is going to be inheriting in the future and I m praying we aren't too late already.

Base: Samp ng of those opposed
Q7A What s the ma n reason why you oppose this use of b oso ds?

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Reasons Oppose Use of Biosolids for Wholesale Fertilizer for Landscaping (verbatim comments)

- Verbatim comments provided by those opposed to the use of biosolids for **wholesale fertilizer for landscaping** can be found below.

Green.

Future use s unknown.

It s not bad, but I don't think manicured lawns should be the priority. Less water usage is great!

I don't want to consume foods grown by our waste.

I do not oppose I say for only landscape.

Human waste in your garden??

I am concerned about run off and contamination.

It is too close to city fe.

Don't know if there may be harmfu effects to humans and animals.

Beehives.

Would want to better understand heath implications.

Unless the biosolids (sewage waste) is treated in a Pyrolysis plant then the heavy metals, pharmaceuticals, chemicals etc. remain in the sewage & is detrimental to the environment with the ability to downstream into water flows eventually ending up in the ocean affecting w ld ife & fish habitats.

Base: Samp ng of those opposed
Q8A What s the ma n reason why you oppose this use of b oso ds?

Ipsos

Reasons Oppose Use of Biosolids for Agriculture Fertilizer
(verbatim comments)

- Verbatim comments provided by those opposed to the use of biosolids for **agriculture fertilizer** can be found below.

Your Walmarts aren t very big like the U.S per say it seems like k nd of a waste right now.

It could be bad.

Unproven.

I oppose the use of bioso ds because t s not the r ght thing to use.

Because I believe eating natural food is always healthier.

Potential contamination of ground water.

Concerns that we may not have enough evidence that pharmaceutical and disease particles have all been removed and won't seep nto the food.

Not certain of health implications would need to understand more.

There isn't enough scientific evidence prov ng the safety of using biosolids as fertilizer for human food production.

Contaminants.

Concerned about cross contamination of agricultural products.

*Simple phi osophy, don't s*** in your own nest.*

Endangered species honeybees.

Human waster should not be on our fields for growing food.

From experience bioso ids are fu l of heavy metals and could contain pathogens if not properly steri ized. Proper testing is simply not done.

Base: Samp ng of those opposed
Q5A What s the ma n reason why you oppose this use of b oso ds?

Ipsos

Reasons Oppose Use of Biosolids for Bagged Fertilizer for Low-Cost Residential Use (verbatim comments)

- Verbatim comments provided by those opposed to the use of biosolids for **bagged fertilizer for low cost residential use** can be found below.

Unsure of impact.

Have honeybees and they are endangered.

I don't want people s poop in my garden.

At the residential level it may not be safely handled due to lack of comp ete knowledge.

Unsure.

I don't trust biosolids uses on private property.

Pathogens and heavy metals, not enough testing is done to ensure public safety.

Gross.

I just don't know enough about negatives.

Again, not sure if there may be harmful effects for humans and animals.

Bad for the environment.

*Again, same philosophy, don't s*** in your own nest.*

Human waste should not be use for growing food, or be around the population.

Even more expensive.

I don't like the idea of private people controlling this.

Base: Samp ng of those opposed
Q10A. What s the ma n reason why you oppose this use of b oso ds?

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Reasons Oppose Use of Biosolids for Fuel for Incineration/Combustion

(verbatim comments) (slide 1 of 3)

- Verbatim comments provided by those opposed to the use of biosolids for **fuel for incineration/combustion** can be found below.

Not enough facilities to use the product.

I feel it is detrimental to the environment.

Too much greenhouse gasses and it s already bad.

Gases.

CO_2 & CH_4 emissions increased with burning.

Prefer other options.

It goes into the air.

It is not a beneficial use. We shou d be using as fert lizer in appropriate areas.

It releases a ot of CO_2 em ssions.

It seems like a waste and there are probab y other things we can burn.

Burning and its impact on carbon emiss ons.

Not used loca ly.

I see this this as the worst option since it will produce emissions.

We should be sequestering, not combusting hydrocarbons.

The negative impact on the environment, we won't know the full results of our lack of action and on our stupidity and putt ng the dollar above our world. It just means that we have already lost this fight. How completely selfish and se f absorbed are we to not have put things in place like, when decid ng to create something, making it il egal to mass produce something that doesn't decompose within 20 years. It may take a b t longer than we would like to have certain things but at least we wou d have a world that s going to be here and have air for us to breathe and our children to breathe in the future.

Base: Samp ng of those opposed
Q9A What s the ma n reason why you oppose this use of b oso ds?

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Reasons Oppose Use of Biosolids for Fuel for Incineration/Combustion

(verbatim comments) (slide 2 of 3)

- Verbatim comments provided by those opposed to the use of biosolids for **fuel for incineration/combustion** can be found below.

Should be used in Victoria.

Impact on neighborhood.

Po nt ess.

The cost to transport, the inability to expect constant use of the solids in heat generation, and the inability to store the solids safely as a result make this a terrible idea.

I support them.

Damage to the env ronment.

I worry about the resulting air pollution and greenhouse gases.

It seems l ke a carbon emitting use.

Burning is pol ution.

Trucking costs of the product seem unnecessary.

Inefficient too much transport needed fert lizer s better.

Concerns over potential contaminants.

There are enough power and fuel options, and we don't need more impacts to the environment.

Because of the pollution that gets put into the air with burning the b oso ds.

The treated sewage (b osolids) were not produced suitable for the cement kilns to burn & the plants could not accept the total volume 100% of the time. The excess b osolid was applied to land.

Base: Samp ng of those opposed
Q9A What s the ma n reason why you oppose this use of b oso ds?

Ipsos

Reasons Oppose Use of Biosolids for Fuel for Incineration/Combustion

(verbatim comments) (slide 3 of 3)

- Verbatim comments provided by those opposed to the use of biosolids for **fuel for incineration/combustion** can be found below.

This would create air born particles, and we need to reduce th s.

It seems l ke there are better uses than burning it and releas ng CO_2.

I am not sure what the impact is on the environment vis a vis carbon footprint.

Base: Samp ng of those opposed
Q9A What s the ma n reason why you oppose this use of b oso ds?

Ipsos

Reasons Oppose Use of Biosolids for Advanced Thermal (Gasification/Pyrolysis Technology) (verbatim comments) (slide 1 of 3)

- Verbatim comments provided by those opposed to the use of biosolids for **advanced thermal (gasification/pyrolysis technology)** can be found below.

It is a solution which is going to take a long time with questionable benefits.

Cost, time, effect on neighbours.

Progress unknown.

I am already overburdened as a taxpayer. I cannot anymore "feel good pro ects.

Prefer other options.

Costly and could make climate change worse.

I have concerns about the long timeline and costs associated w th this use/application of bioso ds.

If th s s going to be s mi ar to coal then you re getting negative emissions not in favour of that at all. We re mostly away from coal and working to erad cate it, not f nd a new way to add it.

It is costly and not necessary. We shou d be selling as ferti izer.

They contain poop.

It doesn't sound super great for the environment.

Unproven technology that seems to carry a very high price tag.

It seems like just a d fferent and possibly expens ve way to produce another carbon emitting fuel source.

Not sure the process and all of its effects have been properly studied.

It takes too darn long to get there and too darn many money when compared to other options available, not to mention the fact that there is no experience n Canada using this. Plus, there may be other factors, like, where such a faci ity be bu ld? I can see locals fighting against such a faci ity for various reasons.

Current level of use.

Base: Samp ng of those opposed
Q11A. What s the ma n reason why you oppose this use of b oso ds?

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Reasons Oppose Use of Biosolids for Advanced Thermal (Gasification/Pyrolysis Technology) (verbatim comments) (slide 2 of 3)

- Verbatim comments provided by those opposed to the use of biosolids for **advanced thermal (gasification/pyrolysis technology)** can be found below.

Time and cost.

Unhealthy.

Too expens ve if t reaches $4500.

Not cost effective and requires too much resources for beneficia results.

This is the most expensive option so far. Whatever is the least cost is what I would prefer.

Too expensive.

Potential cost.

It seems l ke an expensive way to produce another carbon emitting fue source.

Burning gas is still pollution.

Need more nformation and research.

It doesn't seem super environmental y friend y.

Seems costly compared to some of the other options.

Far too expensive.

COST!!

It is not good for plants and animals.

Cost and assumption that there are better uses.

Base: Samp ng of those opposed
Q11A. What s the ma n reason why you oppose this use of b oso ds?

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Reasons Oppose Use of Biosolids for Advanced Thermal (Gasification/Pyrolysis Technology) (verbatim comments) (slide 3 of 3)

- Verbatim comments provided by those opposed to the use of biosolids for **advanced thermal (gasification/pyrolysis technology)** can be found below.

Unknown costs.

Cost, and avai abi ity of alternatives.

Cost/benefit bad.

Too much cost and investment, cost benefit analysis is not stated.

Cost and ength of time to imp ement.

Cost and potential of going excess vely over budget.

Contaminants.

If there are non carbon producing options, why make a polluting one.

Base: Samp ng of those opposed
Q11A. What s the ma n reason why you oppose this use of b oso ds?

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Best Ways to Keep Informed about Topic

- TV news is the number one best way to keep residents nformed about this topic, but several other methods are also desired by many residents.

56% TV NEWS

48% WEBPAGE

45% NEWSPAPER

43% CRD SOCIAL MEDIA

35% RADIO

5% OTHER

4% DON T KNOW

Base: A respondents (n=516)
Q12. What is the best way to keep you nformed about th s top c n future?

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Best Ways to Keep Informed about Topic (by Demos)

- Older residents are less nterested in keeping informed by CRD social media and radio.
- Core are residents and men are less interested in keeping nformed by radio.

Total Familiar (Extremely + Moderately)

	Total	Region		Age			Sex	
		Core	Other	18 34	35 54	55+	Male	Female
Samp e Size	516	348	168	99	171	246	237	276
TV news	56%	56%	57%	61%	52%	57%	58%	55%
Webpage	48%	47%	49%	52%	48%	45%	47%	47%
Newspaper	45%	46%	42%	43%	45%	46%	42%	47%
CRD social media	43%	42%	44%	54%	57%	26%	41%	44%
Radio	35%	31%	40%	39%	43%	27%	29%	41%

Statistically higher **Statistically lower**

Base: A respondents (n=516)
Q12. What is the best way to keep you nformed about th s top c n future?

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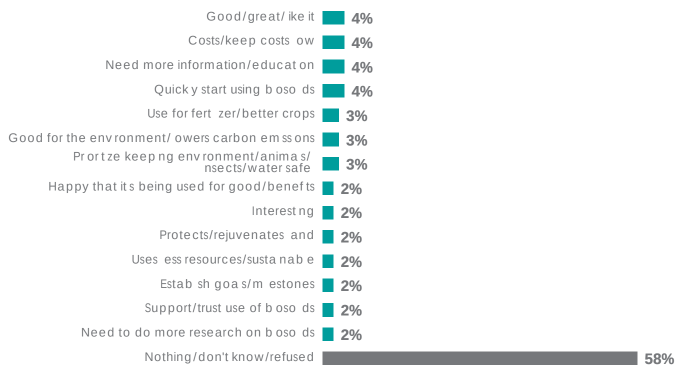
Final Comments

- Most survey respondents had no final comments or suggestions for the CRD on this topic.



Ment ons <2% not shown.
Base: A respondents (n=516)
Q13. Do you have any f na comments about b oso ds and the potent a uses be ng cons dered by the CRD?

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Weighted Sample Characteristics

GENDER	
Male	47%
Fema e	52%
Another gender	1%
AGE	
18 24	7%
25 34	19%
35 44	18%
45 54	13%
55 64	17%
65+	28%
OWN/RENT	
Yes	68%
No	31%
Prefer not to answer	2%
OWN BUSINESS	
Yes	11%
No	87%
Prefer not to answer	2%

COMMUNITY	
Central Saanich	6%
Colwood	4%
Esquimalt	3%
Highlands	2%
Juan de Fuca	0%
Langford	11%
Metchosin	2%
North Saanich	3%
Oak Bay	2%
Saanich	26%
Salt Spring Island	3%
Sidney	4%
Sooke	5%
Southern Gulf Islands	1%
Victoria	26%
View Royal	2%

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About Ipsos

Ipsos is the third largest market research company in the world, present in 90 markets and employing more than 18,000 people.

Our research professionals, analysts and scientists have built unique multi specialist capabilities that provide powerful insights into the actions, opinions and motivations of citizens, consumers, patients, customers or employees. Our 75 business solutions are based on primary data coming from our surveys, social media monitoring, and qualitative or observational techniques.

Game Changers our tagline summarises our ambition to help our 5,000 clients to navigate more easily our deeply changing world.

Founded in France in 1975, Ipsos is listed on the Euronext Paris since July 1st, 1999. The company is part of the SBF 120 and the Mid 60 index and is eligible for the Deferred Settlement Service (SRD).

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Game Changers

In our world of rapid change, the need for reliable information to make confident decisions has never been greater.

At Ipsos we believe our clients need more than a data supplier, they need a partner who can produce accurate and relevant information and turn it into actionable truth.

This is why our passionately curious experts not only provide the most precise measurement, but shape it to provide True Understanding of Society, Markets and People.

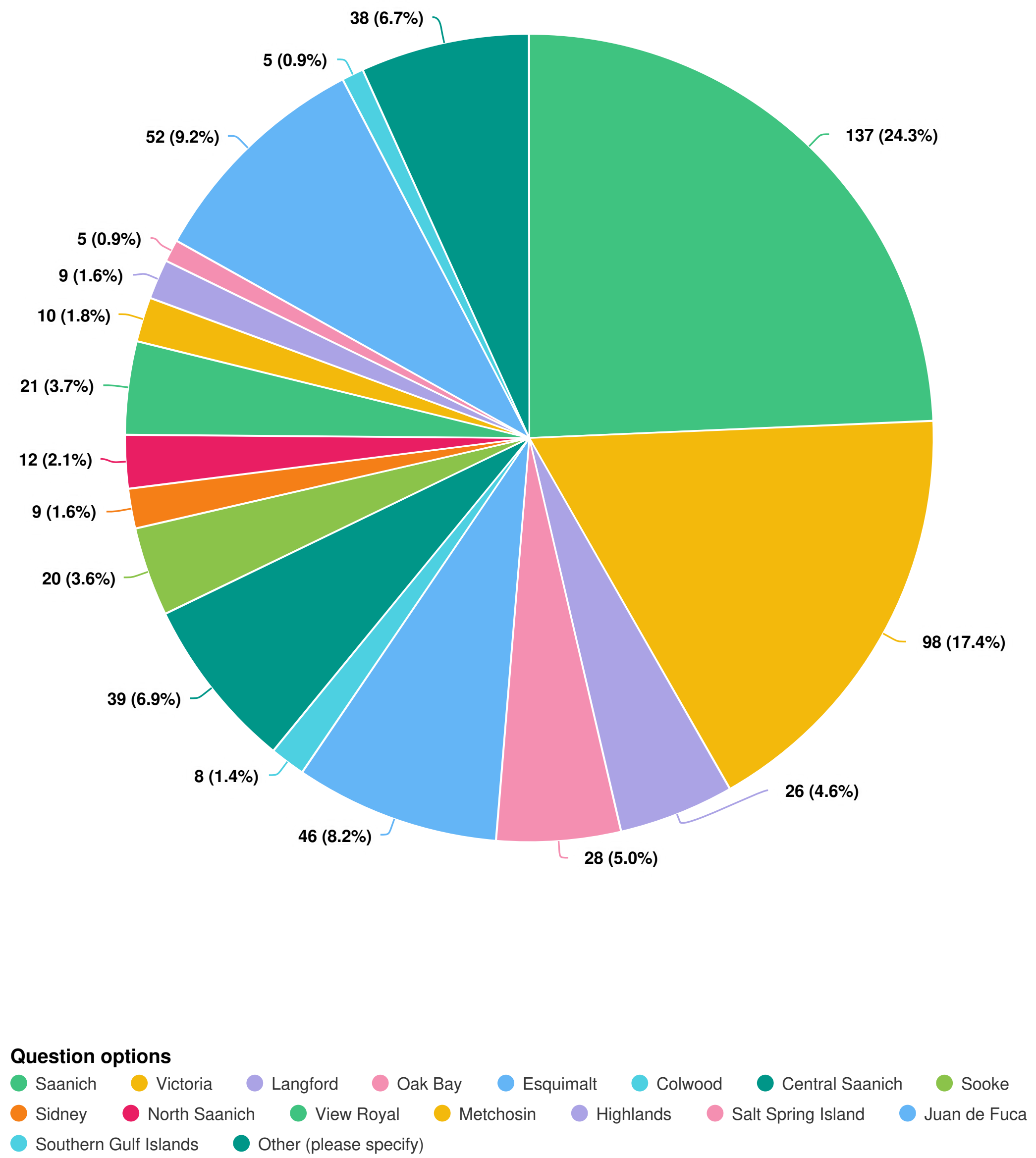
To do this we use the best of science, technology and know how and apply the principles of security, simplicity, speed and substance to everything we do.

So that our clients can act faster, smarter and bolder. Ultimately, success comes down to a simple truth:
You act better when you are sure.

CRD Online Survey

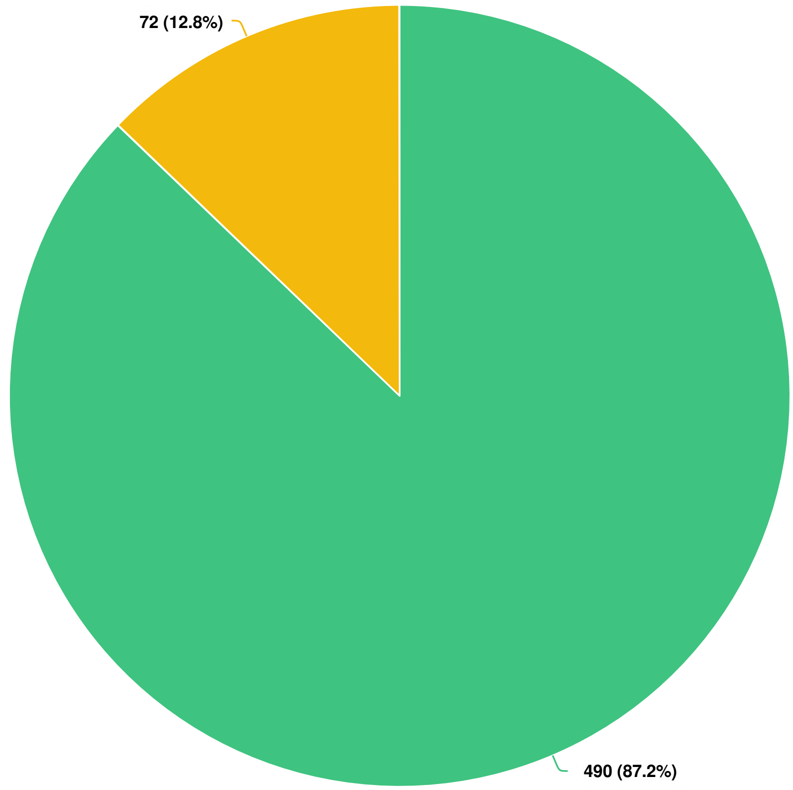
569 people participated in the online survey between January 11 and March 6, 2024. The survey was hosted on the CRD's ***www.GetInvolved.crd.bc.ca*** engagement platform. The highest participation was experienced timed with the survey launch, media coverage and promotion by a third-party non-profit organization, Creatively United.

Question #1 – *Where do you live?*



Optional question (562 response(s), 7 skipped)
Question type: Dropdown Question

Question #2 – *Do you own or rent your home?*

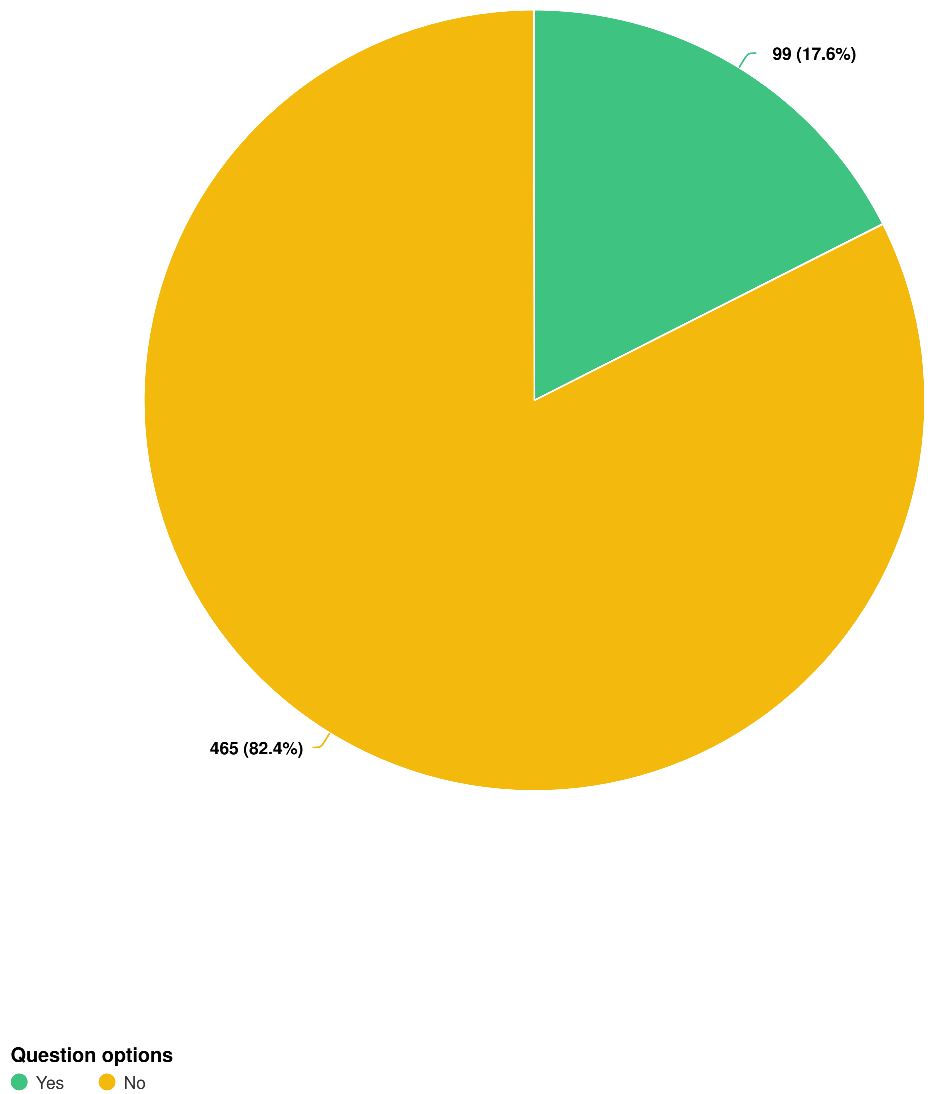


Question options

Own Rent

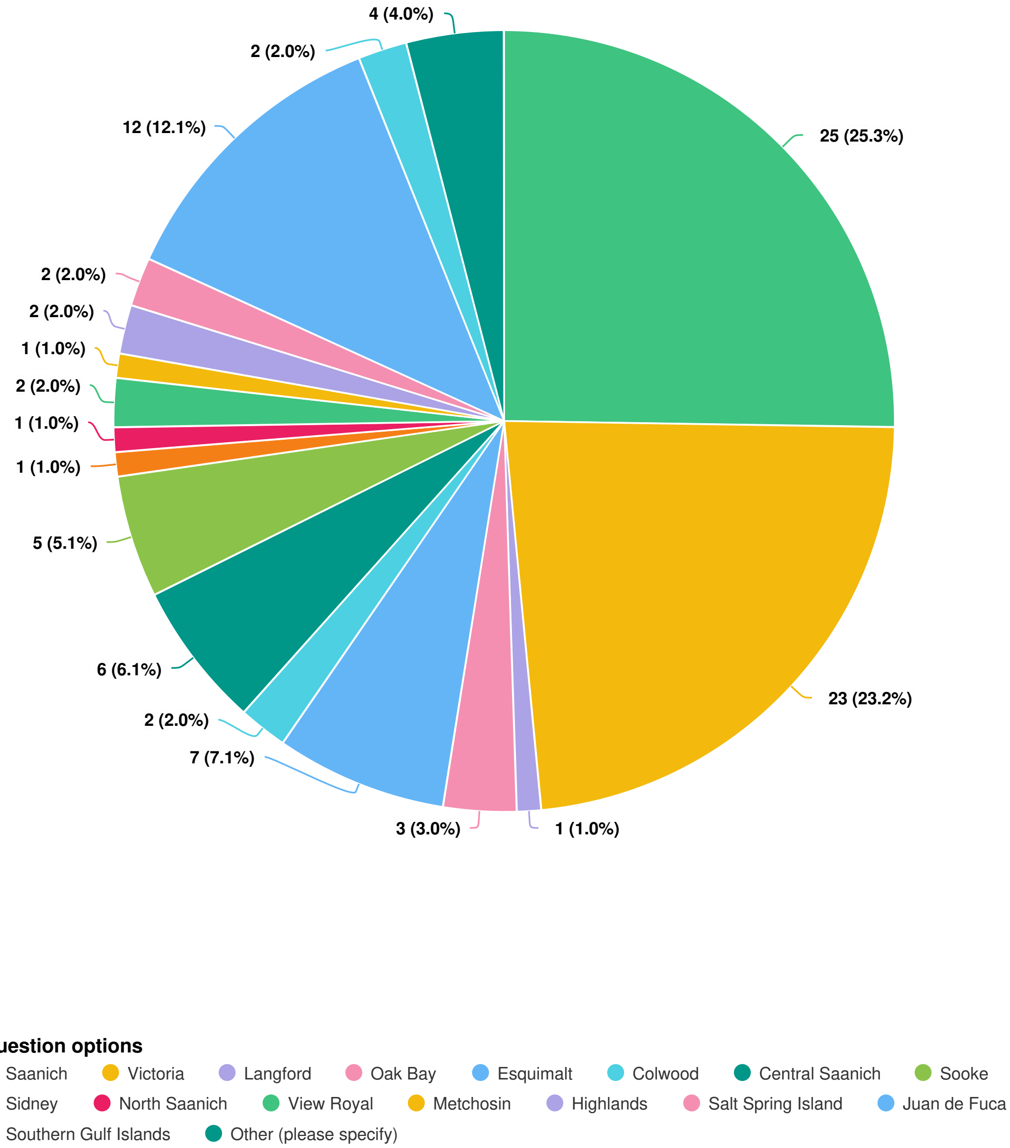
Optional question (561 response(s), 8 skipped)
Question type: Radio Button Question

Question #3 – *Do you own a business in the capital region?*



Optional question (563 response(s), 6 skipped)
Question type: Radio Button Question

Question #4 – *Where is your business located?*

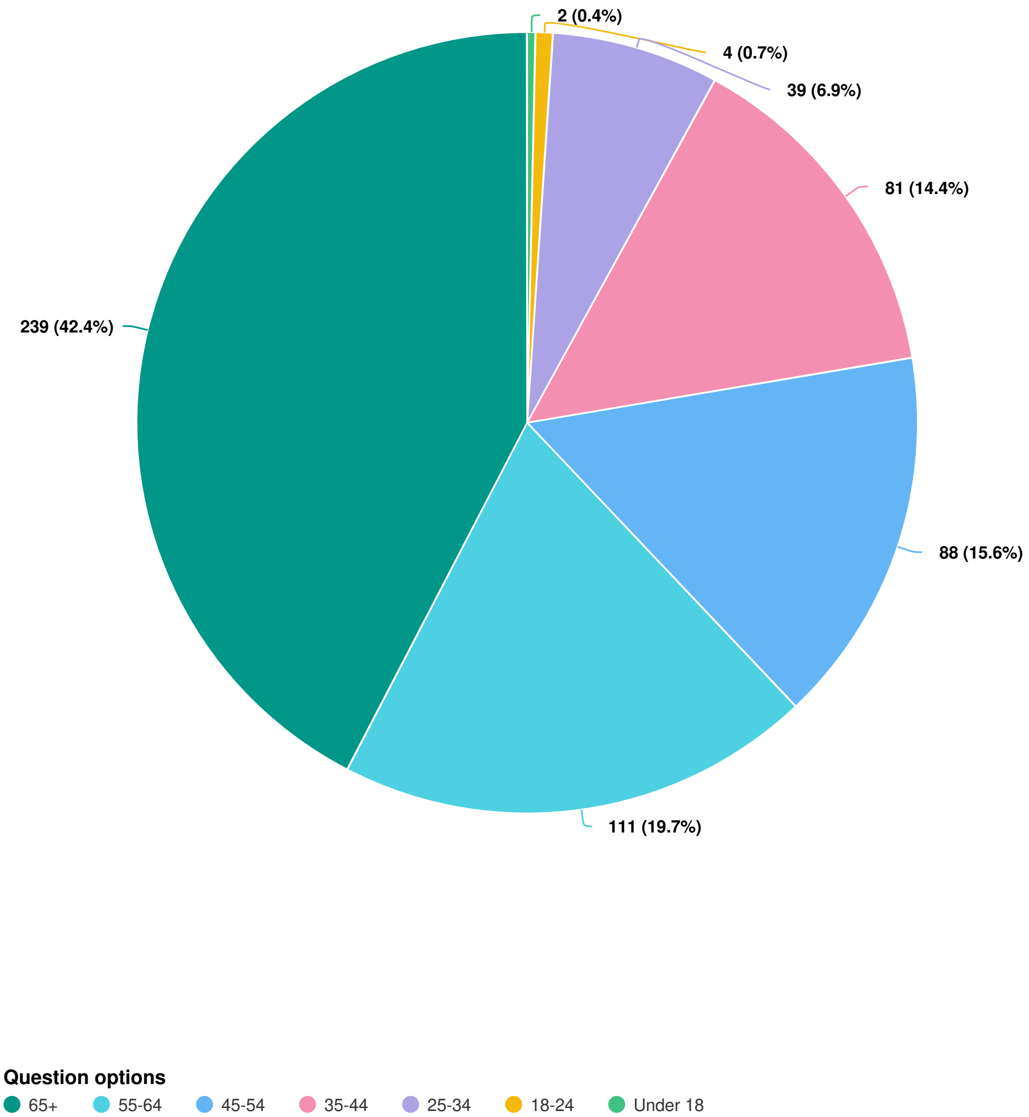


Optional question (99 response(s), 470 skipped)
Question type: Dropdown Question

Question #5 – *How familiar are you with the following topics?*

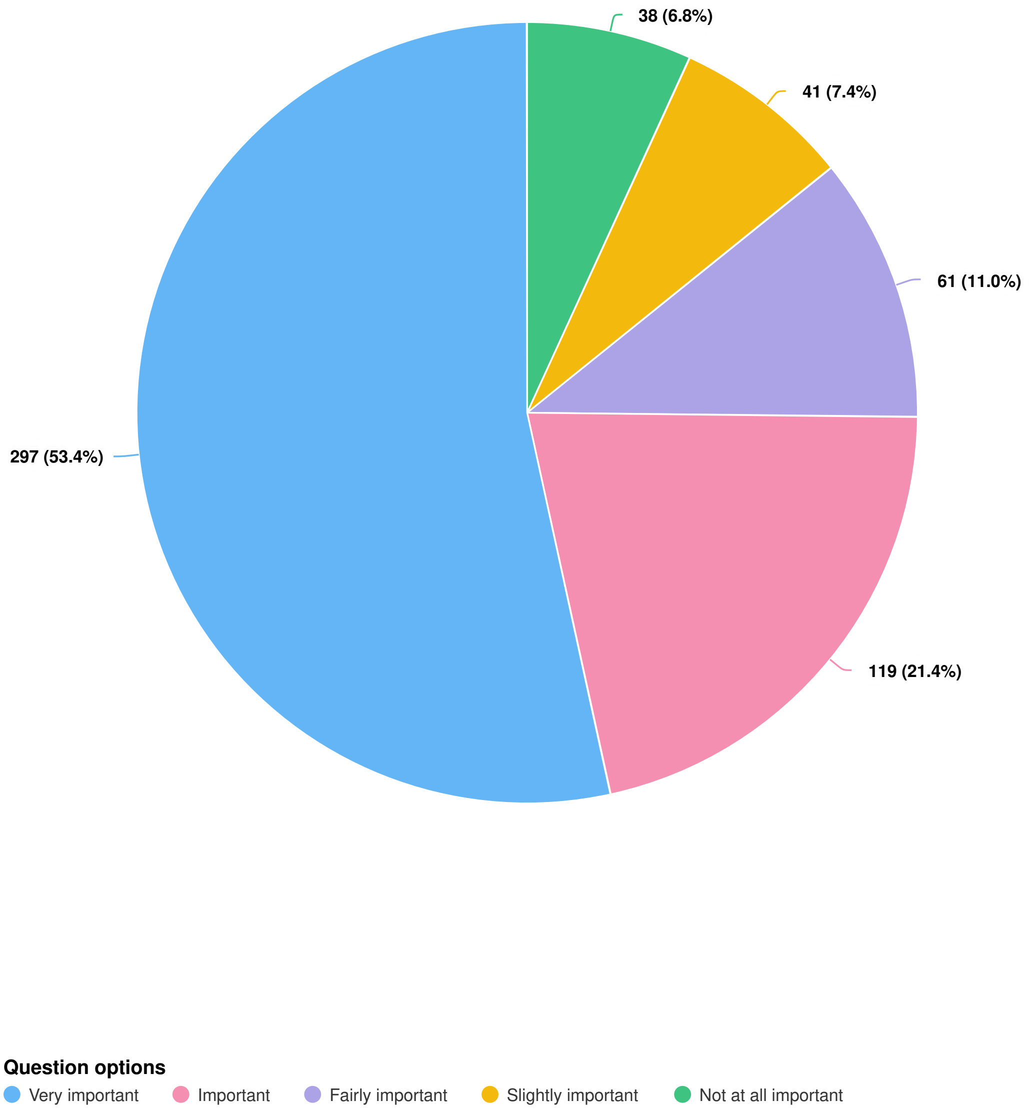
Optional question (562 response(s), 7 skipped)
Question type: Likert Question

Question #6 – *What is your age range?*



Optional question (563 response(s), 6 skipped)
Question type: Radio Button Question

Question #7 – ***How important is it to you how biosolids are maximized for community benefit?***



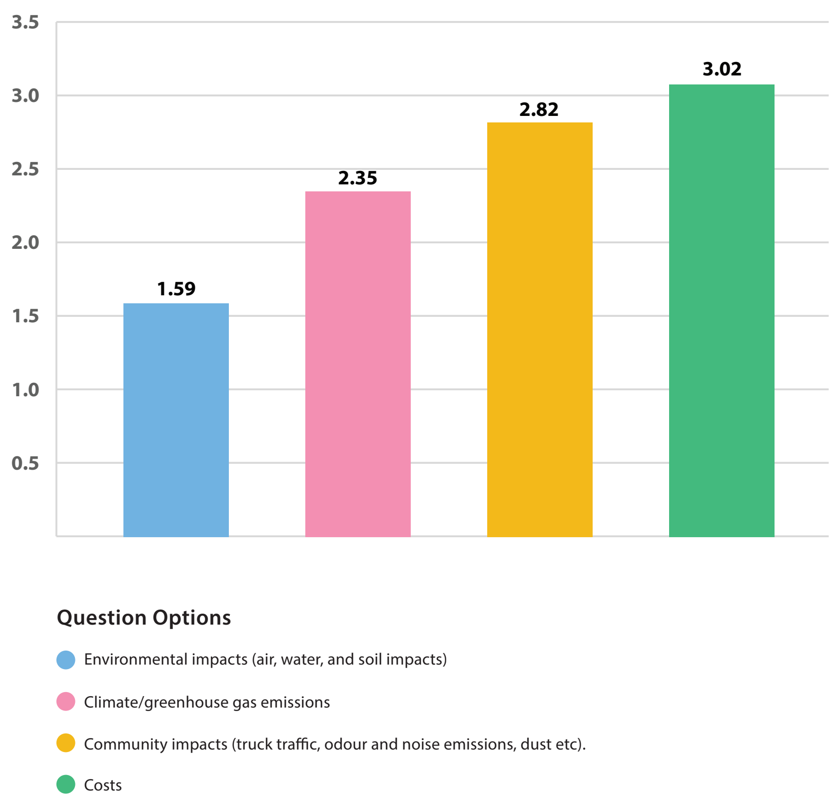
Optional question (555 response(s), 14 skipped)
Question type: Radio Button Question

Question #8 – *Please explain why you chose that level of importance.*

Top mentions included:

- Biosolids should be managed responsibly for the long-term, taking into consideration environment and health. Some respondents also noted costs.
- Land application options are not "beneficial" due to potential risks.
- Biochar/advanced thermal options are the most effective method to reduce risks of biosolids.
- Biosolids should not be landfilled/buried.
- Some respondents feel "beneficial use" is a subjective term.
- Some respondents who felt biosolids should be utilized as a resource mentioned circular economy.

Question #9 – *When planning for the beneficial uses of biosolids, how important are the following considerations to you? Please rank in order of importance (1 being most important – 4 being least important).*



Optional question (552 response(s), 17 skipped)
Question type: Ranking Question

Question #10 – ***Please indicate your level of support for the following potential uses.***

Optional question (563 response(s), 6 skipped)
Question type: Likert Question

Question #11 – *What specifically interests you about the potential benefits biosolids can offer?*

Top mentions include:

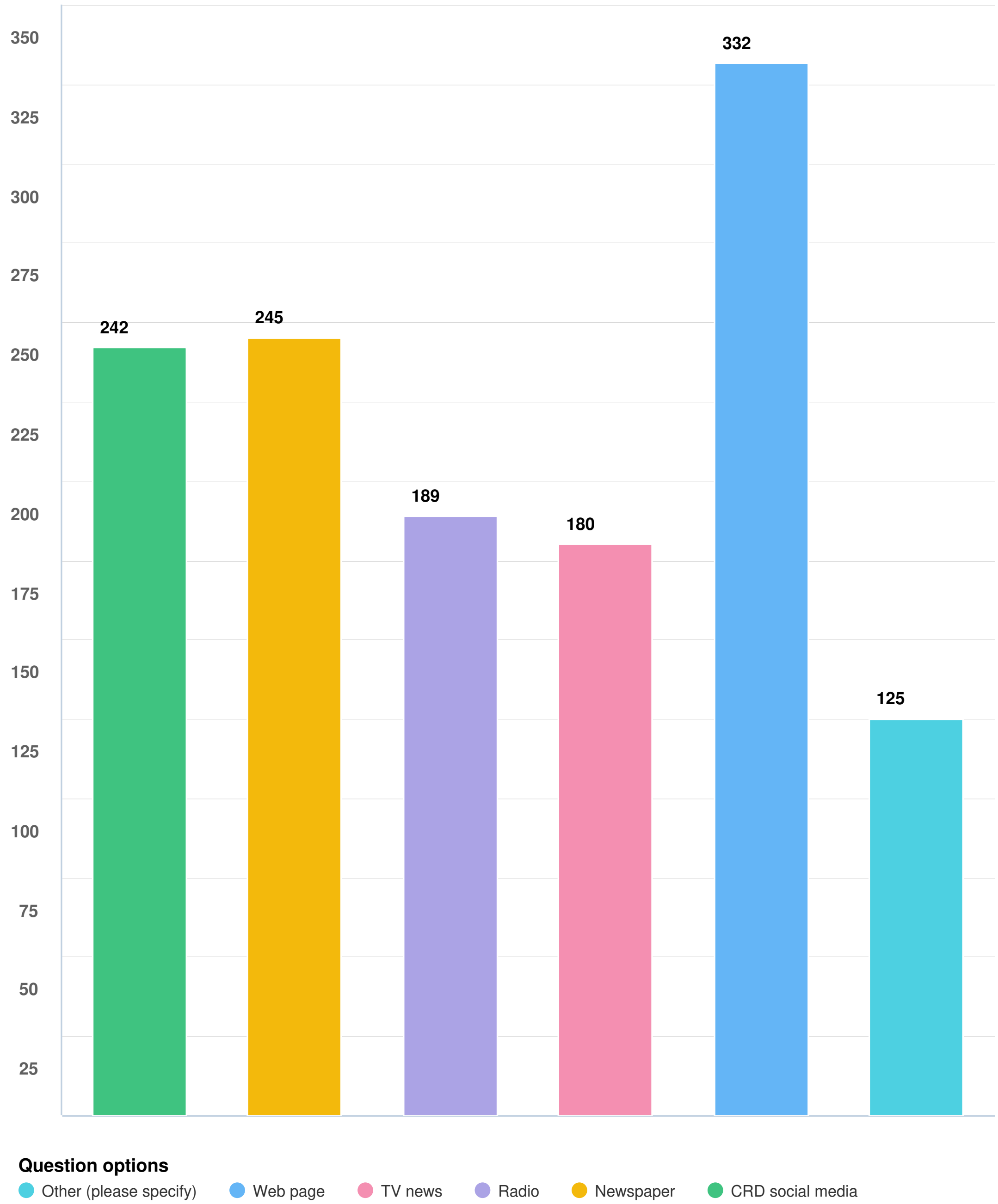
- Biosolids have no benefit unless converted to biochar.
- Some felt biosolids could benefit soils as various forms of fertilizer or soil amendment.
- Some felt it is important to reuse/reduce/recycle waste in a responsible manner.

Question #12 – *Do you have any specific concerns about the beneficial use of biosolids?*

Top mentions included:

- Concern about the toxicity, level of contaminants and specifically Per- and polyfluoroalkyl substances [PFSAs]/forever chemicals.
- Risk [of land application] to environment and plants.
- Biosolids need to be treated.
- Biochar/advanced thermal options are the only beneficial use.

Question #13 – ***What is the best way to keep you informed about this topic in future? Check all that apply.***



Optional question (558 response(s), 11 skipped)
Question type: Checkbox Question

Question #14 – ***Is there anything more you wish you knew about biosolids, and the options being considered? [n=325]***

Top mentions included:

- More detail about plans, progress, and timelines towards piloting advanced thermal options.
- More information about the testing, scientific research and risks associated with land applying biosolids.
- Costs benefit analysis of options.
- Feasibility, experience, and case studies of various options in other jurisdictions.

Open House – Tuesday, February 20, 2024

56 people [of 99 who RSVP'd] participated in the two-hour virtual open house. The open house was an opportunity for the CRD staff and technical consultants to present background information, outline the process and Provincial regulatory requirements for the beneficial use of biosolids, as well as the beneficial-use options being explored.

Attendees were invited to ask questions of the staff and consultants. Questions were moderated by communications consultant Jim Beatty and posed to the panel of Glenn Harris, Senior Manager, Environmental Protection, Peter Kickham, Manager, Regulatory Services, Environmental Protection Division, and GHD Technical Consultant Deacon Liddy. Over 100 questions were submitted during the two-hour session. Attendees were encouraged to provide feedback through the CRD's online survey or ***biosolids@crd.bc.ca***

Key themes:

- Many questions were related to the testing, regulations, and environmental and health risks associated with land application [e.g., metals, microplastics, Per- and polyfluoroalkyl substances] and whether the CRD has considered the associated scientific literature and experience of other jurisdictions.
- Some questions were related to legal liability of land application
- Some questions were about the open house format [e.g., virtual, moderated questions] and status of indigenous engagement.

Watch the recording of the Long-Term Biosolids Management Plan Open House held Tuesday, February 20, 2024: ***Harnessing the Benefits of Biosolids - Virtual Open House (youtube.com)***

Correspondence to the CRD Board of Directors – January 11 – March 6, 2024

24 letters were submitted to the CRD Board between January 11 and March 6, 2024.

Letters were received from individual residents and the following organizations:

- Biosolids Free BC
- Butchart Gardens
- Creatively United for Planet Society
- Friends of Tod Creek
- Mount Work Coalition
- Peninsula and Area Agricultural Commission
- Peninsula Biosolids Coalition
- Peninsula Streams
- Regional District of Nanaimo [RDN]
- Saanich Inlet Protection Society

The majority of correspondence noted risks associated with land application and encouraged the CRD Board to uphold the existing land application ban.

Many letters noted the need to refer to studies and literature about the risks of contaminants such as microplastics and PFAS in biosolids that should be considered.

Some letters noted concern with the consultation process and emphasized the need for greater emphasis on the risks associated with land application and the existing land application ban.

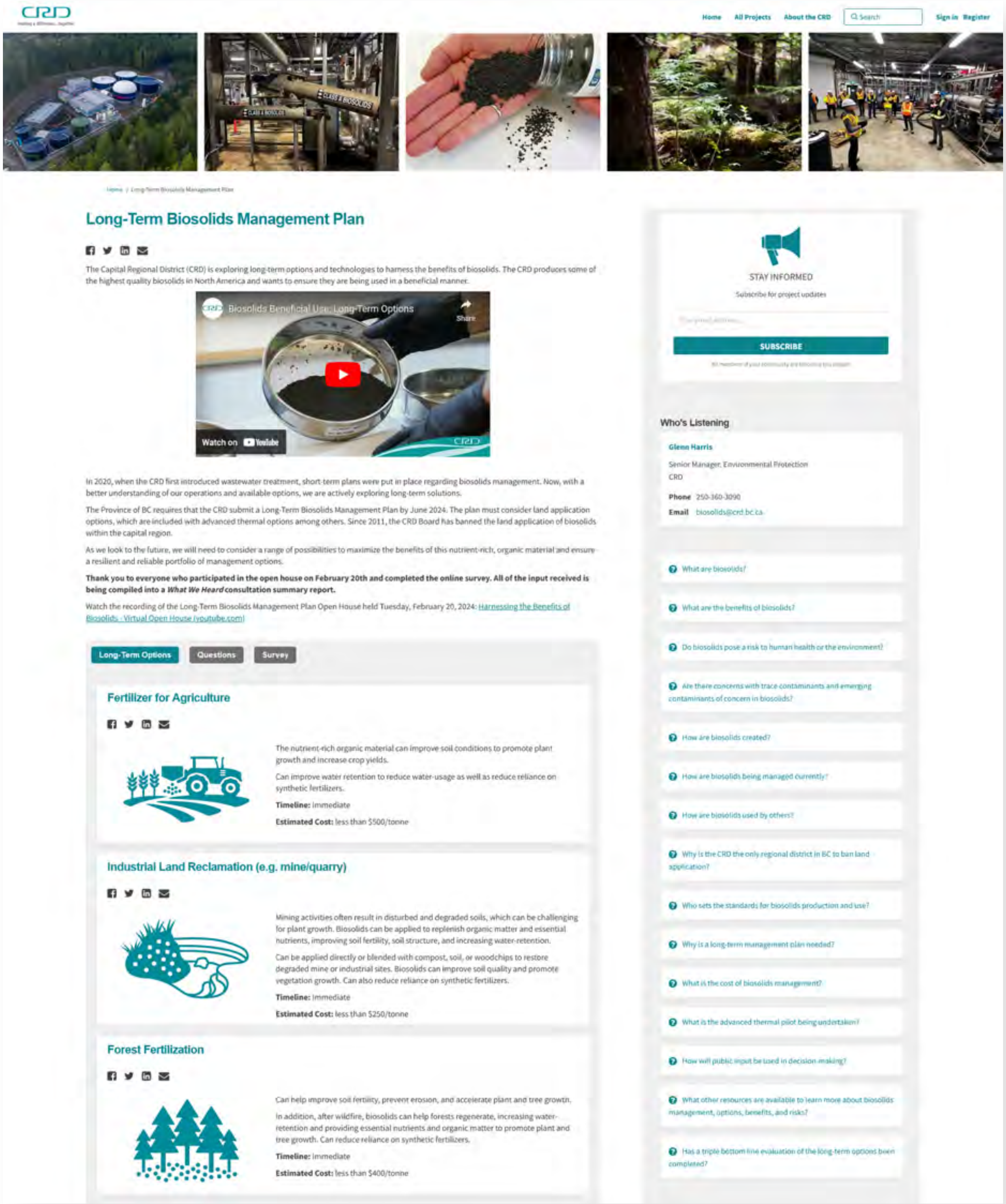
Some letters expressed support for thermal processing of biosolids.

NEXT STEPS

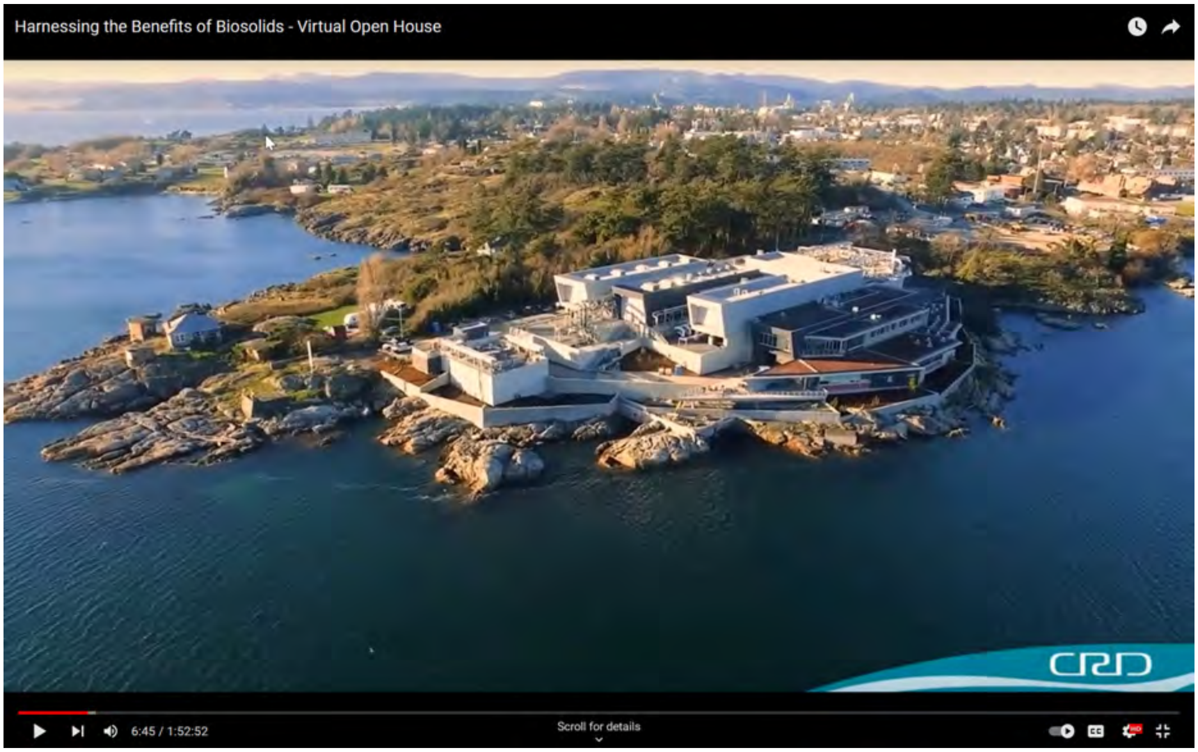
This ***What We Heard*** consultation summary report will be presented to the Technical and Community Advisory Committee [Core Area LWMP] and the CRD Board for Directors in Spring 2024 to inform the development of a long-term biosolids management plan that will be submitted to the Ministry of Environment and Climate Change Strategy. It will also be posted on the project website at ***getinvolved.crd.bc.ca***.

APPENDICES

Webpage Screenshot



Overview Video



Watch the overview video: ***Biosolids Beneficial Use: Long-Term Options (youtube.com)***

Media Release

Making a difference...together

Media Release

For Immediate Release
January 11, 2024

Community consultation begins to determine best use for Biosolids

Victoria, BC- Public consultation is underway as the Capital Regional District (CRD) considers long-term options and technologies to harness the benefits of biosolids, the nutrient-rich by-product from wastewater treatment.

Currently, the region's biosolids are largely being landfilled under emergency measures, while some are beneficially used to offset fossil fuels or for mine reclamation. The CRD is obligated as part of regulatory commitments to find a long-term solution.

"Biosolids are a valuable resource which we must use to benefit our region," said CRD Board Chair Colin Plant. "Public and First Nations consultation will help us shape a sustainable, long-term solution for biosolids management that aligns with our regulatory requirements."

The provincial government requires the CRD to file a long-term plan outlining the beneficial uses for biosolids by Spring 2024.

Biosolids are the by-product of the region's wastewater treatment processes and must meet stringent environmental standards. The CRD produces the highest quality biosolids obtainable, known as "Class A" biosolids. They meet or exceed rigorous provincial standards regarding pathogens and heavy metals to ensure the protection of human and environmental health.

"It's not a topic most people are talking about around the water cooler but it's very important to our region," said CRD Director Barbara Desjardins, Chair of the CRD's Environmental Services Committee. "Our role is to determine how to best maximize the community benefits of this organic by-product. In 2011, prior to introducing wastewater treatment in the core area, the CRD Board of Directors passed a biosolids land application ban based on the concerns of members of the public. However, the province requires that land application options be considered along with the other options the CRD is exploring, including advanced thermal options."

Biosolids can help improve soil fertility, prevent erosion, and accelerate tree and plant growth. Some communities use biosolids as forest fertilizer or to reclaim industrial lands such as mines. Others use it on lawns, golf courses, municipal boulevards and in agriculture, such as orchards, to promote plant growth and reduce reliance on synthetic fertilizers.

Biosolids can also be thermally processed and used as fuel, reducing the requirement for non-renewable fuels such as coal or natural gas. A small percentage of CRD biosolids have been sent to a cement kiln in Richmond but this is not regarded as a reliable long-term option as the facility has had operational difficulties.

Biosolids are commonly used in beneficial ways in communities across North America. In British Columbia., nearly every large community uses biosolids as fertilizer or in compost and biosolids are commonly found in lawn products sold at local retailers.

The public consultation process includes educational videos and materials, an online open house, a statistically valid survey, and an online survey that is open until Friday, March 6, 2024. A Community and Technical Advisory Committee, which includes public representatives as well as those from each of the core municipalities, has been engaging on this topic since October 2023.

To learn more, the public can visit https://getinvolved.crd.bc.ca/biosolids or call Glenn Harris, Senior Manager of Environmental Protection, at 250-360-3090.

The CRD delivers regional, sub-regional and local services to 13 municipalities and three electoral areas on southern Vancouver Island and the Gulf Islands. Governed by a 24-member Board of Directors, the CRD works collaboratively with First Nations and government partners to enable sustainable growth, foster community well-being, and develop cost-effective infrastructure while continuing to provide core services to residents throughout the region. Visit us online at www.crd.bc.ca.

-30-

For media inquiries, please contact:
Andy Orr, Senior Manager
CRD Corporate Communications
Tel: 250.360.3229
Cell: 250.216.5492
Facebook | X | Instagram | LinkedIn | www.crd.bc.ca

Letter

Making a difference...together

Parks & Environmental Services
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

T: 250.360.3078
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www.crd.bc.ca

February 15, 2024

File: 0220 20
Correspondence

RE: PUBLIC CONSULTATION TO SHAPE THE LONG TERM BIOSOLIDS MANAGEMENT PLAN

The Capital Regional District (CRD) is actively exploring long term options and technologies to harness the benefits of biosolids. The CRD produces high quality Class A biosolids and wants to ensure they are being used in a beneficial manner.

A Long term Biosolids Management Plan is required by the Province of BC and must outline how biosolids generated in the capital region will be managed for community benefit. In 2020, when the CRD first introduced wastewater treatment, biosolids short term management plans were put in place. Now, with a better understanding of our operations and available options, we are actively exploring long term solutions.

The Province of BC requires that the CRD submit a Long term Biosolids Management Plan by June 2024. The plan must consider land application options, as part of the beneficial use options analysis. Landfilling biosolids has been used as an emergency measure. However, it wastes valuable space in the landfill and does not meet provincial requirements for beneficial use of biosolids. It is not being considered as a long term option. The CRD is moving ahead with a pilot of thermal technologies for managing biosolids. However, if successful, it will still be 7 10 years before it can be utilized as a long term option. Since 2011, the CRD Board has banned the land application of biosolids within the capital region. In 2023, due to on going challenges with existing options, the CRD Board amended the policy to allow for non agricultural application of biosolids as a short term contingency alternative. The Province of BC requires that the consultation process consider all options that meet beneficial use criteria as defined by regulatory guidance.

As we look to the future, we will need to explore a range of possibilities to maximize the benefits of biosolids. We invite you to learn more and share your ideas. Building on the involvement of the Technical and Community Advisory Committee since October 2023 and First Nations consultation, the public consultation process involves a range of opportunities from January to March 2024, including:

- Project Website: https://getinvolved.crd.bc.ca/biosolids
- Virtual Open House Tuesday, February 20, 2024. Pre registration required at https://us06web.zoom.us/webinar/register/WN_OJ4RQavWRZiEn8T3wS4K6g
- Provide written feedback by email: biosolids@crd.bc.ca
- Online Survey open until Friday, March 6, 2024 Long-Term Biosolids Management Plan | Get Involved CRD

Learn more about biosolids and the different beneficial options being considered and opportunities to provide input at https://getinvolved.crd.bc.ca/biosolids. A Summary Consultation Report will capture What We Heard throughout the process and will be shared online.

ENVS 1852788916 307

We welcome your participation in this process and look forward to hearing from you. If you have any questions, please contact me at biosolids@crd.bc.ca.

Sincerely,

Glenn Harris

Glenn Harris, Ph.D., R.P.Bio.
Senior Manager, Environmental Protection

Attachment: Harnessing the Potential of Biosolids Fact Sheet

Social Media

Capital Regional District
February 29 at 8:00 AM

We appreciate the feedback we have received on the Long-Term Biosolids Management Plan thus far. If you have not shared your thoughts, remember you have until March 6th to complete our survey.

Share your input today and learn more about it by visiting getinvolved.crd.bc.ca/biosolids.

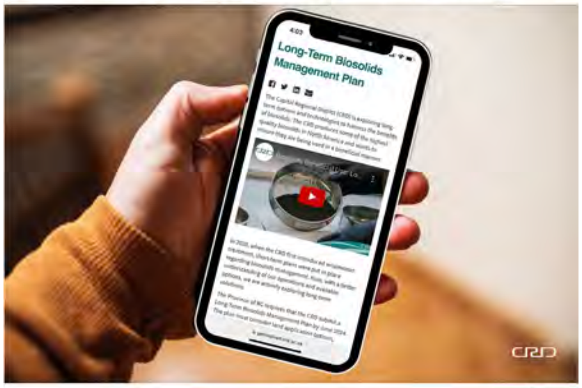
1 · 1 share

Capital Regional District
5d

Today is your last chance to provide your input on the Long-Term Biosolids Management Plan!

As we look to the future, we will need to consider a range of possibilities to maximize the benefits of this nutrient-rich, organic material and ensure a resilient and reliable portfolio of management options.

If you have not done it yet, take the survey by visiting getinvolved.crd.bc.ca/biosolids



1 share

CRD @crd_bc · Feb 20
🚨Don't forget to join us at Today 6PM for our virtual open house!

You'll learn more about the long-term options and technologies the CRD is exploring to harness the benefits of biosolids.

To register, visit getinvolved.crd.bc.ca/biosolids

1 · 1 · 1 · 370

CRD @crd_bc · Feb 16
Have you shared your thoughts on how we can harness the benefits of biosolids in the region?

Get involved today! getinvolved.crd.bc.ca/biosolids

📱Complete the Online Survey by March 6, 2024

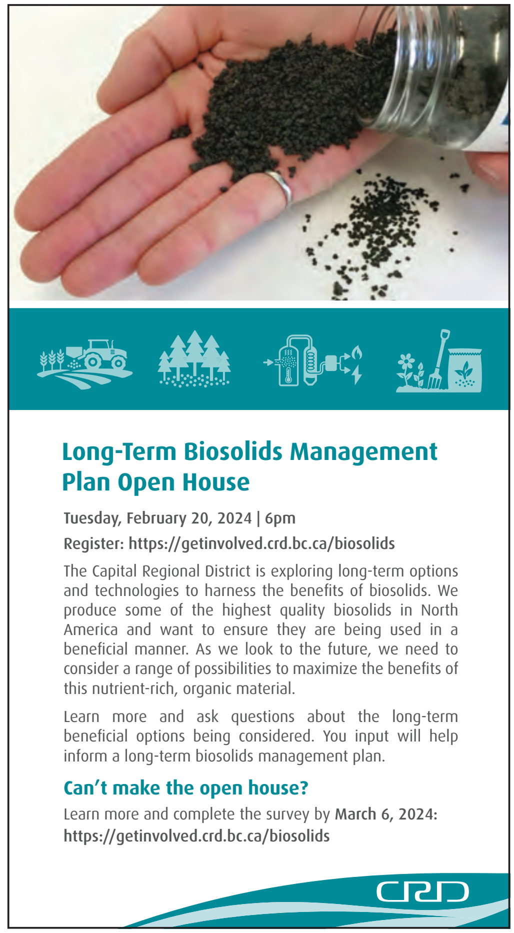
💻Join our Virtual Open House – Tuesday, February 20, 2024, 6pm, Pre-registration required.

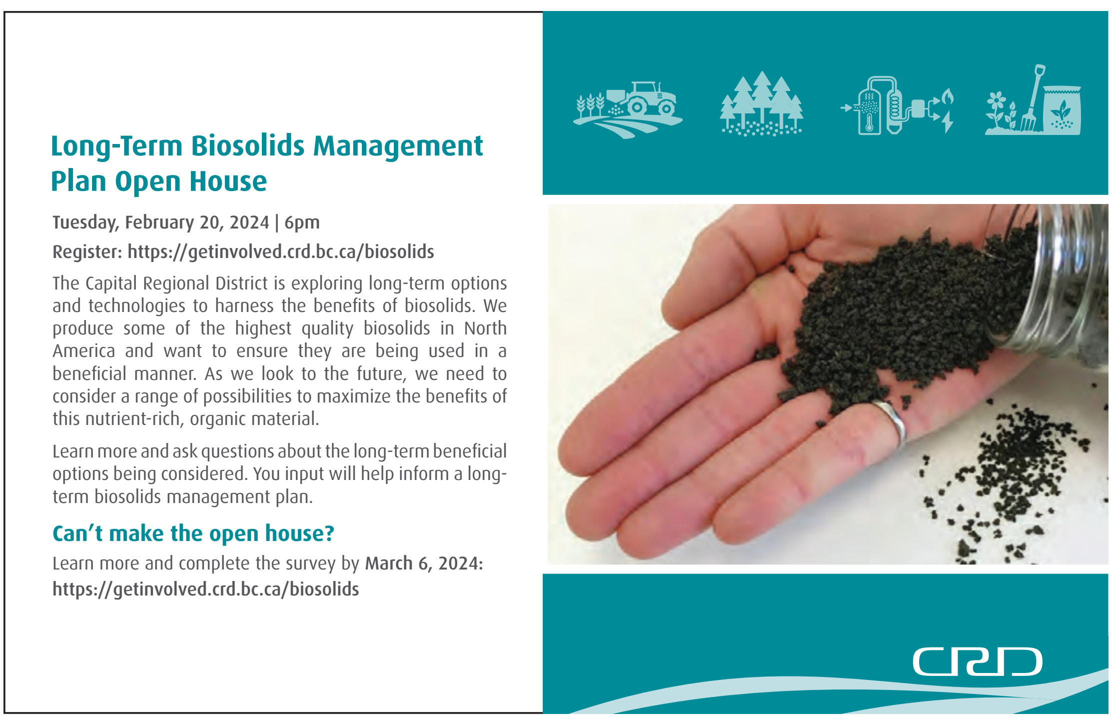
1 · 245

Print Advertising

Right: 3.8" x 7" ad that ran in Black Press: publications on Vancouver Island.

Below: 8.4" x 5.4" ad that ran in Victoria's Times Colonist.





Fact Sheet

Harnessing the Potential of Biosolids

Making a difference...together

Fact Sheet

Capital Regional District | **January 2024**

The CRD is exploring long term options and technologies to harness the benefits of biosolids. The CRD produces some of the highest quality biosolids in North America and wants to ensure they are being used in a beneficial manner.

In 2020, when the CRD introduced wastewater treatment for the core area municipalities and Songhees and Esquimalt First Nations, we implemented a 5-year, short-term plan. Now, with a better understanding of both our operations and available options, we are developing a long-term plan to move us forward into the future.

What Are Biosolids?

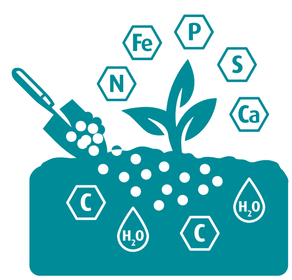
Biosolids are the nutrient-rich by-product of wastewater treatment. They contain nutrients, energy, and organic matter that can be recycled and used in various ways. The most common use is as fertilizer to promote tree and plant growth and as a soil additive to restore degraded industrial lands. Other emerging options may include harnessing energy contained in biosolids through thermal (heating) processes to use as an alternative fuel.

CRD biosolids are dark, dry granular pellets. Approximately 3,300 tonnes of Class A biosolids are generated in the CRD each year. CRD biosolids surpass all provincial standards. This is due to the limited heavy industry in Greater Victoria, the highest standards of sewage treatment, and robust source control programs that prevent metals and other contaminants from ever entering the wastewater system.

Benefits of Biosolids

Biosolids contain important nutrients such as nitrogen, phosphorus, calcium, sulphur, and iron. Benefits include:

- *Adds organic matter and plant nutrients to enrich soil*
- *A natural alternative to synthetic (chemical) fertilizers*
- *Stores carbon in soil and decrease greenhouse gas emissions*
- *Increases soil water retention*
- *Can be mixed with wood chips or yard waste to create compost*
- *Can be used to create alternate fuel*



For generations, biosolids have been safely used around the world by farmers, landscapers, and foresters. More recently in other countries, biosolids have been used in thermal (heating) processes to generate alternate energy sources. Biosolids are commonly used within communities across Canada. In fact, many common bagged fertilizers and soil products sold at local hardware stores and retailers contain biosolids.

How Are Biosolids Being Managed Currently?

Presently, the CRD's biosolids are largely being landfilled as an emergency measure, which does not meet provincial requirements. Further, it is exacerbating a capacity problem at the Hartland Landfill which is filling up at an accelerated rate. In 2011, prior to introducing wastewater treatment, the CRD Board passed a biosolids land application ban based on the concerns of members of the public. The ban remains in place today. Due to limited viable options, short-term exceptions were made for land cover application at Hartland Landfill in 2020 and for non-agricultural, out-of-region land application options in 2023.

Presently, the CRD's biosolids are mostly being landfilled because of challenges with the short-term options, which do not meet provincial requirements. The CRD is currently investigating a pilot study of thermal technologies for managing biosolids. However, if successful, it will still be 7-10 years before it can be utilized as a long-term option.

The Province of BC requires that the current consultation process consider land application options, which are included with advanced thermal options. Any options that don't meet beneficial use criteria will not be included. Landfilling biosolids has been used as an emergency measure. It wastes valuable space in the landfill and does not meet provincial requirements for beneficial use of biosolids.

Who Sets the Standard for How Biosolids Are Managed?

The BC Ministry of Environment and Climate Change Strategy and federal Environment and Climate Change Canada set the standards for wastewater treatment. Regional districts in BC are legally required by the Province to find beneficial uses for biosolids.

Class A biosolids must meet regulatory requirements under the Provincial Environmental Management Act and Organic Matter Recycling Regulation. These stringent requirements outline maximum allowable levels of pathogens and heavy metals to ensure protection of human health and the environment. They also provide strict controls on how and where biosolids may be used.

The Options

As we look to the future, a range of options must be explored. The CRD is exploring all options to use biosolids in ways that are increasingly beneficial for the environment. The CRD is committed to smart, innovative solutions that help reduce greenhouse gas emissions. We need to pursue a variety of options. The Province of BC requires that the CRD submit a Long-Term Biosolids Management Plan by June 2024. The plan must consider land application options, which are included with advanced thermal options among others.

OPTION	BENEFITS	TIMELINE	ESTIMATED COSTS *(per tonne)*	
Industrial Land Reclamation (e.g., mines or quarries) 	Mining activities often result in disturbed and degraded soils, which can be challenging for plant growth. Biosolids can be applied to replenish organic matter and essential nutrients, improving soil fertility, soil structure, and increasing water-retention. Can be applied directly or blended with compost, soil, or woodchips to restore degraded mine or industrial sites. Biosolids can improve soil quality and promote vegetation growth. Can also reduce reliance on synthetic fertilizers.	Immediate	<$250/tonne	LAND-BASED OPTION
Fuel for Incineration / Combustion (e.g., for cement kilns) 	Biosolids are burned or used as an alternative fuel to power facilities, such as cement kilns and pulp mills, reducing reliance on other non-renewable sources like coal or natural gas.	Limited facilities available. The CRD currently utilizes this technology at a plant in Richmond. In-region options are not available.	<$500/tonne	THERMAL OPTION
Forest Fertilization 	Can help improve soil fertility, prevent erosion, and accelerate plant and tree growth. In addition, after wildfire, biosolids can help forests regenerate, increasing water-retention and providing essential nutrients and organic matter to promote plant and tree growth. Can reduce reliance on synthetic fertilizers.	Immediate	<$400/tonne	LAND-BASED OPTION
Pyrolysis or Gasification Technology (to create biochar/gas) 	Biosolids are heated (using little or no oxygen) to make a gas or "biochar". The gas created can be used to produce heat or electricity. Biochar is a type of charcoal that is made from organic material. It can be used as a soil additive to improve soil fertility and enhance water retention.	7-10 years for permitting, siting and construction of a permanent facility. Advanced thermal technology is not currently used for processing biosolids in Canada.	$500-$4,500 /tonne	THERMAL OPTION

OPTION	BENEFITS	TIMELINE	ESTIMATED COSTS *(per tonne)*
Bagged Fertilizer for Residential Use 	The nutrient-rich organic material is bagged and distributed as fertilizer for residential use. Can also be blended with soil, compost or wood chips and made available for residential use. Can improve water retention to reduce water-usage as well as reduce reliance on synthetic fertilizers	Immediate	<$500/tonne
Fertilizer for Agriculture 	The nutrient-rich organic material can improve soil conditions to promote plant growth and increase crop yields. Can improve water retention to reduce water-usage, as well as reduce reliance on synthetic fertilizers.	Immediate	<$500/tonne
Wholesale Fertilizer for Landscaping (e.g., lawns, boulevards, golf courses) 	The nutrient-rich organic material can improve soil conditions to promote lawn and plant growth. Can improve water retention to reduce water-usage as well as reduce reliance on synthetic fertilizers.	Immediate	<$500/tonne

LAND-BASED OPTIONS

Timeline

2011
- CRD Policy – no land application

2020
- Short-term Biosolids Management plan developed in 2020
- Sewage treatment introduced in 2020

2021

2022
- Technical review of long-term options from 2022 to 2023

2023

2024
- Public Engagement from December 2023 to March 2024
  - Draft Long-term Biosolids Management Plan in June 2024

Share Your Thoughts!

Email: biosolids@crd.bc.ca

Online Open House: Date TBD

Website and Survey: www.getinvolved.crd.bc.ca
Complete the online survey by Wednesday, March 6,2024

CRD
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Capital Regional District
625 Fisgard Street, Victoria, BC V8W 1R7
250.360.3000 | www.crd.bc.ca

Open House Presentation by CRD

Long-term Biosolids Beneficial Use Open House

February 20, 2024

CRD
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Management of Residual Wastewater Materials

CRD
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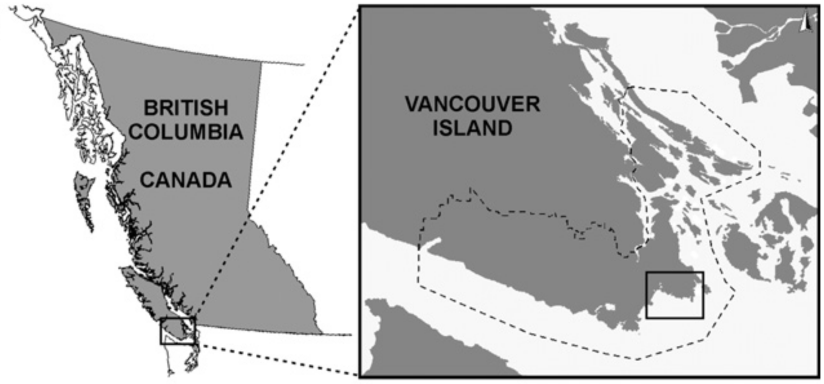
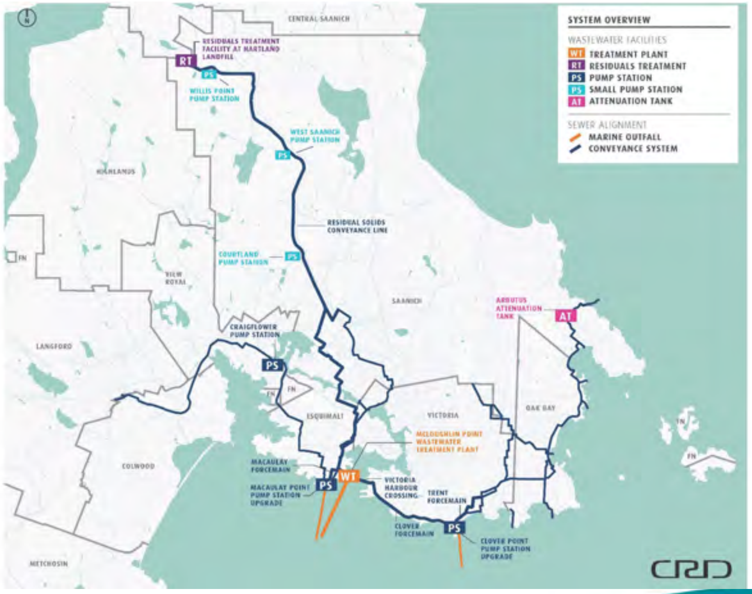
- Production and Management of Biosolids
- Status of Short-Term Biosolids Management Plan
- Technical Evaluation of Beneficial Use Options
- Development of a Long-Term Management Plan
- Questions and Answers

Capital Regional District

- The Capital Regional District (CRD) consists of 13 municipalities and 3 electoral areas.
- The CRD owns and operates seven wastewater treatment plants (WWTP), including the McLoughlin Point Wastewater Treatment Plant.



Core Area Wastewater Treatment



Regional Source Control Program

- Source control is the first step in wastewater treatment.
- Source control is about preventing and reducing contaminants at the source, before they enter the wastewater system.
- Municipal wastewater treatment plants receive discharges from households, industry and commercial sources. Our region has very minimal heavy industry.
- The CRD's source control program is designed to protect:
  1. Human (operator and public) health and safety
  1. Marine receiving environment
  2. Municipal infrastructure
  3. Treatment plants
  4. Biosolids quality

Regional Source Control Program

- Upstream elimination is more effective than downstream treatment.
- The CRD's source control program consists of:
  1. Regulatory inspections under the Sewer Use Bylaw for operations with potential to discharge high strength wastewater, such as food service, breweries, dry cleaning and dental businesses.
  2. Requiring pre treatment such as grease traps and amalgam separators.
  3. Public outreach campaigns encouraging the proper disposal of hazardous chemicals, medications, fats, oils, and greases (FOGs), and unflushable waste.

McLoughlin Point Wastewater Treatment Plant

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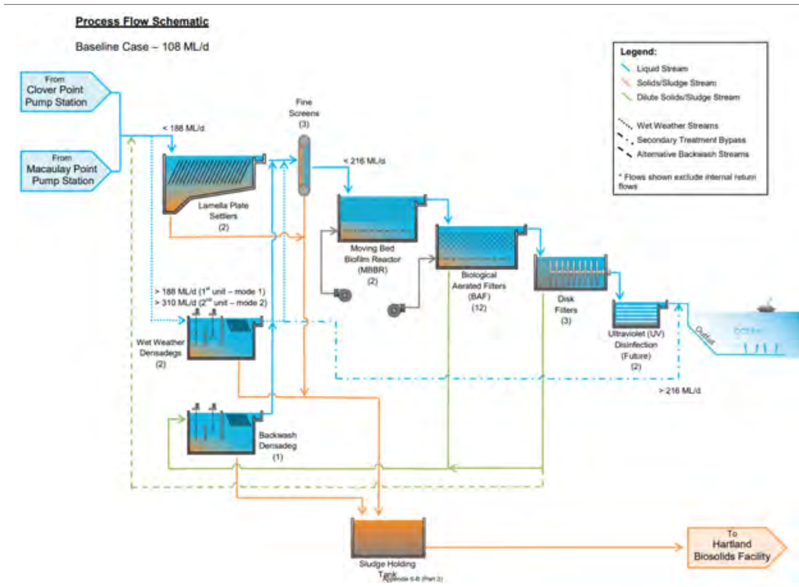
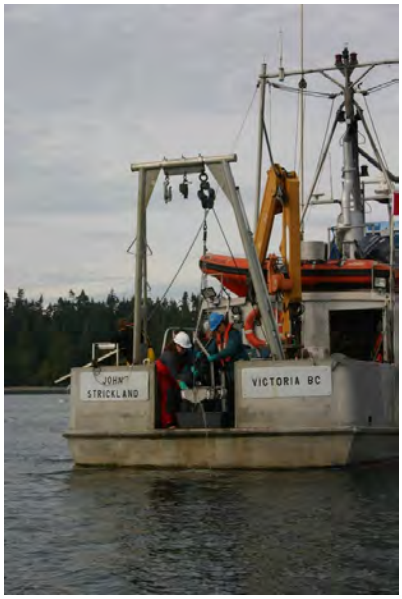
McLoughlin Point Wastewater Treatment Plant

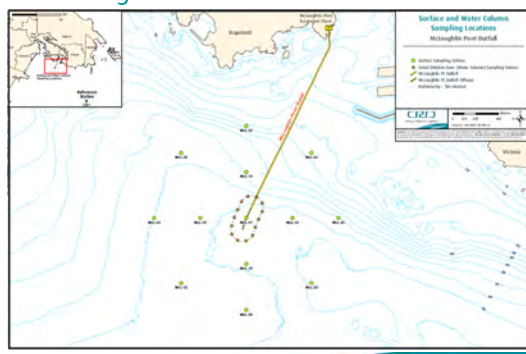
Making a difference...together



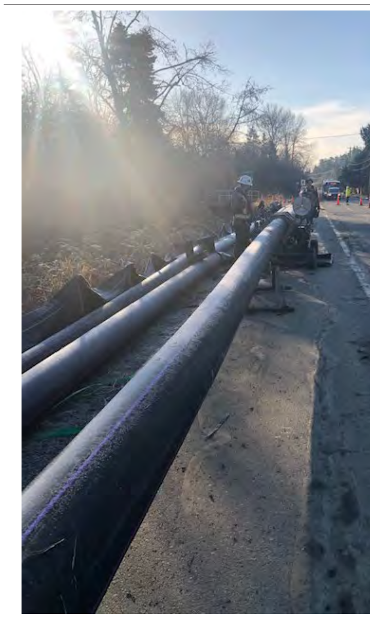
McLoughlin Point Outfall



- Effluent from the treatment plant is discharged into the ocean through a 2-kilometer-long outfall.
- The CRD regularly monitors the sediments around the outfall and the water quality both at the surface and throughout the water column.



Residual Solids Conveyance Line



- The 18-kilometre RSCL brings residual solids from Mcloughlin Point to the Residuals Treatment Facility for further processing

Residuals Treatment Facility

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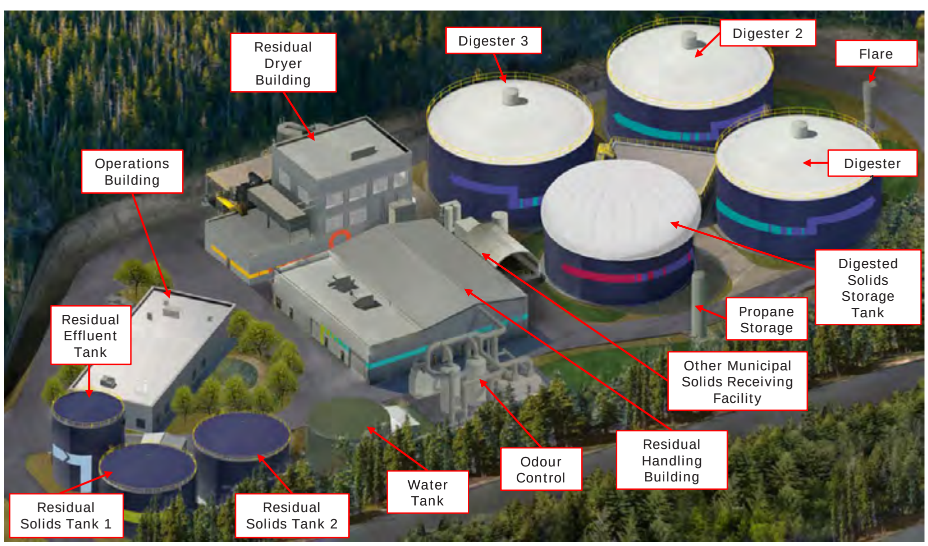
Residuals Treatment Facility

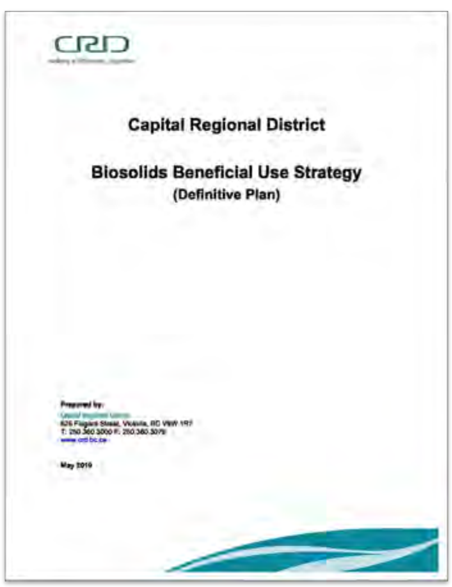
Making a difference...together



Class A Biosolids

- The RTF produces approximately 10 tonnes of dried (over 90% solids) Class A biosolids each day.
- Biosolids are tested regularly for metals and pathogens- results are posted on the CRD website.

Short-Term Biosolids Beneficial Use Strategy (2020-2025)



Capital Regional District

Biosolids Beneficial Use Strategy
(Definitive Plan)

Prepared by:

May 2019

- Developed in early 2019, before wastewater treatment began.
- Strategy consistent with the CRD policy restricting land application of biosolids.
- Conditionally approved by the Ministry of Environment in October 2019.

Short-Term Plan: Alternative Fuel

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- Biosolids are shipped to a cement kiln in Richmond, and used for energy, displacing fossil fuels.
- Regular shipment of biosolids has been challenging.

Contingency Plan: Biosolids Growing Medium at Hartland Landfill

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- Biosolids are mixed with sand and wood chips and applied to closed areas of the landfill to support vegetation growth and reduce methane emissions.

Alternative Contingency Plan: Quarry Reclamation

- Biosolids are used at a gravel quarry near Nanaimo to re-establish vegetation on closed parts of the quarry.

Emergency Plan: Hartland Landfill

- Biosolids have been landfilled under emergency measures much of the time due to various challenges with the short-term and contingency plans.
- Landfilling is not a beneficial use and has been prohibited by the Province.

Long-Term Biosolids Beneficial Use Strategy (2025 onward)

CRD
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- Province required broad consultation.
- Must assess a range of beneficial use options including various types of land application.
- The consultation process must include citizens, local government and Indigenous Communities.

Organic Matter Recycling Regulation

CRD
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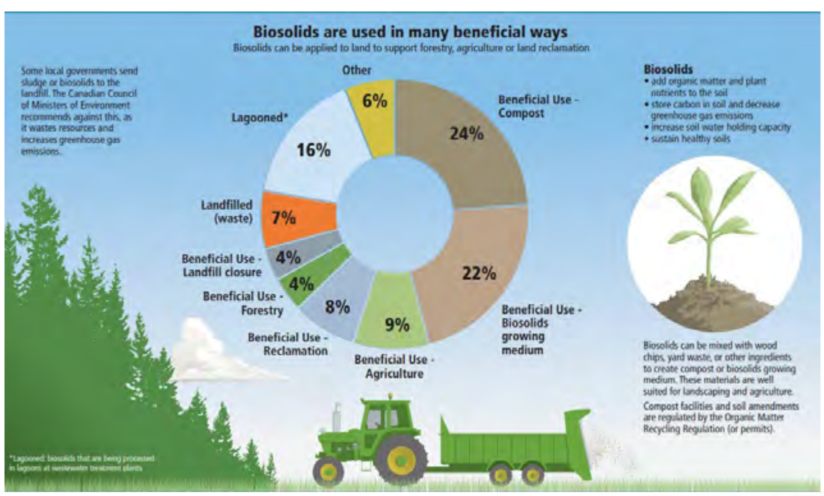
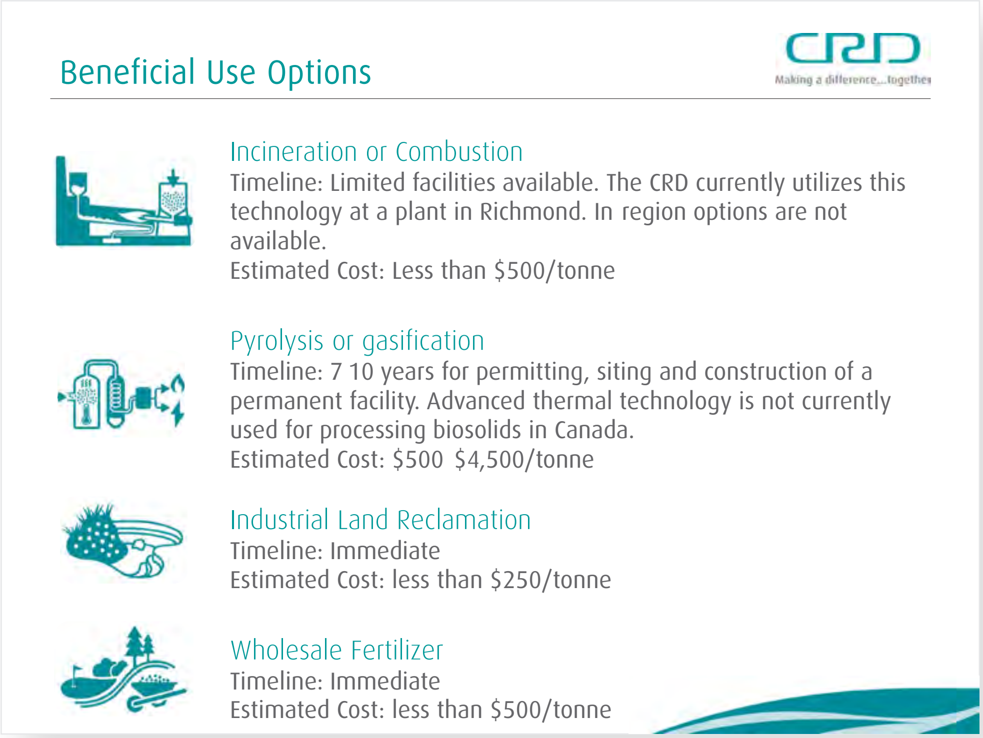
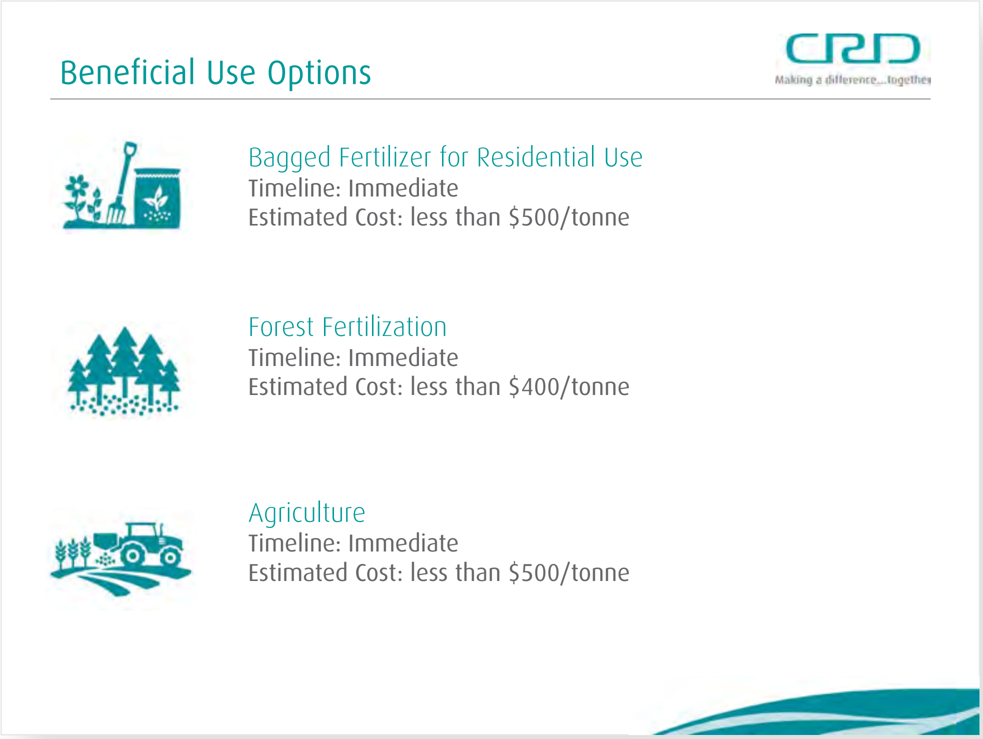
BRITISH COLUMBIA | Ministry of Environment




Beneficial Use Options
Making a difference...together
Incineration or Combustion
Timeline: Limited facilities available. The CRD currently utilizes this technology at a plant in Richmond. In region options are not available.
Estimated Cost: Less than $500/tonne
Pyrolysis or gasification
Timeline: 7 10 years for permitting, siting and construction of a permanent facility. Advanced thermal technology is not currently used for processing biosolids in Canada.
Estimated Cost: $500 $4,500/tonne
Industrial Land Reclamation
Timeline: Immediate
Estimated Cost: less than $250/tonne
Wholesale Fertilizer
Timeline: Immediate
Estimated Cost: less than $500/tonne


Beneficial Use Options
Making a difference...together
Bagged Fertilizer for Residential Use
Timeline: Immediate
Estimated Cost: less than $500/tonne
Forest Fertilization
Timeline: Immediate
Estimated Cost: less than $400/tonne
Agriculture
Timeline: Immediate
Estimated Cost: less than $500/tonne

Advanced Thermal Pilot Programs and Demonstration Plant

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- 2021 thermal pilot studies
- Procurement of an on-site trial is currently in development.
- Anticipated Cost: $10 million

Open House Presentation by GHD

Approach

Scan → **Screen** → **Portfolios** → **Resiliency** → **Select** → **Implement**

- **Scan**: List all available options
- **Screen**: Regulatory requirements (CCME, OMRR)
- **Portfolios**: Develop portfolios of options
- **Current phase**
- **Resiliency**: Future test portfolios
- **Select**: Select resilient portfolio of options based on considerations and Public Consultation
- **Implement**: Annual reviews and update portfolio as required

Considerations → **Public Consultation**

Financial
Environmental Impacts
Environmental Sustainability
CRD Ownership
Reputation
Regulatory Requirements

3

Scan – Available Options

Available options can be broadly categorized as various forms of **thermal processing** or **land application**.

Pyrolysis or Gasification
- Heating with little to no oxygen
- 300 800 C (pyrolysis)
- 600 1000 C (gasification)
- Produces syngas, biochar, steam, ash
- $500 $4,500/t

Incineration or Combustion
- Heating with excess oxygen
- 800 1200 °C
- Cement kilns, pulp mills
- Converts to energy (steam, electricity, heat)
- >$500/t

Forest Fertilization
- Supplementing nutrients in forest soil
- >$400/t

Industrial Land Reclamation
- Reclaiming barren soils damaged from mining
- >$250/t

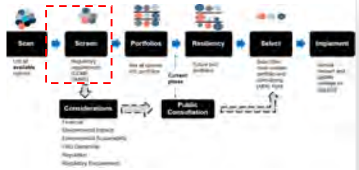
Wholesale Fertilizer for Landscaping
- Blending with soil, compost, or wood chips
- Wholesale distribution (e.g., golf courses)
- >$500/t

Bagged Fertilizer for Residential Use
- Blending with soil, compost, or wood chips
- Residential distribution (e.g., gardens)
- >$500/t

Fertilizer for Agriculture
- Fertilizer for crops
- >$500/t

4

Screen – Regulatory Requirements



BRITISH COLUMBIA | Ministry of Environment

CCME
Canadian Council of Ministers of the Environment
Le Conseil canadien des ministres de l'environnement

From the BC MOE:

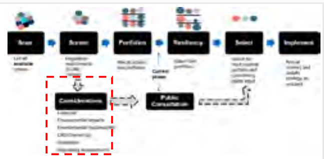
Biosolids are the stabilized products that are recovered at the end of the wastewater treatment process.

Biosolids are rich in nutrients that may be beneficially used to improve soil conditions and provide nutrition for plants. Because of the biological components of biosolids, proper management is important to control the impact on the environment and human health.

In B.C., the Organic Matter Recycling Regulation sets requirements for the production of high-quality biosolids and subsequent beneficial use in land application and composting.

5

Considerations



- Financial
  - Capital cost, operational cost, revenue potential, unit cost at varying scales
- Environmental Impacts
  - Emissions (odour, noise, air, dust), truck traffic, contaminant mass balance
- Environmental Sustainability
  - Value derived products, GHGs, energy recovery, waste co processing, soil/groundwater
- CRD Ownership
  - CRD develops facility or third party provider
- Reputational Considerations
  - Technological maturity, perception
- Regulatory Requirements
  - Permitting schedule and defined process

6

Resiliency – Risks of Interruption

Consider risks to future operations resiliency of external partners:

- Insufficient capital operational continuity
- Change in ownership
- Sustainable market for end product
- Short term shutdown
- New OMRR requirements
- Feedstock interruption, highway closure, wildfire
- Facility reputation facility causing a nuisance
- Facility regulatory non compliance
- Seasonality fluctuations in capacity to receive and process biosolids
- Availability option at capacity, not yet commercially operational
- Minimum tonnage minimum contracted amount

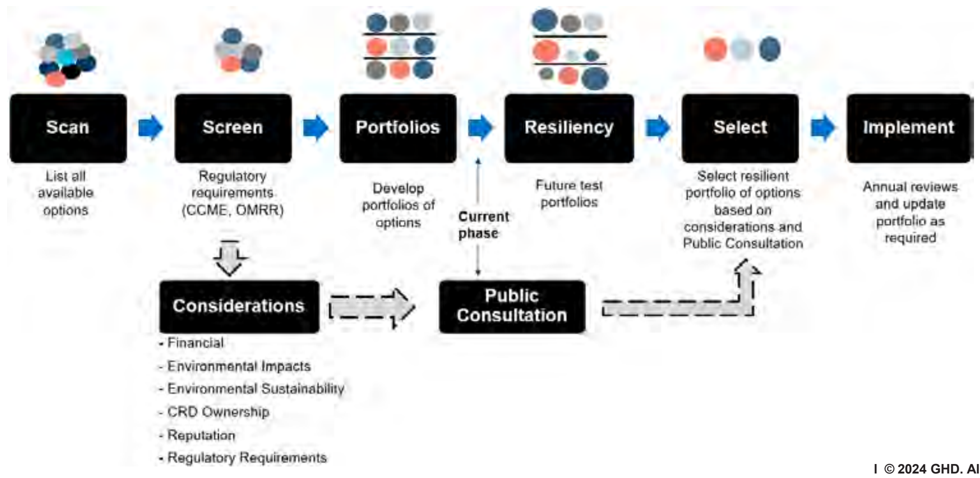
Considerations

	Thermal Processing	Land Application
Financial	High initial capital cost, low economies of scale Potential for revenue to partially off set processing costs	Comparatively low capital cost. Additional investment into storage/transport infrastructure may be required. No potential for revenue generation
Environmental Impacts	Facility will have nuisance emission abatement systems (odour, noise, air/dust)	Potential for nuisance odour, noise, air/dust emissions at application sites (far from population centers)
Environmental Sustainability	Potential to recover energy from waste product GHG emissions from transport (off site combustion)	Reduction of need for synthetic fertilizer Potential for soil/groundwater impacts if OMRR not followed GHG emissions from transport
Reputational	Advanced thermal technology is emerging	Demonstrated commercial implementation
CRD Ownership	CRD would own advanced thermal facility or send biosolids to third party for off site combustion	Biosolids would be sent to third parties or be bagged by the CRD and sold commercially
Regulatory	Facility permits required	Land application plan required per OMRR
Potential Risks of Interruption	Multiple years required to implement advanced thermal facility Unknown market for biochar Unscheduled shutdowns for operational maintenance/commissioning Limited commercially operational biosolids thermal facilities in North America	Fluctuations in need for biosolids (typically project based, seasonal) Unclear if market exists for bagged biosolids product

8

Portfolios

Risks of interruption may be mitigated through **redundancy of options,** achieved by **portfolios** composed of **multiple contingent options.**



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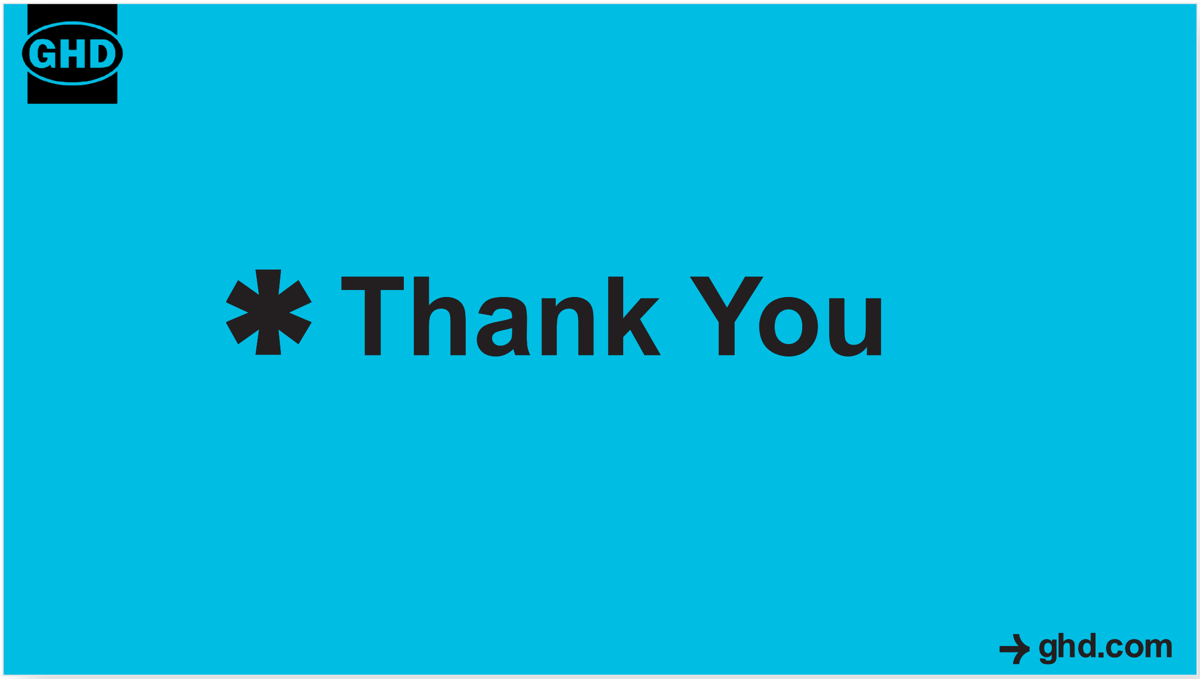
Additional Information

More information can be found at
getinvolved.crd.bc.ca/biosolids

10


GHD
Thank You
ghd.com

Getinvolved.crd.bc.ca Q&A

1. I have a question about pharmaceuticals and other contaminants of emerging concern. Patients undergoing chemotherapy are advised to have their septic tanks pumped after chemo treatment and these chemicals are known to persist in sewage sludge. What, if any, methods are available to remove pharmaceuticals in the CRD wastewater processing options. The Organic Matter Recycling Regulations provide limits for heavy metal land application. Are there standards for land application of micro plastics found in many products entering the wastewater system? Will the high seasonal water table level at the Burgoyne Valley treatment plant prevent composting during the wet months. Can geotubes above grade work in wet conditions? I do hope that I will be able to see the answers to my questions and if possible view this important webinar.

2. Why are biosolids not used to create energy? Clearly our electrical grid cannot handle the demands of our governments “just transition” idea. It would horrify me to know that my garden is grown in the biosolids of human waste and potentially contaminate the water sheds in rural areas.

3. One thing to at hasn’t been addressed is the plan for application of the choices and desired/expected outcomes. Example. : if we vote for land reclamation, what land is being considered for it? How *much* of an effect are we expecting? Are there any reports on other similar projects that we can look at to evaluate potential issues or roi?

4. Gasification.. After construction of plant, what does a distribution plan look like. Do we have distribution infrastructure in place? Is this an extra cost and timeline. How does CRD raise money for this project. Does it affect other ongoing projects.

5. How can I be sure the soil amendment/fertilizer solution doesn’t contain dangerous drugs (fentanyl), heavy metals or a superbug?

6. Do the cost estimates include the expected financial value of all anticipated revenues and the co-benefits? For example, does the $500+ per tonne for pyrolysis include the sale of energy and biochar products? Is there a value attributed to the energy resilience benefits to the community in the event of a catastrophic earthquake or extreme weather that cuts off power supplies? Do the fertilizer options include a value for supporting a resilient agricultural sector? Indeed, the social values of these co-benefits are not in the jurisdiction of the CRD, but partnerships could avail financial value and compensation.

7. (1) Has the option of on-site creation of a series of “silting ponds” that the waste-water passes through slowly, and in lower stages can include marsh-like grasses or other plant and/or animal life so as to process at least part of the waste matter there on the spot? I saw such a facility at Esalen Institute in California that they called a “living machine”. (2) Same question but: if it’s been considered, why not adopted? (too costly? too small of a site? other reasons?). I’m not upset, but would love to understand why, or why not, if considered and rejected, so in future I’ll have a better grasp of the topic. THANK YOU!

Email Correspondence to *biosolids@crd.bc.ca*

1. With regards to the pyrolysis or gasification technology, to create biochar / gas option the estimated cost is a very wide range-- $500 to $4500 a ton. Will any more detailed information on the capital and operating costs of a plant be provided to the public , Environmental Service s Committee and Board in the next 2 -3 months so that such information can be included in the definitive plan being submitted to the Province in June?

2. Thank you for the opportunity to participate in last night's webinar on CRD biosolids management options. I have been following this issue closely including doing extensive reading and attending CRD committee and board meetings. Here is a quick summary of my input following the webinar. I have already filled out the survey.

   1) I believe there is an opportunity to learn from the Australian experience, which appears to be significantly more advanced on biogas production than the North American practices that staff tried to consult with. The Australian Renewable Energy Agency(Arena) continues to make progress e.g. the MALABAR plant in the Sydney suburbs and elsewhere. Perhaps an information sharing agreement could be reached with them on the biogas option. I think the BC and Canadian governments would both be interested in developing Canadian expertise in conjunction with Australian agencies and firms and companies such as Fortis, which has been promoting biogas. Atomic Energy Canada is a good example of Canada showing leadership and international consulting expertise.

   2) If not already known, it should be relatively easy to determine if Hartland site can accommodate the footprint of a biogas facility, or not. Also the costs can be estimated and the percentage cost recovery from sale of biogas / biochar can be determined , based on the Australian experience. If Hartland cannot accommodate the plant , then maybe Bamberton? Obviously not having to transport biosolids is advantageous. Perhaps some 'redundancy' can be built into the system so that production can be continued in part of the plant during maintenance or breakdown.

   3) The gasification option fits well with the regional district taking care of its waste, for the most part, within its borders. The airborne emissions can be minimized using state of the art technology and in my opinion is preferable to spreading more fertilizer over agricultural and forestry land within the region. Biochar can be transported to carefully controlled and monitored remediation sites inside and outside the region, possibly transported by the specialized trucks already developed with a First Nations company.

   4) Our lakes are productive recreational fisheries because they are moderately or more eutrophic already, than other areas. All the climate research shows trends to increasing eutrophication. We don't need to be spreading tons of biosolids around this region or anywhere else where it will inevitably end up in our streams, ponds and lakes and groundwater. Biogas is a beneficial use! The BC government already approved using biosolids as a fuel in the unfortunately failed situation in cement production.

   5) To reiterate, I believe the time is right to engage both Provincial and Federal governments in supporting an innovative biogas /biochar approach and possibly develop Canadian consulting expertise for export.

3. Why aren't these being used to produce heat at one of the current sites such as Commonwealth Rec Ctr or UVIC ?

4. I was dismayed to read the misleading information published in the public consultation materials on biosolids. The information is heavily biased to the supposed “benefits” of biosolid spread and for use as fertilizer yet provides precious little and vague, obscure information on the risks. There is plenty of easy to find information available on the risks, studies from well reputed organizations across Canada and the US that are concerned with the application of biosolids in/near our food and water systems. I have no doubt that our better informed agencies will contact you with links and copies of the information they have on the danger and concern of the practices that the CRD has suggested. Not to mention the ongoing lawsuits in other areas. It is shamefully misleading to exclude the risks and opposition viewpoints in the FAQs and other information. Please take down or delay the site and survey. Review the information that surely will be presented to you, learn about the risks and inform the public of all aspects.

5. Thank you for replying. You didn’t however explain why you have chosen to exclude informing the public of the risks. While you may be required to include it, it would be more responsible and transparent to also include the risks. Given that there have been so many leaks and problems with the poop pipeline, the stench, cost and time overrun, the inability to produce biosolids that the cement factory can use, how can you guarantee that you will not also bungle the testing and production of “safe” and “beneficial” biosolids for any other use? How will you address that? Thank you

6. I am very interested in receiving more details on the bio-solids complete analysis for large applications in agriculture. How do I get involved and where can I locate the details or even get a few samples for independent analysis.? Sorry for dropping this on you and please direct me in the correct direction for future inquiries.

7. My suggestion is to build a facility to turn plastic back into oil and the bio solids could be used as the heat source.

TAVOLA
STRATEGY GROUP

Engagement Summary

Draft Long-term Biosolids Management Strategy

Making a difference...together

Capital Regional District | June 2024

Background

The Capital Regional District (CRD) is required to submit a Long-term Biosolids Management Strategy to the BC Ministry of Environment and Climate Change Strategy by June 18, 2024 with the expectation that all biosolids be beneficially used through a range of options, in accordance with provincial regulation.

The CRD Board endorsed a draft strategy on May 8, 2024 that includes a portfolio of options to be utilized under a prioritization structure.

The Draft Long-term Biosolids Management Strategy and portfolio of options were available for public review and comment from May 13 to June 3, 2024. Feedback received during this time is being presented to the CRD Board for consideration as part of the final review and approval process.

Engagement Methods

"Get Involved" Website

The CRD uses its digital engagement site GetInvolved.crd.bc.ca to share details of the draft Long-term Biosolids Management Strategy and invite feedback. Comments were collected using an online form and reviewed to ensure that personal information could be redacted.

During the feedback period, approximately 1177 visits resulted in three levels of participation:

- Aware (visited at least one page): 913 participants.
- Informed (downloaded documents, visited multiple pages): 459 participants.
- Engaged (shared comments or asked questions): 203 participants.

Media

An information bulletin was sent to media on May 13, 2024, following the CRD Board endorsement of the draft Long-term Biosolids Management Strategy. The bulletin highlighted the portfolio of options, next steps and how to share feedback.

Agenda items from the Board meeting and links for more information were included in the Board Highlights enewsletter sent to subscribers in May. The Chair also highlighted the biosolids long-term plan and next steps in his monthly CFAX update in May.

- Info Bulletin: The CRD invites public feedback on the Long-term Biosolids Management Strategy
- CRD Board Highlights: May 2024

Local media coverage:

- Times Colonist May 19, 2024
- Oak Bay News May 13, 2024
- CFAX Interview May 8, 2024

Social Media

Staff scheduled a series of posts on social media schedule between May 13 to June 3 to promote engagement on the Long-term Biosolids Management Strategy. Each post included a call to action to learn more and share feedback on the Get Involved website. Staff responded to questions received through social media about the Long-term Biosolids Management Strategy when appropriate.

- **Facebook** posts resulted in approximately 7,524 impressions (number of times people saw a post) with a 2.32% engagement rate (percentage of people who clicked, liked, shared or commented).
- **X** posts resulted in approximately 2,814 impressions with a 1.78% engagement rate.
- **LinkedIn** posts resulted in approximately 2,501 impressions with a 5.67% engagement rate.
- **Instagram** posts reached approximately 1,194 people with an engagement rate of 1.59%.

Responses

The following comments were received by the CRD via an online comment form and are provided to the Board as part of the final Long-term Biosolids Management Strategy review and approval process.

The Long-term Biosolids Management Strategy also received comments from the Peninsula Biosolids Coalition in a letter sent on June 4, and two letters send directly to the CRD Board email portal. These letters have been added to this report.

A total of 232 comments were received and common themes were identified. 18 comments indicated a preference for land application. 190 comments indicated a preference for thermal options or opposition to land application. 101 comments received followed a similar format.

Date received	Please provide your feedback on the strategy.
2024/05/13 – 6:45pm	There should be no distinction between in- and out-of-region land application options. As per the outcome of the surveys, ALL land application options should be pursued. The stricter requirements for in-region demonstrate NIMBY-ism and a double standard by our politicians. Listen to the survey outcomes.
2024/05/13 – 6:48pm	Our CRD politicians are dishearteningly presenting a NIMBY perspective by calling for more strict criteria for in vs out of region land application options. The surveys indicated public support for all land application options in and out of region options. Listen to the surveys, not the misinformed politicians (misinformed in continuing to support local land application ban).. Land application can be done safely even when considering contaminants.
2024/05/13 – 7:16pm	Any thermal option ("advanced" or otherwise) will have direct GHG implications. Land application options should be the priority instead. Shame on CRD politicians for not allowing in region options while allowing non-restricted out of region land application. Land application should be UNRESTRICTED no matter where.

2024/05/14 – 3:22pm	This public comment process is a joke and comes nowhere close to meeting provincial requirements for consultation with the public on a long term waste management plan. That said, the first two options make sense. Continued spreading of biosolids at Hartland is going to lead to significant longterm health and environmental impacts owing to bioaccumulation of "forever chemicals" that are present in small amounts in biosolids. While present in small amounts, continued application of 10 tonnes a day to the filling face of Hartland is an irresponsible practice. There should be no land application in region including at Hartland. There should be a full explanation of what went wrong with the Lafarge option where the biosolids were to be burned as fuel, and an effort made to find other similar facilities to Lafarge to take the biosolids as fuel. Lafarge is far from being the only facility that could take them in the interim while the gasifier is being built. If no out of region solution, like Lafarge, can be found, the biosolids should be biocelled and stored until they can be safely removed and destroyed when the pyrolisis process becomes available. This should not be at Hartland which is already under strain.
2024/05/14 – 7:28pm	Tiers should be reversed with priority being in region land application, followed by out of region land application, and and thermal option only if no other solutions are available.
2024/05/15 – 4:51pm	I find it interesting that Technical and Public Advisory Committee as well as the general public do not support the CRD Board's ill conceived land application ban, however the CRD intends to continue down a path that will cost the taxpayer unnecessary millions for an uncertain and unproven technology, which (if successful) will pump huge amounts of carbon dioxide directly into the atmosphere during a climate crisis.
2024/05/17 – 3:42pm	In region contingency options should take priority before out of region options. We process it here, we should manage and re-use it here. Being a sustainable community includes managing our waste within the community, not burdening other communities with it.
2024/05/19 – 6:20am	Please keep biosolids out of the forest. Do not apply it as forest fertilizer, as described in tier two of the board’s strategy. Using biosolids as fuel has productive value. Using biosolids as forest fertilizer would only meddle with forest ecology as it is processed and not derived from the forest.

2024/05/19 – 8:06am	I strongly disagree with dumping biosolids due to the health risks of spreading pollutants such as hormones and medicines passed through human waste. Also the risk of bacteria, virus's, such as MSRA, protozoa, microplastics, etc.
2024/05/19 – 8:59am	As a resident near the Hartland Landfill I am concerned that the strategies will affect the ground water. Many of the near by residents are on a well and have their own septic systems. It seems like all this sewage passing us by will ultimately affect us and we aren't able to use the sewage system ourselves. Its only fair that this project hook up all the surrounding homes to the sewage system since we have to pay for our septic upkeep and CRD costs. I also think this project should hook us up to city water so that we are not always worried about contamination.
2024/05/19 – 1:50pm	Stop being political hypocrites.... land application should be freely done both in and out of region. There should not be more stringent criteria for in region.
2024/05/19 – 2:33pm	Definitely don't put biosolids on agricultural fields. CRD should find some way to detoxify the waste.
2024/05/19 – 3:08pm	do not pour dangerous, forever chemical solids on top of landfill. Find a safer way to store for as long as needed.

2024/05/19 – 4:32pm	We need to fast track the biochar/energy production option.There should be enough data from Australia & elsewhere that we do not need to "reinvent the wheel". There already working plants -why do we need our own "demo" ?Surely Synagro can contribute to the process- they are planning similar facility in US ? Maybe Fortis can get involved.Maybe a joint venture with Australian partner. The prospect of using tier 2 & 3 options for the next 8-10 years to dispose of 10 tons a day poses too many environmental /legal liability /staff time-logistical risks.Lets make the CRD an environmental leader in this field with Provincial/Federal support & create some internationally exportable Canadian expertise.Lets do a REALISTICALLY costed full production facility analysis in the next year & present it to CRD tax payers. Thank you & good job on the what we heard report.
2024/05/19 – 5:48pm	Please read the article from this link. https://biochartoday.com/2024/01/01/micropollutants-in-biochar-produced-from-sewage-sludge-a-systematic-review-on-the-impact-of-pyrolysis-operating-conditions/#:~:text=Biochar%2C%20a%20charcoal-like%20material%20produced%20from%20organic%20waste%2C,harmful%20micropollutants%20in%20biochar%20derived%20from%20sewage%20sludge.
2024/05/19 – 6:03pm	Bio solids should not be spread on land outside of the landfill site. Lands they might be spread upon have an unknown future and the waste could have long term negative impacts. Perhaps they could be shipped to Drax in the UK so they can burn it for electricity generation instead of burning wood pellets from BC's old growth forests. Seriously, generating energy from the waste could be the best solution.
2024/05/20 7:19am	I am always amazed at how little attention decision-makers give to the consequences of their actions. Nobody looks at 'the big picture' - just the political consequences of not responding to 'Mr Floatie.' The biosolid issue should have been part of the planning process from the beginning of the decision of land-based sewage treatment. Decisions made in haste reverberate into the future ... now no one wants the 'products' of the sewage decision. Rightly so, given the presence of 'forever chemicals.' The (provincial) political decision to "build, build, build!" will bring more people to the Island, will create an ever-increasing supply of unwanted PFAS-contaminated 'biosolids.' We are destroying the natural environment which is the foundation for life, and drowning in our own waste. Shitty situation.

2024/05/21 – 11:59am	The only option that makes sense for many reasons is the "Tier 1" Advanced Thermal Option. All other management options outlined in the CRD's long term strategy involved land application of the toxic sludge that is referred to as biosolids. The persistence of "forever chemicals" such as PFASs and the other 80,000 chemicals found in sewage sludge is just too dangerous for humans, livestock and the natural environment. Many other countries and US states have now banned the land application of sewage sludge after learning the hard way that there are so many negative impacts of this approach. Please use common sense, listen to the public who have elected you to make sound decisions on our behalf. Surely you were alarmed at the news that Synagro is being sued in Texas because of the deleterious effects from their sale of biosolids to farmers there. No land application of biosolids!
2024/05/21 – 4:14pm	Dear CRD Board, Thank you for considering my feedback on the draft long-term biosolids management strategy. After reviewing the GHD Technical Memo on the Long-Term Biosolids Beneficial Use Strategy, I have some concerns regarding the selection of “advanced thermal options.” While these options may offer benefits, they also come with significant drawbacks and uncertainties: 1. High CAPEX and OPEX: The capital investment and energy-intensive pre-drying process associated with these options can be cost-prohibitive. 2. Undetermined End Use: The utilization of bio-oil, ash, and biochar remains uncertain and subject to market demand. 3. Controversial Impact: The agricultural and global warming effects of biochar land application are still debated. 4. Contaminant Reduction Uncertainty: The level of reduction and environmental fate of contaminants are not well-defined. 5. Technological Readiness: Pyrolysis and gasification have low technological readiness levels. 6. CCME Guideline Concerns: These thermal processes may conflict with the CCME beneficial use guideline due to negative energy balances and limited residuals recovery opportunities. I recommend considering alternative approaches, such as thermal hydrolysis or hydrothermal processes. These options could offer lower costs, reduced energy input, and more clearly defined beneficial-use products. Additionally, I noticed that the previous survey lacked questions about people’s familiarity with biosolids management technologies. Including such questions would provide valuable insights. Thank you for your attention to this matter.

2024/05/21 – 7:17pm	Just no biosolids on farm/agricultural land.
2024/05/21 – 8:44pm	It is hypocritical for the CRD to rank in-region land application of biosolids as the last resort (tier 3), while placing out of region land application in the tier 2 ranking. Some out of region biosolids land application may be reasonable, but only if the CRD is willing to land apply biosolids within the CRD first. Therefore the CRD should prioritize in region land application, ranking this option as tier 2. Similarity, all other management options that are explored for CRD generated biosolids should prioritize in-region management that is complemented by out of region beneficial uses. Combustion options that do not have a net environmental benefit should not be considered for CRD biosolids. The cost estimate of each management option should be visible to CRD residents, since the cost will be passed onto tax payers.
2024/05/22 – 11:42am	Is the CRD Board's position that the provincial government (Ministry of Environment) is knowingly poisoning people and the environment in order to allow municipal governments to save money? I'm curious as to why the Board doesn't seek advice from experts in this field, and continues to rely solely on the opinions of concerned citizens with no education or experience in environmental science or resource management.
2024/05/22 – 12:22pm	CRD staff has indicated that the cost of a temporary demonstration facility for "advanced thermal" technology is approximately $10 million dollars. If the trial successfully processes all of the biosolids produced for 15 months, the per tonne cost is close to $2500/tonne. This is more than 100 times higher than the per tonne cost of the existing land application options employed by all other Regional Districts in BC. What is the CRD Board thinking?
2024/05/23 – 6:28am	We do not want that garbage here,it should be taken care of from where ever they take it from

2024/05/23 – 7:10am	Disposing city waste in the country is as bad as pumping raw sewage into the ocean. The solution is to make it someone else's problem.The contract for the job should not have been awarded if they didn't have a proper way to dispose of the material..
2024/05/23 8:05am	The thermal plant should have been constructed at the same time as the waste disposal plant. It is unfortunate it was not built as needed but typical of politics and short term thinking. There are many of these thermal plants operating around the world. The need for a 2 year trial is inappropriate, it seems that the right people are not working for the CRD and the right politicians are not making the right decisions to run this issue to ground. The thermal plant should have been phase 1 construction as the treatment plant was built. The CRD should immediately adopt an appropriate sized, proven technology plant and begin construction. A 2 year pilot is a waste of time, there many types of waste to energy plants in Europe, I am sure CRD engineers have multiple options for consideration. Please stop the analysis paralysis.
2024/05/23 – 9:08am	We in Jordan River are against any biosolid land application here or anywhere. Thanks for listening [REDACTED NAMES]

2024/05/23 10:28am	The Tier-1 Advanced thermal option is far superior to the Tiers-2 and -3 options. Construction of an advanced thermal processing facility for CRD sewage treatment of biosolids into biochar should proceed as quickly as possible. Also, planning and development should proceed expeditiously for facilities for accepting and using all the biochar produced by the CRD. This biochar should be used only in ways that have positive environmental and climate effects (carbon sequestration), e.g. a substitute for construction materials such as concrete and tar. The only Tier-2 measures that should be allowed are supplying biosolids for alternative fuel combustion and for supplying biochar production facilities outside the CRD. CRD biosolids should not be used for agriculture, industrial reclamation or forest fertilizer applications because of the threat of environmental contamination. Tier-3 should be for emergency situations only and should comprise the provision of specifically constructed containment facilities to securely and safely store thermally processed biosolids until they can be be further processed into biochar per Tier 1.
2024/05/23 – 4:00pm	Absolutely NO. No to all of it. The simple fact that this waste will contain absolutely everything that is put into the waste system including chemicals, drugs, effluent, detergents, microplastics and so much more is a deterrent in its own right. Undetermined chemicals mixed together to create new unknown chemical compounds... microplastics... pharma drugs... etc. This is going to be dispersed onto land that surrounds the South Islands main drinking water source (Sooke Lake and all of it's surrounding watershed tributaries)! Does the CRD have an exact knowledge of groundwater flow patterns? This has the potential to affect those on well water in addition to municipal water distributed from Sooke Lake. The 'potential' for this to happen alone should be sufficient deterrent to proceed! Our drinking water is our lifeline. Not to mention the adverse effect on wildlife flora and fauna. There are hundreds of micro-biomes on the Island, all of them will be affected in different ways either directly or indirectly by this. How they will be affected is merely speculation, truly unknown, and the resulting "we warned against this" will be words uttered far too late. Other municipalities around Canada use waste treatment plants and other methods to process waste that are non-threatening to the environment. Stop this absurdity before irreparable damage is done! Our forests and Island environments are doing just fine without human waste being sprayed/dumped all over them... We can put people on the moon, rovers on distant planets, but are unable to solve the challenge of what to do with human waste on Vancouver Island without risking our potable water supply and a very delicate ecosystem made up of hundreds of fragile micro-biomes! Think about that for a minute. NO to this absurdity!

2024/05/23 – 4:44pm	I personally feel that if this is to be performed, you are solely responsible for harming future generations. Not only human, but flora, fauna, mamilian, insects and avians to name a few. If what is found in water from human waste is any testimant to what will leach in to ground water, water sheds and tables, thus reaching spawning streams and other sources, it will cause irreparable damage that cannot be un done. Shame on whatever 'science' you are basing this proposal upon. It's an absolute disgrace that this is even considered. Please, never, ever do this. We need to leave a better earth for future generations, and by spreading biosolids, you are guaranteeing a wasteland. Literally.
2024/05/23 – 4:46pm	Biosolids are an added nutrient to the environment and many countries promote their use.
2024/05/23 – 5:43pm	Please keep Victoria's bio solids in Victoria. Don't risk know and possibly more unknown risks/hazzards to spoil our forests and possibly react our Juan de Fuca strait. Thousands of flora and fauna are existing happily and we don't need city biosolids trucked here. Make Victoria produce the planned bio solid product and sell it as planned. Too many risks for no gain.
2024/05/23 – 7:21pm	We should find alternative to spreading biosolids into rural lands! This could seriously harm the wildlife and the drinking water of those on wells.
2024/05/23 – 8:04pm	I feel this is the wrong way of dealing with this. I draw my water directly from Demamiel creek, spreading the bio solids in the hills above my residence will contaminate this creek and effect the salmon bearing stream and my water along with the residents in my neighborhood! Not to mention that this is in the area of the Victoria watershed also! This is a very bad plan and they should look into a better way of dealing with the biosolids. This should not be spread in the hills of a watershed and above residential areas

2024/05/23 – 8:25pm	We need to find a better way than putting biosolids near our water resources.
2024/05/23 – 9:43pm	It is my opinion that this idea is not thoroughly researched or well thought out. The JdF forestry lands happen to be the watershed to many people living in the interface zones not included in the CRD water distribution system. We rely on wells and surface waters to survive. There are many fish bearing streams in this area, plants and fungi that people and wildlife depend on for sustenance. If your feces is so clean, how about you spread it around Sooke Lake watershed
2024/05/24 – 5:46am	Please DO NOT spread any biosolids anywhere ... but especially anywhere near my home in Jordan River. The science is all you need to know to realize what a huge mistake this is. Please review his plan . It is insane
2024/05/24 – 7:38am	We are opposed to any soil applications of Biosolids in Metchosin. Specifically because a great portion of our properties rely on wells for drinking water. This could cause contamination of our groundwater and soil via toxic chemicals and disease causing pathogens. Our region's soil consist of loam and sand and exposed bedrock which means our aquifer 606 is extremely vulnerable to contamination due to its high infiltration rate. We feel that biosolids would be better utilized as a source of energy capture, a combustible fuel alternative.
2024/05/24 – 9:08am	This is a horrible idea when people are trying to be more sustainable by growing crop and raising animals for themselves and for the market. Bio-solids do not belong on rural land, not just because of the people living there but also the wild animals who inhabit these areas. Think again.
2024/05/24 – 10:54am	Only stupid people think that a biosolid is safe to be in OUR WATERSHED!!!! So No! Those dried shit should be where they are made! It is a big NO NO NO NO that it gets here in JDF forests! Get a grip guys, use your knowledge and money earned degree (if you have one) to think twice. NOT IN THE WATERSHED! NOT IN THE FOREST!!!!!!!!!!!! NOT IN JDF community!!

2024/05/24 – 11:45am	Strategy Seems reasonable. But am worried that the land fill/spreading options may end up being implemented if adequate energies/funds are not devoted to other utilisation measures
2024/05/24 – 12:18pm	using metchosin land for biowaste. This is a biodiversity hub that needs to be managed for its Keystone species ans not a dumping ground.
2024/05/24 – 12:27pm	I strongly oppose the distribution of biosolids on land. Now, with human waste laden with antibiotics and other drugs, as well as forever chemicals, it would be ludicrous to imagine that it would benefit life on land. It should not be spread anywhere: not on farmland and not on forests. Yes, it might speed up forest growth for the timber industry, but at the expense of contaminating all of our ecosystems for all time. Go the route of gasifying and creating biochar. A clean, usable product that will actually benefit this place we call home.
2024/05/24 – 1:54pm	The only disposal of biosolids that I approve of is gasification. All efforts should be made to have this option be realized more quickly and at a lower cost. I believe this will be possible if you focus on just this one option. When you consider cost, please deduct the value of the usable energy produced by gasification. Maybe we can profit by turning poop into product. Spreading biosolids on the ground is absolutely out. I'm sure you know that the toxins will leach out of the dangerous dung and into the streams and aquifers. What's worse than what might be in regular human waste is what hospitals and industry put down the sewer drain. Can you imagine? Here's the rule: If you wouldn't eat or drink it, don't put in on the land, anywhere.
2024/05/24 – 6:13pm	Are there no facilities nearby that we can ship to for transition to fuel while we build out Tier 1 option? There would be a revolution if attempts were made to spread it in the watershed of all the people and businesses in non core CRD lands,

2024/05/25 – 4:25pm	We have flagged the issue of Biosolids for some time now and when I attended the CRD meeting in January 2024 I started to feel very uncomfortable about the path of the CRD. Since January we have spoken to many people in our community who are quite rightly aghast when they realize the dangers that spreading Biosolids creates and the plans of the CRD to include surface application to lands in the Juan de Fuca rural resource land areas as part of their regional strategy. BC and Canada do not have standards for Biosolids and science tells us that regardless of standards there is no safe level of containments within Biosolids that permit safe spreading. The toxic materials in Biosolids occur largely due to the presence of Plastics and Pharmaceuticals which have been ingested and then flushed down the local sewers. Simple drying, as is done now at Hartland Landfill does not remove these toxic substances. The dried Biosolids, if dumped anywhere, can and will find their way in to our lands and water and all animals. Wind born dust can easily scatter the poisons ten kilometers from the source point. Rain and snowmelt can dissolve them and carry the poisons into the soil, the interflow water level and into streams, lakes, rivers and most dangerously into the underground aquifers from which so many of us draw our drinking water. The only safe technological approach to clean Biosolids that I have seen is complete burning (pyrolysis). The resulting biochar substance is as clean and inert as we can currently expect. Starting now the CRD is moving to this conclusion, I think, and yet they drag their feet with a study of the process, building of a pilot plant, and then upgrading it to a full size plant to handle the Biosolid product. This, we can expect to take them seven to ten years to complete and in the meantime their plans follow that when they need to get rid of the biosolids they always have the option of dumping it on forested lands well outside the inner urban core of municipalities. Even if our local governments in Metchosin, Sooke, and the Juan de Fuca were given a vote on the plan they would not be able to over come the votes of the other municipalities who only rational is "out of sight, out of mind". Biosolids are dangerous. They can poison and kill animals, birds, fish, humans, and contaminate and kill plants and farm produce by the use of water from local wells. Once polluted we cannot rectify our aquifers. We will be without water. Residents strongly support the ban against dumping any biosolids, anywhere, anytime. Thank you,
2024/05/25 – 6:18pm	Is it intentional that this box is so difficult for the the public to find to comment ? There is no defined safe limit for PFSAs and other "forever plastics" anywhere in the world to show if the PFSAs and other plastics found in the CRD Biosolids are safe to spread or not, so a plan to spread this is unethical, dangerous and potentially criminal. If we the public know about the hazards, one would think "the experts" on CRD staff, the consultants and the Board know. So NO to spreading biosolids. Thank you.

2024/05/26 – 7:24am	I am vehemently against the land application of biosolids. It is untenable in my view to compromise the productive capacity of our soils and compromise our watersheds. The issue is not the human waste, although this would require proper handling. The issue is the other contents of this waste. Micro plastics and more end up in the biosolids. One of my biggest concerns are the PFAS chemicals -also called forever chemicals, that are unfortunately found in common household products like non-stick pans, cosmetics, stain removers and cleaners. There are over 9,000 of these compounds. They are proven to cause cancer, and birth defects among other ailments. These are found in the biosolids and they never go away. Testing for PFAS is very costly and complicated. The only regional solution that I recommend is to incinerate our waste. It is very costly, but this is the price of maintaining our health, and the health of our soils and the ocean. A medium to longterm solution is to ban these chemicals at the source. We have no need of PFAS chemicals in our homes, nor do we need persistent pollutants in the products we use in our homes. If we could garner support at the provincial and federal level, pressure could be applied to manufacturers to only use biosolid-safe ingredients in their products. The issue can be revisited when we can guarantee that the land application of biosolids won't contaminate our soils and our people. Until then, I remain vehemently opposed to the land application of biosolids.
2024/05/26 – 3:20pm	I definitely want to see the ban on land application of biosolids in the CRD maintained. That is, I do not want any biosolids used in land applications in the CRD - or anywhere else.
2024/05/26 – 3:34pm	I do not believe that "nutritive value in biosolids outweighed the land contamination risks" for land application use of biosolids. That assessment is based on a perspective that contamination is understood and predictable. Have a real-time conversation with anyone who has ever suffered from PFAS contamination and see how the perspective of nutritive value outweighing the negative impacts of contamination is transaction-centric, not human-/environment-centric. Please maintain the ban on land application of biosolids!
2024/05/26 – 9:44pm	I am no expert in biosolids (aka bio sludge). I do appreciate that the local food I eat is effected by the quality of our soils. Any decision to add the toxicity of biosludge to the soil my food is grown in is insane. I am sure the CRD is not looking for a nomination for membership in the reckless endangerment club. Safety of our food supply simply cannot be compromised.

2024/05/27 – 5:15pm	Under no circumstances should biosolids be used on our soils, especially after hearing of the legal case in the US concerning hazardous materials found in biosolids by the same company considered by the CRD. To have not had a clear plan for the disposal of this waste right from the start, is where the negligence began.
2024/05/28 – 8:52am	Fossil fuel free thermal conversion, using the latest carbon free technology, is the only way to go. It's the best long term solution that takes into account our region's need to reduce our carbon footprint and stop destroying forests for landfills.
2024/05/28 – 9:45am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:03am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:06am	I strongly support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:09am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:11am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 10:13am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:15am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:19am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:21am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland. It is crucial to avoid incineration or combustion of fossil fuels.
2024/05/28 – 10:22am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:22am	I support biosolid disposal in the kindest way not to impact our planet
2024/05/28 – 10:25sm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 10:27	I support using new technologies or incineration or fossil fuels or biogas or LNG for the thermal conversion of biosolids to eliminate all toxic chemicals. I do not support the continued ban on all land application of biosolids in the CRD, especially at Hartland. The CRD needs to have the possibility to install a plant of its choice to manage our waste, and we need to give them the tools and support to do so. I trust in a sustainable, long term and affordable solution will be sought and found.
2024/05/28 – 10:28	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:46am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:54am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:00am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:01am	1. I support using technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil-free energy. 2. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 11:05am	For Health and community safety concerns, I adamantly oppose any land use applications of biosolids.
2024/05/28 – 11:06am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:10am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:17am	My first wish, expressed only "in general", is to close loops. Thus i would see human waste reintroduced into human sustenance. I understand this isn't feasible on account of challenges of source control and specific considerations like pharmaceuticals. So next best loop closure is to return biosolids to the biosphere. Your blended growing media for reclamation sounds GREAT as well as silviculture with safeguards. Then IF biosolids can be used as fuels, displacing other fuels, OK. But the very last choice should be using other fuels to incinerate biosolids. I want to add: while we here focus on biosolids I hope that liquid "waste" receives as much attention in terms of beneficial use.
2024/05/28 – 11:21am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:23am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 11:25am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:26am	We support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:33am	I support thermal conversion of biosolids, toward production of nontoxic biochar. I believe this needs to be accomplished without the use of fossil fuels. Thank you.
2024/05/28 – 11:41am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 11:44am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:53am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:58am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 12:09pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 12:11pm	Before it was relabeled as "biosolids" this material was referred to as sewage sludge..... It is nasty toxic material and should not be used anywhere in the CRD
2024/05/28 – 12:15	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 12:30pm	support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 12:43pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 12:48pm	Toxic biosolids from Victoria's sewage treatment plant are a public health threat. I call for the CRD and Province of British Columbia to adopt thermal conversion as the only safe and viable solution. Our safety should be paramount.
2024/05/28 – 1:07pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 1:11pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 1:26pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 1:28pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 1:33pm	I am in favour of the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 1:42pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 1:58pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 2:30pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 2:37pm	I support a CRD demonstration project that will use gasification or pyrolysis technology to process biosolids to produce energy and biochar. I support the continued ban on all land application of biosolids in the CRD; including burying in 'Biocells' or use as landcover at Hartland.
2024/05/28 – 2:41pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 2:51pm	No incineration. Use biosolids for energy through gasification.
2024/05/28 – 2:53pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 3:24pm	I DO NOT support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I DO support the continued ban on all land application of biosolids in the CRD, including at Hartland. Sierra Club-Supported Report: AN INDUSTRY BLOWING SMOKE—10 reasons why Gasification, Pyrolysis & Plasma Incineration are not “green solutions” https://www.no-burn.org/wp-content/uploads/2021/03/BlowingSmokeReport-1.pdf The only solution—see "Living Downstream" documentary, interviewing Retired BC Cancer Agency Senior Scientist Researcher Dr. John Spinelli. Free-stream it with your GVPL library card—https://www.hoopladigital.com/title/11043083 Trailer—https://www.youtube.com/watch?v=z2UsmBqYpwo About film—https://web.archive.org/web/20230528204824/https://www.livingdownstream.com/about-film Don't test toxins on the public, in our lungs, bodies, air, water or soil. Keep the toxins out of the biosolids in the first place. Hold The Province and Ottawa accountable for this by binding them to The Precautionary Principle—https://www.sehn.org/precautionary-principle-understanding-science-in-regulation. "If we can stop cancer [and Parkinson's and Alzheimer's] before it begins, why don’t we?" —Kristina Marusic, "A New War on Cancer—The Unlikely Heroes Revolutionizing Prevention"—https://www.kristinamarusic.com/
2024/05/28 – 3:29pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy
2024/05/28 – 3:30pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 3:30pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 3:51pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use biochar and fossil fuel free energy. I support the continued ban on all land application of class A biosolids in the CRD, including at Hartland
2024/05/28 – 4:04pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 4:20pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 4:47pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 5:13pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 5:26pm	I support using new technologies that DO NOT involve incineration or fossil fuels for the thermal conversion of biosolids. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 5:26pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland. I am astonished that we are still having this discussion. Biosolids do NOT belong anywhere in a dump!
2024/05/28 – 5:35pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 5:43pm	So Duh

2024/05/28 – 7:18pm	As most biosolids in low industrial environments across North America have been shown to contain low concentrations of potentially toxic components, most land applications in the short term are likely to show very limited impacts, positive or negative. In the short term it seems likely that Biosolids applied to forest or park lands, especially recent cuts, may well enhance the organic matter regime. My concern is with the longer term application of these materials to food producing surfaces. Again, in the short term, there will likely be a brief enhancement of the organic matter regimen, which in the case of depleted crop lands could represent an improvement and increased yields. My concerns lie with the long term applications of a host of low concentration elements, which have a longer soil residency period, therefore, greater opportunity to find their way in to the food chain and food supply. Increasing longer term, and greater mass applications (as is inevitable with expanding populations) concentrations of all potentially toxic, long residency elements will invariably increase. This is especially critical when producers are working to maintain full Organic Certifications. It also leads to increasing, yet uninformed, ingestion of moderately toxic foods stuffs. . Hence, it is important in my view for the CRD to conduct a proper and complete populations based Risk Assessment followed by the development of a long term Risk Management Plan.
2024/05/28 – 7:33pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 7:43pm	My family and I oppose the land application of biosolids in Shirley. Our watershed is close by, we grow our food, and we're raising our children here. We do not want our community at risk. Please come up with another option. Thank you
2024/05/28 – 7:48pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/28 – 9:41pm	I do NOT support any land use of biosolids or any application on land for any reason. I do NOT support incineration or composting of biosolids or any form of incineration releasing biosolid particles into the air, on land, or water (sea water or fresh water), or our environment. I do NOT support the use of biosolids as fertilizer in wooded areas and forests whether federal or provincial or regional or municipal or privately owned properties.
2024/05/28 – 9:42pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:30pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 10:39pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/28 – 11:03pm	support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD,
2024/05/29 – 6:34am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland

2024/05/29 – 7:36am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 9:06am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 10:43am	This has to be one of the most inadequate public consultation processes I have ever seen and is totally unfit for purpose for consultation on such a complex topic. There is no opportunity to upload documents or provide a detailed response. However, since this is the only way to provide input, let me say the following. Tier 1, using thermal conversion, is the only safe and sensible approach given the potentially long term effects of bioaccumulation of biosolids containing forever chemicals. As more and more is learned about the dangers and persistence of these chemicals that are present in treated biosolids, it becomes ever more important to maintain the ban on land application. The present policy of dumping 10 tons a day at Hartland is a ticking time bomb. This must stop immediately. Given the time to bring Tier 1 onstream (this process should prioritized and accelerated) it is essential that non land application interim solutions be found. The first option in Tier 2 must be to reactive the Lafarge solution. As part of this, the Board should pursue legal options to remedy the farce that Lafarge has become, wasting hundreds of thousands of dollars of taxpayer money and delivering no results. Either Lafarge is in breach of contract or Synagro is for not producing pellets with the required caloric value. Either way, the public has a right to know and the Board a responsibility to shed light on what happened, so as to avoid it happening again. If Lafarge doesn't work, find other similar beneficial fuel uses. Do not resort to land application either out of region, in region or at Hartland. The only safe solution is to biocell the biosolids somewhere other than Hartland until such time as the biosolids can be beneficially used in the pyrolisis conversion plant to produce biochar, which can generate revenue. Tier 3 should be off the table completely. The CRD fortunately has been able to avoid most of the long term risks by not applying biosolids to land in the region. Don't throw all that away for some short term gain. Either use the stuff as fuel, or biocell so that it can be used as fuel in future while Tier 1 option is expedited.

2024/05/29 – 10:55am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 11:19am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 11:20am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 11:23am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 11:47am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/29 – 1:36pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/ 29 – 1:38pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids (also known as solid sewage sludge) to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids (also known as solid sewage sludge) in the CRD, including at Hartland. I welcome information about the decision of the CRD Board regarding this essential ecological and environmental issue.
2024/05/ 29 – 3:07pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/ 29 – 3:10pm	I support using new technologiesthat do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and and produce beneficial use in biochar and fossil free energy. I support the continued ban on all application of biosolidsin the CRD, including at Hartland.
2024/05/ 29 – 7:57pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/ 29 – 8:04pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/ 29 – 9:07pm	I live in Otter Point. I just attended a presentation by Phillipe Lucas. Following this I am 100% opposed to the land application of biosolids. Gasification appears to be the only way forward. Municipalities which vote for land application approval must be prepared to receive the biosolids themselves!

2024/05/29 – 9:09pm	I disagree 100% with applying biosolids/sludge on the land, but I support using gasification or pyrolysis of biosolids/sludge to generate syngas for electricity generation. Mixing of biosolids with wood waste is ok to achieve better gasification or pyrolysis. The charcoal obtained in this process can be used for filtering the emissions from the gasifier or on the land as a soil amendment.
2024/05/30 – 7:24am	I think biosolids should be converted into gas and not put onto the land or in the water.
2024/05/30 – 7:26am	I am an organic farmer and opposed to putting biosolids on the land, particularly on farm land.
2024/05/30 – 8:23am	This reminds me of the Canadian Red Cross decision to ignore emerging science on HIV and continue using contaminated blood. It was a costly decision in many ways, including costing lives. "Only 6 measured parts per billion" does not sound like a lot. But it adds up. Just say "no" to land application. Speed up the biochar option and look at other nations' successes.
2024/05/30 – 9:07am	The only responsible option to deal with bio-solids is advanced thermal. Spreading it out on farm land or any forest is only going to poison (say PFASs) the land , and the water on and in it. Our water source is a well, drawing from an aquifer which is regenerated by rainwater. There are water licences for residences in our area that draw water from creeks. The land around our rural home is our water shed, so please don't poison it .... this concern must apply both inside and outside the CRD. Bio-solids spread on the land must not happen.
2024/05/30 – 9:10am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/30 – 9:12am	Any plan to spread bio-solids on land must not happen!! Bio-solids are proven beyond doubt to be toxic to the environment and to all living things. To do so is beyond irresponsible -
2024/05/30 – 9:31am	I'm curious as to how the CRD has concluded that pursuing "advanced thermal" options at great expense is in alignment with the public feedback received, as this was the least supported option in the representative survey and will cost more than 10 times what other options cost. I also find it ridiculous that the CRD has separated "out of region" and "in region" land application options. If this material is truly "toxic waste" (it isn't) why would they send it out of region to somebody else's backyard?
2024/05/30 – 9:33am	BAD IDEA! Don't do it. Dumping bio solid where it won't have impact of our water and soil. I am COMPLETELY AGAINST THIS!
2024/05/30 – 9:44am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/30 – 10:42am	Current system rejected around the world, unsustainable mass effect even now and is dangerous to public health - spreading toxins, forever chemicals and ever evolving noxious bacteria and viruses into schools, agricultural lands and the very water table in residential areas that rely on wells. Frequent bad odours as you pass Hartland enroute to adjacent Durance Lake and Tod Gowland park recreation area for an increasingly congested, nature-needy city tell it all. Victoria's prime, world-class tourist attraction, Bouchart Gardens, cops it too - what a short- sighted disgrace.
2024/05/30 – 11:05am	I am a resident of the Juan de Fuca regional district. I oppose the land application of biosolids as an option for managing waste and would like to see the current ban remain in place. The CRD should move ahead with establishing gasification processes.

2024/05/30 – 11:19am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/30 – 1:09pm	It seems that the CRD could benefit from some professional help when it comes to managing biosolids. Is there any reason why they do not bring in a tenured professor of environmental or waste management to advise them? Might be a step up from relying on special interest groups focusing on preventing anything from occurring in their own back yard.
2024/05/30 – 1:14pm	$10 Million for a 1-year pilot project, and them a significantly higher amount if the technology works?! The CRD is going to spend more on this (non)-issue than other regions will spend this century!
2024/05/30 – 1:41	If other regions can safely land apply biosolids I'm not sure why we can't. Is the assertion that cancer rates are higher outside of the CRD? Are the forests around Nanaimo a toxic wasteland? The CRD Board should dismiss Phillippe Lucas' statements for the hyperbole they are, and the CRD should bring in the experts that have advised other local governments when these same questions have been asked.
2024/05/30 – 4:11pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/30 – 4:15pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/30 – 4:50pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/30 – 4:52pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/30 – 5:33pm	Tier 1 - I support thermal conversion and ask that you accelerate the timeline. I support processing that does not involve the use of fossil fuels, incineration, or other method that disperses chemicals into the air. I expect that all toxic chemicals will be removed from the biochar. Tier 2 options 1, 2, 3, 4 and Tier 3 option 1, 2, 3 - I do not support any land application, anywhere at any time. There is too much evidence of the dangers of contamination. CRD doesn't take nearly enough care to rigorously test the areas impacted by Hartland. Slow contamination is impossible to reverse. Tier 2 option 5, 6 - Until Tier 1 can be achieved, I support prioritizing the use of biosolids at the Lafarge plant or similar as originally intended. I trust CRD will inform us of and solve the problems that suspended this use. Tier 3 option 3 - Given the existing pressures on landfill capacity, the use of biosolids as coverage on the filling face of Hartland must be eliminated as an option. If all else fails, biosolids must be safely biocelled at a site other than Hartland. It makes sense that Biocelled material can be beneficially used as fuel when Tier 1 becomes available.
2024/05/30 – 5:39pm	I am opposed to any land application either in region or out of region. The biosolid spread at Hartland must stop. The landfill has too much already. There is significant evidence that biosolids are toxic and that over time cause serious harm. Thermal conversion without incineration is the only option. In the meantime you must do your upmost to fix the problems with LaFarge and pursue that option. We are skeptical that you have not said why this option is not working. We think that biocells are a good option to store the waste until thermal conversion is available

2024/05/30 – 6:03pm	I'm very concerned with these two items from the Tier 2 plan: 2. Forest fertilization 3. Production of biosolids growing medium and/or feedstock in soil production Putting human waste, no matter how it's pretreated, onto our forests is reckless to say the least. Our forests are a precious biome, already in danger from other hazards, whether man or climate related. Our forests are vital for our survival. Forests will not respond well to human waste, especially with all the hazard material in it (pharmaceuticals, hormones, poisons, whatever someone decides to flush down their toilet). The same comments relate to using these biosolids a a growing medium or feedstock for soil production. Really? There needs to be some very serious questions raised about where such outrageous ideas came from. Certainly not from qualified scientific sources.
2024/05/30 – 7:28pm	Don't re invent the wheel; go with a working gasification system and get on with disposing of biosolids. spreading it around as" fertilizer" is compounding the harm from toxic substances. Your crd sewage sludge does not belong in my jdfea back yard, contaminating my water sources.
2024/05/30 – 8:42pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/30 – 10:17pm	Biosolids contain toxic 'forever chemicals' that disperse when they adhere to microplastics, so I don't support Tier 3 of the Plan. There is recent research from the UCLA pollution lab on this issue, and I therefore do not support the land application of biosolids anywhere under any circumstances. I do support Tier 1, but until a thermal conversion plant is operational, biosolids must be safely stored for future beneficial use in a biocell facility at a location other than Hartland. Furthermore, like airports across Canada are starting to do, because biosolids have been over-applied at Hartland against provincial approval, when the thermal plant is operational, the Hartland Landfill must be remediated for PFAS and other forever chemicals. Until then, a long term detailed monitoring program like what CRD has underway with the Raincoast Foundation needs to continue. Lastly, CRD's consultation and public education on the issue of biosolids has not been accurate or adequate. The public needs to understand this issue so they can make an informed decision and support building the infrastructure needed to safely handle our region's biosolids. The results of the two surveys that CRD recently did show the importance of public education. Residents who were cold called by IPSOS and who did not know any better, assumed that provincial regulations were adequate and therefore agreed with land application. This was not informed support and frankly, this type of survey is not ethical given the issue involves public health, environmental risk and a huge amount of public money. Please truthfully educate the public and make the right infrastructure investment...no matter what the outdated and inadequate OMRR direct. The Province is wrong , and for the sake of our children, it's time to start pushing back so CRD can deliver what it's citizens want.
2024/05/31 – 6:59am	I support new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland Dump and surrounding lands.
2024/05/31 – 9:55am	More recent research appears to call into question the safety of using biosolids on land. This new information means that the precautionary principle must be followed. I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/05/31 – 9:57am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/31 – 11:46am	I do not support any land application of existing biosolids generated at Hartland whatsoever including the continuing application at Hartland landfill I do support alternate solutions including thermal conversion and processes to generate a benign product for potential value added applications
2024/05/31 – 12:20pm	I am opposed to spreading biosolids on our lands. Please consider other beneficial strategies like gasification and energy production. Please also consider the possible extraction of elements and metals for beneficial use.
2024/05/31 – 1:03pm	We must live within our own means - Rescind the rules that ban land application in the CRD: This rule is outdated at best. A vocal minority of conspiracy theorists with the luxury of plenty of non-working time have the confidence of the CRD Board. This confidence is misguided and will not age well. You, CRD Board, should know better. The more inclusive survey of the CRD voters, taxpayers and ratepayers reports the opposite views. The overworked, inflation weary, underhoused and too-exhausted-to-pay-attention-to-the-rabbitholes-the-vocal-minority-have-dug majority will eventually get the bill for the only facilities for biosolid vapourization this side of Alpha Centauri and vote accordingly. The funds should go to address their aforementioned hyphenated issues. The CRD needs to take responsibility for the products it buys and the food it eats. Eventually the outside communities the CRD expects to accept it's biosolids (because they are too frightening for the CRD but are good enough for colonization of other areas) will pass their own rules banning biosolids from the CRD. I expect the CRD will partner with Space X and stop funding anything else at that point. Humans, dinosaurs and insects have been using land application for waste products since the single cell organism began metabolizing. Just like breathing uses air. If legislation can control the manufacture of ozone damaging chemicals, pesticides and mutagenic antinausea drugs for pregnancy why is the untested wasteful technology something the CRD ratepayers need to fund? Even if the conspiracy theorists are correct, the impact will not be felt in their lifetime and these individuals has expressed little concern for anyone but there own group. The conduct is cultlike. Provence of BC. Please act in an equable manner. And for heavens sake, burning assets for cement plants is not sustainable either. With all that, thank you for your service.

2024/05/31 - 4:12	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/05/31 – 7:44pm	Current research indicates that persistent organic compounds, or emerging pollutants, found in pharmaceuticals and personal care products, microplastics, and per- and polyfluoroalkyl substances (PFAS) have the potential to contaminate ground and surface water, and the uptake of these substances from soil amended by the land application of biosolids can result in contamination of food sources (e.g. fish, berries) and ecosystems that have provided a home for the indigenous flora and fauna and birds and pollinators for centuries and the air that we all breathe when we walk in the woods. Advanced technologies to remove these contaminants from wastewater treatment plant influent, effluent, and biosolids destined for land application along with tools to detect and quantify emerging pollutants are critical for human health protection.
2024/06/01 = 5:08am	I oppose the land application of bio-solids. The ban of this practice must stay in place. I support the strategy of gasification of bio-solids and believe this should be pursued more aggressively.

2024/06/01 – 9:01am	Dear CRD, Biosolid Free BC strongly opposes the land application of biosolids, whether it's in the CRD, at Hartland landfill, or in any other jurisdiction. The available academic evidence makes it evident that due to the large concentration of toxic chemicals found in sewage sludge - which include PFAS, microplastics, pharmaceuticals, PAHs, dioxins and other chemicals of emerging concern - there is no way to avoid significant negative impacts on the environment and public health inevitably associated with the land application of biosolids, nor the associated legal liability for the CRD. In light of these harms, Biosolid Free BC strongly supports alternative approaches that make beneficial use of biosolids in waste-to-energy applications, including industrial uses that displace the use of fossil fuels such as powering cement manufacturing and/or the development of local thermal conversion opportunities in the CRD. We note that despite the significant implications associated with the implementation of effective strategies for the long term management of biosolids, the CRD public consultation process has been completely inadequate and flawed by the lack of balanced, unbiased evidence-based information. Decisions on this file have significant financial, public health and environmental implications, and the general public as well as local First Nations should have been provided with far better opportunities to engage in the decision-making around this issue. Despite the reluctance of senior CRD staff to dutifully provide the Board and the public with the available evidence regarding unavoidable harms and legal liability associated with the land application of biosolids, or to ensure that Synagro's current practices - which have resulted in a number of criminal investigations and lawsuits in the US and Canada - don't endanger our region's environment and public health, we strongly commend the CRD Board for upholding the longstanding and popular regional ban on the land application of biosolids, and will continue to support alternative strategies that don't threaten the future health of our region.
2024/06/01 – 9:31am	I am concerned about the wisdom of using bio solids on food producing fields. I would prefer to err on the side of caution now rather than find too late that this was a mistake.

2024/06/01 – 12:10 pm	I strongly support the continued ban on all land application of biosolids in the CRD, including at Hartland. I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate or at least reduce toxic chemicals and produce beneficial use in biochar and fossil free energy.
2024/06/01 – 6:50pm	1) Above all we should keep waste processing as low tech and as simple as possible. Future energy use (thermal treatments) will be harder to implement, more and more expensive, fuel more and more scarce. Given these future issues, I support land fertilization and creation of compost for farming and use in urban settings. 2) A portion of our community waste stream could be managed locally, within neighborhoods. Waste processing could be more evenly and locally distributed by popularizing the use of composting toilets, neighborhood-located composting sites, and redistribution of finished composted material back within the same neighborhood. This strategy would also avoid the energy use required for transportation to more distant locations.
2024/06/02 – 7:50am	Do not spread biosolids anywhere on Vancouver Island! I'm shocked that you would even consider doing this with the repercussions in the news from south of the border!
2024/06/02 – 8:24am	I strongly support development of a demonstration facility for advanced thermal processing. I am opposed to biosolids being used as a growing medium for agricultural - human or livestock. I am opposed to biosolids being used for forest fertilization. I strongly support the CRD addressing the region's sewage waste in the region as opposed to off loading to another region. Accordingly, I strongly support the CRD retaining its policy banning biosolid land application which it has had in place since 2011. Now is the time for the CRD to prove itself as an environmental leader, and adhere to the guiding policies of its Regional Growth Strategy and protect the region's ecosystems. As stated by the CRD, " We all live in a watershed, regardless of how far we are from a body of water; therefore, the activities we do on land impact our water quality."

2024/06/02 – 10:35am	Thank you for the opportunity to comment. I live near the Hartland landfill and have a well drawing water from the same aquifer as that o Hartland. I don't support applying biosolids on the landfill or other CRD land. Our CRD population is set to increase significantly and the CRD land base outside urban areas and parks is not huge. Although we don't have a lot of industry, we do have a lot of domestic sources of the forever chemicals. Unless source control of forever chemicals is in place (and I don't see that happening), then I support thermal conversion of biosolids into a non-toxic beneficial safe product such as biochar. I am pleased that a trial of this technology is planned. At an earlier on-line information session, a member of the public asked if the CRD had tested for concentrations of some of these forever chemicals in the biosolids. The response was yes but the CRD was not willing to share the results. This lack of transparency does not engender trust in the CRD professionals.
2024/06/02 – 11:26am	Pls move away from incineration and chemicals . We are being poisoned. Our hearts and health compromised.
2024/06/02 – 12:07pm	Burn it as energy. Do not use as fertilizer please.

2024/06/02 – 1:00pm	Comments in response to the long term plan for managing biosolids in the CRD area Thermal Conversion Full support of Tier 1 options for thermal conversion with the following components • expedite planning and construction of demonstration plant • prepare for seamless transition from demonstration plant to fully operational facility • utilize and expand on existing research completed by GHD Environmental to minimize time needed to complete RFP • insure contract agreement with Lafarge is functioning or explore and commit to other industrial facilities using biosolids as fuel • explore biocell specifically designed to store biosolids until they can be effectively thermally processed Land Application Remove land application of biosolids as an acceptable option unless it can be proven that land application is safe in terms of human and environmental health. This position applies to both application within the CRD, including Hartland Landfill and also out of region and is necessary until • scientific literature and legal liability reviews of land application are publicly released and independently reviewed • Raincoast Conservation Society has released it's water quality monitoring data for the Tod Creek Watershed, specifically the areas around Hartland Landfill • Raincoast Conservation has independently commented on CRD data on chemicals of concern especially concerning bio-accumulation • BC Environment has modernized OMRR, and specifically addresses chemicals of emerging concern and long term impacts Public Consultation The CRD has been directed by the Ministry of Environment to submit a long term plan by mid June although the province itself has not provided the necessary information and resources in a timely manner. • public consultation has been impacted and restricted by the ministry requirements and out of date regulations. • critical research, information and education are missing from the consultation dialogue • many stakeholders including environmental groups, farmers and First Nations have had minimal consideration. • the final phase of the public consultation, which closes June, 3 is inadequate in terms of public promotion, access and education. • a robust and ongoing consultation process is necessary as the long term plan evolves especially with respect to thermal conversion options

2024/06/02 – 3:50pm	I live in Shirley, JDF EA. There are a lot of former forest lands here that were removed from TFL. When I hear the term "forest fertilization" in reference to biosolids disposal, I rightly or wrongly presume that means forests in JDF EA. Residents in Shirley are dependent on wells and water licences for domestic water supply. Drought conditions mean that both of those sources are threatened. There is not a comprehensive acquifer study of the area, and many of the water courses are unmapped or not completely mapped. There is no assurance that dumping of biosolids on the forest floor will not leach into our watersheds. There is nothing in this for residents of rural areas such as Shirley that are not on piped water. It is ironic that CRD water is obtained from water bodies in JDF EA but much of the district is not serviced. We are responsible for obtaining and maintaining our water supplies with no help from the CRD. Likewise, rural areas of JDF EA are not on sewer and have to build and maintain our own septic systems with no help from the CRD. Those in the CRD who are on sewers should just pay up and establish the best system of disposing of biosolids, thermal processing, and not dump on other communities. I'm against the dumping of biosolids on the forest floor, that just is adding insult to injury. How about starting the conversation about extending CRD water to rural areas of JDFEA???? That could change the scenario. Or how about getting Acquifer Studies done for the area west of Sooke? Ensuring the creeks are accurately mapped to get a better picture of where the water flows??
2024/06/02 – 5:30pm	I am concerned about the environmental and health risks associated with spreading biosolids on the land as well as potential legal liability in future.
2024/06/02 – 5:32pm	There are too many unknowns to risk spreading biosolids on the land.
2024/06/02 – 6:05pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/06/02 – 7:14pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/02 – 7:15pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/02 – 7:15pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/02 – 7:33pm	I fully support the Tier 1 options for thermal conversion of biosolids. In the interim while the pilot plant is under construction, I support the use of biosolids as fuel for cement plants or similar industrial applications. The land application ban in place in the CRD since 2011 must be upheld, especially as the scientific evidence of the harmful and long term impacts of "forever chemicals" such as PFASs in biosolids continues to mount. In other jurisdictions, governments have been held liable for the devastating impacts that contaminants in biosolids have had on agricultural lands (crops and livestock), and drinking water as a result of land application. The public consultation on this critically important topic has been woefully minimal. People in the capital region deserve better.
2024/06/02 – 7:51pm	I oppose the land application of biosolids! My research found that biosolids contain a complex mix of contaminants including PFAS, microplastics, synthetic organics, pharmaceuticals, in addition to the organic human waste. It is shameful for the CRD to consider this as an option after only recently ceasing the practice of ocean dumping due to the very same pollutants! The CRD should expedite the plan for alternate disposal methods such as incineration with energy recovery or biochar and abandon the environmental disaster of land distribution. I live in the JDF area to enjoy the ocean and forests, not to destroy either simply because it’s cheaper and easier than doing the right thing!

2024/06/02 – 8:13pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/02 – 8:14pm	hello -- I support the continued ban on all land application of biosolids in the CRD, including at Hartland. and, I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. Thank you for your on-going work on finding best solution for the safest means of dealing with this toxic waste product.
2024/06/02 – 8:28pm	You should have thought about this problem before you built the plant.
2024/06/02 – 9:20pm	support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/02 – 9:30pm	I don't believe that the CRD has investigated the safety of biosolids enough to consider them "safe" or "beneficial". There continues to be new evidence of harm. I am sure that the State of Texas does not take legal action just because it can. The biosolids project has been bungled from the start. You must be sure without a doubt that you are doing no further harm. The Hartland landfill is already well past what was intended for biosolid disposal, I am strongly opposed to any further land application there or anywhere else. The biocell storage is a hopeful option until you can get Tier 1 thermal but not incineration in place. Incineration doesn't seem a good option at all, why put more toxins into the air? Richmond plant may be one option in the interim but it is suspicious that CRD won't say why this option can't be sorted out. You must do more rigorous testing to protect the land, water and air around Hartland. So close to farms, parks , aquifers and so many people in the area. It's ridiculous that CRD continues to expand Hartland right next to a park and heavily used lake. I won't let my kids swim in that lake anymore, not since the pipeline went in, not while to odours and spills continue.

2024/06/02 – 9:59pm	As an advocate for sustainable practices, I endorse the adoption of innovative technologies that steer clear of incineration or fossil fuels in the thermal conversion of biosolids. By doing so, we can effectively eliminate harmful chemicals and simultaneously generate valuable biochar and fossil-free energy. Furthermore, I remain steadfast in my support for maintaining the ban on land application of biosolids within the CRD, including the Hartland area.
2024/06/02 – 10:23pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/02 – 10:29pm	na
2024/06/02 – 11:51pm	I oppose the land application of biosolids
2024/06/02 – 11:58pm	I support using new technologies that DO NOT involve incineration of fossil fuels for the thermal conversion of biosolids. I support the continued ban on all land application of biosolids in the CRD including Hartland.

2024/06/03 – 6:13am	To say that I am deeply disappointed in what is currently happening at Hartland landfill is a huge understatement. When this project was proposed and information meetings were held, we were PROMISED by the representatives at the meeting that the biosolids would not be remaining at Hartland. So, I do not find any of these solutions ideal, but we are forced to move ahead and find the best solutions for a poorly planned project. I support using new technologies that DO NOT involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I urge you to accelerate the establishment of this process at Hartland. I support the CONTINUED BAN on all land application of biosolids in the CRD, including at Hartland. Until Tier 1 thermal conversion can be achieved, I support fuel combustion in Richmond (Tier 2 Option 5) or similar as a less harmful / risky choice. I ask that it be made to work, or to tell us why it isn't working. (This option was the original plan and has not yet worked, leaving all biosolids to be spread at Hartland.) If the T2 Op 5 fuel combustion won't work, I support environmentally safe storage (biocelling). Biocelling stores the material until Tier 1 is available, when it can be converted. Given the existing capacity pressures at Hartland, I do not support biocell storage at Hartland.
2024/06/03 – 7:06am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/03 – 9:00am	I believe the only use of the biosolids should be incineration or gasification. Please do not spread this product on the land. The risks are too great.

2024/06/03 – 9:28am	I support thermal conversion processes but not incineration. I ask that you accelerate the timeline for Tier 1. Incineration disperses toxins into the air. Using fossil fuels only adds to greenhouse gasses. I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I oppose land application of any kind, anywhere. This may release toxins into our ecosystem. Therefore, I oppose further biosolids spread at Hartland. Hartland's capacity is already over target from regional growth, with drastically greater than planned dumping of biosolids. Until Tier 1 thermal conversion can be achieved, I support fuel combustion in Richmond (Tier 2 Option 5) or similar as a less harmful / risky choice. I ask that it be made to work, or explain why it isn't working. (This option was the original plan and has not yet worked, leaving all biosolids to be spread at Hartland—without adequate consultation with nearby communities or First Nations.
2024/06/03 – 9:33am	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/03 – 11:41am	I have read a detailed response to the biosolids strategy from my friend [REDACTED NAME] and agree complete;y with that feedback. It is a very well researched outline that approves of Tier One and has excellent changes to recommend in some other aspects, It seems I can just say yes or no, so I'll go for yes below
2024/06/03 – 12:08pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.

2024/06/03 – 12:32pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/03 – 1:57 -m	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/03 – 2:48pm	YES to Tier 1 options for thermal conversion NO to land application unless proven safe for the environment

2024/06/03 – 2:58pm	The proposed strategy is not unreasonable. What is depressing is how long it has taken the CRD to even get to this point. Advanced thermal processing of the anerobic digestate has to be the ultimate goal of the CRD biosolids plan. I have been looking into issues around biosolids management for the past 20+ years. At one time, I felt that the benefits of land application outweighted the risks, in line with CRD staff thinking, EPA guidelines, etc., as long as long as metals contents were below critical threshholds. Research done through the University of Washington in particular has been unable to demonstrate unwanted impacts of land application to soil and streamwater chemistry, at least for the chemicals examined. Potential benefits of land application of Class A biosolids to managed forest lands on eastern Vancouver Island include greater tree productivity, increased soil organic matter and soil carbon sequestration, and improved soil moisture retention- an important consideration as growing seasons become longer, warmer, and drier with climate change. For the past 10 years, I've become convinced that "advanced thermal processing", specifically pyrolysis, is what the CRD needs to be doing. Compared to anerobic digestion, appropriate pyrolysis produces biochar, in addition to energy as gas, oil, electricity, and / or hydrogen. Pyrolysis should destroy many/most contaminants not addressed in the dated EPA and Province of BC guidelines that we rely on; certainly micro- and nanoplastics and, potentially, PFAs and their relatives, although that is the subject of much active research. Metals can concentrate in biochar, compared to anaerobic digestate, but studies to-date suggest those metals are much less mobile in soil. Biochar is a very recalcitrant form of carbon and is a better way (than are biosolids) to increase long-term soil carbon sequestration when applied to land. Like biosolids, application of biochar can increase soil health and productivity on managed forest lands, in reclamation, and even in degraded urban soils. Other feedstocks which may be compatible with biosolids for pyrolysis could include organic "wastes" which are problematic to compost (animal products, invasive vegetation?). Where land application of biochar is consdiered especially risky, its use in other applications (e.g., concrete and asphalt, wastewater and stormater filtration and cleanup) show promise. There is a considerable research literature underpinning biochar production, characteristics, and applications. That said, there are many questions that need to be answered by the CRD before using pyrolysis to complete the treatment of its sewage sludge. What are the contaminants in our biosolids and how does pyrolysis influence them? What forms of energy can be produced via pyrolysis? These are not new issues of concern and have been studied intensively in Europe, Australia, Asia, and much less so in North America. I was not impressed by the "process" that CRD followed when previously looking into thermal processing of biosolids (e.g., ca. 2015-2018?). Nor have I been impressed by provincial approaches on this file. Much of the CRD process insince 2015 seemed almost backwards in its approach. And I think the province is behind on understanding and regulating biochar as a soil amendment. A part of the problem likely is that biochar manufacture and applications cuts across many disciplines, but is a tiny part of any given discipline, at least to those who work in a given discipline.

2024/06/03 – 4:12pm	The original plan to use this as a source of energy and concrete component sounded like a good way to invest in a billion dollars of debt for taxpayers but dumping it on land in any form defeats the original purpose entirely. This project reeks of incompetence.
2024/06/03 – 5:13pm	Do not proceed with the plan to distribute biosolids throughout the lands of the CRD. Look at the experience of other jurisdictions like Texas, which is dealing with toxicity issues everywhere biosolids were spread onto the land.
2024/06/03 – 6:03pm	Stop wasting money and land apply like everyone else.
2024/06/03 – 6:05pm	Land application in region is by far the most responsible option from a climate change perspective. Shame on the CRD for pursuing options that maximize GHG production.
2024/06/03 – 7:25pm	I live in the JDF area and am opposed to the CRD taking any action to dumping biosolids on land in our region. This is not safe, nor is it acceptable for us to have to accept contamination and dangerous chemical filled waste from an urban centre in our wild/rural land.
2024/06/03 – 8:01pm	We oppose further biosolids being spread at Hartland Landfill. Capacity at Hartland is already over target and the dumping of biosolids is drastically greater than planned. We support fuel combustion in Richmond until Tier 1 thermal conversion can be achieved. We were promised this in the beginning. Why isn't it working at Hartland and why is the company that built the plant not responsible for making it work properly? Everyone is concerned about the chemicals in biosolids and its harm to the environment. We support the continued ban on all land applications of biosolids in the CRD, including Hartland. Thank you for your attention to this matter.

2024/06/03 – 5:13pm	I support using new technologies that do not involve incineration or fossil fuels for the thermal conversion of biosolids to eliminate all toxic chemicals and produce beneficial use in biochar and fossil free energy. I support the continued ban on all land application of biosolids in the CRD, including at Hartland.
2024/06/03 – 5:13pm	I STRONGLY oppose any land application of bio solids with the CRD and especially at the Hartland landfill. There is so much research that outlines the detrimental and dangerous implications of land application and I am shocked this is still being considered as an option. Please do the right thing and ban land application of bio solids . This is not a solution. Develop a way to use thermal techniques before further environmental damage occurs
2024/06/03 – 5:13pm	Thank you for the opportunity for public comment. Spreading of human waste and the included chemicals is of great concern to all of us who work for the land and the viability and productivity of the land for current and future generations. At this point in time Thermal Conversion seems the best option. Expensive, but much less expensive than the potential for contamination of our aquifers, watersheds and our forestry and land bases. Ministry of Environment has failed to be up to date with OMRR regulations, has inadequate studies of modern chemicals and the effects on our land and water and has failed to prove that land application is "beneficial use" in the long term. There are many issues in North America and Europe with land application of human sewage sludge (biosolids), Synagro processing, long-term polyflouroalkyls, heavy metals, etc. Cumulative effects are not yet adequately studied and monitored. "Class A" doesn't really mean very much anymore. *(Comment continues on the following page)*

	Location, Location, Location. Hartland Dump was a private garbage dump established "out in the bush" on the back side of DND land in the 1950's. CRD purchased it in 1975 and CRD Environmental Sustainability Services have managed the landfill since 1985. To their credit, they have greatly improved management. However, it is still very poorly situated at the top of key aquifers and Saanich Inlet watershed and has limited capacity. We need to have evolved from: "Out of sight, out of mind" and "Flush and Forget". CRD needs to be seriously siting a second land fill, particularly as the province is decreeing increased population densities in the area. Perhaps the site of a temporary bio-cell could be the impetus for a 2nd better-situated landfill/thermal conversion site in the CRD. It does not seem ethical or moral to move our waste to other regions. We create it we need to deal with it in a sustainable manner. The contracts with CRD, Synagro, LaFarge, need to be looked at because CRD residents seem to be paying for a product that is not usable for the intended LaFarge use and is unproven to be safe for land application. There seems to have been little contact with First Nations. I can't speak for First Nations, but Land managers from T'souke to T'sawout seem to have little knowledge and no enthusiasm of any possibility of land application, so public consultation and information seems to be lacking on many levels. CRD Staff have frequently stated that land application of "Class A" biosolids is a "beneficial use" under OMRR, but the province has failed B.C. residents not having adequate information for cumulative effects of modern chemical to prove "beneficial use". One can only support thermal conversion options as soon as possible, and temporary bio-cell storage for future energy use at this time.

2024/06/04 – 9:26 am	Dear CRD Board. The Peninsula Biosolids Coalition (PBC) is pleased to submit the following comments on the long-term plan for managing biosolids in the CRD Region. Thermal Conversion PBC fully supports top priority is given to Tier 1 options for thermal conversion. There are four components to this Tier that PBC wishes to comment on. 1. Expedite RFP for demonstration plant PBC supports a seamless transition from a demonstration plant to a fully operational facility so the initial plant is in place within two years after which there is continuous operation. The design and regulatory process should be run concurrently to reduce the approval time. The private sector should take the lead on operating the plant to manage the risk and expedite the approval process. The plant should be designed to process both biosolids and construction and demolition waste streams to enable the CRD meet its per capita waste disposal target of 250Kg/person/year in 10 years. 2. Make LaFarge contract work or seek compensation for a failed contract. LaFarge is thermal conversion of biosolids so making its contract work is part of Tier 1. The public needs to know why the contract between CRD and LaFarge has failed to process biosolids and the accountability for this failure. 3. Explore other industrial facilities that can use biosolids as a fuel. There are a number of other facilities such as cement and concrete plants in BC and nearby in other jurisdictions that should be considered in the interim before a thermal conversion plant is operational. 4. Explore a biocell specifically designed to temporarily store biosolids till they can be thermally processed outside Hartland. Again this option belongs to thermal conversion, as this is the ultimate application. *(Comment continues on the following page)*

Land Application of Biosolids

In view of a number of jurisdictions banning land application of biosolids because of chemicals of emerging concern, the PBC cannot support land application till it is assured that land application is safe in terms of potential impacts on public health and the environment. It is generally recognized that the Provincial OMRR is out of date in considering the latest peer reviewed science associated with the impacts of these chemicals on the environment.

This position applies both to application within the CRD including Hartland due to non-compliance with provincial regulations and also out of region.

The PBC will hold this position until:

- The scientific literature and legal liability reviews of land application are publicly released for public consultation
- Raincoast Conservation Society has released its water quality monitoring data around Hartland
- Raincoast Conservation Society has independently commented on CRD data on chemicals of concern especially concerning bioaccumulation.
- BC Environment has modernized OMRR, which specifically addresses chemicals of emerging concern.
- Testing the accumulated deposits of biosolids mixed with garbage at Hartland to ensure no release to the ambient environment.

(Comment continues on the following page)

Public Consultation

We recognize that the CRD has not been given a time extension to submit its plant beyond mid- June and therefore is not able to engage in a comprehensive public consultation as required under Section 27 (2) of the Environment Management Act. However, we are aware that the public response to the CRD survey changed when the general public became aware of the toxicity embedded in biosolids compared when this information was missing from the initial survey. We are also concerned that only 3 of 19 First nations have responded to the opportunities to consult with CRD. Finally there has not been any meaningful opportunity for in person engagement, nor has any been planned before the submission of the long-term plan.

The current consultation process limited to a text box in the CRD website till June 3 is completely inadequate in light of the potentially serious financial, public health and environmental impacts of biosolids management on residents and businesses across the Region.

We request that CRD initiate a long term plan for public consultation as the plan continues to be developed over the coming years and include opportunities for in–person engagement. In this note, we have identified many issues that need to be addressed associated with the thermal conversion facility, independent assessments of risk associated with land application of biosolids and costs estimates for various management options.

We appreciate the ongoing collaboration with the Board and staff as we feel the ongoing engagement of public interests is essential for a properly functioning democracy.

2024/05/23 – 11:24am	Email to CRDBoard@crd.bc.ca Hello, I recently learned more about the nature of biosolids and concerns regarding the dumping of biosolids at the Hartland Landfill. I wish to express concern about this practice and wish to state the I oppose the land application of biosolids in the CRD in general but especially now as it is happening at the Hartland Landfill. I understand that a solution to this would be to consider a thermo-conversion plant to deal with biosolids which would be a healthy sustainable way to deal with biosolids. This should be an emergency situation and considered immediately by the CRD board. Thank you for your attention to this serious matter, [REDACTED NAME] Resident of Saanich

2024/05/27 – 12:54pm	Email to CRDBoard@crd.bc.ca Dear Board members, I am writing to log my absolute opposition to any land application of biosolids within CRD boundaries, ever. They are completely unhealthy and contaminate the soil for an inordinate amount of time. It is simply not the best way to deal with this product. Biosolids can be used as a heat source, making biochar, as is done in many other jurisdictions like in Europe. This option deserves to be researched posthaste. This is our region's opportunity to be a leader in this field in North America. Let's not miss it. Let's not shirk our prime responsibility to be good stewards of our land and water resources. And let's recognize our responsibility as citizens to future generations. Thank you for your immediate attention to this matter. [REDACTED NAME] [REDACTED PHONE NUMBER] Attachment for more information: https://www.youtube.com/watch?v=GFHXzz6NXN4

Making a difference...together

TECHNICAL AND COMMUNITY ADVISORY COMMITTEE
CORE AREA WASTEWATER TREATMENT
Meeting Minutes

Wednesday, May 22, 2024	**1:30 pm**	**Online only (MS Teams)**

PRESENT: B. Donald, C. Coleman (Chair), C. Valeo, D. Kobayashi, D. Monsour, J. Andrews, J. Clary, J. Paul, L. Hatch, M. Engelsjord, S. Rennick

STAFF: D. Green, L. Nickerson (Recorder), P. Kickham

GUESTS: D. Liddy, K. Hamilton, R. Beise

REGRETS: C. Caunce, C. Remington, G. Gillespie, G. Harris, I. Leung, J. Roe, K. Wilson, W. Pugh

Electronic Participation Only

Chair Coleman called the meeting to order at 1:31 pm.

1. Territorial Acknowledgement

Chair Coleman provided a Territorial Acknowledgement.

2. Approval of Agenda

Agenda for the May 22, 2024 Technical and Community Advisory Committee meeting:

MOVED by D. Kobayashi and SECONDED by B. Donald
That the agenda be approved as circulated.
CARRIED

3. Adoption of Minutes of March 14, 2024

Minutes from the March 14, 2024 Technical and Community Advisory Committee meeting.

MOVED by D. Kobayashi and SECONDED by B. Donald
That the minutes of the March 14, 2024 Technical and Community Advisory Committee be adopted as circulated.
CARRIED

4. Chair's Remarks

Chair Coleman thanked the committee members for their involvement and interest, and thanked Vice Chair Kobayashi for chairing the March 14, 2024 meeting.

5. Review of Long-Term Biosolids Management Plan

a. Update to long-term management options format - P. Kickham, CRD

P. Kickham informed the group of the long-term management options for biosolids that were presented to the Capital Regional District (CRD) Board during their meeting on May 8. The options have been divided into three different tiers in order of preference.

These changes are consistent with the recommendations from GHD (CRD's technical advisor for long-term biosolids management planning) except for specifying a distinction between in and out of region, compliance or contingency options, and there are greenhouse gas implications of transporting biosolids longer distances. See Item 7.2 from the CRD Board May 8 meeting.

The group provided comments, asked questions and P. Kickham provided answers.

b. Public consultation update - K. Hamilton, Tavola Strategy Group

K. Hamilton gave a recap and update on the biosolids public consultation process (see Attachment A).

The "What We Heard" Summary Consultation Report, captured and analyzed all of the feedback received.

c. First Nations engagement summary - P. Kickham, CRD

P. Kickham provided an overview of the First Nations engagement process. See the report titled Long-term Biosolids Management Plan First Nations Engagement What We Heard Report. The Board directed staff to explore beneficial use opportunities for biosolids with any First Nations that have expressed interest.

d. Process and next steps - P. Kickham, CRD

The revised long-term biosolids strategy is posted on the Get Involved website showing Tiers 1, 2 and 3 in detail, available for public comment until June 3. All comments received will be included in the final reporting at the June 12 Board meeting. If the Board approves this long-term strategy, it will be submitted to the Province on June 18.

The Board directed staff to retain an independent, unbiased academic researcher to look at the risks and benefits of land application of biosolids and to hire a law firm or legal expert to provide the Board with an understanding of the potential legal liabilities associated with land application of biosolids. CRD staff will be providing information to the CRD Environmental Services Committee and back to the CRD Board in the coming months.

6. Draft Amendment 13 (Inflow and Infiltration and Sanitary Overflows) update on process and next steps - D. Green, CRD

An invitation to review and discuss the Kerr Wood Leidal (KWL) consultant report and draft Liquid Waste Management Plan (LWMP) Section 5 (endorsed by the TCAC at the February meeting) has been sent to Esquimalt and Songhees First Nations for their input and comment. CRD staff hope to have a response by mid-June to engage with both nations as they have a significant interest in the shorelines of the core area.

Staff will also do a wider First Nations notice to the nations in the British Columbia Consultative Database that have interest in this region. Online public consultation will be via the CRD website (similar to how Get Involved is used for other CRD initiatives).

All input will go back to the CRD Core Area Liquid Waste Management Committee. CRD staff anticipate it will also go to the municipalities for their endorsement as the seven core municipalities are participants in the LWMP. It will then go the Board to send Amendment 13 to the Province for their consideration before the end of the year.

7. Next meeting

There are no more meetings scheduled at the moment but that may change.

8. Closing Comments

Chair Coleman thanked the group for their involvement as it has been very helpful in understanding a series of issues.

9. Adjournment

The meeting was adjourned at 1:56 pm.

MOVED by D. Kobayashi and all in favor
That the Technical and Community Advisory Committee meeting be adjourned.
CARRIED

ATTACHMENT A

CAPITAL REGIONAL DISTRICT

Long-Term Biosolids Management Plan

Summary of Public Input
TCAC

May 2024

TAVOLA
STRATEGY GROUP

Engagement Process

IAP2 Informed Consultation Plan

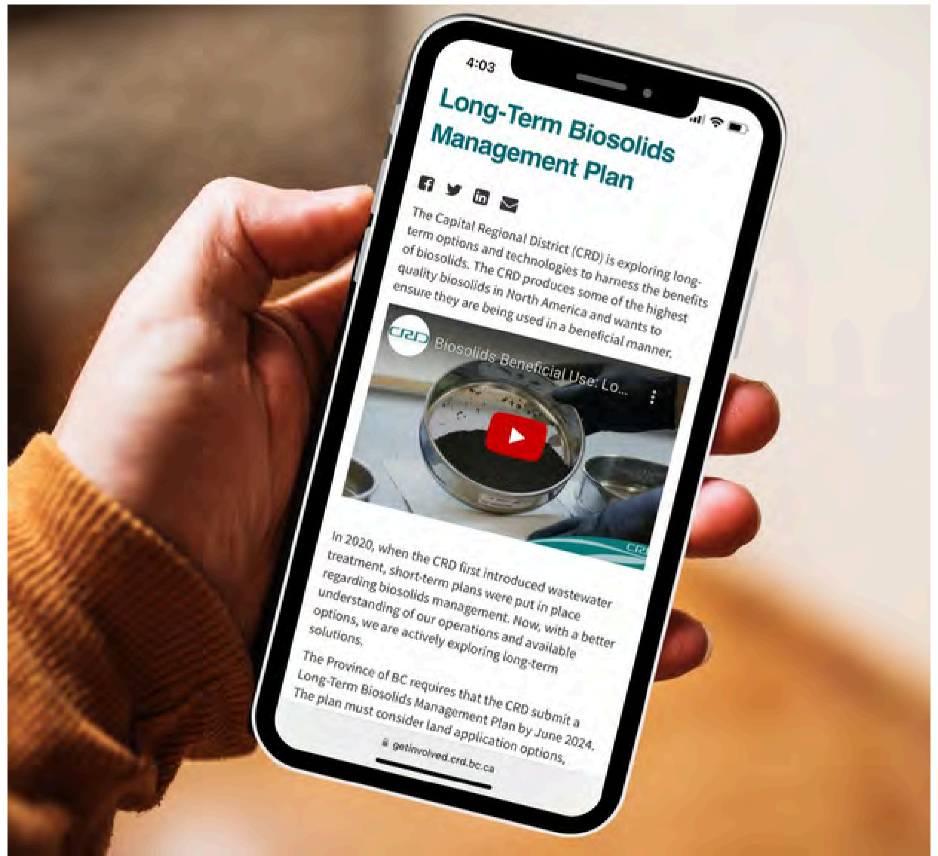
Establish engagement objectives and methods.

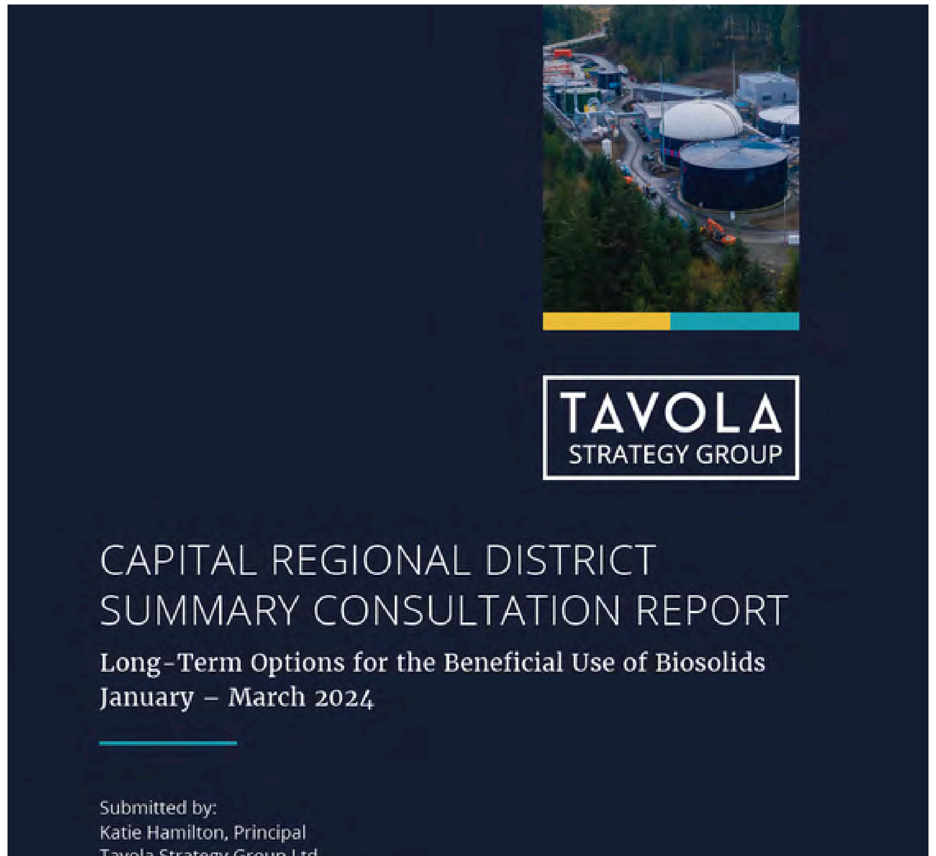
Active Engagement

Awareness-raising and variety of engagement activities to capture input.

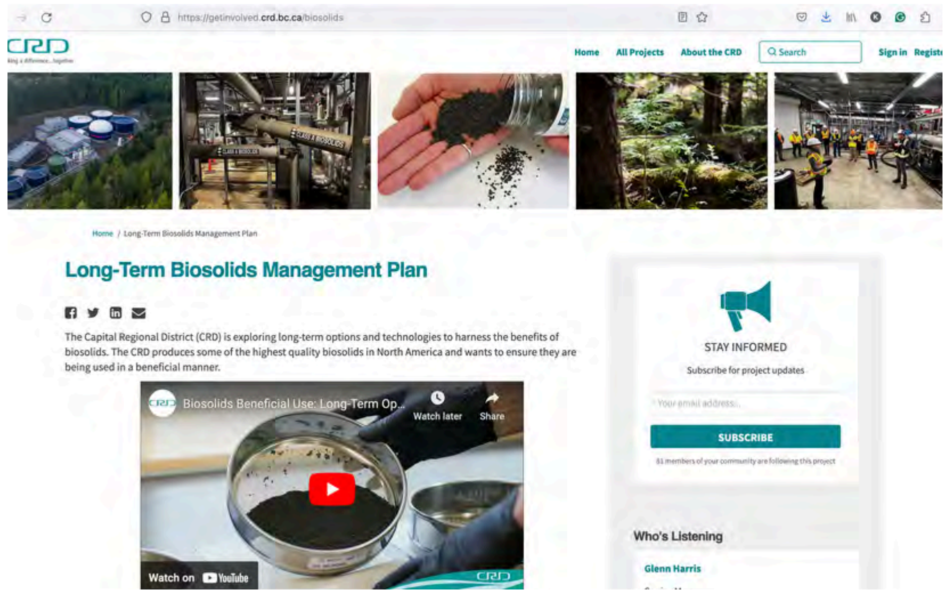
Reporting and Closing the Loop

What We Heard report and communicating results to participants and community.





Engagement Activities



CRD Online Survey
January 11 -
March 6, 2024

Virtual Open House
Tuesday, February 20, 2024

IPSOS Representative Survey
March 1 - March 11, 2024

Participation

569
Online survey participants

516
Representative survey of Capital Region residents

3,300
Unique web visitors

12
Questions and answers via website

56
Open house attendees

12
Subscribers to project updates

7
Emails to biosolids@crd.bc.ca

Part 2:

What We Heard

Over-Arching Themes

- Both surveys indicated “Environmental Impacts [air, water and soil contaminants]” were most important consideration.

- The 2 surveys solicited very different results in terms of options:
  - IPSOS representative survey indicates strong majority support and low levels of opposition to all beneficial uses presented. Support is highest for forest fertilizer and industrial land reclamation.
  - CRD survey indicates substantial opposition to most options other than Advanced Thermal, with least support for bagged residential and agricultural fertilizer.

- The most popular option (Advanced Thermal) in CRD survey was the least popular for the broader general public in the IPSOS survey.

- The level of opposition to all options and associated concerns were much higher in the CRD survey.

Over-Arching Themes

Comparison of survey results regarding options:

LONG-TERM BIOSOLIDS USE OPTION	IPSOS		CRD	
	Support	*Oppose*	*Support*	*Oppose*
Forest fertilizer	85%	4%	41%	51%
Industrial land reclamation (e.g. mine/quarry)	83%	6%	43%	45%
Wholesale fertilizer for landscaping	79%	5%	37%	54%
Agriculture fertilizer	78%	7%	34%	60%
Bagged fertilizer for low-cost residential use	77%	7%	33%	56%
Fuel for incineration/ combustion	66%	9%	49%	38%
Advanced thermal (gasification/pyrolysis technology)	56%	11%	66%	19%

**Numbers may not add to 100% due to summary reporting and rounding.*

Over-Arching Themes

- Many respondents to CRD survey noted concerns:
    - Potential contaminants [e.g. toxicity, PFAS's] and health and environmental risks of land application
    - Felt land application options are not a "beneficial use" due to potential risks.
    - Advanced thermal/biochar options are seen as the most effective method to reduce risks.

- Correspondence, open house, and CRD survey expressed need for more detail about:
    - Piloting advanced thermal options
    - Testing, scientific research and risks associated with land application.
    - Cost-benefit analysis of options and feasibility and case studies of in other jurisdictions.

- The majority of correspondence noted risks associated with land application and encouraged the CRD Board to uphold the existing land application ban.

Next Steps

The *What We Heard* consultation summary report will be submitted to the Ministry of Environment and Climate Change Strategy as part of the Long Term Biosolids Management Plan.

It will be posted on the project website:

www.getinvolved.crd.bc.ca

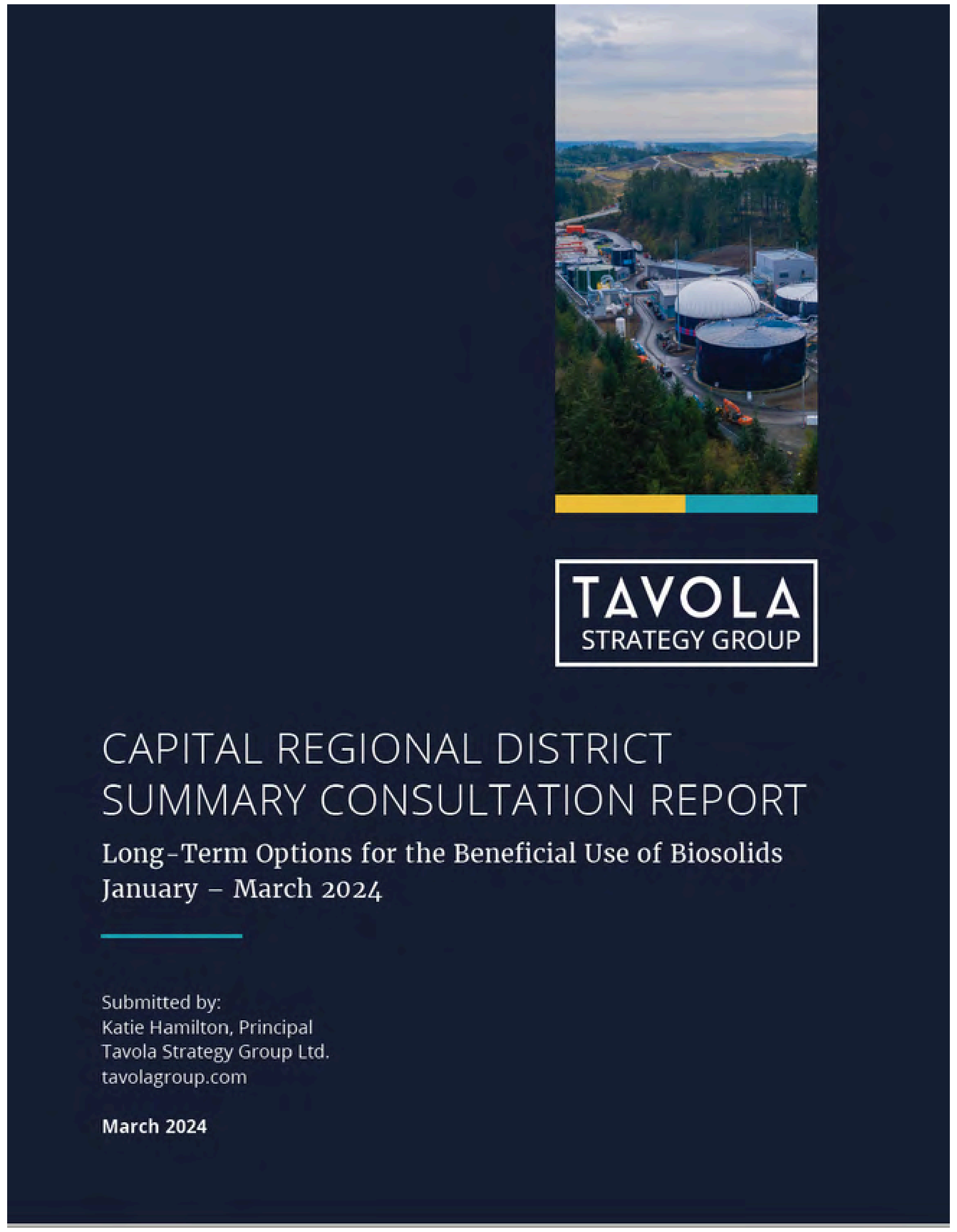


TAVOLA
STRATEGY GROUP

CAPITAL REGIONAL DISTRICT
SUMMARY CONSULTATION REPORT

Long-Term Options for the Beneficial Use of Biosolids
January – March 2024

Submitted by:
Katie Hamilton, Principal
Tavola Strategy Group Ltd.
tavolagroup.com

March 2024

TAVOLA
STRATEGY GROUP

Questions?

We are here to help.

www.tavolagroup.com

BRITISH COLUMBIA

Reference: 412940

March 19, 2025

Cliff McNeil-Smith, Chair
and Directors
Capital Regional District
PO Box 1000
Victoria BC V8W 2S6

Sent via email: crdchair@crd.bc.ca

Dear Chair McNeil-Smith and Directors:

Re: Acknowledgement of Receipt of the Long-term Biosolids Management Strategy

Thank you for the submission of the Capital Regional District's (CRD) Long-term Biosolids Management Strategy on June 18, 2024. The Long-term Biosolids Management Strategy was a commitment in the CRD's Biosolids Beneficial Use Strategy (May 2019) submitted to fulfill the ministerial condition placed on the November 18, 2016, approval of the CRD's Liquid Waste Management Plan (LWMP) Amendment 11.

CRD's LWMP commits to the beneficial use of biosolids. The ministry defines beneficial use in accordance with the Canadian Council of the Ministers of the Environment *Canada-Wide Approach for the Management of Wastewater Biosolids* (October 11, 2012) and the *Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage* (2012). The inclusion of a suite of beneficial use options will place the CRD in a better position to meet its LWMP commitment.

The Long-term Biosolids Management Strategy does not form part of the CRD's approved Liquid Waste Management Plan. Therefore, the CRD must ensure that all beneficial use options outlined in the Long-term Biosolids Management Strategy receive authorization under the *Environmental Management Act,* as required, and that the appropriate mechanism for receiving approval from the electors for any borrowing is pursued.

...2

Ministry of Environment and Parks | Office of the Minister | Mailing Address: Parliament Buildings Victoria BC V8V 1X4 | Telephone: 250 387-1187 Facsimile: 250 387-1356 Website: www.gov.bc.ca/env

Thank you again for your submission.

Sincerely,

Tamara Davidson
Minister of Environment and Parks

cc: Luisa Jones, General Manager, Capital Regional District
Valerie Landa, Administrative Secretary, Capital Regional District

APPENDIX C

FINAL REPORT

Biosolids Land Application – An Updated Review of Human Health and Environmental Risks

Version 2.0

December 12, 2024

Prepared for:

Capital Regional District

Prepared by:

Biowest Environmental Research Consultants

Dr. Christopher J. Kennedy

Table of Contents

1 Introduction

Municipal wastewater treatment yields two primary byproducts: treated wastewater and solid residue, or biosolids. Soil application of biosolids as an organic fertilizer is economic way to beneficially use the carbon and nutrient contents in biosolids to promote soil fertility. A substantial body of research has explored the risks and benefits associated with the land application of biosolids, including numerous studies focused on contaminants, including heavy metals, pathogens, and contaminants of emerging concern (COECs) (Hydromantis Inc., 2010; McCarthy et al., 2015; LRCS Land Resource Consulting Services, 2016; Pozzebon and Seifert, 2023; BC ENV 2024).

There are many benefits associated with the land application of biosolids. Benefits include the addition or organic matter to soil and the associated increase in soil water retention and reduction in soil erosion, as well as the addition of essential nutrients for plant growth. Biosolids can provide a natural alternative to synthetic fertilizers and can store carbon in soil and reduce greenhouse gas emissions (LRCS Land Resource Consulting Services, 2016' BC ENV, 2024). These benefits have been well documented by others and are not the focus of this review. The objective of this report is to build on previous literature reviews assessing potential human health and environmental risks through a comprehensive scan of the recent primary scientific literature and other relevant studies.

As background, the British Columbia Organic Matter Recycling Regulation (OMRR) (available at https://www.bclaws.gov.bc.ca/OMRR) provides a regulatory framework for the production, quality, and application of organic matter products, including biosolids. Its purpose is to ensure that biosolids and other organic materials are used in a way that protects human health and the environment while promoting sustainable resource use. The OMRR was developed based on a review of the available scientific literature in the late 1990s and implemented in 2002. The OMRR has undergone several regulatory reviews, with additional amendments proposed which are noted to include provisions to enable the BC Ministry of Environment and Climate Change Strategy to require sampling and analysis for COECs (BC ENV, 2024). Currently, while the OMRR includes requirements for vector (i.e., rodents, birds and insects) attraction reduction processes, and limits for pathogens and heavy metals, the regulation does not include limits for several key COECs including per- and polyfluroalkyl substances (PFAS), pharmaceuticals and personal care products (PPCPs), and microplastics. While it is acknowledged that the derivation of limits for some of the COECs is complicated by the limited available toxicological data, the importance of recommending limits based on the best available science is essential for the protection of human health and the environment.

In response to concerns over the land application of biosolids, the BC government has convened two technical working groups (TWGs), one in 2015 and a second in 2022, to review scientific information on biosolids production and waste management practices. A summary of the findings of the reports produced by the two TWGs follows.

The findings of the 2015 Technical Working Group were presented in the report titled *A literature review of risks relevant to the use of biosolids and compost from biosolids with relevance to the Nicola Valley, BC* (LRCS Land Resource Consulting Services, 2016). The review focused on risks not addressed by the existing regulatory framework for biosolids management in Canada, including the issue of COECs. Primary environmental and human health risks identified included the potential contamination of ground and surface water by COECs, seasonal risks due to groundwater recharge and runoff following biosolids application, and the potential for livestock and wildlife to be directly exposed to contaminants in biosolids via ingestion of biosolids during foraging, as well as the ingestion of plants that have accumulated the contaminants. Several knowledge gaps were identified, including:

- Insufficient empirical data to conduct detailed human health and ecological risk assessments.

- Lack of data on the ever-expanding list of emerging contaminants of concern present in biosolids.
- Lack of research on the potential synergistic effects of contaminants present in biosolids.
- Limited field studies on biosolid impacts on ground and surface water and subsequent effects in aquatic receiving environments.
- Limited studies assessing the effects of the land application of biosolids on wildlife at all trophic levels.
- Gaps in the understanding of the ability of treatment processes to reduce toxic loading to environmental media and biota.

The report presented several recommendations, including implementing routine public reporting on biosolid composition, focusing on contaminants, including COECs, conducting quantitative risk assessments to address area-specific exposures and associated risks, revising regulations to increase setback distances from watercourses for Class B biosolids and enhanced monitoring programs, to further evaluate the effectiveness of composting and thermal treatment to reduce COECs and to develop public education and source reduction programs to reduce the introduction of contaminants into wastewater systems.

The 2022 TWG provided recommendations in a report titled Organic Matter Recycling Regulation, Technical Working Group Report 2024. The scope of the 2022 TWG was limited and focused on identifying new scientific information on biosolids and compost constituents and management, and on new information on COECS in biosolids and compost since the 2015 TWG. BC ENV (2024) provides the following key messages derived from the TWG findings:

- Each compost and biosolids product is unique to their origin. For example, wastewater treatment plants vary in their input sources (e.g., industrial vs. residential) and may use different treatment processes. Further, the land to which the biosolids (and compost) are applied have unique characteristics. As such, an OMRR application plan specific to the source and the application site should be prepared.
- The importance of source control as the quality of the biosolids (and compost) is directly related to their inputs. The 2022 TWG therefore advocated for regulations that focus on preventing contamination at the source.
- Our understanding is constantly evolving as science advances, and it is challenging to keep pace with evolving science. The 2022 TWG therefore recommended that the ministry devote resources to monitoring the scientific literature and be transparent regarding the research that is used to inform policy.
- To identify and manage COECs it was recommended that the BC ENV develop a comprehensive and transparent strategy that should include not only the presence of COECs, but associated risk. The TWG recommended that the ENV focus on the results of field-based, vs. laboratory-based, studies.
- Provision of context for clear, factual and easily understood information, including providing plain language information on the BC ENV website for why we compost and use biosolids.

Given the large body of scientific literature on the benefits and risks of biosolids that exists, as well as the work conducted by the TWGs convened by the BC ENV, this review is focused on the scientific literature and other relevant reports that have been produced over the last two years (2023 and 2024), with the objective to provide up to date information on the following:

- The human health and environmental risks of both legacy contaminants and COECs, with consideration of environmental conditions typical of the BC south coast.
- Contaminant concentrations in biosolids relative to levels of exposure in general society.
- The limitations of extrapolating lab-based toxicity testing to observations in the environment.
- A summary of the areas of uncertainty in biosolids land application risk, including a summary of relevant techniques for evaluating and addressing uncertainty.
- A summary of biosolids land application techniques that can reduce risk and/or address uncertainty.
- A summary of the risks and concerns that have resulted in land application bans elsewhere.
- An assessment of the overall risks of biosolids land application considering the intent of the Precautionary Principle (Rio Declaration, 1992 and subsequent derivations).

2 Contaminants Present in Biosolids and Associated Risks

Previous studies have identified the presence of numerous contaminants in biosolids. These include legacy contaminants such as heavy metals (Sloan et al., 1997; Evanylo et al., 2006; LRCS Land Resource Consulting Services, 2016; Marchuk et al., 2023) and persistent organic pollutants like polychlorinated biphenyls (PCBs), dioxins and furans (PCDD/Fs) and polycyclic aromatic hydrocarbons (PAHs) (Furr et al., 1976; Bergh and Peoples, 1977). In addition, several COECs have been identified in biosolids, including PFAS (LRCS Land Resource Consulting Services, 2016; Wang et al., 2020; Moodie et al., 2021), microplastics (Crossman et al., 2020; Mohajerani and Karabatak, 2020), PPCPs (LRCS Land Resource Consulting Services, 2016; Mohajerani and Karabatak, 2020; Kinney and Heuvel, 2020) and industrial contaminants such as plasticizers, surfactants and brominated flame retardants. The USEPA (https://www.epa.gov/biosolids/basic-information-about-biosolids) reports that more than 700 contaminants have been identified in biosolids (in at least one instance) since 1993, with the contaminants present in biosolids varying between wastewater treatment plants (WWTPs) depending on inputs to the facilities.

Regulatory agencies, including the BC ENV, have established limits for metals in biosolids, as well as for pathogens. These contaminants are routinely monitored in biosolids prior to land application. Further, as the toxicity of the legacy organic pollutants (e.g., PCBs, PCDD/F, PAHs) is well understood, many of them have existing standards or criteria in Canada and internationally. A sampling program conducted by the BC ENV (2019) indicated that the concentrations of metals, pathogens and legacy organic pollutants were less than the applicable standards/guidelines for biosolids in samples collected from two WWTPs in the province. Further, previous assessments (Smith, 2009; Eriksen et al., 2009; Jensen et al., 2012; WEAO 2001 and 2010; Higgin et al., 2010) have evaluated risks associated with these contaminants in biosolids. These previous studies have indicated a negligible to low potential for risk to human health and the environment. As the use of some of these chemicals have been phased out overtime, concentrations of these contaminants in wastewater (and biosolids) have also decreased overtime. Despite having a good understanding of the potential risks associated with legacy contaminants in biosolids on an individual level, many of the uncertainties discussed throughout this report, including the lack of understanding of the potential for additive and synergistic effects of contaminants in biosolids, also apply to legacy contaminants.

Contaminants of emerging concern are those that have been identified in recent years, primarily due to advancements in laboratory methodologies and the associated reduction in laboratory detection limits. As they are relatively new contaminants, with limited toxicological data, regulatory agencies typically have not derived environmental quality standards for COECs. Further, due to the same limitation as well as a lack of understanding of the fate of these contaminants following land application of biosolids, a limited number of risk assessments have been conducted to assess the potential for COECs in biosolids to adversely impact human health and the environment. Those available (Eriksen, 2009; Smith, 2009; Jensen et al., 2012; Higgens et al., 2010; Kennedy/Jenks, 2017) have concluded that the contaminants generally represent a low risk to human and environmental health based on the low concentrations of most of the COECs identified in biosolids. Further studies (Higgins et al., 2010; Clarke and Smith, 2011; TCEQ , 2021; Warke and McAvoy, 2024) have attempted to prioritize or rank COECs in biosolids, but have encountered similar challenges due to the paucity of toxicity data for many of the COECs.

A review of the recent (2023-2024) literature pertaining to COECs in biosolids indicates that the scientific understanding of select COECs in biosolids is evolving at a rapid rate, with many recent studies focused on PFAS, microplastics and PPCPs. Research focused on the prevalence of these and other COECs in biosolids, their fate following land application, and their toxicities is being undertaken across the globe, including in Canada. This research has highlighted the existing data gaps and uncertainties in our understanding of COECs in biosolids owing to the complex mixture of contaminants present in biosolids, the variability in the contaminant profile observed between sources depending on inputs, and the potential for these contaminants to act additively or synergistically.

With the objective of this report to update previous studies regarding human health and ecological risks from the land application of biosolids, a summary of the recent literature and other information (e.g., regulatory decisions) pertaining to PFAS, microplastics and PPCPs follows. Recent data on the concentrations of PFAS in Canadian biosolids was identified, including from the Capital Regional District (CRD), and has been used to conduct a screening level human health and ecological risk assessment of select PFAS with available toxicological data (Section 2.1.1), as well as a comparison of exposures of PFOA and PFOS in CRD biosolids relative to typical daily exposures intakes of PFOA and PFOS (Section 2.1.2). Additionally, a summary of a 2024 study conducted to rank unregulated organic compounds (UOCs) identified in biosolids is also provided (Warke and McAvoy, 2024) (Section 2.4).

2.1 PFAS

Per- and polyfluorinated alkyl substances (PFAS) are a group of over 4700 aliphatic compounds containing at least one carbon-fluorine (C-F) bond. Due to environmental concerns, North America, Europe, and Australia voluntarily phased out long-chain PFAS (≥8 carbons) in the early 2000s, replacing them with shorter-chain versions. These shorter-chain PFAS are less prone to soil absorption and bioaccumulation, yet they are more environmentally mobile. Despite their reduced bioaccumulation, short-chain PFAS still persist in the environment and can pose risks to human health and the environment (Pozzebon and Siefert, 2023).

Although toxicity and effects data only exist for a small number of PFAS, the health effects of this class of chemicals are well documented. Exposure to PFAS, even at low concentrations, can have significant adverse health effects and effect multiple organs and systems, including liver, kidney and thyroid function, as well as the immune, nervous and reproductive systems (https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/water-talk-per-polyfluoroalkyl-substances-drinking-water.html). Additionally, in the environment, PFAS exposures have been linked to negative impacts on the immune and nervous systems of wildlife, as well as effects on growth, reproduction, and development (ECCC, 2023 and 2024).

In May 2023, Environment and Climate Change Canada and Health Canada published the Draft State of PFAS Report (Government of Canada, 2023), providing a qualitative assessment of the fate, sources, occurrence, and potential impacts of PFAS on the environment and human health. The report highlights the extreme stability of PFAS in the environment, often referred to as "forever chemicals”. The report also emphasizes the potential for cumulative effects from co-exposure to multiple PFAS, which may lead to adverse environmental and health outcomes. In July 2024, an updated draft report (Government of Canada, 2024) was issued which incorporated new information and public comments. The updated report continues to underscore the environmental persistence and potential human health and environmental risks associated with PFAS, and reinforces the need for comprehensive management strategies to mitigate their impact. Additionally, in alignment with the Government of Canada’s 2021 notice of intent to address PFAS as a class of chemicals (https://www.canada.ca/en/health-canada/services/chemical-substances/other-chemical-substances-interest/per-polyfluoroalkyl-substances.html), in August 2024, Health Canada published an objective for Canadian Drinking Water Quality for PFAS of 30 nanograms/L (ng/L) for the sum of 25 PFAS (Health Canada, 2024a).

PFAS have been identified in biosolids globally, and while concentrations of PFAS in biosolids are influenced by inputs to WWTPs, treatment methods, and sludge stabilization techniques, studies have confirmed their presence in biosolids in Canada nationwide (McCarthy, 2015; Letcher et al., 2020; Lakshminarasimman et al., 2021 and Gewurtz et al., 2024).

In response to growing concerns over PFAS in biosolids, in June 2024 the Canadian Food Inspection Agency (CFIA) recommended an interim standard for PFAS in commercial biosolids of 50 part per billion (ppb) of perfluorooctane sulfonate (PFOS) on a dry weight basis (Canada Food Inspection Agency trade memoranda T-4-132 available at https://inspection.canada.ca/en/plant-health/fertilizers/trade-memoranda/t-4-132-commercial-biosolids), with enforcement of the standard to begin as of October 18, 2024. CFIA (2024) indicates that the available data suggest that approximately 92% of Canadian biosolids contain PFOS at concentrations below 50 ppb (ng/g). Data provided by the Capital Regional District (CRD) indicates that the average concentration of PFOS in biosolids from the region is 5.4 ppb (ng/g) and is nearly an order of magnitude below the CFIA limit (see data in Table 1).

The US EPA has prioritized research, restriction, and remediation of PFAS in the environment, including in biosolids, and has defined a PFAS Strategic Roadmap which includes a risk assessment for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) in biosolids. The assessment is currently underway and is anticipated to be completed by the end of 2024 (https://www.epa.gov/biosolids/and-polyfluoroalkyl-substances-pfas-biosolids). During the completion of the assessment, the US EPA has advised states to monitor biosolids for PFAS contamination, identify suspected industrial discharges and implement pre-treatment requirements where appropriate to reduce concentrations of PFAS in biosolids. The US EPA has indicated that if the risk assessment determines that PFOA or PFOS in biosolids may adversely affect public health or the environment, that risk managers will consider options for numerical limitations and best management practices for these compounds.

Additionally in the USA, several states have responded to concerns regarding PFAS in biosolids by enacting rules that limit the concentration of PFAS in biosolids, with Maine (in 2022) and Connecticut (in 2024) implementing bans on the use or sale of PFAS-containing biosolids.

Key findings of recent scientific studies that have evaluated PFAS in biosolids include the following:

1. As the quality of biosolids is dependent on the contaminants present in raw wastewater, it is important to consider upstream controls and monitoring to minimize the input of PFAS-containing wastes into wastewater treatment systems (BC ENV, 2024; Tansel et al., 2024; Gewurtz et al., 2024). In their review of PFAS concentrations in influent, effluent and biosolids samples collected from 27 wastewater treatment plants (WWTPs) across Canada, Gewurtz et al. (2024) identified that PFAS concentrations are the highest in samples from plants that receive landfill leachate.

2. PFAS concentrations in biosolids in the US have not decreased despite the phasing out of the longer chain PFAS in the early 2000s (Pozzebon and Siefert, 2023; Borthakur et al., 2022; Gewurtz et al., 2024). In a study of biosolids sourced from Canadian WWTPs, Gewurtz et al. (2024) reported that except PFOS, the concentrations of long-chain PFAS have generally decreased overtime; however, they remain at measurable concentrations. Further, Gewurtz et al. (2024) found that the replacement of long-chained PFAS with short-chain PFAS has resulted in concentrations of short-chain PFCAs in wastewater influent and effluent increasing over the period of 2009 and 2021, with the short-chain PFAS less frequently detected in biosolids.

3. Recent evidence suggests that PFAS are transformed during the wastewater treatment process. Studies (Helmer et al., 2022; Tansel et al., 2024; Behnami et al., 2024) indicate that some PFAS precursors transform during treatments like anaerobic digestion, potentially altering contaminant profiles and increasing certain PFAS concentrations post-treatment. PFAS not degraded during aerobic and anaerobic digestion will instead become concentrated during treatment (Lakshminarasimman et al., 2021; Gewurtz et al., 2024; Tansel et al., 2024). Carbon chain length significantly affects PFAS partitioning, with longer chain PFAS adsorbed to sludge, and shorter chain PFAS partitioning to the wastewater (Behnami et al., 2024; Gewurtz et al., 2024).

2.1.1 Screening Level Human Health and Ecological Risk Assessment for PFAS in Biosolids

Data collected from 29 Canadian wastewater treatment plants, as summarized in Zhou et al. (2024) from

Letcher et al. (2020) and Lakshminarasimman et al. (2021) indicate that PFOS was the most prevalent PFAS (<0.49–50.4 ng/g dw) in collected biosolids, followed by PFDA (0.11–53 ng/g dw) and PFOA (<0.07–23 ng/g dw) (Zhou et al., 2024; Letcher et al., 2020; Lakshminarasimman et al., 2021).

Gewurtz et al. (2024) summarized data for 42 PFAS in samples collected in 2021 from 27 WWTP across Canada, and reviewed trends in concentrations overtime. The 2021 results were consistent with the previous studies, indicating PFOS is the most prevalent, with concentrations ranging from <0.32 to 96 ng/g dw.

Gerwurtz et al. (2024) reported that the PFAS with the highest concentrations in Canadian biosolids (2018 to 2021) were PFOS, PFBA and the short-chain precursor 5:3 FTCA. Long-chain PFCAs, PFOS, FOSA, the long-chain intermediate transformation products *N*-methylperfluorooctanesulfonamidoacetic acid (MeFOSAA) and N-ethylperfluorooctanesulfonamidoacetic acid (EtFOSAA), PFHxA, and 5:3 FTCA were frequently (in >60 % of the samples) over this period, with the long-chain PFAS likely detected more frequently due to their greater tendency to sorb to solids (Gewurtz et al., 2024; Helmer et al., 2022).

The below table summarizes the concentrations of select PFAS identified in Canadian biosolids (from Letcher et al., 2020; Lakshminarasimman et al., 2021 and Gewurtz et al., 2024). In addition, average PFAS concentrations measured in CRD biosolids (n=3) have been provided for comparative purposes.

PFBA (C4)	**PFPeA (C5)**	**PFHxA (C6)**	**PFHpA (C7)**	**PFOA (C8)**	**PFNA (C9)**	**PFDA (C10)**	**PFUnA (C11)**	**PFDoA (C12)**	**PFBS (C4)**	**PFHxS (C6)**	**PFOS (C8)**
Letcher et al., 2020											
<0.48-3.0	<0.28-6.0	0.17-4.65	<0.08-1.53	<0.07-11.5	0.09-4.72	0.11-23.4	0.19-7.49	0.19-6.09	<0.14-3.48	<0.06-2.43	0.49-**50.4**
Lakshminarasimman et al., 2021											
<2.06	<2.06-14	<2.06-8.3	<2.06-5.2	<2.06-23	<2.06-20	<2.06-53	<2.06-7	<2.06-10	<4.11-11	<**4.11**	<4.11-**27**
Gewurtz et al., 2024 (2021 data)											
<1.3-200	<0.64-12	<0.32-7.9	<0.32-2.6	<0.32-42	<0.31-8.8	<0.31-27	<0.31-3.5	<0.31-7.6	<0.32-7.5	<0.32-**5.4**	<0.32-**96**
Capital Regional District Biosolids											
<1.50	1.28	2.02	0.96	1.11	0.37	1.80	0.738	1.34	0.474	2.2	5.35
Health Canada SSVs (HC, 2019), BC CSR Standards and CCME Soil Quality Guidelines, Residential/Agricultural Land Use, Human Health Protection											
114,000[a]	800[a]	800[a]	800[a]	700[a]	800[a]	NA	NA	NA	61,000[a] 300,000[b]	2,300[a]	2,100[a] 1000[b] 2,000[c]
Grippo et al., (2021), BC CSR Standards and CCME Soil Quality Guidelines, Residential/Agricultural Land Use, Ecological Protection											
2,980[d]	NA	6,200[d]	NA	3,840[d]	24.2[d]	67.7[d]	NA	NA	817[d]	2.8[d]	70,000[b] 10[c] 8.7[d]

Table 1: Concentrations of PFAS reported in biosolids from WWTPs in Canada (in ng/g) (from Letcher et al., 2020; Lakshminarasimman et al., 2021 and Gewurtz et al., 2024) compared to Health Canada SSVs (2019) and BC CSR soil standards for residential and agricultural land use. NA: Not Applicable, [a] Health Canada SSV, [b] BC CSR soil standard, [c] CCME soil quality guideline, [d] Grippo et al. (2021) ESV, **Bold** – concentration exceeds ecological protection guidelines/standards.

Following the land application of biosolids, there is the potential for human and ecological receptors to be exposed to the biosolids, and thus the contaminants, including PFAS, present in the biosolids. Depending on the land application technique used (e.g., injection, incorporation into surface soils, amendments), the biosolids and COECs may be 'diluted'. For this screening exercise, it has been conservatively assumed that there is the potential for human and ecological receptors to be exposed directly to the PFAS concentrations measured in Canadian biosolids. In practice, biosolids are mixed with other materials prior to land application; for example the CRD uses a mixing ratio of 18:1 (5 parts sand, 13 parts wood and 1 part biosolids, or approximately 6% biosolids by volume).

Per standard risk assessment methodologies, including those recommended in guidance from the BC ENV

(2023a), Health Canada (2024b) and the CCME (2020), the concentrations of PFAS presented in Table 1 have been compared to guidelines/standards derived to be protective of human health and ecological direct contact exposures, including for human health, incidental ingestion of soil, and for ecological receptors, direct contact, and for wildlife, soil and food ingestion.

Soil guidelines/standards derived to be protective of human health are available for select PFAS from Health Canada (2019), the BC Contaminated Sites Regulation (CSR) (BC, 2023b) and the CCME (2021). Health Canada recommends human health protective soil screening values (SSVs) for 11 select PFAS including PFOS, PFOA, PFBA, PFBS, PFHxS, PFPeA, PFHxA, PFHpA, PFNA and two fluorotelomer sulfonates (6:2 FTS and 8:2 FTS). The SSVs also consider the potential for PFOS and PFOA to act additively, with an SSV of < 1 for the sum of the ratio of the [PFOS]/SSV_{PFOS} and the [PFOA]/SSV_{PFOA}. Using the maximum concentration of PFOS and PFOA reported in Table 1 (PFOS = 96 ng/g and PFOA = 42 ng/g), the ratio is < 1 and thus meets the SSV. In addition, the BC CSR provides human health protective soil standards for PFOS and PFBS, and the CCME provides a human health soil quality guideline for PFOS. A comparison of the maximum concentrations of the PFAS measured in Canadian biosolids to the Health Canada SSVs, as well as the BC CSR and CCME human health protective soil standards (See Table 1) indicates that the measured concentrations are well below the SSVs, standards and guidelines, with the average concentrations of PFAS measured in CRD biosolids (n=3) well below the Canadian maximum concentrations and all available SSVs, standards and guidelines. As noted, the direct comparison of measured concentrations in biosolids to the standards and guidelines is highly conservative given the mixing that occurs prior to land application. For example, applying the 18:1 mixing ratio used by the CRD, the concentrations of PFAS in Table 1 would be divided by a factor of 18 to provide a resulting exposure concentration. Applying this ratio, the maximum exposure concentration of PFOS (the PFAS measured at the highest concentration) in CRD biosolids would be 0.3 ng/g compared to the lowest standard for human health protection of 1000 ng/g and the lowest standard for ecological health protection of 8.7 ng/g (protective of food chain exposures).

Soil guidelines and standards in BC and available from the CCME for the protection of the environment, are limited to PFOS only. On behalf of the US Department of Energy, Grippo et al. (2021) developed ecological screening values (ESVs) to support screening-level ecological risk assessments at U.S. Air Force (Air Force), Navy, Army, and other U.S. Department of Defense (DOD) sites PFAS have been detected in soils and surface waters. A comparison of the maximum concentrations of PFAS measured in Canadian biosolids to the ESVs and CSR/CCME guidelines/standards for PFOS is provided in Table 1. As presented, concentrations of select PFAS, including PFOS and PFHxS exceed the guidelines for environmental protection, and specifically the CCME soil quality guideline and the Grippo et al. (2021) EVS for soil and food ingestion. Concerning the Grippo et al. (2021) ESV that is exceeded, it is specific to soil and food ingestion of mammalian ground insectivores. Further, concentrations of PFOS exceed the CCME guidelines protective of soil leaching to groundwater for the protection of potable groundwater (10 ng/g) and aquatic life (10 ng/g).

The below discussion considers screening quotients (SQs) for select PFAS; SQs were calculated as the [PFAS] / guideline (or standard or screening value).

The above screening exercise indicates that the concentrations of individual PFAS in both Canadian biosolids, including those from the CRD, for which there is available toxicity data to derive soil guidelines are less than the guidelines derived to be protective of human health (maximum SQ of 0.06 for PFOA), and thus, exposure to these individual PFAS in biosolids, as well as combined exposures to PFOS and PFOA, are not anticipated be associated with risks to human health. As noted the comparison of measured concentrations is highly conservative as amendment would occur prior to application.

The comparison of the PFAS concentrations measured in Canadian biosolids, as reported by Letcher et al., 2020; Lakshminarasimman et al., 2021 and Gewurtz et al., 2024 exceed ecological health guidelines for select individual PFAS including PFOS (maximum SQ =11) and PFHxS (maximum SQ = 1.9). On this basis, there is the potential for the highest concentrations of these PFAS measured in Canadian biosolids to pose a risk to ecological receptors and specifically wildlife exposed via soil and food ingestion. Further, as the maximum PFOS concentrations exceed of soil guidelines protective of drinking water and aquatic life (maximum screening quotient of 9.6), there are potential for risks to both human health and the environment associated with soil leaching to groundwater. The average concentrations of PFAS in the CRD biosolids were all below the available SSVs, ESVs, as well as the CCME guideline and CSR standard for PFOS (i.e., all SQs are well below 1).

The findings of the above screening exercise must be interpreted in the context that guidelines are only available for a small number of the 4700 PFAS known to exist, and that the individual guidelines may not consider the combined toxicity of the PFAS mixture present in biosolids. Further, as PFAS are persistent and accumulate in soils, following the repeated application of biosolids to land, the concentrations of PFAS have the potential to increase overtime.

2.1.2 Estimated Daily Intakes of PFOS and PFOA

As PFAS are ubiquitous in the environment, humans are exposed daily to PFAS from a variety of sources (i.e., consumer products, diet, air, water and soil). Limited data exists on Canadian's exposure to PFAS; however, biomonitoring data indicates that PFAS are present at measurable concentrations in the blood of most Canadians (Government of Canada, 2024).

Using summary statistics from secondary sources for concentrations of PFOA and PFOS in indoor and outdoor air, water and dust in the US, as well as European dietary intake estimates to estimate exposures from food, East et al. (2023) estimated exposure to adults and children over the period of 2011 to 2017. Daily intake estimates for adults were estimated to be 40 ng/day PFOA and 40 ng/day PFOS, and rates for young children (toddlers) were estimated to be 14 ng/day PFOA and 17 ng/day PFOS. A comparison of these estimates using a first-order pharmacokinetic model indicated that the results were aligned with serum concentration measurements from the National Health and Nutrition Examination Survey over the same time period (East et al., 2023), providing evidence that the modeled daily intakes are reasonable. It is noted that although not discussed by East et al. (2023), it is assumed that exposures to PFAS in biosolids would be accounted for in the measured serum contributions in areas where biosolids are applied and represent a potential source.

As measured levels of PFAS in blood in Canada and the US are reportedly similar (Public Health Ontario, 2023), the results of East et al. (2023) have been considered here in an assessment of potential PFAS exposures for Canadians, and a comparison to potential exposures to PFOS and PFOA measured in Canadian biosolids.

Using Health Canada (2024b) exposure equations for the direct soil exposure pathways (i.e., incidental ingestion, dermal contact and inhalation of soil particulate) and receptor characteristics for an adult and a toddler, with the average PFOS and PFOA concentrations in CRD biosolids from Table 1 used as exposure point concentrations, exposure intakes associated with exposures to PFOA and PFOS in CRD biosolids were estimated. A summary of the results summed with the estimates from East et al. (2023) and compared to the Health Canada tolerable daily intakes (TDIs) for PFOA and PFOS are presented in Table 2.

PFAS	Background EDI (East et al., 2023) (ng/day)		EDI from CRD biosolids (ng/day)		Total Exposure Estimate (ng/day)		Total Exposure Estimate (ng/kg-bw/day)		Health Canada Tolerable Daily Intakes (ng/kg-bw-day)
	Toddler	Adult	Toddler	Adult	Toddler	Adult	Toddler	Adult	
PFOA	14	40	0.09	0.03	14.09	40.03	0.85	0.57	60
PFOS	17	40	0.44	0.14	17.44	40.14	1.06	0.57	21

Table 2. Estimated daily intakes for PFOA and PFOS (from East et al., 2023) and from exposures to PFOA and PFOS in biosolids using the maximum PFOA and PFOS concentrations in Table 1. Total exposure estimates are the sum of the EDIs from East et al., 2023 and the EDIs from biosolids.

The total exposure estimates (the sum of the estimated daily intakes from East et al., 2023 and those from CRD biosolids) in ng/kg-bw-day are well below the Health Canada (2021) tolerable daily intakes (TDIs), suggesting that exposures for PFOA and PFOS in biosolids in the CRD, combined with background exposures, are unlikely to represent a health risk. The estimated exposures from the CRD biosolids are conservative as they are based on concentrations measured in the CRD biosolids, which as noted, would be reduced by a factor of 18 following the amendment of the biosolids prior to application.

As with the results of the screening assessment presented in Section 2.1.1, the above evaluation does not consider exposures to the mixture of PFAS in biosolids, which has the potential to act additively with one another as well as with other contaminants in biosolids, and thus is likely an underestimate of total risks associated with PFAS exposures. Despite this, the potential contribution of exposures to PFOS and PFOA from biosolids from the CRD to overall exposures of these PFAS is low, and when amendment of the biosolids is considered, is likely to be negligible.

2.2 Microplastics

Microplastics are pieces of plastic less than five millimeters in diameter and while some microplastics are intentionally manufactured (e.g., microbeads in beauty products), they generally result from the degradation of plastic debris. Microplastics have been identified to be present in biosolids around the globe, including in Canada (Crossman et al., 2020; Gies et al., 2018; Lavoy and Crossman, 2021; Savarajah et al.; 2023). Further, biosolids have been identified as an important pathway for microplastics to enter the environment (Crossman et al., 2020) and agricultural lands where biosolids have been applied are one of the largest reservoirs of microplastics (Pozzebon and Siefert, 2023). Due to their emerging nature, there are no regulations pertaining to microplastics in biosolids (or from other sources) in Canada.

While the studies assessing the prevalence of microplastic in biosolids in Canada were previously limited, Sivarajah et al., (2023) quantified microplastics in biosolids from 22 WWTPs located in nine Canadian provinces. Microplastics were identified in all samples, at concentrations ranging from 228 to 1353 particles per gram dry weight (dw) (median = 636 particles per gram dw). These concentrations are orders of magnitude greater than those reported from previous investigations of microplastics in biosolids in 4 other WWTP in Canada, as well as in other countries (Sivarajah et al., 2023). Importantly, despite the large variation in the concentrations of microplastics observed across the samples from the 22 WWTPs, the investigators did not find a significant difference in the concentrations based on region, the type of WWTP or the sludge treatment type. The results for the Pacific region (n=4) were the highest, with a median concentration of 914 particles per gram dw.

The effects of microplastics on humans and the environment remain largely uninvestigated. In recognition of this, in January 2024 the Government of Canada announced funding of $2.1 million over four years to three academic institutions for the research of microplastics and their potential to impact human health (https://www.canada.ca/en/health-canada/news/2024/01/government-of-canada-funding-research-on-the-health-risks-of-microplastics.html). While there is limited data on health effects, the inhalation of microplastics has been identified as a concern, with the inhalation of microplastics associated with oxidative stress in lung tissues and general inflammation responses in airways (Pozzebon and Siefert, 2023).

Microplastics are highly persistent, resistant to degradation and can accumulate in soils (Xu et al., 2019; Pozzebon and Siefert, 2023). This is of specific concern in areas where there is repeated land application of biosolids. Contrary to the benefits of the land application of biosolids, microplastics from biosolids and their accumulation in soil compromises soil structure and affects nutrient availability, water retention and aeration (Xu et al., 2019). They can also be toxic to soil organisms and thus reduce the beneficial effects these organisms have on soil fertility and structure (Xu et al., 2019). Evidence also suggests the potential for the chemical constituents in mircroplastics to leach into soil and groundwater, and for plants to absorb microplastic particles, serving as a pathway for microplastics to enter the food chain (Xu et al., 2019; Pozzebon and Siefert, 2023).

A recent study (Wang and Good, 2024) identified that microplastics in biosolids can act as vectors for the long-range transport of PFAS, including atmospheric deposition in aquatic systems. The authors indicate that microplastics enriched with PFAS are an important concern due to the ubiquitous nature of both microplastics and PFAS globally, but also their co-occurrence in biosolids and the potential for combined toxicity (Wang and Good, 2024).

The presence of microplastics in biosolids, and the early evidence of effects to both human health and the environment, highlights the need for further research and the implementation of measures to prevent the further introduction of microplastics to the environment. Recent policies limiting single use plastics, along with existing regulations banning use of polymeric microbeads in cosmetics and personal care products, are likely to have resulted in a reduction in microplastics entering WWTPs. Despite this, the laundry of synthetic clothing will continue to contribute to the load of microplastics in biosolids (Crossman et al., 2020); however, the use of microfibre filters in washing machines would reduce microplastics sourced from laundering clothing.

2.3 Pharmaceuticals and personal care products

Pharmaceutical and personal care products (PPCPs) include prescription and over the counter medications and supplements, as well as pharmaceuticals used in agriculture to promote growth and health of livestock (Pozzebon and Siefert, 2023; Hydromantis Inc., 2010; McCarthy, 2015). PPCPs also include other products used for health and cosmetic purposes (e.g,, fragrances). Sub-categories of PPCPs include antibiotics, antimicrobials, steroidal chemicals, fragrances, alkylphenolics, and other PPCPs such as analgesics, antidepressants, antifugals, anti-inflammatories and diuretics, to name a few.

Traditional WWTPs are generally ineffective at removing PPCPs, which often persist through the treatment process. The land application of biosolids has been identified as the primary way that PPCPs enter the environment (Brown et al., 2019; Kinney and Vanden Heuvel, 2020; Pozzebon and Siefert, 2023).

Data indicate that most PPCPs degrade within months after being introduced to the environment; however, some studies indicate that select PPCPs can persist (Garcia-Santiago et al., 2016; McCarthy, 2015; Kinney and Vanden Heuvel, 2020). Further, many PPCPs are considered "pseudo-persistent" as they are continuously introduced to the environment (Pozzebon and Siefert, 2023). The potential for PPCPs to accumulate in soil and transfer to soil invertebrates and plants, as well as to leach to groundwater has been demonstrated (Garcia-Santiago, 2016), although limited data exists on the ecotoxicity of PPCPs, especially in terrestrial systems (Pozzebon and Siefert, 2023). Given the low doses of many PPCPs required to elicit a response in humans, PPCPs are likely to cause a variety of effects on biota if they accumulate in the environment. PPCPs contain endocrine disruptors which have the potential to interfere with human and animal hormonal systems even at low concentrations. Reproductive failure associated with exposure to endocrine disrupting contaminants has been well documented in aquatic systems (Pozzebon and Siefert, 2023).

Further, some antibiotics persist in the environment after land application, affecting soil microbial communities and potentially altering ecosystem functions. They can promote the growth of antibiotic-resistant bacteria, and may disrupt the balance of beneficial soil microorganisms, affecting nutrient cycling and soil health (Black et al., 2019; Pozzebon and Siefert, 2023). Antibiotic resistance has been defined by the World Health Organization as a global threat to health and food security. The promotion of antibiotic-resistant bacteria by PPCPs will contribute to this threat and is specifically concerning given the co-occurrence of antibiotic-resistant bacteria and pathogens in biosolids (Pozzebon and Siefert, 2023). Hung et al. (2022) found that biosolid samples contained significantly higher concentrations of antibiotic-resistant genes when compared to raw agricultural soils, as well as the potential for the airborne spread of the genes. The authors emphasized the importance of their findings to the global concerns regarding antibiotic resistance.

Previous studies (Garcia-Santiago et al., 2016; Kennedy/Jenks, 2017) have conducted preliminary evaluations of the potential effects and risks associated with PPCPs. Additionally, McCarthy (2015) summarized the results of previous risk assessments including those for PPCPs. Overall, the assessments suggest that the potential for human health risks from exposure to individual PPCPs in biosolids is likely low, however, there are limitations and uncertainties in the previous assessments, including the consideration of a small number of PPCPs and the lack of accounting for potential additive and synergistic effects.

Garcia-Santiago et al. (2016) conducted a screening level risk assessment to assess the potential for human exposure to PPCPs measured in biosolids to exceed one therapeutic dose. The study focused on PPCPs shown to persist in WWTPs including carbamazepine, fluoxetine, triclosan, miconazole and ciprofloxacin, and Naproxen. Total exposures via the direct soil exposure pathways, as well dietary exposures, were evaluated. The results of the assessment indicated total hazard quotients (HQs) were less than an HQ of 1.0 (i.e., total exposures were less than one therapeutic dose), with most PCPPs having HQ values of less than 0.1, except for triclosan which has been shown to bioaccumulate, which had an average HQ of 0.28 and a 95% UCLM HQ of 0.95, indicating a potential risk to human health. The mean triclosan concentration reported by Garcia-Santiago et al. (2016) was 5,890 (SD = 3,870) ng/g, while the concentration of triclosan measured in CRD biosolids (n=1) is 1,870 ng/g.

Kennedy/Jenks Consultants (Kennedy/Jenks, 2017) completed a biosolids risk assessment on behalf of Metro Vancouver. A quantitative human health risk assessment was conducted for a small group of COECs detected in biosolids including over the counter pain medications (analgesics) and non-steroidal anti-inflammatory drugs, antidepressants, antibiotics, antimicrobials, plasticizers, and flame retardants. The results of the risk assessment suggested that the concentrations of the COECs in biosolids from the Metro Vancouver region were unlikely to result in adverse health effects to exposed individuals, including children. The assessment further demonstrated that it would take a minimum of a decade and up to one billion years of exposures to the COECs in biosolids to equal a single therapeutic dose of the PPCPs.

The number of PPCPs identified in biosolids continues to grow and there is a general lack of data on the effects of these chemicals in the environment. Given that many of them act via the same mode of action (e.g., endocrine disruptors) and/or belong to the same classes (e.g., antibiotics, SSRIs) it is essential that future assessments consider the combined effect of the mixture of these PPCPs on human health and the environment.

2.4 Prioritization of Unregulated Organic Chemicals in Biosolids (Warke and McAvoy, 2024)

While acknowledging the benefits of the land application of biosolids, Warke and McAvoy (2024) conducted a literature review to compile a database of all reported unregulated organic chemicals (UOCs) present in biosolids. Where data gaps were identified, predictive modelling and an extensive literature search were conducted to determine values for persistence, mobility, bioaccumulation, and toxicity. The prioritization process used these characteristics to rank the UOCs according to their potential impact on human health.

Of 906 chemicals identified in biosolids, 124 were categorized as either high or low priority. Among these, 13 chemicals were classified as carcinogenic, and 22 as endocrine disruptors. Notable examples of endocrine-disrupting chemicals included N-nitrosodimethylamine, cashmeran, nonylphenol, bisphenol A, and several PBDEs. Potential carcinogens identified included 1,2-dichloropropane, 1,4-dioxane, di(2-ethylhexyl)-phthalate, and trichloroethylene.

The priority UOCs were further ranked using scoring based on combinations of mobility, persistence, bioaccumulation, and toxicity. This analysis added eight additional compounds to the high-priority list, resulting in a total of 46 high-priority compounds, with the remaining 78 classified as low priority. The high priority UOCs included several carcinogens (e.g., N-nitrosodiethylamine), endocrine disruptors (e.g., BDE 99, estrone), PPCPs (e.g., fluoxetine, bisphenol-A, carbamazepine, triclosan) and industrial solvents (e.g., trichloroethylene)

Comparison of the Warke and McAvoy (2024) results to those from other studies ranking UOCs in biosolids identified similarities. Of the 46 high-priority UOCs identified by Warke and McAvoy (2024), 38 were also present in other priority lists, including 20 in from Higgins et al. (2010), 14 in a study conducted on behalf of Scottish EPA (WCA, 2019), and 12 in a study conducted by the Texas Commission on Environmental Quality (TCEQ, 2021).

Of the high-priority UOCs identified, several including: bisphenol-A, triclosan, nonylphenol, N-nitrosodimethylamine, 4-chloraniline, triphenyltin (TPhT), and several polybrominated diphenyl ethers (PBDEs) such as BDE 209, BDE 47, and BDE 99, have been associated with effects ranging from endocrine disruption to carcinogenic effects (Warke and McAvoy, 2024). Additionally, triclosan, is known to disrupt thyroid function, may cause reproductive and developmental toxicity and N- nitrosodimethylamine has been linked to neurological, gastrointestinal, and developmental disorders (Warke and McAvoy, 2024).

As noted, previous risk assessments for biosolids-amended soil indicate that most UOCs are below threshold levels for human exposure pathways (HQ < 1). However, Warke and McAvoy (2024) emphasized that preliminary data for pathways involving soil organisms and aquatic systems suggest the potential for HQ values exceeding 1 for certain UOCs including triclocarban, ciprofloxacin, and azithromycin, and that further study is needed for these pathways. Further, while some compounds like caffeine pose minimal risks to humans, they can significantly impact aquatic and soil organisms and antibiotics like ciprofloxacin and azithromycin, as well as fluoroquinolones, have been identified as photosynthetic inhibitors in plants and present potential risks to soil and aquatic ecosystems (Warke and McAvoy, 2024).

While the available data generally support that the measured concentrations of PCPPs in biosolids are low and for the most part do not represent a risk to human health and the environment, the results of Warke and McAvoy (2024) further highlight the number of contaminants in biosolids, and gaps where further research is required to understand potential risks to human health and the environment.

3 Fate and Transport of Contaminants in Biosolids and Considerations of Conditions Typical of the BC South Coast

In sensitive coastal environments, like those present in southern BC, the fate and transport of contaminants, is complex. As discussed throughout this report, land application of biosolids can result in the introduction of a range of contaminants, which may disperse in the environment through soil leaching, erosion, and runoff. This issue is exacerbated by heavy precipitation which can enhance the mobilization of contaminants. Precipitation infiltrates the soil and can leach soluble contaminants into groundwater. In agricultural and rural areas, where biosolids are most likely to be applied, the use of groundwater as a source of drinking water, irrigation water or livestock water, is more likely. Thus, the contamination of groundwater has the potential to result in human health exposures via potable water, as well as livestock and crop exposure. Further, groundwater impacted with contaminants from biosolids can migrate to nearby aquatic systems and result in effects to aquatic ecosystems, as well as entry into the human food chain via seafood consumption.

Heavy rainfall or snowmelt can also create surface runoff, which has the potential to mobilize contaminants from application areas, resulting in impacts to adjacent lands, or migration to nearby water bodies. For example, Crossman et al. (2020) suggested that heavy rainfall may result in the mobilization of microplastics from agricultural soils. The risk of contaminant mobilization via surface runoff is especially high prior to the incorporation of applied biosolids into the soil matrix (LRCS Land Resource Consulting Services, 2016).

Further, prolonged or intense precipitation can saturate soils, resulting in decreased soil adsorption of contaminants and subsequent leaching, as well as soil erosion. Eroded soils carrying adsorbed contaminants may be redistributed across the landscape onto adjacent lands or to nearby waterbodies. Additionally, natural processes such as freeze-thaw and drying cycles can release fine particles from biosolids, facilitating the movement of contaminants into subsurface soils and groundwater.

Tansel et al. (2024) discussed that PFAS persistence and mobility are dependent on soil interactions and precipitation events. Leaching, which is influenced by soil type and water infiltration rates, with higher infiltration rates in areas with high precipitation levels, facilitates PFAS migration to groundwater and surface water. PFAS compounds with long fluoroalkyl chains tend to bind more strongly to solid phases, while shorter-chain PFAS are soluble and prone to leaching and transport. Consistent with other studies (Blake and Fenton, 2020; Drew et al., 2021), Tansel et al. (2024) identified the potential for plant uptake of PFAS from biosolid-amended soils, raising concerns about bioaccumulation in food chains and ecosystems.

PCPPs in biosolids can similarly migrate, with pharmaceuticals showing potential to leach into groundwater (Santiago et al., 2016; Kinney et al., 2006). Gottschall et al., (2012) detected pharmaceuticals and personal care products (PPCPs) in groundwater following biosolids land application. While many PPCPs dissipate within a few months, others, particularly those embedded in biosolid aggregates, can persist for over a year (Kinney and Heuvel, 2020).

Some COECs, due to their persistence and bioaccumulation potential, can be transported long distances. For example, microplastics in biosolids exhibit hydrophobic characteristics, allowing them to adsorb other contaminants. These particles may then be subject to long-range transport (Carbery et al., 2018). Studies (Wang et al., 2024, Strynar et al., 2011) indicate that long-chain PFAS can attach to microplastics or dust and become airborne. These findings raise concerns regarding the multiple contaminant types present in biosolids and their influence not only on the fate and transport of such contaminants, but also on their combined toxicities.

While the science on the fate and transport of COECs in biosolids in advancing, further research is required to fully understand the behaviour of these contaminants in the environment. Field studies in BC that evaluate seasonal influences, such a precipitation levels, on the environmental fate and transport of COECs in biosolids would provide valuable insight, including how the co-occurrence of numerous contaminants impact migration patterns and ultimately exposure pathways for human and ecological receptors.

4 Techniques to Reduce Risks in Biosolids Land Application

Numerous studies have emphasized the importance of government oversight and regulation to limit the risks associated with the land application of biosolids; however, as discussed, available regulations are limited due to the paucity of toxicity data for COECs. This gap, and the uncertainties discussed in Section 6, highlight the critical need for further research, source control to limit the entry of COECs into WWTPs, the development of treatment technologies that degrade COECs in biosolids, and standardized requirements for monitoring COECs in biosolids.

4.1 Recent Research on Treatment Technologies

Recognizing the critical problem that contaminants, and specifically COECs, in biosolids present, recent research has focused on treatment technologies that remove COECs. As noted, conventional WWTPs were not designed to remove COECs and thus, these contaminants will continue to persist in inputs to WWTPs.

Much recent research has been focused on technologies that destroy PFAS. An PFAS Innovative Treatment Team was formed by the USEPA is 2020 to investigate and develop innovative tools and methods to break the carbon fluorine (C-F) bonds in PFAS-containing waste. Four emerging technologies were identified by the team with a technology's suitability dependent on waste characteristics, processing requirements, and potential byproducts, as well as considerations for energy consumption, costs, and system mobility (Berg et al., 2022). Berg et al. (2022) also indicated that additional pretreatment and post-treatment steps may be necessary to enhance effectiveness and manage byproducts, such as volatile PFAS emissions.

The four emerging technologies were summarized by Berg et al. (2022) and include:

- Mechanochemical destruction (MCD), which has been shown to result in over 99% PFAS destruction in laboratory settings. The authors note that this technology requires further study for commercial-scale application.
- Electrochemical oxidation (EO), which uses electrical currents to break C-F bonds in PFAS, has shown successful bench and pilot-scale results, but faces challenges in scaling up.
- Supercritical water oxidation (SCWO) treats waste at high temperatures and pressures, producing heat that can sustain the process, but requires managing acidic byproducts and salt precipitation.
- Pyrolysis and gasification decompose materials at high temperatures, potentially destroying PFAS, and produce useful byproducts like char and syngas. Further research on this technology was noted to be required.

Research briefs on these technologies are available on the PITT's website, providing detailed information on benefits and areas needing further research available at https://www.epa.gov/chemical-research/pfas-innovative-treatment-team-pitt. Each of these technologies were noted by US EPA to be under evaluation, with further pilot-testing and reporting of the results planned for 2021; however, no further updates on these technologies were identified on the above webpage. While showing promise, the technologies are not yet commercially available.

Keller et al. (2024) pyrolyzed biosolid samples from a WWTP in Southern California at temperatures ranging from 400 to 700 °C for two hours. The study evaluated contaminant removal, with most contaminants being eliminated entirely and only minimal residuals detected. Notably, no PFAS were detectable at the lowest temperature tested (400 °C), and overall removal of PPCPs exceeded 99.9%. Microplastic removal ranged from 91 to 97% depending on conditions. Additionally, the resulting biochar was rich in iron and phosphorus, making it a valuable fertilizer additive. The authors of the study indicated that a techno-economic analysis showed that pyrolysis could lead to significant cost savings, with revenue from biochar sales having the potential to offset the capital and operational costs of the drying and pyrolysis systems.

Vo et al. (2024) assessed treatment technologies for microplastics and organic contaminants in biosolids. Their multi-criteria analysis identified anaerobic digestion as the most established and practical approach, indicating that while thermal treatment shows potential, the application requires further advancements in infrastructure, regulatory frameworks, and public acceptance to become widely viable.

Recent studies have explored advanced oxidation treatment methods which are reportedly effective at degrading COECs including PPCPs and PFAS. Booton et al. (2024) indicate that chemical oxidation offers a promising alternative and eliminates persistent contaminants. Compared to biological systems, it is potentially simpler to operate and maintain, while requiring less space for efficient treatment. Key advantages of chemical oxidation are reported by the authors to include its ability to address COECs, its rapid start-up and shutdown capabilities, and its ability to avoid common challenges in biological treatment, such as toxic load management, biomass washout, sludge settling issues, and the complexities of sludge handling and disposal.

The recent research illustrates the potential for available technologies to destroy COECs, demonstrating that with further testing and implementation, that the risks association with the land application of biosolids could be greatly reduced.

4.2 Application Techniques and Site-Specific Application Considerations

Specific application techniques, such as injection, surface incorporation and amendment/mixing of biosolids to produce a biosolids growing media, have been demonstrated to reduce risks associated with biosolids land application. Injecting biosolids below the soil surface reduces bioaerosol dispersion, wind and water erosion, and prevents exposure to contaminants by reducing dust generation and the potential for surface contact. Injection also reduces adherence to plant tissues, and therefore exposures to livestock and wildlife. Similar results may be achieved by mixing biosolids into soil immediately after application (LRCS Land Resource Consulting Services, 2016).

BC ENV (2008), LRCS Land Resource Consulting Services (2016) and others have provided recommendations for reducing risks associated with the land application of biosolids. The recommendations include risk-based planning to reduce exposures, including avoiding sensitive ecosystems and proximity to water bodies, as well as areas with shallow groundwater where leaching of contaminants is more likely. Further, the use of personal protective equipment for workers, adhering to buffer zones required in the OMRR and avoiding application during heavy rainfall and snowmelt will further reduce exposures and the potential for contamination of groundwater and surface water. Implementing waiting periods between application and livestock (and wildlife) exposures is also recommended.

The amendment of biosolids with biochar or wood chips, as done in the CRD, has also been demonstrated to enhance the degradation and/or retention of leachable PPCPs (Pozzebon and Siefert, 2023).

5 Limitations of Extrapolating Lab-Based Testing to the Environment

The limitations in extrapolating lab-based toxicity testing results to real-world environmental scenarios are generally recognized and have been well documented by others (Cairns, 1983; Smith and Cairns, 1993; Hill et al., 1994). These limitations are exacerbated when considering the land application of biosolids owing to the large number of contaminants, including COECs, present in biosolids, and as the fate and toxicity of these contaminants which will vary depending on the mixture present and the application site characteristics. Controlled laboratory conditions cannot replicate the complex, variable nature of these environments.

The key limitations that arise during this extrapolation process include:

1. Laboratory tests are conducted under highly controlled conditions, which typically include simplified systems that do not reflect the complexity of the natural environment. Factors such as contaminant mixtures, environmental conditions (e.g., soil type, pH), and contaminant exposure pathways cannot be replicated in a lab setting.
2. Lab tests typical assess the effects of a single chemical or a small group of related chemicals. In the environment, specifically in the case of biosolids, organisms are exposed to complex mixtures with potential additive, synergistic, or antagonistic effects.
3. Lab studies typically expose test organisms to high concentrations of a single contaminant over short durations in confined spaces, with even chronic tests typically limited in duration. This does not reflect environmental exposures which often involve chronic exposures to low levels of contaminants over large areas. The effects of chronic, low dose exposures are typically underestimated in lab settings, leading to potential inaccuracies when predicting chronic toxicity in the natural environment.
4. In toxicity testing, exposures are usually simplified and typically limited to immersion in a contaminated medium or direct ingestion or inhalation. In natural environments contaminants exposure pathways are more complex and may include cross-media exposures, including food chain exposures. This oversimplification has the potential to underestimate exposures and associated effects.
5. Lab toxicity test methods have been developed for a limited number of species, focusing on model organisms that may not be representative species that are most sensitive to a specific contaminant. Further, lab tests may not include life stages (e.g., juveniles, larvae) most sensitive to the contaminants tested.
6. Laboratory organisms are often maintained in stable environments and lack the physiological adaptations that organisms may develop in response to natural stressors. Additionally, organisms may behave differently in the lab setting compared to in their natural environment, potentially influencing their exposure and response to contaminants.
7. In natural environments, interactions with abiotic factors (e.g., soil composition) and biotic factors (e.g., predation) may influence toxicity. These factors cannot be accounted for in a laboratory.

The above limitations of laboratory-based toxicity studies highlight the need for caution when extrapolating laboratory testing results to the environment. As noted, given the complex contaminant mixtures known to be present in biosolids, the likely potential for synergistic or additive effects, as well as the influence of the characteristics of the application area on fate and toxicity, the importance of field studies in the assessment of potential risks from the land application of biosolids cannot be understated. Field observations, together with laboratory toxicity testing, are essential to understanding risks. The collective results of both, once available, should be considered in the establishment of a risk-based, adaptive management strategy for the land application of biosolids.

6 Uncertainties in the Risks Associated with the Land Application of Biosolids

Numerous uncertainties exist in the assessment of risks associated with the land application of biosolids. Many of these uncertainties have been documented by others (McCarthy, 2015; Pozzebon and Siefert, 2023; Garcia-Santiago et al., 2020; Schoof and Houkal, 2005; LRCS, 2016), including those summarized below and discussed in previous sections of this report. The rapidly evolving science on COECs in biosolids and their fate and effects following land application, as well as the very recent government policies and regulations pertaining to COECs in biosolids in Canada and elsewhere (e.g., CFIA October 2024 limit for PFAS in biosolids; Government of Canada July 2024 draft report of PFAS; Government of Canada 2023 funding for research on microplastics), underscore that the science on COECs is "emerging".

Some of the key scientific gaps and uncertainties related to the land application of biosolids are summarized below:

1. Regulatory agencies have not derived limits for most COECs in biosolids, and further, given the paucity of toxicity (including ecotoxicity and specifically for wildlife at all trophic levels) and fate data for COECs, have not derived environmental quality standards. For the same reason, risk assessments evaluating the potential human health and environmental risks associated with exposures to COECs in biosolids, are limited and have generally focused on only a few of the more common COECs.
2. Due to advances in analytical chemistry methodologies, new COECs present in biosolids continue to be identified. The fate and effects of these contaminants are not well understood and thus, it is not possible to assess the potential for risks to human health and the environment.
3. Existing risk assessments and other evaluations of COECs in biosolids are focused on individual contaminants and are based on toxicity data from laboratory toxicity tests. These risk assessments do not consider that exposures to biosolids would result in the simultaneous exposure to numerous contaminants, and the potential for the contaminants to act additively or synergistically and thus are likely to have underestimated the potential for risks.
4. Similarly, the coexistence of numerous contaminants in biosolids may affect their fate, transport and distribution and therefore potential exposure pathways for human and ecological receptors. As an example, Wang and Good, (2024) identified that microplastics in biosolids can act as vectors for the long-range transport of PFAS. Field studies evaluated the influence of the contaminant mixtures present in biosolids on their environmental fate and transport are required to address this uncertainty.
5. The limited available toxicity data for most COECs is based on laboratory toxicity testing. The limitations and uncertainties associated with lab studies, and the need for field studies to be considered in the interpretation of risks, is highlighted in Section 5.
6. The long-term impacts of COECs in biosolids after land application, including their potential to accumulate overtime, leach into groundwater, enter the food chain, or impact human health or wildlife, are not fully understood. Further research in these areas is essential for the assessment and management of risks.
7. Efficient technologies for detecting and measuring COECs in biosolids and the environment are underdeveloped. Without reliable monitoring, it is challenging to assess or mitigate potential risks associated with contaminants in biosolids.

The rate at which our understanding of COECs in biosolids is advancing, with new data on the fate and effects of COECs being published continuously, underscores the importance an adaptive management framework for the land application of biosolids. . With time, it is anticipated that the uncertainties and data gaps identified here and elsewhere will be addressed, and thus regulators must keep pace with the evolving science and regularly weigh the risks and benefits of the practice in an informed and transparent manner.

7 Biosolid Land Application Bans

Several countries have restricted or banned the land application of biosolids due to concerns about environmental contamination, health risks, and public opposition primarily related to the presence of PFAS in biosolids, and their associated entry into the environment, specifically the human food chain.

In Canada, the land application of biosolids has been banned in specific regions due to environmental and public health concerns. In British Columbia, the Capital Regional District implemented a ban on the land application of biosolids in 2011. The ban was implemented due to concerns regarding COECs in biosolids, and to protect local drinking water sources, the environment, and public health. In March 2023, Quebec announced a temporary ban on the import and land application of biosolids originating from the United States due to concerns over PFAS contamination in imported biosolids. The province is working towards establishing standards for PFAS in biosolids to ensure environmental safety.

The following is a summary of the various countries that have banned or implemented strict regulations on the land application of biosolids.

7.1 United States of America

In the U.S.A., some states and municipalities have imposed restrictions or moratoriums on the land application of biosolids. In 2022, Maine became the first state to ban the land application of biosolids after it found PFAS had contaminated crops or water on over 50 farms throughout the state where sludge had been spread (Carey, 2023). Other states are starting to implement limits and bans. As of October 1, 2024, Connecticut prohibited the sale of PFAS-containing biosolids or wastewater sludge. Further, Michigan, New York, and Wisconsin have implemented interim strategies that limit the PFAS concentrations allowed in land-applied biosolids, and Colorado's interim strategy requires Source Control Programs to evaluate potential PFAS sources if concentrations in biosolids exceed a determined level.

Several more states have pending legislation that would enforce similar restrictions. As an example, Massachusetts is developing legislation that would set maximum levels for the amount of PFAS allowed in any fertilizer sold in the retail market, and proposed legislation in Oklahoma would require a warning label on any product derived from biosolids or sewage sludge.

7.2 Europe

In Europe, several countries have adopted a precautionary approach in banning the land application of biosolids, emphasizing soil and food safety. Switzerland has had a ban on agricultural use in place since 2006 with their current regulation requiring sewage sludge to be combusted, while the Netherlands has imposed stringent limits on several contaminants commonly identified in biosolids, resulting in very limited use. Due to concerns over COECs, including PFAS, pharmaceuticals and microplastics, Sweden, Germany and Austria (Vienna region) have banned the application of biosolids on agricultural land. The ban in Germany was implemented with the amendment of the German Sewage Sludge Ordinance in 2017, and by 2029 biosolids land application will be phased out. Germany is reportedly shifting towards incineration of sewage sludge and phosphorus recovery.

8 Discussion and Conclusion

In British Columbia, approximately 38,000 tonnes of biosolids are produced annually, with approximately 72% of biosolids and biosolids-derived products applied to land (BC ENV, 2019). As discussed throughout, while there are many benefits associated with the land application of biosolids, biosolids contain a complex mixture of contaminants, including COECs. Data on the fate and effects of these COECs is limited, and our understanding of the risks that these contaminants present to human health and the environment is rapidly evolving.

When weighed collectively, the available information on the land application of biosolids, including the information presented by others (e.g., Pozzebon and Siefert, 2023; LRCS Land Resource Consulting Service, 2016; McCarthy, 2015; BC ENV, 2024) and herein, supports the assessment of the practice in the context of the Precautionary Principle. The Precautionary Principle guides decision-makers to take action to protect the environment and public health in the face of environmental or health uncertainties (Goldstein, 2001).

Given the significant data gaps and uncertainties in the land application of biosolids, as well as the rapidly advancing science, previous studies that have concluded a low risk to human health and the environment must be interpreted in the context of the uncertainties. Risk assessments are conducted using the best scientific evidence available at the time of the assessment but must consider the unknowns in the overall interpretation of risks and in management decisions (Yoe, 2019, CSAP, 2016). Based on the data gaps and uncertainties summarized in Section 6, the uncertainty in the risk conclusions made to date, and specifically the potential for the assessments to have underestimated risks to human health and the environment, is categorized as moderate to high, and thus, is not supportive of a conclusion of low risk (CSAP, 2016). Rather, based on the uncertainties and the potential for the assessments to have underestimated risk, the risk conclusions are also uncertain, and cannot be further understood until the data gaps are resolved and the uncertainties are decreased.

In the context of biosolids from the CRD, with the data for PFAS and triclosan discussed herein, a review of the data indicates that the concentrations of the COECs are lower than measured in other Canadian biosolids. As noted, the comparison of the low concentrations of COECs with existing toxicity data suggests that the COECs in CRD biosolids represent a negligible to low risk to human health and the environment. Despite this, given the uncertainties discussed in Section 6, the uncertainty in this conclusion is moderate to high and should be reviewed regularly as the science on biosolids evolves.

Oberg and Mason-Renton (2018) examined how uncertainties and gaps in scientific knowledge were addressed and communicated in British Columbia, compared to Sweden, during their jurisdictional review of regulations on the land application of biosolids. The study highlighted how the jurisdictions had approached the uncertainty in the land application of biosolids differently; with BC taking the position that the absence of evidence of risk implies the practice is safe. Sweden, however, prioritized a precautionary approach, operating under the assumption that the absence of evidence or risk is not equivalent to evidence of absence (Oberg and Mason-Renton, 2018).Given the benefits of the land application of biosolids, the Canada-wide approach (CCME, 2012) encouraging the beneficial use of biosolids versus disposal, and as the scientific evidence available to date suggests that the land application of biosolids represents a negligible to low risk, Sweden’s approach is likely overly restrictive.

Applying the Precautionary Principle aligns with using an adaptive management framework for the land application of biosolids. As noted, with time, it is anticipated that the uncertainties and data gaps identified in this report and elsewhere will be addressed, and thus regulators must keep pace with the evolving science and regularly weigh the risks and benefits of the practice in an informed and transparent manner. In the interim actions such as source control to limit the introduction of COECs to WWTPs, adopting advanced treatment technologies as they become available, careful site selection through the application of risk-based principles, and ongoing monitoring to minimize risks, are essential for the protection of human health and the environment. Such strategies are increasingly emphasized in regulatory guidelines around the globe to ensure biosolids use does not compromise human health and the environment. This approach addresses both the potential risks and the benefits of nutrient recycling while minimizing ecological and human health hazards (Schoof & Houkal, 2005; Gianico et al., 2021).

9 Limitations

This report has been prepared and the work referred to in this report has been undertaken by Dr. Chris Kennedy for the Capital Regional District (CRD). Dr. Chris Kennedy makes no representation or warranty to any other person with regard to this report and the work referred to in this report and he accepts no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

This report has been prepared based on the CRD Terms of Reference and the literature identified during the review. Dr. Chris Kennedy expresses no warranty with respect to the accuracy of the data reported in the literature.

The evaluation and conclusions reported herein do not preclude the identification of additional literature pertinent to the contaminants discussed in this report. If new literature/studies become available, modifications to the findings, conclusions and recommendations in this report may be necessary.

Where information obtained from reference sources is included in the report, no attempt to verify the reference material was made. Dr. Chris Kennedy expresses no warranty with respect to the toxicity data presented in various references or the validity of the toxicity studies on which it was based. Scientific models employed in the evaluations were selected based on accepted scientific methodologies and practices in common use at the time and are subject to the uncertainties on which they are based.

Nothing in this report is intended to constitute or provide a legal opinion. Dr. Chris Kennedy makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory guidelines and standards referred to in this report may be expected over time, especially considering the evolving nature of the science for many of the contaminants evaluated. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

10 References

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV), 2023a. Protocol 1 for Contaminated Sites, Detailed Risk Assessment. Version 4.0. March 20, 2023.

BC ENV, 2023b. Contaminated Sites Regulation B.C. (BC CSR) Reg. 375/96. OC 1480/96. Last amended March 31, 2023 by BC Reg. 133/2022.

Behnami, Ali, Khaled Zoroufchi Benis, Mojtaba Pourakbar, Mojtaba Yeganeh, Ali Esrafili, Mitra Gholami, Biosolids, an important route for transporting poly- and perfluoroalkyl substances from wastewater treatment plants into the environment: A systematic review, Science of The Total Environment, Volume 925, 2024, 171559, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2024.171559.

Berg C, Crone B, Gullett B, Higuchi M, Krause MJ, Lemieux PM, Martin T, Shields EP, Struble E, Thoma E, Whitehill A. Developing innovative treatment technologies for PFAS-containing wastes. J Air Waste Manag Assoc. 2022 Jun;72(6):540-555. doi: 10.1080/10962247.2021.2000903.

Black GP, Anumol T, Young Thomas M. Analyzing a broader spectrum of endocrine active organic contaminants in sewage sludge with high resolution LC-QTOF-MS suspect screening and QSAR toxicity prediction. Environ Science: Processes Impacts. 2019;21(7):1099–114. doi: 10.1039/c9em00144a. [DOI]

Booton, A., Mayer, B.K. & Zitomer, D.H. Chemical oxidation as an alternative for municipal wastewater secondary treatment: a review. *Rev Environ Sci Biotechnol* **23**, 43–65 (2024). https://doi.org/10.1007/s11157-024-09684-5

Borthakur A, Leonard J, Koutnik VS, Ravi S, Mohanty SK. Inhalation risks of wind-blown dust from biosolid-applied agricultural lands: are they enriched with microplastics and PFAS? Curr Opin Environ Sci Health. 2022;25:100309.

Brown, S., Kennedy, L., Cullington, M., Mihle, A. and Lono-Batura, M. (2019), Relating Pharmaceuticals and Personal Care Products in Biosolids to Home Exposure. Urban Agriculture & Regional Food Systems, 4: 1-14 180005. https://doi.org/10.2134/urbanag2018.12.0005

Canadian Council for Ministers of the Environment (CCME), 2012. Canada-Wide Approach for the Management of Wastewater Biosolids. October 11, 2012. PN 1477.

CCME, 2020. Ecological Risk Assessment Guidance Document. PN: 1585. ISBN: 978-1-77202-044-1 PDF.

CCME, 2021. Canadian Soil and Groundwater Quality Guidelines for the Protection of Environmental and Human Health. Perfluorooctane Sulfonate (PFOS). Available at https://ccme.ca/en/res/pfosfactsheeten.pdf.

Canadian Food Inspection Agency (CFIA), 2024. Notice to industry: implementation of an interim standard for per- and polyfluoroalkyl substances (PFAS) in commercial biosolids. Available at https://inspection.canada.ca/en/plant-health/fertilizers/notices-industry/notice-industry-implementation-interim-standard-and-polyfluoroalkyl-substances-pfas-commercial.

Cairns, J. Are single species toxicity tests alone adequate for estimating environmental hazard?. *Hydrobiologia* **100**, 47–57 (1983). https://doi.org/10.1007/BF00027421

Carey, Molly. *Fatal Fertilizer: PFAS Contamination of Farmland from Biosolids and Potential Federal Solutions*, 40 Pace Envtl. L. Rev. 282 (2023) DOI: https://doi.org/10.58948/0738-6206.1870 Available at: https://digitalcommons.pace.edu/pelr/vol40/iss2/2

Chacón, Luz, Liliana Reyes, Luis Rivera-Montero, Kenia Barrantes, Chapter 5 - Transport, fate, and bioavailability of emerging pollutants in soil, sediment, and wastewater treatment plants: potential environmental impacts, Editor(s): Hemen Sarma, Delfina C. Dominguez, Wen-Yee Lee, Emerging Contaminants in the Environment, Elsevier, 2022, Pages 111-136, ISBN 9780323851602, https://doi.org/10.1016/B978-0-323-85160-2.00020-2.

Clarke, B. O., S. R. Smith (2011): "Review of 'emerging' organic contaminants in biosolids and assessment of international research priorities for the agricultural use of biosolids." Environ. Int. 37(1): 226-247

Crossman, Jill, Rachel R. Hurley, Martyn Futter, Luca Nizzetto, Transfer and transport of microplastics from biosolids to agricultural soils and the wider environment, Science of The Total Environment, Volume 724, 2020, 138334, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2020.138334.

CSAP, 2016. Risk Management Decision Framework for BC Contaminated Sites, Phase 2 – Guiding Principles for Applying Risk-based Standards to Ecological Receptors. Prepared for Society of Contaminated Sites Approved Professionals by Azimuth Consulting Group Partnership.

Duong, H.T., Kadokami, K., Nguyen, D.T. *et al.* Occurrence, potential sources, and risk assessment of pharmaceuticals and personal care products in atmospheric particulate matter in Hanoi, Vietnam. *Environ Sci Pollut Res* **30**, 34814–34826 (2023). https://doi.org/10.1007/s11356-022-24630-0

East, A., Egeghy, P.P., Hubal, E.A.C. *et al.* Computational estimates of daily aggregate exposure to PFOA/PFOS from 2011 to 2017 using a basic intake model. *J Expo Sci Environ Epidemiol* **33**, 56–68 (2023). https://doi.org/10.1038/s41370-021-00374-w

Eriksen, G. S., C. E. Amundsen, A. Bernhoft, T. Eggen, K. Grave, B. Halling-Sørensen, T. Källqvist, T. Sogn, L. Sverdrup (2009): Risk assessment of contaminants in sewage sludge applied on Norwegian soils. Opinion of the panel on contaminants in the Norwegian Scientific Committee for Food Safety. Norwegian Scientific Committee for Food Safety (VKM). 05/511-22-final.

Evanylo, G., Sukkariyah, B., Anderson Eborall, M., & Zelazny, L. (2006). Bioavailability of Heavy Metals in Biosolids-Amended Soil. *Communications in Soil Science and Plant Analysis*, *37*(15–20), 2157–2170. https://doi.org/10.1080/00103620600817309

García-Santiago, Xela, Amaya Franco-Uría, Francisco Omil, Juan M. Lema, Risk assessment of persistent pharmaceuticals in biosolids: Dealing with uncertainty, Journal of Hazardous Materials, Volume 302, 2016, Pages 72-81, ISSN 0304-3894, https://doi.org/10.1016/j.jhazmat.2015.09.035.

Gies EA, LeNoble JL, Noël M, Etemadifar A, Bishay F, Hall ER, Ross PS. Retention of microplastics in a major secondary wastewater treatment plant in Vancouver, Canada. Mar Pollut Bull. 2018 Aug;133:553-561. doi: 10.1016/j.marpolbul.2018.06.006.

Goldstein BD. The precautionary principle also applies to public health actions. Am J Public Health. 2001 Sep;91(9):1358-61. doi: 10.2105/ajph.91.9.1358. PMID: 11527755; PMCID: PMC1446778.

Government of Canada, 2023. Draft Draft State of Per- and Polyfluoroalkyl Substances (PFAS) Report. Environment and Climate Change Canada and Health Canada. 2023.

Government of Canada, 2024. Updated Draft State of Per- and Polyfluoroalkyl Substances (PFAS) Report. Environment and Climate Change Canada and Health Canada. July 2024.

Grippo, M., J. Hayse, I. Hlohowskyj and K. Picel. 2021. Derivation of PFAS ecological screening values. Final. September 2021. Environmental Science Division, Argonne National Laboratory. Available at https://www.denix.osd.mil/dodepa/denix-files/sites/85/2022/10/Final-PFAS-ESV-Report_Sept-2021_508.pdf.

Health Canada, 2019. Updates to Health Canada Soil Screening values for Perfluoroalkylated Substances (PFAS). May 2019. Prepared by HC Contaminated Sites Division. Ottawa, Ontario.

Health Canada, 2021. Federal Contaminated Site Risk Assessment in Canada. Toxicological Reference Values (TRVs). Version 3.0. ISBN: 978-0-660-36723-1. Pub.: 200301

Health Canada. 2023. Per- and polyfluoroalkyl substances (PFAS) in Canadians. Ottawa, ON. Available: /content/canadasite/en/health-canada/services/environmental-workplace-health/reports-publications/environmental-contaminants/human-biomonitoring-resources/per-polyfluoroalkyl-substances-canadians.html.

Health Canada, 2024a. Objective for Canadian Drinking Water Quality, Per- and Polyfluoralkyl Substances. ISBN: 978-0-660-72710-3, Pub: 240357. Available at https://www.canada.ca/en/health-canada/services/publications/healthy-living/objective-drinking-water-quality-per-polyfluoroalkyl-substances.html

Health Canada, 2024b. Federal Contaminated Site Risk Assessment in Canada: Guidance on Human Health and Preliminary Quantitative Risk Assessment (PQRA). Version 4.0. ISBN: 978-0-660-68497-0. Pub.: 230531.

Helmer RW, Reeves DM, Cassidy DP. Per- and Polyfluorinated Alkyl Substances (PFAS) cycling within Michigan: contaminated sites, landfills and wastewater treatment plants. Water Res. 2022;210:117983.

Higgins, C. P., J. O. Sharp, J. G. Sepulvado, B. Littrell, G. O'Connor, E. Snyder, D. McAvoy (2010): Trace Organic Chemicals in Biosolids-Amended Soils. State-of-the-Science Review. Water Environment Research Foundation, IWA Publishing. SRSK5T09.

Hill, I.R., Heimbach, F., Leeuwangh, P., & Matthiessen, P. (1994). Freshwater Field Tests for Hazard Assessment of Chemicals (1st ed.). CRC Press. https://doi.org/10.1201/9780203755488

Hung W-C, Miao Y, Truong N, Jones A, Mahendra S, Jay J. Tracking antibiotic resistance through the environment near a biosolid spreading ground: resistome changes, distribution, and metal(loid) co-selection. Sci Total Environ. 2022;823:153570.

Hydromantis Inc., 2010. Emerging substances of concern in biosolids: Concentrations and effects of treatment processes. Submitted to Canadian Council of Ministers of the Environment, pp. 255.

Jensen, J., S. T. Ingvertsen, J. Magid (2012): Risk evaluation of five groups of persistent organic contaminants in sewage sludge. Danish Ministry of the Environment. Environmental Protection Agency. Environmental Project No. 1406 2012.

Keller, Arturo A., Weiwei Li, Yuki Floyd, James Bae, Kayla Marie Clemens, Eleanor Thomas, Ziwei Han, Adeyemi S. Adeleye,Elimination of microplastics, PFAS, and PPCPs from biosolids via pyrolysis to produce biochar: Feasibility and techno-economic analysis, Science of The Total Environment, Volume 947, 2024, 174773, ISSN 048-9697, https://doi.org/10.1016/j.scitotenv.2024.174773.

Kennedy/Jenks Consultants. 2017. Biosolids Risk Assessment for Metro Vancouver. Prepared for Metro Vancouver. May 26, 2017.

Kinney, Chad, Brian Vanden Heuvel, Translocation of pharmaceuticals and personal care products after land application of biosolids, Current Opinion in Environmental Science & Health, Volume 14, 2020, Pages 23-30, ISSN 2468-5844, https://doi.org/10.1016/j.coesh.2019.11.004.

Lakshminarasimman, N., Gewurtz, S.B., Parker, W.J., Smyth, S.A., 2021. Removal and formation of perfluoroalkyl substances in Canadian sludge treatment systems - a mass balance approach. Sci Total Environ 754, 142431.

Lavoy M, Crossman J. A novel method for organic matter removal from samples containing microplastics. Environ Pollut. 2021 Oct 1;286:117357. doi: 10.1016/j.envpol.2021.117357. Epub 2021 May 14. PMID: 34052645.

Letcher, Robert J, Shaogang Chu, Shirley-Anne Smyth, Side-chain fluorinated polymer surfactants in biosolids from wastewater treatment plants, Journal of Hazardous Materials, Volume 388, 2020, 122044, ISSN 0304-3894, https://doi.org/10.1016/j.jhazmat.2020.122044.

Marchuk, Serhiy, Stephan Tait, Payel Sinha, Peter Harris, Diogenes L. Antille, Bernadette K. McCabe, Biosolids-derived fertilisers: A review of challenges and opportunities, Science of The Total Environment, Volume 875, 2023, 162555, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2023.162555.

Mohajerani, Abbas, Bojana Karabatak, Microplastics and pollutants in biosolids have contaminated agricultural soils: An analytical study and a proposal to cease the use of biosolids in farmlands and utilise them in sustainable bricks, Waste Management, Volume 107, 2020, Pages 252-265, ISSN 0956-053X, https://doi.org/10.1016/j.wasman.2020.04.021.

Oberg (Öberg), Gunilla, Sarah A. Mason-Renton, On the limitation of evidence-based policy: Regulatory narratives and land application of biosolids/sewage sludge in BC, Canada and Sweden, Environmental Science & Policy, Volume 84, 2018, Pages 88-96, ISSN 1462-9011, https://doi.org/10.1016/j.envsci.2018.03.006.

Pozzebon, E.A., Seifert, L. Emerging environmental health risks associated with the land application of biosolids: a scoping review. *Environ Health* **22**, 57 (2023). https://doi.org/10.1186/s12940-023-01008-4

Pramanik BK, Roychand R, Monira S, Bhuiyan M, Jegatheesan V. Fate of road-dust associated microplastics and per- and polyfluorinated substances in stormwater. Process Saf Environ Prot. 2020;144:236–41.

Public Health Ontario, 2023. Focus on Per- and Polyfluoroalkyl Substances (PFAS). May 2023. Available at https://www.publichealthontario.ca/-/media/Documents/P/2023/pfas-per-poly-fluoroalkyl-substances.pdf?rev=270b2dc8401c4653903d3a082579a108&sc_lang=en

Sivarajah B, Lapen DR, Gewurtz SB, Smyth SA, Provencher JF, Vermaire JC. How many microplastic particles are present in Canadian biosolids? J Environ Qual. 2023 Sep-Oct;52(5):1037-1048. doi: 10.1002/jeq2.20497. Epub 2023 Jun 26. PMID: 37296527.

Smith, E.P., Cairns, J. Extrapolation methods for setting ecological standards for water quality: statistical and ecological concerns. *Ecotoxicology* **2**, 203–219 (1993). https://doi.org/10.1007/BF00116425

TCEQ, 2021. Chemicals of Interest in Biosolids: Summary of Key Information and Hazard Ranking. February 2021. Available at https://www.tceq.texas.gov/downloads/toxicology/research-projects/biosolids.pdf.

Vo, Phong H.N., Gia Ky Le, Lai Nguyen Huy, Lei Zheng, Chawalit Chaiwong, Nam Nhat Nguyen, Hong T.M. Nguyen, Peter J. Ralph, Unnikrishnan Kuzhiumparambil, Soroosh Danaee, Sonja Toft, Craig Madsen, Mikael Kim, Jim Fenstermacher, Ho Truong Nam Hai, Haoran Duan, Ben Tscharke,

Occurrence, spatiotemporal trends, fate, and treatment technologies for microplastics and organic contaminants in biosolids: A review, Journal of Hazardous Materials, Volume 466, 2024, 133471, ISSN 0304-3894, https://doi.org/10.1016/j.jhazmat.2024.133471.

Wang, Xuebing, Nanyang Yu, Yuli Qian, Wei Shi, Xiaowei Zhang, Jinju Geng, Hongxia Yu, Si Wei, Non-target and suspect screening of per- and polyfluoroalkyl substances in Chinese municipal wastewater treatment plants, Water Research, Volume 183, 2020, 115989, ISSN 0043-1354, https://doi.org/10.1016/j.watres.2020.115989.

Wang, Yuxin, Kelly D. Good, Microplastics and PFAS air-water interaction and deposition, Science of The Total Environment, Volume 954, 2024, 176247, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2024.176247.

Warke, Manas, Drew McAvoy, Prioritization of biosolids-borne unregulated organic compounds, Science of The Total Environment, Volume 955, 2024, 177207, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2024.177207.

WCA, 2019. The Assessment of Organic Contaminants in Material Spread on Land. Final Report to SEPA, from the WCA. January 2019. Available at https://www.sepa.org.uk/media/413269/organic_contaminants_materials_to_land.pdf.

Xu, B., Liu, F., Cryder, Z., Huang, D., Lu, Z., He, Y., … Xu, J. (2019). Microplastics in the soil environment:

Occurrence, risks, interactions and fate – A review. *Critical Reviews in Environmental Science and Technology*, *50*(21), 2175–2222. https://doi.org/10.1080/10643389.2019.1694822

Yoe, C. (2019). Principles of Risk Analysis: Decision Making Under Uncertainty (2nd ed.). CRC Press. https://doi.org/10.1201/9780429021121

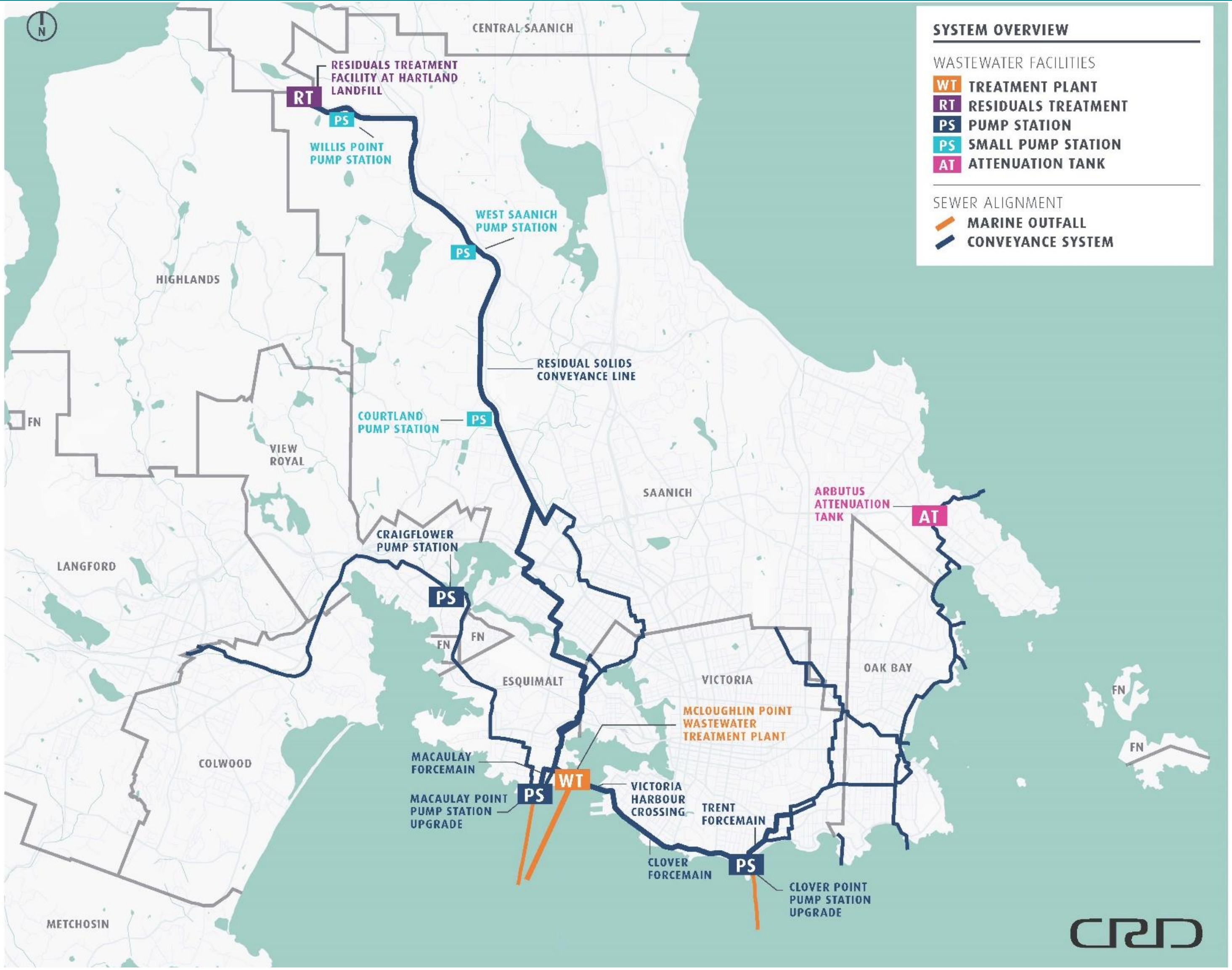
Zhou, Ting, Xuan Li, Huan Liu, Shiman Dong, Zehao Zhang, Zhenyao Wang, Jibin Li, Long D. Nghiem, Stuart J. Khan, Qilin Wang, Occurrence, fate, and remediation for per-and polyfluoroalkyl substances (PFAS) in sewage sludge: A comprehensive review, Journal of Hazardous Materials, Volume 466, 2024, 133637, ISSN 0304-3894, https://doi.org/10.1016/j.jhazmat.2024.133637.

Long-Term Biosolids Management Strategy

Saanich Peninsula Water & Wastewater Commissions

May 15, 2025

Core Area Wastewater Treatment System



CRD

Residuals Treatment Facility

Biosolids

- The RTF produces approximately 10 tonnes of dried (over 90% solids) Class A biosolids each day.
- Biosolids are tested regularly for metals and pathogens- results are posted on the CRD website.

GHD

Long-Term Biosolids Beneficial Use Option Analysis

Capital Regional District

05 July 2023

→ The Power of Commitment

Long-Term Biosolids Management Plan

How did we get here?

- **July 2023**: Options analysis
- **January-March 2024**: Consultation
- **June 12, 2024**: Approval by CRD Board
- **March 2025**: Endorsement by Minister of Environment & Parks

Long-Term Biosolids Management Plan

The options in the Long-Term Biosolids Management Strategy will be utilized under a prioritization structure:

Tier 1
Advanced thermal demonstration plant

Tier 2
Out-of-region compliance options

Tier 3
In-region contingency options

Tier 1

Advanced Thermal

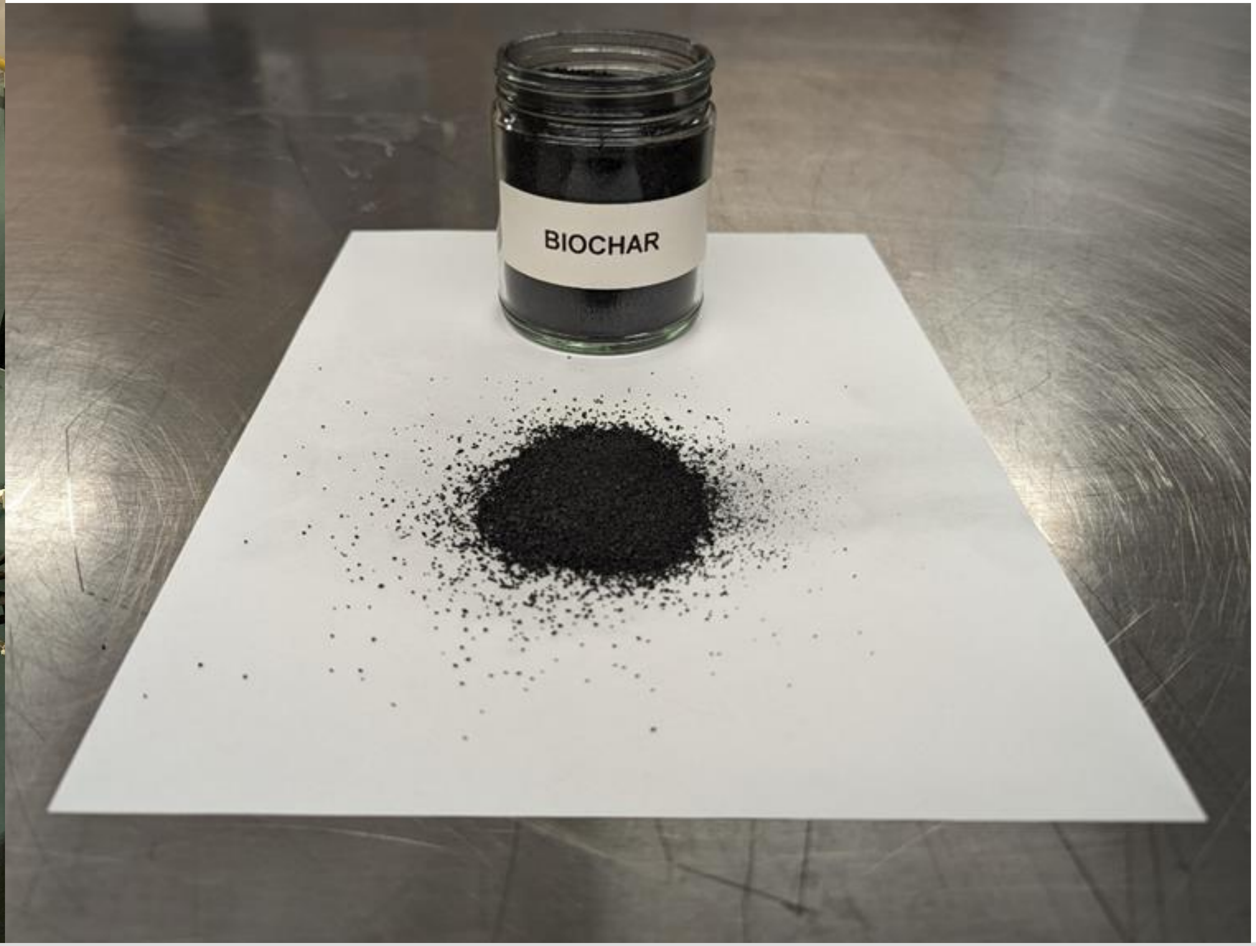
The CRD's preferred, long-term solution for managing biosolids.

Advanced thermal techniques (pyrolysis & gasification) are emerging technologies that process biosolids into a biochar. Contaminants have been shown to be reduced in the biochar.

The CRD is currently procuring a demonstration facility, to test the technology over a longer time period, and under a range of operational conditions. Outcomes from the demonstration will serve as the basis for a scaled, long-term solution.

Tier 1

Advanced Thermal



Tier 2

Out-of-Region Compliance Options

Options the CRD will use to ensure regulatory compliance is achieved while the advanced thermal facility is being implemented.

These include (in priority order):

- Continue alternative fuel combustion in the cement manufacturing facility in Richmond, BC
- Industrial land reclamation such as mine and quarry sites (Cassidy quarry reclamation)
- Forest fertilization
- Production of biosolids growing medium and/or feedstock in soil production (Fraser Valley cedar nursery)
- Partnerships with established biosolids programs

Tier 2

Out-of-Region Compliance Options

- Alternative fuel in a cement kiln
- Fabrication of a growing medium used for reclaiming the surface of a gravel quarry.
- Fertilizer replacement at a cedar nursery
- Incineration for energy at Metro Vancouver's WTE facility

Tier 3

In-Region Contingency Options

Contingency options to ensure compliance with regulatory requirements.

The CRD will implement Tier 3 options on a contingency basis, when options within the Tier 2 portfolio are unavailable.

The CRD will implement Tier 3 options only when options within the Tier 2 portfolio are unavailable, and only after receiving explicit consent from the Board and consulting and engaging with any affected First Nations, should the need for Tier 3 arise.

These include (in priority order):

a) Industrial land reclamation such as mine and quarry sites (acknowledging that some reclaimed sites may eventually have a pastureland end use)

b) Forest fertilization

c) Engineered cover systems at Hartland Landfill; subject to space availability and cover needs

Thank you

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