REGIONAL DISTRICT OF NANAIMO

BIOSOLIDS MANAGEMENT OPTIONS USED IN OTHER JURISDICTIONS

RECOMMENDATION

That the Board receive for information the report on viable biosolids management options used in other jurisdictions.

BACKGROUND

This report is a follow-up to Motion 21-564, passed at the November 9, 2021 regular Board meeting:

> *That staff be directed to provide a report on an assessment of viable biosolids disposal options being utilized in other jurisdictions for future consideration by the Board.*

RDN Biosolids Management in Context

Two relatively unique features influence biosolids management options available to the Regional District of Nanaimo (RDN):

- Island communities face different geographic and transportation challenges compared to most of the country. The most sustainable options for the RDN are likely based on Vancouver Island.
- While many large forests in Canada are on Crown land, Vancouver Island has a large area of privately owned forestlands. Private forestlands are excellent candidates for forest fertilization.

Other factors that influence biosolids management options available to the RDN include:

- **Annual Production:** The RDN produces about 1,300 tonnes of Class A biosolids at French Creek Pollution Control Centre and about 6,200 tonnes of Class B biosolids at Greater Nanaimo Pollution Control Centre. Biosolids production generally increases proportionately with population growth.
- **History of Success:** The RDN has a two-time award-winning biosolids management program and currently manages biosolids in a Forest Fertilization Program and a Soil Fabrication Program. These programs are generally accepted and supported by the public.
- **Regulatory Requirements:** In Canada, each province sets its own policies for municipal biosolids. In BC, the Organic Matter Recycling Regulation (OMRR) governs the construction, production, distribution, storage, sale and use of biosolids and compost. The Canadian Food Inspection Agency regulates biosolids if they are imported or sold in Canada as a fertilizer or soil supplement.
- **Best Practice Guidelines:** Both the Provincial and Federal governments promote best practice guidelines that extend beyond the regulation and encourage the beneficial use of biosolids.

Methodology for the Review of Biosolids Management Options Used in Other Jurisdictions

A list of biosolids management options used in other jurisdictions was developed based on information available through membership groups (i.e., Northwest Biosolids and National Benchmarking), an inquiry to the Ministry of

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Environment and Climate Change Strategy, expertise from the RDN's biosolids management consultant (SYLVIS Environmental Services Inc.), interviews with other jurisdictions, and internet research. While the scan looked worldwide, it focused on techniques used in Canada. Those techniques were then reviewed to determine which are viable for the RDN.

For this report, an option is viable if it:

- Can beneficially manage wastewater sludge, Class A biosolids, or Class B biosolids in the volumes produced by the RDN; and
- Is proven to be technically and financially feasible in Canada and has advanced beyond pilot or demonstration stage.

Landfilling and incineration without waste-to-energy (i.e. direct disposal) offer no benefit and are discouraged by the Province and the Federal government (through the Canadian Council of Minsters of the Environment). Therefore, neither landfilling or incineration without waste-to-energy are considered viable options in this report. Further, biosolid direct disposal does not align with goals in the Liquid Waste Management Plan or support the Board Strategic Goal of 90% waste diversion.

Limitations

This review comments on some space requirements for listed biosolids management options but does not determine whether RDN facilities have space to implement different options or if off-site management areas are available. Similarly, this review comments on the general scale of the cost of some options but does not determine the financial viability of introducing an option to the RDN.

Canadian Management Options

Table 1 provides Canadian examples of biosolids management techniques that may be viable options for the RDN.

Table 1. Canadian biosolids management techniques

Technique	Example Jurisdiction(s), Considerations, and Detail
Forest Fertilization	**Current Examples:** RDN **Past Examples:** Metro Vancouver, City of Prince George, Municipality of North Cowichan Class A or Class B biosolids are applied at an agronomic rate (a rate to match the soil's nutrient uptake) to forest stands with low nutrient concentrations and/or low organic matter content. Fertilization improves tree growth, increases the soil's ability to hold water and returns carbon back to the soil to be stored. Forest fertilization is a proven management option used in BC, Washington State, and New Zealand and Sweden and has minimal requirements for infrastructure and technology.
Soil Fabrication	**Current Examples:** RDN, Metro Vancouver, City of Winnipeg (MN), City of Ottawa (ON) Class A or Class B biosolids mixed with other feedstocks (e.g., wood waste and sand) to fabricate soil. Class A biosolids can be blended into a Biosolids Growing Medium that can be used commercially and applied without a Land Application Plan. Class B biosolids can be blended into a Residuals Growing Medium and applied under a Land Application Plan. Soil fabrication requires the addition of other feedstocks but costs are kept relatively low since this technique does not require sophisticated equipment or technology. Details on using fabricated soil as cover on landfills or mines appear in the rows below.

Technique	Example Jurisdiction(s), Considerations, and Detail
Final Cover for Landfill Closure	**Current Examples:** RDN (at the Harmac Landfill), Metro Vancouver **Past Examples:** Thompson-Nicola Regional District Class A or Class B biosolids are blended with other feedstocks to fabricate a nutrient-rich soil that acts as a fertilizer to promote growth and facilitates revegetation. Biosolids application can reduce the climate impact of greenhouse gas emissions from the landfill, as most of the methane passing through the fabricated soil is oxidized by microbes and turned into carbon dioxide, which is a less potent greenhouse gas. The RDN could use a biosolids product as final cover for the future closure of sections of the Regional Landfill. The volume of biosolids managed in this way would be relatively low but this could be a temporary option to diversify the overall biosolids management program.
Mine Reclamation	**Current Examples**: Metro Vancouver, City of Kamloops (using compost), City of Vernon, City of Chilliwack, City of Edmonton (AB), Region of Waterloo (ON) **Past Examples:** RDN Closed mines typically have poor quality, rocky soils that are often very low in organic matter and/or nutrients. Biosolids can be applied on their own or blended into a reclamation soil mixture. Biosolids applications also assist with slope stability and erosion control. An assessment of biosolids management options performed for the RDN in 2016 did not identify any nearby mine sites that require reclamation. Future mine reclamation projects may require transporting biosolids a significant distance.
Ranchland and Agricultural Fertilization	**Current Example:** City of Campbell River, Metro Vancouver, City of Prince George, City of Calgary, City of Abbotsford, City of Edmonton, Alberta Capital Region Wastewater Commission, City of Red Deer (AB), City of Saskatoon (SK), City of Steinbach (SK), Region of Waterloo (ON), City of Ottawa (ON), City of Toronto (ON), Region of Durham (ON), Halton Region (ON), Niagara Region (ON), City of Greater Sudbury (ON), City of Guelph (ON), Halifax Regional Municipality (NS), City of Charlottetown (PEI) **Past Example:** RDN Biosolids are applied at an agronomic rate as an alternative or supplement to fertilizer. This technique does not require sophisticated equipment or technology. If considered for the RDN in the future, this option would likely have a limited capacity since the agricultural land base near RDN biosolids generating facilities is relatively small. Further, much of the agricultural land is used for high-productivity, intensive agriculture (i.e., dairy farming) which generally does not require a fertilizer like biosolids.

Technique	Example Jurisdiction(s), Considerations, and Detail
Composting	**Current Examples:** Town of Ladysmith, Comox Valley Regional District, Town of Gibsons, District of Sechelt, District of Squamish, City of Kamloops, City of Kelowna, City of Vernon, Regional District of Central Okanagan (at a site in AB), City of Penticton, Metro Vancouver, City of Calgary (AB), Alberta Capital Region Wastewater Commission (AB), City of Winnipeg (ON), Greater Moncton Wastewater Commission (NB), City of Fredericton (NB), City of St. Johns (NL) **Past Example:** RDN Composting is a widespread biosolids management option in BC. Dewatered sludge or biosolids are blended with a bulking agent (e.g., wood chips, sawdust, yard trimmings) that provides carbon and increases porosity. Microorganisms in the presence of oxygen break down the organic matter and turn the product into compost. The addition of the bulking agent greatly increases the volume of the product. Compost generators must also establish a consistent market for the compost. Composting facilities require operational space and odour buffers that likely exceed the space available at existing RDN wastewater treatment facilities. If transported to a new facility, compost producers need to set up or alter their operations to include biosolids in their process.
Marginal Land Improvement	**Current Examples:** City of Powell River, Municipality of North Cowichan, City of Calgary, City of Greater Sudbury (ON), Halifax Regional Municipality (NS) The term 'marginal land' is often used to mean less-than-ideal land, however in an economic sense it means land that has little agricultural value because crops produced from the area would be worth less than any rent paid to access the area. Class A or Class B biosolids can be applied to marginal lands to add organic matter and plant-essential nutrients, enhance soil properties (e.g., tillage, water holding capacity), and improve productivity. In some cases, biosolids application can be used to manage invasive species like Scotch broom. RDN biosolids could be used in marginal land improvement projects, subject to site availability.
Willow Biomass Production	**Current Example:** City of Calgary, City of Edmonton Biosolids are applied to marginally productive land to improve soil quality and provide nutrients to grow short-rotation crops like willow and produce wood fibre for composting, livestock bedding, landscaping, and biofuel. Calgary received Federal grant assistance to expand their program and now operates with 300 ha of established willows. Considerations when selecting a suitable site include available land, transportation distance, soil nutrient requirements, access to water for irrigation, and equipment accessibility. Examples are based on Alberta's soil and climate conditions; however, an estimated 250 hectares of suitable land could potentially manage the annual production of RDN biosolids.

Technique	Example Jurisdiction(s), Considerations, and Detail
Thermal drying (Pelletization)	**Current Examples:** Capital Regional District, City of Hamilton (ON), City of Toronto (ON), City of Laval (QC) **Future Example:** Metro Vancouver Using a relatively new technology in Canada, sludge or biosolids are dried at high temperatures to produce pellets that can be used as a biofuel, fertilizer, or soil conditioner. Drying removes a significant amount of moisture and reduces the volume of the product. Capital, operating, and maintenance costs are high. Facilities must also be designed to mitigate the fire and explosive potential of pellet manufacturing. The Capital Regional District (CRD) is using this technique as their short-term beneficial use strategy. The CRD transports dried biosolids pellets to Lower Mainland cement plant and pays the company to use biosolids pellets as an alternative fuel source. Ash from combustion is integrated into cement products. City of Hamilton began operations in 2020. The project received Federal grant funding. Pellets are used as a food-grade fertilizer or a fuel source. Metro Vancouver plans to build a biosolids dryer to pelletize sludge, with construction currently estimated to start in 2024. Metro Vancouver's cost estimate was $197 million in 2019 and increased to $337.7 million in fall 2021. If a sustainable market for the purchase of this product develops on Vancouver Island, the RDN could consider this technology in the future. If all of the RDN, CRD, and Metro Vancouver use this technique at the same time, there may be competition for the local pellet market.

Emerging Technologies

Table 2 presents several emerging technologies for biosolids management. These examples are covered for interest but not considered viable options for the RDN because they are not yet proven in Canada. Further, they require a large capital investment, and such projects tend to be adopted by jurisdictions with a larger tax base and in combination with significant grant support from senior levels of government.

Table 2. Emerging technologies for biosolids management

Technology	Description	Jurisdiction / Status
Hydrothermal Liquefaction	This new technology applies heat and alkaline materials to sludge to produce a transportation biofuel or liquid fertilizer instead of biosolids.	**Metro Vancouver:** Pilot planned
Gasification	Gasification is the high-temperature treatment of biosolids in a closed tank with limited, controlled oxygen supply. This converts biosolids into gas (carbon monoxide, hydrogen, and methane), and a very small amount of inert ash. The gas can be reused as an energy source and the inert solids can be reused as a soil amendment or for other purposes.	**Linden, USA:** Achieved mechanical completion in 2021
		City of Lebanon, USA: Operational
		District of Delta Diablo, USA: Site selection and permitting
		City of Logan, Australia: Demonstration

Technology	Description	Jurisdiction / Status
Pyrolysis	Pyrolysis is the high-temperature thermal treatment of biosolids in the absence of oxygen. The manipulation of operational parameters such as retention time, heating ramp rate, and maximum temperature, which allows for optimization of maximum solid by product (biochar), liquid (bio-oil), and gas (biogas) production.	**Maui, USA:** Construction
		Silicon Valley Clean Water, USA: Operational
Fluidized Bed Incineration	Preheated air is used to fluidize a bed of sand in a controlled, high-temperature tank, and biosolids are then mixed with the sand. The resulting large surface area in combination with ample oxygen leads to highly efficient combustion. This produces ash that can be reused as a soil amendment or for incorporation into cement products.	**Northeast Ohio Regional Sewer District, USA:** Operational

Conclusions and Next Steps

The review of biosolids management options used in jurisdictions across Canada found that:

- 98% of the jurisdictions listed in Table 1 manage biosolids using land application.
- The RDN's current biosolids management techniques are a good fit for the challenges and opportunities unique to this region.
- No other options have merits that far outweigh the options currently used in the RDN.

Next steps include:

- Continue to monitor advancements in biosolids management in other jurisdictions in Canada.
- Liaise with staff from other local governments to keep informed of developing biosolids management strategies in those jurisdictions.
- Continue to pursue the existing programs as long term biosolids management strategies for the region.
- Consider other viable options and pilot programs to diversify the biosolids management program.
- Monitor emerging biosolids management technologies in the spirit of continuous improvement.

FINANCIAL IMPLICATIONS

There are no financial implications to receive this report for information.

STRATEGIC PLAN ALIGNMENT

Environmental Stewardship - Protect and enhance the natural environment, including land, water, and air quality for future generations.

Biosolids are rich in nutrients and may be beneficially used to improve soil conditions and provide nutrients to support plant growth. The Liquid Waste Management plan commits to the beneficial use of biosolids.

- **Forest Fertilization:** Biosolids applied for forest floor will release nutrients over several years, providing a sustained source of nutrients and improving tree growth. Due to their high organic matter content, biosolids applications improve the soil's water holding capacity, thereby decreasing run-off and erosion and improving resistance to drought conditions.

- **Soil Fabrication:** It can take hundreds to thousands of years for the earth to create a few centimetres of soil because soils form from the weathering of solid rock and the breakdown of organic material. Even with the assistance of glaciation, which speeds up the weathering process, soils take tens of thousands of years to form. Biosolids management can fabricate soil products in only a few months, turning an often-finite resource into a sustainable resource.

Environmental Stewardship - Achieve the 90% waste diversion target as per the Solid Waste Management Plan.

Reusing biosolids diverts biosolids from the Regional Landfill and helps the RDN meet this target.

Climate Change - Be leaders in climate change adaptation and mitigation, and become net zero by 2032.

Productive forest stands represent the largest active carbon sink system in the region. The RDN biosolids forest fertilization program provides nutrients and carbon to the forest floor and accelerates the capture of carbon in the aboveground forest stands.

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