DISCUSSION PAPER

Capital Regional District
Core Area Wastewater Treatment Program

Biosolids Management Strategy

Discussion Paper – Biosolids Management Strategy
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1 Objective

Biosolids management constitutes a significant element in any wastewater management program. Accordingly, over the past two years the CRD has invested significant effort to develop a biosolids management strategy that meets the needs and goals of the broader wastewater management program. The strategy developed recognizes key global drivers - resource limitations, energy efficiency and self sufficiency, climate change - while balancing the pursuit of evolving approaches with an appropriate level of risk mitigation.

This Discussion Paper describes the adopted biosolids management strategy and how the CRD will move forward as the Core Area Wastewater Treatment Program advances from conceptual planning to the implementation phase.

2 Strategy Elements

2.1 Overview

Biosolids, by definition, are primarily an organic, semi-solid *wastewater product that remains after solids are stabilized … and are suitable for beneficial reuse* (Tchobanoglous et al. 2003). Discussion Paper 036-DP-4 describes the adopted Distributed Wastewater Management Strategy and approaches/technologies identified to stabilize wastewater solids and concurrently extract energy and resources as part of these solids processing activities. Key elements of this processing include anaerobic solids digestion, biomethane production with the green fuel produced used in the community natural gas system, and phosphorus recovery to produce a commercial-grade slow release fertilizer product. The resulting stabilized and dewatered product is biosolids, which is the focus of this paper and following discussion.

The biosolids management strategy recognizes that biosolids can best be managed through a multi-use zero waste strategy. A small portion of the biosolids produced will be directed to a willow coppice demonstration program. This is an emerging biosolids management approach that has significant benefits in terms of greenhouse gas management and production of a value-added final

product. The remaining biosolids will be further dried for use as a green fuel in the industrial sector. The initial target customer would be the cement manufacturing sector, where the current use of coal would be partially off-set by the use of the dried biosolids fuel. In order to not fully rely on third-party contracts, the thermal destruction of dried biosolids, either alone or in conjunction with solid waste residuals management, provides the CRD with another option for biosolids management.

The following sections further discuss the willow coppice demonstration program (Section 2.2), green fuel for industry (Section 2.3) and thermal destruction (Section 2.4).

2.2 Willow Coppice Demonstration Program

2.2.1 Description

Although a term unfamiliar to the general public, the term coppice refers to the purposeful short-rotation growing and harvesting of trees. Subsequent to planting, trees are allowed to grow for about 3 years before being mechanically harvested and allowed to grow for another 3 years. This cycle can be repeated many times (e.g. 7 cycles or 21 years) before the tree becomes ineffective in this application and is replaced.

In the context of a biosolids management program, land applied biosolids provide some of the macro- and micro-nutrients required by trees for their growth. Harnessing the sun's energy to drive biomass growth through photosynthesis, where biosolids provide some growth nutrients, leverages the energy potential contained in the biosolids. The harvested trees are chipped and thus the biomass is now in the form of woodchips. Woodchips are a value-added, saleable product that can be used in composting programs or other typical applications.

The potential also exists to sell the woodchips as a green fuel source to third-party energy-from-biomass utilities as these energy markets develop. In this context the biosolids-derived biomass may off-set energy that may have had to otherwise originate from fossil fuel sources. In this case the biomass off-sets the greenhouse gas emissions associated with fossil fuel use, where these emissions, unlike those of biomass combustion, are considered anthropogenic.

2.2.2 Why a Demonstration Program?

Biosolids-based willow coppice programs have seen limited implementation elsewhere in the world, most notably in Sweden. The mechanical equipment needed for such programs is commercially available. However, like any agricultural-type activity, the success of a coppice program will depend on many site-specific factors including tree type, land availability and topography, and soil and climate conditions. For these reasons, the CRD has elected to pursue a demonstration-scale program to generate information for use in assessing the long-term feasibility of such a biosolids management approach.

Besides addressing the scientific aspects of the approach, the demonstration program will also provide information on the markets and saleability of the woodchips for traditional uses. In addition, the energy-from-biomass sector in British Columbia is still in its infancy but is anticipated to develop over time. By first implementing a demonstration-scale program, the CRD mitigates its risk of generating a green fuel before local markets sufficiently develop.

In terms of scale, the demonstration program would utilize about 1% of the biosolids generated initially by the Core Area Wastewater Management Program. This program is of sufficient scale such that full-size equipment could be used and its use properly evaluated for the topography of the trial sites. At the same time, this scale would still practically allow intensive environmental monitoring of the site areas and thus produce the data needed for rigorous scientific assessment.

2.2.3 Program Elements

The main elements of the demonstration program will include:

- Detailed program development
- Procurement of the identified site(s) through purchase or lease
- Site preparation
- Planting of the trees
- Truck-haul transport of biosolids to the site(s) and land application
- Environmental monitoring of the site and the trees
- Harvesting and chipping of the tree biomass
- Woodchip sale

To implement the demonstration program at this scale the CRD will need to purchase or lease land sites with a total area of approximately 12 ha. The sites would be selected from marginal lands not normally used for conventional agricultural purposes and could originate from forest sector holdings.

Three sub-plots of 4 ha each will be developed, using sub-plots with dimensions of about 40 m x 25 m and areas for triplicates plots for each soil treatment / tree species being trialed. One 4 ha plot will be developed with a variety of willow clones with various biosolids application rates (e.g. 600, 900 and 1200 kg N/ha). Another 4 ha plot will be developed with alders, which are known to coppice but have not been actively coppiced elsewhere but may be more suitable to the West Coast conditions than willow species. The third 4 ha site will be dedicated to the slower growing non-composting hybrid poplar, of which much is known on the West Coast and therefore would serve as a comparison to the willow and alder coppice plots.

In all cases, the conditions in the soil, surface runoff from the plots, groundwater and the tree biomass will be monitored for heavy metals, pathogens and micro-constituents (e.g. endocrine disrupting chemicals). Greenhouse gas (carbon dioxide, methane, nitrous oxide) soil fluxes will also be monitored at the sites. The demonstration program would be operated for about 10 years (e.g. at least 3 planting-cutting cycles or longer) to provide robust scientific data.

2.2.4 Potential Partners

Globally there is much interest in wastewater-related resource recovery and the broader topic of energy security. As such, academic and research institutions such as the University of Victoria, University of British Columbia and Camosun College could be key partners in conducting the scientific research of the program. Wastewater industry organizations, such as the Water Environment Federation and Water Environment Research Foundation, could be engaged to lever research funding for scientific programs.

Locally, the Province of British Columbia has been notably proactive on these fronts and several ministries could be considered potential funding partners, including the Ministry of Environment and Ministry of Forestry. Similarly, the Canadian Forest Service is a potential federal government partner.

The idea of short-rotation tree harvesting has attracted attention from the private forest sector in British Columbia as a way to diversify their operations. These private companies are obvious partners in such a program.

Finally, biosolids management is of interest to other local utilities that provide wastewater services, such as Metro Vancouver and the Regional District of Nanaimo. The CRD already has working relationships with these utilities and a formal partnering in the demonstration program could be pursued.

2.3 Green Fuel for Industry

2.3.1 Description

Using biosolids to create a green fuel for the cement industry, or any other industry that typically uses coal as an energy source, requires that the biosolids first be dried to reduce its moisture content from approximately 70% to less than 5%. Once dried the biosolids have energy content similar to that of a low-grade coal and, as a result, can be combusted directly without limitation.

The biosolids management strategy envisions the CRD providing the infrastructure needed for biosolids drying, located in an industrial site within the Core Area. This infrastructure may be on the same site as other wastewater-related solids processing facilities, depending on land availability and area requirements. Although the CRD will incur costs

for facility construction and operation/maintenance, the dried biosolids will be a saleable, revenue generating green fuel product. The biogenic nature of dried biosolids makes it attractive to cement industries since it reduces the carbon footprint of their operations. The dried biosolids would be truck-hauled to cement kilns in the Lower Mainland.

Initially, the strategy envisions that 99% of the biosolids generated by the Core Area Wastewater Management Program will be dried and directed to the cement industry sector. In the future, should the coppice demonstration program prove successful and additional lands are available, biosolids quantities in excess of the initially installed dryer system capacity would be diverted to a full-scale coppice program. However, it is expected that production of a green fuel via dried biosolids would continue to be a significant long-term element of the District's biosolids management strategy.

2.3.2 Risk Mitigation

One of the initial key risks to the CRD is the successful engagement of the cement industry in its biosolids management strategy, where third-party contracts need to be developed and accepted. As the CRD moves from the conceptual planning to implementation phase of the Core Area Wastewater Management Program in July 2009, a priority activity will be to begin discussions with the local cement industry with a goal of securing the necessary contracts.

With the biosolids management strategy envisioning that the majority of biosolids will be dried to produce a green fuel for the cement industry, for the foreseeable future, the main risk for the CRD is the third-party contracts with the industrial sector. Once in place, if these contracts are terminated the CRD will have to direct the undried or dried biosolids elsewhere. In the short-term, the biosolids would be disposed of in the existing CRD landfill. Particularly if they are dried, the biosolids would have a minimal short-term impact on long-term landfill capacity. In the longer-term, another biosolids management option would be required, which is the focus of Section 2.4.

2.4 Thermal Destruction

As noted in Section 2.1, the thermal destruction of dried biosolids, either alone or in conjunction with solid waste residuals management, provides the CRD with a third option for biosolids management. The continued development of thermal technologies and the scale-based cost sensitivity of these technologies necessitates a detailed analysis of options available. In addition, provision of a regional facility that would accept biosolids and/or solid waste residuals from other utilities or municipalities may provide notable advantages and partnering opportunities.

To this end, as part of its risk mitigation activities during the early part of the implementation phase of the Core Area Wastewater Treatment Program, the CRD will concurrently pursue the analyses required to develop a biosolids end use strategy that focuses on thermal destruction.

3 Actions

In the conceptual planning of its Core Area Wastewater Treatment Program the CRD has developed an innovative biosolids management strategy that considers local and global issues while balancing the pursuit of evolving approaches with an appropriate level of risk mitigation. As the Program moves from the conceptual planning phase to the implementation phase in July 2009, the CRD need to pursue several key activities:

- Begin discussion with the Lower Mainland cement manufacturing industry with the objective of securing long-term dried biosolids acceptance contracts.
- Undertake a detailed study that investigates thermal destruction as a third option for biosolids management, which considers solid waste residuals in addition to biosolids and regional partnering approaches.
- Develop the willow coppice demonstration program and engage partners for its implementation.

References

Tchobanoglous, G., Burton, F.L., and Stensel, H.D. 2003. Wastewater engineering: treatment and reuse, 4th edition. Metcalf & Eddy, Inc and McGraw-Hill, Inc.