

ROOT: Re-earthing Organics on Thetis

An overview of composting on Thetis Island and the feasibility for an on-island community composting system

August 2021



This report was prepared by the ThINCpod of Summer 2021:

Charlotte Fesnoux

Jacob Frankel

Breanna Sadler

Connor McRae-Pharo



Table of Contents

1.0 Call to Action	3
1.0 Composting on Thetis Island	5
1.1 History of Local Initiatives	5
1.2 Composting Survey Results	7
2.0 Composting Regulations in BC	11
3.0 Possible Scenarios	13
3.1 Scenario 1: Centralized Composting System	13
3.1 (a) Jollity Farm	13
3.1 (b) Public Areas	18
3.2 Scenario 2: Decentralized Composting System	19
3.3 Scenario 3: Hybrid Composting System	21
3.4 SWOT Analysis	22
4.0 Compost Education	24
5.0 Discussion	26
6.0 Conclusion	28
Acknowledgements	29
References	30

1.0 Call to Action

The heat has been turned up on the issue of organic waste on Thetis Island. It is estimated that over a third of the food produced around the world is thrown away (FAO, 2021). In the Cowichan Regional District (CVRD), up to 30% of residential garbage going into landfills is organic waste (Tetra Tech, 2017). Treating organic waste as garbage has many problems. Contrary to popular belief, organic materials will not decompose in the anoxic environment of a landfill. Instead, organic materials break down *anaerobically*, releasing methane gas, which has 30 times the heat-trapping capacity of the more talked about greenhouse gas carbon dioxide (Princeton University, 2014), making food waste one of the leading causes of global climate change (WWF, 2021). Leachate, a concentrated liquid runoff from organic matter, can enter the groundwater from landfills, further spreading accumulated pollution and contaminants. Furthermore, organic waste takes up a large portion of space in landfills, and finding new sites for future landfills is often a lengthy and expensive process, and requires more land. As landfills reach their maximum capacity, local governments are searching for means to reduce and divert waste.

Composting provides a sustainable solution to this massive problem while offering other benefits. Composting is the controlled, aerobic and thermophilic biological decomposition of organic matter. It returns nutrients like carbon, phosphorus, and nitrogen (all essential nutrients for healthy plant growth) to the soil, while significantly reducing the release of methane. The application of high quality compost to crops means that the use of chemical, human-made fertilizers is reduced or eliminated. Compost is not only a minimal-effort low-cost fertilizer, it has high concentrations of organic matter which enhance water retention in soils. Compost revitalizes compacted, marginal, contaminated soils into a diverse rich resource that promotes higher yields of agricultural crops while reducing production costs for farmers. Composting not only benefits agricultural activities, but can aid in reforestation, wetland restoration, and habitat revitalization efforts (EPA, 2021). It is abundantly clear that composting has many benefits and is an effective means of organic waste diversion, allowing communities to reclaim an important resource from the municipal waste stream while reducing competition for space in landfills.

Like other Gulf Islands, Thetis does not have access to municipal organic waste collection services, nor does it have a community composting facility. Thetis Islanders must deal with their organic waste at a household level. Although a large proportion of Thetis Islanders compost, many still do not. Their organics often find their way into the waste stream and are hauled off the island in the form of garbage. Conversely, each spring, local farmers and gardeners have been importing finished compost by the truckload, further increasing the cost on the environment and one's pocketbooks. This dichotomy presents a clear solution: local, on-island composting, benefiting not only local gardeners and farmers, but the community as a whole. This solution however, is by no means a straightforward task and the complications have made the implementation of a community composting initiative on Thetis Island challenging.

After years of trying to establish a community composting system, Elisabeth Bond of Jollity Farm reached out to other members of the community for help. The Thetis Island Nature Conservancy

(ThINC) was contacted in March of 2021 and decided to take over this challenge. During the summer of 2021, a small team working for ThINC explored the potential for the creation of an on-island community composting system. ROOT: Re-earthing Organics on Thetis presents their findings and includes an overview of what has been done previously to promote composting on Thetis Island, a summary of the results of a survey that helped identify the composting habits of island residents, a discussion of current composting regulations in BC and how these impact the implementation of community composting systems, and a feasibility study based on community feedback and regulations. The ROOT report is a first step. It presents a pathway towards a community composting solution that will help create resilient soils for a resilient community.

1.0 Composting on Thetis Island

1.1 History of Local Initiatives

While many metropolitan areas across BC offer waste collection services, remote communities, including the Gulf Islands, need to be more creative. In collaboration with the CVRD, the Thetis Island Residents' & Ratepayers Association (TIRRA) operates an on-island solid waste and recycling depot, the TIRRA Solid Waste Site (SWS). While this facility has benefited the Thetis Island community tremendously, it does not collect nor process organic waste.

In response to this lack of organic waste services, Elisabeth and Noah Bond of Jollity Farm have been seeking ways to divert such “waste” away from landfills, and to encourage local composting on the island. Jollity has conducted surveys and educational workshops over the past five years or more, to raise awareness about composting and the important role it plays in a sustainable community.

For several years now Jollity has been working with TIRRA to collect organic waste from community members, who can drop off their organics at the SWS during open times, two days a week. These organics are then brought to Jollity where they are added to Jollity's agricultural waste and processed onsite. This system has only a minimum capacity and is not designed to be efficient nor is it able to collect larger volumes and produce more compost. Jollity has been seeking ways to expand their operation in order to divert more organic waste from the landfill and create more easily accessible, high quality compost for the farm as well as for local gardeners. In 2021, community members collectively purchased over \$10,000¹ worth of compost through Jollity from off-island sources, clearly demonstrating the need for an on-island source.

In 2019 - 2020, Jollity conducted research and spoke with provincial, regional, and Island Trust governing bodies in regards to expanding their composting activities. The proposed compost operation was to be professionally planned by a certified agrologist, John Paul PhD PAg from Transform Compost Systems.

To support the composting initiative, Jollity explored various grants, including the FCC AgriSpirit Fund. To ensure that public funds are used to support projects that benefit the public, the FCC AgriSpirit grant requires that a registered charity applies or a non-profit organization partnering with a local government entity. In collaboration with TIRRA, Jollity approached the CVRD to partner in this venture. The CVRD declined, stating that, “if the compost facility was on TIRRA property, was a TIRRA program, and there was a clear plan for the public use of the compost product, the CVRD may be able to support the application” (March 11, 2020).

¹ This figure is likely much more as it does not include those who did not purchase through Jollity Farm. Additionally, a significant portion of the \$10,000 was shipping costs.

Thetis Island Land Use Bylaws (Bylaw NO. 89) also posed a barrier. According to Islands Trust planner, Marnie Eggen, a composting facility on Thetis Island is only permitted on land zoned Public Utilities (S-2). She advised Jollity to apply for rezoning from the current Rural Residential (R-2) zoning to S-2, a process that could take six months to two years at a cost of approximately \$2000.

TIRRA's hesitancy to implement a composting system at the SWS stemmed from their agreement with the BC Ministry of Highways and Infrastructure, who own the land. The SWS is a not-for-profit operation, with user fees for garbage, and parcel taxes for recycling and site overhead. As part of the lease, TIRRA is required to minimize structures, and manage the property so as to avoid any contamination, water run-off issues, and maintain the site in pristine condition. While the Thetis Island Official Community Plan (OCP) promotes composting, current Thetis Island Land Use Bylaws prohibit any activity which could, through purposeful actions or accidents threaten the ground water by leachate, increase vermin favoured environments, or contribute to odours in residential neighbourhoods.

In March 2021, Jollity Farm and TIRRA asked ThINC, under its community food security mandate, to create a proposal that would help push a community composting initiative forward. The initiative became ThINC's selected focus project during the summer of 2021.

1.2 Composting Survey Results

An initial step in the ROOT project was to gain insight into the composting habits of Thetis Islanders as well as to gauge the level of interest in a community composting initiative. In June 2021, a survey was circulated to the Thetis Island community for a period of two weeks. The online component of the survey was disseminated through eSPOKES, Facebook, and the ThINC website, and received 69 responses. Sixteen additional responses were acquired in-person over the course of a Saturday at two local markets on the Island: Howling Wolf Market and Jollity Farm Market. This resulted in a total of 85 responses: 78.8% full-time residents and 21.2% part-time residents. As Thetis Island has a total adult population of approximately 365, the survey reflected roughly 23% of the island's adult population. It is important to note that the results of the survey only reflect a sample of the Thetis Island community, and likely attracted those who are already interested in composting.

Key findings from the survey are summarized in the following paragraphs.

The vast majority of respondents (92.9%) compost, and nearly 60% view composting as 'extremely important' (Figure 1). Only two respondents viewed composting as 'somewhat important', and no one stated that it was 'not at all important'.

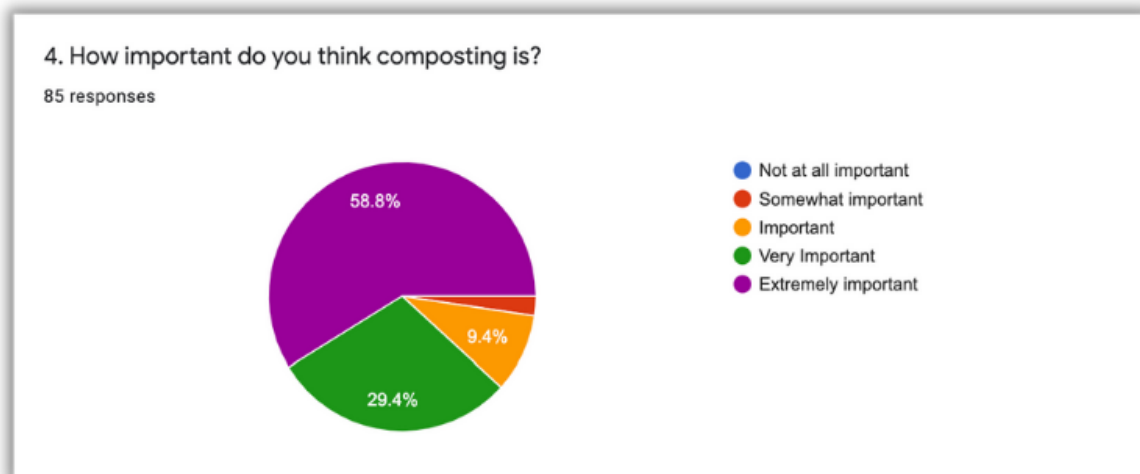


Figure 1. Community Composting Survey, Question 4

The most popular method of composting at 56.5% is an enclosed composter, such as a black bin². Over 60% of participants are interested in having access to a system that could properly process their meat and/or dairy products. Forty-five percent of respondents felt there were no barriers to prevent them from composting, however other participants identified wildlife and lack of know-how as the main obstacles to composting.

² Unfortunately, as blackbins are static, they need to be aerated manually (flipped, stirred). They can also harbour pathogens and attract unwanted wildlife, such as rats. Because of this, it is not recommended that dairy and/or meat products be put into such composters.

Almost one-third of participants felt 'proficient in proper methods of composting'; 24.7% did not; and 43.5% said they sometimes felt they were. However, 90% of participants were interested in improving their current composting methods through education such as attending workshops (61.2%) and reading articles shared with them (70.6%) (Figure 2). One person commented that, "it would be helpful to have someone knowledgeable come to my home to see if what I am doing can be improved."

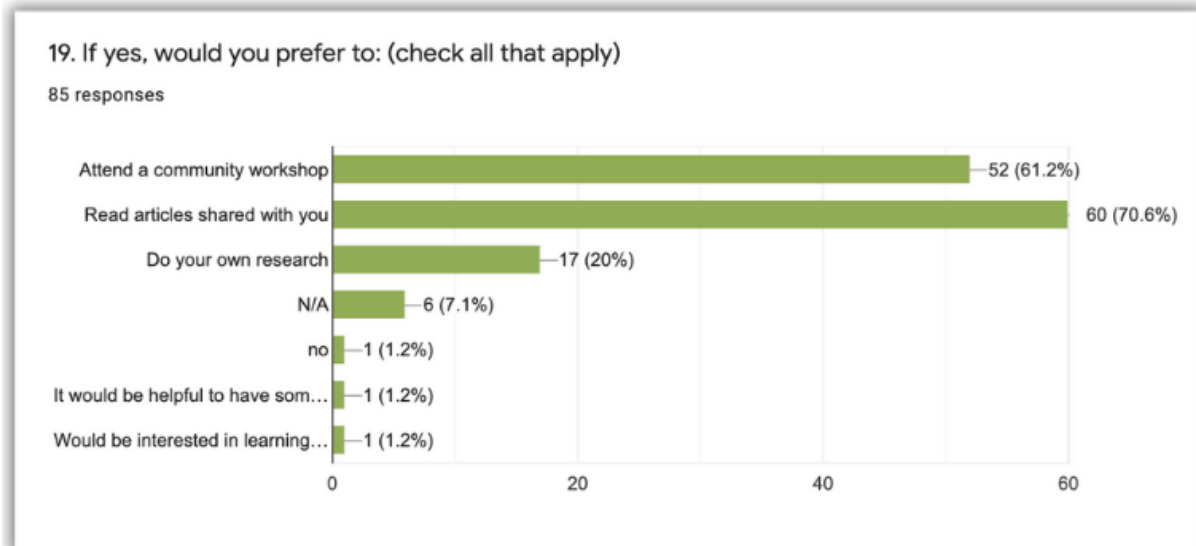


Figure 2. Community Composting Survey, Question 19

Sixty percent of respondents stated that some or all of their compost came from off-island, and nearly 72% of respondents said they would be interested in acquiring more compost on-island. This compost would undoubtedly be used as a soil amendment as a whopping 89.4% of respondents engage in either gardening (76.5%) or farming (12.9%) on Thetis Island!

The vast majority of respondents (94.1%) expressed interest in a community composting initiative, either for their own benefit or for the benefit of the community (Figure 3).

When asked what form of community composting system participants would be interested in³, over 50% expressed interest in education to improve home/community composting. Almost 45% were in favour of a centralized composting system (at Jollity Farm), 40% preferred a decentralized system, and just over 41% of respondents liked the idea of a hybrid system. A few comments were made that the centralized system should not take place on private property. One person suggested the TIRRA solid waste and recycling depot⁴, while another person said "whatever works best for the people managing the system".

Respondents felt that a community system should be financed by: pay-by-use (nearly 65%), grants (over 57%), and donations (46%). However, these results are dependent on the 'type' of

³ Respondents had the option of choosing more than one answer

⁴ TIRRA's SWS was not included in the survey as at the time it was not considered to be a candidate

system that would be implemented (e.g., centralized vs decentralized; on private property vs on common property, etc). Twenty percent of responses made up the 'other' category with the most popular answer being that the system should be financed through the sale of the finished product.

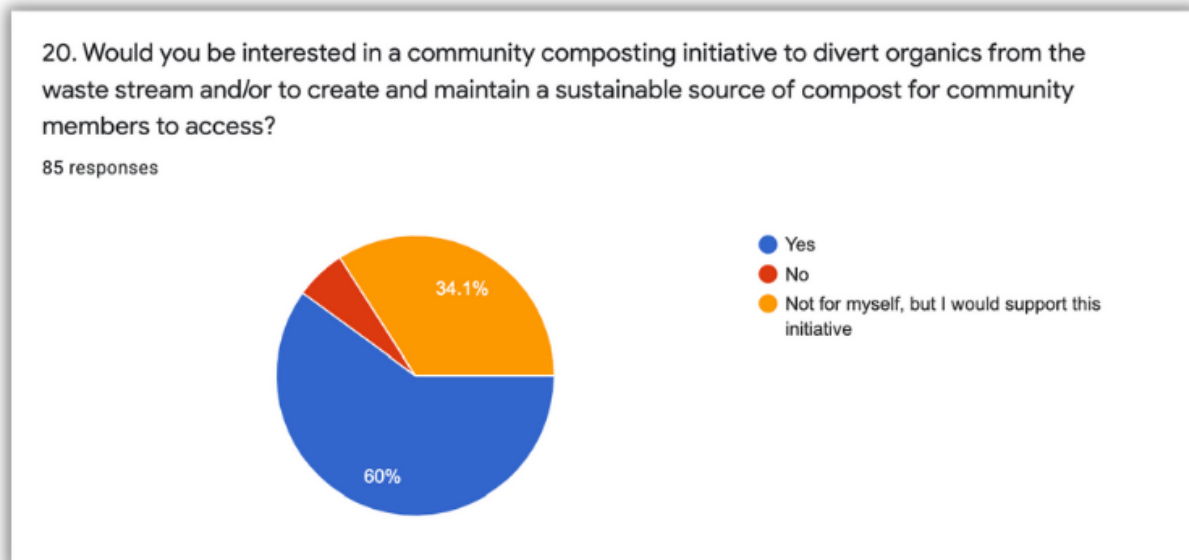


Figure 3. Community Composting Survey, Question 20

As the majority of respondents already compost (92.9%), it was important to know *how* Thetis Islanders would intend to engage in the system. Results showed that 55.3% were interested in buying compost, 54.1% were keen to contribute to the system by donating their organic waste, and over 23.5% were interested in volunteering (Figure 4).

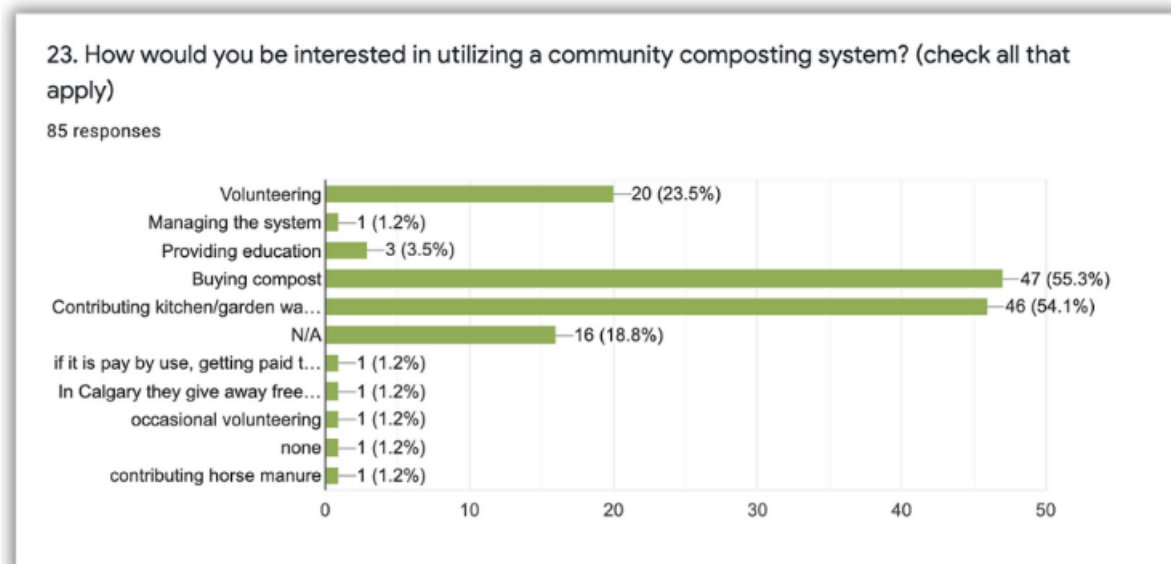


Figure 4. Community Composting Survey, Question 23

The main results of this survey indicated that people are interested in learning more about composting, would support a system that could deal with dairy and meat products, and would be interested in a system where people could receive compost in return for their involvement. Part-time residents also expressed an interest in composting, but many found it challenging as they were not resident on the island long enough to establish their own composting system. Some included their organics in their garbage, while others buried it or brought it with them off-island to be disposed of in their home community. The main concerns expressed revolved around the cost of the project, its operation in terms of 'man-power', and the location and accessibility of the potential site.

Although the survey results reflect only a sample of the Thetis Island community, they provided insights into the composting habits and interests of the community, which helped guide the project.

2.0 Composting Regulations in BC

Community composting systems in BC are subject to a multitude of regulations and enactments. At the provincial level, the government creates legislation that regulates waste management through various acts, including the *Environmental Management Act* (EMA), the *Public Health Act* (PHA), and the *Agricultural Land Commission Act* (ALCA) (Hulse, 2015). Specifically, compost is regulated through the [Organic Matter Recycling Regulation](#) (OMRR)⁵; the Agricultural Waste Control Regulation (AWCR); the Agricultural Land Reserve Use, Subdivision and Procedure Regulation (ALRUSPR); and the Mushroom Production Facilities Regulation (MPFR) (Hulse, 2015). Other enactments may also affect the siting of composting facilities and treatment, and discharge of leachate, for example the Groundwater Protection Regulation. The provincial acts also give regional and municipal governments the ability to create bylaws that regulate waste management, including composting (Hulse, 2015).

OMRR is the principle regulation concerning composting in BC. It “governs the construction and operation of compost facilities and the production, distribution, storage, sale and use of biosolids and compost. It provides guidance for local governments and compost and biosolids producers on how to use organic material while protecting soil quality and drinking water sources ([Government of BC, 2021, a](#)).” OMRR also defines what feedstock materials/inputs can be used in a composting facility. Every facility, regardless of what they are composting or their production rates, must comply with the OMRR, with some [exemptions](#) (Government of BC, 2021, b). These include:

- Backyard composting – the composting of food waste or yard waste, or both, at a site where:
 - a) the food waste or yard waste is generated by the residents of a residential dwelling unit, *and*
 - b) the annual production of compost does not exceed 20 cubic metres;
- Agricultural composting – the composting of agricultural by-products in accordance with the Code of Practice for Agricultural Environmental Management, except it does not include:
 - a) human or animal food waste that is diverted from residential, commercial or institutional sources,
 - b) waste materials derived from non-agricultural operations, *or*
 - c) wood waste derived from land clearing, construction or demolition;
- Demonstration gardens – demonstration gardens for the composting of yard waste in quantities not exceeding 100 cubic metres per year

There are two authorization processes for composting facilities, depending on size and waste stream. Facilities “that process food waste and/or biosolids, and possess the design capacity to

⁵ OMRR: <https://www2.gov.bc.ca/gov/content/environment/waste-management/food-and-organic-waste/regulations-guidelines>

produce 5,000 tonnes or greater of finished compost per year (must) obtain a permit or operational certificate” ([Government of BC](#), 2021, c). Smaller facilities that compost less than 5,000 tonnes dry weight of finished compost per year processed from any feedstocks listed in the [OMRR](#)⁶ require authorization from the Ministry of the Environment (MOE) ([Government of BC](#), 2021, d). To do so, a [Notification](#)⁷ must be sent to the MOE 90 days before the operation starts, and must include:

- A copy of a personnel training program plan that addresses the site-specific training needed to operate the compost facility in compliance with the Regulation
- An operating and closure plan for the facility, developed by a qualified professional
- Design plans and specifications for the facility, developed by a qualified professional
- A leachate management plan for the facility, developed by a qualified professional
- An odour management plan for the facility, developed by a qualified professional

There are some situations where this regulation, while still applicable, is subject to other laws depending on the location of the facility, such as on land in the Agricultural Land Reserve (ALR), or the type of material used as a feedstock (Hulse, 2015). If the composting facility is located on land in the ALR, a notification must also be sent to the Agricultural Land Commission (ALC).

In addition to provincial regulations, local governments have the authority to regulate composting facilities through bylaws under the Local Government Act (LGA), Community Charter, and the Environmental Management Act (EMA) (Hulse, 2015). Although provincial regulations take precedence over local bylaws, local governments can enact restrictions or conditions that are more stringent than provincial regulations and that do not conflict with them (Hulse, 2015).

Under Section 25(3) of the EMA, Regional Districts have the authority to manage municipal solid waste within their district ([Government of BC](#), 2021, e). In relation to composting facilities, Regional Districts create bylaws that include: regulating, prohibiting or respecting the handling of recyclable material; the management of compost facilities; requirements that a facility operator hold a recycler licence, comply with a code of practice, or provide security or insurance; the enforcement of bylaws; and the provision of penalties (Hulse, 2015, p. 29).

Unlike Regional Districts, municipalities do not have any specific jurisdiction to regulate composting facilities. However, with respect to compost operations outside the ALR, a municipal government can enact bylaws that regulate land use and zoning, business licencing, nuisances (Hulse, 2015), and buildings. These powers are granted by the Community Charter and the LGA. With respect to composting operations within the ALR, municipalities have limited regulatory power and cannot prohibit a “farm-use” facility (Hulse, 2015, p. 31).

⁶ Organic matter suitable for composting: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/18_2002#Schedule12

⁷ The notification form has no attached application fee nor annual fee:

https://www2.gov.bc.ca/assets/gov/environment/waste-management/waste-discharge-authorization/guides/forms/epd-omr-03_omrr_notification_of_compost_facility_form.pdf

3.0 Possible Scenarios

3.1 Scenario 1: Centralized Composting System

The first community composting system being presented is a centralized system in which all municipal organic waste would be collected and processed in one location. A centralized facility would have the potential to effectively process large volumes of organic waste and would produce finished compost, available for all community members. The system would be more streamlined than a decentralized system as there would only be one location, and therefore fewer individuals would require training. However, a centralized facility would be a larger operation to manage, and would be more expensive to initiate.

Two sub-scenarios are explored in the following section: Jollity Farm and a public setting. The Jollity Farm scenario was the only centralized location proposed in the survey as at the time no public areas were presented as possible locations. However, new information suggests that there is potential for a composting site to be situated on TIRRA's SWS, and it will also be examined.

3.1 (a) Jollity Farm

Out of the 85 respondents, 44.7% of Thetis Island residents (full and part-time) that completed the recent composting survey said that they would be interested in a centralized facility at Jollity Farm. This is in comparison to 40% who preferred a decentralized system (e.g., distributed compost pods located throughout the island), and 41.2% were in support of a hybrid model.

A centralized composting operation at Jollity Farm (Lot 90, Pilkey Point Road) would include both a collection point and a processing site. The collection site would be situated in the first parking area just off Pilkey Point Road, and would be open daily so that members of the community could drop off their organic waste at their convenience. Based on the survey results and a conservative estimate of 0.5 kg/capita/day of food waste (Hoover & Moreno, 2017), it is estimated that Jollity Farm could collect upwards of 6.94 tonnes⁸ of municipal food waste per year⁹.

The long-term vision for the collection site would include a small shipping container covered by a mural using infographic style artwork to inspire as well as instruct the community on how to dispose of their waste into the correct bins. At night, the drop-holes would be covered by screens which would prevent rodents from entering.

⁸ Annual weight of municipal food waste collected at Jollity Farm: 38 participants x 0.5 kg/capita/day x 365 days/year = 6.94 tonnes

⁹ This estimate is provided for initial review, but detailed calculations would be made at the detail design stage and at that time a new survey could be put out that includes soliciting information on usage patterns

Three times a week, Jollity farmers would collect the organics and transfer them to the processing site where the municipal organic waste would be mixed with their agricultural waste and managed in accordance with the OMRR. To ensure that the materials are contained and can be managed with ease, as proposed, the site would be built upon an impermeable surface and sheltered by a roof (Figure 5).



Figure 5. O2 Composting Facility (source: O2 Compost)

Materials would be flipped by tractor through a multi-bay system: virgin materials, first flip, and final product (cured compost). The finished product would primarily be used on the farm (>50%), but excess compost would be shared with and sold to the community depending on individual needs and input from community members.

Two additional bays could be constructed to store cured compost and carbon rich materials¹⁰.

An alternative to the static pile (as described above), is an aerated static pile (ASP) system which maintains aerobic processes through forced air ventilation. The ASP system would have a smaller footprint than a windrow¹¹ or a static pile system, and would also be able to recycle its leachate. The ASP system has more expensive start-up costs, but is easier and simpler to maintain, resulting in improved risk management at lower labour cost (EPA, March 12, 2021).

Regulations

Although agricultural composting is exempt from the OMRR, farm sites that import organic material from elsewhere (e.g., residences, restaurants) and or sell/give away compost must comply with its regulations. Furthermore, as Jollity Farm is on residentially zoned land (R-2), it does not fall under the AEM Code of Practice, and again, requires compliance with the OMRR.

Facilities that process less than 5000 tonnes / year require a [Notification](#) (Government of BC, 2021, f) for 'Construction or Beginning Operation of a Compost Facility' to be submitted to MOE at least 90 days prior to the start of composting operation. The Notification includes documents as outlined in 'Regulations in BC'.

If the compost facility is located outside the ALR, and on land that is not zoned for Agriculture as a primary use, which is the case of Jollity Farm, it must also abide by the enactments set out by local government bylaws, including Thetis OCP Bylaw No. 88 and Regulatory Bylaw No. 89.

¹⁰ Carbon rich materials include wood chips, dried leaves, saw dust, etc.

¹¹ Compost organized into rows of long piles that are aerated periodically by either manual or mechanical turning

Note that Jollity has 'Farm Status'¹², which means they have met certain criteria, including "generating a minimum amount of gross income from a qualifying agricultural use based on the size of the parcel of land." (Government of BC, 2020, para. 5). Through the Farm Practices Protection Act (FPPA, aka Right to Farm) this may protect them from liability for nuisance claims arising from any odour, noise, dust or other disturbance resulting from a farm operation (Hulse, 2015, p. 39).

Jollity may also have to obtain a Waste Stream Management Licence (facility licence) from the Cowichan Valley Regional District (CVRD), as per Bylaw No. 2570, Waste Stream Management Licencing Bylaw (CVRD, a). The application requires documents similar to those of the OMRR notification: operating plan, closure plan, leachate plan, etc. all prepared by a qualified professional, and has a \$1000 application fee. To maintain the facility licence, monthly statements and throughput data are required as well as an annual administration fee of \$500. For more details, see Bylaw NO. 2570 (CVRD, b). However, after recent communications with Ilse Saraday, Environmental Technologist from the CVRD, under Bylaw NO. 2570 there may be potential for the CVRD Manager to waive the facility licence requirements if the facility adheres to the OMRR and if the municipal throughput falls under an unspecified volume¹³.

Thetis Island is not a part of a municipality, but it does exist within the Islands Trust area. Land use planning on Thetis Island is governed by the Islands Trust Act (ITA-1974) and the land authority under the Thetis Local Trust Committee (TH-LTC). The governance structure ensures that land use decisions in each LTC meet the various regulatory requirements, and embraces the unique "preserve & protect" mandate laid out under the ITA. Trust Council Programs Committee is currently undergoing a revision of its Policy Statement and part of the overarching lens being used is Climate Change. As part of the adaptation and building resilience within the Trust Area (TA), local farming plays an important role in increasing resilience as it builds food security. Given the island's interconnectedness with the sea, all farming activities must plan carefully to ensure they do not negatively impact the sensitive ecosystems that surround the farms. The TH-LTC does not regulate composting specifically, but it can enact other bylaws that impact composting operations. These include bylaws regulating buildings, land use, and nuisance. Jollity Farm is located upon land zoned R-2 (rural residential), on which agriculture is permitted as an ancillary use.

Currently, under TH-LTC bylaws, composting facilities on Thetis Island are only allowed on S-2 zoned properties (Islands Trust, 2017, a). This was confirmed on July 28, 2021 by Islands Trust Planner, Jamie Dubyna by email who also stated, in regards to the Jollity situation, "composting waste produced on-site could occur as part of the regular farming activity on the lot, but composting waste produced off-site would not fall under the permitted uses in the R-2 zone". According to local trustees, there may be potential for these bylaws to be amended to exempt composting. Additionally, an argument could be made to characterize imported waste materials

¹² Jollity Farm holds Farm Status both at Lot 90 and Lot 62

¹³ A number of attempts were made to obtain this number. It was recommended by Ilse Saraday that Jollity Farm conduct a pilot to better determine the tonnage of incoming residential food and yard waste.

as agricultural inputs, and to approach composting and compost sales as a home occupation use.

If this zoning hurdle was overcome, and all provincial and regional regulations were met, including compliance and the meeting of standards of the OMRR, Jollity Farm could legally collect and process municipal organic waste and sell/give away the finished composted product.

The following flowchart (Figure 6) illustrates the regulatory process Jollity Farm would have to undergo to include municipal organic waste into their composting system.

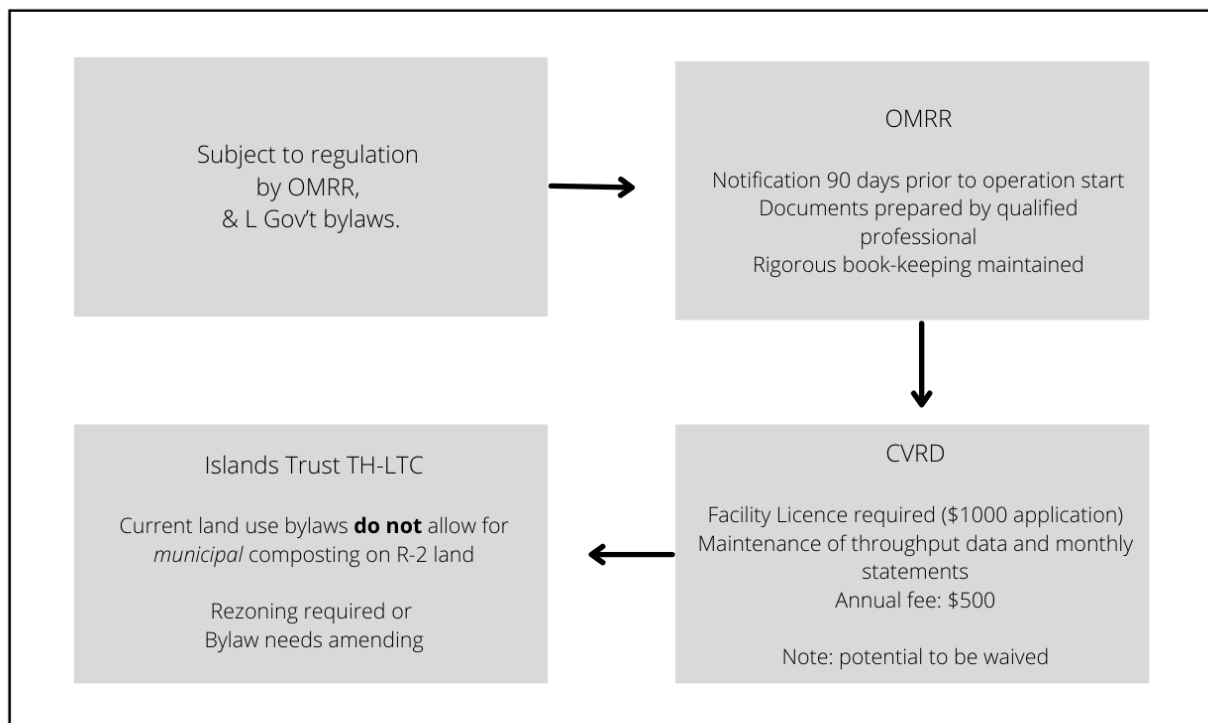


Figure 6. BC Compost Facility Regulatory Framework for Facilities not in the ALR (or agriculturally zoned land)

Project Cost and Funding

The cost of a small-scale composting facility would vary depending on the type of system (e.g., static pile, aerated static pile, in-vessel¹⁴, etc) and who does the work, but a project at the proposed scale is estimated to total around \$50,000¹⁵ in start-up capital (O2 Compost), not including the facility licencing fees for the CVRD. The majority of this cost (~ \$40,000) would be related to the infrastructure: commercial construction and materials, and could climb higher

¹⁴ In-vessel systems describe a group of methods that confine composting materials within a container or vessel

¹⁵ Quote for an ASP system

considering the current escalating cost of lumber. However, the use of locally sourced and milled wood and volunteer labour could reduce the cost of construction.

The OMRR notification is free, but the completion of accompanying documents is not as they involve design and specification by a qualified professional. Several qualified professionals on Vancouver Island and the Mainland offer these services, and through a competitive bid process such as a Request for Proposals (RFP), Jollity Farm could secure the most appropriate system and service package for their needs.

As previously mentioned, the licencing of the facility comes at a cost. The CVRD requires a \$1000 licencing fee as well as a \$500 annual fee. This does not include the costs related to the qualified professional who must prepare the documents for submission. Again, depending on the weight of municipal organics throughput, there is potential for the facility licence to be waived.

To help finance a community composting facility that takes place on a farm, there are a couple of options: The Beneficial Management Practices Program through the Environmental Farm Plan (EFP) and the Organics Infrastructure Program. Note that both program intakes are currently closed.

The goal of the EFP program is to reduce agriculture's impact on the environment. Through this program, the farm may be eligible to apply for cost-shared incentives through the Beneficial Management Practices Program. Funding supports the implementation of actions that reduce environmental risks identified in the EFP workbook (ARDCorp, 2020). This includes waste management. The first step in this process includes booking a no-charge appointment with an Environmental Farm Plan Advisor through ARDCorp (ARDCorp, 2020). The Planning Advisor visits the farm and identifies any environmental risks on the farm within the Environmental Farm Planning workbook. If the Advisor determines that a waste management system is required, then the farm can apply for funding. Agrologist, Hubert Timmenga suggested Daryl Zbeetnoff¹⁶ as an Advisor.

The CleanBC Organics Infrastructure Program, funded in part by the Government of Canada, invests \$30 million towards organics processing infrastructures in British Columbia, such as composting facilities or anaerobic digesters. Its aim is to divert unprocessed municipal organic waste from landfills and to better manage agricultural waste (Government of BC, 2021, g).

¹⁶ Hubert Timmenga and Daryl Zbeetnoff work as a team: Zbeetnoff advising, Timmenga as the qualified professional for the design and implementation of a composting system

3.1 (b) Public Areas

In light of new information, provided by Paul Duncan who has been conducting an independent review of TIRRA's SWS, an alternative site for a centralized community composting facility could be the TIRRA SWS. The SWS is situated on S-2 zoned land and already collects waste and recycling. The Thetis Island OCP encourages TIRRA to "continue working with other agencies to provide for solid waste disposal" and to support the "composting of organic household refuse and garden refuse" (Islands Trust, 2017, b, p. 26). According to Duncan, TIRRA has the legal authority to pursue a zero-waste community, to operate the existing SWS to include community composting, and to relocate the site if necessary.

The OCP calls for any new community facilities to be grouped with other community services. "Rezoning applications for additional Community Service lands should be considered with a view to concentrating compatible developments. As the community centre, fire hall and school are currently in close proximity, consideration should be given to locating possible future facilities nearby." (Islands Trust, 2017, b, p. 8). Moving community composting to close proximity to the community centre, fire hall, and school is not a feasible short-term option as it will require significant community input. The only short-term feasible public area alternative is to use the existing SWS.

A community composting system operated by TIRRA at the SWS may more easily comply with current regulations and bylaws set out by local governments. However, TIRRA would require Board approval and broad community support. Like any other community composting system, the site would have to be strictly managed to comply with the OMRR and ensure the safety of the environment and human wellbeing. This would require the construction of a composting facility and the creation of a new job.

3.2 Scenario 2: Decentralized Composting System

An option for a decentralized and distributed system of composting was presented on the survey, in part, as a response to the amount of red tape already evident in relation to a centralized system. The results of the composting survey showed that 40% of respondents would prefer this type of system.

A decentralized composting system would host a network of individual composting units spread throughout the Thetis Island community. These units would be located in LERN¹⁷ neighbourhoods and/or areas considered central to groups of homes on Thetis Island that have expressed interest in participating in the program.



Figure 7. Jora Composting Unit

The method of composting and type of unit would ultimately be the choice of the participants. However, the Jora Composter model (Figure 7) is recommended as it is easy to use, takes many forms of organic materials, including meat and dairy products (not liquids), is pest safe, fast, and can be used year round. Also, if managed properly, it can eliminate pathogens and seeds through high temperatures. A single Jora 400 (14.2 cubic feet) has the capacity to compost for 30 people, and can generate approximately 780 kg finished compost per year¹⁸. Depending on size, individual units range between \$800 - \$1200, including shipping and taxes.

To compare the Jora with other forms of organic waste diversion, see Table 1.

Table 1. Comparing Different Methods of Organic Waste Diversion

	Enclosed Bin (aerobic composting)	Jora tumbler (aerobic composting)	Digester (anaerobic digestion)
Pros	Less expensive than a tumbler Drains excess moisture more readily Large volume for a small	Takes all types of food waste inc meat, bones, and dairy (not liquids) 100% pest proof Fast composting (6-8	Takes most organics, inc pet waste (if located away from food producing plants) Very little maintenance

¹⁷ LERN: Local Emergency Response Neighbourhoods. There are 27 LERN communities on Thetis

¹⁸ Jora 400 average output / year = 780 kg (52 weeks/year / 8 week cycles x 2 compartments x 60 kg/compartments)

	footprint	weeks) Dual chamber for continuous use Easy to access finished compost by inverting drum over a bin or wheelbarrow Kills pathogens and seeds with high temperatures	
Cons	Less durable (thin plastic, brittle in winter) Can attract and harbor burrowing pests such as rodents Slower composting (2-3 months)	Most expensive	Does not generate finished compost

Source: Seaman, 2012 and Compost Education Centre, 2015

A decentralized system would require a high degree of communication and coordination among participants, but could present a robust learning experience and a convenient cost-effective (shared costs) form of food waste diversion and compost creation for its users.

Regulations

Although it would appear that this form of community composting could bypass provincial and local government regulations, similar to the centralized scenario, it too must comply with all provincial, regional, and municipal regulations and bylaws, as described in section 2.0: Composting Regulations in BC.

Although the use of in-vessel composters does reduce the risk of leachate and odorous compounds entering the environment, there is still leachate/contact water and odour that would require management. Also, feedstock and final product management is important for the protection of the environment which would require the same management as non in-vessel facilities.

In summary, a decentralized system would face the same local government regulations as the centralized system, although it is likely the need for a facility licence could be waived.

3.3 Scenario 3: Hybrid Composting System

The final scenario combines the centralized and decentralized systems. Survey results showed that 41% of respondents were in favour of a hybrid system. Such a system would provide increased accessibility to high quality compost to those who would like to compost within their neighbourhoods, while also ensuring that Jollity Farm is supported with an increased influx of organic materials.

While this system would present the community with more options and generate benefits of both the centralized and decentralized models, it is also subject to all the same challenges and barriers that both models of community composting face. These include, but are not limited to, leachate management, temperature control, and maintaining records for the governing bodies, such as the OMRR. Again, as it currently stands, a community composting system of any kind on Thetis Island is restricted through zoning bylaws, and would not be allowed on any land but S-2, which Thetis has in short supply (Islands Trust, 2017, a).

3.4 SWOT Analysis

The following SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis compares the centralized, decentralized, and hybrid systems.

Table 2. SWOT Analysis Comparing the Three Community Composting Systems

Strengths		Weaknesses	
Centralized <ul style="list-style-type: none"> • Decreased ecological footprint • Increased food security • Fewer people to train • Strong community buy-in (survey results) • Greater volume • Could produce compost for farming (depending on system) • Less management for community members • Less coordination between community members • Streamlined system (fewer composters) 	Decentralized <ul style="list-style-type: none"> • Decreased ecological footprint • Increased food security • Increased accessibility • Learn hands-on composting skills • Increased community engagement • Ensures a return to residents, specifically gardeners • Don't have to buy compost 	Centralized <ul style="list-style-type: none"> • Significant red tape: provincial, regional, Thetis Island LTC • Lack of human resources • Decreased accessibility • Larger operation to manage • Expensive start up costs • Lack of available land • Lower volume of finished compost available for community members 	Decentralized <ul style="list-style-type: none"> • Significant red tape: provincial, regional, Thetis Island LTC • Multiple people to train • Requires increased coordination • Not necessarily for farm use • Dependent on participant commitment • Finding suitable locations
Hybrid <ul style="list-style-type: none"> • Decreased ecological footprint • Increased food security • Presents options to participate in centralized or decentralized system, which may attract a greater number of participants • Increased accessibility • Opportunity to learn hands-on composting skills 		Hybrid <ul style="list-style-type: none"> • Significant red tape: provincial, regional, Thetis Island LTC • Multiple people to train • Lack of human resources • Larger operation to manage • Expensive start up costs • Lack of available land • Requires increased coordination 	

<ul style="list-style-type: none"> • Increased community engagement • Ensures a return to residents - gardeners and farmers • Don't have to buy compost • Greatest volume • Greatest potential to effectively divert organic waste on Thetis 		<ul style="list-style-type: none"> • Dependent on participant commitment 	
Opportunities		Threats	
Centralized <ul style="list-style-type: none"> • Build circular economy • Set an example for the Trust Area and other communities • Proactively addressing zoning bylaw issues (if at Jollity) • Public education and awareness • Product for island residents • Expanded production • Composting education hub 	Decentralized <ul style="list-style-type: none"> • Build circular economy • Set an example for the Trust Area and other communities • Proactively addressing zoning bylaw issues • Public education and awareness • Product for island residents • Compositing skills building • Hands-on involvement • Increased social cohesion 	Centralized <ul style="list-style-type: none"> • Regulations • Project longevity • Environmental management considerations • Water use • Extreme weather • Storage of carbon source (e.g. chips, bark mulch, etc) - could pollute water if not managed • Run-off • Pests 	Decentralized <ul style="list-style-type: none"> • Regulations • Project longevity • Environmental management considerations • Possible mismanagement - of leachate, organic input • Lack of participation • Reduced production for farms
Hybrid		Hybrid	
<ul style="list-style-type: none"> • Build circular economy • Set an example for the Trust Area and other communities • Proactively addressing zoning bylaw issues • Public education and awareness • Product for island residents • Expanded production • Composting education for Thetis Island • Increased social cohesion 		<ul style="list-style-type: none"> • Regulations • Project longevity • Environmental management considerations • Possible mismanagement - of leachate, organic input • Lack of participation • Lower quantity produced • Water use • Extreme weather • Storage of carbon source (e.g. chips, bark mulch, etc) - could pollute water if not managed • Run-off • Pests 	

4.0 Compost Education

Establishing a composting system is just one part of the equation. To implement real change, human behaviour needs to be addressed. Human behaviour is at the root of most sustainability problems, including those related to climate change, pollution, deforestation, and waste (Linder et al., 2018). Education is a powerful tool in creating this change. Education helps build awareness and understanding, which are prerequisites for action. Regardless of the composting system used: centralized, decentralized, or hybrid, it must be supported by a robust education campaign.

Survey results demonstrated that the vast majority of Thetis Islanders were keen to develop their composting know-how whether they already composted or not. While the ROOT project focussed primarily on the feasibility of a community composting system on Thetis Island, initial steps were taken towards addressing composting education. Three educational initiatives were presented to the community in August 2021: an infographic, a presentation at the Nature House, and a Compost Crawl across the Thetis Island community.

Infographic: An infographic, available to view on the ThINC website, was created to develop community awareness around the issue of food waste. It illustrates the environmental and economic costs of organic materials going into the landfill, and presents composting as a practical and beneficial solution. It also incorporates local statistics which helps the information be more vivid, tangible, and relatable (Linder et al., 2018). This infographic is to be printed and posted at various visible locations in the community, including the notice board at the ferry terminal and at the Community Centre.

Presentation: a 1-hour presentation, 'Composting with the ThINCpod' was held at the Nature House on August 13th, 2021. Similar to the infographic, the presentation outlined what composting is and why it is important, but it also shares how composting works and different methods of composting. The presentation drew 11 community members and spurred a vibrant discussion. The presentation can be found on the ThINC website.

Compost Crawl: Held on August 14, 2021, this event was designed to give community members the opportunity to learn from local expert neighbours about diverse composting methods and other forms of organic waste diversion across Thetis Island. The event presented a range of organic waste diversion methods including a 2-bin vermicompost, an in-vessel tumbler, a digester, windrows, and brushwood composting. Across the five locations, the number of visits totalled 32.

Recommendations for Future Composting Education Initiatives

To effectively communicate the importance of composting and to increase its efficacy, future composting education campaigns could capitalize on theories from behavioral psychology and behavioral economics. A 2013 study found that information-based campaigns are commonly

used to promote behavioural changes by enhancing knowledge about an environmental problem (Linder et al. 2018). This attitude-behaviour approach is often an ineffective way to influence behavioural change (Linder et al., 2018). Therefore, behavioral insights could be integrated into educational materials to “nudge” people towards pro-environmental behaviours. In addition to making composting more relatable and tangible to the Thetis Island community, as implemented in the infographic, future materials could incorporate ‘local descriptive social norms’ that promote good composting behaviours. The more specific and local to Thetis Island the social norm, the more effective it would be (Linder, et al., 2018). For example, in a study that tried to encourage guests to reuse their towels, messages such as, “The guests in this room tend to reuse the towel,” were more effective than the more general “The guests in this hotel tend to reuse their towel” (Linder et al., 2018). Another step towards pro-environmental behaviour would be to address the barriers on Thetis Island, as identified in the survey, that prevent people from composting such as lack of know-how, lack of space, smell, wildlife, etc. Removing these barriers would make it easier for residents to compost.

In addition to nudges that promote composting, training and outreach to support individual household composting, as well as access to testing could be provided as part of any program moving forward.

5.0 Discussion

The results of the summer 2021 community composting survey demonstrated that Thetis Islanders are keen to see a local and community-oriented solution to organic waste diversion on the island, whether they plan to participate directly or are simply in support of it.

Three broad scenarios were presented in this report: a centralized composting system, a decentralized composting system, and a hybrid composting system. The scenario with the greatest support was a centralized system at Jollity Farm¹⁹. Some survey respondents expressed hesitancy about locating a community composting facility on private property; however, the option to locate a composting facility at Jollity has several advantages over a publicly located and operated facility which would require public funding and volunteer or paid labour to manage the space²⁰. The farm would be responsible for installing the required infrastructure, managing and processing the organic waste, keeping records, and reporting to government agencies. In return, Jollity would produce more compost for its farming operations while at the same time, reduce the need to purchase and ship compost to the island from elsewhere. Elisabeth and Noah Bond of Jollity Farm have stated that they would be willing to share and/or sell the finished product to community members. Many people on Thetis Island rely on Jollity Farm for their weekly groceries, and being able to contribute to their farming practices in this way would be a step forward towards an overall more sustainable community.

The decentralized composting system would have the advantage of neighbours pooling organic waste resources together to create their own compost, as well as overall increased accessibility. Clear communication and active ongoing participation by residents would be required. This option would provide ample learning opportunities and could increase community cohesion, but would require greater coordination. The greatest disadvantage to this model is that the layers of government approvals required and regulatory requirements may be too onerous for small groups of households unless undertaken at a community level by a community organization such as TIRRA.

One of the biggest barriers to most of the community composting systems proposed on Thetis Island are Thetis Island Land Use Bylaws, specifically those around zoning and management of disposal of waste materials.

According to local Island Trustee, Doug Fenton, “Under Section 5.4 Waste Disposal of the Islands Trust, Trust Council’s current Policy statement (amended 1998, p.19) speaks to the safe management of solid waste but reflects past paradigms regarding waste management and sees OM (organic matter) as a waste stream vs. a valued resource of OM, nor does it provide a pathway to be able to scale from the backyard to community composting.”

¹⁹ Note that no other centralized scenarios were presented to the community in the survey

²⁰ As it was presented as an option much later in the project, TIRRA’s SWS did not receive as much attention as the others. Future work on the community composting initiative should re-examine the potential for this site.

Thetis Island Trustees Peter Luckham and Doug Fenton have suggested that the TH-LTC create a Bylaw similar to SSI Bylaw 418 (2008) on Salt Spring Island. Such a Soil Removal and Deposit Bylaw for Thetis would define a process that either exempts compost from regulations so on-island management is permitted or permits a designated place or space on a specified property that allows composting of off-property organic materials. To accomplish this, at the August 3, 2021 Local Trust Committee meeting, the TH-LTC started a new project: Soil Removal and Deposit Bylaw. The timeline is estimated to be 12 - 24 months. Throughout the project's life, Trustees will continue to work with islanders, and planners will generate reports. There will be opportunities for public input and consultation with local groups/experts/SMEs by using the Delegation and Town Hall portions of the regular meeting agendas.

In addition to the introduction of the new Bylaw, Fenton notes that it may benefit Jollity Farm to rezone from R-2 to Agriculturally zoned land (A-1). The agriculture designation would allow the farm to expand its operations in more ways than just composting.

If the barriers mentioned above were resolved, a community composting system could be within reach. As mentioned, the system would have to comply with various regulations and enactments, and would come at a price. However, once throughput data is established, the CVRD may waive the required facility licence, and thus application and annual fees, which would reduce costs substantially. Furthermore, if the composting facility were implemented on Jollity Farm, then farm related grants could be accessed, including the Beneficial Management Practices Program and the Organics Infrastructure Program. These could help implement infrastructure to meet the OMRR requirements. Finally, an RFP should be announced to solicit bids from qualified contractors in order to find the most appropriate and cost effective person(s) to guide the process.

Irrespective of which system is put in place, if any, continued community composting education is essential to diverting organic waste from the landfill. Composting and non-composting Thetis Islanders alike expressed interest in learning more on the subject. Moving forward, educational materials, including infographics and pamphlets, guided by behavioural nudge research, should be disseminated and composting workshops should be held to provide practical information about composting and waste diversion to community members. A list of compost champions (local experts) will be made available on the ThINC Thetis Island Food Mosaic²¹ so those who are keen to learn more know where they can get help. An educational campaign could prove a cost-effective way to increase composting and diversity waste on the island but would still require funding and/or community support through volunteership.

²¹ Developed by the 2020 ThINCpod, the Thetis Island Food Mosaic is a food map identifying local producers, markets and retailers, and food education/workshop facilities. It can be found on the ThINC website.

6.0 Conclusion

The cost of sending organic materials to the landfill has far-ranging consequences. Landfills are filling up, and their anoxic environments spur the production of methane gas and leachate. These toxic byproducts are contributing toward climate change and the pollution of groundwater resources. In addition to the impact on the environment, organic materials are heavy and increase hauling costs substantially. The solution to this substantial, yet easily avoidable problem is on-island composting. Composting recycles nutrients from organic waste back into the system, and produces a valuable resource. Known as 'black gold' to many farmers and gardeners, compost revitalizes soils and promotes robust plant growth.

Many Thetis Islanders already compost, but not everyone is in a situation to do so. A community composting system would provide increased access to composting for all residents of, and visitors to, Thetis. Hauling costs would be reduced as would the need to import compost. The first step in closing this loop is to view organic "waste" as a valuable resource rather than something to be thrown away.

This report provided an overview of composting on Thetis Island and explored the possibilities for an on-island community composting system. It is clear that Thetis Islanders want a community orientated solution to organic waste diversion, but implementing a system is no small feat. Several layers of government will require navigation and it will be imperative that the system does not harm the environment nor human health. However, finding a pathway that allows community composting would be a win-win for all: island gardeners and farmers, the community, and the Earth.

Acknowledgements

The ThINCpod 2021 gratefully acknowledges the valuable assistance of the following individuals for their support in the development of this report:

- Hubert Timmenga, P.Ag., BC Institute of Agrologists
- Ian Ralston
- Doug Fenton, M.E.P., certified E.P., and Trustee, Islands Trust

Through this process, the ThINCpod also consulted with:

- Lynne Smith, Area G Director, Cowichan Valley Regional District
- Ilse Saraday, Environmental Technologist, Recycling and Waste Management, Cowichan Valley Regional District
- Paul Duncan, Thetis Island Residents and Ratepayers' Association
- Peter Luckham, Islands Trust Chair / Trustee, Island Trust
- Jamie Dubnya, Planner, Islands Trust
- Doug Pepper, Regional Agrologist - Southern Vancouver Island, Ministry of Agriculture
- Jordan Tam, Senior Environmental Protection Officer, Ministry of Environment
- Linden Terry, Environmental Protection Officer, OMRR/AEMCoP

The ThINCpod would also like to thank Ann Eriksson for her tireless help with editing and mentorship, and Elisabeth and Noah Bond and Wendy Hinsperger for bringing this matter to our attention and for their efforts in seeking to resolve the on-going issues around community composting on Thetis Island.

This project was funded by:

Thetis Island Nature Conservancy
Canada Summer Jobs, the Government of Canada
Thetis Island Residents and Ratepayers' Association

References

- ARDCorp. (2020). *Environmental farm plan program*. BCAC.
<http://ardcorp.ca/programs/environmental-farm-plan/>
- Carrington, D. (2021, March 4). *People wasting almost 1bn tonnes of food a year, UN report reveals*. The Guardian.
www.theguardian.com/environment/2021/mar/04/people-wasting-almost-billion-tonnes-food-year-un-report.
- Compost Education Centre. (2015). *Factsheet series: Backyard food waste digester*.
www.compost.bc.ca/wp-content/uploads/2015/01/Backyard-Food-Waste-Digester-3.pdf
- CVRD. (a). *Facility licencing*. Retrieved July 13, 2021 from www.cvrld.ca/2464/Facility-Licencing
- CVRD. (b). *CVRD Bylaw NO. 2570: A bylaw to regulate the management of municipal solid waste and recyclable material*. Retrieved July 13, 2021 from www.cvrld.ca/DocumentCenter/View/519/Bylaw-2570
- Environment Canada. (2015). *Technical Document on Municipal Solid Waste Organics Processing*. Retrieved July 20, 2021 from www.ec.gc.ca/gdd-mw/3E8CF6C7-F214-4BA2-A1A3-163978EE9D6E/13-047-ID-458-PDF_accessible_ANG_R2-reduced%20size.pdf
- EPA. (2021, March 12). *Types of composting and understanding the process*. United States Environmental Protection Agency.
www.epa.gov/sustainable-management-food/types-composting-and-understanding-process
- FAO. (2021). *Technical platform on the measurement and reduction of food loss and waste*. Food and Agriculture Organization of the United Nations.
www.fao.org/platform-food-loss-waste/en/
- Government of BC. (a). *Organic matter recycling regulation & guidance*. Retrieved July 10, 2021 from www2.gov.bc.ca/gov/content/environment/waste-management/food-and-organic-waste/regulations-guidelines
- Government of BC. (b). *Environmental management act and public health act*. Organic Matter Recycling Regulation (consolidation - July 13, 2021). Retrieved July 15, 2021 from www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/18_2002#part2
- Government of BC. (c). *Compost in B.C.* Retrieved (2021, July 10) from www2.gov.bc.ca/gov/content/environment/waste-management/food-and-organic-waste/regulations-guidelines/compost

Government of BC. (d). *Apply for a Waste Discharge Authorization*. (2021, July 10). www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/apply#composting

Government of BC. (e). (2021, June 16). *Environmental Management Act: Part 3 - municipal waste management*. www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/03053_03#section25

Government of BC. (f). *Notification Form for Construction or Beginning Operation of a Compost Facility: for authorization to discharge waste under the Environmental Management Act. Organic Matter Recycling Regulation*. (Retrieved 2021, July 10). www2.gov.bc.ca/assets/gov/environment/waste-management/waste-discharge-authorization/guides/forms/epd-omr-03_omrr_notification_of_compost_facility_form.pdf

Government of BC. (g). *Organics Infrastructure Program*. (Retrieved 2021, July 25) from www2.gov.bc.ca/gov/content/environment/waste-management/food-and-organic-waste/organic-waste-diversion/organics-infrastructure-program

Government of BC. (2006, March). *Improvement district manual*. BC Ministry of Community Services. https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/local-governments/governance-powers/improvement_district_manual.pdf

Government of BC. (2020, July 29). *Helping B.C. farmers maintain farm status* [News Release]. Agriculture, Food, and Fisheries. <https://news.gov.bc.ca/releases/2020AGRI0045-001412>

Hoover, D., & Moreno, L. (2017, October). *Estimating Quantities and Types of Food Waste at the City Level*. Natural Resources Defense Council. www.nrdc.org/sites/default/files/food-waste-city-level-report.pdf

Hulse, M., & Curran, D. (2015, April). *Compost Regulation in British Columbia: Regulatory Overview, Best Practices and Recommendations for Law Reform*. Environmental Law Centre, University of Victoria. www.elc.uvic.ca/wordpress/wp-content/uploads/2016/05/2013-03-05_Compost_Regulation_in_BC_FINAL.pdf

Islands Trust. (2017, January, a). *Thetis Island Land Use Bylaw NO. 89*. <https://islandstrust.bc.ca/wp-content/uploads/2020/05/thbl-89-LUB-consolidated-jan-24-2017.pdf>

Islands Trust. (2017, January, b). *Thetis Island official community plan: Bylaw NO. 88*. <https://islandstrust.bc.ca/wp-content/uploads/2020/05/thbl-88-OCP-consolidated-jan2017.pdf>

Linder, N., Lindhal, T., & Borgstrom, S. (2018, March 22). Using Behavioural Insights to Promote Food Waste Recycling in Urban Households—Evidence From a Longitudinal Field Experiment. *Frontiers in Psychology. Environmental Psychology*.
www.frontiersin.org/articles/10.3389/fpsyg.2018.00352/full

O2 Composting. *Our Past Projects: Woodland Farm*. Retrieved August 2, 2021 from
<https://www.o2compost.com/projects.aspx?item=225>

Princeton University. (2014, March 27). *A more potent greenhouse gas than carbon dioxide, methane emissions will leap as Earth warms*. Science Daily. Retrieved August 5, 2021 from
www.sciencedaily.com/releases/2014/03/140327111724.htm

Seaman, G. (2012). *Compost tumblers vs compost bins: Pros & cons*. Earth Easy.
<https://learn.eartheasy.com/articles/compost-tumblers-vs-compost-bins-pros-cons/>

Tetra Tech. (2017, October). *2017 waste composition study*.
www.cvrld.ca/DocumentCenter/View/92731/2017-CVRD-Waste-Composition-Study_IFU

WWF. (2021). *Fight climate change by preventing food waste*. World Wildlife Fund.
<https://www.worldwildlife.org/stories/fight-climate-change-by-preventing-food-waste>