Comox Strathcona Waste Management

Staff Report

DATE: November 5, 2019

FILE: 5380-03

TO: Chair and Directors
Comox Strathcona Waste Management Board

FROM: Russell Dyson
Chief Administrative Officer

Supported by Russell Dyson
Chief Administrative Officer

R. Dyson

RE: Finished Compost Material Utilization – Fireweed Farmstead

Purpose
The purpose of this report is to provide the Comox Strathcona Waste Management (CSWM) Board (Board) with the results from the contract arrangement with Fireweed Farmstead, for the supply of compost from the pilot project at the Comox Valley Waste Management Centre (CVWMC).

Recommendation from the Chief Administrative Officer:
For information only.

Executive Summary
The CSWM service entered into an agreement with Fireweed Farmstead in 2017 to receive compost material from the CVWMC organics composting pilot facility, the first non-government user of the material. In exchange for the compost, the Fireweed Farmstead was required to provide the CSWM service with analytical testing results for the soil amended with the compost, and to create an educational compost comparison garden to illustrate the differences in vegetable growth between plants grown in regular soil and amended soil. In March 2018 Fireweed Farmstead picked up 240 cubic yards of compost material for their trial in a two acre fallow field, and an accessible compost comparison garden. Fireweed Farmstead met all requirements of the contract and provided the following results of the pilot:

- The comparison garden demonstrated visible improvements to the quantity and quality of a variety of vegetables grown in the soil that had been amended with compost.
- The compost was found to make operations easier for weed control and cropping.
- The amended soil in field two showed an increase in many of the nutrients required for plant growth, and anecdotally showed less wireworm damage to plants within the amended garden bed.
- Contamination within the compost was documented, including vegetable labels, pens and pencils, asphalt roofing shingles, small bits of broken plastic and glass.
- Public education will be an important component of any future regional organics facility to ensure that contamination is minimized or eliminated.

Prepared by:	Concurrence:	Concurrence:
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Background/Current Situation

The CSWM service is processing co-mingled kitchen/food and yard waste collected from the Town of Comox and the Village of Cumberland curbside collection programs using the Gore Cover System at the CVWMC. A contract was signed with Net Zero Waste Inc. for the development, operation, and maintenance of the pilot project, and the project commenced in June 2013.

The facility meets the requirements of the British Columbia Organic Matter Recycling Regulation (OMRR) to be considered a Class A compost, and is safe for use in growing crops for human consumption. The capacity of the facility allows for the processing of 2,400 tonnes of organic material annually; we are operating just below this threshold with 2,184 tonnes processed in 2018.

At the January 2017 Board meeting, delegates from the Fireweed Farmstead in Merville made a request to the Board for use of an estimated 260 cubic yards of compost material from the CVWMC organics composting pilot facility. In exchange for the material, the Fireweed Farmstead proposed to provide the Comox Valley Regional District with analytical testing results for the soil amended with the compost, and to create an educational compost comparison garden to illustrate the differences in vegetable growth between plants grown in regular soil and amended soil. The Board waived the requirement for Fireweed Farmstead to obtain insurance for this project, but due to these challenges with insurance, the project was delayed from the 2017 to 2018 growing season.

Initial reservations about the quantity of finished product to be made available led to restrictions on who could access the compost. Until 2019, all finished compost material was made available only to member municipalities, government agencies, and school districts of the CSWM service area free of charge. An exception was made in 2018 to facilitate this project with Fireweed Farmstead.

In March 2018 Fireweed Farmstead picked up 240 cubic yards of compost material from the CVWMC organics composting pilot facility for their trial in two acre fallow field, and an accessible compost comparison garden. The farmers made every effort to keep all other variables equal between the two comparative beds including location, watering, weeding and plants grown. Compost was applied in a two inch thick layer on average, and tilled into the soil in April.

As detailed in the report from Fireweed Farmstead, included in Appendix A: 'Net Zero Compost Project Report, Feb 2019', the comparison garden demonstrated visible and quantifiable improvements to the quantity and quality of the vegetables grown in the soil that had been amended with compost. A variety of plants and vegetables were grown, with the most significant differences between the two gardens showing in the sunflowers and the potatoes. The farmers also commented that amending with the compost made it easier to weed and dig into, making it more accessible by reducing the physical demands of gardening. The amended soil in field two showed an increase in many of the nutrients required for plant growth, and anecdotally they saw less wireworm damage to plants within the amended garden bed as well. Contamination within the compost was documented,

including vegetable labels, pens and pencils, asphalt roofing shingles, small bits of broken plastic and glass.

To share the results of their experience with the soil amendment, on July 21, 2018 Fireweed Farms held a composting event at their farm for interested residents to see the results first hand. The CSWM compost educator Gayle Bates was able to attend the event and make connections with residents about the Comox Strathcona Garden Education Centre, and the importance of reducing organics going to landfill.

To further facilitate the sale of materials to other users, including farms and residents, a rate for the sale of 'Organic Compost Material' at $13 per cubic metre was established within Bylaw No. 170 in late 2018, and made effective Jan 1, 2019.

Policy Analysis
The Comox Strathcona Solid Waste Management Plan (SWMP) was approved by the Ministry of Environment and Climate Change Strategy on May 23, 2013, and recommends the development of regional composting capacity as the primary organics diversion strategy. The aerobic composting of organic material rather than decomposition of the same organic material in the landfill will also reduce greenhouse gas emissions.

Options
The Board has the following options to consider:

1. Request staff to distribute the results of the comparison garden analysis to the public through existing education contractors and other communication outreach programs.
2. Not actively promote the quality of and opportunity to purchase organic compost material to the public at this time.

Financial Factors
There was no cost to the CSWM service for participation in this project. Introduction of a rate for the sale of 'Organic Compost Material' has been available since January 1, 2019 when the revised Bylaw No. 170 went into effect. The price was set at $13 per cubic meter. The purchase price for 'Organic Compost Material' will be reconsidered during the next revision of the Tipping Fees and Charges Bylaw No. 170.

Legal Factors
British Columbia's OMRR governs the production, quality, and land application of certain types of organic material, and specifies requirements for composting facilities and the material they produce. Based on this regulation, the finished compost material produced from the Gore Cover System technology in place at the CVWMC organics composting pilot facility meets the pathogen reduction requirements, vector attraction reduction requirements, and quality criteria to be classified as a Class A compost, and is safe for use in the production of crops for human consumption.

Intergovernmental Factors
The CVWMC organics composting pilot project processes co-mingled food and yard waste from the Town of Comox and the Village of Cumberland curbside collection programs. As a result of their participation in the program, the two municipalities are offered bulk finished compost material at no charge. Quantities of finished compost material are reserved each year for the Town of Comox (100 tonnes) and the Village of Cumberland (160 tonnes).

In May 2015 the Board approved that any surplus finished compost material (in excess of the reserved quantities for the Town of Comox and the Village of Cumberland) be made available to

other member municipalities of the CSWM service area at no charge, on a first come first served basis. Sufficient surplus material will be available in 2020 to meet the demands of the other member municipalities, and also offer sales to the public and farmers.

Interdepartmental Involvement
The CVWMC organics composting pilot project is being led by the engineering services branch of the CSWM service. Project support is provided by a number of branches as required, including but not limited to Financial Services and Corporate Services.

Citizen/Public Relations
The analytical soil test results and the compost comparison garden information provided by Fireweed Farmstead should be used in future education campaigns for composting and organic waste diversion by the education contractors for composting and schools. Handouts and an updated website page could be developed to support the beneficial use of this material.

Attachments: Appendix A – "Fireweed Farmstead - Net Zero Compost Project Report, Feb 2019"

Appendix A

FIREWEED
Est. 2016
FARMSTEAD

Net Zero Compost Project Report

February 2019

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Introduction

In April of 2016 we (Fiona McQuillan and Jens Onneken) purchased the farm at 6669 Island Hwy in Merville with the intent of building a farm business. The property is approximately 20 acres and consists of three greenhouses, an irrigation pond, barn and private family home. The property had previously been used as a hydroponic vegetable operation. Our goal is to build a mixed farm with an agri-tourism component.

As part of the field condition assessment, we conducted a soil test in October of 2016 with Pacific Soils Analysis Inc. The soil tests revealed we were in need of organic matter, nitrogen, phosphorus, potassium, calcium and magnesium.

Shortly after we conducted the soil testing we became aware of the Net Zero Compost Pilot Project at the CVRD. We had heard of the Net Zero compost from a farmer in Maple Ridge who had acquired it from Abbotsford. She had been very happy with her produce results using it. After several emails with Mateo Ocejo of Net Zero, we put a proposal together for the CVRD for private pilot project utilizing the compost on our farm in exchange for a report and analyses of the soil pre and post compost application.

We contacted Abbotsford Garlic and Greens farm in Abbotsford (***http://abbotsfordgarlicandgreens.com/***) that at that time was exclusively using the Abbotsford Net Zero Compost to find out their experience.

> *"Fiona: If you go to our website (abbygarlic.com) you will find older posts where we talk about Net Zero compost. It is the only amendment we use for our garlic. We do plant green manure crops like white mustard in fallow seasons but the Net Zero compost is seed and weed free, has many of the minerals and trace elements plants need, breaks down slowly so there is no nitrogen flush typical of inorganic fertilizers and the worms love it!*
>
> *Best product we`ve ever used. I should mention my partner is also a certified commercial composter and was in the business years ago. We used to make our own compost, but don`t bother any more.*
>
> *Good luck. It`s a great product. Dave Kyle/ Abby Garlic*

Our Proposal

In December of 2017 we presented our proposed project to the CVRD council.

Part 1:

1. ***Test soil in field 2 – about 2 acres***
2. ***Apply 1 inch of compost over this area (240 yards)***
3. ***Re-test soil and compare – give results to the municipality***

Part 2:

1. ***Create educational "compost comparison" garden***
2. ***A raised bed with no compost, and one raised bed with 1 inch of compost incorporated into the soil***
3. ***Grow the same vegetables in each bed and compare yields***

The proposed project was approved. Unfortunately the project did not go forward that year due to issues with insurance, but these were resolved in early 2018 and in March of 2018 we trucked 240 yards of compost to our farm.

Part 1: Field Compost Testing

Introduction

The field we chose to conduct the analytical component was historically used for cattle grazing and then hay production, but had been left fallow for at least 10 years. We believe some of the top soil had been removed by a previous owner. Our goal for this field is to use it in vegetable production.

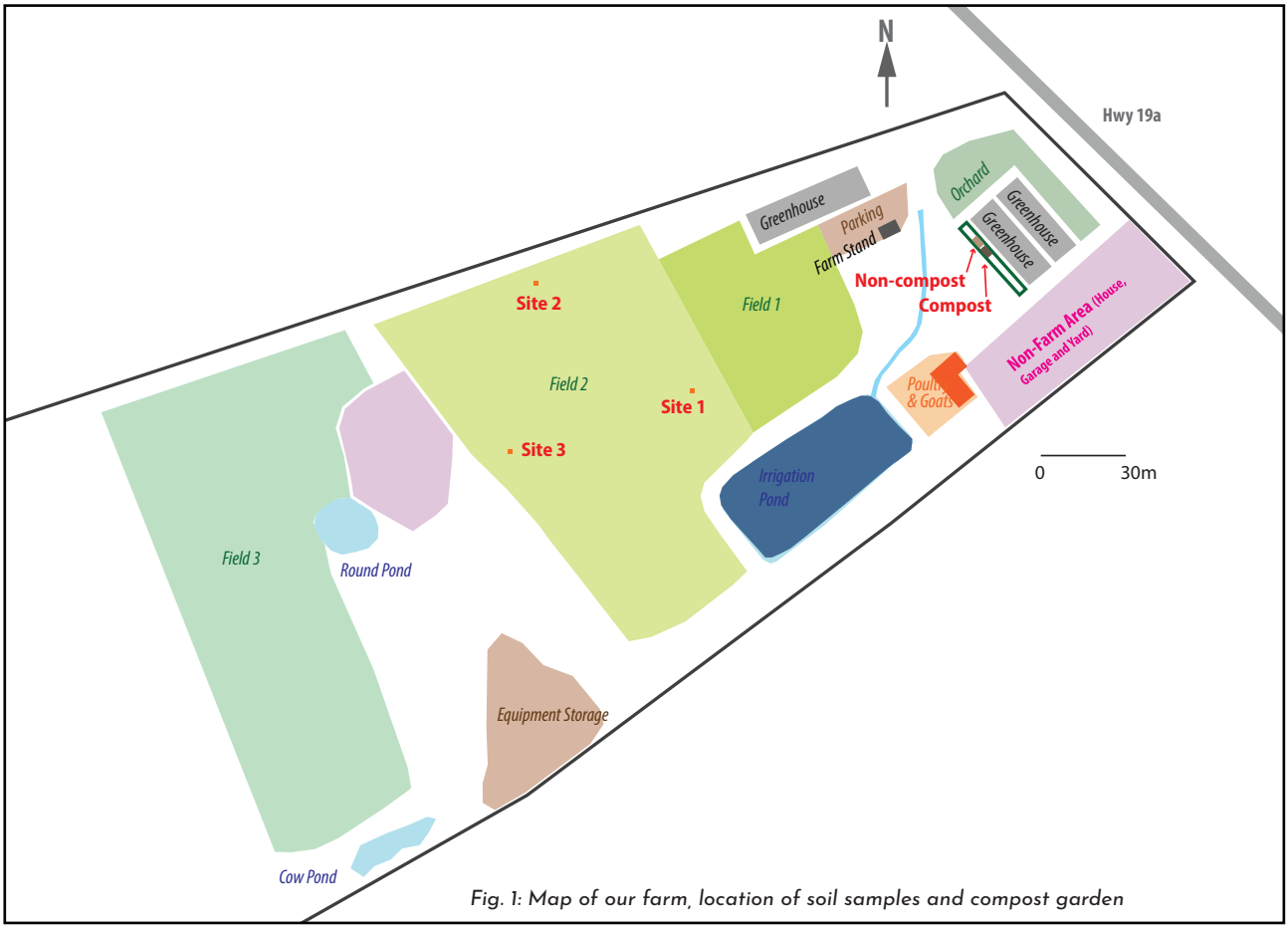

Fig. 1: Map of our farm, location of soil samples and compost garden

Sampling Procedure

Three sites were chosen in the field, and a garden trowel worth of soil collected. These were placed in a clean bucket, mixed, placed in a ziplock bag and mailed to Exova Labratories in Edmonton. The pre-compost sample was collected in April. Approximatley 1 inch of compost was then placed over the sample sites. The compost was mixed in with a clean shovel and a second sample set was taken in September and emailed to Exova in October. The results are in Table 1.

Results

Table 1: Soil Testing Analysis

	Method	Units	Nominal Detection Limit	Pre-compost	Post-compost	% change
Available nutrients						
Phosphorus	Available	µg/g	5	**7**	**30**	3.29
Potassium	Available	µg/g	25	**82**	**493**	5.01
Calcium	Available	mg/kg	30	**451**	**2070**	3.59
Magnesium	Available	mg/kg	5	**57**	**325**	4.70
Sodium	Available	mg/kg	30	**<30**	**36**	higher
Classification						
C:N ratio			0.1	**15**	**18**	0.20
Nitrogen	Total	%	0.02	**0.29**	**0.28**	-0.03
Organic matter	Calculated Value	%	0.04	**8.35**	**9.89**	0.18
Carbon	Total Organic	%	0.04	**4.18**	**4.94**	0.18
Hotwater Soluble						
Boron	Hot Water Soluable	mg/kg	0.2	**0.2**	**1.1**	4.50
Metals Strong Acid Digestion						
Antimony	Strong Acid Extractable	mg/kg	0.2	**0.3**	**0.3**	0.00
Arsenic	Strong Acid Extractable	mg/kg	0.2	**5**	**5.1**	0.02
Barium	Strong Acid Extractable	mg/kg	1	**54**	**58**	0.07
Beryllium	Strong Acid Extractable	mg/kg	0.1	**0.3**	**0.3**	0.00
Cadmium	Strong Acid Extractable	mg/kg	0.01	**0.17**	**0.16**	-0.06
Chromium	Strong Acid Extractable	mg/kg	0.5	**35.5**	**36.7**	0.03
Cobalt	Strong Acid Extractable	mg/kg	0.1	**15.1**	**14.3**	-0.05
Copper	Strong Acid Extractable	mg/kg	1	**34.2**	**40.2**	0.18
Lead	Strong Acid Extractable	mg/kg	0.1	**6.9**	**7.2**	0.04
Mercury	Strong Acid Extractable	mg/kg	0.05	**<0.05**	**<0.05**	no detectable change
Molybdenum	Strong Acid Extractable	mg/kg	1	**<1.0**	**<1.0**	no detectable change
Nickel	Strong Acid Extractable	mg/kg	0.5	**23.3**	**22**	-0.06
Selenium	Strong Acid Extractable	mg/kg	0.3	**0.4**	**0.4**	0.00
Silver	Strong Acid Extractable	mg/kg	0.1	**<0.1**	**<0.1**	no detectable change
Thallium	Strong Acid Extractable	mg/kg	0.05	**0.05**	**<0.05**	no detectable change
Tin	Strong Acid Extractable	mg/kg	1	**<1.0**	**<1.0**	no detectable change
Uranium	Strong Acid Extractable	mg/kg	0.5	**<0.5**	**<0.5**	no detectable change
Vanadium	Strong Acid Extractable	mg/kg	0.1	**135**	**116**	-0.14
Zinc	Strong Acid Extractable	mg/kg	1	**63**	**63**	0.00
Physical and Aggregate Properties						
Texture						
Clay	Adj. for <2mm (<um)	% by weight	na	**6**	**10**	0.67
Sand	Adj. for >2mm (50-200um)	% by weight	na	**45**	**42**	-0.07
Silt	Adj. for >2mm (2-50 um)	% by weight	na	**24**	**24**	0.00
Particle Size Analysis - Wet Sieve						
2.0mm sieve	% retained	% by weight	na	**24.7**	**24.2**	-0.02
Salinity						
Electrical Conductivity	Saturated Paste	dS/m	0.01	**0.11**	**0.3**	1.73

Part 2: Compost Comparison Garden

After the compost was delivered in March 2018, the compost comparison garden was set up. The goal of the compost comparison garden was to see what differences there would be in plant growth and yield between one garden area with the Net Zero compost and one without, all other variables being the same (ie plants grown, watering, weeding, etc.). The area that was chosen was in a small field area we developed the year prior at the side of one of our greenhouses. During the previous year this area had been used in lettuce production. Minimal organic compost and some seaweed had been used over the entire area during that time.

The two bed areas were approximately 3x2.5m, and each divided into three seperate raised beds. This area was chosen as it would be easy to fence and monitor through the growing season. The area was fenced off by a 1.5m high fence to keep deer out.

Once the beds were formed, compost was added to the compost garden side. The compost was anywhere from 1 to 3 inches thick when spot tested, it was probably closer to an average of 2 inches thick. This was more than originally proposed. After the compost was added both areas were rototilled.

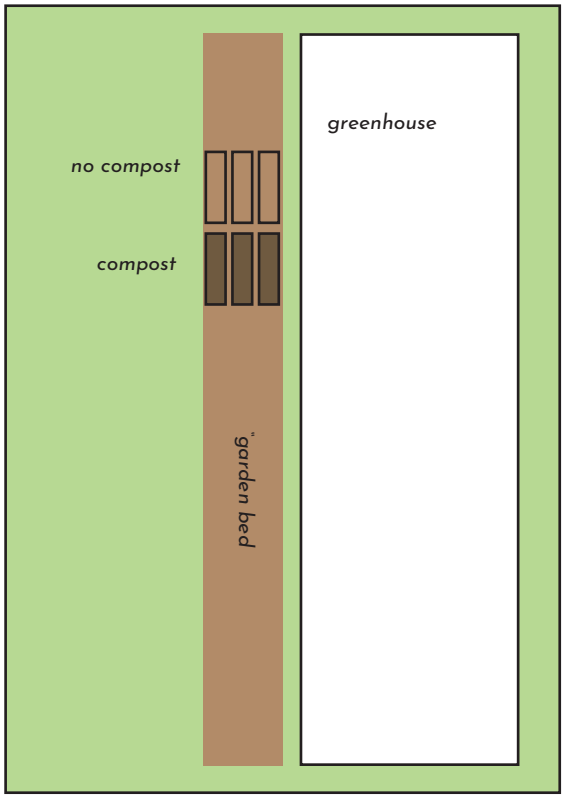

Photo 1. Loading up compost to put into comparison garden

Photo 2. Comparison garden before compost added (side getting compost)

Photo 2. Comparison garden before compost added (side NOT getting compost)

Photo 3. After adding compost

Photo 4: Addition of compost. Due to irregular surface the soil/ compost added was anywhere from 1 to 3 inches thick.

Photo 5: After both sides have been rototilled.

A variety of vegetables, herbs and flowers were planted from April to May. Most of these plants were started in our greenhouse. One bag of seed pototoes were purchased and divide-equally between the two gardens.. The vegetables grown were;

- tomatoes.
- cabbage
- swiss chard
- dill
- sunflowers
- alyssum
- potatoes
- beets
- chives
- lettuce

Results

Most of the plants were transplanted in May. The detailed growth measurements are in Table 2 in the appendices. The detailed information in Table 2 is for tomatoes, beets, potatoes, lettuce, sunflowers and dill. The following are some of the observations and photos of the growth of these plants and a few others that were grown.

Tomatoes: Three plants were planted per side. Tomatoes were harvested well before they ripened because of the weather condition/ chance of getting blight) The non-compost tomatoes produced 7.75lbs (left in photo 8), The compost tomatoes produced 10.6lbs (right in the photo 8). We did not notice any discernible difference in taste.

Photo 6: Compost tomato plants

Photo 7: Non-compost tomato plants

Photo 8: Non-compost tomatoes on left, compost tomatoes on right

Cabbage: By June 4 the cabbages grown in the compost side were double the size in the non-compost side. Unfortunately our ducks did sneak in and ate a lot of each cabbage so we never were able to get an end result.

Swiss Chard: Ten swiss chard were planted each side. By June the compost chard was double the size of the non-compost (2.5 inch vs 5 inch). It bolted in July.

Dill: Three dill plants were transplanted on each side in May. By June 4 the non-compost dill was 6 inches, the compost dill was 13 inches.

Photo 9: June: Non-compost dill - 6 inch

Photo 10: June: Compost dill - 12.5 inch

Sunflowers: We saw the most dramatic difference in plant size in the sunflowers. The compost garden sunflowers a month and a half after planting were approximately three times the size of the non-compost sunflowers, which they continued to maintain into the late summer.

Photo 11: June: Non-compost sunflower - 8 inch

Photo 12: June: Compost sunflower - >24 inch

Alyssum: No measurements taken, around double the size in the compost garden by June.

Potatoes: The plants in the compost garden were larger but it was the yield of potatoes that was quite different. In the non-compost side 5 of the 6 seed potatoes germinated, all 6 germinated in the compost side. Because of the spacing all of the potatoes had to be harvested, I could not just harvest 5 in the compost side. The yield difference was significant: 3.4lb non-compost garden, 13.25lbs compost garden (harvested Aug 26). The quality of the potatoes seemed to be the same.

Photo 13: June: Non-compost potatoes

Photo 14: June: Compost potatoes

Photo 15: Compost (on the left) and Non-compost (on the right) potato harvest

Beets: The beets were small when transplanted and some were killed off by wireworm on both sides. The top 10 beets from each garden was selected and weighed. From the non-compost garden 2.0lbs harvested; Compost garden 6.75lbs (harvested Aug 22)

Photo 16: June: Non-compost beets

Photo 17: June: compost beets

Photo 18: June: Compost beets (top) and Non-compost beets (bottom)

Chives: The chives were well established in pots when transplanted. They bushed out more in the compost garden.

Photo 19: June: Non-compost lettuce (right row)

Photo 20: June: Compost lettuce (right row)

Lettuce: The lettuce was also transplanted while quite small. Several lettuces were killed off by wireworm. Over the spring we observed that their was more wireworm kill-off in the non-compost garden. Our hypothesis is that the growth of the lettuce was much faster in the compost garden and the plants were able to withstand a wireworm attack. The lettuce bolted in July, but the compost lettuce was 2- 3x the size of the non-compost lettuce.

Additional Observations about Compost

While shovelling and applying the compost we observed a number of contaminants. These included:

- vegetable labels
- pens and pencils
- asphalt roofing shingles
- small bits of broken plastic
- small bits of broken glass

Photo 22: One of the ashphalt shingles found in the compost

Probably the most concerning was finding a paring knife. Anything sharp like the glass, metal and knives are certainly of the most concern with safety while handling.

An additional observation is the addition of the compost made the soil easier to work with. It was easier to weed, and dig into. We think that this is of particular interest for the elderly demographic of gardeners in the Comox Valley.

Conclusion

The CVRD Net Zero compost had a significant effect on the growth of vegetation in the garden ammended with it. The results were variable from plant to plant, with the sunflowers and potatoes showing the biggest difference. There also seems to be more consistency with the plant sizes in the compost garden.

The addition of the compost increased many of the nutrients required for plant growth. However there are a few elements that did decrease such as nitrogen. A detailed break-down of each element is beyond the scope of this report.

There seems to be a relationship between the wireworm damage and the presence of compost. We think it may be because of the accelerated rate of growth so plants like lettuce were larger and more able to withstand attacks of wireworm. A more detailed study would have to be done to test out this theory.

Photo 21: View of the compost comparison garden on July 4, 2018

APPENDIX 1: Table 2 Compost Comparision Garden - Measurement Log

	Date Seeded directly	Date transplanted out	Height when planted	DATE (measurements, observations) most measurements are an average unless otherwise stated										
				April 24	May 11	May 23	June 4	June 22	July 10	July 26	Aug 4	Aug 22	Aug 26	Sept 12
Tomatoes (NC)	**na**	May 15 (3 planted)	15cm	na	na	20cm	24cm	27cm	29cm	30cm	32cm (24 to 40cm) tomatoes are still green	40cm avg	no change, few tomatoes red	harvest
Tomatoes (C)	**na**	May 15 (3 planted)	15cm	na	na	20cm	24cm (leaves are more green, less curled)	30cm	45cm	52cm	avg 60cm high (but same amount of tomatoes as NC	70cm avg	no change, few tomatoes red	harvest
Beets(NC)	na	May 1 (12 planted)	5cm	na	5cm	7cm	7cm (a few died/ wireworm)	8cm	10cm	13cm	15cm	beet topharvest -2.0lbs	na	na
Beets(C)	na	May 1 (12 planted)	5cm	na	5cm	7cm	12cm (a few died/ wireworm)	14cm	16cm	18cm	22cm	harvest - 6.75lb	na	na
Potatoes (NC)	May 1 (6 planted)	na	na	na	no germination yet	8cm avg	20cm (8 - 25cm, great variability in size)	25cm	27cm	33cm	35cm (8 - 32cm, great variability in size)	40cm. Also look like they need to be harvested	harvest - 3.4lbs	na
Potatoes (C)	May 1 (6 planted)	na	na	na	no germination yet	10cm (more than double the actual size)	35cm (much larger plants)	35cm (much larger plants, getting bushier rather than taller)	40cm. Plants are growing together	>45cm, hard to get sizes as they have grown together. >2x	>40cm, hard to get sizes as they have grown together. >2x size of NC	starting to die back a bit - need to harvest	harvest - 13.25lb	na
Lettuce (NC)	na	May 1 (20 planted)	4cm	na	4cm	4cm	5cm (Lots of wireworm kill-off >30% gone	7cm	10cm. Growth is a bit yellower than compost lettuce	all bolted (10 to 40cm)	all bolted (10 to 40cm)	pulled	na	na
Lettuce (C)	na	May 1 (20 planted)	4cm	na	4cm	5cm (healthier lookin	12cm (<5% wireworm kill-off)	16cm	20cm	all bolted	all bolted, avg 50cm	pulled	na	na
Sunflowers (NC)	April 24 (5 planted)	na	na	na	no germination yet	3 germinated, 8cm	12cm	20 - 40cm	30-50cm	60 - 100cm	quite variable - largest 120cm, smallest 45cm	quite variable - largest 120cm, smallest 45cm. Flowers increasing in size	no change	no change
Sunflowers (C)	April 24 (5 planted)	na	na	na	3cm (4 germinated)	18cm	40cm	65cm	120cm	180 - 200cm	200 -250cm	200 -250cm - flowers increasing in size	no change	no change
Dill (NC)	na	April 28th, (4 transplanted)	4cm	na	4cm	7cm	15cm	20cm	25cm	30 - 55cm (a bit yellower)	60cm - 100cm	unchanged, enegy is into the seed heads	unchanged, starting to dy off	pulled
Dill (C)	na	April 28th (4 transplanted)	4cm	na	6cm	20cm	33cm (bushier as well)	50cm	75cm	100cm	130cm avg	unchanged, enegy is into the seed heads	unchanged, starting to die off	pulled