USVI Safe, Efficient, and Effective Vegetative Debris Management Plan*

Mulching and Composting:
A Commitment to Sustainability and Resiliency

November 7, 2017

Why should we compost and mulch?

Mulching and composting is the safest, most efficient, and most effective way to manage our vegetative debris.

There is a substantial amount of herbaceous, softwood, and hardwood vegetative debris on the ground on the Islands. Mulching and composting is the best possible way to help the islands with vegetative debris management well into the future (not only during this disaster response). It is a process perfected by nature over millions of years, and it is straightforward, easy, safe, and time-tested. Large and successful composting operations exist all over the world.

We need the vegetative debris.

The integrity of the fragile and unique ecology of the islands can be negatively impacted by removing the vegetative waste through burning or burying. The carbon associated with this debris needs to be put back into the soil. With the amount of soils that have runoff during the hurricanes, mineral deficiencies are likely to occur. Finished compost will help to rebuild depleted soils and improve soil quality and health. Mulch can be used to reduce water loss through evapotranspiration from the soil, improve soil quality and health over time, and act as a buffer against heavy rains, thus reducing soil erosion.

Chipping, grinding, or shredding—and composting—of vegetative debris results in mulch and compost. These are commodities that are very badly needed on so many fronts Territory-wide. Compost and mulch also:

- Create a rich nutrient-filled material, humus (like potting soil), that has many uses
- Increases the nutrient content in soils and helps regenerate poor soils
- Helps soils retain moisture
- Reduces or eliminate the need for chemical fertilizers
- Suppresses plant diseases and pests
- Promotes higher yields of agricultural crops
- Has the ability to cleanup (remediate) contaminated soil
- Improves soil's ability to store carbon, helping address climate change
- Improves plant growth
- Reduces energy use for irrigation, and need for irrigation water

* See Appendix G for list of sources for this document.

All over the world—including in the sub-tropics and tropics—large quantities of wood and other vegetative waste are effectively composted in a manner that improves soil health.

We need to be concerned about our air and surrounding waters.

Mulching and composting will greatly minimize the carbon's (smoke and particulates) accumulation in the atmosphere and ocean.

We need to use this opportunity to establish post-disaster sustainable waste management.

This is an opportunity to get a leg up on acquiring the infrastructure needed for comprehensive management of our vegetative and organic debris—which makes up around 50% of our normal waste stream—thus continuing our progress forward on more sustainable management of solid waste in the Islands.

Mulching and composting are very safe.

On very rare occasions, mulch piles have spontaneously combusted, but this is due to a number of factors, including:

- The piles not being constructed properly
- Lack of moisture in the piles
- A dry climate

In the Virgin Islands, fires do not carry in our high humidity (annual mean relative humidity I 75%; presently, it's even higher). When trash in a landfill is not mixed with copious soil, this allows fugitive methane to escape from dumps. Or, arsonists might set fire to areas already invaded by "fire-following" African grasses (Guinea grass). Both of these are examples of human folly.

If aerated properly—thought the simple mixture of chipped/shredded wood and other vegetative debris while allow for air circulation in a pile—compost only warms up to 140 to 150 degrees. On rare occasions, it can reach 200 degrees F if it is mishandled. These temperatures are far too low to start a fire (water boils at 212 degrees F).

Continuously aerated, wet wood chips are not a fire hazard. Dry chips can ignite. But again, humid air inhibits the spreading of fire.

Mulch and compost piles will be managed routinely for their moisture content in order to sustain the pace of decomposition (in the case of composting). Keeping the piles moist and aerated is the basic work of making mulch and compost. In addition, for the most part, the wood we have here is low-risk grade, that is, it is not cone-bearing trees loaded with flammable resins. In sum, like any biomass material, piles won't combust spontaneously if they are kept moist and aerated.

Mulching and composing makes great economic sense for us.

Composting can create jobs and support our economy:

- Composting can be small-scale and local, in addition to the large sites we'll need to create.
- Jobs will be local.
- Composting is importantly linked to urban farm production.
- Composting can diversify farm products and increase farm income.
- Compost products tend to be used locally.
- Use of compost products sustains additional businesses and green jobs.

On a per-ton basis, composting a ton of waste sustains four times as many jobs as sending that ton of waste to a landfill or incinerator. Positive economic arguments for chipping and composting (making valued commodities) do not stop with the debris removal, but continues beyond this disaster as basic infrastructure for comprehensive and sustainable solid waste handling well into our future.

We can use ALL of the resulting compost and mulch locally.

On-island experts all agree that <u>all</u> of the compost and mulch produced from the disaster's vegetative debris can be utilized locally. See Appendix A for more information on uses.

We understand that there is a pile of wood chips on St. Croix left over from a storm seven years ago. That pile was not managed for composting, and should not be used as an example for not pursuing composting and mulching. Professional management of the mulching and composting will result in a more effective end result.

<u>What steps do we need to take?</u>

We need to first segregate our precious tropical hard woods like Mahogany.

It makes the most sense to first, segregate tropical hard woods for use by local woodworkers, artisans, and students. This can take place through education so people sort it at their residences, and then at the mulching/composting locations (set aside for beneficial use). This will take care of a very small percentage of downed trees.

We need to chip into wooded areas where it is feasible.

Where it is appropriate, pull-behind chippers should be used to blow chips directly back into the adjoining wooded areas from the roads (such as the National Park lands on St. John). This eliminates the need to move the unprocessed/downed wood or chips to central locations. It also puts the nutrients directly back into the ecosystem where they are needed. The chips will be beneficial to next generation plant growth and it will help build soil. It should be distributed in thin layers when blown through the chipper chute. Likely, this can only be done on some roads through wooded areas. The chute will have to be maneuvered back and forth to create a thin layer of chips in the vegetated area. Piles of chips are not recommended.

We need to issue an RFP for mulching and composting services.

We should establish windrow composting on St. John, St. Thomas and St. Croix. The optimum goal is to keep as much of the vegetative debris near the locations where it was created (limit moving it to other locations). The Waste Management Authority should quickly issue a RFP to help establish this system. There are a number of qualified companies (some listed in Appendix D) that can establish professionally-operated composting operations, which will provide clean compost from three to 12 months. The RPF should seek contractors to establish windrow composting locations on all three islands. The Authority should seek contractors who have experience composting untreated wood waste and green debris in a manner that will result in a valuable end product. It can be the responsibility of the selected contractor to offer the end-product compost, with support for the government. Government agencies should be given priority in providing the end-product compost for use on public land.

What is the mulching and composting process?

1. Collection and chipping:

The vegetative debris needs to be collected and size reduced, which is happening in some locations around the Territory already. This is accomplished with chainsaws, tow-behind chippers, tub grinders, or shredders and can employ local people to collect the debris, run the machinery, and convey chips and grindings if equipment is allocated to the islands, or contract services are secured. Chipping, grinding, or shredding the material once is most efficient. It is important to chip the material to the right size the first time. If chipping cannot be coordinated within the islands, other contractors may be available to size reduce the material. Island-based trucks would need to convey and dump material into "windrows" in designated areas for mulching and composting. Areas need to be chosen and managed so as to limit wood chips from being washed into the ocean.

2. Mulching:

Mulching and distributing wood chips could address about 20-40% of the vegetative waste.

Mulch consists of wood chips or shredded wood, which is piled and distributed to users right away. If clean (no plastics or other materials mixed-in), this material can be used immediately once chipped. Some mulch (wood chips) need to be saved to provide a base for the composting operation. If the mulch piles are not distributed immediately, they then should be managed for composting.

Some example uses for mulch (wood chips):

- Offered to local residents and businesses for free
- Stabilizing slopes
- Utilize at hotels for mulching around horticulture
- Rebuild government green infrastructure (stormwater management) projects

3. Composting:

Composting could take up the remainder of the vegetative waste (60 to 80%). {Some heavily contaminated material would have to be managed through other means.}

Island-based trucks would need to convey and dump material into “windrows” in designated areas. Composting materials through “passive aerated static windrows” would be most efficient and beneficial in the long run. Equipment is not available on the islands to manage turned windrows (such as windrow turners). Passively aerated windrows are a lower tech solution that rely on larger wood chip sized to allow air to travel through the pile, promoting the breakdown of vegetative debris. Much of the vegetation will be herbaceous with softwood and some hardwoods. This plant material ground and mixed together will create a very good mixture for successful passive composting.

This really is just about properly designing the windrows, and then managing the incoming material so that the windrows can be piled and spaced appropriately. There are a number of compost experts on the islands that can help play an important advisory role with this process, such as Dave Minner (Gift Hill School – Iowa State), and the UVI Extension Service. They all worked together on-island a few years ago for a major composting training.

- It does not take that long to make a product: from three to 12-months depending on the mixtures of waste (more fruit, leaves, grass, and vegetables will speed-up the process).
- Rain, humidity, and the normal temperature in the islands is good for the piles.
- The piles don’t need to be turned
- There should be no problem with the carbon to nitrogen (C/N) ratio. Along with periodic monitoring of moisture (a very basic and easy process), keeping the piles moist, and constructing the piles according to prior recommended dimensions, this C/N ratio will help reduce the possibility of spontaneous combustion.
- A screening machine would be beneficial at the end of the process to make the compost finer, and to screen out remaining wood chips or any plastic. These seasoned wood chips will help accelerate the composting process (they include bacteria and other organisms that will help kick-start new composting).

Some example uses for compost:

Finished compost is beneficial for erosion control, roadside use and new construction, trees and shrubs, landscaping and container mixes, agriculture, fruit and vegetable crops, turf establishment and maintenance, sports fields, around the two airports and building topsoil anywhere where soil structure has been compromised. Using composted product as a soil amendment would also avoid use of fertilizers, and their accompanying impacts on watersheds, and helps to retain water and reduce erosion. Composted product could be mixed with pulverized glass to make an excellent backfill material. Compost could also be mixed and used for utility trench backfill.

Composting will result in a 50% reduction of material. Arguably, the best air-curtain incineration will do is maybe 90% reduction, with 10% ash remaining (which needs to be disposed-of, and likely will contain higher concentrations of contaminates). The remainder of the burned wood will have been wasted into unused heat and emissions, such as carbon monoxide, carbon dioxide, other oxides, particulates, and other constituents that will negatively impact the environment. Composting has some emissions (heat, moisture, carbon dioxide), but not on par with incineration. So, the difference between the two options is that we’ll have 40% net

material (composting vs. incineration) which will be distributed as final produce anywhere from three to 12 months, and the key is that material has multiple beneficial uses vs. air pollution and wasted heat.

There will be some noise from chippers and grinders, and use of diesel fuel for machinery.

Potential locations on all three islands for composting and mulching sites:

St. Croix: Renaissance Property

St. John: 7 Rem Carolina No. 1, Coral Bay (10-15 acres)

St. Thomas: Still to be identified

See Appendix E for more information on the composting process, and Appendices A and F for some specific locations for the finished compost.

Eventually, other materials can be composted. In the longer-term, we could add bio-solids processed at the sewage treatment plant and food waste from restaurants and institutions (both, consistent supplies of nitrogen needed for effective composting). This will further reduce the impact of waste on our landfills, and create even better-quality compost for our residents and agencies to use.

The goals here are immediate (manage the disaster debris) and longer-term (provide for long-term organics management on the islands).

Why shouldn't we consider air-curtain incineration?

Air-curtain burning has great potential for negatively impacting the health of our people.

Air-curtain incinerators do not burn at the same efficiency as other incinerators such as kilns or waste-to-energy facilities. In this case, efficiency is being referred to as the amount of unburned material that will end up in the air. No matter how efficient an air-curtain incinerator is, particulate matter (small particles both seen and unseen) are produced. These are released into the air and can cause pulmonary difficulties, particularly for individuals with asthma. It is extremely important to point out, that a host of other toxins, too many to cite, will be emitted into the air as well, and what we do not breathe here, will have impacts downwind of us. These include very toxic dioxins, furans, and heavy metals. Our Department of Health should be asked to address potential health issues especially for people with asthma, other respiratory disease, and heart conditions. Of particular concern, is that people are already breathing increased diesel and gasoline emissions from generators, and many are exposed to indoor mold.

Air-curtain incineration is particularly concerning in areas of high humidity and inversions. Failed air quality tests in others areas where air-curtain incineration was used was due to these factors.

We need to consider the experience of air-curtain incinerators after Superstorm Sandy.

Air-curtain incinerators were used at Floyd bennet field in New York City after Superstorm Sandy, an area that failed some air quality tests. This is a very large parcel of federal land, and the closest residence was 0.8 miles away. The operation did not go well. In fact, when the New Jersey Department of Environmental Protection travelled to NYC to view the operation, they decided not to allow the use of air-curtain Incinerators in New Jersey to deal with storm debris in that state.

When we consider the cost of options like burning it is important to incorporate "externality costs."

Externality costs are those costs that are hard to put an immediate number to. This includes the health impacts of air pollution, the effect of particulates from burning deposited on our land and surrounding waters, long-term management of leachate from the Anguilla and Bovoni landfills where burner ash will be deposited, and the increased cost of landfill closure and monitoring due to ash disposal.

Air-curtain incinerator do sometimes have flames and embers that could escape the burning unit.

This has the potential for surrounding fire hazard. See Appendix B for images of air-curtain incineration.

Air-curtain incinerator ash should NOT be put back into our soils.

The ash could potentially have a high pH (9) which will not be beneficial to most of our soils that have a high pH already. In addition, it is unknown whether other material would be burned with the vegetative debris. If so, there is great potential for other toxics and contaminates to be left in the ash. Even if other debris is not burned, it will be nearly impossible to keep plastics (like bags, tarps, etc.) that are tangled in the bush waste from the burners. Air-curtain incinerator ash is not like char one would get from burning wood in kiln.

Wood and organic material are resources that should not be destroyed through burning.

Open burning of wood and woodchips simply creates pollution that affects all living organisms, and this is particularly problematic in the islands due to humidity and the elevated ambient air temperature. Any type of incineration to manage the material is not beneficial at any level when considering numerous negative effects.

There are a number of other important unanswered question about air-curtain incineration.

See Appendix C for these questions.

How much will composting cost?

Until an RFP is issued, it is difficult to identify an overall cost, but experts agree that immediate costs will be competitive with the $4 million dollar estimate for air-curtain incineration on the islands. I addition, it is critical to consider three important points:

- Externality costs for air-curtain incineration will dwarf those costs for composting and mulching
- Composting and mulching produce a product that will have many important uses on the islands
- Composting and mulching keep the organic material in the vegetative debris on the island to improve soil, vs. burning which does not eliminate or destroy the vegetative debris, it only transforms it into air pollution, ash, and waste heat.

Appendix A: Potential End Users for Mulch and Compost

General Uses:

St. Croix:

Similar uses to the other islands. The UVI has much more property here and could use a lot of it to augment their grassy areas. There are a number of agricultural and horticultural purposes. Compost can be spread on the industrial areas on the south side of the island, helping to better manage a number of sites there that already were in a deteriorated condition. The landfill can provide similar solutions to those on St. Thomas.

St. John:

In construction projects: private houses, commercial establishments, and government-sponsored (e.g., DPW, other). The material can be used to filter run-off water (berms to keep construction run-off on site), it can be used as "fertilizer" to help accelerate the growth of shrubbery and other plants on the site. It is a soil amendment that will retain water.

Island Green could help facilitate the distribution of the compost on St. John. They could take ownership of it.

St. Thomas:

Similar uses to St. John, and at the UVI location for similar horticultural purposes; by the DPW on roadsides; by the VI government for other government projects; and by the Port Authority on their properties. In addition, there are many areas that need erosion control measures. Compost in combinations with other engineered systems (matts, etc.) is creates an optimum system to reduce soil loss. Last resort: On the landfill mixed in with daily cover, but more importantly, for those areas where final cover is needed. The compost will augment plant growth needed to maintain a viable landfill cover.

Specific Locations:

St. Croix Commitments as of 11/7:

Buccaneer Hotel and Golf Course
Commissioner of Agriculture
University of the Virgin Islands

St. Croix Viable Options (under development):

Annaly Farms
Colony Cove Beach Resort
Captain Morgan Rum Distillery
Carambola Golf Club
Carlton Golf Course
Chenay Bay Resort

Cramer Park
Cruzan Gardens
Cruzan Rum Distillery
DC Canegata Ballpark
Divi Carina Bay Resort
Estate Great Pond Park
Farleigh Dickinson Territorial Park
Grange Gardens
Montessori Ecological Marine Camp
National Guard St. Croix
Public Elementary through High School Fields
Randall "Doc" James Racetrack
Randolf Schulterbrandt Agricultural Grounds
Reef Golf Course
Renholdt Jackson Sports Complex
Renaissance St. Croix Carambola Resort
Ridge to Reef Farm
St. George Village Botanical Garden
The Buccaneer and its Golf Course

St. John Commitments as of 11/7:

Coral Bay Community Council
Eco Serendib Villa and Spa
Gallows Point Resort
Gifft Hill School
Island Green Living Sustainable Living Center
Josephine's Organic at Coral Bay Garden Center
National Park Service
Westin Resort and Villas

St. John Viable Options (under development):

The ball park in Cruz Bay (the top soil here was bad before the storms)
Botanica Home & Garden Center (off Centerline Rd.)
Carolina Corral
Paradise Lumber and Hardware
Virgin Islands Environmental Resource Station

St. Thomas Commitments as of 11/7:

Calypso Realty
Commissioner of Agriculture
Emerald Beach Best Western
Island View Guest House
University of the Virgin Islands

St. Thomas *Viable Options (under development):*

Emile Griffith Park
Clinton Phipps Racetrack
Crystal Cove Resort
Frenchman's Reef Marriott
Mahogany Run Golf Course
Montessori School
National Guard St. Thomas
Plantation Crown and Hawk Botanical Garden
Public Elementary through High School Fields
Sapphire Village Condos
Secret Harbor Resort
Sugar Bay Resort and Spa

Appendix B: Images of Air-curtain Incinerators

Note and Credits: The US Army Corps of Engineers performing an Air Curtain Burning of over 77,000 cubic yards of vegetative debris, mostly tree branches downed by Hurricane Sandy at Floyd Bennett Field in Brooklyn, N.Y., Nov. 28, 2012. Source: Chris Kleponis, https://www.dvidshub.net/image/790740

Note and Credits: A US Army Corps of Engineers air-curtain burning pit in Savannah, Georgia. Source Savannah division of Army Corps. https://www.flickr.com/photos/savannahcorps/12074999196/in/photostream/

Appendix C: Important Questions Regarding Air Curtain Incinerators

1. What are the locations where the incinerators will be sited?
2. How many incinerators will be used at each site?
3. Will constructed pits or containers be used for the burning?
4. What will be the hours of operation?
5. What are the meteorological conditions at each site?
6. How will wind and temperature conditions be factored? For instance, after Hurricane Sandy, the Army Corps of Engineers burned wood at the Floyd Bennett field in NYC during the month of November. On the warmer and more humid November days, air quality exceedances took place. Those days are much cooler than what is experienced every day in USVI. Is there a temperature level at which the burning would cease? Same question for wind conditions.
7. How much material will be burned at each site?
8. What material will be burned (just vegetative waste, or mixed debris)?
9. How long will the incinerators operate? Approximate start date and approximate end date.
10. What DPNR and or federal air permits are needed? Have permit applications been made?
11. Will DPNR or EPA conduct air monitoring, immediately downwind of the incinerators?
12. Will there be a commitment of not operating the incinerators until the air monitoring equipment is set up and operating?
13. After hurricane Sandy, EPA did air monitoring and found some violations of air quality standards. However, EPA tested quite a distance away from the air curtain incinerators. Will DPNR or EPA commit to establish the monitors immediately downwind from the air curtain incinerators?
14. What will be tested as part of the air monitoring (dioxins, furans, heavy metals, particulates, etc.)?
15. When reporting air test results, EPA used 24- hour averages, even when the incinerator did not operate 24 hours each day. Will there be actual test results shared with the public and not just 24-hour averages?
16. Will DPNR or EPA post air monitoring results on a publicly available website?
17. How much ash is produced from each air curtain incinerator?
18. Where will the ash be disposed of?
19. Will there be ash testing, and if so, what testing practical will be used?
20. Will a private contractor operate the air curtain incinerators? Was an RFP issued and what contractor(s) was selected? Please provide a copy of the RFP and background on the contractor if one has been selected.
21. Has a cost comparison been done comparing the cost of burning vs. the cost of composting the wood and green waste?
22. How much will it cost to operate the air curtain incinerators?
23. Burning plastic creates dioxin and other air contaminants. What will be done to ensure that plastics and other non- wood waste are burned in the incinerators?
24. In addition to plastics and non-woody debris, what controls will be used to make sure that contaminated wood waste such as treated lumber is not burned?
25. Is there the ability to add pollution controls to the air curtain devices?
26. After Hurricane Sandy, the state of New Jersey would not allow the use of air curtain incinerators. They were used in NYC at Floyd Bennet Field, federal land that was a long

distance from homes. The Army Corps of Engineers planned to burn for 16 weeks but stopped after four weeks. Why?

27. The burning at Floyd Bennet Field occurred during the month of November. Burning in the USVI will be in a hot and humid environment. How will that affect local air quality?
28. The Army Corps of Engineers was in charge of the air curtain incinerator operation in New York City after Hurricane Sandy. When that was completed, what percentage of wood was burned and what percentage was composted?

Appendix E: How to Process Material Using Passive Aerated Static Windrows

1. **Estimate volumes of vegetative debris currently collected, and the approximate volume that remains to be collected:** A simple drone survey works great for estimating volumes stockpiled quickly, and be used to track progress during the grinding operations. At this time, the Army Corps of Engineers estimates the following quantities of untreated wood waste and green waste were generated on each island: 450,000 cubic yards on St. Croix, 213,000 cubic yards on St. Thomas, and 11,000 cubic yards on St. John, not including downed trees in the St. John National Park.

2. **Locate various sites where there are open, flat areas that can handle large quantities of material in windrows:** Sites need to be in well-drained areas, with slopes no more than about 1-2%. Windrows should be placed in a decentralized strategy, as there are not enough large open areas available to concentrate all of the vegetative materials. A decentralized strategy better distributes the nutrients, reduces the trucking distance, and gives the community equal space burden and equal access to the end product. In densely populated areas, most of the downed vegetation will have to be removed and windrowed where space is available. The heat, rainy periods, and tropical humidity hasten the process, and composted material can be used in three to 12 months.

3. **Grind (a.k.a. shred or chip) the material:** The Army Corps of Engineers or private contractors (or simultaneous) can acquire services for a large shredder to bring the material ideally to a 1-inch to 3-inch size. This size will increase aeration, and reduce the potential for spontaneous combustion of the piles.

4. **Build windrows:** Once the size is reduced, the mixture is placed in windrows (long piles of the chipped material) 8-12’ tall by 10-14’ wide. The windrow rows should be as long as the space allows. The size of a windrow is generally determined by the equipment that is used to build it.

5. **Water the windrows:** The windrows should be kept moist. If rainwater does not suffice, a sufficient local—non-salt water—fresh water source needs to be available. This also will help keep the already low risk of fire even lower.

Appendix F: Commitment Form to Take Mulch and Compost

Help Make the Hurricane Response More Environmentally Sustainable

Composting Commitment:

Hurricanes Irma and Maria have left the US Virgin Islands with a large amount of wood waste and green waste which can be composted. Composting reflects the territorial commitment to dealing with hurricane debris in an environmentally sustainable manner. After about a year of composting, large amount of organic mulch will be produced that can be used to enrich the soils in the territory.

We the undersigned will accept free mulch after the composting process. The mulch is a suitable substitute for fertilizer and can be widely used at hotels, farms, schools, public works projects and home construction.

Your commitment to accept free mulch at the end of 2018 or early 2019 will allow the Waste Management Authority to properly plan the comprehensive composting operation.

____Yes, I will accept free mulch from the government of the US Virgin Islands.

Name:
Address:
Phone:
E-mail:

You will be contacted a month before the free mulch will be made available. Please fill this form out as soon as possible so planning can begin. Thank you.

More information at: www.islandgreenliving.org

Return this form to: Carly Swope, Island Green Living Association at info@islandgreenliving.org