SCOPING REPORT ON SARGASSUM INFLUXES IN THE VIRGIN ISLANDS

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Scoping Report on Sargassum Influxes in The Virgin Islands

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Table of Contents

Introduction

Since 2011, sargassum influxes have been affecting the Caribbean region, becoming a recurring threat over recent years in the Eastern Caribbean, including in Anguilla, Virgin Islands (VI)[1] and Montserrat. These influxes have resulted in increasingly negative ecological and socio-economic impacts including biodiversity loss in coastal and marine ecosystems; health impacts associated with emissions of hydrogen sulphide and ammonia; and socio-economic and livelihood impacts in the tourism, fisheries and marine transport sectors. The project, "Sustainable sargassum management in Anguilla, British Virgin Islands and Montserrat" aims to implement a participatory and multi-level approach to manage sargassum influxes to protect and enhance coastal and marine biodiversity and associated livelihoods. It is being implemented from 2021-2024 by the Caribbean Natural Resources Institute (CANARI) in collaboration with Department of Natural Resources – Anguilla, Ministry of Natural Resources, Labour and Immigration – VI, Department of Environment – Montserrat, Centre for Resource Management and Environmental Studies (CERMES) of the University of the West Indies, and the Organisation of Eastern Caribbean States (OECS) Commission. It is funded by a grant from the Darwin Initiative.

This scoping report for VI presents findings from:

- A desk-based review drawing on published data, reports and journal and newspaper articles and unpublished data, reports and plans/strategies for monitoring and management of sargassum influxes.
- A scoping study conducted from January to May 2022 that involved key informant interviews and field visits to stranding sites to develop site profiles and identify the most at-risk and vulnerable areas for sargassum influxes. The key informant interviews were conducted with eight informants from management agencies, research institutions, civil society and fisherfolk organisations and tourism-related enterprises that are impacted by sargassum influxes and/or engaging in management (see Appendix 1 for the interview questions and Appendix 2 for list of key informants). The interviews sought to gather additional information to fill information gaps identified in the desk review and better understand local impacts and management capacities and practices. Field visits were undertaken to seven stranding sites, which included capturing current photos of strandings (and sourcing past photos if limited strandings at present) and characterising the sites based on ecological, geophysical and socio-economic conditions to develop profiles and assess the level of exposure and vulnerability (see Appendix 3). Informal and opportunistic interviews were also conducted during the site visits with local resource users, where feasible, to further supplement information.

The report findings will inform the design and implementation of capacity building, communications and knowledge mobilisation and further research and monitoring activities in the BVI under the project.

[1] The terms Virgin Islands (VI) and British Virgin Islands (BVI) are used interchangeably. The former is their official name, but the latter remains in customary use, especially in projects and publications to distinguish from the USVI.

Brief history of sargassum influxes

Sargassum strandings along coastlines of VI have been reported since July 2011 (CDEMA, 2011). Sargassum mostly impacts the southern coastlines. Northern coastlines are rarely impacted. It should be noted that tourism-based beaches are mainly located along the northern coastlines (Government of the Virgin Islands, 2015). Prior to 2016, the Virgin Islands only experienced low levels of sargassum influxes based on the Government's assessment (Government of the Virgin Islands, 2015). However, UNEP-CEP (2018) classified the severity of sargassum influxes for the Virgin Islands as generally very high compared to other countries within the region. Local media reports provide a timeline of observations (Table 1).

Table 1: History of Sargassum Inundations as reported by local media outlets in the British Virgin Islands since 2011.

SOURCE	DATE	LINK
BVI Property & Yacht Guide	September 2011	Sargassum Sounds the Alarm
BVI Beacon	October 2015	Sargassum: More than a Stink?
BVI Beacon	October 2015	Fish Kills, Water Woes Blamed on Sargassum: Photo Gallery
BVI Government Information Services (GIS) Media Centre	November 2015	Sargassum Seaweed Phenomenon
BVI News Online	May 2017	Government Announces Return of Sargassum Seaweed
BVI Beacon	May 2018	Seeking Solutions to Sargassum as Quantities Increase
BVI News	May 2018	Seaweed Causing Ferry Dock Stink: Stench Welcoming Visitors
Virgin Islands News Online (VINO)	June 2018	Dreaded Seaweed Invades VI Shores Once Again
Virgin Islands News Online (VINO)	May 2019	VI Residents Urged to Utilise "Dreaded "Sargassum Seaweed
BVI News Online	August 2019	Dorian Blows Thick Blanket of Sargassum Along Anegada
BVI Property and Yacht Guide	September 2019	Sargassum: A New Normal
Virgin Islands News Online	October 2019	Sargassum Clean Up Begins on Anegada

Sargassum influxes in 2015 impacted southern coastlines and beaches in Tortola, from Pockwood Pond to Brandywine Bay. Other impacted areas included: Road Town Harbour, Prospect Reef, Dolphin Discovery, and Sea Cow's Bay. Impacted businesses such as 'Swim with the Dolphins' closed their operations in order to conduct clean-up activities (VINO, 2015a). Mass fish kills were also recorded in 2015 (VINO, 2015b).

In 2017, impacted areas also included the main port of entry at the Road Town Jetty (VI News, 2017b). Sargassum influxes in 2018 were also recorded near Tortola and its sister islands, including areas such as: Trellis Bay, Beef Island, Sea Cows Bay, sections of East-End and Fat Hogs Bay (VINO, 2018). The Road Town Ferry Terminal was once again impacted, along with the Beef Island port. Odour of decaying

sargassum in these areas impacted ferry operators, visitors and nearby residents (Smith, 2018).

In June 2019, sargassum caused obstruction at the Government dock in Trellis Bay, Beef Island leading to use of an alternative docking area for ferry services (VI Tourist Board, Government of the Virgin Islands, 2019). In August 2019, in the aftermath of Hurricane Dorian, one of the largest influxes of sargassum was recorded along the western coast of Anegada island (VI News, 2019). The sargassum was reported to be up to two metres in depth and blocked the main dock of Anegada (VI News, 2019; Climate Home News, 2019). Negative impacts associated with these large influxes have included fish kills due to low levels of dissolved oxygen, obstruction of boating channels, damage of boat propellers, disruption in water supply and temporary closure of businesses. Fishing vessels and equipment, such as fish traps, have also been damaged. Hydrogen sulphide gas produced from the decaying sargassum has also affected residents and businesses located along the coastline (VI News, 2017a; Sloat, 2019).

According to Sargassum Monitoring (2021), impacted beaches / coastlines reported in 2021 included Peter Island (Sand Pierre Bay) and Loblolly Bay, Anegada. The risk of sargassum coastal inundation in and around the British Virgin Islands has been reported at mostly low risk levels for beginning of 2022 (NOAA and USF, 2022).

Past or current management plans

There are no plans/strategies in the British Virgin Islands that directly address sargassum. However, the issue has been recognised through national statements made in Parliament (by the Deputy Premier and Minister for Natural Resources and Labour) and through recommendations provided in other plans/strategies. Statements to Parliament have suggested management actions to reduce negative impacts of influxes, and have also highlighted the benefits of sargassum in stabilisation of coastline and supporting marine life (Van der Plan *et al*, 2020; UNEP-CEP, 2021).

The National Sustainable Development Plan (2021) recommends the development of a sargassum policy focused on potential uses and financing as one of the priorities under National Goal 4 of the plan (Virgin Islanders focused on Environmental Sustainability) (Government of the Virgin Islands, 2021).

The Waste Management Strategy - Final Report on Waste Characterisation (2019) identifies recommendations for prevention, collection and recovery of sargassum (Department of Waste Management, 2019b). These include:

- Prevention by containment with deflection booms in sensitive areas
- Various collection methods:
    - In water collection through use of reinforced fish nets towed by small boats or by hand, so as to avoid large stranding of Sargassum
    - Manual clean-up utilising lightweight equipment, with removal of sargassum recommended before decomposition so as to reduce health hazards.
    - Mechanical clean-up (recommended only for mass stranding).
- Recycling/composting recommendations:
    - Co-composting / Anaerobic digestion

    - Mulching
    - Production of sargassum based bioplastics; sargassum based products were identified as a potential replacement for polypropylene containers.
    - Sargassum based bio stimulants
    - Production of charcoal briquettes
  - Consideration given to incinerating sargassum (for mass influxes)
  - Disposal of sargassum by spreading / burying on beach or disposing at landfill.

These recommendations were adapted from the 'Prevention and Clean-up of Sargassum in the Dutch Caribbean' document (Dutch Caribbean Nature Alliance, 2019).

Sargassum research or monitoring studies or plans for future work

Studies conducted by Ocean Harvest Technology (2016) and de Vrije and López-Contreras (2016) in the British Virgin Islands have analysed the main components of pelagic sargassum (*Sargassum natans* and *Sargassum fluitans*) as a percentage of dry weight (Desrochers et al, 2020). The sample analysed by de Vrije and López-Contreras (2016) identified the presence of ash (22.4%), apart from the usual components of sargassum. Ocean Harvest Technology (2016) analysis of the mineral/nutritional components and heavy metals notably identified iodine (85.3 parts per million dry weight) and arsenic (45 parts per million dry weight; of which 62% was found to be inorganic arsenic). Inorganic arsenic is of particular concern as it is highly toxic and can bioaccumulate along the food chain (Desrochers et al, 2020).

In 2015, water quality testing was conducted in priority areas impacted by sargassum. These tests indicated low levels of dissolved oxygen at Sea Cows Bay, Road Town and East End Harbour which resulted in mass fish kills **(**Ministry of Natural Resources, Labour and Immigration, Government of the Virgin Islands, 2016).

At the 'Sustainable sargassum management in Anguilla, British Virgin Islands and Montserrat' project launch held on December 1, 2021, representatives from the Ministry of Natural Resources, Labour Immigration, indicated that drafting of regulations for drones was in progress. Drones are currently used by the Ministry and also by Town and Country Planning Department to assess hurricane damage and estimate mangrove coverage (Hastings, 2021). Hence, there is good potential to utilise drones in sargassum monitoring, and currently the Ministry is budgeting to acquire more advanced drones.

Legislation, policies and strategies relevant to sargassum management

The list of relevant legislation, policies and plans includes the following:

- National Sustainable Development Plan, 2021 (Government of the Virgin Islands, 2021a)
  - Recommends development of a sargassum policy.
  - National strategies to diversify the economy and to improve traditional industries suggest incentivising private sector to use organic material such as sargassum for developing fertiliser.

    - One recommendation provided for 'greening' of fisheries sector is to include sargassum concentrations as part data collection and monitoring systems.
- Protected Areas System Plan 2007-2017 (Government of the British Virgin Islands, 2008)
    - A draft disaster response plan has been developed by the National Park Trust to respond to threats from natural hazards to protected areas. These plans are to be updated to be site specific and address multiple disasters. In addition, disaster responses are recommended to include damage assessment and clean up strategies.
- National Parks Act, 2006 and National Parks Regulations 2008
- The Virgin Islands (UK) Climate Change Adaptation Policy, 2012
- Green Paper on Environmental Management Climate Adaptation Bill, 2019 (Government of the Virgin Islands, 2019a)
    - Proposed bill seeks to establish: (i) a Council on Sustainable Development and Climate Adaptation, (ii) Sustainable Development and Climate Adaptation Committee, (iii) Environment Authority, (iv) as well as a new department under the Ministry of Natural Resources and Labour – Department of Environment, Conservation and Climate Adaptation to prioritise integrated coastal zone and ocean management. The bill will make provisions for the Ministry of Natural Resources and Labour to legally regulate seabed and coastal zones. The bill also covers management of invasive species and will ensure legal requirements for climate adaptation policy.
- Virgin Islands (UK) Food Security and Sustainability Act, 2022
    - The Act includes considerations for local fisheries management through development of a Fisheries Management and Development Plan, and establishment of (i) Agriculture and Fisheries Management Unit, (ii) Virgin Islands Agriculture and Fisheries Authority, and (iii) Fisheries Advisory Committee.
- Fisheries Act, 1997 and Fisheries Regulations, 2003
- Merchant Shipping Act, 2001 – outlines powers of Ports Authority as it relates to removal of stranded vessels.
- VI Ports Authority Act (1990) and VI Port Authority Regulations 1995
- Beach Use Policy, 2019 - identifies sargassum landings as a threat to beaches and identifies Government's role in notifying public of hazards on beaches (Government of the Virgin Islands, 2019b) .
- Beach Protection Act, 1982
- Marine Estate Administration Policy, 2021 – policy aims to include disaster risk reduction and climate considerations in use of marine estate (seabed and territorial waters vested in the Crown; considered as public asset) (Government of the Virgin Islands, 2021b).
- Strategic Blue Economy Roadmap 2020-2025 (Government of the Virgin Islands and the United Nations Development Program, 2020)
    - Roadmap identifies future opportunities to develop new and emerging sectors through proposed investment strategy and pilot projects. Under new and emerging opportunities in the blue economy, one proposed activity is to launch the UNDP Blue Lab which can support biotechnology and waste management, for example, through the reuse of sargassum.
    - Strategic Blue Economy Roadmap also proposes a National Ocean Governance / Blue Economy Coordination Committee which will implement the blue economy roadmap and provide an overview of marine management.

- Physical Planning Act, 2004 – Legislation covers: (i) Environment protection area management plan, (ii) Environmental Impact Assessments, (iii) Environmental protection area order for beaches, (iv) Public access to beaches, (v) Protection of coastal zones, (vi) Designation of marine parks, and (viii) Regulating waste in beaches and seashores.
- National Physical Development Plan for the British Virgin Islands, 2019 (Government of the Virgin Islands, 2019c) – apart from guiding development and spatial planning, the plan considers disaster resilience and preparedness, and aims to reduce hazard risks to water systems. Policies are included for marina and harbour development and coastal areas.
- Public Health Ordinance (Cap. 194), 1977 – Act ensures water quality (purity of water supplies), prevention / removal of nuisances and insanitary conditions.
- Tourist Board Ordinance. Act. Chapter 280. Ordinance 1969 guides the British Virgin Islands Tourist Board which is responsible for development of sustainable tourism (VI Tourist Board, 2019b).
- The Virgin Islands Comprehensive Disaster Management Strategy (2019-2025)
    - Outlines the roles of National Disaster Management Council and Department of Disaster Management.
    - The strategy identifies the role of the Ministry of Natural Resources, Labour and Immigration in chairing the Energy, Environment and Climate Adaptation Committee of the National Disaster Management Council (NDMC)
    - Strategy aims to support conservation and climate resilience through environmental and disaster risk management. Recommendations include (i) conducting disaster risk assessments, (ii) training Community Emergency Response Team (CERT) to collect preliminary data at community level, (iii) increasing accessibility to geographic information systems (GIS) and modelling tools, and (iv) improving damage assessment methodology (Department of Disaster Management, Government of the Virgin Islands, 2019).
- Disaster Management Act, 2003 - establishes role of governor in declaring disaster areas, and guides establishment of national disaster management council and development of national disaster management plan.
- Disaster Management Policy, 2003
- Energy Policy, 2016 – consideration given to waste to energy streams.
- Resilient National Energy Transition Strategy, 2019 – consideration given to waste to energy streams.
- Waste Management Strategy for the British Virgin Islands, 2019 (Department of Waste Management, 2019a) – Strategy is guided by circular economy principles and aims to minimise waste, reduce emissions and minimise land space for waste collection. Strategy also considers waste generated energy through incineration and aims to support local waste management initiatives such as developing worm composting facilities for use in organic agriculture.
- The Waste Management Strategy, Final Report on Waste Characterisation 2019 (Department of Waste Management, 2019b) was conducted in the aftermath of Hurricane Irma and Maria to inform an updated solid waste management strategy by providing updated characterisation of waste. In this report, sargassum is listed as sargasso weeds and characterised under organic waste and special waste.

Institutional arrangements for managing sargassum

The Ministry of Natural Resources and Labour is the lead agency for response to sargassum influxes, and is supported by the Ministry of Education, Culture, Youth Affairs, Fisheries and Agriculture along with other government agencies, businesses and community organisations (Government of the Virgin Islands, 2015). Although there is currently no sargassum management committee in place, it was suggested that issues related to sargassum can be included in discussions of the Climate Change Adaptation Committee (Hastings, 2022, pers. comm.).

The Strategic Blue Economy Roadmap proposes the development of the National Ocean Governance / Blue Economy Coordination Committee which will implement the blue economy roadmap and provide an overview of marine management. When formed, this committee can also potentially address sargassum related issues (Government of the Virgin Islands and the United Nations Development Programme, 2020). According to its terms of reference the committee is required to meet twice per year and will be chaired by a representative of the Office of the Premier. Organisations to be represented on the Committee include:

- Ministry of Natural Resources, Labour and Immigration
- Department of Agriculture and Fisheries
- Town and Country Planning Development
- Virgin Islands Shipping Registry
- Department of Disaster Management
- National Parks Trust of the Virgin Islands
- Virgin Islands Tourist Board
- H. Lavity Stoutt Community College
- Marine Tourism Industry Representative
- Fishing Industry representative
- Any other additional experts / observers invited as the need arises.

Relevant stakeholders

Table 2 sets out known BVI sargassum stakeholder identities, mandates and likely interests. The engagement of these entities, in various ways, may be necessary for management to succeed.

Table 2: List of stakeholders with interest in sargassum management.

Stakeholder organisation name	Brief description of stakeholder – responsibility/ mandate/ sector	Likely interest in Sargassum management/ Darwin Sargassum OTs project
Government		
Ministry of Natural Resources, Labour and Immigration	Responsible for management of the natural resources	- Engaged in public education on Sargassum / its uses - Responsible for policy development and implementation to address Sargassum impact and influx. - Responsible for monitoring of coastlines - In need of sargassum management plan

Stakeholder organisation name	Brief description of stakeholder – responsibility/ mandate/ sector	Likely interest in Sargassum management/ Darwin Sargassum OTs project
Department of Agriculture and Fisheries - Ministry of Education, Culture, Youth Affairs, Fisheries and Agriculture	Ensures sustainable food security within agricultural and fisheries sector.	- Identifying removal methods for sargassum - Research into production of compost and sargassum based fertilisers - Public education/sensitisation on sargassum impacts and its uses - Provides support to the Ministry of Natural Resources, Labour and Immigration
Department of Disaster Management, Deputy Governor's Office	Coordinates disaster management policies/plans/programmes (disaster prevention/mitigation, preparedness, response/recovery)	- Sharing sargassum forecasts / CERMES bulletins
Environmental Health Unit, Ministry of Health and Social Development	Provides environmental health services in areas related to food hygiene, water quality, vector control, wastewater, general environmental sanitation, and port health.	- Assists in coordinating clean-up efforts - Public Education/Sensitisation
Department of Waste Management, Ministry of Health and Social Development	Responsible for collection and disposal of solid waste	- Sargassum waste management
Virgin Islands Shipping Registry	Maritime administration	- Concerns related to impacts of sargassum on boats / fishing vessels
The Water and Sewerage Department	Manages water supply and sewage disposal	- Public Education/Sensitisation on sargassum impacts - Concerns related to sargassum impact on potable water supply
British Virgin Islands (BVI) Tourist Board	● Statutory Board under Premier's Office ● Promotes/markets tourism destinations and service providers within VI	- Concerns related to impacts of sargassum near popular tourist sites
BVI Ports Authority	● Statutory Board under Premier's Office ● Supports seaport facilities and services	- Concerns related to impacts of sargassum near docks/ports - Involved in planning clean-ups
H. Lavity Stoutt Community College (Statutory Board under Ministry of Education, Culture, Youth Affairs, Fisheries and Agriculture)	● National Tertiary level educational institute	- Public Education/Sensitisation - Assists in clean-up activities
National Parks Trust of the Virgin Islands (Statutory Board under Ministry of Natural	● Preserves and manages designated natural and cultural protected areas	- Public Education/Sensitisation

Stakeholder organisation name	Brief description of stakeholder – responsibility/ mandate/ sector	Likely interest in Sargassum management/ Darwin Sargassum OTs project
Resources, Labour and Immigration)		
Civil Society		
Seventh Day Adventist Church; Rotary and Rotaract Clubs; The Filipino Society	Various Community Groups	- Assisted in clean-up efforts
Unite BVI	A BVI registered non-profit that brings together people, great ideas and resources to tackle community and environmental challenges	- Bridging public-private partnerships and utilizing business-based solutions to meet the challenges and opportunities presented by Sargassum in the BVI. - Hosted a 2016 Sargassum Conference on partnership and business opportunities. - Special interest on sargassum's effect and impact on endangered sea turtle populations in the BVI
Jost van Dyke Preservation Society	Promotes the conservation of Jost Van Dyke, British Virgin Islands, its adjacent smaller cays and marine system through research and monitoring, education and restoration	- Concerns related to impacts of sargassum on these coastal/marine areas; can provide local knowledge on sargassum impacts and can also benefit from communication of knowledge on best practices.
Green VI	Waste disposal, recycling	- Involved in planning clean ups - Waste disposal and management - Public Education/ Sensitisation
Virgin Gorda Fishermen's Cooperative	● Fishing group in Virgin Gorda ● Hosts youth summer programmes and Fishing tournaments	- Livelihood can be possibly impacted by sargassum influxes; can provide local knowledge on sargassum impacts and can also benefit from communication of knowledge on best practices
Jost Van Dyke Fisherfolk Association	Represents the interests of Jost Van Dyke fishers	Livelihood can be possibly impacted by sargassum influxes ; can provide local knowledge on sargassum impacts and can also benefit from communication of knowledge on best practices.
Tortola fishers	Represents the interests of Tortola fishers	Livelihood impacted can be possibly by sargassum influxes; can provide local knowledge on sargassum impacts and can also benefit from communication of knowledge on best practices.
Anegada Fishers	Represents the interests of Anegada fishers	Livelihood impacted can be possibly by sargassum influxes; can provide local knowledge on sargassum impacts and can also benefit from communication of knowledge on best practices.
BVI Sport Fishing Association	Represents the interest of sport fishers	Livelihood impacted can be possibly by sargassum influxes; can provide local knowledge on sargassum impacts and can

Stakeholder organisation name	Brief description of stakeholder – responsibility/ mandate/ sector	Likely interest in Sargassum management/ Darwin Sargassum OTs project
		also benefit from communication of knowledge on best practices.
Marine Association of the BVI	Non-profit organisation representing interests of marine industry; including assisting promoting employment/training within marine industry, and assisting in identifying marine shelters during hurricane season	Concerns related to impacts of sargassum on marine sector.
Private Sector		
Tidal Roots Farm, Tortola	Private organic farm	- Has been experimenting with the seaweed as fertilizer for the organic farm operation; can contribute / benefit from knowledge exchange and development of plan.
Farm at Paraquita Bay; various farms	Privately owned farms	- Has been processing sargassum to be used as fertilisers; can contribute / benefit from knowledge exchange and development of plan.
Drake's Traders, Clarence Thomas Ltd, Alfonso Warner Insurance, Trident Trust	Various Businesses	- Has assisted in clean-up efforts
BVI's Ferries and Taxi Services	Inter-island sea transportation	- Impacted by sargassum accumulation at docks
Virgin Gorda Yacht Harbour	Privately owned yacht harbour in Virgin Gorda	- Impacted by sargassum accumulation at docks
BVI Yacht Charters	Privately owned company focused on bareboat charters	- Impacted by sargassum accumulation at docks
BVI Scuba Organisation / Dive Operators Association	Representing interests of dive shop owners and involved with the upkeep and funding of marine parks and protecting the environment	- Activities impacted by sargassum influxes
The BVI Chamber of Commerce & Hotel Association	Association representing interests of local businesses and hotel owners	- Hotels/businesses along coastal areas can potentially be impacted by sargassum influxes

Financing

Under key performance strategies for the Ministry of Natural Resources, Labour and Immigration in the 2021 and 2022 budget summary and estimates, consideration was provided for hiring contractors to remove and dispose of sargassum for the period of May – September for 2021 and 2022 at priority sites related to mass sargassum events. However, details of budget allocations were not provided (Government of the Virgin Islands, 2021c; Government of the Virgin Islands, 2022).

Districts may also use a portion of their budget to fund sargassum related activities. In 2019, an unspecified portion of the US$14,881,44 budget allocated under undefined activities, for District 9 (Virgin Gorda and Anegada), was disbursed to fund sargassum clean-up efforts in Handsome Bay (Durand, 2020).

Exposure and vulnerability assessments

An assessment conducted after the passage of Hurricane Dorian in 2019 identified various sites impacted by sargassum influxes, which included Setting Point dock and Pomato Point on Anegada. It was noted that, in the past, these sites were rarely impacted by sargassum. The extent of the sargassum impact at Setting Point was assessed through satellite imagery provided by the Environment Systems, UK (via a data sharing agreement for post hazard impact analysis). Satellite imagery was processed to differentiate vegetation and was compared to previous imagery capture in November 2018 and to unimpacted sites post Hurricane Dorian (e.g. Eastern point). GIS analysis then determined the extent of sargassum impact at Setting and Pomato points. At Setting Point, it was estimated that 589 meters of coastline extending over an area of 39,059 square metres was affected, and 187 meters of coastline extending over 8,368 square metres was impacted at Pomato Point. In total, 776 meters of shoreline with an area of 47,427 square metres was impacted by sargassum influxes caused by the passage of Hurricane Dorian (Ministry of Natural Resources, Labour and Immigration, n.d). The use of this method to quantify the area impacted by sargassum reduced the amount of site visits required and allowed for effective estimation of clean-up costs (Smith-Claxton, 2021).

Site profiles for seven sites have been conducted as part of scoping under the project (see Appendix 3). Data analysis needs to be finalised and information validated with key stakeholders in the VI. However, strategic adaptive management can start once there is a regular schedule for updating all site profiles.

Past and current management responses

The benefits of sargassum have often been highlighted by Government officials and have stated that low concentrations of decomposing sargassum in open areas may only cause minor symptoms and could be managed to make sargassum an asset. Therefore, the Government recognised sargassum as ‘part of a healthy and balanced environment’ and its position was to not completely remove sargassum, as it may not have been financially feasible (Government of the Virgin Islands, 2015). The main goal of the national management response has been to reduce sargassum building up along priority coastlines and beaches so as to facilitate natural dispersion or decomposition and minimise any potential negative impacts (Government of the Virgin Islands, 2015). Management efforts undertaken by the Government include on-going clean up exercises, and public education and sensitisation programmes.

Public education campaigns have included distribution of brochures, and organising public talks explaining the origins of Sargassum, its benefits and negative impacts, as well as tips for removal from beaches. Public education initiatives often encourage community members and businesses to engage in clean-up efforts and to utilise sargassum as compost/fertiliser. Government officials also highlight the

main concern of prolonged exposure to hydrogen sulphide from decaying sargassum near beaches and marinas (Department of Information and Public Relations, Government of the Virgin Islands, 2018). Public education campaigns have also included workshops targeted at the tourism sector to provide information on practical approach/possible action (Conservation and Fisheries Department, n.d.; Government of the Virgin Islands, 2015; Department of Conservation and Fisheries, Government of the Virgin Islands, 2016; Government of the Virgin Islands, 2019e). Public advisories have also been issued for persons to wait between two to three weeks before clearing/collecting large amounts of sargassum to prevent removal of any marine animals (VI News, 2017a).

Community-based clean-up activities have been planned by the Government in partnership with various businesses and community groups. The first nationwide clean-up exercise was conducted in 2015 and was coordinated by the Ministry of Natural Resources, Labour and Immigration. During this exercise, volunteers removed 1,000 bags of sargassum from priority coastline areas. Government's focus and main response to sargassum is to continue partnering with community groups and businesses in clean-up efforts due to the need for manpower and resources. Residents have also been encouraged to volunteer time to clean up coastal areas. These clean-up activities have focused on utilising hand tools/small machines to reduce sand removal from beaches. However, the Government has coordinated clean-up efforts using heavy machinery when needed; this has occurred in Handsome Bay in Virgin Gorda (Government of the Virgin Islands, 2015).

After large masses of sargassum impacted coastlines along Anegada with the passage of Hurricane Dorian in August 2019, aerial reconnaissance was conducted to determine the extent of the impact (Smith, 2018). High levels of sargassum influx were observed in Setting Point and Pomato Point. Areas around the Setting Point ferry dock were also affected and resulted in navigational hazards. In response to this event, the Ministry of Natural Resources, Labour and Immigration hired contractors to clean along Anegada shorelines. Contractors also had to provide estimates for labour required, mobilise heavy equipment for clean-up (hi macs and customised backhoes to prevent sand removal), and identify disposal sites for sargassum. The clean-up efforts took place over a period of five days from 3rd – 7th September and were supervised by the Finance and the Environment Units from the Ministry. The disposal site identified was located within the vicinity of the impacted coastline so as to reduce transportation costs. Impacts of salt intrusion into soil was minimised due to nearby hypersaline ponds and lack of agriculture activities occurring within the area. The site also allowed for quick drying of sargassum to reduce impact of hydrogen sulphide gas on residents and visitors (Ministry of Natural Resources, Labour and Immigration, n.d; Ministry of Natural Resources, Labour and Immigration, Government of the Virgin Islands, 2015)**.** During July – August 2021, contractors were also hired to remove sargassum from the water intake at Handsome Bay and Trellis Bay dock areas (Government of the Virgin Islands, 2022). Previously coastlines were monitored to determine priority areas for clean-up. However, monitoring and surveillance of coastlines has reduced over recent years as priorities have shifted post Hurricane Irma (Claxton-Smith, 2021).

In 2015, sargassum obstructed intake at a water plant in Handsome Bay. This affected the odour and taste of potable water for many residents of Virgin Gorda. The Water and Sewerage Department (W&SD) responded by adjusting chlorine dosage in the water supply and increasing water testing at impacted areas. Public service announcements advised to boil water prior to use. It was noted that

relevant authorities stated that the affected water supply did not pose a health hazard. Also, the desalination plant in Handsome Bay was contaminated with sargassum causing water shortages in Virgin Gorda. To maintain water supply, water was barged in from Tortola by the Government. (VINO, 2015c; 2015d).

Responses to influxes include reporting to relevant agencies such as VI Ports Authority, and it has been implied that relevant agencies have informal plans to guide clean-up activities (Smith, 2018). In 2015, previous government/national plans to remove seaweed from coastlines included obtaining a *purpose-built* machine but this plan was not deemed viable and the benefits of sargassum floating mats as fish spawning grounds outweighed the cost of the machine. Government has indicated that if sargassum is not repurposed for compost then it may be disposed of via incineration (VI News, 2017a).

Sargassum has also impacted private marinas, and one solution has been to flush marina channels. This has been done by utilising docked boats as mobile flushing stations by continuously running their engines over a period of time. This has proven effective but was not a cost-efficient long-term solution. Nanny Cay marina has been piloting the use of marine de-icers or circulators from Canada to assist in removing sargassum from the marina. These have been used to create movement in the water through an impeller system and assists with flushing the marina (Nanny Cay, 2019). Other private businesses such as ' Swim with Dolphins' have conducted water testing after sargassum influxes and have also utilised pumps to remove water from inside the facility. This business also utilised heavy machinery to remove tonnes of sargassum, and initial clean-up efforts in 2015 cost an estimated US $12,000 (VINO, 2015e). Sargassum influxes also impacted Anegada fishermen in 2015, obstructing their boats and affecting fishing activities. In response, fishermen organised clean up exercises in collaboration with the National Parks Trust (VINO, 2015f).

The Government's response has also included a commitment to regional collaboration. A two-day regional sargassum conference was held in 2016 on Moskito Island and was hosted in collaboration with the Government, Virgin Unite, The Caribbean Council, the UK Foreign & Commonwealth Office and the Organisation of Eastern Caribbean States. Discussions were held among various experts and stakeholders and highlighted sargassum research and potential uses for sargassum (Sargassum Information Hub, n.d.). Along with various organisations, territories and countries from the Wider Caribbean Region, VI also signed the declaration to establish a "Caribbean Programme for Sargassum" at the First International Conference on Sargassum in 2019 which was organised by the Regional Council of Guadeloupe (ACS, n.d.).

Sargassum uses that have or are being piloted

The Department of Agriculture has also been experimenting with the use of sargassum as a fertiliser (Government of the Virgin Islands, 2015). Sargassum has been collected by truck and taken to the Agriculture Department where it is treated by washing out the salt , drying and then breaking down for farmers to use as mulch (Sloat, 2019). Residents have been encouraged to harvest and utilise sargassum seaweed potentially as fertiliser or compost (Department of Information and Public Relations, Government of the Virgin Islands, 2018).

Green VI is working in collaboration with the Department of Waste Management, the Department of Agriculture and local entrepreneurs to explore the management of organics, including sargassum, in composting and potentially anaerobic digestion applications.

Local farmers utilise sargassum for composting. Tidal Roots Farm in Tortola have been experimenting with the use of sargassum as fertiliser in organic farming (Ulrich, 2019). Green Technology (Green Tech) VI, in partnership with Canadian universities (Trent and Ryerson) and a private company (Green Science), is in the process of piloting vermiculture machines (worm bins) as a waste management project through its waste composting facility "Waste Not". Waste materials being used in these bins includes sargassum which will be processed into fertilisers for use by farmers (Durand, 2018, Department of Waste Management, 2019b).

At the 'Sustainable sargassum management in Anguilla, British Virgin Islands and Montserrat' project launch held on December 1, 2021, it was noted that Unite BVI facilitated an international sargassum conference. Following that, the chemical composition of sargassum was analysed from Virgin Gorda. It was noted that inorganic arsenic was present.

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Appendix 1. Key Informant Interview Questions

Sargassum Monitoring and Management Capacity Assessment				
Scoring system to assess functional capacity: **0 (n/a) = Not applicable to agency/organisation** **1 = Very low or none** **2 = Low or initial progress achieved** **3 = Moderate or progress somewhat achieved** **4 = High or being improved** **5 = Full capacity** **DK – don't know**				
No.	**Questions**	**Sources of Evidence** ***(In each instance, provide evidence and/or an explanation to support the score provided. Examples of the type of evidence are suggested as guidance)***	**Scores** ***(Insert scores 0, 1, 2, 3, 4, or 5)***	**Identify Areas for Improvement** ***(For each question, probe the associated aspects that need improving)***

1.	What are the main sargassum management and monitoring activities in which your agency/organisation is involved? (e.g. Early warning and monitoring, clean-up efforts; community sargassum management projects, development of management plan, creation of new products from sargassum, etc.)	**Open-ended for respondents**		
A. Governance / Enabling Environment *(Ask all respondents)*				
2.	Does **your agency/organisation** include sargassum management and/or monitoring in its mandate or mission? (i.e. is it a priority focus)	Give examples of ways that sargassum monitoring/management has been included in the mandate or mission (e.g., outlined in the agency/organisation plans, policy or other relevant documents)	Provide a rating on the extent to which your agency/organisation includes sargassum management and/or monitoring in its mandate or mission? Ranges from 1 (very little to no consideration/inclusion) to 5 (full consideration /inclusion) **Score:**	Can you suggest ways that sargassum monitoring and management could be better considered in the mandate/mission (e.g. included in priority setting and programming of your agency/organisation)?
3.	Have **national** vulnerability and impact assessments included a focus on sargassum (including exposure to sargassum impacts, socio-economic drivers of vulnerability, and community-level assessments)? Have they been participatory?	List any national assessments that included sargassum Can you give examples of how national vulnerability and impact assessments could include sargassum? E.g. who else should be involved?		

		Have there been any specific sargassum risk or impact assessments in your sector? If so, can you provide more details on these assessments and who was involved.		
4.	What policies or legislation are there to support sargassum management and monitoring at these levels: **National?** **Sectoral?** **Organisational?** (These can include for example, biodiversity or marine laws, strategies or policies or Sargassum Management Strategies)	Give some examples of existing legislation, policies or strategies that support sargassum management and monitoring Can you give some examples of any laws, strategies or policies that are missing or need strengthening?		
5.	Does your agency have linkages or support from any regional organisation for managing or monitoring sargassum influxes? (E.g. CHTA and CRFM have provided guidance information for tourism and fisheries stakeholders, CERMES puts out Sargassum Bulletins etc.)	Give some examples of which organisations and the support that was provided Can you give examples of other ways that regional agencies can provide support to your organisation in Sargassum monitoring and/or management?		
C. Monitoring of sargassum (A*sk all respondents)*				
6.	How does your organisation/agency engage in monitoring / collecting / storing information and data (including historical data) on sargassum?	List information and data collected or available (data on damage and loss from sargassum strandings/events, including	Provide rating on the extent to which your organisation/agency collects and/or stores sargassum information and data (historical data, damage/loss data)	Can you identify any gaps in the information and data collection system for sargassum?

		costs of damages/estimated losses?) Describe whether it is routinely or sporadically collected. Indicate if there is a specific tool for collecting the data and whether specific data is consistently collected.	Ranges from 1 (very little to no extent) to 5 (fully carries out activity) **Score:**	
7.	How are responsibilities and roles defined and assigned amongst **your staff/members** who conduct sargassum monitoring measures?	Give examples of how the responsibilities/roles are assigned Can you give examples of how staff/member roles and responsibilities for conducting sargassum monitoring measures could be improved?		
8.	Are your monitoring activities linked to management and adaptation planning **within your sector or at the national level**?	Give examples of how the implementation of the sargassum monitoring measures are linked to sectoral/national management or adaptation planning How could monitoring be better linked to sectoral/national risk management planning?		
9.	Are your monitoring activities, **linked to a sectoral or national early warning system?**	Give examples of how your monitoring activities contribute to the sectoral or national early warning system Can you describe how your activities could be better linked to a sectoral or national early warning system?		
10.	Are **your staff/members** knowledgeable, adequately qualified and competent in monitoring and managing sargassum influxes?	Give examples of any training or other opportunities that staff have to improve their knowledge, qualifications and competencies to implement monitoring and management activities		

		What is needed to improve the knowledge, qualifications and the competencies of responsible staff?		
D. Resources (financial and equipment) ***(Ask all respondents)***				
11.	Does **your agency's/organisation's** annual budget make provisions for sargassum monitoring and management?	Give an estimation of the % budget allocation for sargassum monitoring and management. Indicate which year budget allocations began and if this has occurred every year since	Provide rating on the extent to which your agency/organisation's budget makes provision for sargassum monitoring and management Ranges from 1 (very little to no provision) to 5 (full provisions made) **Score:**	What areas need additional budget in order to achieve sargassum monitoring and management?
12.	Has **your agency/organisation** had to rely on project funding for the implementation of monitoring and management?	Indicate the % of sargassum monitoring and management budget that comes from project funds. Indicate some of the sources of these funds What areas require more financial support?		
13.	What equipment and tools are available to **your agency/organisation** for sargassum risk assessments, monitoring and management measures?	List some of the equipment and tools available. What additional equipment or tools are needed?		
E. Coordination , Stakeholder Engagement and Communication ***(Ask all respondents)***				

14.	Is **your agency/organisation** part of a national coordination body, network or partnership to support sargassum monitoring and management?	Give the title of the coordination body network or partnership and describe your involvement	Provide rating on the involvement of your agency/organisation in a national coordination body, network or partnership to support sargassum monitoring and management? Ranges from 1 (very little to no involvement) to 5 (full involvement) **Score:**	What ways could your agency/organisation enhance its participation in national coordination bodies or networks?
15.	What level of coordination and collaboration is there **amongst governmental, non-governmental actors and stakeholders at national and community levels for sargassum monitoring and management**? (This includes vulnerable communities such as the elderly, persons with disabilities, women and children)	Give examples of the agencies that work together. Give examples of the vulnerable groups that are already engaged Which other agencies should be involved? How could vulnerable groups be better engaged?		
16.	What staff capacity and procedures are there in **your organisation/agency** for mobilising and engaging stakeholders and partners with respect to sargassum monitoring and management?	Explain the processes used for mobilising and engaging stakeholders/partners Does your agency have a specific strategy for communicating about sargassum? Does your strategy/process include regular communication and updates on sargassum related topics? (e.g. influxes, methods of clean-up etc., sargassum data (historical data)) In what ways could your agency/organisation enhance the communication and sharing of information on sargassum? What are the areas where capacity needs enhancing?		

G. Does your organisation engage in Evaluation and Learning related to your sargassum activities? *(If yes go to 17. If no end survey)*				
17.	Does your **agency/organisation** use a monitoring and evaluation (M&E) system/framework/procedures to assess the process used and outcomes for sargassum management?	Give an example of the M&E procedures used Are there specific targets and indicators your organisation has developed as part of M&E plan or system to assess your performance or the impacts of implemented sargassum management strategies? How do you apply the M&E plan or system? Through either internal meetings to review or stakeholder consultations/surveys? # of communication releases; amount of budget allocated for sargassum management; # of constituents/monitoring areas impacted by landings received assistance; volume of sargassum removed….	Provide rating on the extent to which your agency/organisation uses a M&E system/ framework/ procedures to assess process used and outcomes for sargassum management. Ranges from 1 (very little to no extent) to 5 (fully carries out activity). **Score:**	How could M&E of sargassum management be improved?

18.	What gender and cultural considerations are incorporated by **your agency/organisation** in M&E of sargassum management?	Give examples of how gender and cultural considerations are incorporated into M&E of sargassum management performance Are there specific targets and indicators in your M&E plans related to gender or culture? Do you consider e.g. women fisherfolk or women-led enterprises? Do you consider impacts on cultural assets, practices or values? How could gender and cultural concerns be better integrated into M&E?

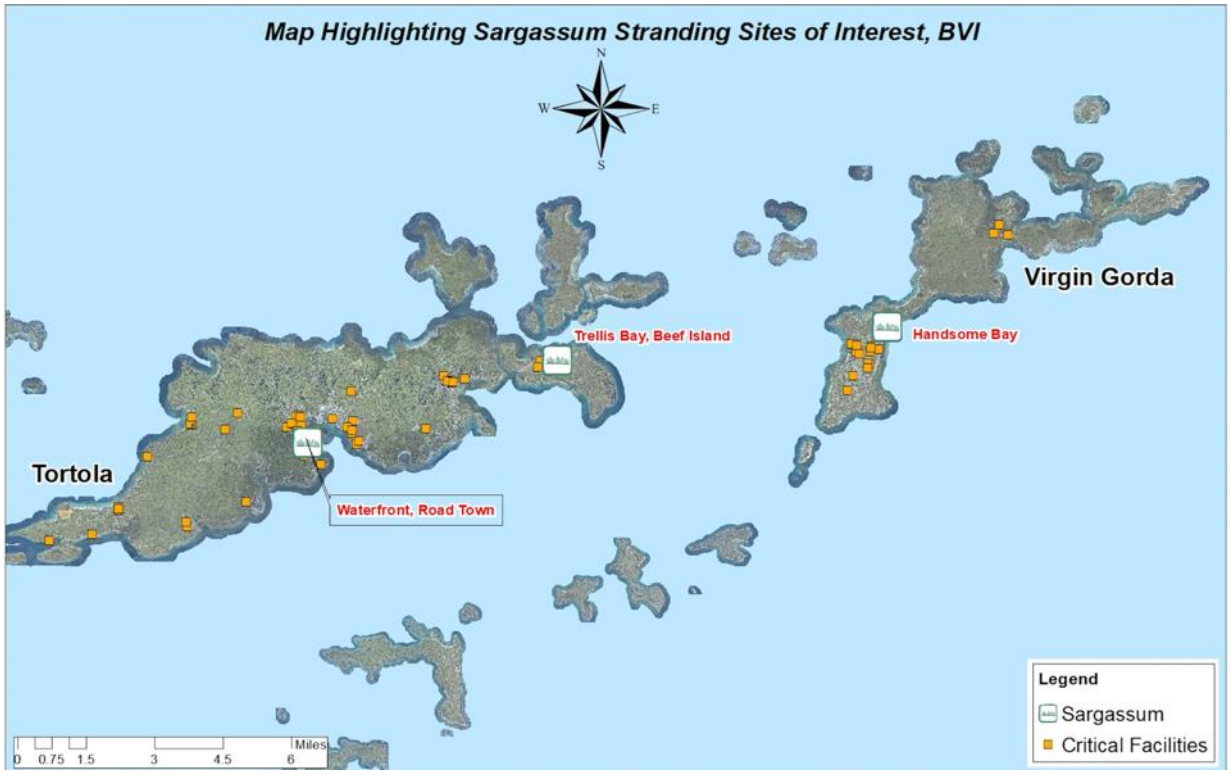
Appendix 2. List of Virgin Islands Key Informants

Organisation	Name / Position	Gender
1. Ministry of Natural Resources	Mervin Hastings (Marine Biologist)	Male
2. Environmental Health Unit	Lionel Michael (Chief Environmental Health Officer)	Male
3. Green VI	Charlotte McDevitt (Executive Director) Natasha Harrigan (Senior Project Manager)	Female Female
4. Department of Waste Management	Neville Allen (Acting Manager)	Male
5. Department of Disaster Management	Melanie Daway (Senior Technical Planning Manager) Sheniah Armstrong-Jones (Deputy Director)	Female Female
6. Unite BVI	Kim Takeuchi (Foundation Manager)	Female
7. Department of Agriculture and Fisheries	Tessa Smith-Claxton (Assistant Secretary) Abbi Christopher (Fisheries Specialist)	Female Female

Appendix 3. Location Profiles of Sargassum Stranding Sites

Sargassum influxes impact the entirety of the Virgin Islands (UK). However, three (3) sites were identified by the Ministry of Natural Resources (Hon. Vincent Wheatley, 2 April 2022, pers. comm) to be of most concern for sargassum management. These, as shown on the map, are:

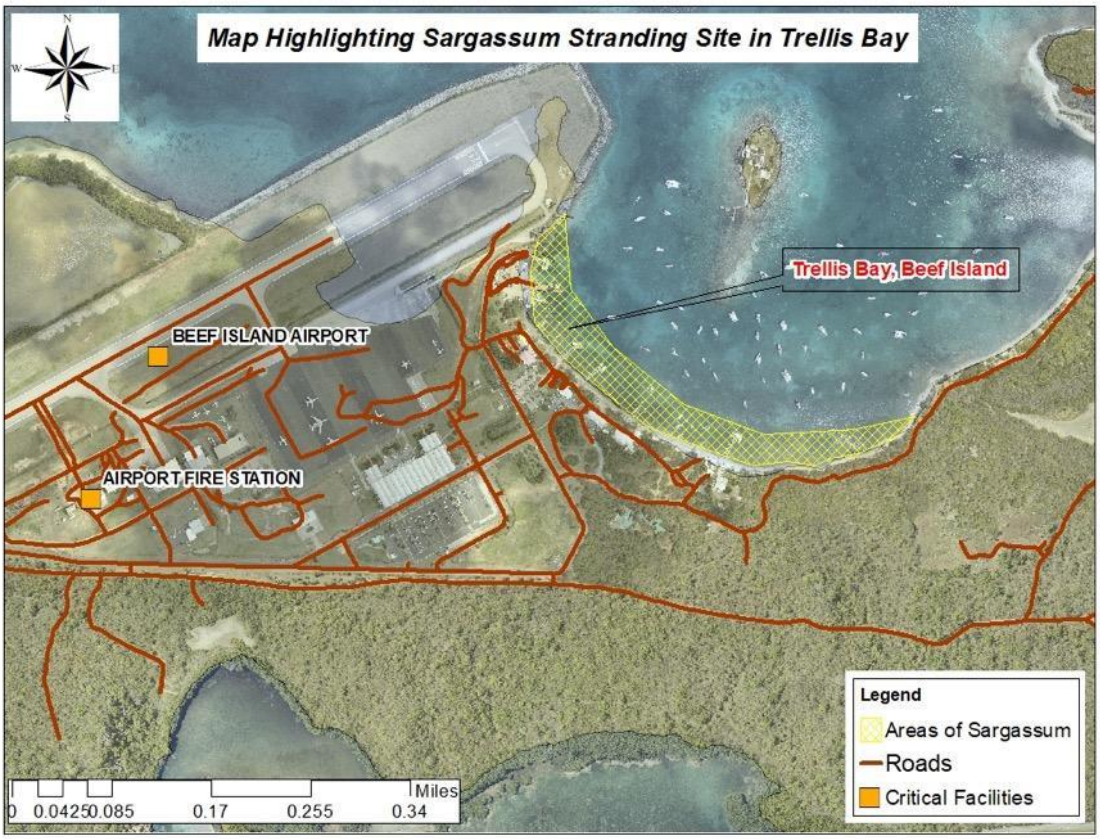
1. Trellis Bay, Beef Island
2. Handsome Bay, Virgin Gorda
3. Road Town Harbour, Tortola



The following section includes profiles of the priority sites and four others across the Virgin Islands (UK) that have been affected by sargassum influxes and inundations. Each profile maps the location and sets out some basic descriptive features such as its social and ecological characteristics, vulnerability factors and site access. Ultimately, along with other information and noting that sargassum situations tend to be quite dynamic, the profiles provide a basis for a sargassum adaptive management strategy with guidance on where to focus most cost-effectively, that is acceptable to stakeholders and/or decision-makers.

Two of the profiles (Indigo, Camanoe Island and Sea Cow's Bay, Tortola Island) are incomplete due to lack of data. They can be completed as the sargassum adaptive management strategy is implemented.

Trellis Bay, Beef Island



Above: Trellis Bay

SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
TRELLIS ● Barge and Ferry Access Point to Virgin Gorda from Western side of Trellis Bay smaller vessels provide ferry service to other outer-lying island (Guana Island and Scrub Islands, which both house resorts) and private boat service for the residential community of Great Camanoe Island; ● Mostly commercial: A series of restaurant, bars and other small tourism-related businesses line the waterfront; ● Close Proximity (~70 meters) to the Terrance B. Lettsome International Airport; ● During one severe sargassum influx, an ambulance boat from Virgin Gorda with a patient could not dock at their procedural drop-off zone due to the Sargassum blocking the dock and being forced to relocate to the other end of the Bay to dock. **LONG BAY** ● A series of vendors are set up to cater to visiting cruise ship guests. ● Government of the Virgin Islands (Ministry of Natural Resources, Labour and Immigration) is actively working to establish a Beach Management Plan (spring 2022).	**TRELLIS** ● Gently sloping, fine-sand barrier beach; ● Seagrasses and some corals are contained within the bay; ● Typical beach vegetation (seagrape, coconut palm, buttonwood mangrove). Beach more 'natural' on eastern edge with more exotic/ornamentals found around businesses/areas of human settlement. **LONG BAY** ● Sandy barrier beach ● Known sea turtle nesting sites for Leatherback Sea Turtles. ● Adjacent Salt Ponds; ● Hurricane-damaged coastal mangroves.

VULNERABILITY FACTORS	
Geophysical features	Prevailing Easterly trade winds and currents draw sargassum to the SW corner of the bay.
Is there adequate access to the bay to facilitate clean-up efforts	Yes: Adequate access for mechanical and manual clean-up efforts. Nearly every business on the bay had vehicular access.
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	No
How close is the community to the Bay?	Not Close. This is a commercial area with businesses.
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	Far: >1km
Volume of sargassum during scoping assessment	None/Low (March 2022)

VULNERABILITY FACTORS	
Volume of sargassum historically (2011-present)	Extremely High
Is the beach heavily used by locals?	Yes, this is a popular recreational site
Is the beach heavily used for tourism?	Yes, most persons using the beach are visit
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	Yes: Each business takes responsibility for clean-up in their own areas of the bay. It was recognised that this is easier for upwind/current businesses where accumulation tends to be less.
Is there evidence of community efforts to use sargassum	Some. One business owner also owns an organic farm and is experimenting with composting using vermiculture methods. Some businesses used as fertilizer in and around ornamental plants only.
Presence of church and community groups that advocate for government assistance?	Some. In October of 2015, the Rotary Club Sunrise partnered with the Department of Conservation and Fisheries to host a Sargassum Clean Up.

BEACH ACCESS	LOCATION	TERRAIN
Vehicular	Ferry Dock/Barge	Off main road (paved)
Vehicular	Trellis Bay Market -Loose Mongoose	Dirt Road just off of a paved main road
Vehicular	Long Bay Beach	Dirt Road.

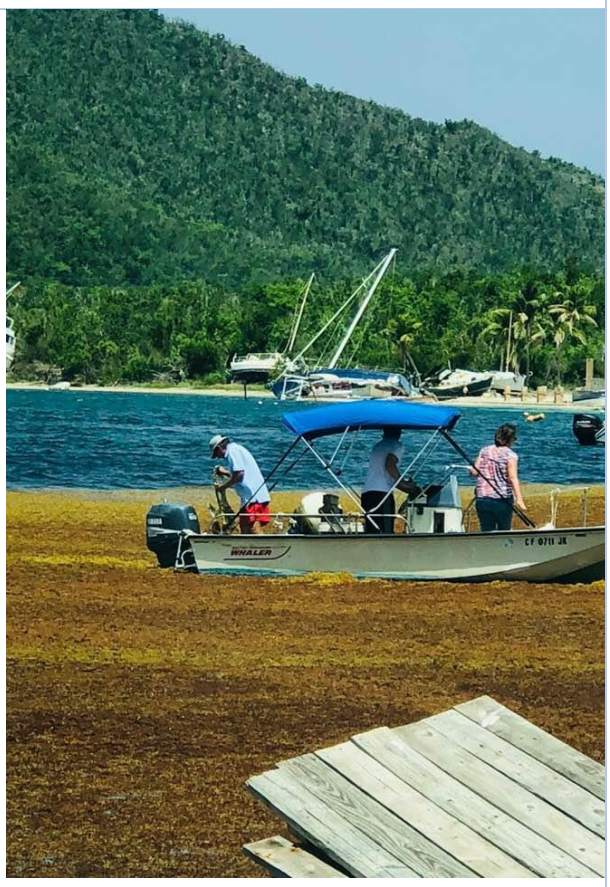
NOTES

According to the on-site inspection, Trellis Bay has no protection against the inflow of Sargassum which is likely to accumulate given prevailing wind and current patterns in the VI. Business owners usually removes sargassum as it comes ashore, and the quantity of Sargassum removed varies based on their position in the Bay, with lower quantities accumulating on the Eastern edge and most of the sargassum being swept downwind/down current to the Southwestern corner of the Bay.

The problem severely effects the businesses at the Western End of the bay. When there is excessive sargassum accumulation, Speedy's Ferry has been forced to cease operations, diverting all ferry service into Roadtown. Trellis Bay Market reported business sales losses of approximately 50% of total revenue during period of sargassum accumulation.

While Trellis Bay acts like a "catcher's mitt," occasionally wind shifts will pull sargassum mats downwind and strandings will occur at Long Bay Beach. Department of Conservation and Agriculture Beach Wardens are responsible for clean up at Long Beach and remove sargassum strands manually with rake and wheelbarrows (see images below).

Trellis Bay – Sargassum Accumulation



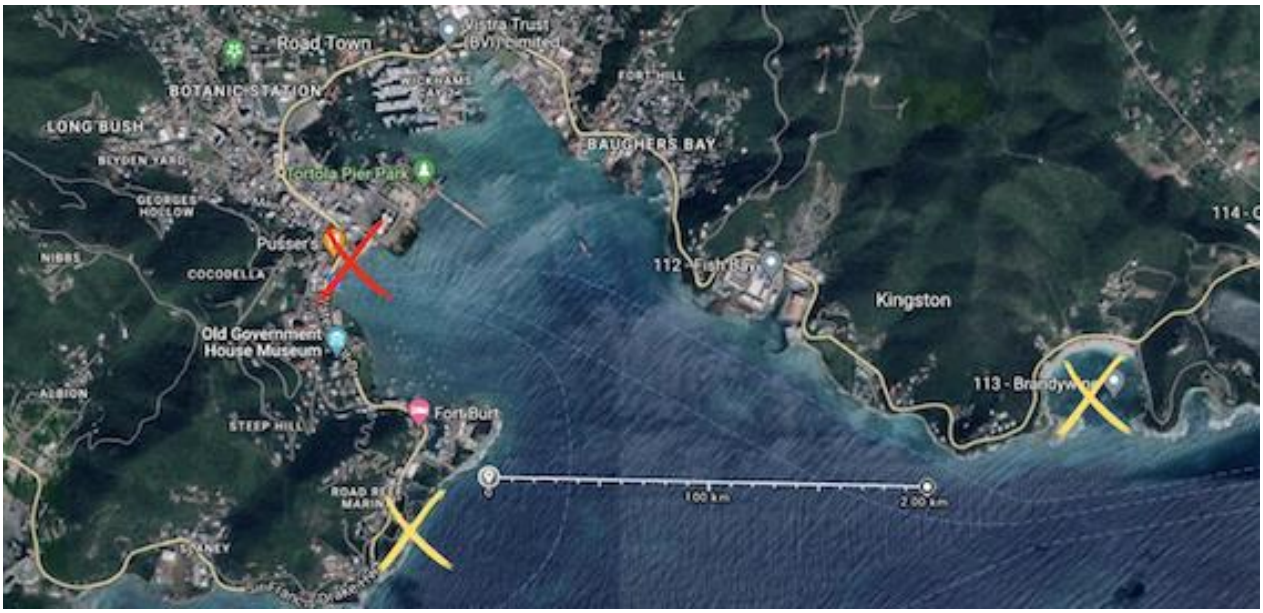
Above: (L) Trellis Bay inundation, July 2017; and (R): Trellis Bay inundation July 2018. (Photos: Burton Smith)

Above: (L) June 2019 inundation and (R) : Clean up efforts by Government. (Photos: Vincent Wheatley).

Long Bay Beach – Sargassum Accumulation

Above: (L): Sargassum accumulates at Long Bay beach in June 2020 and (R): Beach Wardens from the Department of Fisheries and Agriculture clean up sargassum. (Photos: From Facebook video, Dean Sportsman Greenaway).

Road Town Harbour, Tortola



SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
• Business/Commercial Centre of Road Town • Active (Domestic/International) Seaport /Ferry Terminal an Dock for Passenger Ferries to/from Anegada, Virgin Gorda and U.S. Virgin Islands.	• The greater Road Town area is heavily developed and there are few noteworthy ecological features. • Fringing coastal mangrove communities were badly damaged during Hurricanes Irma and Maria and there are on-going efforts to restore degraded sites. Sargassum accumulation smothers and kills young newly-planted seedlings.

VULNERABILITY FACTORS	
Geophysical features	
Is there adequate access to the bay to facilitate clean-up efforts	Yes, but requires heavy equipment.
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	No
How close is the community to the Bay?	This is a heavily populated area; but most of the buildings on the waterfront are commercial or government offices.
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	There is no school located on the waterfront.
Volume of sargassum during scoping assessment	A no-low sargassum volume was observed during assessment (March 2022)
Volume of sargassum historically (2011-present)	Extremely High
Is the beach heavily used by locals?	NA (No beach); however, this is an important port for accessing sister islands and the USVI.
Is the beach heavily used for tourism?	No (No beach); however, the Roadtown Ferry terminal is port of entry for many visitors. There is concern about this impact that this situation as it is often visitors' first impression of the VI. This was documented: Seaweed Causing Ferry Dock Stink: Stench Welcoming Visitors
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	The Government of the Virgin Islands has supported clean up initiatives. As the site is a port, clean up needs to be accessed with heavy equipment and is an unlikely candidate for community-based initiatives which typically focus on beach and recreational areas.
Is there evidence of community efforts to use sargassum	N/A – Residents are more likely to take sargassum from beach areas.
Presence of church and community groups that advocate for government assistance?	N/A Probably not viable in this location for aforementioned reasons.

BEACH ACCESS	LOCATION	TERRAIN
Vehicular	Ferry Dock/Roadtown Ferry Terminal	Off main road (paved)
Vehicular	Brandywine Beach	Off main road (paved

NOTES

SARGASSUM ACCUMULATION – Road Town, Tortola

Above: (L-R): Sargassum Accumulation at Road Town Ferry Dock and Clean up, November 2014 (R) Photos: VI Beacon.

Above: (L): Sargassum Clean up at Road Town Ferry Dock, May 2017 (Photo: 2 of Us Photography); and (R): Sargassum chokes entrance to Road Town Harbour, September 2018 (Photo: VI Beacon).

SARGASSUM ACCUMULATION – Other "Greater Road Town Area."

Above: (L) Sargassum inundation at the former site of Dolphin Discovery at Prospect Reef just outside of Road Town Harbour, September 2015; and (R): Brandywine Beach, September 2015 (Photos: Virgin Islands News Online).

Sea Cow's Bay (includes Nanny Cay) Tortola

SARGASSUM ACCUMULATION – Sea Cow's Bay & Vicinity

Above: (L-R) Sargassum inundation at Sea Cow's Bay, September 2015 (Photos: Virgin Islands News Online).

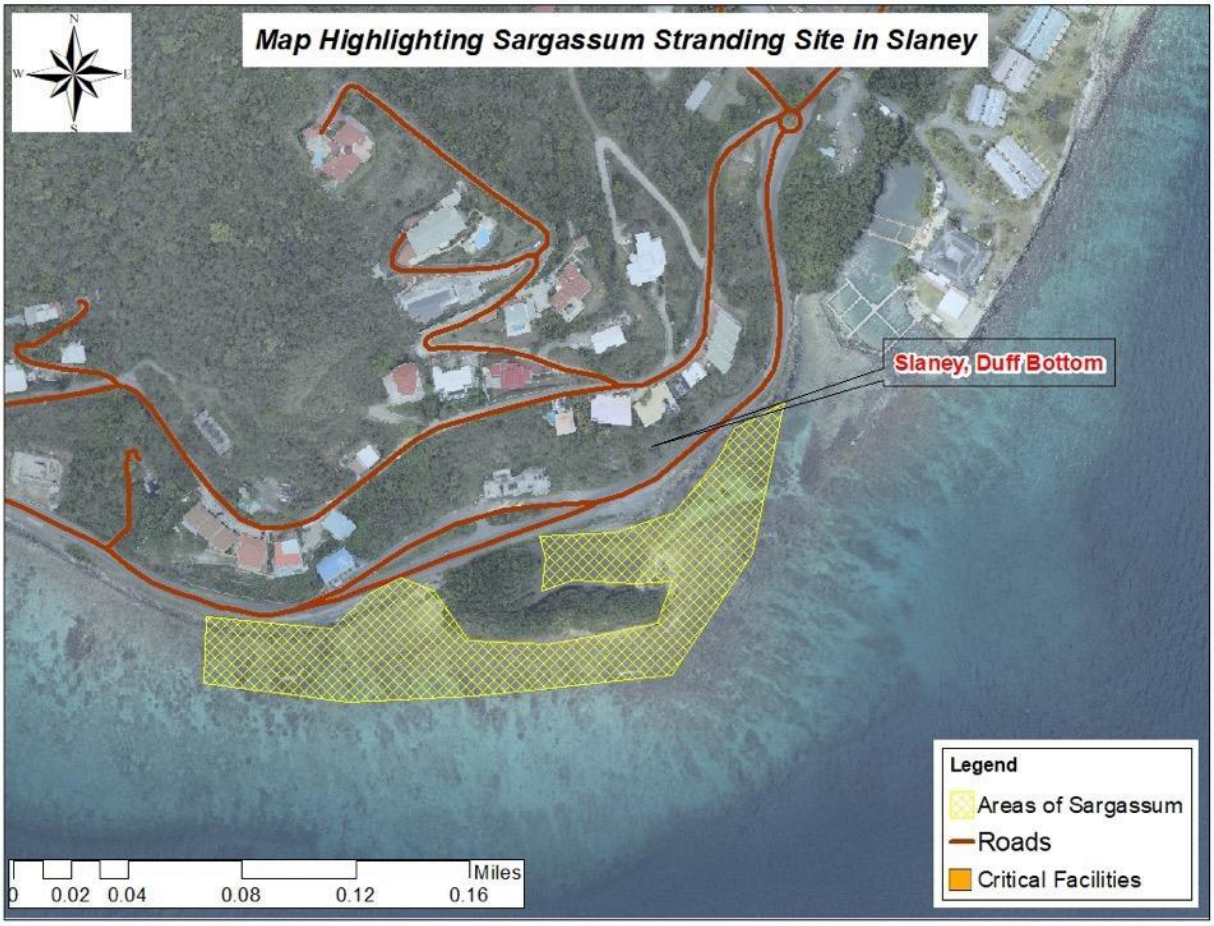
SARGASSUM MANAGEMENT – Nanny Cay Resort and Marina

Above: (L) Aerial view of Nanny Cay with Sea Cow's Bay in the Background and (R): Information Taken from Nanny's Cay's website about the Marina's efforts to manage the sargassum problem.

SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
• TBC	• TBC

VULNERABILITY FACTORS	
Geophysical features	N/A
Is there adequate access to the bay to facilitate clean-up efforts	N/A
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	No
How close is the community to the Bay?	N/A
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	N/A
Volume of sargassum during scoping assessment	A no-low sargassum volume was observed during assessment (March 2022)
Volume of sargassum historically (2011-present)	Extremely High
Is the beach heavily used by locals?	No
Is the beach heavily used for tourism?	No
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	N/A
Is there evidence of community efforts to use sargassum	N/A
Presence of church and community groups that advocate for government assistance?	N/A

Slaney, Tortola

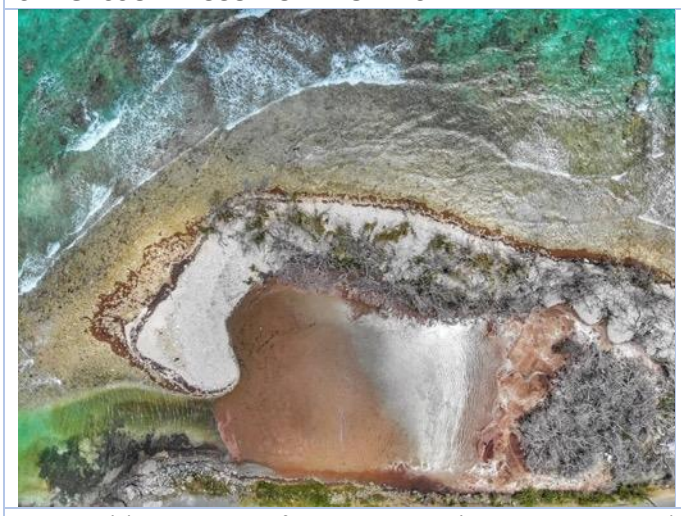


SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
● A Bar and restaurant is located across the road. ● The site is adjacent to the Sir Francis Drake Highway.	● Coral rubble beach ● Small lagoon containing a red mangrove habitat with other coastal vegetation (e.g. seagrape, *Thespesia populnea*, etc.). ● The site is actively used by wetland birds and other shorebird species, possible nesting sites for plovers and sandpipers.

VULNERABILITY FACTORS	
Geophysical features	
Is there adequate access to the bay to facilitate clean-up efforts	Roadside access; however the berm is very narrow and located immediately on the Sir Francis Drake Highway. Site Clean-up would need heavy equipment and possible use of vessels.
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	No
How close is the community to the Bay?	N/A
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	N/A
Volume of sargassum during scoping assessment	A no-low sargassum volume was observed during assessment (March 2022)
Volume of sargassum historically (2011-present)	Extremely High
Is the beach heavily used by locals?	No
Is the beach heavily used for tourism?	No
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	No
Is there evidence of community efforts to use sargassum	No
Presence of church and community groups that advocate for government assistance?	N/A

BEACH ACCESS	LOCATION	TERRAIN
Vehicular	Slaney	Off main road (paved)
NOTES		

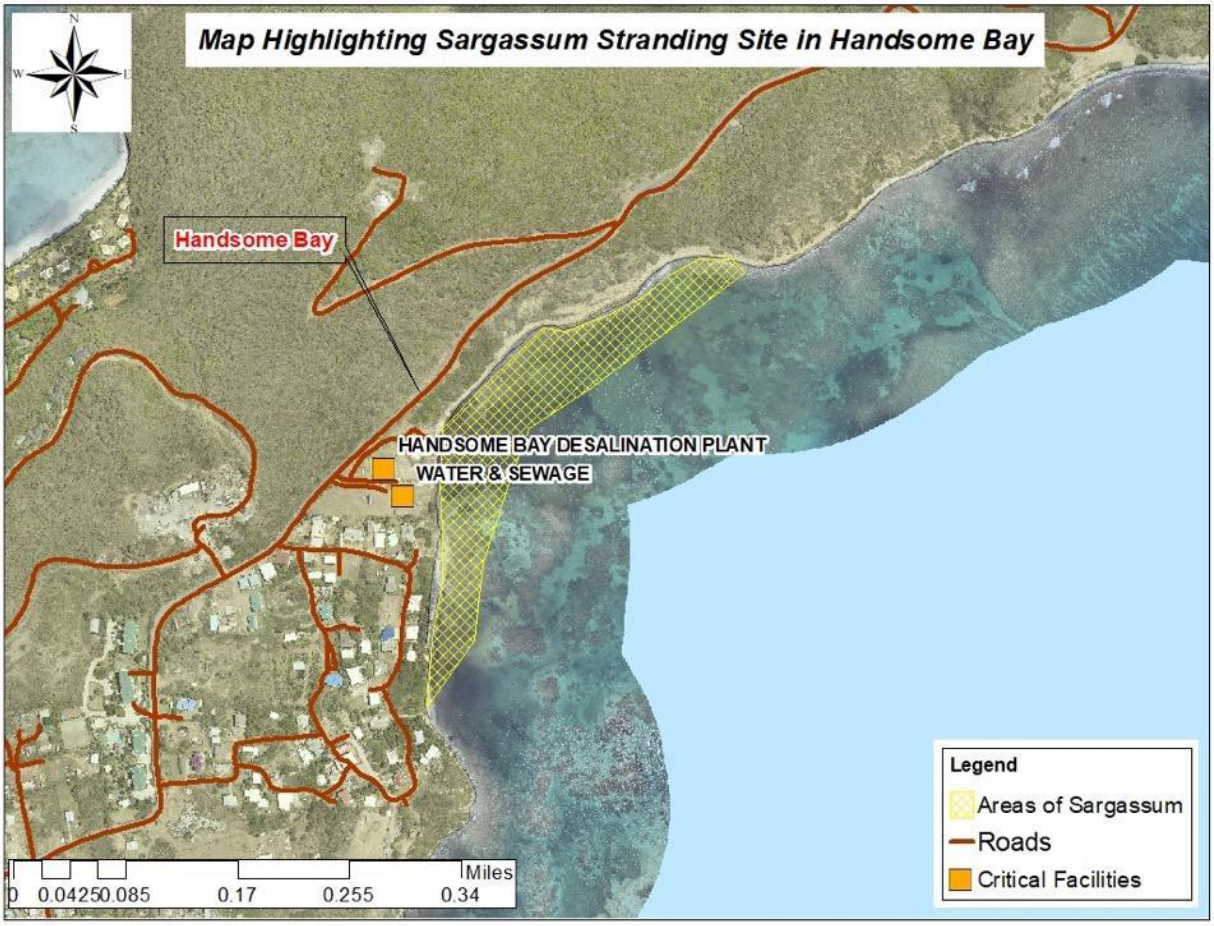
SARGASSUM ACCUMULATION – SLANEY

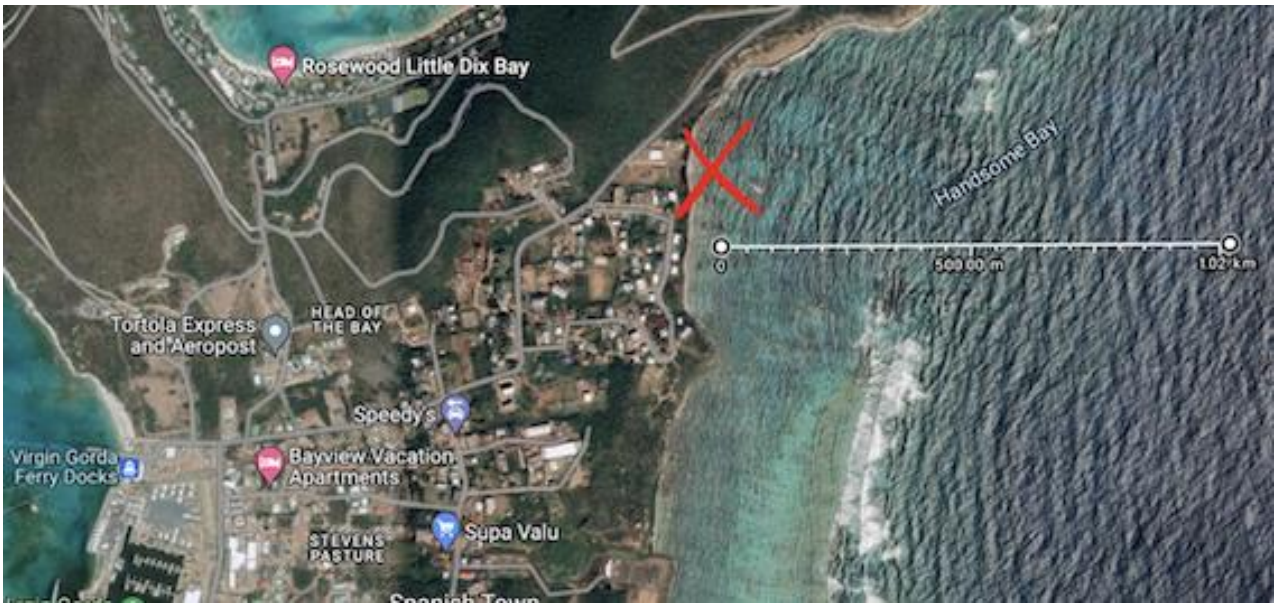


Above: (L) Aerial view of Slaney in 2018 (Photo: Alton Bertie): and (R): Aerial view in May 25, 2022 (Photo: R. Smith).

Above(L): An owner from an adjacent business cuts a path through the mangroves at Slaney (September 2021) in an attempt to ease the accumulation of sargassum, which proved to be unsuccessful (May 25, 2022). (Photos: S. Zaluski).

Handsome Bay, Virgin Gorda





SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
• Residential Community • A Reverse-Osmosis Water generation facility is located on the bay.	• Seagrape and beach morning glory/goat's foot (*ipomoea pes-caprae*) • Some shorebirds observed during visit • Turtles reported to infrequently nest on this beach.

VULNERABILITY FACTORS – Handsome Bay, Virgin Gorda	
Geophysical features	Prevailing winds and current lead to heavy sargassum accumulations
Is there adequate access to the bay to facilitate clean-up efforts	Yes, heavy equipment can access the bay.
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	No
How close is the community to the Bay?	This is a residential community, the community is immediately adjacent to the stranding site.
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	The R.O water plant is located at the site; The airport is ~ 1km way; Valley Day School is ~1km; Clinic is about 1.5 km away;
Volume of sargassum during scoping assessment	A "low" accumulation of sargassum (April 2022) was observed; however, the beach still contains large mounds of the decaying seaweed).
Volume of sargassum historically (2011-present)	Extremely High
Is the beach heavily used by locals?	This is a residential neighbourhood.
Is the beach heavily used for tourism?	No
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	Some. MNRL has spearheaded government-community initiatives (see flyer below) and other groups (Green Sprouts) report carrying out small scall clean ups.
Is there evidence of community efforts to use sargassum	Minimal. Sargassum was piled on site and believed to help address erosion issues at the beach (*pers communication, V. Wheatley*).
Presence of church and community groups that advocate for government assistance?	There are some local community groups and churches. These groups may not be immediately located on Handsome Bay; however, Virgin Gorda is a small island. Groups include Lion's and Leo's Clubs, Green Sprouts and VG Rock.

BEACH ACCESS	LOCATION	TERRAIN
Vehicular	Handsome Bay	Beach

NOTES

Handsome Bay is primarily a residential area situated along the southern coast of Virgin Gorda. Recreational use of this beach is mainly by locals who live on or near the bay, some residents report spearfishing in this area. The bay, which is exposed to the Atlantic Ocean to the East, receives extreme amounts Sargassum yearly, and often is the first location to indicate the arrival of Sargassum in mass quantities for the Virgin Islands. Initially, Sargassum was manually/mechanically removed from the bay and transported to dumps by trucks. Due to the damage to the beaches, the method has been revised. The current solution is to pile the

Sargassum onto the beach and bury it beneath the soil and sand on the beach. As the Sargassum decomposes, the piles offer protection from storm surges and act as buffers for the beach. In terms of community involvement, most times Sargassum is just left on its own until it piles up and becomes a nuance. However, there are small-scale beach cleanups done by a local environmental youth advocacy group, Green Sprouts. Some notable impacts of the sargassum problem include:

- There was one instance in which Sargassum clogged the intake pipe of the desalination plant. The facility was in operational for nearly a year. The pipe has been extended further out to prevent this. (Interview, Hon. Vincent Wheatley, April 2, 2022).
- One resident with a severe respiratory had to be repeatedly sent to the clinic. Her physician has recommended that she move from her home.
- Decomposing sargassum is correlated with the rusting of metallic objectics such as vehicles and pipes etc. in nearby homes.

Sargassum Accumulation Events – Handsome Bay, Virgin Gorda

Above (L): Dead Fish on the Beach at Handsome Bay, 2015 and (Center): Sargassum accumulation, 2015. Photos: Todd Van Sickle, the VI Beacon, Octobe 2, 2015. (R): MNRLI Flyer Calling for Community Members to support Sargassum Clean-up Efforts at Handsome Bay.

Above (L): Handsome Bay Sargassum accumulation, June 2019 (Photos: Vincent Wheatley).

Above (L-R) Sargassum inundation at Handsome Bay, July 2021. Photos: Orlando Stevens

Indigo, Camanoe Island

SARGASSUM ACCUMULATION – GREAT CAMANOE ISLAND

Above: Sargassum inundation at Great Camanoe Island, May 2018. (Photo: Yacht Shots VI).

SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
• Private residential community, comprised mainly of vacation homes.	• N/A

VULNERABILITY FACTORS – Great Camanoe Island	
Geophysical features	N/A
Is there adequate access to the bay to facilitate clean-up efforts	N/A
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	No
How close is the community to the Bay?	Camanoe
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	N/A
Volume of sargassum during scoping assessment	N/A
Volume of sargassum historically (2011-present)	N/A
Is the beach heavily used by locals?	N/A
Is the beach heavily used for tourism?	No
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	N/A
Is there evidence of community efforts to use sargassum	N/A
Presence of church and community groups that advocate for government assistance?	There is a homeowner's association.

BEACH ACCESS	LOCATION	TERRAIN
Private Vessel	Great Camanoe Island	Marina
NOTES Great Camanoe is a private island comprised of vacation and luxury homes. Sargassum mainly collects at the deep marine at Indigo Plantation.		

Setting Point/South Coast, Anegada

SELECT SOCIAL KEY FEATURES	SELECT ECOLOGICAL KEY FEATURES
• Main Point of access for the community (Ferry/Barge access); • Heavily settled area; • Numerous small tourist-related businesses (Bars/Restaurants and small hotels/inns; • Mooring field which provides access for visiting charter yacht tourists • Fisherman's Wharf near the Settlement.	• Anegada is one of the most ecologically sensitive areas in the VI; • Horseshoe Reef, one of the Caribbean's largest barrier reefs, extends outward from Anegada to the SE. • Extensive coastal fringing mangroves on the island's south coast.

VULNERABILITY FACTORS – Anegada	
Geophysical features	
Is there adequate access to the bay to facilitate clean-up efforts	Yes
Is the area important for fishing? (presence of fish market and other infrastructure e.g. jetty)?	Yes. Fisherman's wharf and Setting point are the departure/arrival locations for residential fisherman. Fishing is an important part of the community.
How close is the community to the Bay?	The Settlement, which contains the majority of residential homes is just inland from Anegada's southern coastline.
Proximity of bay to schools and other infrastructure (e.g. polyclinics)	The ferry dock is located in Setting Point
Volume of sargassum during scoping assessment	N/A Did not visit (Presumably Little/None)
Volume of sargassum historically (2011-present)	Low; however, Following the passage of Hurricane Dorian, Anegada experienced an extreme inundation.
Is the beach heavily used by locals?	Yes
Is the beach heavily used for tourism?	Yes
EVIDENCE OF RESILIENCE	
Is there evidence of community efforts to clean-up?	N/A – Volume too high for community-based efforts.
Is there evidence of community efforts to use sargassum	N/A
Presence of church and community groups that advocate for government assistance?	N/A

BEACH ACCESS	LOCATION	TERRAIN
Vehicular	Setting Point	Sandy Beach
NOTES Anegada is not typically a Sargassum inundation site for the VI; however, following the passing of Hurricane Dorian, the island experienced a massive influx of Sargassum. While Sargassum invasions may threaten beach tourism and ecologically sensitive areas elsewhere in the Caribbean, in the VI, many of the sites where sargassum accumulates in the VI are built up areas of human settlement. Although invasions may only be episodic in Anegada, the island should be considered very vulnerable to sargassum invasions due to the high economic reliance on beach tourism and fishing.		

SARGASSUM ACCUMULATION – ANEGADA

Above: Sargassum inundation at Anegada (Setting Point), August 29, 2019, Following Hurricane Dorian. Photos: Andrew Fahie, Facebook.

Above (L-R) Aerial photos of Anegada's South Coast August 29, 2019 Following Hurricane Dorian. Photos: Vincent Wheatley, Facebook.