



Infrastructure

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Introduction

A variety of entities – both public and private – provide infrastructure and services in the USVI related to drinking water, energy, wastewater, solid waste, and stormwater. This section provides an overview of these infrastructure and services, including regulatory and administrative context, service providers, and the systems. This section also provides information on physical infrastructure and facilities related to schools. Following the 2017 hurricanes, substantial amounts of federal funding were allocated for infrastructure repairs and upgrades, such as through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery (CDBG-DR) program. The Virgin Islands Housing Finance Authority (see Housing section) is generally the fiduciary agent for these funds and manages over \$1 billion program funds, including the CDBG-DR program.

Much of the information in this section is derived from the U.S. Virgin Islands Hurricane Recovery and Resilience Task Force (2018). [USVI Hurricane Recovery and Resilience Task Force: Report 2018](#); Alderson, D.L., Bunn, B.B., Eisenberg, D.A., Howard, A.R., Nussbaum, D.A., and Templeton II, J. (2018). [Interdependent Infrastructure Resilience in the U.S. Virgin Islands: Preliminary Assessment](#). Naval Postgraduate School, Monterey; and the service providers themselves.

Drinking Water

Regulatory and Administrative Context

In the United States, the Safe Drinking Water Act (SDWA) is the primary federal law that governs drinking water and is overseen by the U.S. Environmental Protection Agency (EPA). The SDWA allows states and territories to regulate drinking water in their jurisdictions if they meet minimum requirements with regulations that are at least as stringent as federal requirements. This delegation is known as “primacy,” and in the USVI, the Department of Planning and Natural Resources (DPNR) is the primacy agency for drinking water through its Public Water System Supervision program under the Environmental Protection Division. Accordingly, DPNR regulates drinking water systems, cisterns, water haulers, and well providers. As of the summer of 2022, DPNR is updating its Drinking Water Standards Rules and Regulations. However, as recently as 2015, EPA identified some gaps in the USVI’s drinking water program under the SDWA, including related to environmental monitoring, data input, facility inspection, and training, as well as financial and programmatic challenges.

In addition to DPNR, the Public Service Commission (PSC) regulates water systems’ rates and represents consumers in disputes, while the Department of Health (VIDOH) regulates bottled water.

Environmental Context

There are limited freshwater resources for drinking water in the USVI. Additional details on these resources are included in the Natural Resources section. Rainwater cisterns, purchased bottled water, and desalination of ocean water provide water for general use and drinking.

Water Infrastructure and Providers

The vast majority of the USVI population, including those with Virgin Islands Water and Power Authority (WAPA) service (see below), uses rainwater harvesting cisterns, with some estimates as high as 95%. Cisterns are required for all residential buildings, sized based on the roof area, but not for public housing buildings. This water is typically used for running water in homes, but not always for drinking water.

Most USVI residents typically use bottled water purchased in stores for drinking water. On St. Thomas and St. Croix, this bottled water is typically WAPA or well water that has been re-filtered. Bottled water use contributes to plastic waste problems throughout the USVI. Some residents also buy water from WAPA and/or private water haulers to fill cisterns, especially during times of water stress (i.e., drought). Private water haulers obtain water from private wells or purchase water from WAPA. On St. Thomas, water haulers typically charge twice the amount of standard WAPA rates.

Cisterns are typically exposed, making contamination a regular challenge. Many residents have in home multi-stage water filtration systems and do use cisterns for drinking water. A common practice is to treat cisterns with chlorine bleach. In limited areas, mostly around Coral Bay on St. John, cisterns are treated with ultraviolet (UV) light. However, cistern contamination remains a concern. Based on one VIDOH study, 64% of households had bacteria in their cistern water, and 32% had bacteria in the water from the kitchen faucet, even though 96% of the households reported that they treated the water. EPA has long identified this issue as a concern and produces factsheets to address it. VIDOH is working on guidelines and programs to assist cistern users. Additional testing and treatment are priorities. Further, use of high volumes of bleach can cause local ecosystem damage.

In addition to WAPA and water haulers, approximately 50 to 80% of USVI hotels and condominiums provide their own water, typically with small reverse osmosis systems. Some private water companies and haulers have (or plan to build) their own reverse osmosis systems to compete with WAPA. Table 1 shows a break-down of the USVI housing units by water source.

Table 1. USVI Population by Water Source

Water Source	Percentage of USVI Housing Units ^a	Percentage of STX Housing Units	Percentage of STJ Housing Units	Percentage of STT Housing Units
Public system	39%	42%	21%	38%
Cistern, catchment, tanks, or drums	72%	70%	85%	73%
Delivery vendor or water truck	14%	8%	21%	18%
Supermarket or grocery store	37%	23%	18%	53%
Some other source	3%	3%	1%	2%

^a It is presumed that some housing units have multiple sources of water, so percentages do not sum to 100.

As shown in Table 1, cistern, catchment, tanks, or drums is the most common water source in the USVI and in each island. St. Thomas tends to be fairly reflective of the USVI as a whole in terms of water sources. St. John tends to have a lower percentage of households who use a public system or supermarket or grocery store for their water source and a higher percentage of households who use delivery vendors or water truck or cistern, catchment, tanks, or drums for a water source. St. Thomas tends to have substantially more households that use supermarkets or grocery stores for a water source.

Water and Power Authority (WAPA)

An autonomous government-owned public utility, the Virgin Islands Water and Power Authority (WAPA) is the largest water system in the USVI, serving nearly 13,000 customers connected to the WAPA system, more than 80% of which are residential and the remainder commercial. Roughly 40% of USVI housing units have access to the system. Table 1 shows a break-down of the USVI housing units by water source. WAPA produces water through desalination by reverse osmosis of ocean water at three plants, two located at the Richmond Power Plant on St. Croix and one located at the Randolph Harley Power Plant on St. Thomas. These desalination plants are owned and operated by a private for-profit company called Seven Seas Water, under agreement with WAPA. Following the reverse osmosis process, WAPA treats the water and distributes it to storage tanks and pumps the water to distribution mains. A reinforced underwater distribution pipe transports water from St. Thomas to St. John. WAPA Water Quality Reports for 2020 do not indicate any SDWA violations, although as referenced earlier, EPA has identified some gaps in the USVI drinking water program, including related to monitoring and validity of results.

Much of the system is old, and leaks and other infrastructure problems are challenges. For example, roughly 30% and 10% of water is lost in the distribution system on St. Croix and St. Thomas, respectively. These challenges were exacerbated by recent hurricanes and are anticipated to get worse with climate change impacts (e.g., increased intensity of storms). In addition, there is limited service coverage.

Nearly all of WAPA's budget is from federal grants, with 95% of funding for system rehabilitation and maintenance derived from EPA. WAPA's water rates are also an affordability challenge for many customers, and outages are a concern. Residential services fees do not provide consequential revenue, and many of WAPA's largest customers (e.g., local government, schools, and hospital) are behind on payment. As it has for the last 10 years, WAPA also lacks access to capital markets, and cash flows are a regular problem. These financial issues have led to project delays. Increasing competition from private haulers and delays in payment exacerbate these financial challenges.

In addition, the desalination process can have important impacts on and be impacted by other environmental issues:

- In the summer of 2022, sargassum seaweed impacted water production at the St. Croix reverse osmosis desalination plant. Rising temperatures due to climate change and increased nutrients, including from fertilizers and wastewater, are potential key causes.
- Energy and water provision are closely linked in the USVI, as both are provided by WAPA, and the facilities are also co-located and rely on each other for inputs. Accordingly, there are vulnerabilities and opportunities, especially in terms of costs, supplies, and infrastructure between these two sectors.
- Desalination by reverse osmosis is an energy intensive process with potential environmental challenges related to waste products (e.g., salt brine).

Energy

Regulatory and Administrative Context

Several entities are involved in the territory's energy system. As an autonomous government-owned public utility, WAPA is the exclusive entity for generating and distributing energy throughout the USVI.

United States federal involvement, including by the Department of Energy, is generally limited to technical assistance, funding, and oversight support, including for renewable energy deployment and energy efficiency and conservation. The USVI Energy Office (VIEO) is responsible for planning, oversight, and coordination, including for renewable energy deployment, while the Public Service Commission (PSC) regulates WAPA's rates and oversees contracts with WAPA. The Legislature oversees the energy sector and associated policies, such as the US Virgin Islands Renewable and Alternative Energy Act of 2009.

Service Provider: Water and Power Authority (WAPA)

WAPA serves approximately 45,000 residential customers and 9,000 commercial and industrial customers in the USVI. St. Croix has its own power system, while St. Thomas and St. John (and Water Island and Hassell Island) share a system. The 141 MW capacity Randolph Harley Power Plant (Generating Station) in Krum Bay on St. Thomas provides power generation for the St. John-St. Thomas system, with a peak demand of approximately 59-66 MW. The 101 MW capacity Estate Richmond Power Plant (Generating Station) on St. Croix provides power generation for the island's system, with a peak demand of approximately 37-44 MW. Therefore, combined peak demand for the USVI is typically approximately 100 MW, depending in part on seasonal fluctuations. Fuel (#2 fuel oil, diesel, propane, and/or liquified propane gas) arrives to Charlotte Amalie's port and Christiansted's port via tanker ships and is transported by contracted gas trucks to storage facilities near the power plants in Krum Bay and Estate Richmond. Liquefied propane gas can also be transported via barge and then ships directly to the storage facilities. From the storage facilities, fuel is supplied to each power station's six fossil fuel generators via pipeline. WAPA is in the process of converting these generators to run on liquefied petroleum gas. At the time of this report, five of the six on St. Croix were converted, but only one of the six on St. Thomas was converted. Both facilities also rely on desalinated sea water from the co-located Seven Seas desalination and reverse osmosis plants (see Drinking Water section). As referenced in the Drinking Water section, the nexus between energy generation and drinking water is an important topic in the USVI.

With capacities exceeding peak demand, both power plants maintain their own backup generation and reserves. Krum Bay and Estate Richmond fuel reserves include supplies for 10 to 14 days of fuel oil and 18 days of liquefied petroleum gas at Krum Bay and 19 days at Estate Richmond.

At the time of writing, on St. Croix, the utility-scale installation designed and constructed by Toshiba International provides an additional 4.7 MW of power generation, and net metering provides an additional 5 MW of power generation. On St. Thomas, two utility-scale solar installations provide an additional 3.9 MW of power generation, and net metering provides an additional 10 MW of power generation. Two of the utility-scale installations are owned by private investors who have a power purchase agreement with WAPA. The St Croix solar field suffered minor damage during the 2017 hurricanes, while both installations in St. Thomas were destroyed and had to be completely re-built. The combined 15 MW net metering capacity is based on a limit set by WAPA's Net Metering Program. WAPA also has 3 MW of solar capacity from small solar panels on top of streetlights. There are also private

solar installations not tracked by WAPA, although the VIEO is developing a Distributed Generation Inventory and Analysis to track renewables, alternative fuels, and backup power.

Net Metering

The USVI's net metering program was created in 2007 and permits customers to install rooftop solar panels and supply excess power to the grid in return for a bill credit, based on WAPA's retail electricity rate. It has been determined that the buyback rate was too high, and the program is no longer offered.

In general, ground-mounted solar installations are more feasible on St. Croix because of the flat terrain. Accordingly, roof-mounted solar installations are more of a priority on St. Thomas and St. John. There is interest in expanding opportunities and incentives for renewable energy, including on brownfields, and attracting further solar developers.

Energy is distributed through a network of high-voltage transmission lines and lower-voltage distribution lines, including over 1,000 miles for power lines, and five substations on St. Thomas, two substations on St. Croix, and one substation on St. John. Submarine cables distribute power from St. Thomas's system to St. Johns, Water Island, and Hassell Island.

Peak demand has decreased in recent years, partially due to the 20% decrease in population observed by the US Census between 2010 and 2020. Lower demand is also explained by customers leaving the grid after the 2017 hurricane impacts when many residents went without electricity from WAPA for between 90 and 120 days. However, peak demand has increased from a territory-wide low of 66 MW in May of 2018 following the 2017 hurricanes. Larger customers, including major hotels, have installed their own stand-alone diesel generators, straining WAPA's finances.

As of 2018 WAPA rates were between \$0.36 and \$0.43 per kWh, depending on the customer. These are among the highest rates in the world and much higher than the US mainland average of \$0.10 per kWh. However, the cost of generating and distributing power is not entirely covered by customer bills, and the USVI government spends considerable general fund resources every year covering the gap. These rates are blended across all customers, and the cost of energy is the same regardless of the island or the time of day or year, even though the generation and distribution expenses vary. While WAPA has Advanced Metering Infrastructure (AMI) to monitor customers' energy usage, it lacks the infrastructure to bill based on the actual cost of energy production and delivery.

In general, WAPA's power infrastructure is oversized and old, with vulnerabilities exposed by recent hurricanes and likely to be further exacerbated by climate change impacts (e.g., increased intensity of storms). While outages remain a common problem, anecdotal reports suggest that recovery from regular power outages is improving as upgrades to the system continue.

The systems' isolation and lack of interconnectedness exacerbate these vulnerabilities. Further, the reliance on imported fuels causes cost and reliability issues. More broadly, WAPA has financial challenges due to rising costs, customer defections, and non-payment. Regulatory and governance coordination is another obstacle, including posing a barrier to deployment of renewable energy facilities.

WAPA and the USVI have made recent investments in battery storage, underground electrical lines, and WAPA is currently concluding a massive, territory-wide effort to strengthen transmission by converting from wood poles to hurricane resistant composite poles. Multiple underground transmission contracts have been awarded on all three islands, with the goal of 50% of customers having underground electrical service to the meter bases.

There is interest in increasing renewable energy deployment, and in the long term, the goal is to decentralize the electric grid and build in more resiliency and redundancy, for example with smaller generation plants with their own battery storage.

Fuel source is one of many issues jeopardizing WAPA's stability and future. When the HOVENSA oil refinery operated in St. Croix, WAPA had a reliable and discounted fuel source, though it was subject to price fluctuations of a global commodity. The refinery closed in 2010, causing a high degree of uncertainty surrounding the critical purchase of fuel. WAPA's weak financial performance, high debt, low cash flow and poor debt service have caused repeated downgrades to its bond rating, limiting its ability to generate funds and purchase fuel. Converting to liquified propane gas (LPG) was seen as a way to lower generation costs and user rates. These savings have not been realized to date due to disagreements between WAPA and its contracted LPG provider.

St. Croix Refinery

From 1966 to 2012, one of the largest petroleum refineries in the world operated in Limetree Bay on the southern side of St. Croix. This refinery was one of the largest employers in the USVI and provided a reliable source of fuel for WAPA prior to its closure. Most recently known as the Hovensa (a joint venture between Hess Corporation and Petroleos de Venezuela) refinery, following its closure, the refinery transitioned to a fuel storage terminal owned by Limetree Bay Terminals, LLC (LTB). After a series of accidents and unplanned petroleum releases, LTB was forced to close by EPA. LTB filed for bankruptcy in July 2021, after investing billions of dollars to upgrade and re-open the facility. The site is currently known as Ocean Point Terminals, owned by the West Indies Petroleum Limited and Port Hamilton Refining and Transportation, LLLP. There have been recent discussions about restarting refinery operations at the facility. Ongoing contamination remains a concern among many St. Croix residents.

Wastewater

Regulatory and Administrative Context

In the United States, the Clean Water Act (CWA) is the primary federal law that governs wastewater and is overseen by the U.S. Environmental Protection Agency (EPA). The CWA requires a permit for any point source discharge (e.g., pipe, canal, other "discrete conveyance") of pollutants into a "water of the United States" and allows states and territories to manage permitting programs, as long as their regulations are at least as stringent as federal requirements. For these requirements in the USVI, the DPNR Division of Environmental Protection (DEP) administers the Territorial Pollutant Discharge Elimination System (TPDES) program under the agency's Water Pollution Control Program in accordance with the CWA and local USVI code. The DEP also runs the Water Quality Management Program which oversees water quality protection of the marine waters of the USVI, including monitoring and assessment and associated reporting. In 2019, DPNR updated its Water Quality Standards Rules and Regulations. However, as recently as 2015, EPA identified some gaps in the USVI's Clean Water Act

program(s), including related to environmental monitoring, data input, permitting, facility inspection, enforcement, and program implementation, as well as financial and programmatic challenges.

DPNR also oversees onsite sewage disposal systems (OSDS) permitting under Coastal Zone Management and associated USVI code and permits.

Service Provider: Virgin Islands Waste Management Authority (VIWMA)

The Virgin Islands Waste Management Authority (VIWMA) is a semi-autonomous agency and the primary public provider of wastewater services in the USVI, serving approximately 40% of the USVI population, although this varies across islands and between neighborhoods (Table 3). VIWMA itself was created in 2004 in response to enforcement actions. VIWMA also manages the USVI's solid waste management services (see Solid Waste below).

VIWMA oversees over 400 miles of sewer pipe, 30 pump stations, and eight treatment plants, including five on St. Thomas, one on St. Croix, and two on St. John. VIWMA manages six of the treatment plants, while the private contractor Veolia manages the Anguilla wastewater treatment plant on St. Croix and the Red Point wastewater treatment plant on St. Thomas, per requirements as part of enforcement action by EPA. According to local news outlets, there have been payment disputes between VIWMA and Veolia, leading to threats of departure. However, at the time of writing, Veolia's current contract runs through 2027, after which point VIWMA has plans to transfer operations of the plants from Veolia contractors to its own staff, currently being trained.

The VIWMA system collects and transports nearly four million gallons of wastewater every day, 1.6 million gallons from St. Croix, 2.1 million gallons from St. Thomas, and 130,000 gallons from St. John. Per USVI law, any property within 60 feet of a public sewer must connect to the system, and user fees are incorporated into the tax bill for properties connected to the system at the current rate of \$110.77 per equivalent residential unit (ERU). These fees are therefore not based on usage. At the time of writing, VIWMA is also working with the Lieutenant Governor's Office and Tax Assessors Office on coordinating fee assessment and collection. VIWMA is also working to establish a fee for septage waste haulers delivering septage to VIWMA's receiving facilities, similar to the new tipping fee for solid waste (see Solid Waste section), although there is no fee for that service at this time.

Most of the VIWMA system has pipes that carry both wastewater and stormwater (known as a "combined system"), so during rains, untreated discharges of sewage mixed with rainwater (combined sewer overflows or CSOs), occur.

Specific information about each island is included below:

- On St. Croix, approximately 30 - 40% of the population is served by VIWMA's wastewater system, mostly around Christiansted and Frederiksted. Fifteen pump stations throughout the island transport wastewater to the Anguilla WWTP. That plant has the capability to use the effluent for agricultural applications. The plant relies on WAPA for electricity but is supposed to have backup generators.
- On St. Thomas, there are several wastewater treatment plants and associated independent systems. Six pump stations and the Red Point (officially Pedrito A. François) wastewater treatment plant serve Charlotte Amalie and its surroundings; three pump stations and the

Mangrove Lagoon wastewater treatment plant serve the southeast portion of the island; Vessup wastewater treatment plant serves Red Hook and the east part of the island; Brassview wastewater treatment plant serves the north part of the island; and Bordeaux wastewater treatment plant serves the west part of the island.

- On St. John, three pump stations and the Cruz Bay wastewater treatment plant serve the west part of the island; one pump station and the George Simmonds wastewater treatment plant serve the central part of the island; and two pumping stations and the Calabash Boom wastewater treatment plant serve the east part of the island. While the Cruz Bay plant operates 24-hours per day, the other plants operate intermittently. In general, St. John's wastewater infrastructure is known to be oversized based on the island's current population because of over-estimated development projections that never came to fruition. VIMA has had plans to direct more wastewater to the Cruz Bay plant. Table 3, shows a break-down of the USVI housing units by wastewater disposal source.

VIWMA operates this system under enforcement actions by the EPA for violations of the CWA, dating back to 1984 and amended in 1996 and in 2021 specifically for the Harold Thompson system (also known as the Anguilla wastewater treatment plant) on St. Croix.

There are several existing challenges with VIWMA infrastructure, including knowledge gaps from old and unmapped infrastructure, infrastructure access issues, lack of monitoring and control, and old and failing infrastructure characterized by illicit cross-connections, inflow from groundwater and stormwater, leakage, and design flaws. Clogged wastewater lines due to grease and wipes is also a big issue. In addition, only a limited portion of the population (approximately 30 - 40%) have access to the public sewer system. The age and condition of infrastructure was exposed as a greater problem following recent hurricanes and in the context of climate change projections (e.g., sea level rise, increased intensity of storms). Financial stressors compound these issues, especially as VIWMA fees are not usage-based. VIWMA lacks funds to conduct comprehensive repairs and upgrades and has had instances of inadequate resources to pay contractors (e.g., Veolia). The enforcement actions against the agency also pose challenges.

Following the 2017 hurricanes, FEMA allocated tens of millions of dollars of funding for wastewater infrastructure, which is anticipated to address some of these issues.

Other Wastewater Handlers

In addition to VIWMA, there are also widespread private wastewater systems (e.g., "package plants"), such as those operated by large hotels and Cruzan Rum and Diageo Distillery. These systems operate independently of VIWMA but must meet applicable federal and USVI regulatory requirements under DPNR and monitor and report to DPNR. Information availability and compliance are previously identified challenges. Currently, many of these facilities dispose their sludge at VIWMA landfills for free, although VIWMA is developing a fee system for that service (see above).

Remaining areas of the USVI are served by private onsite sewage disposal systems (OSDS) (i.e., septic systems). While it may not be practical to extend sewer service into more remote areas, failing OSDS systems have been identified as one of the primary sources of groundwater contamination in the USVI, with management, siting, maintenance, and enforcement of these systems particular challenges. In

particular, soil and geology conditions (e.g., insufficient pervious soil of two to four feet) in the Territory have been shown to make OSDS perform poorly in the UVI. Together with the centralized wastewater issues described above, OSDS contribute to water quality problems described above and in the Natural Resources section. In addition, nitrogen from wastewater has been identified as a potential cause of recent sargassum seaweed problems. Table 3 shows a break-down of the USVI housing units by wastewater disposal method.

Table 3. USVI Housing Units by Wastewater Disposal Method

Wastewater Disposal Method	Percentage of USVI Housing Units	Percentage of STX Housing Units	Percentage of STJ Housing Units	Percentage of STT Housing Units
Public sewer	43%	40%	25%	47%
Septic tank or cesspool	56%	59%	73%	51%
Other means	1%	1%	3%	2%

As shown in Table 3, St. John has a higher percentage of housing units that rely on septic tanks or cesspools for wastewater disposal, while the St. Croix and St. Thomas breakdowns are fairly similar to each other and the USVI as a whole.

Solid Waste

Regulatory and Administrative Context

Solid waste management in the USVI is governed by EPA environmental regulations and USVI code, including the DPNR permitting program for solid waste disposal facilities under the agency’s Solid Waste Management Program. In addition, since the Anguilla Landfill (see below) is located close to St. Croix’s Henry E. Rohlsen Airport, U.S. Federal Aviation Administration (FAA) height regulations also govern that facility.

Service Provider: Virgin Islands Waste Management Authority (VIWMA)

VIWMA manages the Anguilla Landfill on St. Croix and the Bovoni Landfill on St. Thomas, with contractor services, as well as the St. John Susannaberg Transfer Station, which was previously a landfill until 1993. These landfills collect over 180,000 tons of waste each year, and the average USVI resident produces roughly 9 pounds of trash per day, nearly 40% more trash than the average U.S. mainland resident. Most residents collect their household waste and bring it to roadside pick-up locations with 20-cubic yard collection bins, designated convenience centers, and/or directly to the landfills. These drop-off locations have schedules posted on the VIWMA website and are generally open six or seven days per week. There are capacity limitations at the landfills and drop-off locations.

Throughout the USVI, approximately 15% of homes have residential collection service, including approximately 3,500 customers on St. Thomas and approximately 10,000 customers on St. Croix, with that difference largely a result of terrain, access, and road infrastructure variations. Commercial and industrial businesses and residential properties with four or more units are required to utilize a private waste hauler for waste disposal, and several haulers bring their waste to the VIWMA landfills. Until recently, these haulers did not pay a fee for this service, but in 2022, VIMA introduced a tipping fee that

will be phased in over four years, starting at \$2.50 per cubic yard, which will increase to \$3.75 in 2023. VIWMA plans to use the revenue to help the agency become more self-sufficient. There is almost no recycling or composting in the USVI, and burning of wood and green waste is prohibited by a USVI law passed in 2017. There have been various waste-to-energy and biomass plans proposed that have not come to fruition.

As described in the Wastewater sub-section above, VIWMA's funding is primarily from the USVI government's General Fund and Special Fund, with some additional revenues from sewer fees, waste hauler permits, and special waste disposal permits. Compliance violations fines and penalties also provide some revenue. As referenced above, VIWMA is in the process of introducing tipping fees for solid waste, which are anticipated to help the agency's finances, but the lack of tipping fees for waste haulers has been an untapped revenue source for years. In general, VIWMA has argued that General Fund budgeting for the agency is not sufficient to cover its costs.

There have been enforcement actions against both landfills under EPA regulations, and in the case of the Anguilla Landfill, also under FAA regulations because of bird strikes risk. Under EPA enforcement actions, both landfills were scheduled to close by 2021. At the time of writing, the Anguilla Landfill is on track to close, although VIWMA may extend its use for another five to seven years. There are plans to build a new landfill, with three potential sites identified. With greater capacity and adjacent land for potential expansion, there are no immediate plans to close Bovoni Landfill, on the other hand.

Environmental impacts from the landfills, including to air, soil, soil gas, surface water and groundwater, are immediate challenges as highlighted by enforcement actions. The pending closure of the Anguilla Landfill also raises logistical challenges for identifying and implementing alternative sites. Lack of recycling and illegal dumping are also key concerns. At the time of writing, VIWMA is developing plans to upgrade and develop further convenience centers to avoid illegal dumping and public health and environmental issues posed by unsupervised waste drop-off locations. The agency is also developing long-term plans for a recycling program, in coordination with these convenience centers

Recent hurricanes have also highlighted infrastructure and debris management issues, including in the context of climate change projections (e.g., increased intensity of storms). Roadside trash collection bins are uncovered and often located near guts. Regardless of location, rain events and spillage related to these bins can carry large loads of pollution into guts that eventually feed sensitive ocean resources.

Stormwater

Regulatory and Administrative Context

Stormwater discharges from point sources (e.g., pipes, canals, culverts) are typically regulated under the Clean Water Act, National Pollutant Discharge Elimination System (NPDES) program, as part of municipal separate storm sewer (MS4) permitting in urbanized areas in the United States. Because of combined sewer, the USVI is covered under Phase I of that permit, rather than Phase II. While there are stormwater standards in the USVI, they have not been adopted or widely used. At the time of writing, the Territory's stormwater handbook is in the process of being updated. USVI code does include requirements related to stormwater, such as erosion and sediment controls as part of Earth Change Plans and required post-construction stormwater measures under the Territory's Environment Protection Law of 1971, as amended. DPNR has also engaged in efforts to advance stormwater

management more broadly. In particular, DPNR's Water Pollution Control Program oversees Construction General Permits for construction activities greater than one acre and Multi-Sector General Permit for industrial activities, and the Non-point Source Pollution/Earth Change Program oversees Earth Change Permits. The Water Quality Management Program works on monitoring and protection efforts. As recently as 2015, EPA raised concerns that the USVI's Clean Water Act Nonpoint Source Pollution Program data had not been tracked since 2009.

Other DPNR divisions and roles are also related to stormwater, including Building Permits, Coastal Zone Management, Comprehensive and Coastal Zone Planning, Environmental Enforcement, Environmental Protection, Fish and Wildlife, Archaeology and Historic Preservation. While intermittent watercourses known as guts (or ghuts) in the USVI are protected by several areas of the territory's code, comprehensive stormwater management and enforcement remains lacking. For more information on the protection of guts, see the Natural Resources section.

Other USVI agencies also have roles related to stormwater:

- The Department of Agriculture (VIDA) oversees soil conservation practices, buffers along guts, and the Virgin Islands Conservation District (VICD).
- VIMWA manages landfills, solid waste, and wastewater all of which can be sources of polluted runoff, although WIMA efforts seek to protect waterbodies.
- WAPA wells can be impacted by polluted runoff.

Drainage System

The USVI's stormwater system consists of drainage culverts, inlets, swales, and guts. These features generally only contain water after heavy rainfall and/or during the rainy season, and there are only limited perennial freshwater resources in the Territory. The Department of Public Works (DPW) is responsible for planning, construction, and maintenance of drainage infrastructure (as well as roads, parking areas, and other infrastructure). DPW's gut efforts include flood mitigation projects, cleaning, and coordination with VIWMA on sewage impacts. These efforts are in conjunction with DPNR's permitting efforts related to stormwater. As referenced in the Wastewater section, the USVI also has combined sewer systems with stormwater and wastewater in shared pipes, especially in the denser areas of the Territory, such as Charlotte Amalie, Christiansted, and Frederiksted. Where the system is separated, wastewater pipes are often located within guts.

There have been both stormwater quantity and quality issues previously highlighted in the USVI. In terms of quantity, inadequate drainage and the capacity of guts and other drainage infrastructure have exacerbated flooding, especially during recent hurricanes and intense periods of rain. Climate change impacts (e.g., increased intensity of storms) will likely exacerbate these challenges, even though overall annual rainfall in the region has decreased. In terms of water quality, as referenced in the Wastewater sub-section above, leaky pipes, combined sewer overflows and untreated stormwater threaten water quality. Stormwater entering the wastewater system during and following storms, causing backups and overflows, is a common problem. Increased unmanaged and unplanned development can and has exacerbated these concerns. More broadly, the lack of standard and enforced stormwater management practices in the USVI continues to pose challenges. Additional information on water quality issues with regard to natural resources is included in the Natural Resources Section.

Schools

Administrative Context

The Virgin Islands Department of Education (VIDE), an executive branch of the territory's government, oversees public education, including for kindergarten through 12th grade, programs and services for special needs and adults through age 21, and a variety of other support services, including transportation for students, libraries, and child nutrition. The U.S. Department of Education provides some oversight and funding. There are also religious and other private entities that run private schools in the USVI, funded by tuition, grants, private donations, and endowments, as well as federal grants and some VIDE funding.

System and Infrastructure

As of 2017/2018, there are 31 public schools in the USVI, serving 13,194 students, down from 13,805 students in 2016, prior to the 2017 hurricanes. There are 28 private and parochial schools in the USVI. VIDE operates three operations facilities that support students, including the VIDE headquarters and a curriculum center on St. Croix and a St. Thomas-St. John curriculum center on St. Thomas. These facilities were severely damaged and closed by the 2017 hurricanes. In total, VIDE manages approximately 3 million square feet of property across 44 locations.

The only higher learning institute in the territory, the University of the Virgin Islands, operates primary campuses on St. Thomas and St. Croix, a learning center on St. John that was destroyed by Hurricane Irma, and an extension campus on St. Martin/St. Maarten. The university is designated as a public, co-ed, land-grant Historically Black College/University (HBCU) and offers undergraduate and graduate degree programs in 47 disciplines, along with online, community, certificate, and continuing education programs. Funding sources include the USVI general fund, tuition and fees, grants, contracts investments, gifts, donations, and endowments.

Following the 2017 hurricanes, with funding from the U.S. Congress, VIDE has engaged in *The Educational Facility Master Plan* for modernization and new construction of USVI public schools. The plan covers physical and programmatic initiatives, including consolidation of 32 educational facilities to 18, over a five-year process. The plan proposes to replace or newly build six school facilities and modernize and/or expand 16 school facilities. The plan's vision statement is: "*The Educational Facility Master Plan (EFMP) will define design standards and concepts to support flexible learning environments and the realization of this academic vision.*"

As part of this initiative and broader educational goals, USVI education stakeholders have expressed particular interest in the following: increasing the role of schools as community centers, walkability and access around schools, recreational opportunities, high quality and culturally appropriate design, and collaboration with diverse stakeholders, including local communities, government actors, and the private sector. Additional hurricane recovery and other funding sources are anticipated. At the time of writing, facility assessments have been completed at the 18 facilities and detailed feasibility studies have been completed at five of those facilities.

School facilities' physical vulnerabilities have been identified as a challenge, particularly exemplified by the 2017 hurricanes. These vulnerabilities are anticipated to be exacerbated by climate change impacts, such as increased intensity of storms, and in some cases, sea level rise. Extreme heat for school facilities

is another increasingly concerning challenge. Educational stakeholders have also raised concerns about building code standards related to school facilities and the prior use of sub-standard construction materials.

DRAFT

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 1.1





Esri, NASA, NGA, USGS

Legend

Surface Water Bodies	Land Cover (2012)	WAPA Water Infrastructure
Guts	Developed Land	Water Distribution Pipe Network
Major Roads	Barren Land	
National Park Service Land	Undeveloped Land	

Drinking Water - St. John

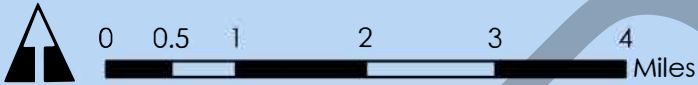
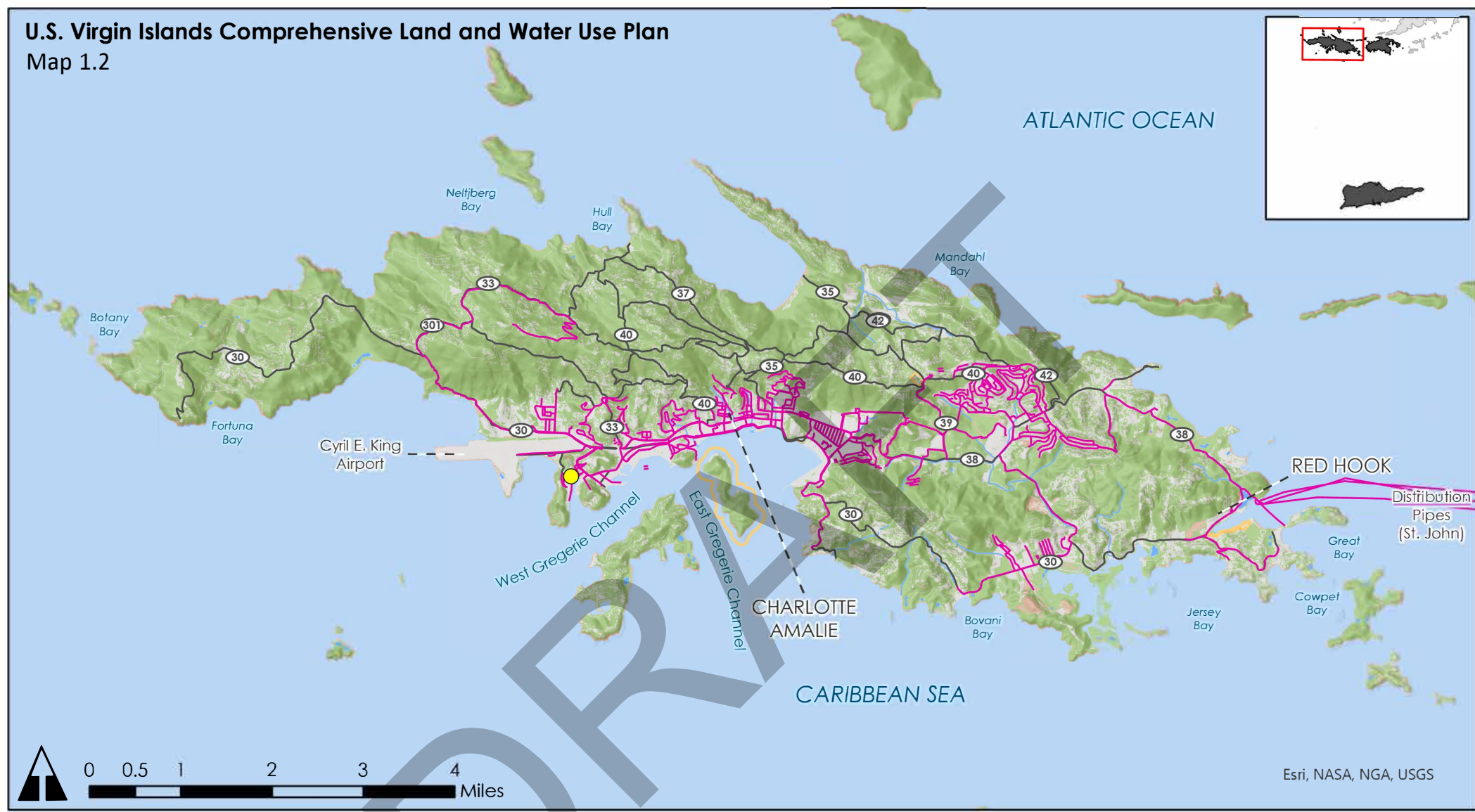



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, WAPA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 1.2



Esri, NASA, NGA, USGS

Legend

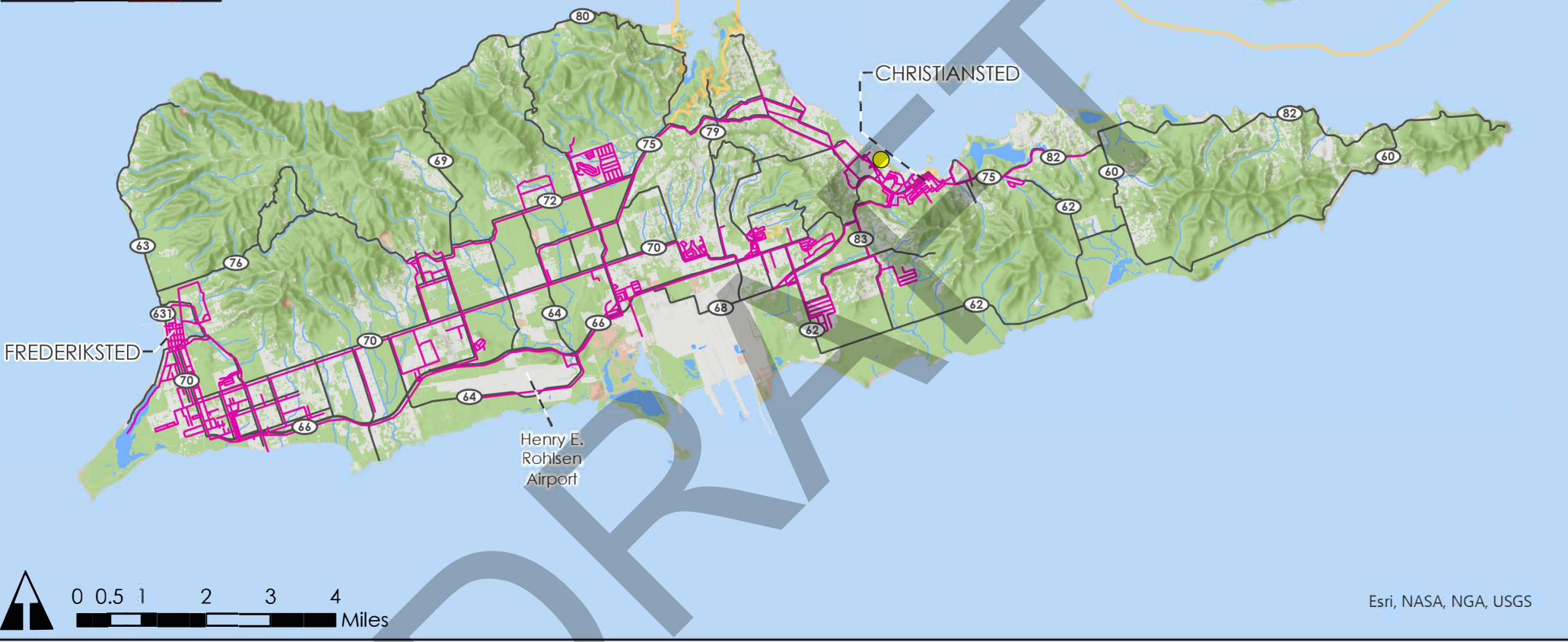
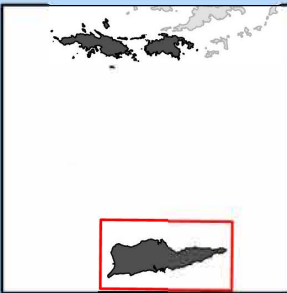
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|----------------------------|--------------------------|----------------------------------|
| Surface Water Bodies | Land Cover (2012) | WAPA Water Infrastructure |
| Guts | Developed Land | Desalination Plant |
| Major Roads | Barren Land | Water Distribution Pipe Network |
| National Park Service Land | Undeveloped Land | |

Drinking Water - St. Thomas



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, WAPA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.



Esri, NASA, NGA, USGS

Legend

- Surface Water Bodies
- Guts
- Major Roads
- National Park Service Land

- Land Cover (2012)**
- Developed Land
 - Barren Land
 - Undeveloped Land

- WAPA Water Infrastructure**
- Desalination Plant
 - Water Distribution Pipe Network

Drinking Water - St. Croix



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, WAPA
Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan
Map 2.1



Esri, NASA, NGA, USGS

Legend

- | | | |
|----------------------------|--------------------------|-----------------------------------|
| Surface Water Bodies | Land Cover (2012) | WAPA Energy Infrastructure |
| Guts | Developed Land | Substation |
| Major Roads | Barren Land | Powerlines |
| National Park Service Land | Undeveloped Land | |

Energy - St. John

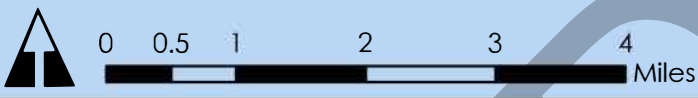
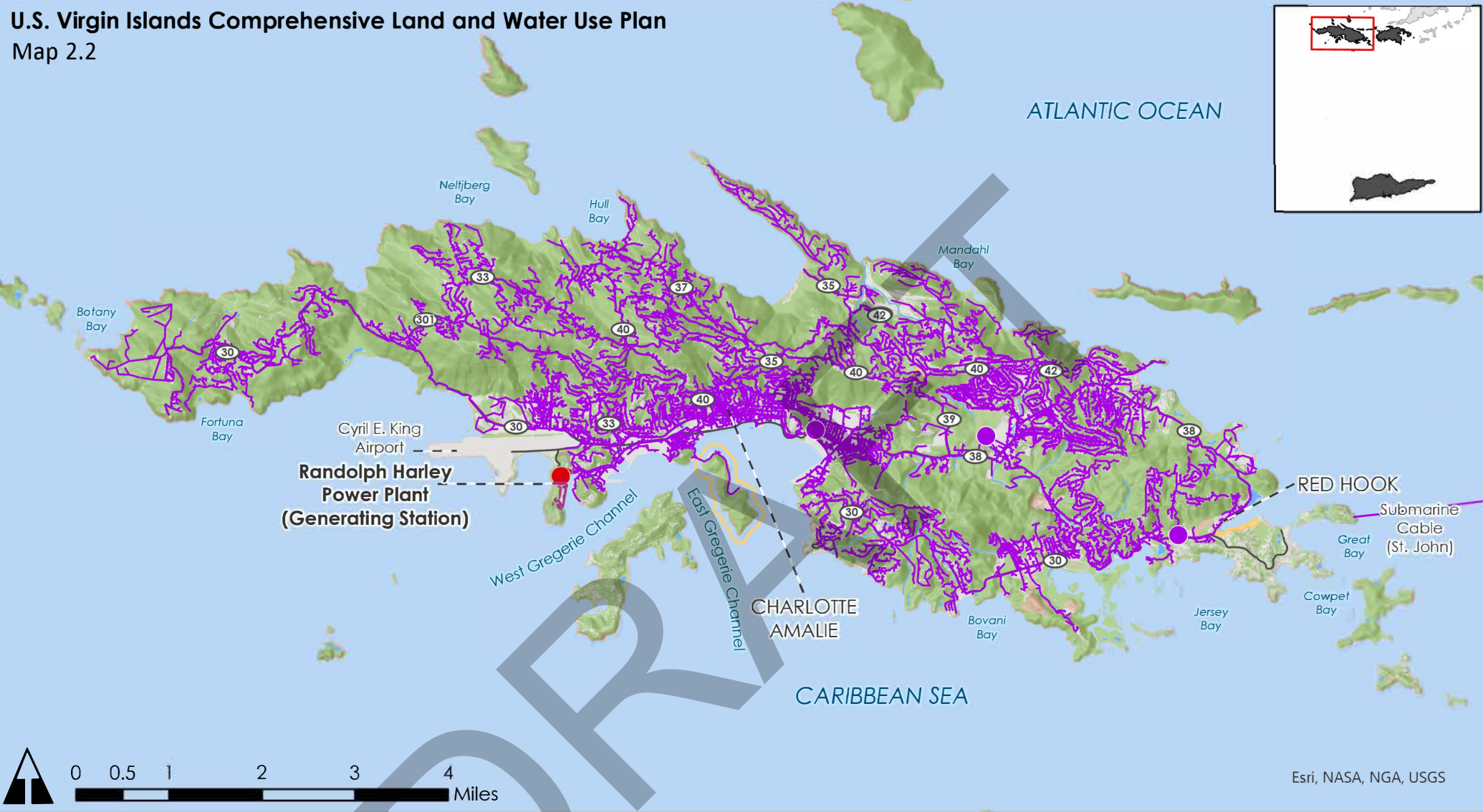


Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, WAPA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 2.2



Esri, NASA, NGA, USGS

Legend

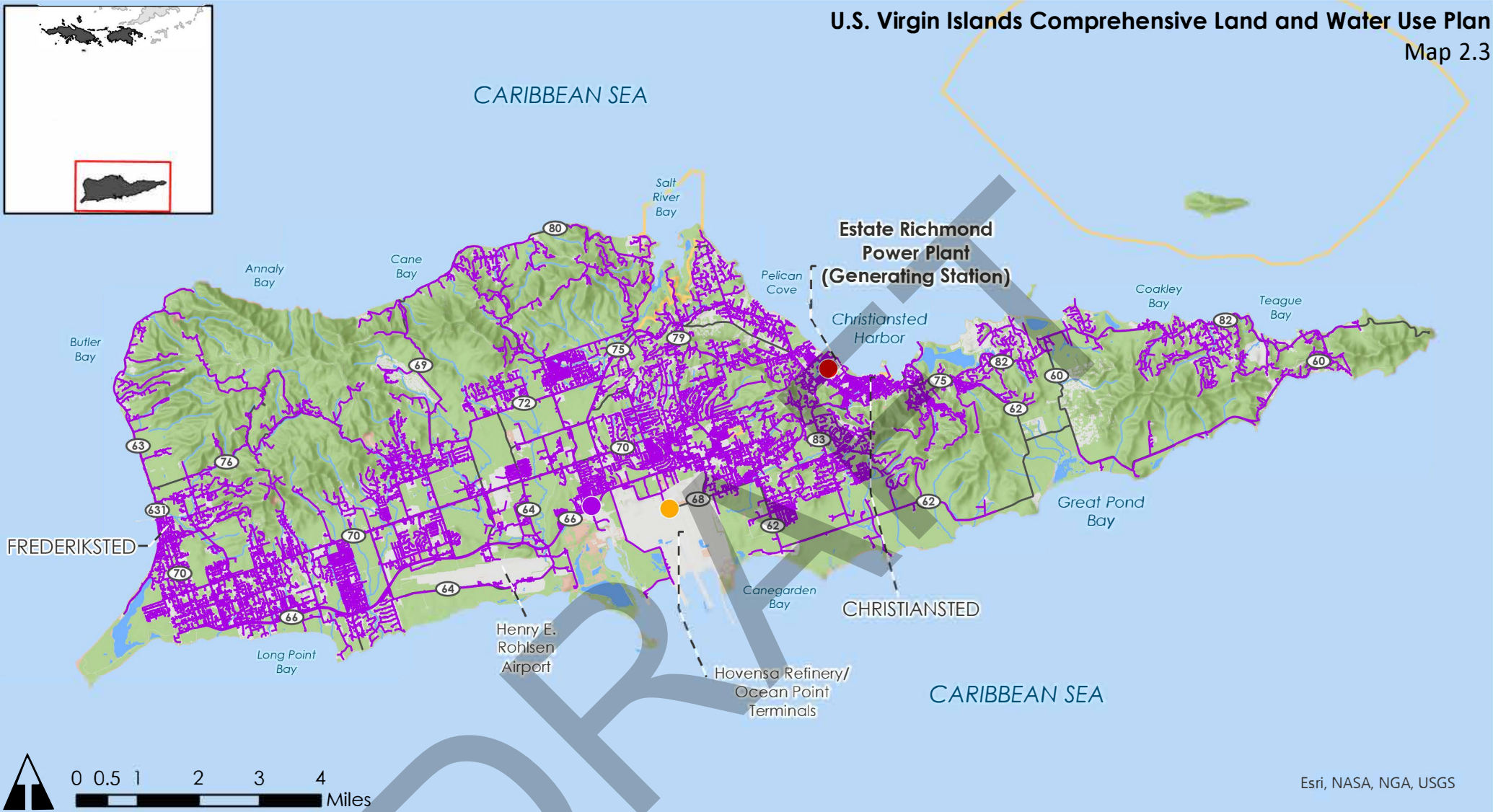
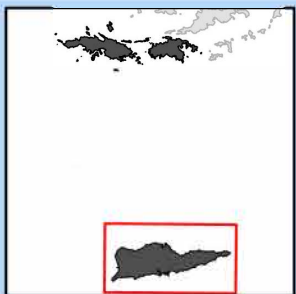
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|----------------------------|--------------------------|-----------------------------------|
| Surface Water Bodies | Land Cover (2012) | WAPA Energy Infrastructure |
| Guts | Developed Land | Power Plant |
| Major Roads | Barren Land | Substation |
| National Park Service Land | Undeveloped Land | Powerlines |

Energy - St. Thomas



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, WAPA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.



Esri, NASA, NGA, USGS

Legend

- | | | |
|----------------------------|--------------------------|-----------------------------------|
| Surface Water Bodies | Land Cover (2012) | WAPA Energy Infrastructure |
| Guts | Developed Land | Power Plant |
| Major Roads | Barren Land | Substation |
| National Park Service Land | Undeveloped Land | Powerlines |
| Refinery | | |

Energy - St. Croix



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, WAPA
Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan
Map 3.1



Esri, NASA, NGA, USGS

Legend

- Surface Water Bodies
- Guts
- Major Roads
- National Park Service Land
- Land Cover (2012)**
- Developed Land
- Barren Land
- Undeveloped Land
- VIWMA Solid Waste Infrastructure**
- Bin Sites

Solid Waste - St. John

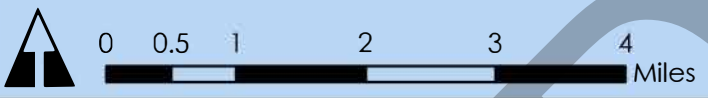
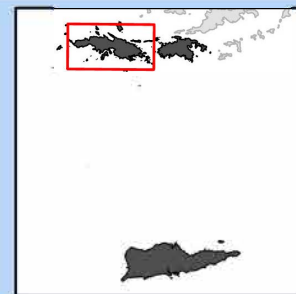


Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, VIWMA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 3.2



Esri, NASA, NGA, USGS

Legend

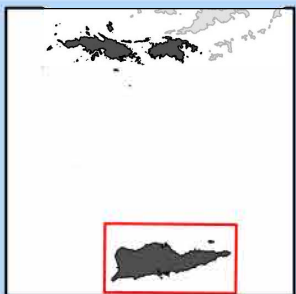
- Surface Water Bodies
- Guts
- Major Roads
- National Park Service Land
- Land Cover (2012)**
- Developed Land
- Barren Land
- Undeveloped Land
- VIWMA Solid Waste Infrastructure**
- Bin Sites
- Landfills

Solid Waste - St. Thomas



Date: 4/24/2023



Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, VIWMA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.



Legend

Surface Water Bodies	Land Cover (2012)	VIWMA Solid Waste Infrastructure
Guts	Developed Land	Bin Sites
Major Roads	Barren Land	Landfills
National Park Service Land	Undeveloped Land	

Solid Waste - St. Croix

Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, VIWMA
Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan
Map 4.1



Legend

Surface Water Bodies	Land Cover (2012)
Guts	Developed Land
Major Roads	Barren Land
National Park Service Land	Undeveloped Land

Surface Water Resources - St. John



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, NOAA Office for Coastal Management, USDA Forest Service








Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 4.2



Legend

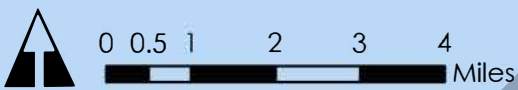
-  Surface Water Bodies
-  Guts
-  Major Roads
-  National Park Service Land
-  Land Cover (2012)
Developed Land
-  Barren Land
-  Undeveloped Land

Surface Water Resources - St. Thomas



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, NOAA Office for Coastal Management, USDA Forest Service
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.



Esri, NASA, NGA, USGS

- Legend**
- Surface Water Bodies
 - Guts
 - Major Roads
 - National Park Service Land
 - Land Cover (2012)
 - Developed Land
 - Barren Land
 - Undeveloped Land

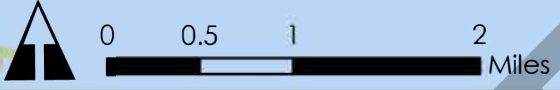
Surface Water Resources - St. Croix



Date: 4/24/2023
 Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, NOAA Office for Coastal Management, USDA Forest Service
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 5.1



Esri, NASA, NGA, USGS

Legend

- Surface Water Bodies
- Guts
- Major Roads
- National Park Service Land
- Land Cover (2012) - Developed Land
- Land Cover (2012) - Barren Land
- Land Cover (2012) - Undeveloped Land
- VIWMA Wastewater Infrastructure - Minor Pumpstations
- VIWMA Wastewater Infrastructure - Wastewater Treatment Plant

Wastewater - St. John

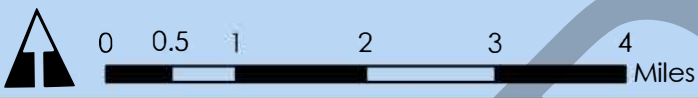


Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, VIWMA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.

U.S. Virgin Islands Comprehensive Land and Water Use Plan

Map 5.2



Esri, NASA, NGA, USGS

Legend

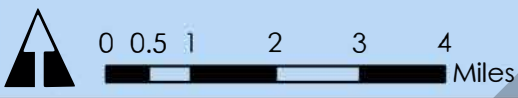
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|----------------------------|--------------------------|--|
| Surface Water Bodies | Land Cover (2012) | VIWMA Wastewater Infrastructure |
| Guts | Developed Land | Major Pumpstations |
| Major Roads | Barren Land | Minor Pumpstations |
| National Park Service Land | Undeveloped Land | Wastewater Treatment Plant |

Wastewater - St. Thomas



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, VIWMA
 Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.



Esri, NASA, NGA, USGS

Legend

- Major Roads
 - Surface Water Bodies
 - Guts
 - National Park Service Land
- Land Cover (2012)**
- Developed Land
 - Barren Land
 - Undeveloped Land

- VIWMA Wastewater Infrastructure**
- ▲ Major Pumpstations
 - ▲ Minor Pumpstations
 - Wastewater Treatment Plant

Wastewater - St. Croix



Date: 4/24/2023

Source: U.S. Census Bureau, OCHA Centre for Humanitarian Data, VIWMA
Note: This map is for informational purposes only and is not suitable for legal, engineering, or surveying purposes.