Dominica Geothermal Development Company

Government of Commonwealth of Dominica

Dominica Geothermal Risk Mitigation II Project
Construction of Transmission Lines and Substations

Environmental and Social Impact Assessment
Draft

November 2023

The photograph on the left shows the proposed location for Tower 29 and the typical land use along the Overhead transmission line. The photograph on the right shows the alignment of 33 kV underground transmission line in the urban areas of Roseau City.

Contents

List of Tables

List of Figures

List of Acronyms

ANSI	American National Standards Institute
ARAP	Abbreviated Resettlement Action Plan
BMP	Biodiversity Management Plan
BOQ	Bill of Quantities
C-ESMP	Contractor's Environment and Social Management Plan
CBD	Convention of Biological Diversity
CLO	Community Liaison Officer
CITES	Convention on the International Trade in Endangered Species
CoI	Corridor of Influence
CSO	Civil Society Organization
DGDC	Dominica Geothermal Development Company
DGPP	Dominica Geothermal Power Plant
DGRMP	Dominica Geothermal Risk Mitigation Project
DGRMP II	Dominica Geothermal Risk Mitigation Project II
DOMLEC	Dominica Electricity Services Ltd.
DSWMC	Dominica Solid Waste Management Corporation
E&S	Environment and Social
EHS	Environmental, Health and Safety
EHSG	Environmental, Health and Safety Guideline
EIA	Environment Impact Assessment
EMF	Electro Magnetic Field
ENSO	El Niño Southern Oscillation
ESCP	Environment and Social Commitment Plan
ESIA	Environment and Social Impact Assessment
ESF	Environment and Social Framework
ESMP	Environment and Social Management Plan
ESS	Environment and Social Standard
FGD	Focus Group Discussion
FSI	Transmission line network from Fond Cole substation to Sugarloaf substation
FWPD	Forestry, Wildlife and Parks Division
GBV	Gender Based Violence
GDP	Gross Domestic Product
GHG	Green House Gas
GIIP	Good International Industry Practice
GLI	Transmission line network from the geothermal power plant to Laudat substation
GFI	Transmission line network from the geothermal power plant to Fond Cole substation
GoCD	Government of Commonwealth of Dominica
GRM	Grievance Redress Mechanism
GTI	Transmission line network from the geothermal power plant to New Trafalgar substation
HMP	Habitat Management Procedure
IAS	Invasive Alien Species
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
ILO	International Labour Organization
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature

HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
KBA	Key Biodiversity Area
kV	kilovolt
LMP	Labor Management Plan
MTPNP	Morne Trois Pitons National Park
MHW&NHI	Ministry of Health Wellness and New Health Investment
MSIP	Management Strategies and Implementation Plan
MW	Megawatt
O&M	Operation and Maintenance
ODM	Office of Disaster Management
OHS	Occupational Health and Safety
OHSA	Occupational Health and Safety Administration
OHL	Overhead Transmission Line
OHT	Overhead Transmission
PAC	Project Affected Community
PAI	Project Area of Influence
PAP	Project Affected Person
PFI	Transmission line network from Padu substation to Fond Cole substation
PPE	Personal Protective Equipment
RoW	Right of Way
SDS	Safety Data Sheet
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SEP	Stakeholder Engagement Plan
SF6	Sulfur Hexafluoride
SOP	Standard Operating Procedure
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
TA	Technical Assistance
TL	Transmission Line
TPI	Transmission line network from Trafalgar substation to Padu substation
UGC	Underground Cable
UNESCO	United Nations Educational, Scientific, and Cultural Organization
VEC	Valued Environmental Component
WHO	World Health Organization
WNT	Waitukubuli National Trail
WW	Wotten Waven

1 Introduction

The Government of the Commonwealth of Dominica (GoCD) is working towards integrating geothermal electricity capacity and strengthening the resilience of the national grid in Dominica. In consequence, the government is working on building a 10 MW domestic geothermal power plant (DGPP), planned as a public-private partnership (PPP), supported by the on-going World Bank-funded Dominica Geothermal Risk Mitigation Project (DGRMP) and implemented by the Dominica Geothermal Development Company Ltd (DGDC).

The proposed Dominica Geothermal Risk Mitigation II Project (hereafter referred to as 'the Project' or 'DGRMP II') will construct and operate the first phase of transmission network development to evacuate the power to the Dominica Electricity Services Ltd. (DOMLEC) system from the ongoing construction of a 10 MW geothermal power plant. When complete, the Project will make an important contribution to the region's socio-economic development and the Commonwealth of Dominica. It will provide a stable source of electricity for the island and reduce the overall reliance on diesel generation.

DGDC has carried out an environmental and social (E&S) assessment of DGRMP II following the World Bank Environmental and Social Framework (ESF) requirements and national regulations. DGDC has prepared an Environmental and Social Impact Assessment (ESIA), an Abbreviated Resettlement Action Plan (ARAP), a Stakeholder Engagement Plan (SEP) and Labour Management Procedures (LMP). The ESIA is presented in this report, and other reports are presented as standalone documents.

1.1 Dominica Geothermal Power Plant (DGPP)

DGPP includes the construction of a 10 MW geothermal power plant in Laudat. This will be developed by a private consortium under the Built-Operate-Transfer arrangement. The procurement is in progress, and the construction works are expected to start in 2024. ESIA of the DGPP was completed in 2018 by Jacobs New Zeeland Ltd and updated in 2022. All these documents are available on DGDC's website: https://www.geodominica.dm/esia/.

1.2 Dominica Geothermal Risk Mitigation Project (DGRMP)

The World Bank funded DGRMP includes the construction of a production well and a reinjection well and technical assistance for the preparation of new transmission network investment to integrate the DGPP into the national grid. An ESIA for the DGRMP was prepared in 2021 by Eclipse Inc., Dominica. An ESIA Addendum was prepared in 2021 by ERM to complement the previous two ESIA studies under the DGPP and DGRMP, to provide updates on gaps identified and further assess the E&S impacts based on the updated project details, including an updated ESMP compliant to national and various international financing agencies. This ESIA includes RAP, SEP and an Occupational Health and Safety (OHS) manual. All these documents are available on DGDC's website.

The construction of both wells, under DGRMP, was completed successfully in April 2023. The completion of the drilling will facilitate the government in finalizing negotiations with its private partner for the DGPP.

1.3 Dominica Geothermal Risk Mitigation Project II (DGRMPII), the Proposed Project

The proposed World Bank funded project would finance the first of two phases of the transmission network expansion required to support the development of the DGPP. In the face of limited financial resources for investment in the electricity system, meeting the needs of Fond Cole is the higher priority because it serves the greater part of national demand in the southern part of the island. Hence, the first phase entails the construction of new 33 kV and 69 kV transmission lines and associated substations to

evacuate electricity generated at the DGPP to Fond Cole. The second phase would extend the 69 kV transmission line from the Fond Cole substation to the Sugar Loaf substation in the north of the island (referred to as FSI or west coast alignment in this document); a follow-up investment project would finance it.

The proposed project will have two components:

> (a) Component 1. Transmission Network Development for Integration of DGPP. This component will support the construction of new transmission lines and substations connecting the DGPP with Fond Cole. A stock of emergency spare parts will be financed and stored in DOMLEC's existing warehouses to allow efficient and fast response to future extreme weather events.
>
> (b) Component 2: Technical Assistance and Project Implementation Support. This component will finance technical assistance to: (i) improve the capacity of DOMLEC to operate and manage the 33kV and 69kV networks sustainably, including in management of environmental and social issues, a more complex task than managing the present 11kV system (ii) promote female participation in the electricity sector; (iii) technical assistance and capacity building in regulatory framework development, grid modernization and renewable energy resource assessment and (iv) support project implementation by DGDC.

The proposed project will run in parallel with DGRMP, the outcome of which is expected to be 10MW of geothermal generation capacity becoming available to the DOMLEC system. When both projects are completed, the share of renewable electricity used by the domestic power system is expected to increase significantly while the reliability of the electricity supply will be improved as the majority of the aged diesel generators exceed their unit's maximum operational hours and life expectancy will be displaced by the new geothermal capacity. The average cost of electricity generated (and consequently the tariff paid by consumers) is expected to decrease proportionally. DGRMP and DGRMP II will, between them, enable significant greenhouse gas (GHG) emission reductions by displacing the diesel generating units that would continue to operate or be retired and replaced under the current 'business as usual' baseline.

The construction of two new transmission lines at 69 kV and 33 kV will create redundancies in the connection between the DGPP and Fond Cole substation. The 33 kV line will be routed underground along an existing road, which avoids areas at risk of landslide or flooding as well. These measures will increase the electricity system's resilience to hurricanes. During preparation, designs that would increase the resilience of all substations and the 69 kV overhead transmission line to future hurricanes and flooding will be explored further and incorporated into the final design. Other resilience and adaptation measures will also be considered, such as additional system redundancy, rapid system restoration methods, and optimum levels of spare parts holdings.

A location map showing the proposed geothermal power plant, wells constructed under DGRMP and the proposed transmission line under DGRMP II is given in Figure 1.1. All these facilities are located close to the Roseau valley on the southwestern side of the country.

1.4 The Environmental and Social Assessment

This ESIA is based on field studies and data collected from March to July 2023 by two international environmental and social consultants, Dr. Venkata Nukala and Miki Terasawa. They conducted field studies with the support of two local biodiversity specialists and a social specialist to collect the primary data, reviewed the available secondary data, reviewed the ESIA documents for the geothermal power plant and drilling wells, and conducted public consultations. The methodology followed for biological studies is given in Annex 1.

1.5 Content of the Report

Chapter 1 has introduced the background of the proposed project. **Chapter 2** reviews the prevailing government regulatory requirements relevant to the environmental assessment and World Bank ESF applicable to this project, and actions taken by DGDC to comply with these requirements. **Chapter 3** describes the proposed project facilities and other salient information relevant to the environmental and social assessment. A description of the baseline environmental, biological and social conditions in the project area is presented in **Chapter 4**. Potential environmental and social issues from the Project implementation, as well as the appropriate mitigation measures to address these negative impacts, have been discussed in **Chapter 5**. An Environmental and Social Management Plan (ESMP) is presented in **Chapter 6**. The proposed institutional arrangements for managing and monitoring E&S impacts and risk are given in **Chapter 7**, together with the proposed grievance mechanism. Finally, **Chapter 8** describes the consultations carried out with the stakeholders. A detailed baseline report on the biodiversity is given in **Annex 1**.

Figure 1.1: Location of Proposed Geothermal Power Plant and Transmission Lines

2 Project Description

This chapter presents a detailed description of the proposed activities to be carried out under Component 1 of the Project.

2.1 Transmission Line Network Expansion

Component 1 will entail the construction of new transmission lines and three substations connecting the geothermal power plant with the national electric system load centers in Fond Cole (near Roseau City in the southwest). Network expansion will take place in four segments:

- A 69 kilovolt (kV) transmission line of 7.5 km from the geothermal power plant to the Fond Cole substation (GFI) consists of underground and overhead installation. To reduce land acquisition and easement in the Glasgow community, a part of the GFI transmission line will be installed underground on a public road from the Fond Cole sub-station up to the Glasgow community. Thereafter, GFI will switch to an overhead installation with about 20 pole structure sites.
- A 33 kV underground transmission line, totaling 10 km that connects between the geothermal power plant and New Trafalgar substation (GTI), between Trafalgar and Padu substations (TPI), and between Padu and Fond Cole substations (PFI). TPI and PFI will be placed under the major road between Trafalgar and Roseau City.
- An 11 kV underground transmission line of 0.5 km connecting the geothermal power plant to the Laudat substation (GLI).
- A new 69/33/11 kV substation at Fond Cole; a new 33/2.2 kV substation at New Trafalgar; and a new 33/11 kV substation at Padu.

An overview of the Project and the location of its elements is provided in Figure 2. 1.

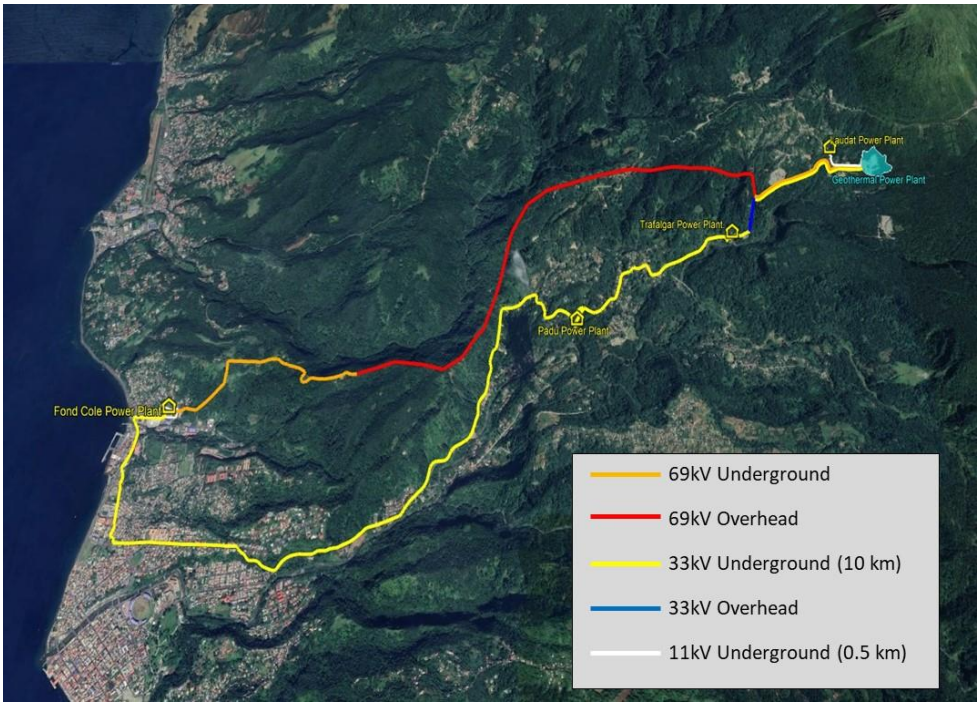


Figure 2.1: Project Location Map.

2.2 Overhead Transmission Line (OHL)

About 4.8 km of the proposed 69 kV line from the Geothermal Power Plant to the Fond Cole substation (GFI) will be an overhead transmission line (OHL). It will be constructed from the geothermal power plant in Laudat to Glasgow. This alignment passes along the ridge of the Roseau valley mountains with steep slopes, so OHL is chosen for this section.

2.2.1 Pole Structures

The construction of OHL requires about 21 steel pole towers with stays. The locations of these poles are given in Figure 2.2. The original pole structure locations are shown in the red line, but the locations of a few pole structures require diversion due to the recent expansion of a cable car development. The proposed diversion is shown as a white line. The average height of each pole will be about 20m. Three types of pole structures will be built in the project; specifications of these structures are discussed below, and typical drawings of these structures are given in Figure 2.3.

- Type A. Suspension tower. A single monopole, tapered, 6mm wall thickness (embedded in the earth up to a depth of 2.5m). The average footprint of this structure is 160 square meters. There will be seven A-type towers.
- Type B. Tension/Angle tower. A single monopole, tapered, 6mm wall thickness (embedded 2.6 m), used predominantly for spans not exceeding 400 meters and in instances where Type A structures are exposed to uplift conditions. The average footprint of this structure is 210 square meters. There will be nine B-type towers.
- Type C. Tension tower. A triple pole structure consists of three tapered poles with 6mm wall thickness (embedded 2.3m). Used predominantly for spans exceeding 400 meters. The structure can accommodate small line angle deviations and is suitable for spans up to 1000 meters. The average footprint of this structure is 280 square meters. There will be five C-type towers in the project.

Figure 2.2: GFI Overhead Transmission Line from Geothermal to Glasgow

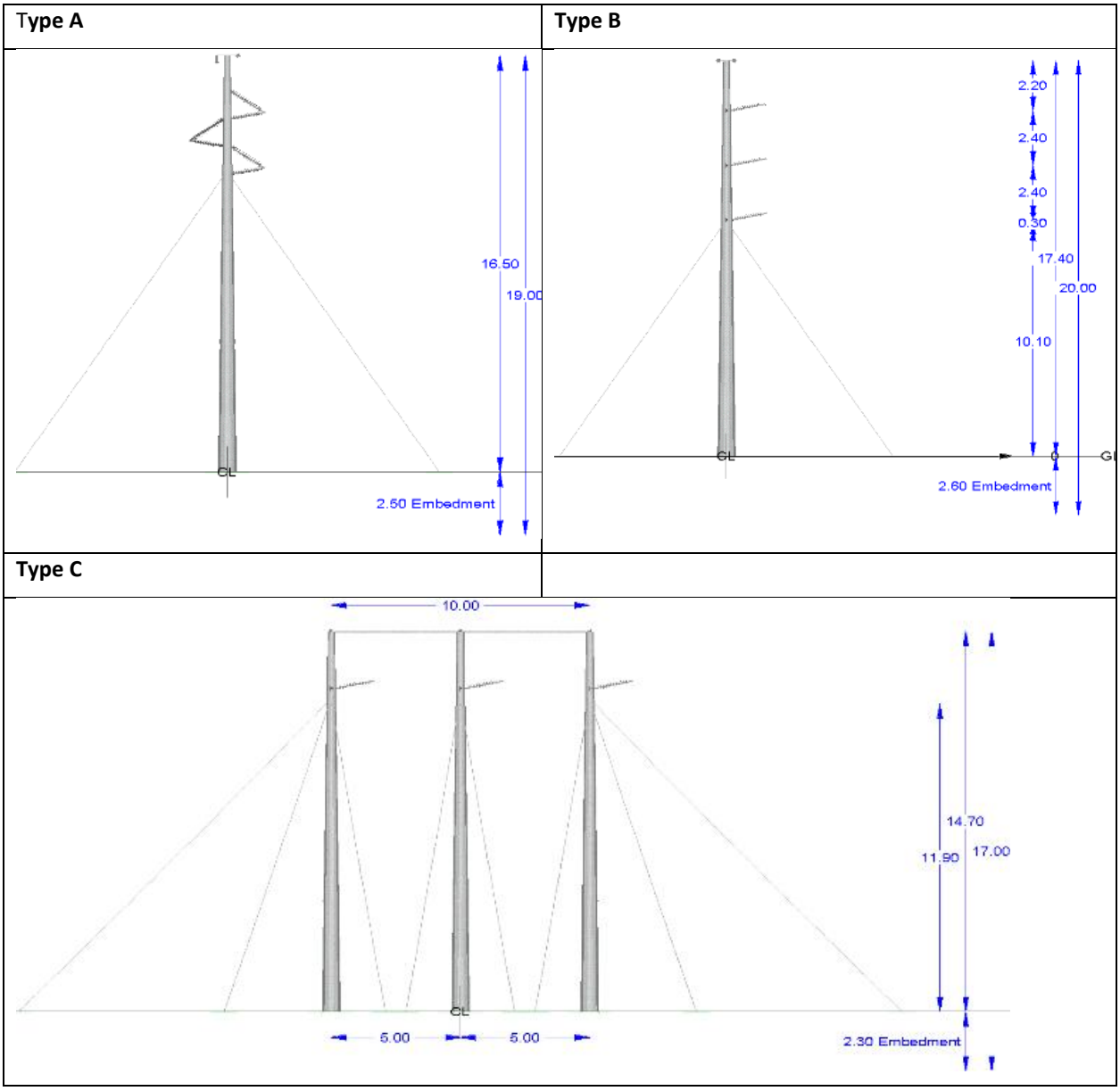


Figure 2.3: Typical Designs of Type A, B and C Structures

2.2.2 Construction Methods

The steps generally involved in the construction of towers are summarized below.

- Site Preparation. This may include clearance of the land to construct foundations for towers and stays.
- Civil works. These include excavations for the foundations of the towers and stays. The foundations are mechanically excavated and filled with concrete (about 3 m^3 per pole and 3 m^3 per stay). Concrete would be delivered by ready-mixed concrete trucks.

- Steel Erection Steelwork sections for the towers will be delivered by access road (to be built). The normal procedure is to install the stays first. Thereafter, the pole base section is installed, together with the associated concrete foundation. The top pole section(s), which are connected by means of a slip joint, may be installed by means of a small crane truck. The stays are first pull tested to verify tension capacity, then connected to the monopole structure at the correct specified pre-tension.
- Conductor Stringing. Stringing is undertaken using a winch to pull the conductor along the towers and a 'tensioner' at the other end to keep the conductor above the ground. Typically, the sections depend on the requirement of angle towers decided during the construction phase. These winch locations are not fixed and can be selected to minimize impact at sensitive locations.
- Testing of Equipment Overhead line components, including conductors, insulators, towers, joints and fittings, are designed and tested to prove compliance with structural, mechanical and electrical requirements.

2.2.3 Construction Equipment

The minimum construction equipment required for the construction of OHL is given below.

- All terrain crane 10 t, 2 numbers
- All terrain crane of 25 t, 2 numbers
- All terrain metallic derrick 25 t, 2 numbers
- Stringing equipment, 2 sets
- Crawler tractor with blade 100 HP, 2 numbers
- Wheeled tractor (80 HP) with trailer (3 t), 2 numbers
- All terrain truck with auto batching concrete mixer, 2 numbers
- All terrain transport truck, 2 numbers
- Tension and brake station for controlled tension stringing of three phase conductors simultaneously, 1 set
- Tension and brake station for controlled tension stringing of OPGW or Shield wire conductors simultaneously, or individually, 1 set

2.3 Underground cables

Underground cables (UGC) will be constructed for the following sections:

- 11 kV – A 0.5 km section from the geothermal power plant to the Laudat substation (GLI).
- 33kV – A 10.5 km line from the geothermal power plant to Fond Cole substation with three sections – Geothermal power plant to Trafalgar substation (GTI), Trafalgar substation to Padu substation (TPI), and Padu substation to Fond Cole substation (PFI). The initial section of the line passes through the existing right of way of Laudat's hydropower pipeline. Then, it will pass through the public road up to the Fond Cole substation. About 2 km of the UGC is located in the urban areas of Roseau city, in which 0.4 km is located along the highway.
- 69 kV – About 2.7 km of the proposed 69 kV line from the geothermal power plant to the Fond Cole substation (GFI) will be a UGC. The first 1.2 km of the 69 kV line from the geothermal power plant to Tower 30 will be UGC, and then the last 2 km of the section is from Tower 12 to Fond Cole. The tail end section of GFI will be installed on the public road connecting the Glasgow community and Fond Cole.

2.3.1 UGC Construction

33 KV

Cables will be laid by digging open trenches. The approximate width and depth of the trenches for 11 and 33 kV lines are 0.4 m and 0.9 m, respectively. Two major types of cable trenches can be constructed in the project:

- Cable trench under roadways
- Cable trench under sidewalks/natural ground

For a passage in a cable trench under roadways, the work steps can be summarized by the following:

- Excavation (depth is 0.9 m, Width is 0.4 m),
- Shielding,
- Lowering of the water level, (if it was necessary)
- Ducts laying, (1 single duct for 33 KV cables and 1 duct for FO cable)
- Formwork and pouring of concrete encasement all around the ducts, (0.4*0.35 m2)
- Backfilling and compacting using approved materials with a maximum layer thickness of 20 cm,
- Laying of the warning grid at 20 cm above the concrete block,
- Repairing the top layer of asphalt as it was initially.
- Note. The initial restoration of the upper layer of asphalt will take place approximately every 1.5 to 2 km in length. Hence, if many short and not successive cable trench passages under asphalt take place, the upper layer can be temporarily replaced by a layer of concrete, until the moment of asphalting for about 2 km arrive. This will avoid accidents and any probable risk of natural ground settlements.

For a passage through a cable trench under sidewalks or natural ground, the same steps will be repeated but without the concrete encasement all around the ducts.

A general representation of the cable trench is shown in Figure 2.4. Two ducts will be placed in this trench, one duct will be reserved for the passage of the three 33 KV phases, and another one will be for the FO cable, so the ducts' set will comprise the following:

- 1 duct HDPE (D = 140 - 160)
- 1 duct for the FO cable (D = 50 mm)

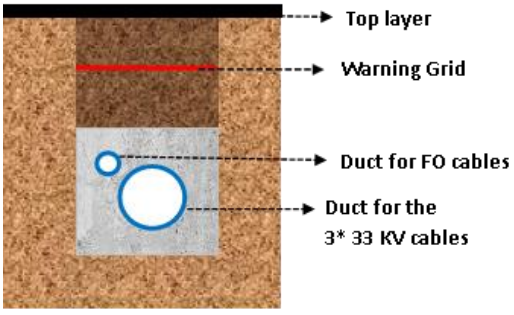


Figure 2.4: Typical Designs of 33 kV UGC cable trench

69 kV

The approximate width and depth of trenches for the 69 kV line are 0.6 m and 1.5m, respectively. Two major types of cable trenches can be defined:

- Cable trench under roadways
- Cable trench under sidewalks/natural ground

For a passage in a cable trench under roadways, the work steps can be summarized by the following:

- Excavation,
- Shielding,
- Lowering of the water level, (if it was necessary)
- Ducts laying using special spacers,
- Formwork and pouring of concrete encasement all around the ducts,
- Backfilling and compacting using approved materials with a maximum layer thickness of 20 cm,
- Laying of the warning grid at 20 cm above the concrete block,
- Repairing of the top layer of asphalt as it was initially.

For a passage through a cable trench under sidewalks or natural ground, the same steps will be repeated but without the concrete encasement all around the ducts.

The typical trench of the 69 kV UGC is similar to 33 kV UGC, as shown in Figure 2.4, but there will be 4 ducts, 3 ducts for HDPE (D = 140 - 160 mm) and one for Fiber Optical (FO) Cable (D = 50 mm). A typical representation of the duct set is shown in Figure 2.4. Each duct set will include:

- Three HDPE ducts for the three phases of the 69 kV cables (estimated D=140-160 mm),
- One HDPE duct for the fiber optic cable (estimated D=50 mm)
- Selection and properties of the Conductor's set
- (69 kV Single core Aluminum 252 mm^2)

Figure 2.5: Typical Designs of 33 kV UGC cable trench

Junction Boxes

About 8 power Junction Boxes are previewed all along this 33 kV UGC. The minimum length, width and height of 33 kV power junction boxes are 5m, 2.5m and 0.7 m, respectively. They will be placed at a 1.5 m minimum depth. Each of these boxes will have a cast iron cover. The upper level of these boxes will be the same as the natural ground level.

About 4 power junction boxes are envisaged for the 69 kV section. The minimum length, width and height of 33 kV power junction boxes are 9m, 2.5m and 0.7 m, respectively. They will be placed at a 1.5 m minimum depth.

Horizontal Directional Drilling

No horizontal directional drilling is expected all along this 33 kV UGC link from the new Geothermal power station to the Fond Cole substation.

2.3.2 Construction Equipment

- Set of equipment for UGC pulling in ducts, 2 sets
- Set of joining cable tools 69 kV and 33 kV, 2 sets
- Set of cable terminations installation tools, 2 sets
- Equipment for underground detection of utilities, 2 sets
- Excavator, 1 number

2.4 Substations

The Project will construct three new substations within the boundaries of the existing power plant and substation facilities. These three new substations are:

- One 69/33/11 kV substation at Fond Cole diesel power plant,
- One 2.2/33 kV substation at Trafalgar hydroelectric power plant,
- One 33/11 kV substation at Padu hydroelectric power plant.

2.4.1 Fond Cole Substation

The 69/33/11 kV substation will be located on the premises of the Fond Cole power plant. Due to the very limited area available for the Fond Cole substation and to keep enough space for future extension, the selection of a 69 kV double busbars GIS substation is retained.

The substation contractor will be responsible for the design, procurement, and construction of the whole substation, including civil and electromechanical works. They include:

- Supply and Installation of 69 kV GIS double busbar indoor switchgear with all accessories,
- Supply and Installation of a 33 kV and 11 kV Metal-Clad switchgears,
- Supply and Installation of one 69/11 kV 15 MVA transformer, one 33/11 kV 18MVA transformer and one 11/0.4 kV 160 kVA auxiliary transformer,
- Supply and installation of all HV, MV and LV control and power cables,
- Supply and installation of 33 kV and 11 kV power cables and their corresponding terminations kits with all accessories,
- Supply and installation of earthing system with all accessories, lightning protection system and outdoor lighting,
- Supply and installation of all control and protection system including local SCADA system with remote supervision,
- Supply and installation of all auxiliary services AC & DC with batteries and chargers,
- Supply and installation of telecom equipment and FO links,
- Test and commissioning of all outdoor & indoor electrical equipment, control and protection system, SCADA system, etc.
- Provide a list of all signals/measurement/controls signals to be exchanged with power plant and corresponding LV cables (measurements, signals, controls, FO, etc.) pull all these cables and connect them from both substation and interface panel sides
- Connect 11kV cables to power plant 11 kV switchgear

2.4.2 Trafalgar Substation

The substation contractor will be responsible for the design, procurement, and construction of the whole substation including civil and electromechanical works:

- Design drawings for all electrical and civil works,
- Supply and Installation of a 33 kV Metal-Clad switchgear,
- Supply and Installation of two 2.2/33 kV 4 MVA transformers and one 33/0.4kV 160 kVA auxiliary transformer,
- Supply and installation of all MV and LV control and power cables,
- Supply and installation of 33kV and 2.2kV power cables and their corresponding terminations kits with all accessories,
- Supply and installation of earthing system with all accessories, lightning protection system and outdoor lighting,
- Supply and installation of all control and protection system including local SCADA system with remote supervision,
- Supply and installation of all auxiliary services AC & DC with batteries and chargers,
- Supply and installation of telecom equipment and FO links,
- Test and commissioning of all outdoor & indoor electrical equipment, control and protection system, SCADA system, etc.
- Provide a list of all signals/measurement/controls signals to be exchanged with the power plant and corresponding LV cables (measurements, signals, controls, FO), pull all these cables and connect them from both substation and interface panel sides.
- Pull 2.2kV power cables and all needed control/protection/communication cables till existing 2.2 kV switchgear.

2.4.3 Padu Substation

The substation contractor will be responsible for the design, procurement, and construction of the whole substation including civil and electromechanical works:

- Design drawings for all electrical and civil works,
- Supply and Installation of a 33 kV Metal-Clad switchgear and two 11kV cabinets as extension of the existing 11kV switchgear,
- Supply and Installation of two 33/11 kV 3.5 MVA transformers and one 33/0.4kV 160 kVA auxiliary transformer,
- Supply and installation of all MV and LV control and power cables,
- Supply and installation of 33kV and 11kV power cables and their corresponding terminations kits with all accessories,
- Supply and installation of earthing system with all accessories, lightning protection system and outdoor lighting,
- Supply and installation of all control and protection system including local SCADA system with remote supervision,
- Supply and installation of all auxiliary services AC & DC with batteries and chargers,
- Supply and installation of telecom equipment and FO links,
- Test and commissioning of all outdoor & indoor electrical equipment, control and protection system, SCADA system
- Provide a list of all signals/measurement/controls signals to be exchanged with power plant and corresponding LV cables (measurements, signals, controls, FO), pull all these cables and connect them from both substation and interface panel sides

2.4.4 Civil works

The typical civil works to be carried out under the proposed new substations are summarized below.

- Soil investigations
- Levelling
- fencing construction + gates
- Heavy railroads
- Building Construction
- Firewalls construction
- Retaining walls
- Duct banks and cable trenches
- Drainage and sanitation work
- Video surveillance
- Exterior and interior lighting
- Water distribution
- Earthing
- Plastering, painting, tiling, waterproofing.

2.4.5 Construction Equipment

The minimum equipment required for the construction of substations are given below.

- Mobile crane, 2 numbers
- Transport truck, 1 number
- Primary injection equipment, 1 number
- Protection relay testing equipment, 1 number
- Earth resistance measurement equipment, 1 number
- Set of equipment for civil works, including concrete mixer, 2 sets

2.5 Access Roads

About 3.65 km of earthen access roads will be built to access the tower locations during the construction and maintenance stages. The proposed roads are earthen and made with locally available volcanic gravel material known as *tarish*. The details of the access roads are shown in Table 2.1.

Table 2.1: Details of Access Roads

S.No.	Tower Number	Length of Access Road in meters
1	12	91
2	13	331
3	14	251
4	15	251
5	16	212
6	17	426
7	18	502
8	19	390
9	23	51
10	24	56
11	26	42
12	27	538
13	28	341
14	29	70
	30	102

	Total	3,654 m Or 3.65 km

A typical design of the proposed access roads is shown in Figure 2.6. The average width of the proposed road is 3.5 m. The contractor will be responsible for the design of these roads, including the retaining structures for the protection of cut slopes. The approximate tarish material required for the construction of the access road will be about 800 m^3.

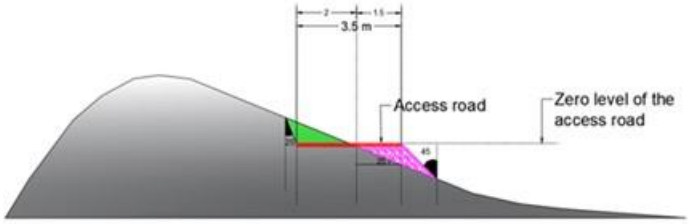


Figure 2.6: Typical Designs of Access Roads

2.5.1 Construction Methods and Equipment

The typical construction activities to be carried out for the access roads include:

- Soil investigations
- Land clearing and management of vegetation waste as per the ESMP
- Excavation, levelling and compacting
- Balancing cut and fill material. Disposal of excess cut material or procurement of more fill material.
- Procurement of tarish materials
- Laying of tarish material and compacting
- Retaining walls for slope protection

2.6 Resilience Development

Component 1.2 of the Project includes procurement of a stock of emergency spare parts and equipment, as part of resilience development, that is sufficient to allow efficient and fast response to future extreme weather events. In addition, technical assistance will be provided to DOMLEC to develop the emergency preparedness plan."

2.7 Operation and Maintenance Phase Activities

DOMLEC will operate and maintain (O&M) the transmission line facilities according to its general system maintenance procedures. These procedures include periodic inspections that require access to the towers and visual checks of the line corridor. If any defects or repairs are detected, maintenance crews will be deployed to fix them.

Routine maintenance is normally for the purposes of conductor sag adjustment, insulator replacement, and working on the fibre optic junction box installed on the monopole. This would require the use of a bucket truck, together with a suitable pole climbing system.

2.8 Land Use Restrictions Along the Transmission Line Corridor

2.8.1 Land Use Restriction on Midspan

This is the first time an overhead transmission line network as high as 69kV will be installed in Dominica. Considering safety and based on international good practices, there will be land use restrictions under overhead transmission lines. The land use restrictions within 15.5 m on either side of the pole are shown in Figure 2.7. No buildings are permitted within the wire zone under the overhead transmission lines. At the pole sites in the wire zone, i.e. within a radius of 6.5m around each pole, no structure (e.g., livestock enclosures, fences), mechanized equipment and trees/crops taller than 2m are permitted. At the pole sites in the border zone, i.e., in a radius of between 6.5m and 9m around each pole, no tree or structure taller than the distance to the pole (for example, the maximum tree height should be less than 10m if it is located from 10 m from the pole). In addition, along the right-of-way, i.e., midspan between one pole site and another, no structure or tree is allowed within 18m below the conductors.

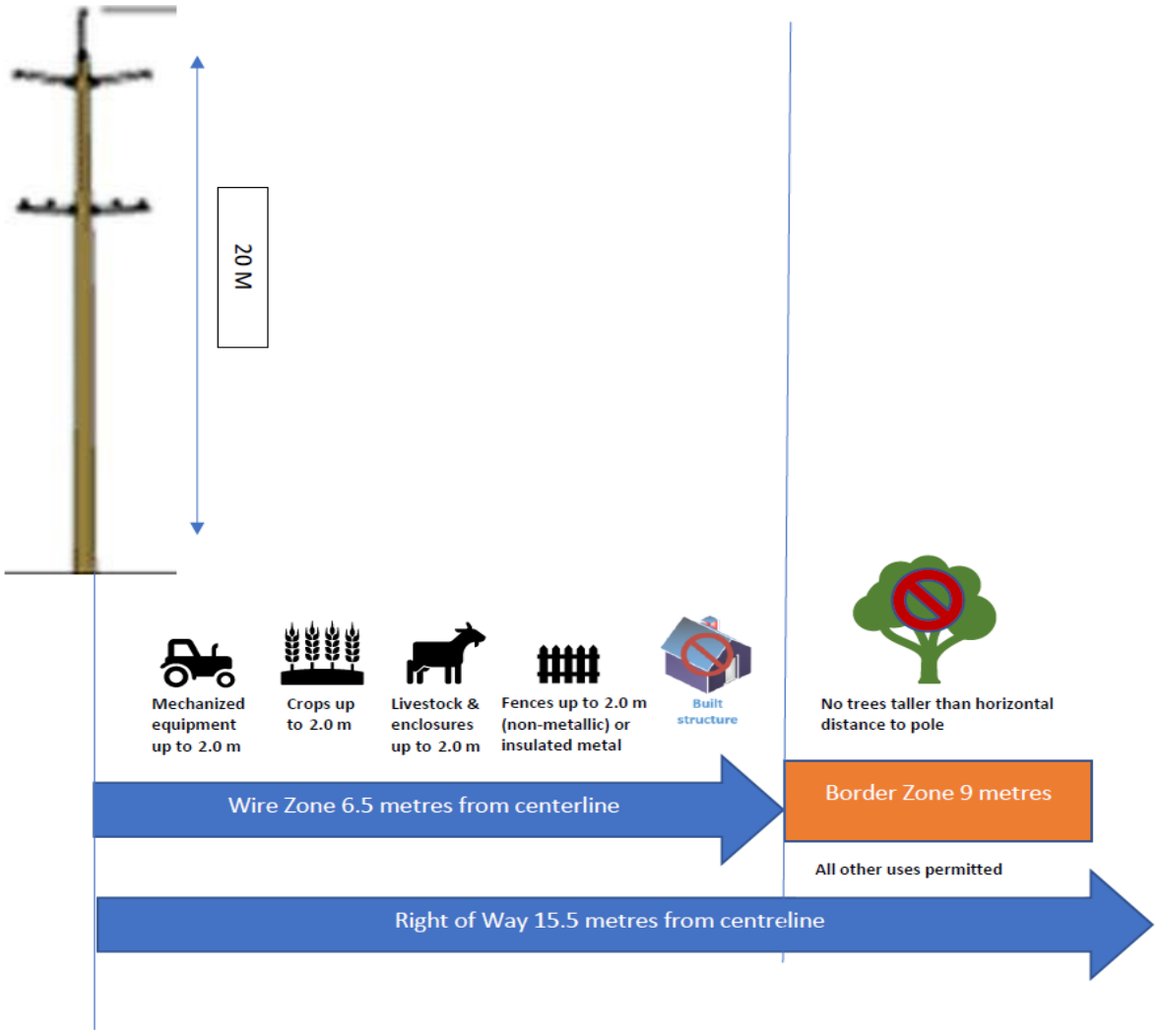


Figure 2.7: Right of Way Land Use Restriction

Because of the land use restrictions posed by the 69kv overhead transmission lines, the lands under the transmission lines will be under easement. An easement will be applied to the width of 31m within the right of way, from one pole structure location to another.

2.8.2 Land Use Restriction on Access Roads

The lands for the access roads will be under easement. All affected lands are forest and/or agriculture lands in mountainous terrain. The access roads would facilitate landowners' easy access to their own lands in the mountains and would have a limited impact on assets and livelihoods. It is, therefore, considered appropriate that the land required for access roads would be under easement.

2.9 Alternatives Considered in the Project Designs

2.9.1 Selection of Alignment

The transmission line alignment and design are carefully planned considering the experiences of the existing transmission line system in the country, terrain and natural hazards. These are summarized below;

- The OHL alignment is chosen to avoid the landslide-prone areas, houses and settlements in Glasgow, and a cable car development.
- Monopole towers are selected compared to lattice towers for structural integrity and their adoptability for the mountainous terrain and easy restoration in case of damage.
- Designs of towers for various wind speeds of 215 km/hour, 252 km/hour and 282 km/hour from the experience of previous hurricanes. Finally, a wind speed of 288 km/hour to withstand Hurricane Category 5 (with wind speeds of 252 km/hour or more) based on the experience of Hurricane Maria (265 km/hour) in 2017.

2.9.2 Underground versus Overhead Lines

The Project considered two alternatives for the design and construction of the transmission lines. They are underground cables and overhead transmission lines. The project has adopted both alternatives. The underground lines are built in the urban areas and near the settlements to minimize the land acquisition and easement requirements of OHL, and they are also not prone to hurricanes. Whereas the overhead transmission lines are built only in accessible and mountainous terrains. The UGC is more expensive to construct than OHL.

2.9.3 Alternatives to Alignment

The alignment of the OHL is optimized to minimize the impact on the residential structures. GFI was originally planned to be installed overhead from the geothermal power plant to the Fond Cole substation. However, the household survey and field visits found the overhead installation would have an impact on their plans to develop the property. To avoid potential social distress associated with routing an overhead transmission line through the Glasgow area as well as high land acquisition costs, DGDC decided to switch to an underground cable from the Fond Cole substation to the Glasgow community.

The underground cable installation from Fond Cole to Glasgow will be about 550m. A 5m wide corridor will be required for trenching. The total land requirement for this segment will be about 2,750 m^2 (or

29,600.75 sq ft). The underground cable will be installed mostly on public roads. However, there will be a diversion from the public road to connect the cable to the Fond Cole substation. Four land plots will be affected by permanent as well as temporary land acquisition for the diversion. Figure 2.8 provides the underground installation route in yellow on the public road and orange on the private land (the red line was the original overhead installation). The orange line will pass through the land borders. Three affected land plots are privately owned, and one plot is owned by the Government. There is no encroacher or squatter on the public land. The changes in the adjustment reduced potential PAPs from 19 to 2.

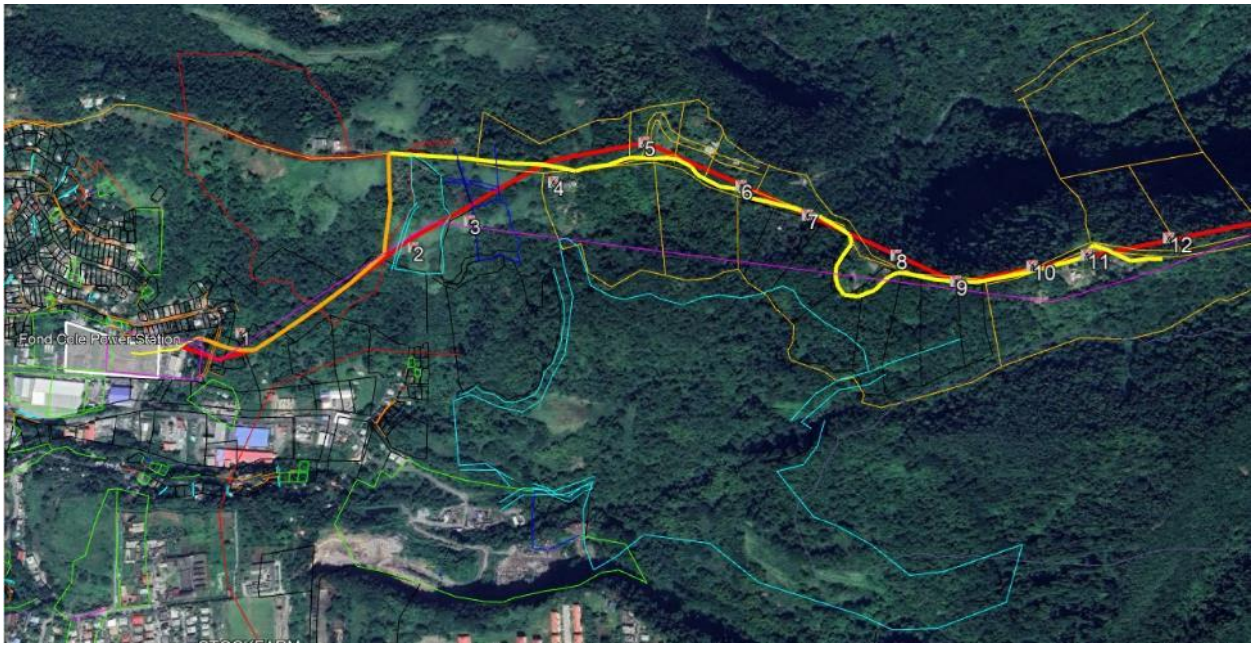


Figure 2.8: GFI from Fond Cole Sub-station to Glasgow Community

2.10 Associated Facility

The associated facility for the project is the geothermal power plant, which is a two-unit geothermal power plant with a gross capacity of 10 MW. A summary of the facilities under the plant is given below, and the location of these facilities with respect to the current project is given in Table 2.9.

- Power plant comprising 2 x 5 MW units (either single flash steam condensing cycle or organic Rankine cycle units (binary turbine), which will be adjacent to wells WW-P1 and WW-03. The binary power plants may use wet cooling or dry cooling;
- Production well WW-P1 – The existing geothermal production well at Laudat is indicated to have the potential to generate 6 to 11 MW and will be the sole production well for the project;
- Reinjection wells WW-R1 (located in Trafalgar) and WW-01 (located in Wotten Waven) – The used geothermal fluid (brine and possibly some steam condensate) produced from production well WW-P1 would be disposed of into reinjection well RV-I2 via a 250 to 300 mm diameter reinjection pipeline of up to 0.8km in length;
- Steamfield infrastructure including two-phase piping, steam separator, atmospheric flash tank, brine collection and disposal system, condensate collection and disposal system, pressure relief system, storage sump and rock muffler;
- Supporting infrastructure, including existing well pads, turbine building, primary and ancillary equipment, cooling system, and water supply

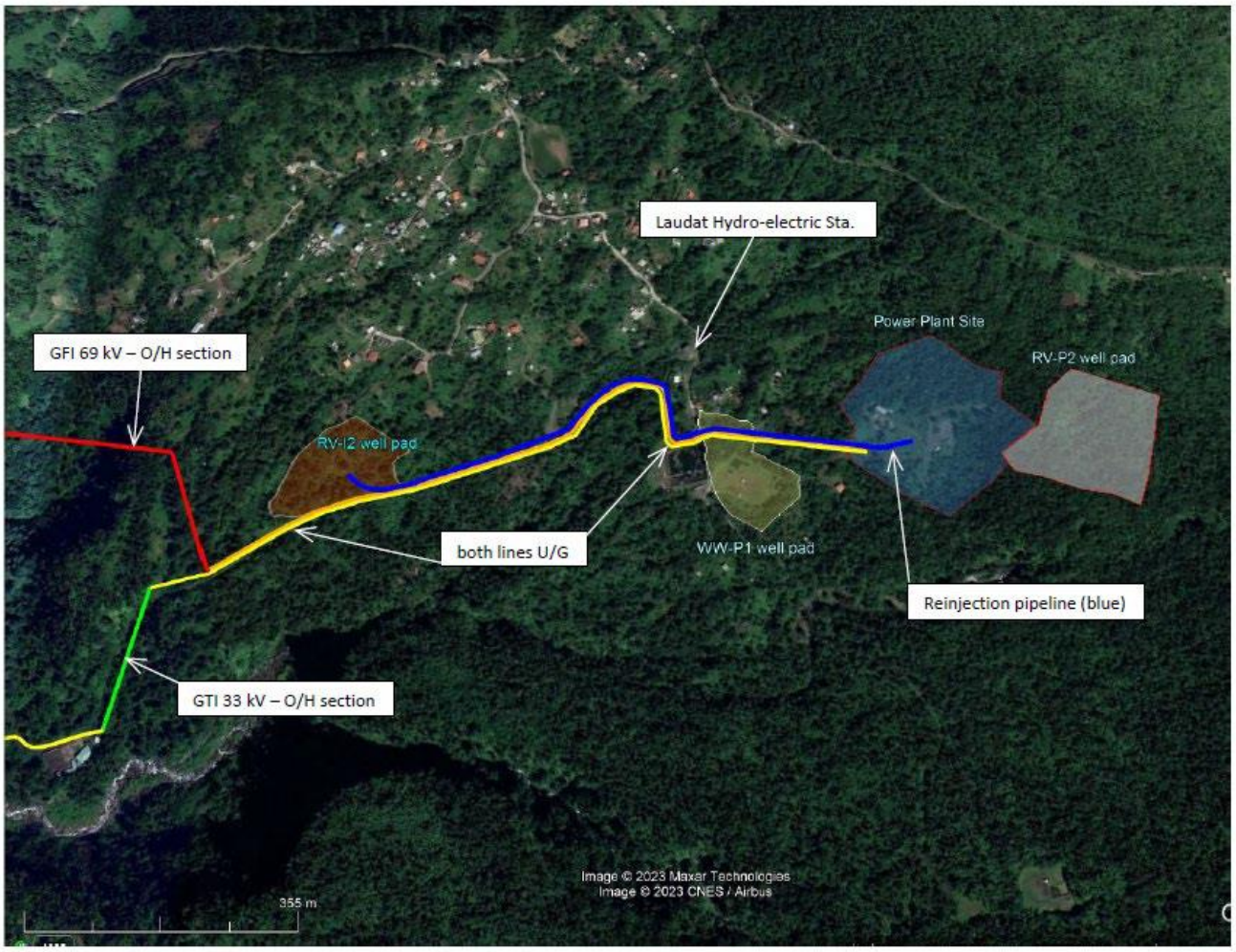


Figure 2.9: Locations of Associated Facilities

2.11 Contracting and Construction Timeline

Contractors will be procured through World Bank Standard Bidding Documents for procurement of 'Plant Design, Supply and Installation'. The construction works will be carried out under two lots.

- Lot 1. New 2.2 kV/11 kV/33 kV/69 kV substations
- Lot 2. New 11 kV/33kV/69kV OHL and UGC transmission lines

The construction period is 18 months.

3 Legal, Regulatory and Administrative Framework

This chapter provides an overview of the national legislation and the World Bank Environmental and Social Framework relevant to the project's environmental and social assessment and actions that are taken (or to be taken) by DGDC to meet these requirements.

3.1 Applicable Environmental and Social Regulations

3.1.1 Physical Planning Act (2002)

This is an act to make provision for the orderly and progressive development of land in both urban and rural areas and to preserve and improve the amenities thereof; for the grant of permission to develop land and for other powers of control over land use. This act also makes provision for the regulation of the construction of buildings and related matters. It also protects the environment and is administered by the Physical Planning Authority established by the act.

The EIA process in Dominica with respect to legal guidelines is as follows:

Section 2.1 of the Physical Planning Act 2002 No.6, defines environmental impact assessment as "the process of collection, analysis, evaluation and review of information on the likely effects of a proposed development on the environment and the means to overcome adverse effects which enables the Authority to determine whether development permission should be granted and with what conditions, the procedure for which is prescribed in regulations made under this Act."

This is the principal act that makes provision for orderly and progressive development and use of land and provides for the regulation of the construction of buildings and related matters. This act provides the Physical Planning Division with the legal mandate to grant permission to develop land and determine whether an environmental impact assessment is required for development deemed as having significant environmental harm.

Section 17 and 18 of the Act outlines the requirement of landowners to develop land under and in accordance with the terms of development permission granted prior to the commencement of such development, including operations in, on, or under any land and the making of a material change in the use of any building or land or the subdivision of land.

According to Section 23 of the above-mentioned Act 23:

> (1) Subject to the provisions of this section, an environmental impact assessment shall be carried out in respect of an application for a development permit for any development set out in the Third Schedule.
>
> (2) Notwithstanding the provisions of subsection (1), the Authority may, after consultation with the Chief Environment Officer, require an environmental impact assessment in respect of an application for permission for any development (other than development set out in the Third Schedule) where the proposed development would be likely to have significant effects on the environment having regard to:
>
> (a) The nature of the proposed development.
>
> (b) The geographical scale and location of the proposed development.
>
> (c) The extent of the changes to the environment likely to be caused by the proposed development.

(d) The degree of scientific certainty about the nature of the proposed development and its likely impact on the environment.

(e) Any development plan for the area.

(f) Any other matter as may be prescribed in the regulations.

Section 22 of the Physical Planning Act also outlines the necessity of public and stakeholder participation in development proposals for which environmental impact assessment, EIA, is required. There should be a public notice at site and in newspaper for comments.

Schedule 1 Section 9 (4)(d) - Part 1 outlines matters for which provisions may be made in the development plan with respect to roads as follows:

1. Reservation of land for roads and establishment of public rights of way, including public rights of way to beaches.

2. Closing or diversion of existing roads and public and private rights of way.

3. Construction of new roads and alteration of existing roads.

4. The line, width, level, construction, access to and egress from and the general dimensions and character of roads, whether new or existing.

5. Providing for and generally regulating the construction or execution of works incidental to the making or improvement of any road, including the erection of bridges, culverts, gullies, fencing, banners, shelters, the provision of artificial lighting, and seats and the planting or protecting of grass, trees and shrubs on or adjoining such road.

3.1.2 Forest Act 1990

The Forests Act provides legal mechanisms for the conservation and control of forests. Consequently, it outlines the provision to declare any private land as protected forest if it is required for, among other factors, the protection against storms, landslides, soil erosion and the deposition of mud, stones and sand upon agricultural land in addition to the maintenance of water supplies in springs, rivers, canals and reservoirs.

3.1.3 Forestry and Wildlife Act 1992

This Act provides protection and mechanisms for conserving and managing wild mammals, freshwater fish, amphibians, crustaceans and reptiles.

3.1.4 National Parks and Protected Areas Act, 1975

This act establishes national parks, forest reserves and protected areas, including marine parks for Dominica. The Act also gave legal status to the Morne Trois Pitons National Park (1975), the first unit of the proposed National Park System. It protects the fauna and flora of the Park, outlines the purpose and uses of the Park and sets the boundaries of the park under the relevant Schedule.

3.1.5 Environmental Health Services Act (No. 8 of 1997)

The Environmental Health Services Act makes provision for the conservation and maintenance of the environment in the interest of health generally and about places visited by the public. The act gives the Environmental Health Division the authority to carry out the functions of the Minister of Health, including investigation and advice on environmental pollution management, waste disposal and air quality

assessments. The act also makes provisions for granting permission for discharge into the environment of any pollutant or contaminant upon satisfaction that appropriate measures are taken to minimize these pollutants or contaminants.

3.1.6 Solid Waste Management Act

The act makes provision for the establishment of the Solid Waste Management Corporation with the responsibility of making provision for the collection, transport, storage, treatment and disposal of solid waste in Dominica. The act details the corporation's functions, including making provision for the management of medical and hazardous wastes, the management of sanitary landfills and for developing and introducing alternative and non-traditional waste disposal measures.

3.1.7 Dominica Water & Sewerage Act, Chapter 43:40, 1989

The objective of the legislation is "to see to the orderly and coordinated development and use of Dominica's water resources, to conserve and protect such resources for the benefit of present and future generations of Dominicans and to provide the Dominican public with a safe, adequate and reliable supply of water and with dependable sewerage services."

The authority for water management, including water catchment protection, has been bestowed on the Dominica Water and Sewerage Company, DOWASCO. The Company is also legally responsible for controlling pollution of freshwater resources. There is some overlap with the Forestry Division concerning the protection of water catchment areas.

3.1.8 Central Water Authority Regulations, No. 1 (1973)

The objective of the legislation is "to see to the orderly and coordinated development and use of Dominica's water resources, to conserve and protect such resources for the benefit of present and future generations of Dominicans and to provide the Dominican public with a safe, adequate and reliable supply of water and with dependable sewerage services."

3.1.9 Employment Safety Act

Dominica's Employment Safety Act, 3 of 1983, provides for safeguarding safety and health at work, establishing consultative and advisory committees, and appointing safety officers. It makes provision for inspections to be conducted at each workplace by safety officers appointed by the Minister of Labour to ascertain whether there are breaches of the act and whether the safety of employees is protected.

3.1.10 Noise Abatement Act

The Noise Abatement Act No. 10 of 1993 makes provisions for noise control with a view to abatement. It provides for approval for noise generation in the operations of a business; however, approval must be granted by the Planning Authority.

3.1.11 Labour Standards Act No 2 of 1977

This act makes provision for the fixing of the minimum wage and for the determination of working hours, leave and general matters relating to the welfare of workers in Dominica. It establishes the eight-hour workday and the 40-hour workweek. Workers exceeding these hours are to be paid overtime.

3.2 Regulatory Institutions

The following institutions are responsible for Environmental and Social issues in the project.

Institution	Role and Responsibility on E&S Issues
Ministry of Environment, Forestry, Wildlife and Parks Division (FWPD)	Conservation, management, and sustainable resource use of all forest reserves, national parks, nature sites, and the WNT, as well as soil and water conservation, enforcement of forestry, wildlife and national parks legislation, research and monitoring, public relations, and environmental education
Ministry of Health Wellness and New Health Investment, MHW NHI	The responsibility for environmental monitoring is administered by the Environmental Health Department (EHD) of the Ministry of Health, Wellness & New Health Investment. Its functions are described in the Environmental Health Services Act, # 8, of 1997. The department's mandate is to investigate problems and institute remedial measures with respect to environmental pollution, the management and disposal of solid and liquid waste, food safety and vector control activities. The department also has the mandate for reviewing building plans and monitoring workplace safety to reduce the impact of the environment on public health. Additionally, there is also the responsibility for conducting research in public health; however, this is done on a limited scale due to institutional capacity limitations. While the EHD's primary function is environmental monitoring, the Division works along with other divisions of the MHW&NHI for the organization and implementation of health services in Dominica. Care is provided using the Primary Care Strategy, where services are delivered to communities via a health team in health districts nationwide. An Environmental Health Officer works with this team to provide services through inspections and other health promoting strategies for preventing communicable and environmentally related non-communicable diseases. The MHW&NHI and EHD also conduct environmental assessments to ascertain whether conditions exist in the environment which contributes or have the potential to contribute to adverse human health conditions and, if necessary, request abatement or mitigation to reduce negative health impacts.
Physical Planning Division	Physical Planning guides and regulates Dominica's physical development with authority granted by the Physical Planning Act 5 (2002). The division monitors building, engineering, mining and other operations in Dominica. The division is concerned with safeguarding the public's health, safety and interest instead of private interest. If required, the Physical Planning division evaluates building proposals to ascertain structural integrity, land use and environmental assessments and manages development control. The division reviews all building applications and development plans. Land-use planning is another important function of the division. The policy carried out by the Planning Division guides how land is used. It systematically assesses land potential balanced with environmental impacts and current and future demands. The primary goal of land-use planning is to balance the needs of the resident population with the needs of the environment. In the interest of preservation and cultural heritage, the physical planning division is also responsible for protecting Dominica's architectural and cultural heritage. They may, by authority, restrict the demolition, renovation or extension of any building which needs to be preserved. The division also carries out the function of environmental protection. Where any part of the country is considered as environmentally vulnerable, the division advises the government to declare such an area a protected area.

Institution	Role and Responsibility on E&S Issues
Solid Waste Management Authority	The Dominica Solid Waste Management Authority was established for the management of solid waste in Dominica. Their primary function is the collection and disposal of household waste; however, they are also mandated to collect and dispose of medical waste. The corporation also manages the country's only landfill in the community of Fond Cole, where waste is buried in lined trenches
National Emergency Management Office	The Office of Disaster Management (ODM) is part of the Ministry of Environment, Climate Resilience, Disaster Management and Urban Renewal structure. It manages the country's emergency operations and is committed to taking proactive and timely measures to prevent or reduce the impact of disasters on the Dominican people and economy. ODM works closely with the National Emergency Planning Organization (NEPO), a governmental organization responsible for planning and organizing counter-disaster measures at the central level. One of NEPO's key functions is to develop, operate, and maintain a National Emergency Operations Centre following the National Disaster Plan requirements. The senior Dominican disaster management body is the National Emergency Planning Organization (NEPO) Advisory Committee. The general direction and control of the Organization resides with the Honourable Prime Minister through this committee.
Labour Relations and Occupational Health and Safety Department	The Labour division of the Ministry of National Security manages labour relations. Their functions include the resolution of disputes between employees and employers and also are responsible for occupational Safety and Health, including Employee safety at work sites. The department collaborates with the MHW&NHI EHD to implement the Occupational Health and Safety Guidelines requirements by conducting safety inspections of worksites and investigating injuries and conditions arising out of work-related conditions. Employees are bound by the Occupational Disease Notification regulations, which mandate reporting work-related injuries and conditions to the Labour Division, after which investigations are carried out.
Ministry of Housing and Urban Development, Lands and Surveys Division	The Lands and Surveys Division or Lands Department provides regulatory informational and managerial services and policy advice to public and private sector agencies for effective management and utilization of land resources of the State. It is responsible for land mapping and provision of land surveying and land information services for all government agencies/divisions.

3.3 Relevant International Treaties

Dominica is a signatory to various international conventions that are relevant to the Project are given below:

The Convention on Biological Diversity (CBD): Objectives of the CBD include conservation and sustainable use of biological diversity, access to and equitable distribution of the benefits of genetic resources, and appropriate transfer of technology.

The Convention on the International Trade in Endangered Species (CITES): CITES's goal is to safeguard against threats to the survival of listed species arising from international trade in specimens, parts, or products of those species.

The International Plant Protection Convention (IPPC): IPPC is an intergovernmental treaty to protect the world's plant resources from spreading and introducing pests and promoting safe trade.

UN Framework Convention on Climate Change: International environmental treaty addressing climate change, negotiated and signed by 154 states at the United Nations Conference on Environment and Development, informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992.

3.4 World Bank Environmental and Social Framework and Guidelines

The WB ESF sets out the WB's commitment to sustainable development and mandatory requirements for Bank financed projects. The Bank's ESF is used to assess and manage the projects' environmental and social risks and impacts. The Environmental and Social Standards (ESSs) are designed to avoid, minimize, reduce, mitigate and compensate/ offset the adverse environmental and social risks and impacts. The projects supported by the WB are required to meet the 10 ESSs relevant to the project.

The ESIA will be undertaken in compliance with ESS1 requirements and other relevant ESSs, as follows:

- ESS1: Assessment and Management of Environmental and Social Risks and Impacts: The ESIA will be prepared to assess all risks and impacts related to relevant standards (ESS2, ESS3, ESS4, ESS5, ESS6, and ESS8), including stakeholder engagement and assessment and management of environmental and social risks and impacts.
- ESS2: Labor and Working Conditions: The ESIA will assess labor risks and working conditions on different types of project workers as per ESS2.
- ESS3: Resource Efficiency and Pollution Prevention and Management: The ESIA will assess the risks and impacts related to ESS3, including identifying the use of resource-efficient technologies and techniques during construction and operation.
- ESS4: Community Health and Safety: ESIA will assess the potential risks what are the potential risk and impacts of the project on community health and safety.
- ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement: The RAP will assess the risks and impacts related to land acquisition as well as physical and economic displacement.
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources: The ESIA has collected baseline information on biodiversity, including identification and assessment of any critical habitats, natural habitats and modified habitats in accordance with ESS6 within the project area of influence (100m from the transmission line alignment).
- ESS7: Indigenous Peoples: The island is also the home of the Kalinago, an indigenous group with a population of 3,000. They reside in the northeast of the island, thus, will not be affected by the Project. So, ESS7 is not relevant to the Project. However, in case an area of cultural significance is identified during construction, the chance find procedures will be applied (see Section 5.8.1).
- ESS8: Cultural Heritage: The project will not impact any known cultural heritage. However, the chance find procedures are included in the ESMP.
- ESS 9 Financial Intermediaries: Since no financial intermediary is involved in this project, ESS 9 is not applicable.
- ESS10: Stakeholder Engagement and Information Disclosure: A Stakeholder Engagement Plan (SEP) developed for the overall project will be used to map out stakeholders and engage them throughout the project's life.

3.4.1 WBG General EHS Guidelines, 2007

The WBG General EHS Guidelines 2007 guides users on common EHS issues potentially applicable to all industry sectors. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for the assessment and monitoring of impacts. The EHS guidelines also provide guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities. The guideline highlights the general approach to the management of EHS issues at the facility or project level. The guideline entails the inclusion of EHS considerations into corporate and facility-level business processes in an organized, hierarchical approach highlighting the identification of EHS project hazards and associated risks. Further, the risk management strategies will incorporate engineering and management controls to reduce or minimize the possibility and magnitude of undesired consequences when impact avoidance is not feasible.

3.4.2 Environmental Health and Safety Guidelines for Electric Power Transmission and Distribution

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas.

3.4.3 Comparison of WB ESSs and National Regulations

Although the ESIA is prepared based on the World Bank ESF, not on the national legislative framework and requirements, it is ensured that the national requirements are met. Table 3.3 compares the ESSs with national legislative framework and requirements and explains how the ESIA meets both requirements.

Table 3.1: WB ESSs and Comparison with relevant National Laws

World Bank ESS requirements		Dominica's policy framework and requirements	Gaps between ESSs and Dominica's regulatory requirements	Gap-Bridging Measures
ESS	**Requirements**			

ESS 1: Assessment and management of Environmental and Social Risks and Impacts	ESS 1 requires the Borrower will assess, manage and monitor the environmental and social risks and impacts of the project throughout the project life cycle so as to meet the requirements of the ESSs in a manner and within a timeframe acceptable to the Bank.
	
	The Borrower will: (a) Conduct an environmental and social assessment of the proposed project, including stakeholder engagement; (b) Undertake stakeholder engagement and disclose appropriate information in accordance with ESS10; (c) Develop an ESCP, and implement all measures and Actions set out in the legal agreement, including the ESCP; and (d) Conduct monitoring and reporting on the environmental and social performance.
		Physical Planning Act 2002 requires an environmental impact assessment shall be carried out in respect of an application for a development permit for any development set out in the Third Schedule. EIA is needed for the substations and power transmission lines.	There are no clear guidelines for developing the EIAs. Scope of EIA may not cover all WB ESS.
			
			No provision for associate project projects/activities;
			
			Does not emphasize a hierarchy of measures in ES risk management planning
				• The following documents are prepared to comply with ESS1.
				  • ESIA
				  • ARAP
				  • SEP
				  • LMP
				  • ESCP
				• ESIA is prepared in compliance with government requirements,
				• The ESMP will be made an integral part of the bidding document so that the Contractor (as for the provision of services) shall adhere to the provisions prescribed in the ESMP during the execution of the project.

ESS 2: Labour and Working Conditions	There are a number of requirements of ESS2 under the following heading: • Working conditions and management of worker relationships; • Protecting the work force; • Grievance mechanism; • Occupational Health and Safety	Employment Safety Act 1983 Labour Standards Act No 2 of 1977	Current OHS legislation is not adequate (No separate legislation on OHS). Lack of industry-specific standards on OHS	• Labour Management Procedures (LMPs) will be implemented in the project implementation • During implementation, the contractor will submit an OHS plan/manual for the approval of DGDC before starting the construction activities.

World Bank ESS requirements		Dominica's policy framework and requirements	Gaps between ESSs and Dominica's regulatory requirements	Gap-Bridging Measures
ESS	**Requirements**			
	• Contracted workers; • Community workers; and; • Primary supply workers			
ESS 3: Resource Efficiency and Pollution Prevention and Management	The Borrower shall consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention.	Water & Sewerage Act, 1989 Solid Waste Management Act Noise Abetment Act, 1993	Lack of suitable enforcement mechanisms for legislation on resource use efficiency in projects	• Resource efficiency and pollution prevention in any project activity are captured in ESIA/ESMP. • WBG EHS guidelines or/ National standards (depending on which one is stricter) related to environmental protection and resource efficiency will be complied with by the project.
ESS 4: Community Health and Safety	There are several requirements of ESS4 under the following headings: • Community health and Safety and • Security personnel	The EIA process identifies the direct and indirect human health impact as one of the components in assessing the effect of development projects.	• There is limited coverage as ESIAs' scope does not necessarily include community safety issues.	• ESIA/ESMP of the project will address all community health and safety issues that arose during the project implementation.
ESS 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	There are several requirements of ESS 5 under the following headings: • General (Eligibility classification; Project design; Compensation and benefits for affected persons; Community engagement; Grievance mechanism; Planning and implementation); • Displacement (Physical displacement; Economic displacement); • Collaboration with other responsible agencies or subnational jurisdictions; and;	Land Acquisition Act, the Land Survey Act 53:04 , and the Electricity Supply Act (No. 10 of 2006)	• There is no national requirement to prepare a resettlement plan. • There is no national requirement for census. • There is no indication of the timing of payment in the national law. Upon the issuance of 2nd Gazette, the land belongs to the State. • The national law has a provision for absentee owners. Compensation is kept by the High Court.	• ESS5 precedes. ARAP is prepared in compliance with ESS5 requirements

World Bank ESS requirements		Dominica's policy framework and requirements	Gaps between ESSs and Dominica's regulatory requirements	Gap-Bridging Measures
ESS	**Requirements**			
	• Technical and financial assistance.		• While squatters do not have legal rights, the national law allows them to gain legal rights after 12 years of undisturbed occupation. • The national law has a provision for negotiation with landowners but not community engagement.	
ESS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	There are number of requirements of ESS 6 under the following headings: • General (Assessment of risks and impacts following a precautionary approach); • Conservation of biodiversity and habitats; • No Net Loss is achieved to mitigate the loss of natural habitats, where critical habitats are impacted, Net Gain will be demonstrated for the biodiversity values for which critical habitat is designated. • Legally protected and internationally recognized areas of high biodiversity value; • Invasive alien species; • Sustainable management of living natural resources and primary suppliers.	Forest Act 1990 Forestry and Wildlife Act 1992 National Parks and Protected Areas Act, 1975	• Does not specifically require Biodiversity Management Plan even where biodiversity impact is found significant in the EIA	• All the provisions of relevant laws are complied with by the project. • The ESMP includes a Biodiversity Management Plan.

World Bank ESS requirements		Dominica's policy framework and requirements	Gaps between ESSs and Dominica's regulatory requirements	Gap-Bridging Measures
ESS	**Requirements**			
ESS 8: Cultural Heritage	There are a number of requirements of ESS 8 under the following headings: • Stakeholder consultation and identification of cultural heritage (Confidentiality; Stakeholders' access); • Legally protected cultural heritage areas; and • Commercial use of cultural heritage	• Ministry of Youth, Sports, Culture and Constituency and Empowerment, or the Dominica Museum are responsible.	• Does not include intangible cultural heritage • Does not provide for the application of globally recognized practices in the study, documentation and protection of cultural heritage •	• ESMP includes chance find procedures.
ESS 10: Stakeholder Engagement and Information Disclosure	There are a number of requirements of ESS 10 under the following headings: • Engagement during project preparation (Stakeholder identification and analysis; Stakeholder Engagement Plan; Information disclosure; Meaningful consultation); • Engagement during project implementation and external reporting; \Grievance mechanism; and; • Organizational capacity and commitment	• Physical planning act envisages stakeholder engagement during ESIA preparation	• Does not require stakeholder analysis and preparation of a stakeholder engagement plan • Does not provide for continuous stakeholder engagement/consultations beyond the EIA process during the construction and operation phase	• The project has prepared a Stakeholder Engagement Plan (SEP) to ensure that stakeholder engagement activities are effective and meaningful consultation is carried out, including guidelines for establishing a comprehensive GRM with clear, safe and accessible procedures to identify and respond to grievances, including SEA/SH, cases.

4 Baseline Environment

This chapter presents a detailed overview of the physical, biological, and socio-economic environment within the project's influence area and the results of the primary investigations. For the biodiversity surveys, a 100-m wide corridor was considered as the corridor of influence.

4.1 Physical Environment

4.1.1 Terrain

Both OHL and UGC pass through the mountainous terrain. The 69 kV overhead transmission alignment mainly passes along the ridge of the Roseau Valley, and the 33 kV UGC mainly passes along the valley along the existing road. Both lines start from the geothermal power plant on the southwestern periphery of the village of Laudat. An elevation profile of the 69 kV line is shown in Figure 4.1. The maximum and minimum elevations are 552 m and 42m, respectively. The topographic characteristics of the project alignment are further discussed in the biodiversity section.

Figure 4.1: Elevation Profile of 69 kV line

4.1.2 Climate

The climate of the project area varies based on the terrain. The higher elevations above 400 m near the geothermal power plant have an annual rainfall of 5000 to 6000 mm. The lower elevations near Fond Cole have an annual rainfall of about 2,500mm. In general, the climate of Dominica is tropical, with high temperatures and heavy rainfall. The magnitude of variation in ambient temperature is low, generally ranging from 26°C during the day in January to 32°C in June. The relative humidity in Roseau oscillates between 70 and 90%. The driest season occurs between February and May, but humidity seldom falls below 85%. On the highest peaks, temperatures can drop to 13°C. The significant topographic gradient results in much cooler temperatures in the country's interior mountains. Wind blowing generally from an easterly direction with average wind speeds of 5.38 m/s. The east trade winds blow during most of the year, but there is a southeast pattern from July to September when tropical storms can hit the island.

Although its intensity may vary depending on the location on the island, rain is present throughout the year and most of the rainfall is brought by the trade winds. The heaviest rainfall is concentrated between June and October. The average annual rainfall can reach 9,000 mm over the most exposed mountains. Rainfall on the west coast (leeward side) is much more moderate, of the order of 1,800 mm per year. The amount of rainfall explains the intense humidity that bathes the island. Orographic effects on storms occur in mountainous areas, with annual rainfall >8,000 mm experienced in the high montane forests, while in the lowland forests, rainfall varies from 2,000 to 5,000 mm/year.

4.1.3 Hydrology

The transmission line alignment falls within the Roseau River watershed. This is one of the largest watersheds in Dominica. The major streams in this watershed are: La Riviere Pardu, Roseau (Queen's River), Riviere Blanc, Riviere Claire, Trois Pitons River, and Riviere Douce. The 39 kV line crosses two large intermittent ravines flowing from the steep cliff near DOMLEC's vertical hydro- electric water pipeline overlooking the Trafalgar Falls Visitor Center and Papillote Wilderness Retreat, respectively. It also crosses a minor seasonal stream on the highway near the port. The 69 kV line is not crossing any streams.

The water quality sampling and analysis conducted in the ESIA of the Geothermal Power Plant has assessed the water quality as very good.

4.1.4 Geology

The island of Dominica is a submerged mountain chain summit at the eastern edge of the Caribbean Tectonic Plate. It is the youngest of the Lesser Antilles volcanic arc islands, which was formed from the subduction of the North American tectonic plate under the Caribbean tectonic plate. It is almost entirely comprised of volcanic rocks which have been formed over many millions of years during numerous eruption events. These events have mainly taken the form of phreatic or phreatomagmatic explosive eruptions, usually leaving behind lakes or craters. The oldest formations exposed on Dominica are massive basaltic lava flows and breccias of Miocene age, found between Rosalie and Pagua, with numerous Pliocene age dykes cutting through.

4.1.5 Natural Hazards

Hurricanes

The Caribbean is one of the most hurricane-prone regions in the world and major hurricane events can leave Caribbean countries with fractured infrastructure, thousands of people affected, and governments struggling to put together the necessary resources to finance emergency assistance and relief, recovery, and reconstruction. On average, one major hurricane hits Dominica every 15 years.

Dominica is located in the hurricane belt, and some of the most devastating hurricane experiences (e.g. Marilyn, Lenny, Dean) have occurred since 1995 in the current active phase of the north tropical Atlantic. There is also significant year-to-year modulation of hurricane frequency and tracking by El Niño Southern Oscillation (ENSO) events. Since 1979, tropical systems of note (storms and hurricanes) which have impacted Dominica include David (1979), Gert (1981), Gilbert (1988), Hugo (1989), Iris (1995), Marilyn (1995), Hortense (1996), Lenny (1999), Dean (2007) and Maria (2017).

Landslide

Landslides are a potential hazard throughout Dominica, especially in the steeper areas that receive higher rainfall. Some areas near the 69 kV OHL alignment are landslide-prone, and the final alignment was selected by avoiding these landslide areas.

Seismicity

The risk of earthquakes is classified as moderate to very low in the Roseau Valley (from the online map available on the Physical Planning Division website). Most of the transmission line is located within a very low-risk seismic area.

4.1.6 Air Quality

A baseline air quality assessment was conducted in the ESIA of the geothermal power plant in 2018. The parameters monitored are H_2S, NO_2, SO_2, ozone, PM_{10} and $PM_{2.5}$. The monitoring was undertaken at 30 locations for two 15-day periods (one during the wet season and one period during the dry season). The monitoring sites represent a variety of environments across the island of Dominica, including the capital (Roseau), villages in the vicinity of the Project (Laudat, Trafalgar, Fond Cani, Wotten Waven), and the Project area itself (near Laudat). The results are summarized below.

Key conclusions resulting from the baseline monitoring include:

- Minor differences were observed between the wet and dry season measurements.
- NO2 levels were low and not significantly affected by anthropogenic emissions.
- Ozone concentrations were similarly low and did not appear to be significantly affected by anthropogenic emissions.
- SO2 concentrations were variable, with some locations, particularly in the Wotten Waven and Morne Prosper sites, having the highest measurements. Given the absence of SO2 discharges in the area however, it is likely that these readings are a result of the analysis method for the SO2 passive samples where H2S was also present, resulting in false positive levels.
- H2S concentrations were above the odour threshold limit of 0.3 µg/m3 at all sites, and at many sites in the Project, the area exceeded the nuisance threshold value of 7 µg/m3. The highest concentration of H2S measured was 19.1 µg/m3 as a 15-day average. Using a conversion factor to estimate concentrations from longer averaging periods to 1-hour averages equates to around 62 µg/m3 as a 1-hour average for comparison with the odour threshold of 7 µg/m3. However, the measured concentrations are not considered unusual for an active geothermal area.
- Particulate matter (as PM10 and PM2.5) monitoring results indicated some influence from anthropogenic emissions (i.e. burning vegetation on agricultural plots of land).

4.1.7 Noise Level

ESIA of the geothermal power plant includes baseline noise data at the villages of Laudat, Trafalgar, Copt Hall, Shawford, Fond Cani, Morne Prosper and Wotten Waven. The noise levels are generally well below the national standards and EHSGs. The main sources of noise in the area surrounding the Project are local fauna, residential noise, low traffic on local roads, and wind and water courses. Ambient noise levels are generally louder during nighttime due to local fauna, such as insects and nocturnal wildlife. In the vicinity of local traffic-generating developments, such as schools, hotels and tourist attractions, noise levels were somewhat higher.

4.2 Biological Environment

Primary baseline surveys were carried out in the project area for the biodiversity assessment. The surveys were carried out during the dry (March and April 2023) and wet (July 2023) seasons. The surveys mainly focused on the 69 kV alignment, a new greenfield alignment, and proposed access roads. A detailed biodiversity report is given in Annex 1, and a summary is in this section.

The proposed transmission line traverses a geographical area with varied biological environments. The biological environment of the transmission line corridor includes three ecological zones. These zones are identified based on the vegetation, elevation and rainfall characteristics. These zones are (i) secondary rainforest, (ii) transitional/semi-evergreen forest, and (iii) dry scrub woodland. The dry scrub woodland is

located in the "West Coast Shrub Woodland, " a Key Biodiversity Area (KBA) but not a designated protected area. The ESIA addendum prepared for the geothermal power plant in 2021 concluded that the project area is not a critical habitat for any threatened species. The baseline studies found the presence of the vulnerable, Red-necked Amazon Parrot (*Amazona arausiaca*) along the OHL. The review of secondary literature also confirms the presence of two other threatened bird species, the Imperial Amazon Parrot (*Amazona imperialis*), and the Black-capped Petrel ~~(*Pterodorma hasistata*~~ (*Pterodroma hasitata*), in the project area.

4.2.1 Secondary Rain Forest

Secondary Rain Forest occurs above 275 meters (900 feet) elevation above mean sea level in areas previously occupied by mature rain forests that have experienced disturbance from timber harvesting, shifting agriculture and hurricanes. These areas receive annually 3,810-6,350 mm (150-250 inches) of rainfall. Abundant pioneer species and an assortment of regenerated rainforest species characterize the vegetation in this zone. The canopy height is approximately 24 meters. The initial sections of the UGC line near the power plant and 69 kV pole structure locations from 17 to 30 are in this zone. A typical photograph of this ecosystem is shown in Figure 4.2.

Figure 4.2: Secondary Rain Forest at Pole Structure #30

4.2.2 Transitional Forest / Semi-Evergreen Forest

Transitional Forest/Semi-Evergreen Forest is usually found at elevations between 214 -396 meters (700-1300 ft) above mean sea level, mostly on Dominica's west and north sides. Annual rainfall in this ecosystem ranges from 2,540- 3,810 mm (100-150 inches). It is found within a relatively narrow zone between the secondary rainforest and dry scrub woodland. This vegetation type is mainly semi-evergreen. Its floristic composition comprises a combination of species, including dry scrub woodland and rainforest species. Most of this ecosystem is under cultivation or previously has been cultivated at one time. This vegetation type is largely secondary woodland. The canopy height varies based on the level of disturbance, but it is usually in the range of 18-24 meters (60-80ft) high. The proposed 69 kV pole locations from 12 to 16 are located in this zone. A typical photograph of this ecosystem is shown in Figure 4.3.

Figure 4.3: Secondary Transitional Forest near Pole #13

4.2.3 Dry Scrub Woodland

Dry Scrub Woodland is the main vegetation type of the seasonally dry lowland areas of Dominica's leeward or Caribbean side. It occurs along the west coast from the shoreline up to an elevation of approximately 213-244 meters (700-800 feet) above mean sea level. It is in the "Rain Shadow" of the island, and annual rainfall ranges from 1,270-2,540 mm (50-100 inches). It is dominated by deciduous trees and shrubs, most of which flower in the dry season (February to June) when they are practically leafless. The dominant trees usually reach a height of 15-18 meters. The undergrowth forms a dense thicket characterized by a diversity of smaller trees and shrubs, vines, climbers, and herbaceous plants. The tail-end of the GFI near the Fond Cole and 36 KV line along the existing road mainly passes through this ecosystem. A typical photograph of this ecosystem is shown in Figure 4.4.

Figure 4.4: Degraded Dry Scrub Woodland Near Tail end of 69 kV line

4.2.4 Mammals and Reptiles

The mammal species reported in this ecosystem are opossums (*Didelphis marsupialis*), agoutis (*Dasyprocta leporina*), and bats. Opossums were recorded during the field surveys within the secondary rainforest zone.

The reptile species recorded during field surveys are the invasive Puerto Rican-Crested Anole (*Anolis cristatellus*), the Dominica tree lizard (*Anolis oculatus*) and the Dominica ground lizard (*Pholidoscelis fuscatus*). The other reptile species known to occur in these areas but not recorded during the field surveys are tree gecko (*Hemidactylus mabouia*), golden skink (*Mabuya mabouya*), Lesser Antillean iguana (*Iguana delicatissima*), Dominican boa *(Boa constrictor nebulosus)*, and the black-and-white checkered snake (*Liophis juliae*).

The "West Coast Shrub Woodland' is a KBA due to the presence of a critically endangered frog species known as 'mountain chicken' (*Leptodactylus fallax*). The proposed transmission line on the GFI segment does not cross any watercourses, so this frog species is not found in the project area.

4.2.5 Birds

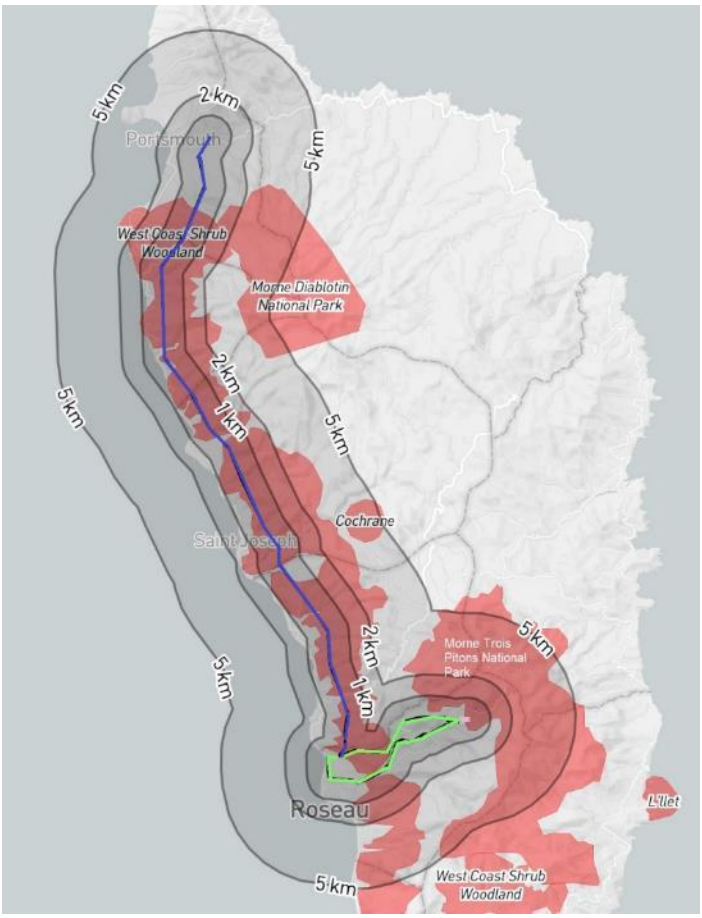
A total of eighteen (18) bird species were visually and aurally encountered in the project area, mainly in the secondary rainforest ecosystem. The avifauna recorded comprised only resident species. The diversity of birds included parrots, hummingbirds, euphonias, flycatchers, warblers and finches, among other avian species typically associated with secondary rainforest and agricultural cultivations.

Globally threatened species of concern within the transmission line's area of influence include the Red-necked Amazon Parrot (*Amazona arausiaca*, a vulnerable species), the Imperial Amazon Parrot (*Amazona imperialis*, a critically endangered species), and the Black-capped Petrel (*Pterodroma hasitata)*, an endangered species All three threatened species are listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. During the field surveys, Red-necked Parrots were observed foraging within the area of influence (except in the dry scrub woodland). The Imperial Parrot, though not observed, is reported to utilize the forest and airspace within the region as a migration corridor between the rainforest habitat around the foothills of Morne Watt (Morne Trois Pitons National Park) and habitats in the Central Forest Reserve and Northern Forest Reserve.

The nocturnal surveys within the zone of influence at Laudat could not verify the presence of the Black-capped Petrel. However, recent collaborative research has confirmed the presence of the Black-capped Petrel, in the airspace over Laudat, on its flyways to and from nesting grounds near the summit of Morne Micotrin and other mountain summits within the district.

4.3 Legally Protected and Internationally Recognized Areas of High Biodiversity Value

An IBAT (Integrated Biodiversity Assessment Tool) report was used to assess the proximity of the project to Legally protected and Internationally Recognized Areas of High Biodiversity Value. Morne Trois Pitons National Park is a legally protected area located about 1 km from the project (near the geothermal power plant and West Coast Shrub Woodland, a Key Biodiversity Area (KBA) located within the alignment (near Fond Cole). A map showing these is given in Figure 4.5.



Note: The green line represents the project alignment, and the blue line for future phases. KBAs from 1 to 5 km from these transmission lines.

Figure 4.5. Legally Protected Areas and KBAs near the Project

Morne Trois Pitons National Park

The Morne Trois Pitons National Park, a UNESCO World Heritage Site, is located about 500m from the buffer zone of the geothermal power plant and about 1 km from the overhead transmission line. The Park comprises some of the best remaining examples of volcanic island ecosystems in the Caribbean. The park protects active volcanic and geothermal areas, mountains, clear streams, various forms of wild fauna, and various types of tropical forests for conservation, educational, scientific, recreational and scenic purposes. The Park provides habitat for Dominica's two endemic Amazona parrots. Red-necked parrot (*Amazona Arausiaca*, a vulnerable species) and Imperial parrot (*Amazona imperialis*, a critically endangered species). The park also provides a habitat for another endangered bird species, Black-capped Petrel.

Morne Diablotin National Park

Morne Diablotin National Park is a national park in the northern mountain ranges of Dominica. The park is located about 30 km from the project alignment. The park comprises 3,335 hectares and was established in January 2000, primarily to protect the habitat of the critically endangered imperial parrot.

West Coast Shrub Woodland

"West Coast Shrub Woodland' (the area is 12,242 ha) is a KBA, but not a protected area. The presence of a critically endangered frog species known as the mountain chicken frog (*Leptodactylus fallax*) triggered

the KBA criteria. The proposed transmission line alignment does not cross any rivers that habitat these species, and hence, there will be no impact on the species from the project activities.

4.4 Critical Habitat Assessment

This section aims to identify the occurrence of critical habitat features based on the five critical habitat criteria defined in the World Bank ESS6. The assessment is carried out for the following critical species listed in the IBAT and baseline studies. Details of these species and their likely occurrence near the project sites are described in Table 4.1.

Table 4-1: List of Threatened Species Considered for Critical Habitat Assessment

Species English and Scientific Names	Threatened Status	Habitat Requirements	Distribution in the Country	Likelihood of present near the project sites
Red-necked parrot (*Amazona Arausiaca*)	Vulnerable	Forests	The Morne Diablotin National Park, the Morne Trois Pitons National Pa, the Northern Forest Reserve, and the Central Forest Reserve	Present near the project sties. Red-necked parrots are seen close to OHL during both dry and wet seasons. They visit the project sites only for foraging. They generally do not breed and nest outside the national parks and forest reserves.
Imperial Parrot (*Amazona imperialis*)	Critically Endangered	Forests	The Morne Diablotin National Par,the Morne Trois Pitons National Park, the Central Forest Reserve, and the Northern Forest Reserve	Present near the project sties. The Imperial Parrot was not observed during the field survey. However, anecdotal information indicates that the Imperial Parrot utilizes the forest habitat near Laudat to forage. Also, the airspace within the environs of the village of Laudat is used as a migration corridor between the rain forest habitat in the foothills of Morne Watt (Morne Trois Pitons National Park) and habitats in the Central and Northern Forest Reserve.
Black-capped Petrel (*Diablotin Pterodroma hasitata*)	Endangered	Steep forested areas	Based on recent studies and fieldwork conducted in search of nesting Black-capped Petrels on Dominica, it is believed that a small population exists, but specific breeding areas are yet to be located.	Possible to present in the project area, but mainly as a flyway. The Morne Diablotin National Park, the Morne Trois Pitons National Park, and the Northern high mountain Forest Reserve provide suitable nesting sites for the threatened Black-capped Petrel. They fly between both these national parks. Major river valleys along the west coast act as flyways for Black-capped Petrels flying to and from breeding sites on the forested slopes and cliffs of

Species English and Scientific Names	Threatened Status	Habitat Requirements	Distribution in the Country	Likelihood of present near the project sites
				the tallest mountains in the interior of Dominica
Mountain Chicken frog (*Leptodactylus fallax)*	Critically Endangered	Rivers	The major streams along the west and ~~east~~ south coast of the island.	Not present in the project area. The project alignment does not cross any major streams of west coast, and baseline surveys confirm that it is not present in the project area. *Therefore, this species is not a critical habitat feature of concern for this project.*

Critical Habitat Criteria

Critical habitat is defined in the World Bank ESS as the areas with high biodiversity importance or value, including (a) habitat of significant importance to Critically Endangered (CR) or Endangered (EN) species, as listed in the IUCN Red List of threatened species or equivalent national approaches; (b) habitat of significant importance to endemic or restricted-range species; (c) habitat supporting globally or nationally significant concentrations of migratory or congregator species; (d) highly threatened or unique ecosystems; (e) ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described in (a) to (d).

Guidance notes to the ESS6 are available but do not include guidance on methods or thresholds for critical habitat determination. The following approach has therefore been considered for the assessment of critical habitat for the terrestrial conditions applicable to this project:

- Key Biodiversity Areas (KBA), including Important Bird Areas (IBA) and Alliance for Zero Extinction (AZE) sites, provide important indicators of potential critical habitat. Careful consideration is also to be given to legally protected areas, Ramsar wetlands of international importance, UNESCO-recognized world heritage sites, and Government recognized conservation initiatives.
- ESS6 Criterion (a) requires an assessment against both global (IUCN) and national red list ratings. ESS6 critical habitat criterion (a) places emphasis on national red lists, while footnote 13 proposes that national red list ratings should be given priority over IUCN (global) red list ratings.
- Where a significant proportion (>= ±0.5%) of the national or global population of a species has a likely presence within the project area, consideration is to be given for the habitat to have significant importance for the species under ESS6 Criterion (a), (b) or (c).
- By IUCN definition, a CR species faces an extremely high risk of extinction, and its continued survival in the wild is in a critical state. Therefore, evidence of the use of habitats within the project-affected area by a surviving population of a CR species suggests that these habitats have significant importance for the species under ESS6 Criterion (a).

- ESS6 Criterion (b) can be achieved for range-restricted species with evidence or believed to occur within the project-affected area where the full extent of that area overlaps a significant proportion (± 1%) of a species' distribution range.
- There is no specific guidance for the assessment of Criteria (d) and (e), and each situation needs to be assessed on a case-by-case basis.

Criterion (a) - habitat of significant importance to Critically Endangered or Endangered species, as listed in the IUCN Red List of threatened species or equivalent national approaches.

There is evidence of the presence of three threatened bird species near the transmission line alignment. The Red-necked parrot was recorded during the field surveys. The parrot species forage near the project area. These two bird species are at risk of collision with the transmission lines. Mitigation is required to address these impacts and demonstrate net gain as required by ESS6.

Black-capped Petrel has not been recorded during baseline surveys, but the alignment is close to the flight route for Petrels flying to and from Morne Trois Pitons, and research reveals their presence in the area as its flight path will be well above the power lines. The petrel nests in natural crevices or burrows on steep slopes in Morne Trois Pitons and Morne Micotrin. The project will have no direct impact on this bird, and net gain requirements are not applied.

Criterion (b) - habitat of significant importance to endemic or restricted-range species.

Both the parrot species are endemic to Dominica and qualify as critical habitat features for this project. These two bird species are at risk of collision with the transmission lines. Mitigation is required to address these impacts and demonstrate net gain as required by ESS6.

General threats to both parrot species include poaching, among others. Indirect impacts of the project may influence this threat, and mitigation is presented to address potential illegal wildlife trade.

Criterion (c) – habitat supporting globally or nationally significant concentrations of migratory or congregatory species.

There are no globally or nationally significant concentrations of migratory or congregatory species likely to qualify as critical habitat features for this project.

Criterion (d) - highly threatened or unique ecosystems

Habitats in the project-affected area are disturbed for agricultural use, and there is no reason for recognition of unique characteristics.

Criterion (e) - ecological functions or characteristics that are needed to maintain the viability of the biodiversity values described above in (a) to (d).

No specific ecological functions or characteristics have been identified that are essential to maintain the above critical habitat features, and no critical habitat is therefore recognized under this criterion.

4.5 Socioeconomic Environment (Baseline)

Dominica is made up of 10 parishes. DGRMP II will be implemented in Roseau Valley in St. George parish.

4.5.1 Demography

According to the World Bank's Databank, the total population of Dominica was 72,737 in 2022. The male/female ratio is about 50/50. 71% of the population lives in urban areas. About 20% of the population is less than 14 years old, about 70% of that is between 15 and 64 years old, and about 10% of that is above

65 years old. The working-age population is about 28%. The following table provides the demographic trend and overview in the last five years.

Table 4-2: Demography of Dominica

	2018	2019	2020	2021	2022
Total Population	70,823	71,428	71,995	72,412	72,737
Male (% of total population)	50.1	49.9	49.8	49.8	49.7
Female (% of total population)	49.9	50.1	50.2	50.2	50.3
Urban population (% of total population)	70.5	70.8	71.1	71.4	71.7
Population ages 0-14 (% of total population)	20.6	20.4	20.1	19.9	19.6
Population ages 15-64 (% of total population)	70.2	70.5	70.7	70.8	70.8
Population ages 65 and above (% of total population)	9.2	9.2	9.2	9.3	9.5
Working age population	29.4	28.9	28.5	28.0	27.7

In St. George, the population was 20,791 in 2011[1], with about 50/50 male/female ratio. There are 7,377 households. The average household size was 2.8 persons.

4.5.2 Education

Compulsory education is between five to 16 years old in Dominica. Primary education is for seven years, and secondary education is for five years. The school enrolment is high. According to the World Bank, the enrolment was 100% for boys and girls at primary and secondary schools between 2019 and 2021. While the primary completion rate was 100% for boys and girls in 2021, the lower secondary completion was 24%: 14% among boys and 35% among girls. Every village in the Roseau Valley had its own primary school, but pupils must travel to Roseau once they reach secondary school age. This can represent a significant cost for parents, especially for transport.

4.5.3 Economy

According to the World Bank, Dominica's GDP growth was 5.9%, and GDP per capita was US$ 8,414.50 in 2022.[2] The economic growth rate dropped by -9.49% in 2017 as a result of Hurricane Maria. Construction industry growth had a significant role in the recovery to 6.37% in 2018 and 10.23% in 2019. The GDP

[1] Population_and_Housing_Census_2011.pdf (stats.gov.dm)

[2] https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=DM

proportion of this sector climbed to 9.5%. However, the economy suffered because of COVID-19, dropping to -17.55% in 2020.[3]

Agriculture and tourism are two key sectors in Dominica. Tourism accounts for close to 25% of GDP and employment.4 CIA estimates in 2017, services accounted for 65.1% of GDP, agriculture accounted for 22.3%, and industry accounted for 12.6%.5 IMF indicated in 2019, the direct contribution of tourism was 12.2% of GDP. Tourism accounts for about 10.5% of total employment, mainly in hospitality sectors (e.g., hotels and restaurants).[6]

4.5.4 Ethnicity

The great majority of the population is of African descent. English is the official language and is understood by everyone, but due to historical French influence, a French-based Creole language is widely spoken. The majority of Dominicans are Christian. More than 60% of them are Catholic.

The island is also the home of the Caribs, an indigenous group with a population of 3,000. They reside in the northeast of the island, thus, will not be affected by the Project.

4.5.5 Gender

According to the Bureau of Gender Affairs, Dominica had 1,035 reported cases of gender-based violence in 2015. 87% of survivors were women.7

In 2013, women's labor force participation was 59.5%, while men's participation was 70.6%. The 2011 Population and Housing Census indicates the majority of women and men work in the service sector (37% and 30%, respectively). Women's employment is focused on the service sector. 3.4% of women work in agriculture, and 3.3% of them are employed in industry. Substantially more men work in those sectors: 13.6% in agriculture and 12.8% in industry. The unemployment rate for women was 9.9%, which was lower than that for men. The overall unemployment rate was 11.3%.[8]

4.5.6 Governance of Communities

Dominica has municipal and village councils for local governance. There are three municipal councils in Dominica, i.e., the Roseau City Council, the Portsmouth Town Council, the Canefield Urban Council, the Carib Council for indigenous people, and 37 village councils. The council is managed by a chairperson, while a clerk manages the day-to-day administration of the council's affairs. The council has the authority to adopt by-laws that control the operations of its village district. The ability to enforce many of these rules, however, is hampered (as it is for other councils) by the centralization of many services.

---

[3] Eastern Caribbean Central Bank, Annual Economic and Financial Review 2017-2021

[4] https://thedocs.worldbank.org/en/doc/7276af45227db85e778cd1586c68e040-0350082021/original/mpo-dma.pdf

[5] https://www.cia.gov/the-world-factbook/countries/dominica/#economy

[6] https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=0CDgQw7AJahcKEwioq72JuYKAAxUAAAAAHQAAAAQAw&url=https%3A%2F%2Fwww.imf.org%2F-%2Fmedia%2FFiles%2FPublications%2FCR%2F2023%2FEnglish%2F1DMAEA2023002.ashx&psig=AOvVaw1jc_OW4M7AetdzFlECz-zU&ust=1689020299361398&opi=89978449

[7] https://genderaffairs.gov.dm/publications/booklets/file/43-data-on-gender-based-violence

[8] https://www.ilo.org/wcmsp5/groups/public/---americas/---ro-lima/---sro-port_of_spain/documents/publication/wcms_651946.pdf

4.5.7 Cultural Heritage

The complex and ancient history of human occupation of the island has led to numerous influences on current and past architecture in the Roseau Valley. Dominica's rich architectural heritage includes the old market square, St. Patrick's Roman Catholic Cathedral in Roseau, traditional arts and crafts, festivals, and cultural events. These sites are located about 2 km from the proposed project activities. The cultural heritage sites near the project sites are natural landscapes with aesthetic and tourism significance, including Trafalgar Falls (located about 250 m away from the nearest 33 kV UGC line), the hot springs of Wotten Waven (about 1 km from 33 kV UGC line), and the Morne Trois Pitons National Park, a UNESCO World Heritage Site (about 1.5 km from the nearest 69 kV overhead line).

The Waitukubuli National Trail is the only large-scale marked trail in the East Caribbean and is an important attraction for Dominica's image as the 'Nature Isle'. The Waitukubuli National Trail was officially declared as an eco-tourism site on May 10, 2013, in accordance with the GoCD Statutory Rules and Orders No. 7 of 2013 National Parks and Protected Areas Regulations. Many tourists visit Dominica to experience the rugged and untouched side of the Caribbean. The trail provides a relatively accessible marked route through the island's entire length.

4.5.8 Transportation

The area observed is characterized by a variety of terrain types ranging from flat areas to steep and mountainous areas with jutting rock formations of which the topography makes driving conditions dangerous. The Roseau Valley area is served by a dual carriageway which begins at Valley Road and provides a link for traffic between Roseau and Roseau Valley.

Cruise Ships

Cruise ships are a regular occurrence in Roseau during the cruise seasons (November to March), and occasionally, there can be as many as two or three in the port in a single day. They can range in size from a small ship with 100-200 passengers to a 'Royal' class cruise ship with over 4,000 passengers. Many cruise ships that stop for the day in the cruise terminal in Roseau allow visitors to visit the Trafalgar Falls and other tourist sites in the Roseau Valley due to the proximity to the port. The passengers from cruise ships add to the road network as they tend to travel by either buses or private taxis.

Public Transport Network

The public transport network serving Roseau is largely unstructured and demand-driven. A relatively high volume of buses on the network serves all communities. The buses are privately owned, and rates are fixed by the National Transport Board. Some buses double as taxis for tourists after receiving training and certification. While not all of these buses are likely to be public – some are most likely from the cruise ship passengers being shuttled to tourist sites. Anecdotally, the public transport services in Roseau run regularly and are popular with the locals.

5 Potential Environmental and Social Impacts and Risks and Their Mitigation

5.1 Impact Assessment Methodology

Potential environmental and social impacts and risks were identified on the basis of a review of ESIAs of the geothermal power plant (DGPP) and well construction (DGRMP) projects, feasibility study reports, field visits, stakeholder consultations, and experiences from the construction of similar projects. The significance of potential impacts was assessed using the criteria and methodology given in the ESIAs of the DGPP and DGRMP.

Impact Magnitude

The potential impacts of the project have been categorized as major, moderate, minor or minimal based on consideration of the parameters such as: i) duration of the impact; ii) the spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of the potential impacts of the project has generally been identified according to the categories outlined in **Table 5.1**.

Table 5.1: Parameters for Determining Magnitude

Category	Description
Major/Large	Fundamental change to the specific conditions assessed resulting in long-term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline; would violate national standards or Good International Industry Practice (GIIP) without mitigation
Moderate/Medium	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change.
Minor/Small	Detectable but small change to the specific conditions assessed.
Negligible	No perceptible change to the specific conditions assessed.

Sensitivity of Receptor

Sensitivity is specific to each aspect and the environmental resource or population affected, with criteria developed from baseline information. Using the baseline information, the sensitivity of the receptor is determined by factoring in proximity, number exposed, vulnerability and the presence of receptors on site or in the surrounding area. Generic criteria for determining the sensitivity of receptors are outlined in Table 5.2 below. Each detailed assessment will define sensitivity in relation to its environmental or social aspect.

Table 5.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
High	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes

Sensitivity Determination	Definition
Medium	Receptor with little capacity to absorb proposed changes
Low	Receptor with some capacity to absorb proposed changes
Negligible	Receptor with good capacity to absorb proposed changes

Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor have been determined and the significance of each potential impact was established using the impact significance matrix shown in **Table 5.3**.

Table 5.3: Criteria for Determining Significance of Impacts

		Magnitude of Impact			
		Major/Large	Moderate/Medium	Minor/Small	Negligible
Sensitivity/Vulnerability of Receptor	High	Major	Major	Moderate	Negligible
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

5.2 Summary of Assessed Impacts

The project's potential impacts and their significance have been assessed using the methodology described in Section 5.2 above. A summary of these impacts and their significance are presented in **Table 5.4,** along with the key mitigation measures. A detailed assessment of impacts and proposed mitigation measures are given in the subsequent sections.

Table 5.4: Potential Impacts and Their Significance

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
A	**ESS 1 Related Impacts and Risks**					
1	As per the World Bank's Environmental and Social Risk Classification, the Project risk is categorised as 'Substantial'.	Medium	Moderate	Moderate	Implementation of the ESCP, ESMP, ARAP, LMP and SEP to mitigate impacts associated with the Project implementation. DGDC staff will include an Environmental and Social Lead, a Social Specialist, a site Officer for OHS, environmental consultants and a Community Liaison Officer to oversee the overall implementation of the ESCP, ESMP, ARAP, LMP and SEP. The contractor will engage an EHS Specialist, a Biodiversity Specialist, and adequate site OHS supervisors during construction. They will be responsible for the implementation of the ESMP. The owner's Engineer's staff included an EHS Specialist and a Social Risk Management specialist to supervise the ESMP, SEP and LMP implementation.	
B	**ESS 2 Related Impacts and Risks (during Construction)**					
2	Potential labour risks (discrimination in employment and pay) associated with the hiring of project workers (direct workers of DGDC, contracted workers of Contractor and Owner's	High	Minor	Moderate	Implementation of the LMP to mitigate impacts associated with the construction of the Project. Contractors will follow the provisions of Dominican Labor Laws and LMP. No discrimination and equal opportunity	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
	Engineer), including risks of child and forced labour				Equal work, equal pay No hiring of workers less than 18 years of age Contractors will provide the details of the suppliers and relevant licenses. Workers' grievance redress mechanism (GRM). Contractors are obliged to set up GRM to redress work-related grievances among workers.	
3	Occupational safety risks on workers due to hazards associated with constructing transmission lines and substations (working on heights and mountain slopes, use of heavy machinery, hot weather, etc.)	High	Moderate	Major	Contractors will develop an occupational health and safety plan as part of Contractor ESMP, which will be reviewed and approved by DGDC. Contractors will implement the approved plan. Regular training program for workers on occupational health safety (monthly training and daily toolbox talks) Incident investigation and reporting Use of relevant personal protection equipment at all times	
4	Potential health risks due to inadequate housing for the non-local (foreign workers) (about 40 foreign workers are expected to be employed by the Contractors)	High	Minor	Moderate	Contractors shall provide and maintain all necessary accommodation and welfare facilities for the contracted workers at the Site or other places where the Installation Services are carried out. Contractors shall establish a mechanism to collect the complaints from the workers and address those complaints by the workers' GRM.	
5	Working at height along the slope for tower erection	High	Moderate	Major	Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. Use of fall prevention devices, including full body harnesses used in conjunction with shock-absorbing lanyards or self-retracting inertial fall	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
					arrest devices attached to fixed anchor points or horizontal lifelines.	
6	Impacts from labour influx and potential cultural conflicts between communities and workers	High	Minor	Minor	The Contractor's code of conduct shall cover a program to promote awareness among the construction workers on respecting the local community.	
7	Risk of gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH)	Medium	Minor	Minor	Proactive GBV/SEAH prevention measures will be put in place, such as GBV/SEAH-related training to sensitize workers and the local population along the project implementation area. The Project GRM has an uptake mechanism for SEA/SH-related grievances.	
C	**ESS 2 (OHS) Related Impacts and Risks (during O&M)**					
8	Exposure to Electro Magnetic Fields (EMF) from grid station equipment and the power lines (EMFs will affect the health of workers).	High	Negligible	Negligible	WHO and World Bank-endorsed standards on EMF and noise levels will be complied with through design considerations. These include adequate spacing between the equipment and fencing/boundary wall or right of way.	
9	Firefighting and cooling, and stormwater design drainage facilities in the grid stations. The improper design of these facilities poses a risk to workers' health and safety.	High	Minor	Moderate	The Contractor will design air conditioning, ventilation, firefighting and cooling, and stormwater management facilities.	
10	Audible noise will be generated by substation equipment during the operation.	Medium	Minor	Minor	Contractor will design (i) equipment that generates low sound levels, (ii) equipment layout to minimize the acoustic noise and (iii) acoustic barriers (walls or enclosures) wherever necessary to maintain noise levels that comply	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
					with national standards at offices and at the periphery of the station.	
11	Workers' health and safety during maintenance of transmission lines.	High	Moderate	Moderate	Only allowing the trained and certified workers to maintain or repair the electrical equipment. Establishment of work zones to separate workers on foot from traffic and equipment Training of DOMLEC staff on OHS aspects and maintenance of 33 kV and 69 kV lines Implementation of Standard operating procedures (SOPs) of DOMLEC	
12	Workers' health and safety during maintenance at substations	High	Moderate	Moderate	Use of relevant personal protection equipment at all times Availability of firefighting, shelter during hot weather, first-aid and rescue facilities at the site	
D	**ESS 3 Related Impacts and Risks (during Construction)**					
13	Improper sourcing of *tarish* material (volcanic gravel of 800 m^3) for the construction of access roads and aggregates (120 m^3) for concrete works for tower foundations.	Medium	Moderate	Moderate	Use of approved quarries of the Physical Planning Division for procurement of *tarish* and other quarry material.	
14	Excessive use of energy for construction activities	Low	Minor	Minor	Procurement of energy-efficient equipment and fuel-efficient vehicles.	
15	Soil erosion from land clearing and earthwork activities	High	Moderate	Moderate	Divert the stormwater from the cleared areas to a retention area and then to natural drainage. Keep the site free from the stagnation of water. Use of cleared vegetation for erosion control.	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
16	Wastewater discharges from the construction sites	Medium	Moderate	Moderate	Construction of wastewater worksites (e.g., soak pits for drilling mud) and oil-grease separators for vehicle washing drainage)	
17	Risk of soil and water pollution from the construction activities	Medium	Moderate	Moderate	Storage of fuels and chemicals in contained facilities. Provide safety Data Sheets for all fuels used at the site. Availability of spill kits and trained personnel for immediate cleanup of any oil spills	
18	Air and noise pollution from construction activities	High	Moderate	Major	No construction during the night near the residences and sensitive areas. Maintenance of equipment as per manufacturers' standards.	
19	Generation of spoils (excess earth of about 160 m^3) from the construction of towers	High	Minor	Minor	Minimize the generation of the spoils by reusing the excavated material wherever feasible. Stockpiled for future use or revegetated as permanent landscaping.	
20	Generation of construction waste, including solid waste and hazardous waste	Medium	Minor	Minor	Segregation of solid waste into kitchen waste (organics), paper, glass, plastic (recyclable) and inert (non-recyclable). Placement of containers with adequate size and numbers to collect these wastes Transport and handover the above wastes to the landfill site at Roseau	
E	**ESS 3 (Pollution) Related Impacts and Risks (during O&M)**					
21	Greenhouse gas emissions of about 2,500 tCO2e (over a 30-year period)	High	Negligible	Negligible	Net greenhouse gas emissions for overall power generation and evacuation from the	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
	from site clearing, materials life cycle and power leakages				geothermal power plant will be minus 700,000 tCO2e – over a 30-year period.	
22	Oil spills and leaks from the transformers (these spills have the potential to contaminate soil and water resources)	High	Minor	Moderate	Contractor will design oil containment and recuperation systems around all transformers.	
23	Potential leakage of Sulphur-hexafluoride (SF6) gases from switchgears and circuit breakers. SF6 is the most potent greenhouse gas.	Medium	Minor	Minor	Operators of electrical switchgear will take all reasonable measures to prevent emissions, including timely repair. Operators will check every twelve months for leaks.	
F	**ESS 4 Related Impacts and Risks (during Construction)**					
24	Impact on existing public utilities such as drinking water supply pipelines, electrical poles and telephone cables from the construction of UGC	High	Major	Major	Use appropriate tools to locate utilities prior to trenching and avoid impacts on the underground utilities. Maintain a minimum distance of 0.5m from other utilities. Coordinate with relevant utility companies for relocation of these utilities if required.	
24	Impact on traffic from the construction of UGC (about 0.4 km on the highway and 1.6 km in dense urban areas are the busy roads) causing increased traffic congestion and blocking access to side roads (construction of 200 m section requires a week)	High	Moderate	Major	Traffic control measures around the worksites placing traffic cones and using flag personnel to maintain the smooth flow of traffic	
25	Construction of UGC near the hospitals (Dominica-China Friendship Hospital) and two health centers) and schools (a high school, a primary school and a nursery school) will block	High	Moderate	Major	Construction activities near the Princess Margaret Hospital will ensure either the entrance gate or exit gate will always be accessible.	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
	access to these facilities. Businesses on the highway and road to Fond Cole station will also be affected (construction of 200 m section requires a week)				Temporary access over the trenches will be provided to other health centers, schools, residences and businesses affected by the UGC.	
26	Safety hazards due to the construction of trenches and increased traffic on local roads, especially for children, elderly people and tourists.	High	Moderate	Major	Barricade the trenches on both sides with hard fencing (near the settlements, schools and all along urban areas) to prevent the risk of falling into the trenches. Placing adequate signboards and flagmen to divert the community away from the construction works. Engagement with tourist operators during construction. Implement a traffic management plan (e.g., avoiding school hours, following speed limits, hiring experienced drivers, etc.), including awareness-raising and safety measures.	
27	Dust from earthworks and construction vehicular movement and construction equipment	High	Minor	Moderate	Frequent sprinkling as per weather requirements of water on the local roads and worksites to control dust emissions	
28	Exposure to noise from construction works	High	Minor	Moderate	Restrict construction activities during the daytime near the residences. Plan activities in a way that the noisiest activities are undertaken during periods that will result in the least disturbance Avoid school hours for construction activities near schools	
G	**ESS 4 Related Impacts and Risks (during O&M)**					

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
30	Exposure to electric and magnetic fields (EMF) from the overhead transmission lines	Medium	Minor	Minor	The EMF levels for the proposed voltage will be limited due to low voltage levels of 69 kV. However, contractors will evaluate potential exposure to the public against the EMF reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure.	
31	Overhead powerlines are susceptible to natural hazards such as hurricanes	High	Major	Major	The tower structures will be designed for a wind speed of 288 km/hour to withstand Hurricane Category 5 (with wind speeds of 252 km/hour or more) based on the experience of Hurricane Maria (265 km/hour) in 2017	
32	Risk of landslides due to the construction of towers and access roads along mountain slopes.	High	Minor	Moderate	Contractor will design and construction slope protection structures	
33	Community health and safety risks during maintenance and repair	High	Minor	Minor	Access to the site will be restricted to DOMLEC staff and approved Contractor staff. Barricade the work areas (near the settlements) with hard fencing to prevent the entry of the community into the construction areas. Provision of safe corridors for pedestrian movement Placing adequate signboards and flagmen to divert the community away from the work sites.	
34	Visual impacts of overhead transmission lines on the land scale aesthetics	High	Negligible	Negligible	Overhead lines are located away from the settlements on the mountain ridges and withing the tree canopy height, and hence will not obstruct the view of the sea and mountain landscape.	Negligible

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
H	**ESS 5 Related Impacts and Risks**					
34	Acquisition/easement of about 329,430 square ft of land for construction works and transmission line corridor from 25 people.	High	Moderate	Major	PAPs will be compensated for their loss of land, structure, trees/crops, and/or land use restriction by the GoCD. Compensation Payment follows the national procedure (valuation, negotiation, and compensation). ARAP implementation will be monitored by DGDC.	
35	Impact on the vulnerable (8 PAPs have low income).	High	Minor	Minor	Implementation of ARAP	
I	**ESS 6 Related Impacts and Risks (during Construction)**					
36	Clearance of 2.94 ha of land (0.27 ha for trenching, 0.44 ha for pole structures, 0.56 for span/ROW and 1.67 ha for access roads) for construction activities will require removal of vegetation (modified habitats)	Medium	Major	Major	Although no natural habitat is lost from the proposed transmission line, DGDC will restore 2.7 ha to compensate for the loss of natural habitat under the DGPP by restoring the degraded forest areas with the support of the Forest and Wildlife Division. Implement the biodiversity management plan (BMP) in the ESMP to address impacts on flora and fauna. Vegetation removal management include-on site decomposition, burning, or be recycled as fire wood or building material where possible. Provide wood to the community for use as fences or for charcoal production. This is acceptable according to Dominican law.	
37	Mortality and Injury to fauna due vegetation clearing and habitat loss	High	Minor	Moderate	Conduct pre-construction field screening to repel, rescue and relocate fauna from the construction sites.	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
					Vegetation in the disturbed areas will be regenerated rapidly. Code of conduct for workers and employees' protection of flora and fauna and a ban on hunting and unnecessary tree cutting. Any violation of the code of conduct leads to strict punishment, including termination.	
38	Spread of Invasive Alien Species in the forests located close to the work sites	Medium	Moderate	Moderate	Using the designated roads for the construction vehicles Construction vehicles will be brought to the site in an as-clean-as-new condition to ensure that invasive plant material and seed-bearing soil are not introduced.	
39	Illegal wildlife trade	High	Negligible	Negligible	All bidding documents and construction contracts are to include specific provisions forbidding hunting or collecting natural resources by workers.	
J	**ESS 6 (Biodiversity) Related Impacts and Risks (during O&M)**					
40	Risk of bird collision from the transmission line (red-necked parrots are recorded along the 4.8 km overhead transmission line alignment. They visit the areas mainly for foraging)	High	Moderate	Major	The risk of bird collision is minimized by adopting underground cables in the initial section near the geothermal plant. The OHT line is only 4.8 km long and is located about 1.5 km from the Morne Trois Pitons National Park at its closest point. Installation of Wire-marking devices increases the line profile and visibility along the overhead transmission lines to minimize bird collisions. They have a reflective and fluorescent plate, illuminating in low light.	

#	The impact of various activities	Sensitivity	Magnitude	Significance Before Mitigation	Key Mitigation Measures	
					Installation of bird strike indicator, an automated vibration-sensing and recording tool designed to detect bird strikes on power lines.	
41	Impacts from tree cutting during maintenance activities under the overhead transmission line corridor	High	Moderate	Major	Conduct pre-construction field screening to repel, rescue and relocate fauna from the construction sites.	
K	**ESS 8 (Cultural heritage) Related Impacts and Risks (during O&M)**					
42	Impacts on cultural heritage and chance finds during construction	High	Negligible	Negligible	Adoption of Chance Find Procedures. Upon discovery of a physical artefact work will be stopped, and the site will be fenced and reported to the Ministry of Youth, Sports, Culture and Constituency Empowerment, followed by the Dominica Museum in Roseau. Neither the DGDC nor the Contractor will disturb any chance finds further until a competent specialist (Cultural Heritage Specialist) appointed by the Ministry of Youth, Sports, Culture and Constituency completes the investigation.	

5.3 ESS 2 (Labour and Working Conditions) Related Impacts and Risks

5.3.1 Potential labour risks

The Project would require a small labor force for civil work. For the construction of underground transmission lines, around 10-12 contracted workers would be required per 300m segment, including a few skilled workers (likely regional or international). The Contractor would work on 4-5 segments at a time. Similarly, around 10-12 workers would be anticipated per pole structure site for the construction of the overhead transmission line network. The Contractor for substations will also engage a small workforce of 10 to 15 people to install the equipment in the existing substations. The estimated number of contracted workers will be 100, of which 40 will be foreign (international and regional workers), and the remaining will be local. A construction camp is not expected to be established by the contractor as there is a lot of rented accommodation available in the country due to its tourism potential. The foreign workers will be accommodated in rented houses or hotels (as currently practiced for the well-drilling Contractor under DGRMP). There are potential labour risks, such as discrimination in employment and pay, associated with the hiring of project workers (i.e., direct workers of DGDC and contracted workers of civil work Contractors and Owner's Engineer).

Mitigation

The following mitigation measures will be implemented:

- An LMP has been prepared with measures to address potential labour risks. Implementation of the LMP to mitigate impacts associated with the construction of the Project.
- Contractors will apply the following guidelines when dealing with workers:
    - There will be no discrimination with respect to any aspects of the employment relationship, such as Recruitment and hiring; compensation (including wages and benefits; working conditions and terms of employment; access to training; job assignment; promotion; termination of employment or retirement; or disciplinary practices.
    - Harassment, intimidation and/or exploitation will be prevented or addressed appropriately.
    - Special measures of protection and assistance to remedy discrimination or selection for a particular job will not be deemed as discrimination.
    - Vulnerable project workers will be provided with special protection.
- Contractors will provide job/employment contracts with clear terms and conditions, including rights related to hours of work, wages, overtime, compensation and benefits, annual holiday and sick leave, maternity leave and family leave. The code of Conduct included in this LMP will be applicable to all project workers.
- Contractors will ensure compliance with the Code of Conduct, including providing briefings/awareness raising on the Code.
- Contractors will ensure compliance with occupational health and safety procedures and COVID-19 specific procedures (see ESMP), including that the workers are properly trained in the application of the standards that are relevant to the work.
- Contractors and retained contractors will ensure no person under the age of 18 shall be employed. Age verification of all workers will be conducted by the contractors.
- Workers shall be recruited voluntarily, and no worker is forced or coerced into work.
- All workers will be made aware of the Worker's Grievance Mechanism (see below) to raise work-related grievances, including any sensitive and serious grievances on SEA/SH.

5.3.2 Occupational Safety Risks in Construction

The potential Occupational health and safety risks (OHS) associated with the construction of overhead transmission lines include, among others, exposure to physical hazards from the use of heavy equipment and cranes; hot weather; working on steep slopes in mountainous terrain, trip and fall hazards; exposure to dust and noise; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery.

The potential OHS risks associated with the construction of underground transmission lines include working in trenches and confined spaces; risk of collapse of trenches; exposure to live traffic near the construction sites, exposure to physical hazards from the use of heavy equipment and cranes; hot weather; exposure to dust and noise; falling objects and exposure to electrical hazards from the use of tools and machinery. The potential OHS risks during the O&M stage include exposure to live power lines, electric and magnetic fields, and working at height.

Mitigation

The following mitigation measures will be implemented by the contractors:

- The contractor will be required to prepare, obtain approval for, and implement an occupational health and safety (OHS) plan from the DGDC. These plans will be prepared in compliance with the World Bank Group's EHSGs and national regulations. If these guidelines cannot address any specific aspect of OHS, international good practices such as OSHA and ILO will be applied. OHS Plan should contain general guidance for all identified hazards under each work activity, and site-specific OHS hazards and risks during construction, and control and preventive Measures proposed by the Contractor. The Plan shall be reviewed and updated if there are any changes in the construction methodologies.
- OHS Plan should contain general guidance for all identified hazards under each work activity, and they should be presented in three discrete headings, (a) Contractor's Standards on the identified hazard management, (b) Expected Site-specific OHS hazard and risks during construction, and (c) Control and Preventive Measures proposed by the Contractor.
- The OHS plan will be reviewed and approved by the Owner's Engineer and the World Bank.
- Conduct a 'job hazard analysis' at the new construction site to identify potential hazards that may arise from the proposed works or working conditions for the project workers and implement necessary control measures. The job hazard analysis should be part of the contractor's method statements, which will be reviewed and approved by the Owner's Engineer. The specialists of the Owner's Engineer will also visit the construction sites prior to the start of construction to ensure the control measures are in place.
- Regular site inspections and safety audits by the Owner's Engineer team, both by the OHS specialist and the site engineers. Since the site engineers will be present at the worksites all the time, they will be trained by their OHS team on monitoring the safety aspects of the construction works.
- Regular training program for workers on occupational health safety (monthly training and daily toolbox talks), code of conduct, and emergency response plan. Special attention will be focused on safety training for workers to prevent and restrict accidents and on the knowledge of how to deal with emergencies.
- Incident investigation and reporting, including a complete record of accidents and near misses, will be maintained.
- In order to protect all project personnel and visitors, the Contractor will provide personal protective equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, body

harness, protective clothing, goggles, full face eye shields and ear protection. The contractor will also provide training to workers on how to use them and maintain them in a sanitary and reliable condition and replace the damaged ones immediately with new ones.

- Adequate water supply and mobile toilets, medical and first aid care facilities at the worksites
- Contractors will have dedicated and qualified OHS inspector/supervisor at each work site to ensure compliance with the OHS Plan.
- Awareness-raising material will be used, including posters, signage, booklets, and others at the worksites.
- A complete record of accidents and near misses will be maintained.
- More detailed mitigation measures to address potential OHS risks associated with the various activities of transmission line construction are detailed in ESMP. They include measures to address risks when working with live wires, working at heights, confined spaces, and moving equipment.

With the above mitigation measures, the residual impacts have been assessed as negligible.

5.3.3 Potential Health Risks to Workers in Construction

About 40 foreign workers are expected to be employed by the Contractors. Potential health issues for these workers are associated with the use of inadequate housing including those relating to sanitation, drinking water, fire, quality and quantity of food, temperature control and recreation, amongst others.

Mitigation

The following mitigation measures will be implemented by the contractors

- Contractors shall engage local workers to the maximum extent feasible
- Contractor shall provide and maintain all necessary accommodations with all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, recreation, first aid, and firefighting).
- Contractors shall establish a mechanism to collect the complaints from the workers and address those complaints by the workers' GRM.

With the above mitigation measures, the residual impacts have been assessed as negligible.

5.3.4 Impacts from Labour Influx

For the proposed project activities, the average labour requirement per day is 100. Unskilled workers will be hired locally; however, the skilled works will be brought by the contractor from abroad. It is estimated that about 40 foreign skilled workers work on this project. The regional/international workers would be accommodated in rented houses or hotels, as currently practiced for the well-drilling Contractor under DGRMP. The potential risks associated with labour influx are social tension arising between the local community and the construction workers, which may be related to differences due to competition for local resources, an increase the rate of crimes and/or perception of insecurity by the local community, increased burden on and competition for public service provision, and influx of people may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), infectious diseases such as COVID19, or the incoming workers may be exposed to diseases to which they have low resistance. The presence of workers in local communities can also result in intimate relations as well as sexual exploitation and abuse, and sexual harassment. Dominica is a tourist-destination for many foreigners and many foreign travellers visit Dominica every year. Hence, the risks associated with the influx of foreign workers are expected to be minor.

Mitigation

The following mitigation measures will be implemented:

- This situation will be addressed by an awareness campaign implemented at the beginning of the construction phase. The Contractors will be aware of the possibility and risks of miscommunications between local residents and workers, which could easily lead to conflicts. This will be prevented by raising awareness and implementing a Code of Conduct for the workers. The Contractor shall develop a Worker Code of Conduct to govern the behavior of workers on-site and in local communities.
- The contractor's code of conduct shall cover the program to promote awareness among the construction workers on respecting the local community.
- The awareness campaign will also be aimed at the risk of interaction between the resident population and the construction workforce, including the spreading of sexually transmitted diseases such as HIV/AIDS.
- The contractor will ensure local water usage will not be affected by the project water usage by the project or compete with the water requirements of the local community.
- The Contractor's monthly training program will cover topics related to respectful attitude while interacting with the local community.
- COVID-19 protocol measures, specified in the national and WHO guidelines, will be complied with, and these measures are specified in detail in ESMP.

With the above mitigation measures, the residual impacts have been assessed as negligible.

5.3.5 Risk of Gender-Based Violence

The interaction between the Project construction labor force and the communities, and especially on the women workers, may lead to Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH). The GBV risks in the project are expected to be minor due to limited labour influx.

SEA/SH Action Plan

Commensurate with this risk level and also to be proactive, the Project has proposed several proactive measures. The following SEA/SH Action Plan will be implemented and will include the following measures:

- Inclusion of clause on GBV/SEA/SH behavior obligations in the employment contracts of all employees and construction workers aimed at strengthening measures to address and prevent SEA/SH in the workplace and construction areas.
- Awareness training of DGDC, Engineer, contractors and sub-contractors staff to sensitize them about SEA, and SH, and their responsibilities to prevent
- Posting of Code of Conduct standards in the village community centres
- Raising awareness that SEA/SH is prohibited
- Awareness to explain suspicious situations and the signs of SEA/SH;
- Provide information on the use of GRM to report cases of SEA/SH and Code of Conduct breaches and assist victims of SEA, if signs of SEA are identified/or a victim approaches them to complain about SEA;
- Awareness to communities, particularly women, and male and female children, to understand the risks of SEA and SH and the roles and responsibilities of parties involved in project implementation on SEA and SH prevention, processes for reporting incidents of project-related SEA/SH, and the corresponding accountability structures.
- Strengthen the Contractors' obligations and capacity to public health and safety risks and ensure contractor supervision capacity to monitor the mitigation of these risks.
- Proactive GBV/SEA prevention measures will be put in place, such as GBV/SEA related training to sensitize workers and local population along the project implementation area and ensuring that

GRM for the project will also take care of GBV related issues if any. The Project GRM has an uptake mechanism for SEA/SH related grievances.

- There will be adequate mechanisms in place to protect the local vulnerable population, especially women and minors, from risks associated with the influx of workers (harassment, underage sex). This mechanism will ensure the sensitization and enforcement of the code of conduct by the Contractor employees and workers and all other parties that are involved in the project implementation.
- Additionally, the Contractor will employ their skilled staff and apply unskilled construction labor from the local population as far as possible to minimize an influx of outsiders into the communities.

5.3.6 Exposure of Workers to Electro Magnetic Fields

Transmission lines and grid station equipment generate electrical and magnetic fields (EMF), which are considered to be health hazards, although it was not scientifically proven. The exposure limits for EMF fields developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) - a non-governmental organization formally recognized by WHO[9], are given in Table 5.5. Electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines.

Table 5.5: Standards for EMF Exposure

	Electric Field (kV/m)	Magnetic Field (μT)
Public Exposure	5	200
Occupational Exposure	10	1000

Mitigation

- Exposure to EMF levels will be assessed during the design stage by the Contractor. WHO and World Bank-endorsed standards on EMF levels will be complied with through design considerations. These include adequate spacing between the equipment and fencing/boundary wall or right of way.
- Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities;
- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE). Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.

[9] EMF Fields, WHO Webpage http://www.who.int/peh-emf/standards/en/

5.3.7 Audible Noise from Transmission Lines

Audible Noise from the Transmission Line occurs primarily in foul weather. In Dry Weather conditions, the conductor usually operates below corona inception level and generates few corona sources for audible noise. However, in wet conditions, water drops impinging or collecting on the conductor produce a large number of corona discharges, thereby creating bursts of noise. Therefore, the audible noise increases to such an extent that sometimes it represents one of the limitations of the design of transmission line conductors. The auditable noise levels from the 69 kV lines are expected to be minor.

Mitigation

Contractor will design (i) equipment that generates low sound levels, (ii) equipment layout to minimize the acoustic noise and (iii) acoustic barriers (walls or enclosures) wherever necessary to maintain noise levels that comply with national standards at offices and at the periphery of the station.

5.3.8 Workers' Health and Safety during O&M

Workers may be exposed to occupational hazards from contact with live power lines during maintenance and operation activities. They are also exposed to occupational hazards when working at elevation and live wires and exposure to electric and magnetic fields and to fuels during maintenance and operation activities. Additional risks associated with the substations are the risk of fires.

Mitigation

The following mitigation measures will be implemented

- The substation facilities are designed with air conditioning, ventilation, firefighting and cooling, and stormwater management facilities.
- Conduct a job hazard analysis to identify the hazard risks. Only qualified people use proper test equipment and personal protective equipment.
- Establishment of work zones to separate workers on foot from traffic and equipment
- Training of DOMLEC staff on OHS aspects and maintenance of 33 kV and 69 kV lines
- Implementation of Standard operating procedures (SOPs) of DOMLEC
- Component 2 of the DGRM will include capacity building of the DOMLEC in the management of 33 kV and 66 kV lines. These will include the development of standard operating practices on OHS while maintaining these lines.
- Additional measures to address risks associated with working with the live power lines and working at height are given in ESMP.

5.3.9 Fire and Explosions

Fires and or explosions in substations resulting from the ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers.

Mitigation Measures

Storing flammables away from ignition sources and oxidizing materials. Further, the flammables storage area should be:

- Remote from entry and exit points into buildings
- Away from facility ventilation intakes or vents
- Have natural or passive floor and ceiling level ventilation and explosion venting
- Use spark-proof fixtures

- Be equipped with fire extinguishing devices and self-closing doors and constructed of materials made to withstand flame impingement for a moderate period of time.
- Providing bonding and grounding of, and between, containers and additional mechanical floor-level ventilation if materials are being, or could be, dispensed in the storage area
- Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems
- Defining and labelling fire hazards areas to warn of special rules (e.g. prohibition in the use of smoking materials, cellular phones, or other potential spark-generating equipment)
- Providing specific worker training in handling flammable materials and in fire prevention or suppression

5.4 ESS 3 (Resource Efficiency and Pollution Prevention) – Related Impacts and Mitigation Measures

5.4.1 Impacts from Quarry and Borrow Activities

Quarry material will be required for construction activities such as access roads and tower foundations. Access roads will be earther roads formed with locally available *tarish* material (volcanic gravel) (about 120 m^3). Aggregates (about 120 m^3) will be required for tower foundations. Improper sourcing of these construction materials will have significant impacts on the physical and biological environment of the quarry and quarry sites.

Mitigation Measures

The following mitigation measures will be implemented:

- The Contractor will use approved quarries of the Physical Planning Division for procurement of tarish and other quarry materials.
- The list of approved quarries is available at the following website https://www.physicalplanning.gov.dm/applications/planning-approved/approved-quarries
- Contractor will submit the details of quarries for the approval of DGDC prior to procurement. DGDC's environmental specialist will carry out due diligence on these facilities to ensure they are operated with the requirement of environmental compliance with the permits and good practices.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.4.2 Soil Erosion

The clearing of the land for the access roads, trenches and tower foundations will result in the erosion of soil. The exposed soil surface is prone to sedimentation from stormwater runoff.

Mitigation Measures

The contractor will implement the following measures

- Strip the topsoil, store and respread it after completion of works
- Disturbance area will be minimized and clearly demarcated.
- Works will only be conducted within the works zone.
- Vehicle movements will be restricted to the defined roads/tracks.
- Where possible, the works area will be designed to ensure stormwater runoff drains into the site.

- Where required, sediment controls will be put in place. These will include, but not be limited to, sediment ditches, sediment ponds, sediment fences and silt socks. Silt curtains, fibrous mats etc., will be placed across as temporary stormwater drains to reduce the efflux velocity of the water and to aid in settling suspended sediment from the water.
- Deposit surplus material in previously approved areas or reuse it as fill material.
- Stabilization and progressive reforestation of affected areas with plants and vegetation native to the island.

5.4.3 Wastewater Discharges from Construction Sites

The potential sources of wastewater generation in the construction sites are construction yards and sites where directional drilling is used. The wastewater discharges from the directional drilling contain high sediment loads. These discharges will impact the soil and groundwater quality and aquatic environment if they are discharged into natural drains and streams without any prior treatment.

Mitigation

The following mitigation measures will be implemented:

- Soak pits, or Sedimentation ponds of adequate size and capacity, will be built for the treatment of drilling liquids to allow the sediments to settle. Final discharges from the sedimentation ponds shall comply with World Bank EHSG standards for wastewater standards. The settled sediments will be periodically removed and will be disposed of at the designated spoil disposal sites.
- Contractor will provide oil-water separates at the discharges of the vehicle washing drainages.
- The contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the water.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.4.4 Risk of Soil and water pollution from Construction Works

During construction, there is a high risk of accidental spills and leakages from fuel and oil tanks, vehicles, machinery and stored chemicals that are used in construction areas, yards, and storage sites. Earthworks for site clearance and foundation during rainy periods may carry the sediment load to the nearby water bodies. Other potential sources of soil and surface water and groundwater pollution are improper storage and handling of materials, including hazardous materials, discharges from construction sites and material storages, lack of proper drainage facilities, spillage of fuels, erosion from material stockpiles, etc.

Mitigation

The following mitigation measures will be carried out by the contractor to minimize soil and water pollution.

- Store project-related materials or waste in the officially agreed and designated sites.
- Storage of fuels and chemicals in contained facilities and taking appropriate measures to avoid and contain any spillage
- Confine the contaminants immediately after such accidental spillage and clean up oil spills using spill kits.
- Collect contaminated soils, treat and dispose of them as a hazardous waste
- Topsoil from cultivated lands in the construction areas is to be stripped and stockpiled where practical for later use for restoration of spoil disposal sites.

- Temporary stockpiles to be protected from erosion.
- Contractor will develop a pollution prevention and emergency response plan as part of C-ESMP and submit it for DGDC approval. The plan will detail procedures to minimize and address the risk of soil and water pollution.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.4.5 Air and Noise Pollution from Construction

During construction, air and noise emissions from the construction activities will cause temporary nuisances to the residents along the project alignment. The UGC line passes through Roseau Valley Road, and hence, many residences and businesses are located adjacent to the UGC and will be subjected to air and noise pollution from construction activities. Major sources of air and noise pollution are earthworks and emissions from construction-related traffic and equipment. The construction activities will also generate airborne dust and particulate matter. The dust raised from the above activities will have impacts on crops, animals and public health.

Mitigation

The following mitigation measures will be implemented;

- Construction equipment and vehicles will be well maintained so that emissions are minimal and comply with applicable emission standards.
- Dust generation from construction sites would be restricted as much as possible, and water sprinkling would be carried out throughout the construction period.
- Construction activities near the settlements will be limited to daytime only.
- High noise-producing equipment will be provided with mufflers or acoustic enclosures.
- A GRM is in place to receive complaints from the public on various aspects of environmental issues, including noise pollution. These grievances will be addressed by the contractor by adopting the necessary measures.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.4.6 Generation of spoils

Excavations for earthworks for access roads, trenches and tower foundations will generate excess earth material (about 160 m^3). Most of these earth material can be reused for construction if it meets the quality standards needed for the work.

Mitigation

The contractor will implement the following mitigation measures to minimize the generation of spoils:

- Minimize the generation of spoils by reusing it for refilling the trenches
- recycling the excavated material for access roads to the maximum extent possible by using them as the aggregate material in the base subbase, concrete works, and filling of trenches
- Stockpiled for future use at designated and approved sites or revegetated as permanent landscaping.
- If spoil disposal is needed, it will be disposed of in the approved sites.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.4.7 Generation of Waste

Solid waste will be generated from the work sites and offices, which includes food waste, paper and plastic, and garbage. As the workers live in rented houses, no organic waste is expected to be generated at the construction sites. The construction works generate large quantities of excess materials from construction sites (concrete, discarded material, etc.) and wastes from construction yards, including other debris. In addition, small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti-freeze; contaminated soil; spillage control materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, spent filters, contaminated soil, etc.). It is imperative that such waste is responsibly disposed of to avoid adverse environmental and human health impacts.

Mitigation

The following mitigation measures will be implemented by the contractor:

- Before commencing the construction activities, the contractor will be required to prepare a Waste Management Plan and submit it to the DGDC for their review and approval.
- Collection and segregation of solid waste into kitchen waste (organics), paper and plastic (recyclable) and garbage (non-recyclable). Three kinds of waste bins (with different colors) with adequate numbers and capacities will be placed for the segregation of the waste at source.
- The contractor will place containers of adequate size and numbers in place for the collection of various types of wastes (metal, rubbers, used fuels, batteries, etc.) from the worksites, and transport these wastes regularly to a centralized facility.
- The contractor will return the empty containers to the suppliers.
- Handling chemicals properly. Storage of chemicals 100 meters away from any water sources.
- Transport and hand over the above wastes to the landfill site at Roseau by paying requisite fees to the Solid Waste Management Corporation that maintains the landfill site.
- No disposal sites, permanent or temporary, will be established by the contractor.
- Additional measures are detailed in the ESMP.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.4.8 Greenhouse gas emissions

Greenhouse gas (GHG) emissions from the implementation of the Project are estimated using the World Bank " Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, Version 2.0 January 2013 (hereinafter "Guidance Note") and IPCC 2006 guidelines. Three sources of emissions are considered for accounting for GHG from the Project.

Direct generation emissions associated with losses

Impacts relevant to this source result from technical loss reductions in the transmission line facilities being supported by the project. Losses can be reduced by upgrading overloaded or not properly sized transformers, increasing conductor capacity, installing reactive power equipment, and undertaking other types of maintenance interventions. The losses in the transmission lines are generally estimated at 2%. The direct generation emissions associated with these losses (emission factor 0.6545 tCO2/MWh) are estimated to be about 25,000 tCO2e.

Emissions from Land Clearing for Civil Works

Construction of towers, transmission line ROW, and some other project facilities, such as access roads, require land clearing. The total land to be cleared for ROW is 0.08 km^2. The clearing may affect the carbon

stored in biomass and soil. Emissions from land clearing can be calculated as a one-time emission of CO2 based on the available dry biomass carbon for the total cleared areas for construction. According to IPCC guidelines, a Temperate climate has 100 tons/ha of dry biomass, of which average carbon content is taken as 70 percent. Total land clearing emissions for 0.08 km^2 are 250 tCO2.

Sulfur hexafluoride fugitive emissions

SF6 is used in insulation and current interruption applications in transmission and distribution systems. SF6 is used in gas-insulated switchgear and substations, gas circuit breakers, and (less frequently) in high-voltage, gas-insulated lines. SF6 may escape as fugitive emissions during the manufacturing, installation, use, maintenance, and disposal of this equipment. Sealed distribution equipment may not emit any SF6 during use, but transmission equipment often requires periodic refilling and hence has higher rates of fugitive emissions during use. The amount of SF6 emitted during operation and decommissioning is related to the number and type of equipment used, as well as the maintenance and recycling procedures. SF6 emissions could occur in all transmission and distribution projects, depending on the type of equipment installed, refurbished, or maintained. Countries report SF6 emissions from the power sector in their national emissions inventories, and emissions factors from these inventories provide one way to estimate their magnitude (the emission factor considered is 0.119 gSF6/MWh). Circuit breakers containing SF6 will be used in the grid station, and the S6 emissions are estimated to be SF6 emissions are estimated as 5,500 tCO2e.

Total Emissions from Project

Embodied emissions and construction emissions have not been calculated since the information will be known only at the construction stage. The total Project emissions from the above three sources are estimated to be 2500 tCO2e.

Net Emissions

The geothermal power plant will produce about 65 GWh annually, and net GHG emissions from this renewable energy are estimated as minus 700,000 tCO2e. Considering the associated facility of the project as a renewable geothermal project, the net emissions from the proposed transmission lines will be negative.

5.4.9 Risk of Oil Spills and Leaks from Transformers

Fuels, oils and lubricants will be used in transformers. There will be a risk of leakages from these equipment and spillages during storage and handling. These leaks and spills will contaminate soil and water resources in the subproject area.

Mitigation

Contractor will design oil containment and recuperation systems around all transformers and oil-filled reactors. The storage facilities for oils will be designed in the bunded areas and will be covered on the top to avoid direct expose to sunlight and rain.

5.4.10 Potential leakage of Sulphur-hexafluoride

Potential leakage of Sulphur-hexafluoride (SF6) gases from switchgears and circuit breakers. SF6 is the most potent greenhouse gas.

Mitigation

Operators of electrical switchgear will take all reasonable measures to prevent emissions, including timely repair. Operators will check every twelve months for leaks.

5.5 ESS 4 (Community Health and Safety) – Related Impacts and Mitigation Measures

5.5.1 Impact on Public Utilities

The proposed underground cabling works may impact the existing public utilities such as drinking water supply pipelines, electrical poles, power lines and telephone lines, and access roads to some streets. The impact is significant in the urban areas of Roseau town due to the limited right of way of the existing roads. If the public utilities are not located prior to construction works, there will be significant impacts on the public services provided to the local communities.

Mitigation

- The DGDC will coordinate with the relevant authorities to identify the location of these utilities and avoid these utilities for trenching activities.
- Use appropriate tools to locate utilities prior to trenching and avoid impacts on the underground utilities.
- Coordinate with relevant utility companies for relocation of these utilities if required.
- A minimum distance of 0.5 m is to be maintained from the existing utilities.

5.5.2 Restriction of Access

Construction of UGC near the hospitals (Dominica-China Friendship Hospital) and two health centers) and schools (a high school, a primary school and a nursery school) will block access to these facilities. Businesses on the highway and road to Fond Cole station will also be affected (construction of a 200 m section requires a week).

Mitigation

- Construction activities near the Princess Margaret Hospital will ensure either the entrance gate or exit gate will always be accessible.
- Temporary access over the trenches will be provided to other health centers, schools, residences and businesses affected by the UGC.

5.5.3 Safety Hazards due to Increased Traffic

The UGC trenching activities will affect the normal traffic on the highway and local traffic and could lead to traffic congestion. The construction activities can potentially impact the residents of settlements along the Roseau Valley Road, particularly the movement and safety of school children and elders. Due to the increased use of trucks and other vehicles on the existing narrow roads (which are two-lane roads) in the project area, pedestrians, particularly elderly people and children, will be more exposed to dangerous situations, leading to traffic accidents. The Roseau Valley Road is also extensively used by tourists during the cruise season to travel to tourist places and hiking. Tourists are also will also be exposed to construction hazards.

Mitigation

- The contractor will develop and implement a traffic management plan with adequate measures such as proposing traffic diversion measures, alternate routes for local traffic, avoiding school hours, following speed limits, hiring licensed drivers, etc.). The plan will be implemented with the aim of ensuring access to residential areas and preventing unsafe situations, especially near schools, housing areas, and construction areas. A sample drawing showing the proposed traffic management activities near the construction sites is in Figure 5.1.

- Barricade the trenches on both sides with hard fencing (near the settlements, schools and all along urban areas) to prevent the risk of falling into the trenches.
- The road should not be stopped for existing traffic. The contractor will maintain the traffic on both sides of the highway by placing appropriate control measures and flagmen.
- Involvement of tour operators in the stakeholder engagement activities during construction
- Road signage will be fixed at appropriate locations to reduce safety hazards associated with project-related vehicular traffic.
- Liaison with traffic police will be maintained
- Project drivers will be trained in defensive driving.
- Ensure that all construction vehicles observe speed limits on the construction sites and on public roads.
- Provide adequate signage, barriers, and flag persons for traffic control.

With the above mitigation measures, the residual impacts have been assessed as minimal.

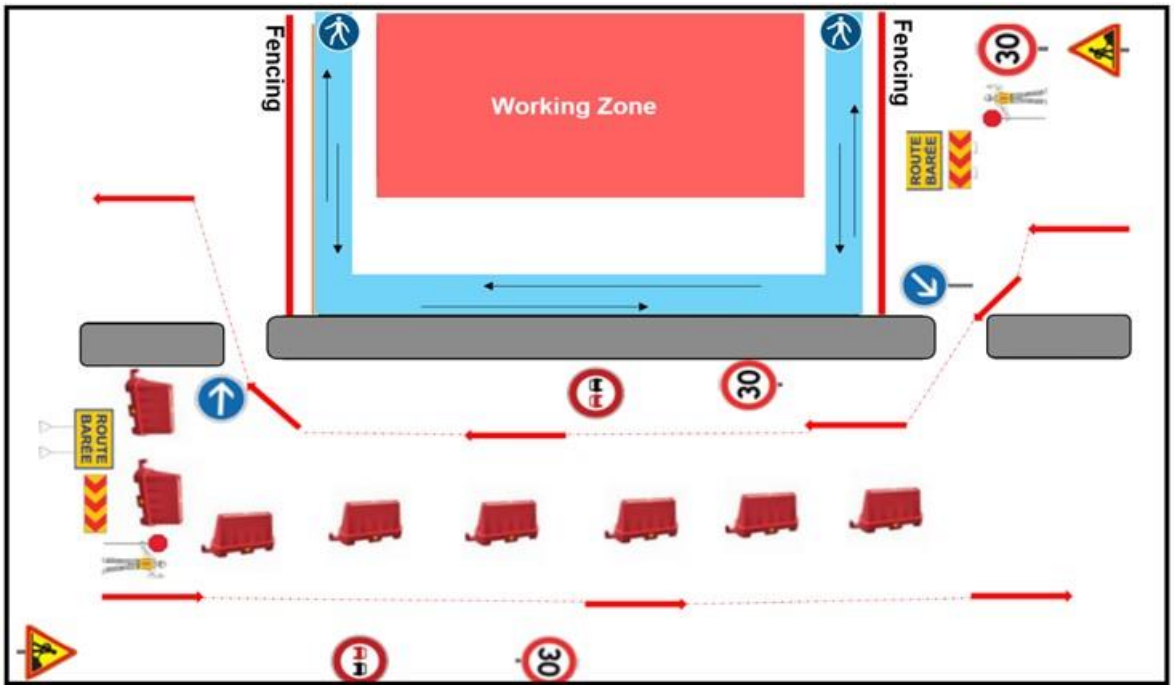


Figure 5.1. Traffic Management at the Construction Sites

5.5.4 Dust from Construction Activities

The construction activities, particularly earthworks, will generate airborne dust and particulate matter. In addition, vehicular movement along the local roads for the transport of quarry material will also generate a lot of road dust. The dust raised from the above activities will have impacts on crops, animals and public health. The generation of dust will be a major issue in the construction.

Mitigation

The following measures will be implemented.

- Dust generation from construction sites will be restricted as much as possible and water sprinkling will be carried out as appropriate, especially at those places where earthmoving, excavation will be carried out.
- Frequent sprinkling of water on the local roads and worksites to control dust emissions. The contractor has to mobilize adequate water sprinkling trucks.
- A GRM is in place to receive and address complaints from the public on various aspects of environmental issues, including dust pollution. Contact information on GRM will be placed around civil work sites.

With the above mitigation measures, the residual impacts have been assessed as minimal.

5.5.5 Employment Opportunities in Construction Activities

About 60 unskilled workers will be employed by the contractors. The project offers good opportunities for local residents to apply for employment as unskilled and skilled construction workers. The contractor will be recommended to employ local workers and technicians to the extent possible. In addition to maintaining good relations with the local communities, maximizing local employment may also be cost-effective since engaging the workforce from other parts of the Country could be costlier. All these new opportunities for work for local residents could boost employment and improve the social and economic position of the population for a short time. This will be a major positive impact on the project.

Mitigation

The contractors will be required to formulate a labour management policy to ensure the equitable availability of employment opportunities to all communities within the project area, particularly the project-affected persons.

The contractor will adopt the following Labor-Management Guidelines while preparing the labour-management policy:

- encourage to engage local workers/laborers with the same terms and conditions as outside workers/laborers;
- integrating provisions to redress labour-related grievances in the Grievance Redress Mechanism (GRM), which should be well known to the laborers/workers and accessible. Workers will be provided with GRM contact information when signing the contract and during toolbox talks;
- prohibition of child labor;
- no engagement of forced and bonded labor;
- provision of a safe and healthy working environment to workers; and
- taking steps to prevent accidents, injury, and disease and appropriate treatment for those suffering from occupational injuries/diseases; and encouraging insurance facilities for workers.

5.5.6 Community Health and safety during O&M

The potential risks to the community during routine maintenance works will be, among others, dust, noise, and traffic nuisance from the excavation of trenches to repair the UGC lines, construction vehicles and movement. Potential community health and safety issues associated with road projects may also include pedestrian safety and traffic safety. Pedestrians and bicyclists are at the greatest risk of serious injury from collisions with moving vehicles and the risk of falling into trenches. The visual impacts from the overhead transmission lines and towers will be negligible as overhead lines are located away from the settlements on the mountain ridges and withing the tree canopy height, and hence will not obstruct the view of the sea and mountain landscape.

Mitigation

The following mitigation measures will be implemented

Access to the site will be restricted to DOMLEC staff and approved Contractor staff

Barricade the work areas (near the settlements) with hard fencing to prevent the entry of the community into the construction areas.

Provision of safe corridors for pedestrian movement

- Placing adequate signboards and flagmen to divert the community away from the work sites
- Implementation of No Blowing of Horn Zones, particularly in settlement areas
- Installation of Signages
- Monitoring noise level maintained at national standard

5.6 ESS 5 Land Acquisition, Restrictions on Land Use and Involuntary Resettlement) – Related Impacts and Mitigation Measures

5.6.1 Resettlement Impacts of the Project

It is estimated that about 329,430 sq ft of land will be affected by the Project by land acquisition or easement. About 25% of the total land requirement will be acquired for trenching and pole structure locations. The remaining 75% of the land will be under easement, affected by midspan or access roads (detailed in the following table):

Table 5-6. DGRMP II Land requirements

	Land Acquisition		Easement		Total
	Trenching	Pole Structure	Span	Access Roads	
Land required (sq ft)	17,715.89	57,979.26	64,337.00	189,398.92	
Total (sq ft)	75,695.15		253,735.92		329,431.07

It is estimated that about 30 land parcels will be affected by land acquisition and/or easement. Of the plots affected by the current alignment, 24 land parcels are privately owned, while two are owned by the Government. It is expected that an additional two to three privately owned plots will be affected by the final alignment to be determined by the contractor. Under the current alignment, the Project will affect 25 Project Affected Persons (PAPs) by land acquisition and/or easement. The household survey indicates there are no tenants on private lands or encroachers/squatters on the public lands (including public roads for the installation of underground cables). The majority of the PAPs will be affected by both land acquisition and easement. The impact on PAPs is summarized in the table below:

Table 5-7. Civil Work Impact on PAPs

	Land Acquisition & Easement	Easement Only	Total
Pole Structure, Midspan, and Access Road	13	-	13
Pole Structure and Midspan	2	-	2
Pole structure and Access Road	1	-	1

Midspan Only	-	6	6
Trenching and Access Road	1	-	1
Trenching Only	2	-	2
Total	**19**	**6**	**25**

.

5.6.2 Impact of Structure

The current alignment does not anticipate any impact on structures. Through field visits and consultations, DGDC avoided the impact on commercial structures that belong to two people.

5.6.3 Impact on Crops/Trees

Seven PAPs have crops/trees on the affected lands. Two PAPs have crops/fruit trees on their lands, while three PAPs have forest trees on their lands. Two PAPs confirm there are crops/trees on the affected lands but do not know the type of crops/trees. Once the exact location of pole structures and midspan is determined, the valuation of affected crops/trees will be carried out by the Ministry of Agriculture and Fisheries.

5.6.4 Impact on Livelihood

Four PAPs derive agricultural income from affected lands. One PAP has orange trees, while another cannot confirm the project impact until the final alignment is determined. Two PAPs indicate midspan would not interfere with their cultivations. DGDC will have continued consultations with four PAPs during preparation and monitor the impact on their livelihoods.

5.6.5 Vulnerable PAPs.

Eight PAPs have low income, earning less than EC$1,000 per month on average.[10] None of the vulnerable PAPs will have a substantial loss of land by land acquisition. However, DGDC will have regular consultations, support them through GoCD social programmes (elderly pension, health care services, etc.), and monitor the Project's impact on their livelihoods.

5.6.6 Compensation

Detailed measures to compensate for the above impacts are detailed in the ARAP. These include

- PAPs will be compensated for their loss of land, structure, or trees/crops by the GoCD.
- Valuation for lands and structures will be done by the Lands Department. Valuation for trees/crops will be done by the Ministry of Agriculture and Fisheries.
- Easement Valuation. This is the first time 69kV overhead transmission lines will be installed in Dominica. Considering the land use restrictions to be imposed within RoW and access roads, the lands will be under easement, and the affected landowners will be compensated. The valuation methodology is being determined by the Lands Department.
- Compensation Payment. Following the national procedure (valuation, negotiation, and compensation).
- RAP implementation will be monitored by DGDC and verified by the Owner's Engineer.

[10] Current minimum wage in Dominica is EC$7.5 per hour, which roughly translates to EC$1,320 per month.

5.7 ESS 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) – Related Impacts and Mitigation Measures

5.7.1 Impact on Flora and Fauna from Construction Activities

The construction activities will require clearance of 2.94 ha of land (0.27 ha for trenching, 0.44 ha for pole structures, 0.56 for span/ROW and 1.67 ha for access roads) and removal of vegetation from agricultural sites (no natural forests will be cut) mostly. The clearing activities will have an impact on wildlife. Land clearing activities will not affect any nests of the threatened birds as their breeding grounds are located in the national parks away from the construction sites.

Mitigation

A biodiversity management plan is prepared to mitigate the impacts on flora and fauna from construction activities. This plan is included in the ESMP, and the key mitigation measures from this plan are included below.

Pre-clearing Surveys and Rescue and Relocation

Once the area slated for vegetation removal has been demarcated, the Contractor's biodiversity specialists will conduct pre-vegetation clearing surveys. Specialists with demonstrated experience and knowledge of terrestrial plant and fauna species will be required to confirm whether any endangered or endemic fauna are present in the area to be cleared and to be handled appropriately. The following management measures will be utilized:

- Acoustic deterrents will be used to disperse terrestrial ground-dwelling and flying fauna;
- The biodiversity Specialist will record any fleeing fauna by type and number of individuals, as feasible, to supplement baseline records;
- Any reptiles, amphibians, or small mammals remaining in the area slated for vegetation removal will be captured, photographed, measured, and relocated to suitable nearby habitats. This will be performed by specialists and trained locals. Suitable habitat will be determined prior to clearing surveys and will be within similar ecological characteristics and requirements;
- If Project vegetation removal and ground-disturbance activities cannot avoid the bird-nesting and bat-breeding season (April through August), pre-clearing surveys will identify features to be avoided and 20 m buffers will be set up around sensitive areas during the construction phase;
- Examples of sensitive features and areas are active endemic or threatened bird nests, maternal bat roost colonies and other microhabitats that are being used for reproduction and raising young.
- Rescue and relocation efforts will be recorded within a monitoring database. Every individual rescued will be provided with an ID number. Rescue and relocation records will include a photograph, time, date, collector, location coordinates and mortality (if any).

Best Practice Vegetation Removal

- DGDC will implement and manage activities related to the vegetation removal and tree felling process. The specific objectives of this project are to implement best-practice vegetation clearing methods. To minimize impacts, DGDC will implement the following best-practice measures:

- Technical delimitation of authorized clearing areas, using security tape at the height of 1.5 m, visible enough to isolate the intervention area, and implementation of enforcement measures to avoid footprint "creep" into surrounding areas;
- Maintain vegetation barriers and trees where feasible;
- Inspection of each target tree to identify risks and potential emergency situations, considering the location, inclination, physical state, extraction trails, wind conditions, and determination of the desired fall path;
- Completion of vegetation removal and tree felling by workers with experience and training in tree felling;
- Biologist identification of any sensitive fauna species in the area where tree felling will occur;
- Tree felling during a time when impacts to fauna (breeding birds and bats) are minimal;
- Whenever possible, vegetation clearance activities should commence outside the breeding season of the key threatened species. The breeding season for the key bird species is between January and August; Bats breed between April and August. Advice should be sought from local authorities and experts on this matter;
- One day prior to tree felling and vegetation removal, fauna dispersal utilizing noise (i.e., horns, machine equipment-chainsaws or other appropriate measures, etc.);
- Presence of contractor's biologist onsite as observers during vegetation removal to capture and relocate fauna offsite to undisturbed nearby habitat;
- Use of low-impact and directed logging techniques;
- A phased, directional approach to tree felling to allow mobile animals to escape from forest clearing activities; trees will be felled in a direction that will minimize damage to neighbouring vegetation;
- Avoid piling clear-felled vegetation on standing live vegetation, and
- Manage cleared material to minimize potential bushfire sources.
- Vegetation removal management include-on site decomposition, burning, or being recycled as fire wood or building material where possible. Provide wood to the community for use as fences or for charcoal production. This is acceptable according to Dominican law.

Revegetation of Temporary Areas

DGDC will support measures designed to conserve and revegetate as much cleared vegetation as possible within the Project Area. The contractor will implement the following measures:

- Rehabilitation of all disturbed areas (e.g., temporary laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation;
- Specialists will determine the selection of native trees and shrubs to replant to ensure appropriate succession of native trees and reduce the potential for bushfires;
- In appropriate areas, native and endemic trees that may be used as food sources by native bats and birds will be planted in temporarily cleared areas; and
- Habitat will also be restored and/or enhanced to increase the value to wildlife. For example, rocks and woody debris can be added to areas to increase availability of wildlife refuges.

Habitat Management Biodiversity Offset Proposed in the Power Plant ESIA

- The proposed transmission line development under DGRMP II will not impact any natural habitats, and the anticipated impacts on the biodiversity and critical habitat features are mitigated through adequate mitigation measures with no residual impacts (see mitigation measures in Sections 5.7.1

to 5.7.5). Hence, DGRMP II does not warrant any biodiversity offset measures. However, the biodiversity offset measures in the Power Plant ESIA are re-presented here to explain the DGDC's original plans to address the loss of natural habitats associated with the power plant development.

- The construction of the power plant requires clearing vegetation within 4.62 ha, of which 2.7 ha is natural tropical forest habitat. DGDC will identify degraded areas due to Hurricane Maria for restoration based on reduced and broken habitat cover, barely exposed ground, downed or damaged trees, and areas of debris build-up due to Hurricane Maria. DGDC will restore 2.7 ha to compensate for the loss of natural habitat and adhere to the "like-for-like or better" principle.
- DGDC will implement a Habitat Management Procedure (HMP) to offset impacts on terrestrial natural habitats by the geothermal plant. The plant construction requires clearing vegetation within 4.62 ha, of which 2.7 ha is natural tropical forest habitat.
- The objectives of the HMP are to i) provide enhancement measures for post-Maria terrestrial biodiversity of the area and ii) establish biodiversity offset required to achieve No Net Loss of Natural Habitats, with input from local specialists and stakeholders as appropriate.
- The activities to be undertaken include:
    - Plant native tree species and native grasses with organic fertilizer in areas where trees have fallen to stabilize ground conditions on bare slopes, improve ecological resilience, and reduce rainwater run-off and erosion;
    - Plant native tree species in areas surrounding well pads and other infrastructure to reduce erosion and improve landscape connectivity;
    - Support local nurseries to grow more trees to be planted and used by the local community as possible;
    - Restore river courses by planting native trees, removing fallen trees and large rocks that may cause flooding and increased erosion; and
    - Create microhabitats and hibernacula for animals impacted by the loss of tree canopy cover.
    - DGDC will identify degraded areas due to Hurricane Maria for restoration based on reduced and broken habitat cover, bare exposed ground, downed or damaged trees, and areas of debris build-up due to Hurricane Maria. DGDC will restore 2.7 ha to compensate for the loss of natural habitat and adhere to the "like-for-like or better" principle. Additional areas for restoration include sloped areas without trees or vegetation exposed by Hurricane Maria and landslides.

Artificial Lighting and Management

- Reduce the duration of light to the extent possible via the use of timers and motion detectors;
- Avoid ultraviolet (UV) light and shorter wavelength light;
- Use low wattage lamps (<70 Watts (W));
- Use yellow light or red light that does not contain blue, violet, or UV wavelengths, as these attract fewer insects than UV or bluish/white lights;
- Plan and design light intensity and configuration, spacing, height, and directionality to reduce the intensity and spillage of light to minimize overall illumination;
- Use light only when needed and preferably turn off lights during times of peak bird migration;
- Ensure there are light-exclusion zones within the Project property;
- Avoid upward pointing lights and install directional accessories on existing light units to direct light away from sensitive areas and minimize light spill, if necessary; and

- Adapt mitigation measures if lights are shown to have an impact based on bird, bat, and invertebrate monitoring reports.

5.7.2 Spread of Invasive Alien Species

Invasive alien species (IAS) present a significant risk to biodiversity and are easily spread by linear projects unintentionally or intentionally through a lack of awareness of the risks. Measures will be implemented to avoid the potential for accidental or unintended introductions, including the transportation of substrates and vectors (such as soil and weed-infested machinery) that may harbor IAS.

Mitigation

- Construction sites will be rehabilitated at the earliest opportunities, and rehabilitation plans will IAS control measures appropriate to the IAS risks prevailing in the project area.
- Construction vehicles will be brought into the site in an 'as-clean-as-new' condition to ensure that invasive plant material and seed-bearing soil are not introduced.
- All vehicles will be cleaned on a regular basis to prevent the unintentional spread of IAS withing the project area.
- IAS will be regularly controlled in construction vehicle parking and operational areas.

5.7.3 Potential risks associated with an illegal wildlife trade

The project is located within an area that supports exceptionally rich biodiversity, which includes many threatened species. One of the primary reasons for species to be threatened is illegal hunting. The influx of labor can be a major source of poaching. Construction workers are often mobile, well-resourced, and coming from far away, often with little incentive to conserve local resources. Demand for timber for construction work can be a driver of deforestation, and traceability of such timber can be difficult.

Mitigation

- All bidding documents and construction contracts are to include specific provisions forbidding hunting or collecting natural resources of workers. Contracts can also include articles that require the use of access controls/checkpoints, zero tolerance of any illegal biodiversity resources in worker sites (such as wildlife products sold to construction workers; products of illegal hunting along access roads; pets taken from the wild), and offer workers appropriate food/canteen options that will reduce demand for seeking local food options.
- The DGDC will provide a safe and anonymous line for reporting activity for workers, communities or any stakeholders whereby they are safe from retribution from other community members, organized crime or government officials.
- If a crime is committed, national authorities need to be alerted immediately. In addition, sometimes, live animals can be rehabilitated, and the appropriate national authorities or non-government organizations need to be contacted to collect the animals to avoid risks of harm to people and the animal(s).
- Contractors shall be responsible for demonstrating that timber procurement is limited to those suppliers that can demonstrate that timber is legitimately sourced and does not contribute to significant conversion or degradation of natural or critical habitats.

5.7.4 Bird Collision with the Overhead Transmission Lines

Three threatened species occur near the project area. Imperial Parrot (Amazona imperialis), a critically endangered species, Red-necked Parrot (Amazona arausiaca), a vulnerable species and Black-capped Petrel (Pterodroma hasitata), an endangered species. The core habitat for both the parrot species is

Morne Trois Pitons National Protected Area. The corridor of influence (COI) of the overhead transmission line is not a habitat for these species, but the parrots visit for foraging purposes. The COI is not a breeding area for these parrots. During the field investigations during the dry season (March and April 2023) and wet season (July 2023), the Red-necked Parrot species are noticed along the transmission line alignment. The Imperial Parrot, though not observed, is reported to utilize the forest and airspace within the region as a migration corridor between the rainforest habitat around the foothills of Morne Watt (Morne Trois Pitons National Park) and habitats in the Central and Northern Forest Reserve.

The field surveys, including nocturnal surveys, during both dry and wet seasons, within the zone of influence at Laudat could not verify the presence of the Black-capped Petrel, a seabird. However, recent collaborative research has confirmed the presence of the Black-capped Petrel, in the airspace over Laudat, on its flyways to and from nesting grounds near the summit of Morne Micotrin and other mountain summits within the district.

The length of the overhead transmission line Is 4.8 km and is located along the ridge of the Roseau Valley, and does not cross any valley. The valleys are the usual migration corridor for the petrel, and the overhead transmission line is not expected to have any impact on this bird. It also should be noted that some sections of the proposed overhead lines are located within the corridor of old 11 kV overhead lines. These 11 kV lines were not in use since they were damaged by a hurricane in 2017. Before this, they were in operation for nearly 3 decades, and there was no report of bird collisions from these lines (also note that there was no active monitoring to record bird collisions). The alignments of the old 11 kV and proposed 69 kV OHLs are shown in Figure 5.2.

As the red-necked parrot is noticed in the COI for foraging, there is a risk of bird collision with these species. As these birds are not expected to perch on the poles of the power lines, there will be no risk of electrocution.

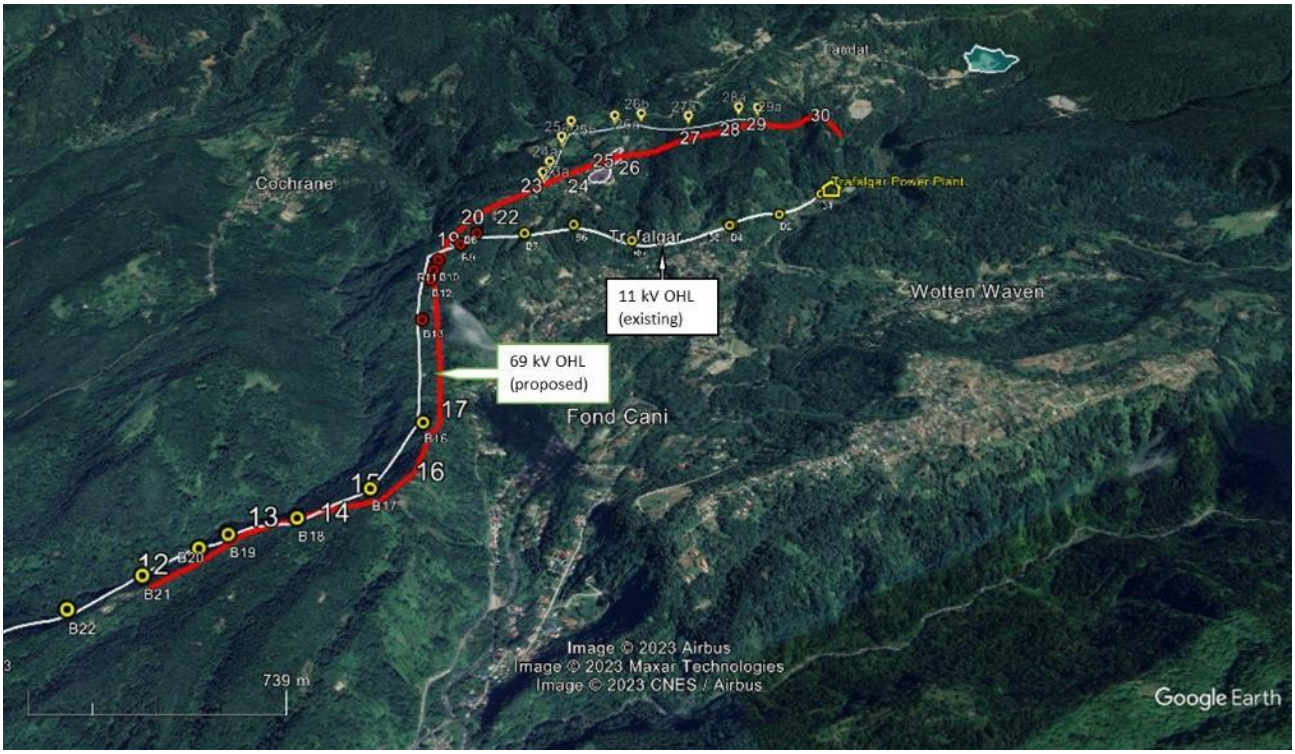


Figure 5.2. Alignment of old 11 kV and proposed 69 kV OHLs

Mitigation

The risk of bird collision is minimized by adopting underground cables in the initial section near the geothermal plant. The following measures will further minimize the risk of bird collision.

- Installation of Wire-marking devices increases the line profile and visibility along the overhead transmission lines to minimize bird collisions. They have a reflective and fluorescent plate, illuminating in low light.
- Two types of marking devices exist.
    - Passive Markers. Passive wire markers increase line visibility by increasing the line's profile.
    - Active wire markers increase the line profile and use movement to increase visibility.
- Installation of a Bird Strike Indicator (BSI) is an automated vibration-sensing and recording tool designed to detect bird strikes on power lines. BSIs use accelerometers to record stress waves and vibrations caused by a bird strike. BSI sensors are installed on the monitored wires and transmit strike activity wirelessly to a nearby base station where the data is recorded. BSIs allow data to be collected 24 hours a day and in all weather conditions.
- Monitoring the effectiveness of markers and diverters to ensure their effectiveness in reducing bird collisions.
- Monitoring will be conducted periodically and over an extended period to gather sufficient data for analysis. If the markers and diverters are found to be ineffective or if bird collisions persist, adjustments to the installation or alternative measures may need to be considered to improve their effectiveness.
- The Contractor team will include a bird specialist during the design phase to design the bird diverters. The specialist will carry out adequate consultations during this process with the relevant stakeholders, including NGOs.

5.7.5 Impacts on Critical Habitat Features

Where critical habitat features are subjected to project impacts, ESS6 requires a net gain to be demonstrated for the biodiversity values for which critical habitat was designated. Net gains are defined within ESS6 as additional conservation outcomes that can be achieved for the biodiversity values for which the natural or critical habitat was designated and may be achieved through the implementation of additional programs *in situ* to enhance habitat and protect and conserve biodiversity.

An assessment of critical habitat identified vulnerable red-necked parrots that qualify under ESS6 critical habitat Criterion (a) and are potentially impacted by the project.

Data is not available to quantify impacts on the other two bird species, however, impacts are expected to be minimal as these species are rare, and limited forest habitat exists near the transmission lines, providing limited incentive for birds to cross their huge core habitats, which are national parks (Morne Trois Pitons & Morne Diablotin national parks occupy about 15% of the country's area).

Mitigation included within the ESIA to address impacts to these species include:

- Measures to manage construction-related impacts such as pre-clearing surveys, and rescue and relocation of fauna, best practice vegetation removal, revegetation of temporary areas, and artificial

lighting management and control of invasive align species. These measures are further elaborated in the ESMP.

- DGDC will restore 2.7 ha to compensate for the loss of natural habitat from the geothermal power plant development with the support of the Forest and Wildlife Division and adhere to the "like-for-like or better" principle
- Measures recommended by the World Bank Paper[11] to address illegal wildlife trade at the project level shall be implemented. These include requirements on contractors to implement induction and awareness programs for staff and workers to highlight the importance of biodiversity and provide the basis for enforcement of policies that prohibit the killing of animals, taking of pets and any engagement in consumption or trade in wildlife products.
- The installation of bird diverters to minimize the risks of bird collisions and the installation of automated sensors for record of bird collisions will minimize the risk of collision of all bird species.

Many additional measures provided within this ESMP to address environmental and biodiversity impacts will indirectly benefit these critical habitat species.

Residual impacts similarly cannot be quantified; however, the residual impact on these species is expected to be minimal. Hence, no measures are therefore needed to demonstrate the net gain required under ESS6.

5.8 ESS 8 – Related Impacts and Mitigation Measures

5.8.1 Chance finds during construction

The project activities will not impact any known cultural heritage sites. However, there is a risk of chance finds during the earth works for access roads, foundation of towers and trenches.

Chance find Procedures

Chance find procedures that will be used during this Project are as follows:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a nightguard shall be present until the Ministry of Youth, Sports, Culture and Constituency takes over;
- Notify the Owner's Engineer, who in turn will notify the responsible local authorities immediately (within 24 hours or less);
- Responsible local authorities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historical, scientific or research, social and economic values;
- Decisions on how to handle the finding shall be taken by the relevant authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance), conservation, preservation, restoration, and salvage;
- Implementation of the authority decision concerning the management of the finding shall be communicated in writing by the relevant department; and

[11] World Bank Paper - Illegal Logging, Fishing, and Wildlife Trade : The Costs and How to Combat it. (https://openknowledge.worldbank.org/handle/10986/32806)

- Construction work could resume only after permission is given from the local authorities and relevant departments concerning the safeguard of the heritage.

5.9 Cumulative Impacts

A cumulative impact assessment has been prepared in the ESIA Addendum of DGRMP[12]. It was derived from desktop reviews of publicly available information, information obtained during the ESIA process, and information provided by DGDC.

The above assessment has been updated in the ESIA considering the DGRMP II and potential subsequent project on the transmission line along the west coast. The assessment has been updated in this ESIA by including the transmission line development in the Project.

The following are definitions for key terminology used in the cumulative impact assessment.

- **Cumulative Impact:** Impacts that result from the successive, incremental, and/or combined effects of an action, project, or activity added to other existing, planned, and/or reasonably anticipated actions, projects, or activities. For practical reasons, the identification, assessment, and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concern and/or concerns of Project-Affected Communities (PACs).
- **CIA:** Process to identify and evaluate cumulative impacts.
- **Other Projects**: Existing, planned, or reasonably expected future developments, projects and/or activities potentially affecting Valued Environmental Components (VECs).
- **External Drivers:** Sources or conditions that could affect or cause physical, biological, or social stress on VECs, such as natural environmental and social drivers, human activities, and external stressors. These can include climate change, population influx, natural disasters or deforestation, among others. These are typically less defined and planned than Other Projects.
- **Valued Environmental Components (VECs):** Environmental and social components considered important by the scientific community and/or potential PACs. VECs may include:
- Physical features, habitats, and wildlife populations (e.g., biodiversity, water supply); Ecosystem services (e.g., protection from natural hazards, provision of food); Natural processes (e.g., water and nutrient cycles, microclimate);
- Social conditions (e.g., community health, economic conditions), and Cultural heritage or cultural resources aspects (e.g., archaeological, historical, traditional sites).

5.9.1 Description of Other Projects Considered in Cumulative Impact Assessment

In addition to the transmission line development under the current project, the following projects have been considered for the cumulative impact assessment.

- **Geothermal Plant**. Includes a Geothermal Plant with an associated reinjection pipeline and steam gathering system. The components are located within the Roseau Valley. The reinjection pipeline will extend for approximately 1.21 km, and the steam gathering system will run for approximately 1km.
- Other Projects, such as

[12] IFC's Cumulative Impact Assessment (CIA) guidance - Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets (IFC, 2013)

- **West Coast Transmission Line**. Includes the development of a 69 kV transmission line along the west coast from Fond Cole to Sugar Loaf (also known as the FSI line). Currently, DGDC is pursuing two options, one underground cable along the highway or an overhead line.
- **Cable Car Dominica** includes the development of a 6.6 km detachable single-core cable car project, which will provide safe, fast access to the boiling lake from Trafalgar.
- **Sanctuary Rainforest Eco Resort and Spa** is a resort currently under construction near Laudat.
- Construction of Roseau River Walls (river training walls and related road and drainage works along the Roseau River, including relocation of utility infrastructure, construction of sidewalks, and installation of street lighting). These workers are being carried out on a necessary basis (in the sections where the river banks are damaged).
- Housing Recovery Project (World Bank)
- Leveraging Eco-Tourism for Biodiversity Protection (World Bank)

- External drivers such as natural hazards and climate change

5.9.2 Valued Environmental Components

Valued Environmental Components (VECs) selected for the cumulative impact assessment for the ESIA Addendum of DGRMP are given below. The same VECs have been used for the current ESIA.

- Terrestrial and Aquatic Biota (flora and fauna)
- Land Traffic
- Community Health and Safety
- Landscape Aesthetics

5.9.3 Assessment of Cumulative Impacts

An updated assessment of the cumulative impacts is given in Table 5.8.

Table 5-8. Analysis of Cumulative Impacts

#	Impact type	Description
A	VEC	**Terrestrial and Aquatic Biota (flora and fauna)**
1	Potential Impacts from the Transmission Line Development in the Project	The land clearing for access roads, tower locations, UGC, and construction activities will impact flora and fauna. These impacts are discussed in detail in this chapter. During operation, there will be potential avian risks. The significance of these impacts has been assessed as Moderate to Major, but with the implementation of the suggested mitigation measures, the residual impacts are Negligible to Minor.
2	Potential Impacts from the Geothermal Plant	During Construction, activities such as pipeline installation, vegetation removal, soil movement, and use and storage of hazardous waste and materials may result in distribution and habitat changes for terrestrial fauna, death of fauna from collision with vehicles and elimination of terrestrial flora within the Project's layout including access roads and laydown area. During Operations, activities such as routine maintenance, reception and delivery of materials, generation of electricity, storage and use of hazardous waste and materials could cause the following potential impacts: hazardous

#	Impact type	Description
		materials spills on the ground, habitat loss, increased noise and vibrations, air emissions, and increased exposure to light. The disturbances described above could result in vegetation cover loss and distribution changes for the fauna in the Geothermal Plant area. Mammals and birds are largely mobile, and most of the bird species identified during the baseline are considered migrant species, which makes them less vulnerable to anthropogenic intervention. Therefore, it is not expected that the Geothermal Plant construction and operations phases will result in an overall reduction in their abundance and diversity. The impact is considered Minor. The potential impact on less mobile species will be considered Moderate.
3	Potential Impacts from Other Projects	*West Coast Transmission Line*. There are two potential alternatives for the proposed west coast alignment. If the overhead line is chosen, the impacts will be similar to the current project. The line also crosses many valleys, and these sections are prone to bird collision. If the UGC line is considered, it will cross the rivers, which may harbor the endangered mountain chicken frog species. The impacts may vary from Moderate to Major based on the alignment chosen. *Cable Car and Resort Projects*: During Construction, land clearing will be required for the cable car construction, offices and parking. Construction activities could disturb fauna in the area, causing distribution and habitat changes from altered terrestrial habitats. The movement of trucks and heavy machinery could result in collisions with fauna. During the traffic season, the noise associated with the activities may impact the local wildlife and birds. The risks are Major. *River Training Works:* Construction activities could disturb fauna in the area, causing distribution and habitat changes from altered terrestrial and aquatic habitats. The movement of trucks and heavy machinery could result in collisions with fauna. After Construction, potential impacts include collisions with project vehicles or disruptions to aquatic fauna during maintenance work. The impacts are expected to be Minor. *Housing Recovery Project:* Construction activities could disturb fauna in the area, causing distribution and habitat changes from altered terrestrial habitats. The movement of trucks and heavy machinery could result in collisions with fauna. The impacts are expected to be Negligible. *Leveraging Eco-Tourism for Biodiversity* Protection Project. The project will benefit Dominica's three national parks (Morne Trois Pitons, Morne Diablotin and Cabrits) and the Kalinago Territory through support for intersectoral planning and design as well as the implementation of nature-based tourism models that enhance opportunities for sustainable livelihoods. The impacts will be mostly beneficial.
4	Potential Impacts from External Drivers	*Climate Change and Natural Hazards*: Rising temperatures associated with longer-term global climate change could potentially affect some special status species ranges. Changes in precipitation and natural disasters could also affect vegetation growth and/or result in vegetation removal.
5	Cumulative Impact	The Project, other projects, and external drivers could have potential negative impacts on terrestrial flora and fauna. Effects and disturbances caused by the

#	Impact type	Description
		plant construction activities will be short-term and reversible. The Project embedded controls and management plans, including the vegetation plans related to visual impacts, will mitigate potential impacts to an acceptable level (mostly **Minor** or **Negligible**). Additionally, the potential impacts are localized to respective project sites. However, the West Coast TL is yet to be defined, resulting in a conservative estimation of **Moderate** impacts. In sum, the current Project could potentially contribute incrementally to the adverse impact, but further VEC conversion and/or degradation is not likely to occur, and once the West Coast transmission line is defined, the Project's contribution will be expected to be **Minor** to **negligible**.
B	**VEC**	**Land Traffic**
1	Potential Impacts from the Transmission Line Development in the Project	During the Construction of the project, the traffic associated with construction activities will be Negligible. However, the construction activities in Roseau City and along the Roseau Valley will significantly affect the local traffic due to trenching along the existing roads and this impact will be will be a Major. During Operations: Most traffic will be related to routine maintenance. The impacts during Operations will be Negligible.
2	Potential Impacts from the Geothermal Plant	During Construction, which is expected to last 18 to 24 months, there will be an increase in the volume of land traffic, consisting of cars and light trucks transporting equipment and parts. This increase in road traffic can affect the conditions of road infrastructure, disturb users of adjacent properties, lead to traffic delays, and possibly have public safety implications. However, a high volume of traffic is not expected during the Construction phase. The impacts during Construction will be Minor. During Operations: Most traffic will be related to routine maintenance and regular operations activities, including the daily commute of plant personnel which will be a maximum of 6 round trips per day. The impacts during Operations will be Negligible.
3	Potential Impacts from Other Projects	*West Coast Transmission Line.* If the UGC alignment is chosen, as this passes along the busiest highway in the country, the impacts during the Construction on the existing traffic will be Major. If the OHL option is chosen, the impacts will be Minor. The impacts associated with the following project are Minor**.** Cable Car and Resort Projects: During Construction and operation, there will be an increase in traffic. *River Training works:* During Construction, transport of personnel, heavy trucks delivering or picking up equipment and machinery, and maintenance vehicles could cause congestion. *Housing Recovery Project:* During Construction, transport of personnel or materials may cause congestion and increased vehicle traffic. Leveraging Eco-Tourism for Biodiversity Protection Project. The project rehabilitates hiking trails around the Morne Trois Pitons National Park. There will be very limited civil works in the project, and the impacts are negligible.

#	Impact type	Description
4	Potential Impacts from External Drivers	*Climate Change and Natural Hazards*: To the extent the frequency or intensity of severe storms and flooding could be influenced by climate change, these could potentially damage some roads. Natural disasters may also result in damaged roads.
5	Cumulative Impact	The Project and other projects could contribute to the potential negative impacts on this VEC by increasing land traffic. The external driver could exacerbate traffic due to potential damage to road infrastructure. The mitigation measures proposed by the Project will appropriately mitigate the negative impacts and contribution (**Minor** for the short-term Construction and then **Negligible** for operation). In sum, the Project could potentially contribute incrementally to the adverse impact, but VEC conversion and/or degradation is not likely to occur, or the Project's contribution will be expected to be negligible.
C	VEC	**Community Health and Safety**
1	Potential Impacts from the Transmission Line Development in the Project	During Construction, the potential risks to the community are exposure to construction hazards (vehicle movements and roadside trenches) and nuisances from Construction related activities, such as dust, noise, and traffic congestion. The lines and substations will be designed with fire safety hazards and compliance with electromagnetic field standards. These potential impacts will be Major, but with the application of mitigation measures, the impacts are Minor. A small labor influx of about 40 foreign workers is expected during Construction. There may be a labor camp, or they may be accommodated in rented houses or hotels (as done in DGRMP I). The risk of SEA/SH will be low. During Operations, the impacts are associated with the maintenance activities, which are Negligible.
2	Potential Impacts from the Geothermal Plant	During Construction, air quality could be negatively affected by activities related to earth movement and terrain preparation, movement of heavy machinery and increased land traffic in surrounding areas. These activities could increase the amount of dust and certain gases (CO_2 and H_2S) in the environment. These potential impacts will be localized and short-term, and with the application of the proposed mitigation measures, the impact will be Minor. During Operations, there will be no emissions that will negatively affect air quality, apart from workers' travel to the site, which is considered Negligible. However, if the injection well has to be shut down during an emergency, there may be additional air emissions. Due to the extraordinary nature of this circumstance, it is expected to be of a low occurrence. Therefore, the impact will be Minor or Negligible.
3	Potential Impacts from Other Projects	*West Coast Transmission Line:* During Construction, the potential risks to the community are exposure to construction hazards (vehicle movements and roadside trenches) and nuisances from the Construction related activities, such as dust, noise, and traffic congestion. These potential impacts will be localized and short-term, and with the application of the proposed mitigation measures, the impact will be Negligible. *Cable car and Resort Projects:* During Construction, air quality could be negatively affected by activities related to earth movement, which will generate dust, and by emissions from diesel engines' combustion gases. During Operations, no additional impacts are expected.

#	Impact type	Description
		River Walls: During Construction, air quality could be negatively affected by activities related to earth movement, which will generate dust, and by emissions from diesel engines' combustion gases. *Road Network Improvement:* During Construction, air quality could be negatively affected by activities related to earth movement, which will generate dust, and by emissions from diesel engines' combustion gases. *Housing Recovery Project:* During Construction, air quality could be negatively affected by activities related to earth movement, which will generate dust, and by emissions from diesel engines' combustion gases. Eco-tourism project: The proposed civil works for hiking trails will be carried out away from communities, and there will be no impacts on community health and safety.
4	Potential Impacts from External Drivers	*Climate Change and Natural Hazards*: Rising temperatures associated with longer-term global climate change could potentially affect the dispersion and thermodynamics of pollutants emitted into the air.
5	Cumulative Impact	The Project, other projects, and external drivers could contribute to the potential negative impacts on this VEC: decreased quality of the air shed. However, the other projects are already in operation, and therefore their impacts are already considered in the Project baseline and residual impact assessment. The Project's embedded controls and mitigation measures proposed will appropriately mitigate the negative impacts and contribution (**Minor** or **Negligible**). In sum, the Project could potentially contribute incrementally to the adverse impact, but further VEC conversion and/or degradation is not likely to occur, or the Project's contribution will be expected to be negligible.
D	VEC	**Landscape Aesthetics**
1	Potential Impacts from the Transmission Line Development in the Project	During Construction, the landscape will be affected by site-clearing activities, construction equipment and construction-related traffic. These activities are small-scale and spread over a 10 km long (for the 69 kV); the impacts are negligible. The proposed OHL lines are located on the mountain ridges away from the settlements, and hence they will not obstruct the view of the communities to the valley and sea. The towers are located within the canopy height and will be surrounded by trees. The project's impact on landscape aesthetics is Negligible.
2	Potential Impacts from the Geothermal Plant	During Construction, the landscape will be affected by site-clearing activities, construction equipment and construction-related traffic. Of these, the only permanent effect will be site-clearing, new infrastructure, land use restrictions, and the associated loss of flora. The Project has mitigation measures for visual impacts. After mitigation measures, the impact during Construction will be Moderate to Minor. During Operations, there will be no changes to landscape aesthetics.
3	Potential Impacts from Other Projects	*West Coast Transmission line:* If the OHL option is chosen, there will be some impacts if they obstruct the *view* of the communities to the sea and landscape. However, the impacts are expected to be negligible; the lines and towers will be masked by the thick vegetation around the power lines.

#	Impact type	Description
		Cable Car Dominica: During Construction, the landscape may be affected by site-clearing activities, construction equipment and construction-related traffic. During operation, the cable car is highly visible. However, this will be run for tourists during the cruise season and could become a tourist attraction to watch. *Resort and Spa:* During Construction, the landscape will be affected by site-clearing *activities*, construction equipment and construction-related traffic. As this will be a tourist resort, there will be landscaping activities, thus compensating construction-related impacts. *River Walls*: During Construction, the landscape will be affected by site-clearing activities, construction equipment and construction-related traffic. Of these, *the* permanent effects will be site-clearing, new infrastructure and the associated loss of flora. *Housing Recovery Project:* During Construction, the landscape may be affected by site-clearing activities, construction equipment and construction-related traffic. Of these, the permanent effects will be limited to any new housing projects since existing housing that is restored will not incur additional impacts. Eco-tourism Project: The project will improve the nature-based tourism nature-based tourism infrastructure; hence landscape impacts are mainly beneficial.
4	Potential Impacts from External Drivers	*Climate Change and Natural Hazards:* Changing temperatures and a higher risk of drought could lead to vegetation loss.
5	Cumulative Impact	The Project and other Projects will contribute to the potential negative impacts on this VEC by reducing flora. Additionally, landscape aesthetics was identified as a highly valued VEC by stakeholders. The Project could potentially contribute incrementally to the adverse impacts that already exist, and some degree of VEC conversion and/or further degradation or perception of degradation is likely to occur. Actions will be implemented in the medium term to mitigate potential adverse cumulative impacts on the VEC.

5.9.4 Mitigation Measures

Internationally recognized good practices for managing cumulative impacts include:

- Effective application of the mitigation hierarchy (avoid, reduce, and remedy) in the environmental and social management of the specific contributions of a project to expected cumulative impacts; and
- Undertaking best efforts to engage, leverage, and/or contribute to multi-stakeholder collaborative initiatives or discussion groups to implement management measures that are beyond the capacity and responsibility of any individual project developer. (IFC, 2013).

The embedded controls and management measures included in the ESIA and the ESIAs of Geothermal Plant projects provide a means to mitigate the specific contributions of the Project to effects on VECs, following the mitigation hierarchy. Supplementing these controls and management measures, the CIA provides a framework of additional actions that DGDC will apply in the regional and Project context to manage potential cumulative impacts on these VECs.

Project Level

Effective application of the mitigation hierarchy (avoid, reduce, remedy) to manage individual contributions of cumulative impacts will be applied as best practice. DGDC has incorporated a number of physical or procedural embedded controls in the Project design. These are considered from the very start of the impact assessment process as part of the Project, and are factored into the pre-mitigation impact significance ratings. In addition, a number of mitigation measures detailed in the ESIA have been proposed to address the potential impacts of the Project. The ESIA also includes an Environmental and Social Management Plan, which summarizes the mitigation and monitoring measures for all environmental parameters, including the VECs assessed in this cumulative impact assessment.

At the Project level, the above measures are considered sufficient to address the contributions of the Project to cumulative impacts on the identified VECs related to landscape aesthetics.

Regional Level

Ultimately, the management of cumulative impacts is the responsibility of government and regional planners. However, it is considered best international practice that private-sector developers make the best efforts to engage relevant stakeholders and promote the management of cumulative impacts in their project areas.

The assessment identifies that Terrestrial and Aquatic Biota and Landscape Aesthetics is a high-priority VEC. Therefore, the development and implementation of a multi- stakeholder collaborative management framework, to the extent possible, is recommended. DGDC has agreed to foster such collaboration by participating, to the extent feasible and practicable, in working groups and/or industry organizations aimed at addressing the management of potential impacts on regional resources to which DGDC's Project could incrementally contribute with respect to cumulative impacts.

Here are some initiatives that DGDC will take to strengthen a collaborative management framework for the VECs that the Project could contribute cumulatively with medium priority:

Landscape Aesthetics

- Promote the creation and maintenance of green spaces around the Project and other project areas.
- Promote the use of colors for Project components that blend into the natural surroundings.

Terrestrial and Aquatic Biota

- Promote information sharing related to impacts from the Project and the other projects to enrich common information and identify potential synergies in information gathering and mitigation measures.
- Evaluate opportunities to use shared access roads with other projects in the vicinity.
- Promote the creation and maintenance of urban green spaces around the Project and other project areas.
- Recommend the collaborative monitoring of impacts on biota among the projects, with adaptive management.

6 Environmental and Social Management Plan

This chapter describes the proposed institutional mechanism, mitigation and monitoring plans for the management of environmental, social, safety and health issues of the Project and the inclusion of mitigation and monitoring measures in contractors' bidding documents.

6.1 Objectives of ESMP

The basic objective of the ESMP is to manage the adverse impacts of project interventions in a way which minimizes the adverse impact on the environment and people of the project area. The specific objectives of the ESMP are to:

- Facilitate the implementation of the mitigation measures identified during the present ESIA and discussed earlier in the document;
- Draw responsibilities for DGDC and its Owner's Engineer and contractors for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters in order to:
    - Ensure the complete implementation of all mitigation measures,
    - Ensure the effectiveness of the mitigation measures;
- Implement environmental and social training programs for the implementation staff.

6.2 Inclusion of ESMP in contract documents

In order to make the Contractors fully aware of the implications of the ESMP and responsible for ensuring compliance, technical specifications in the tender documents will include compliance with mitigation measures proposed in ESMP. The Contractor will be made accountable through contract documents for the obligations regarding the environmental and social components of the project.

DGDC will include the following Environmental, Social, Health and Safety (E&S) Conditions in the bidding documents:

- Past performance of the Contractor on E&S aspects, including sexual exploitation and abuse and gender-based violence;
- E&S Staff with the Contractor;
- Mitigation measures to address construction impacts;
- Code of conduct of Contractor's Personnel;
- Management Strategies and Implementation Plans (MSIP) to manage the E&S Risks.

Each of the above conditions is elaborated in **Table 6.1**.

Table 6.1: E&S Conditions in the Bidding Documents

(DGDC includes this table in the bidding documents)

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	DGDC
1. Past performance of the Contractor on E&S is one of the eligibility criteria for the shortlisting process	The Contractor's past performance on compliance with E&S is an indicator of the Contractor's commitment and capability for implementation of the ESMP.	The Bidder shall "declare any civil work contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the non-compliance of any environmental, or social (including sexual exploitation and	Bidder to make the Declaration	DGDC uses this information to seek further information or clarifications in carrying out its due diligence

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	DGDC
		abuse (SEA) and gender-based violence (GBV) or health or safety requirements or safeguard in the past five years."		
2. 2.2.6 Bank's SEA and/or SH Disqualification	Contractor's past performance	At the time of Contract Award, not subject to disqualification by the Bank for non-compliance with SEA/ SH obligations	Bidder to make the Declaration	DGDC uses this information to seek further information or clarifications in carrying out its due diligence
3. Contractor shall propose adequate E&S Specialists in his team (E&S specialist, bird specialist, site supervisors)	The Contractor's staff should include adequate E&S specialists who are responsible for the implementation of all mitigation measures on E&S risks and compliance with ESMP.	The Bidder shall propose an Environmental, Social, Health and Safety (E&S) Specialist and a bird specialist as the Contractor's Key Personnel at the Site. The Bidder shall provide details of the proposed specialists, including academic qualifications and work experience. The E&S Specialist should have a minimum bachelor's degree in engineering or a master's degree in sciences related to environmental management. The bird specialist should have masters degree in zoological sciences. The Specialists should have 5 years of experience working on monitoring and managing E&S risks related to infrastructure projects.	The Bidder is to submit the CV of the proposed E&S Specialist and the bird specialist.	DGDC will review and approve
4. Implement Mitigation Measures to Address Construction-Related Impacts given in ESMP	The mitigation measures to address potential E&S risks and impacts should be included in the bidding documents. The Contractor shall be made responsible for the implementation of the mitigation measures through the necessary conditions in the contract.	DGDCs will ensure the ESMP in the General Specifications of the Bidding Document, and the reference to this document will be provided in the Conditions of the Contract as follows: • The Contractor shall implement the mitigation and monitoring measures given in the ESMP to address E&S risks associated with the construction works. The Consultant shall refer to the ESIA of the Project, which is available on the DGDC website, for further guidance. • The Contractor shall comply with the World Bank Group's General Environmental Health and Safety Guidelines and applicable sector-specific guidelines.		DGDC will include this condition in the bidding document

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	DGDC
4. Code of Conduct for Contractor's Personnel	All workers hired by the Contractor should sign a code of conduct to ensure compliance with the E&S obligations of the Contract.	The Bidder shall submit the Code of Conduct that will apply to the Contractor's employees and subcontractors. The Code of Conduct will state that the workers will comply with the following E&S requirements: • Wearing Personal Protective Equipment (PPE) in the workplace at all times • Non-discrimination in dealing with the local community by race, ethnicity, gender, religion, disability, sexual orientation, gender identity, social, or health status • Respectful attitude while interacting with the local community • Prohibit sexual harassment, particularly towards women and children • Prohibit violence, including sexual and/ or gender-based violence • Respecting the reasonable work instructions • Protection and Bidder use of the property The suitability of the Code of Conduct can be assessed and discussed as part of the Bid/Proposal evaluation and negotiations. The successful Bidder is required to implement the agreed code of conduct upon contract award.	The bidder shall submit a code of Conduct with the bid documents.	
6. Contractor's Management Strategies and Implementation Plans (MSIP) to manage the E&S Risk	The Contractor's proposal should include his understanding of the E&S requirements of the project and the proposed strategies to manage the E&S risks.	The Bidder shall submit Management Strategies and Implementation Plans (MSIP) to manage the following key E&S risks: • Strategy for the protection of workers and community from the construction-related hazards inside the terminal • Strategy to minimize impacts on flora and fauna from land clearing and construction activities. • Pollution prevention (wastewater, air and noise emissions) and management	The Bidder will submit MSIP along with the Bid Documents.	

Condition	The rationale for the inclusion of this Condition in the Contract	Specifications to be included in the Bidding Documents	Responsibility	
			Bidders	DGDC
		• A waste management strategies for proper collection and disposal of waste • Traffic management plan to ensure smooth traffic flow around the worksites and the safety of local communities from construction traffic • Hazardous material management plan safe storage and handling • Strategy to address labor influx impacts on the local communities • Gender-based violence and sexual exploitation and abuse prevention and response action plan • Emergency response plan and early warning system • Bird collisions with transmission lines and preventive measures. The Contractor shall be subsequently required to submit (before mobilization) the Contractor's Environment and Social Management Plan (C-ESMP) by the above strategies and Condition 4 of this Table.		

6.3 Environmental and Social Management During Construction

6.3.1 Pre-construction Stage Mitigation Plans

The pre-construction stage will mainly include the mobilization of the contractor and finalization of the following conditions/documentation by the Contractor:

- Design of substation and OHL complying with the EMF exposure limits, fire safety noise and adequate pollution control measures
- Contractor's Environmental and Social Management Plan (C-ESMP) with site-specific management plans, including OHS plan;
- Labour Management Procedures to be followed for hiring and management of labour;
- The mobilization of E&S Specialists

Each of the above conditions is elaborated in **Table 6.2**.

Table 6.2: E&S Conditions in the Pre-Construction Stage

Condition	The rationale for the inclusion of this Condition	Description of the Condition	Responsibility	
			Implementation	Supervision
1. Preparation of Contractor's Environmental and Social Management Plan (C-ESMP)	The Contractor shall submit site-specific management plans to address E&S risks following the ESMP requirements and MSIP proposed in the bid documents.	The Contractor to submit for approval and subsequently implement their Environment and Social Management Plan (C-ESMP). The C-ESMP should be submitted prior to the commencement of construction works, and no construction activities will be carried out under the project until approval of the C-ESMP. The C-ESMP will include the following site-specific management plans on: • Occupational health and safety management plan (also referred as health and safety manual in the bidding documents) • Community health and safety management plan • Waste management plan • Wastewater discharges management plan • Air and noise emissions management plan • Hazardous material management and spill control plan • Workers Accommodation Plan • Management of labour influx and facilities for the foreign workers • Labour recruitment procedures and labour management • Traffic management plan including transport of materials from quarries • Training plan for E&S risks including HIV/AIDS, sexual exploitation and abuse, and gender-based violence • Emergency Response Plan • Grievance Redress Mechanism • Demobilization plan after completion of works The Contractor shall review the C-ESMP every six months and update it as required.	Contractor	DGDC

Condition	The rationale for the inclusion of this Condition	Description of the Condition	Responsibility	
			Implementation	Supervision
2. Mobilization of E&S Specialists	The E&S Specialists should be mobilized during pre-construction for the preparation of C-ESMP.	The Contractor shall submit the CV" of following E&S Specialists for DGDC review and approval, and mobilize them. • EHS Specialist • Bird Specialist The EHS Specialists should be present at the site throughout the construction period.	Contractor	DGDC
3. The hiring of Construction Labour	Hiring procedure for construction workers, including the signing of the code of conduct	Provisions in labour management procedures (LMP) will be followed. The Procedures will include terms and conditions of employment, including hours of work, wages, overtime, compensation and benefits, holidays, leaves, and so on. The procedures will set out measures to prevent and address harassment, intimidation and/or exploitation. All workers shall sign the code of conduct and they will be terminated from employment if not complied with the code of conduct.	Contractor	DGDC
5. Construction storage facilities	The contractor will need areas for setting up storage areas.	The contractor shall set up storage facilities within sites approved by the DGDC.	Contractor	DGDC

6.3.2 Construction Stage Mitigation Plans

Detailed mitigation plans for construction stage impacts have been prepared on the basis of the detailed impact assessment covered under Chapter 5 and presented in **Table 6.3**. These plans are project-specific and, to the extent possible, site-specific; however, contractors will be required to carry out further detailing of the key aspects to prepare site-specific management plans as part of C-ESMP for review and approval of DGDC.

Table 6.3: E&S Impacts and Risks in Construction and Mitigation Measures

(**Note**: DGDC will include this Table in the Contract Specifications of the Bidding Documents under Employer's Requirements)

E&S Aspect	Impacts	Mitigation Measures
ESS2 (labour and Working Conditions) - Related		

Labour recruitment	Potential labour risks in the recruitment of workers	• Contractors will apply the following guidelines when dealing with workers:
		  ○ There will be no discrimination with respect to any aspects of the employment relationship, such as Recruitment and hiring; compensation (including wages and benefits; working conditions and terms of employment; access to training; job assignment; promotion; termination of employment or retirement; or disciplinary practices.
		  ○ Harassment, intimidation and/or exploitation will be prevented or addressed appropriately.
		  ○ Special measures of protection and assistance to remedy discrimination or selection for a particular job will not be deemed as discrimination.
		  ○ Vulnerable project workers will be provided with special protection.
		• Contractors will provide job/employment contracts with clear terms and conditions, including rights related to hours of work, wages, overtime, compensation and benefits, annual holiday and sick leave, maternity leave and family leave. The code of Conduct included in this LMP will be applicable to all project workers.
		• Contractors will ensure compliance with the Code of Conduct, including providing briefings/awareness raising on the Code.
		• Contractors will ensure compliance with occupational health and safety procedures and COVID-19 specific procedures (see below) including that the workers are properly trained in application of the standards that are relevant to the work.
		• Contractors and retained contractors will ensure no person under the age of 18 shall be employed. Age verification of all workers will be conducted by the contractors.
		• Workers shall be recruited voluntarily, and no worker is forced or coerced into work.
		• All workers will be made aware of the Worker's Grievance Mechanism (see below) to raise work related grievances, including any sensitive and serious grievances on SEA/SH.

Occupational health and Safety	General risks associated with the construction of	• The contractor will be required to prepare, obtain approval of, and implement an occupational health and safety (OHS) plan. These plans will be prepared in compliance with the World Bank Group's EHSGs and national regulations. If these guidelines cannot address any specific aspect of OHS, international good

E&S Aspect	Impacts	Mitigation Measures
	transmission line activities	practices such as OSHA and ILO will be applied. OHS Plan should contain general guidance for all identified hazards under each work activities, and site-specific OHS hazard and risks during construction, and control and preventive Measures proposed by the Contractor. The Plan shall be reviewed and updated if there any changes in the construction methodologies. • OHS Plan should contain general guidance for all identified hazards under each work activities and they should be presented in three discrete headings, (a) Contractor's Standards on the identified hazard management, (b) Expected Site-specific OHS hazard and risks during construction, and (c) Control and Preventive Measures proposed by the Contractor. • The OHS plan will be reviewed and approved by the Construction Owner's Engineer and the World Bank. • Conduct a 'job hazard analysis' at the new construction site to identify potential hazards that may arise from the proposed works or working conditions for the project workers and implement necessary control measures. The job hazard analysis should be part of the contractor's method statements, which will be reviewed and approved by the Owner's Engineer. The specialists of the Owner's Engineer will also visit the construction sites, prior to the start of construction, to ensure the control measures are in place. • Regular site inspections and safety audits by the construction supervision team, both by the OHS specialist and the site engineers. Since the site engineers will be present at the worksites all the time, they will be trained by their OHS team on monitoring the safety aspects of the construction works. • Regular training program for workers on occupational health safety (monthly training and daily toolbox talks). Special attention will be focused on safety training for workers to prevent and restrict accidents and on the knowledge of how to deal with emergencies. • Incident investigation and reporting, including a complete record of accidents and near misses, will be maintained. • In order to protect all project personnel and visitors, the Contractor will provide personal protective equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, body harness, protective clothing, goggles, fully face eye shields and ear protection. The contractor will also provide training to workers on how to use them and maintain in a sanitary and reliable condition and replace the damaged ones immediately with the new one. • Availability of medical and rescue facilities at the site for implementation of an emergency response plan • Adequate water supply and mobile toilets, medical and first aid care facilities at the worksites • Contractors will have dedicated and qualified staff to ensure compliance with the OHS Plan.

E&S Aspect	Impacts	Mitigation Measures
		• Awareness-raising material will be used, including posters, signage, booklets, and others at the worksites. • A complete record of accidents and near misses will be maintained. • First aid facilities will be made available at the worksites and in the workers residences. The contractors will engage qualified first aider(s).
	Workers may be exposed to occupational hazards from contact with live power lines during construction, maintenance, and operation activities	• Only allowing trained and certified workers to install, maintain, or repair electrical equipment; • Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities. • Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.
	Workers may be exposed to occupational hazards when working at elevation during construction, maintenance, and operation activities.	• Testing structures for integrity prior to undertaking work. • Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others; • Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point; • Installation of fixtures on tower components to facilitate the use of fall protection systems; • Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached; • Hoisting equipment should be properly rated and maintained and hoist operators properly trained; • Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident; • When operating power tools at height, workers should use a second (backup) safety strap; • Signs and other obstructions should be removed from poles or structures prior to undertaking work; • An approved tool bag should be used for raising or lowering tools or materials to workers on structures.

E&S Aspect	Impacts	Mitigation Measures
	Rotating and Moving Equipment. Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations.	• Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions. Examples of proper design considerations include two-hand operated machines to prevent amputations or the availability of emergency stops dedicated to the machine and placed in strategic locations. Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards. • Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance, in conformance with a standard such as CSA Z460 Lockout or equivalent ISO or ANSI standard • Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms
	Confined Spaces. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space	Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces. Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations. Prior to entry into a permit-required confined space: • Process or feed lines into the space should be disconnected or drained, and blanked and locked-out. • Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space.
	Lack of relevant PPE's will increase the risk of worker's exposure to construction hazards.	Personal Protective Equipment (PPE) provides additional protection to workers exposed to workplace hazards in conjunction with other facility controls and safety systems. These include • Eye and face protection: Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation. • Head protection; Falling objects, inadequate height clearance, and overhead power cords. • Hearing protection; Noise, ultra-sound. • Foot protection: Falling or rolling objects, pointed objects. Corrosive or hot liquids.

E&S Aspect	Impacts	Mitigation Measures
		• Hand protection: Hazardous materials, cuts or lacerations, vibrations, extreme temperatures. Recommended measures for use of PPE in the workplace include: • Selection of PPE should be based on the hazard. and selected according to criteria on performance and testing established by recognized organizations. • Active use of PPE if alternative technologies, work plans or procedures cannot eliminate, or sufficiently reduce, a hazard or exposure • Identification and provision of appropriate PPE that offers adequate protection to the worker, co-workers, and occasional visitors, without incurring unnecessary inconvenience to the individual • Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out. Proper use of PPE should be part of the recurrent training programs for employees
Health of workers	Inadequate facilities for workers risks in construction affect the workers' health.	• Workers' accommodation will include all adequate facilities (safe drinking water and sanitation, kitchen, rest areas, etc.) including entertainment facilities so that there will be minimal interaction between them and local communities • Separate facilities will be provided to men and women workers • The Contractor shall establish a mechanism to collect the complaints from the workers and address those complaints by the approved GRM plan
Labour influx	Impacts from the influx of labor on the local community from the outside areas	• This situation will be addressed by an awareness campaign implemented at the beginning of the construction phase. The Contractors will be aware of the possibility and risks of miscommunications between local residents and workers, which could easily lead to conflicts. This will be prevented by raising awareness and implementing a Code of Conduct for the workers. The Contractor shall develop a Worker Code of Conduct to govern the behaviour of workers on-site, and in local communities. • The awareness campaign will also be aimed at the risk of interaction between the resident population and the construction workforce, including the spreading of sexually transmitted diseases such as HIV/AIDS. • The contractor will prepare a labour management plan prior to construction works for approval of DGDC. • The contractor's code of conduct shall cover the program to promote awareness to the construction workers on respecting the local community. • The contractor will ensure local water usage will not be affected by the project water usage by the project or compete with the water requirements of the local community.

E&S Aspect	Impacts	Mitigation Measures
		• The Contractor's monthly training program will cover topics related to respectful attitude while interacting with the local community. • Regular toolbox talk with workers
Gender-based violence GBV/Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH)	Risk of gender-based violence GBV/Sexual Exploitation and Abuse (SEA)/Sexual Harassment (SH)	• Inclusion of clause on GBV/SEA/SH behaviour obligations in the employment contracts of all employees and construction workers aimed at strengthening measures to address and prevent SEA/SH in the workplace and construction areas. • Awareness training of DGDC, CSC, contractor, sub-contractor and service providers staff to sensitize them about SEA, and SH, and their responsibilities to prevent • Posting of CoC standards in public spaces at workers residences, and village information centers and public places of adjoining/neighboring communities • Raising awareness that SEA/SH is prohibited • Awareness to explain suspicious situations and the signs of SEA/SH; • Provide information on the use of GRM to report cases of SEA/SH and Code of Conduct breaches and assist victims of SEA, if signs of SEA are identified/a victim approaches them to complain about SEA; • Awareness to communities, particularly women and male and female children, to understand the risks of SEA and SH and the roles and responsibilities of parties involved in project implementation on SEA and SH prevention, processes for reporting incidents of project-related SEA/SH, and the corresponding accountability structures. • Strengthen the Contractors' obligations and capacity to public health and safety risks and ensure contractor supervision capacity to monitor the mitigation of these risks. • Proactive GBV/SEA prevention measures will be put in place, such as GBV/SEA related training to sensitize workers and local population along the project implementation area and ensuring that GRM for the project will also take care of GBV related issues if any. • There will be adequate mechanisms in place to protect the local vulnerable population, especially women and minors, from risks associated with the influx of workers (harassment, underage sex). This mechanism will ensure the sensitization and enforcement of the code of conduct by the Contractor employees and workers and all other parties that are involved in the project implementation. • Additionally, the Contractor will employ their skilled staff and apply unskilled construction labor from the local population as far as possible to minimize an influx of outsiders into the communities.

E&S Aspect	Impacts	Mitigation Measures
Health management of workers	Covid-19 related risks	• Contractors should ensure that workers are hired locally to the extent possible. • Contractors should provide training to all workers on signs and symptoms of COVID-19, how it is spread, how to protect themselves (including regular handwashing and social distancing) and what to do if they or other people have symptoms, as well as policies and procedures listed here. Training of workers should be conducted regularly, providing workers with a clear understanding of how they are expected to behave and carry out their work duties. Training should address issues of discrimination or prejudice if a worker becomes ill and provide an understanding of the trajectory of the virus, where workers return to work following infection. • A summary of basic guidelines and COVID-19 symptoms should be displayed at all civil works sites, with images and text in relevant ethnic languages. • Workers who are sick or showing possible symptoms should not be allowed on work site, should be isolated and referred to local medical facilities immediately. • Contractors should review worker accommodation arrangements to see if they are adequate and designed to reduce contact with the community. • • Contractors should provide workers with appropriate forms of personal protective equipment. • Contractors should ensure handwashing facilities supplied with soap, disposable paper towels, and closed waste bins exist at key places at the work site. • DGDC and contractors should together implement a communication strategy with the community in relation to COVID-19 issues on the site.
ESS3 (Resource Efficiency and Pollution Prevention) - Related		
Quarry sites	Adverse environmental impacts due to illegal quarry sources	• The Contractor will use approved quarry sites and operators to procure materials for the construction works. • The Contractor will submit the details of quarry sites and operators for approval of DGDC. • The list of approved quarries are available at the following website https://www.physicalplanning.gov.dm/applications/planning-approved/approved-quarries.

E&S Aspect	Impacts	Mitigation Measures
Soil erosions	Soil erosion and sedimentation from construction activities	The Contractor will develop an Erosion and Sediment Control Procedure that they and all Subcontractors will implement during all Project construction works. The Erosion and Sediment Control Procedure will incorporate a Landslide Management Procedure, which will contain measures to reduce the potential impacts of landslides (slope stabilization, planting, sandbags etc.), and Stormwater Management Procedures. In order to reduce erosion and sedimentation during Construction, the following general mitigation measures should be applied: • Strip the top soil, store and respread it after completion of works • Disturbance area will be minimized and clearly demarcated. • Works will only be conducted within the works zone. • Vehicle movements will be restricted to the defined roads/tracks. • Where possible, the works area will be designed to ensure stormwater runoff drains into the site. • Where required, sediment controls will be put in place. These will include, but not be limited to, sediment ditches, sediment ponds, sediment fences and silt socks. Silt curtains, fibrous mats etc., will be placed across as temporary stormwater drains to reduce the efflux velocity of the water and to aid in settling suspended sediment from the water. • Deposit surplus material in previously approved areas or reuse it as fill material. • Stabilization and progressive reforestation of affected areas with plants and vegetation native to the island.
Wastewater discharges from the construction sites	Pollution of surface water resources	• Sedimentation ponds, of adequate size and capacity, will be built for the treatment of discharges from the construction sites allow the sediments to settle. Final discharges from the sedimentation ponds shall comply with World Bank EHSG standards for wastewater standards. The settled sediments will be periodically removed and will be disposed of at the designated spoil disposal sites. • The contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the water
The risk of soil pollution by construction works	The potential risk of soil pollution from the storage of fuels and other hazardous waste	• Storage of fuels and chemicals in contained facilities and taking appropriate measures to avoid and contain any spillage. • Confine the contaminants immediately after such accidental spillage and clean up oil spills using spill kits. • Collect contaminated soils, treat and dispose of them as a hazardous waste • Topsoil from cultivated lands in the construction areas to be stripped and stockpiled where practical for later use for restoration of spoil disposal sites. • Temporary stockpiles to be protected from erosion.

E&S Aspect	Impacts	Mitigation Measures
		• Contractor will develop a pollution prevention and emergency response plan as part of C-ESMP and submit it for DGDC approval. The plan will detail procedures to minimize and address the risk of soil and water pollution.
Air and noise pollution from construction	The emissions from vehicles and construction equipment will pollute the air, causing health and safety issues as well.	• Construction equipment and vehicles will be well maintained so that emissions are minimal and comply with the applicable standards. • The Contractor will submit emission certificates for all vehicles/ equipment/machinery used for the project. • Regular pollution checks for construction vehicles shall be made. • High noise-producing equipment will be provided with mufflers or acoustic enclosures. • Construction planning takes into consideration of the school timings opening and closing and the timings of the examination. • Please refer to ESS 3 for measures to mitigate impacts of dust and noise pollution on community.
Generation of spoils (excess excavation) and their disposal	Indiscriminate disposal of spoils/ debris will cause nuisance and pollution of soil and water	The Contractor will make sure that excavated material is managed accordingly, as per the following provisions. • Excavated topsoil will be transported to, and stockpiled in, designated topsoil storage areas. • Prior to filling, sub-grade surfaces of depressions will be free of standing water and unsatisfactory soil materials will be removed. • All unnecessary excavated materials will be transported and deposited outside of the site at an approved facility. • Where excavated material is suitable to be used for fill and backfill, the material will be segregated and transported to a stockpile location at the construction site.
Construction waste, including solid waste	the areas of the construction works; Contamination of soils and water resources; Impacts on animals; Impacts on human health; Odours from residues in surrounding areas; and	The Contractor is required to develop a Waste Management Procedure that they and all Subcontractors will implement during all Project construction works. During construction, the Contractor shall be responsible for the clean-up of the Site on a daily basis. The Site is to be kept clean and tidy at all times and clean-up shall be performed throughout the day with a final emphasis on site clean-up at the end of each shift. This clean-up emphasis is to contribute to the safe working conditions at the Site. Disposal of waste materials, both solid and fluid, shall be in accordance with local regulations, good hygiene and good construction practice, including the avoidance of oil or chemical spillage or run-off into local waterways. At a minimum, the waste management plans, specific to each activity, shall demonstrate compliance with the following: • Particular attention should be given to the use and re-use of materials to minimize waste and, whenever practicable, using materials and products from sustainable sources. The Waste Management Procedure will be prepared in accordance with the waste hierarchy described above.

E&S Aspect	Impacts	Mitigation Measures
	Waste due to poor management of recyclable waste.	• Mechanisms for the collection, identification, temporary storage, and transportation of the waste before its transfer outside the Project areas. Waste will be stored in closed containers away from direct sunlight, wind and rain. Waste packaging will be in good condition, undamaged, corrosion and leak free. Waste will be stored so as to prevent or control accidental releases to air, soil, and water resources. In addition, waste will be stored in a manner that prevents the commingling or contact between incompatible wastes. Sufficient space is needed between incompatibles or physical separations such as walls or containment curbs. • Waste signs will be put on all waste containers and collection areas. Each sign will be highly visible and easily seen by the person using the waste container or area. Each container or waste area sign will be labelled as Domestic Waste, Non-Hazardous Waste or Hazardous Waste and include the responsible person with contact information and how to handle the waste. • Descriptions of responsible parties, procedures for registering and documentation of waste transfers, options for recycling, treatment and disposal of waste, including the proposed final destinations of those that cannot be reused, and measures for the reuse of waste; • Solid waste produced during construction will be disposed of in compliance with the regulatory requirements and classification regulations and will be outlined in the Waste Management Procedure. Expected types and estimation of waste volumes should be provided in the Waste Management Procedures. And, • Trainings for staff awareness. • Disposal. Transport and hand over the above wastes to the landfill site at Roseau by paying requisite fees to the Solid Waste Management Corporation that maintains the landfill site.
Hazardous waste	Adverse health impacts and pollution due to improper management of hazardous waste	• The Contractor will develop a Hazardous Substances Management Procedure that they and all Subcontractors will implement during all Project construction works. Under the Hazardous Substances Management Procedure, the Contractor will induct their workforce to be made aware of hazardous substances, with reference to the applicable Safety Data Sheets (SDS). They will also attend mandatory safety training in the correct way to use and handle hazardous substances. Training must be adjusted to be compliant with the laws of Dominica and any other relevant regulations prescribed by the competent authorities. For the handling of hazardous materials and waste: • Workers will be provided with the appropriate Personal Protective Equipment (PPE) for the handling and use of hazardous substances. • Emergency facilities, first aid points, clinics, eye wash fountains, emergency showers will be identified/provided where required.

E&S Aspect	Impacts	Mitigation Measures
		• Other facilities that will be available include fire extinguishers, first aid, communication equipment, emergency doors and alarms. • Smoking will be restricted to designated areas and all flammable liquids will be kept away from hot work areas. • Oil, fuel and lubricants storage and dispensing stations will be restricted to established locations. Dispensing area should be located on an impervious surface and under shelter where possible. • Oily and/or hazardous waste will be separately collected and disposed of by an appropriately licensed operator. • Storage areas will be identified and unauthorized entry will be controlled by use of barriers warning signs and close supervision. All hazardous substances will be stored away from construction activities under covered stores. 'No Smoking' signs will be placed at these locations and all storage areas shall have minimum one dry powder type fire extinguisher. • Hazardous and toxic wastes stored on site will be minimized by increasing the frequency of pick-ups where necessary. The producer of hazardous waste may store hazardous and toxic waste on-site for a maximum of 90 days. This period may be extended if the amount that is produced is less than 50 kg/day. • Adequate ventilation will be provided where volatile wastes are stored. • Secondary containment should be included wherever liquid wastes and hazardous substance are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater), in that specific location. • Triple rinsing must be undertaken before empty chemical containers can be treated as non- hazardous solid wastes. • Hazardous waste will be directed to the DSWMC for proper disposal. • Wherever possible, less hazardous substances will be obtained as substitutes. • DGDC will include contractual clauses that describe the requirements for transportation and disposal instructions so that they are handled appropriately and implement a “cradle-to-grave” approach where documentation for accountability is maintained from removal all the way to final disposal (noting quantities, types of materials, and names of people and companies handling the material).
ESS 4 (Community Health and Safety)		

E&S Aspect	Impacts	Mitigation Measures
GBV-SEA/SH Risks	GBV-SEA/SH risks may arise due to labor influx	Please refer to ESS-2 for the measures to address GBV/SEA/SH risks
Utilities	Potential damages to existing utilities or disruption of services and properties from construction activities	• Contractor will coordinate with the relevant authorities for identifying the location of these utilities and avoid these utilities for the trenching activities. • Contractor Use appropriate tools to locate utilities prior to trenching and avoid impacts on the underground utilities. • Coordinate with relevant utility companies for relocation of these utilities if required. • When Cracks in structures or damage due to construction works, the contractor will either repair the cracks to the satisfaction of the owner or pay compensation to the owner.
Traffic Management	Traffic congestion and blocking of access to side roads, residents, including schools, hospitals and businesses	• The contractor will develop and implement a traffic management plan with adequate measures such as proposing traffic diversion measures, alternate routes for local traffic, avoiding school hours, following speed limits, hiring licensed drivers, etc.). The plan will be implemented with the aim of ensuring access to residential areas and preventing unsafe situations, especially near schools, housing areas, construction areas. • In the traffic management plan, measures will be provided to ensure that the existing road network continues to provide safe and convenient access to all road users, including pedestrians and cyclists. For the purpose of pedestrian safety, it is important to liaise with road controlling authorities, schools, residents, businesses, sports facilities, major events organizers and emergency services. Consideration may need to be given to the speed at which the vehicles are permitted to travel on the public road network, especially in rural areas. • Disruption to access from houses and shops to roads: The contractor will make alternative arrangements for access to residences and businesses. • The highway should not be stopped for existing traffic. The contractor will maintain the traffic on both sides of the highway by placing appropriate control measures and flagmen. • Road signage will be fixed at appropriate locations to reduce safety hazards associated with project-related vehicular traffic. • Project drivers will be trained in defensive driving. • Ensure that all construction vehicles observe speed limits on the construction sites and on public roads. • Provide adequate signage, barriers, and flag persons for traffic control. • It is important that measures are put in place to minimize the potential impacts of the construction traffic. These measures are typically identified through the requirement for a traffic management plan. Where required this may seek to control the

E&S Aspect	Impacts	Mitigation Measures
		times of operation (e.g. avoiding peak periods or when large cruise ships arrive at Roseau Port) or routes used.
Community health and safety	Community exposure to work hazards, STIs and communicable diseases	• Barricade the work areas with hard fencing to prevent the entry of community in the construction areas. • Placing of adequate signboards and flagmen to divert the community away from the construction works. • Implementation of a traffic management plan near the construction sites • Community awareness programs on construction-related hazards, including awareness programs in schools. Construction activities such as blasting and excavation, particularly at the borrow areas, may pose safety risks to the nearby population. • First aid medical facilities will be made available at the worksite. • To ensure safe construction during the construction phase, lighting devices and safety signboards will be installed in the temporary accesses. • Plants and equipment will be installed sufficiently away from the settlements. • Proper caution signage, barricading, delineators, lightings etc., will be installed at the Construction zone and temporary diversions. • Proper traffic management will be ensured near roads of the Construction zone. • Road safety education will be imparted to drivers running construction vehicles. In case of negligent driving, suitable action will be taken. • Traffic rules and regulations will be strictly adhered to. • Adequate signage, barriers and persons with flags during construction to control the traffic will be provided. • Speed restrictions shall be imposed on project vehicles to control speeding. • Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations. • The general public/ residents shall not be allowed to any of the risk areas of the project, e.g., excavation sites, construction sites and areas where heavy equipment is in operation. • An Emergency Response system in case of any incidence will be developed and implemented.
Dust from vehicular movement on local roads and construction activities		• Dust generation from construction sites will be restricted as much as possible and water sprinkling will be carried out as appropriate, especially at those places where earthmoving, excavation will be carried out. • Frequent sprinkling of water on the local roads and worksites to control dust emissions. The contractor has to mobilize adequate water sprinkling trucks.

E&S Aspect	Impacts	Mitigation Measures
		• A GRM is in place to receive and address complaints from the public on various aspects of environmental issues, including dust pollution.
Employment Opportunities in Construction Activities	Non-compliance with labour management procedures	• Implement labour management procedures (LMP) • Encourage to engage local labour with the same terms and conditions as outside workers. • Each Contractor needs to establish a GRM for labour and community-related grievances. Monitor and notify community-related grievances to DGDC. • Prohibition of child labour. Persons below the age of 18 are not employed • No engagement of forced and bonded labor • Provision of a safe and healthy working environment for labour • Taking steps to prevent accidents, injury, and disease and appropriate treatment for those suffering from occupational injuries/diseases; and encourage insurance facilities for labour
ESS6 (Biodiversity Conservation) -Related		
Biodiversity Management Plan	Construction activities for TL right-of-way (RoW), and access road, which will result in vegetation and habitat loss, fragmentation, noise, erosion and sedimentation, wildlife disturbance and displacement. Operation of heavy machinery and vehicles for transportation, which will create noise, vehicular mortality, accidental fuel spills, and related wildlife disturbance; Erosion and sedimentation of water courses;	Implement the following Biodiversity Management Plan **Pre-clearing Surveys, and Rescue and Relocation** Once the area slated for vegetation removal has been demarcated, the Contractor's bird specialist will conduct pre-vegetation clearing surveys. Specialists with demonstrated experience and knowledge of terrestrial plant and fauna species will be required to confirm whether any endangered or endemic fauna are present in the area to be cleared, and to be handled appropriately. The following management measures will be utilized: • Acoustic deterrents will be used to disperse terrestrial ground-dwelling and flying fauna; • Specialist will record any fleeing fauna by type and number of individuals, as feasible, to supplement baseline records; • Any reptiles, amphibians, or small mammals remaining in the area slated for vegetation removal will be captured, photographed, measured, and relocated to suitable nearby habitat. This will be performed by specialists and trained locals. Suitable habitat will be determined prior to clearing surveys and will be within similar ecological characteristics and requirements; • If Project vegetation removal and ground-disturbance activities cannot avoid the bird-nesting and bat- breeding season (April through August), pre-clearing surveys will identify features to be avoided and 20 m buffers will be set up around sensitive areas during the construction phase.; • Examples of sensitive features and areas are active endemic or threatened bird nests, maternal bat roost colonies and other

E&S Aspect	Impacts	Mitigation Measures
	Introduction of invasive species during vegetation removal and transportation of vehicles, equipment and soil; and	microhabitats that are being use for reproduction and raising young. • Rescue and relocation efforts will be recorded within a monitoring database. Every individual rescued will be provided an ID number. Rescue and relocation records will include a photograph, time, date, collector, and location coordinates and mortality (if any). **Best Practice Vegetation Removal** DGDC will implement and manage activities related to the vegetation removal and tree felling process. The specific objectives of this project are to implement best-practice vegetation clearing methods. To minimize impacts, DGDC will implement the following best-practice measures: • Technical delimitation of authorized clearing areas, using security tape at a height of 1.5 m, visible enough to isolate the intervention area, and implementation of enforcement measures to avoid footprint "creep" into surrounding areas; • Minimize cleared areas and any temporary work sites; • Maintain vegetation barriers and trees where feasible; • Inspection of each target tree to identify risks and potential emergency situations, considering the location, inclination, physical state, extraction trails, wind conditions, and determination of the desired fall path; • Completion of vegetation removal and tree felling by workers with experience and training in tree felling; • Biologist identification of any sensitive fauna species in the area where tree felling will occur; • Tree felling during a time when impacts to fauna (breeding birds and bats) are minimal; • Whenever possible, vegetation clearance activities should commence outside the breeding season of the key threatened species. The breeding season or the key bird species are between January and August; Bats breed between April and August; Amphibians breed year round, but primarily between May and July. Advice should be sought from local authorities and experts on this matter; • One day prior to tree felling and vegetation removal, fauna dispersal utilizing noise (i.e., horns, machine equipment-chainsaws or other appropriate measures, etc.); • Presence of Contractor's biologist onsite as observers during vegetation removal to capture and relocate fauna offsite to undisturbed nearby habitat; • Use of low-impact and directed logging techniques; • A phased, directional approach to tree felling to allow mobile animals to escape from forest clearing activities; trees will be felled in a direction that will minimize damage to neighboring vegetation;

E&S Aspect	Impacts	Mitigation Measures
		• Avoid piling of clear-felled vegetation on standing live vegetation, and • Manage cleared material to minimize potential bush fire sources. • Vegetation removal management include-on site decomposition, burning, or be recycled as fire wood or building material where possible. Provide wood to the community for use as fences or for charcoal production. This is acceptable according to Dominican law. **Revegetation of Temporary Areas** DGDC will support measures designed to conserve and revegetate as much cleared vegetation as possible within the Project Area. The contractor will implement the following measures: • Rehabilitation of all disturbed areas (e.g., temporary laydown areas) will be undertaken following construction. This will be done in such a way as to facilitate natural regeneration of vegetation; • Specialists will determine selection of native trees and shrubs to replant to ensure appropriate succession of native trees and reduce the potential for bush fires; • In appropriate areas, native and endemic trees that may be used as food sources by native bats and birds will be planted in temporary cleared areas; and • Habitat will also be restored and/or enhanced to increase the value to wildlife. For example, rocks and woody debris can be added to areas to increase availability of wildlife refuges. **Habitat Management Biodiversity Offset** • The proposed transmission line development under DGRMP II will not impact any natural habitats, and the anticipated impacts on the biodiversity and critical habitat features are mitigated through adequate mitigation measures with no residual impacts (see mitigation measures in Sections 5.7.1 to 5.7.5). Hence, DGRMP II does not warrant any biodiversity offset measures. However, the biodiversity offset measures in the Power Plant ESIA are re-presented below to explain the DGDC's original plans to address the loss of natural habitats associated with the power plant development, and will be implemented along with the DGRMP II. • DGDC will implement a Habitat Management Procedure (HMP) to offset impacts to terrestrial natural habitat due to the Geothermal power plant . The Project modifications consist of clearing vegetation within 4.62 ha, of which 2.7 ha is natural tropical forest habitat. • The objectives of the HMP is to i) provide enhancement measures for post-Maria terrestrial biodiversity of the area, and

E&S Aspect	Impacts	Mitigation Measures
		ii) establish biodiversity offset required to achieve No Net Loss of Natural Habitats, with input from local specialists and stakeholders as appropriate. • The activities to be undertaken include: • Plant native tree species and native grasses with organic fertilizer in areas where trees have fallen to stabilize ground conditions on bare slopes, improve ecological resilience, and reduce rainwater run-off and erosion; • Plant native tree species in areas surrounding well pads and other infrastructure to reduce erosion and improve landscape connectivity; • Support local nurseries to grow more trees to be planted and used by local community, as possible; • Restore river courses by planting native trees, removing fallen trees and large rocks that may cause flooding and increased erosion; and • Create microhabitats and hibernacula for animals impacted by the loss of tree canopy cover. • DGDC will identify degraded areas due to Hurricane Maria for restoration based on reduced and broken habitat cover, bare exposed ground, downed or damaged trees, and areas of debris build up due to Hurricane Maria. DGDC will restore 2.7 ha to compensate for the loss of natural habitat, and adhere to the "like-for-like or better" principle. Additional areas for restoration include sloped areas without trees or vegetation exposed by Hurricane Maria and landslides.
	Use of artificial night light during construction activities, which will create wildlife disturbance and mortality	**Artificial Lighting and Management** • Reduce the duration of light to extent possible via the use of timers and motion detectors; • Avoid ultraviolet (UV) light and shorter wavelength light; • Use low wattage lamps (<70 Watts (W)); • Use yellow light or red light that does not contain blue, violet, or UV wavelengths, as these attract fewer insects than UV or bluish/white lights; • Plan and design light intensity and configuration, spacing, height, and directionality to reduce the intensity and spillage of light to minimize overall illumination; • Use light only when needed and preferably turn off lights during times of peak bird migration; • Ensure there are light-exclusion zones within the Project property; • Avoid upward pointing lights and install directional accessories on existing light units to direct light away from sensitive areas and minimize light spill, if necessary; and • Adapt mitigation measures if lights are shown to have an impact based on bird, bat, and invertebrate monitoring reports.

E&S Aspect	Impacts	Mitigation Measures
	Potential poaching and illegal trade of wildlife	**Illegal Wildlife Trade** • The Contractor's code of conduct for workers will include conditions on the protection of flora and fauna and ban on cutting of trees, and a ban on hunting and poaching of wildlife. Employees found violating would be subject to strict actions, including fines and termination of employment. • Contractors instruct workers on forbidding hunting or collecting natural resources of workers. Contracts can also include articles that require use of access controls/checkpoints, zero tolerance of any illegal biodiversity resources in worker camps (such as wildlife products sold to construction workers; products of illegal hunting along access roads; pets taken from the wild) and offer workers appropriate food/canteen options that will reduce demand for seeking local food options. • The DGDC GRM provides a safe and anonymous line for reporting activity for workers, communities or any stakeholders whereby they are safe from retribution from other community members, organized crime or government officials. • If a crime is committed, national authorities need to be alerted immediately. In addition, sometimes, live animals can be rehabilitated, and the appropriate national authorities or non-government organizations need to be contacted to collect the animals to avoid risks of harm to people and the animal(s). • Contractors shall be responsible for demonstrating that timber procurement is limited to those suppliers that can demonstrate that timber is legitimately sourced and does not contribute to significant conversion or degradation of natural or critical habitats
	Adverse impacts due to the introduction of invasive alien species on biodiversity	**Spread of Invasive Alien Species (IAS)** • Use the designated roads for accessing the construction sites. Avoid using the forest roads and passing through the forests by construction equipment, vehicles and labour. • Native tree species will be used for the plantation activities • Construction sites will be rehabilitated at the earliest opportunities, and rehabilitation plans with IAS control measures appropriate to the IAS risk prevailing in the project area. • Construction vehicles will be brought to the site in an 'as-clean-as-new' condition to ensure that invasive plant material and seed-bearing soil are not introduced. • All vehicles will be cleaned on a regular basis to prevent the unintentional spread of IAS within the project area. • IAS will be regularly controlled in construction vehicle parking and operational areas, including construction sites
	Risk of bird collision with the Birds	**Bird Collisions** • Installation of Wire-marking devices increases the line profile and visibility along the overhead transmission lines to minimize

E&S Aspect	Impacts	Mitigation Measures

		bird collisions. They have a reflective and fluorescent plate, illuminating in low light.
		• Two types of marking devices exist.
		  o Passive Markers. Passive wire markers increase line visibility by increasing the line's profile.
		  o Active wire markers increase the line profile and use movement to increase visibility.
		• Installation of a Bird Strike Indicator (BSI) is an automated vibration-sensing and recording tool designed to detect bird strikes on power lines. BSIs use accelerometers to record stress waves and vibrations caused by a bird strike. BSI sensors are installed on the monitored wires and transmit strike activity wirelessly to a nearby base station where the data is recorded. BSIs allow data to be collected 24 hours a day and in all weather conditions.
		• Monitoring the effectiveness of markers and diverters to ensure their effectiveness in reducing bird collisions.
		• Monitoring will be conducted periodically and over an extended period to gather sufficient data for analysis. If the markers and diverters are found to be ineffective or if bird collisions persist, adjustments to the installation or alternative measures may need to be considered to improve their effectiveness.
		• The Contractor team will include a bird specialist during the design phase to design the bird diverters.

ESS8 (Cultural Heritage) - Related		
Chance finds during construction.		Chance find procedures that will be used during this Project are as follows: • Stop the construction activities in the area of the chance find; • Delineate the discovered site or area; • Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a nightguard shall be present until the responsible agency (Ministry of Youth, Sports, Culture and Constituency) take over; • Notify the Owner's Engineer who in turn will notify the responsible local authorities immediately (within 24 hours or less); • Responsible local authorities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists (within 72 hours). The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historical, scientific or research, social and economic values; • Decisions on how to handle the finding shall be taken by the relevant authorities. This could include changes in the layout

E&S Aspect	Impacts	Mitigation Measures
		(such as when finding an irremovable remain of cultural or archeological importance), conservation, preservation, restoration, and salvage; • Implementation of the authority decision concerning the management of the finding shall be communicated in writing by the relevant department; and • Construction work could resume only after permission is given from the local authorities and relevant department concerning the safeguard of the heritage.

6.3.3 Construction Stage Monitoring Plans

The proposed monitoring plan to be carried out during the construction stage of the Project to ensure contractors are complying with the mitigation measures is given in **Table 6.4,** along with the monitoring indicators and frequency. The Contractor will be responsible for the implementation of the plan and submit the results in their monthly reports. The Owner's Engineer will supervise the implementation. DGDC will also engage an independent E&S Monitoring Consultant for an independent monitoring of the parameters listed in Table 6.4.

Table 6.4: Effects Monitoring Plan During Construction

(**Note**: DGDC will include this Table in the Contract Specifications of the Bidding Documents)

E&S components	Monitoring Parameters	Frequency of Monitoring
Health and safety risks	Sanitation status of Onsite and Office buildings Usage of adequate PPEs Adequate Health and Safety Training for workers Fire Safety measures on site Incident/ Accident Records Permit to Work Records Labour Records Labour Insurances Vehicle Log Books Grievances – Labour and Community GBV-SEAH incidents	Weekly
Safety of workers	Accident Group Insurance of Workers, provision of personal protective equipment/ Use of ear muffs and other personal protective equipment by the workers	Daily during the construction stage
Dust	Visual observation at the construction sites	Daily at all work sites
Waste water discharges	Turbidity, Conductivity, and pH will be conducted at site with the help of portable kits, effluents from construction sites.	Weekly basis

E&S components	Monitoring Parameters	Frequency of Monitoring
Obstruction of drainage	Roadside drainage discharge, water impounding area during rain, waterlogging	Daily during the construction stage
Waste	Waste inventory for both hazardous and non-hazardous waste, Waste Labeling, storage and disposal records	Weekly at yards and storage areas
Noise	Measurement of noise using portable meters	Weekly at all work sites
Number of felled trees	Statistics of removed and planted trees, nurseries and plantations	During the time of tree felling on a daily basis
Wildlife	Visual inspection of the site area for death or injury of any higher faunal species, and habitat disturbances due to project activities.	Daily during the construction stage
Control of Invasive Alien Species (IAS)	Risk assessments conducted prior to species introductions, regular equipment and vehicle cleaning and control of IAS.	Daily during and after the construction stage
Fire-hazard	Project management checklists, site monitoring, fire-extinguishers in offices and work sites	Daily during the construction stage
Community Health and safety	Nuisance to adjoining communities from the construction related works, grievances due to annoyance from the construction related works.	Daily during the construction stage
Road safety	Traffic Signals, no horn signs, road signals and markings, speed control and GPS-tracking, traffic related incidents	Daily during the construction stage
Grievance Redressal	Management of Grievance Redress Mechanism	During the construction stage
Traffic Management	Compliance with Traffic Management Plan	Daily during the construction stage
Gender-based violence and human trafficking	Review and addressing grievances	Daily during the construction stage
Stakeholder engagement	Compliance with SEP	During the preconstruction and construction stage

6.3.4 Reporting on ESMP Compliance

DGDC and its Contractors will prepare periodic monitoring reports on the status of implementation of ESMP and will be submitted to World Bank for their review and feedback. Details of these reports and their content are given in **Tabl6.5**.

Table 6.5: ESMP Monitoring and Compliance Reports

#	Title of the Report	Contents of the Report	Frequency of Report Preparation	Report to be prepared by
1	E&S Monitoring Report	The compliance status of the Project with environmental and social mitigation and monitoring measures. Besides the report also covers: • environmental incidents; • wildlife-related incidents, • health and safety incidents, • health and safety supervision: • Usage of PPEs by workers • worker accommodations • Training conducted and workers participated • Workers grievances • Community grievances • Chance find (if any)	Monthly	Contractor
2	ESMP Monitoring Report	The compliance status of overall Project with ESMP requirements	Quarterly	DGDC
3	Incident Reports	Incident investigation reports for all major incidents covering details of the incident, root cause analysis, and actions taken to address the future recurrence of this event.	Initial investigation report within 24 hours Detailed Investigation Report within 15 days	Contractor

6.4 Environmental and Social Management During Operation

6.4.1 O&M Stage Mitigation Plans

Detailed mitigation plans for operation and maintenance (O&M) stage impacts have been prepared on the basis of the detailed impact assessment covered under Chapter 5.

Table 6.6: E&S Impacts and Risks in O&M and Mitigation Measures

Impact	Mitigation Measures	Responsibility for implementation
Workers' health and safety during routine maintenance works	• Contractor is required to prepare, obtain approval of, and implement an occupational health and safety (OHS) plan. These plans will be prepared in compliance with the World Bank Group's EHSGs. The plan will be reviewed and approved by DOMLEC.	DOMLEC
Workers may be exposed to occupational hazards from contact with live power lines during construction, maintenance, and operation activities.	• Only allowing trained and certified workers to install, maintain, or repair electrical equipment; • Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities. • Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface.	DOMLEC
Workers may be exposed to occupational hazards when working at elevation during construction, maintenance, and operation activities.	• Testing structures for integrity prior to undertaking work. • Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others; • Establishment of criteria for the use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to point; • Installation of fixtures on tower components to facilitate the use of fall protection systems; • Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached; • Hoisting equipment should be properly rated and maintained and hoist operators properly trained; • Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent	DOMLEC

Impact	Mitigation Measures	Responsibility for implementation
	strength. Rope safety belts should be replaced before signs of aging or fraying of fibres become evident; • When operating power tools at height, workers should use a second (backup) safety strap; • Signs and other obstructions should be removed from poles or structures prior to undertaking work; • An approved tool bag should be used for raising or lowering tools or materials for workers on structures.	
Electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines and in grid stations.	• Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities; • Training of workers in the identification of occupational EMF levels and hazards; • Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers; • Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE). Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials.	DOMLEC
Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers	Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be: • Remote from entry and exit points into buildings • Away from facility ventilation intakes or vents • Have natural or passive floor and ceiling level ventilation and explosion venting • Use spark-proof fixtures • Be equipped with fire extinguishing devices and self closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems	DOMLEC

Impact	Mitigation Measures	Responsibility for implementation
	Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment) • Providing specific worker training in handling flammable materials and in fire prevention or suppression	
Community health and safety from exposure to maintenance works	• Ensure that all construction vehicles observe speed limits on the construction sites and on public roads • Provide adequate signage, barriers, and flag persons for traffic control. • Barricade the work areas with hard fencing to prevent the entry of the community into the construction areas. • Frequent sprinkling of water on the local roads and worksites to control dust emissions	DOMLEC
Impact on Birds	• Installation of Wire-marking devices increases the line profile and visibility along the overhead transmission lines to minimize bird collisions. They have a reflective and fluorescent plate, illuminating in low light. • Monitoring the effectiveness of markers and diverters to ensure their effectiveness in reducing bird collisions. • Monitoring will be conducted periodically and over an extended period to gather sufficient data for analysis. If the markers and diverters are found to be ineffective or if bird collisions persist, adjustments to the installation or alternative measures may need to be considered to improve their effectiveness. • The Contractor team will include a bird specialist during the design phase to design the bird diverters.	Installation by Contractor and monitoring by DOMLEC

6.4.2 O&M Stage Monitoring Plans

The proposed monitoring plan to be carried out during the O&M stages of the Project is given in **Table 6.7,** along with the monitoring indicators and frequency. DGDC's ESU staff will be responsible for the implementation of the plan.

Table 6.7: Effects Monitoring Plan During O&M

Parameter	Means of Monitoring	Frequency	Responsibility for implementation
Noise Quality at substations	Field Measurements	Yearly	DOMLEC
EMF at substations and overhead transmission lines	Field Measurements	Yearly	DOMLEC
SF6 leaks	Field Sampling and Analysis	Yearly	DOMLEC
Bird Collisions	Site monitoring	Monthly	DOMLEC
Community health and safety	GRM	Monthly	DOMLEC

6.5 Capacity Building and Training

The environmental and social training will help to ensure that the requirements of the ESMP are clearly understood and followed by all project personnel. The E&S staff of the Owner's Engineer and contractors will be responsible for implementing these trainings. The contractor will also be required to provide environmental and social training to its staff to ensure the effective implementation of the ESMP. The training plan shall include a program for the delivery of intermittent training to cover the subjects included in **Table 6.8**. Training should be carried out initially at the induction of staff and repeated throughout the project.

Table 6.8: Environmental and Social Training Programs

Contents	Participants	Trainer	Schedule
Environmental and social impacts of the Project and ESMP requirements of the Contractor; World Bank Group Environmental Health and Safety Guidelines. The contents for the second and subsequent training programs will cover topics related to the issues associated with on-going construction activities.	All the technical Staff of DGDC, and relevant technical staff of DOMLEC who are involved in the management of environmental and social issues associated with routine operation and maintenance of the project. Site Engineers of the Owner's Engineer and E&S staff of the Contractors.	E&S staff of the Owner's Engineer	During the initial stages of the Project implementation. The training will be repeated every six months.
Environmental and Social issues associated with the ongoing construction works; Workers' health and safety	Site Engineers of the Contractor, DGDC, and the Owner's Engineer	EHS staff of the Contractor	On a monthly basis
Code of Conduct Occupational Health and Safety	Construction crew	Contractors EHS Staff	Prior to the start of the construction activities and during the construction activities (To be repeated as needed.)
Capacity building of DOMLEC in management of 33 kV and 69 kV lines	DOMLEC O&M Staff	Consultants	During implementation of Component 2 of the project

6.6 Budget for Implementation of ESIA

A lump sum budget is provided for the implementation of the ESMP, which is estimated at 1% of the contract value. This amount will be entered in the Bill of Quantity of respective lots. The Contractors shall provide a Breakup of this Lump sum item within thirty (30) days of Commencement of Works. The budget for implementing the ESIA, including the ESMP, SEP, staffing and capacity building measures are given in Table 6.9.

Table 6.9: ESIA Budget

S.No.	Description	Unit	Quantity	Rate, USD	Amount, USD	Remarks
1	Contractors key E&S personnel (E&S specialist and bird specialist)	staff	2			Included in construction cost
2	Capacity building programs (refer to Table 6.8)	Number	10	5,000	50,000	Includes travel costs of trainers and material
3	Personal protection equipment to workers	Number	100	200	20,000	
4	Management of waste	Lump sum			20,000	Fees for landfill site
5	Dust control at works sties and access roads, and pollution prevention	Lump sum			20,000	
6	Traffic management plan	Lump sum			20,000	
7	Vegetation clearing surveys and biodiversity monitoring	Lump sum			25,000	
8	Bird diverters and wire marking devises (at 10 m intervals along 4.8 km of OHT line)	Numbers	480	100	48,000	
9	Bird striker Indicator systems (at 1 km intervals), including establishing a base system for remote monitoring	Number	5	35,000	175,000	
10	Environmental monitoring during construction (Table 6.5)	Lump sum			20,000	
11	Environmental monitoring during operation (Table 6.7)	Lump sum			50,000	
12	SEP Implementation				18,000	Refer to SEP for the breakdown
13	Staffing Budget for Environmental Consultants (flora and fauna) of DGDC	Person months	18	5,000	90.000	Two consultants, each for 9 months
14	Budget for engaging Independent E&S Consultant	Person months	12	5,000	60,000	Two consultants, each for 6 months
	Total				**616,000**	

7 Institutional Arrangements

Details of institutional arrangements for the implementation of the ESMP are given in this chapter.

7.1 Institutional Arrangements for ESMP Implementation

7.1.1 DGDC, the Employer

The principal responsibility for the implementation of ESMP is the DGDC and its contractors. DGDC has experience working with the World Bank and has recently completed the DGRMP. The organogram of the DGDC is shown Figure 7.1. There are eight permanent staff members at DGDC, including Eight positions are Managing Director, DGRMP II Program Manager, E&S Lead, Social Specialist, Finance/HR Lead, Community Liaison Officer, Program Support Officer, and Site Officer.. E&S implementation of DGRMP has been satisfactory. Under the proposed project, DGDC will engage additional environmental consultants on flora and fauna. Further, technical specialists, including EHS specialists from DOMLEC will be appointed as secondees to the project. .

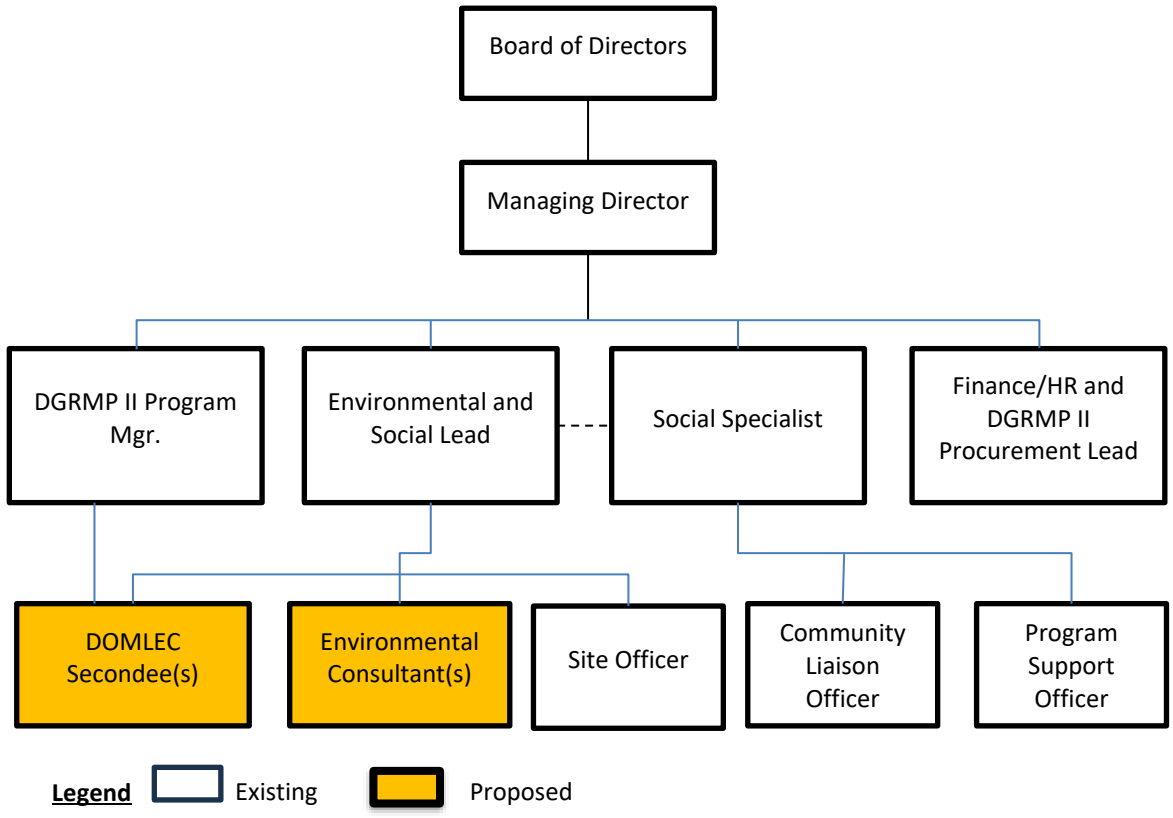


Figure 7.1. DGDC Organogram

7.1.2 Owner's Engineer, the Project Manager

The Project Manager (Owner's Engineer) is appointed by the Employer (DGDC) to perform duties delegated by the Employer. The Owner's Engineer will be responsible for the supervision of environmental and social mitigation measures as per ESMP and compliance monitoring of the construction contractor's

activities and prepare periodic monitoring reports for submission to WB and DGDC., review monthly monitoring reports submitted by Contractors, identify needed corrective actions and follow-up actions, conduct regular site inspections to validate monitoring reports and identify unanticipated environmental impacts, compel contractors to take corrective actions within the specified timeframe to address non-compliances, organize stakeholder consultations workshops that will serve as the external monitoring mechanism for the project. Sofreco was engaged as the Owner's Engineer and will be responsible for carrying out the above tasks. The Engineer's team includes one EHS Specialist and one Social Risks Management specialist who shall directly assist the DGDC with its duties.

7.1.3 Independent E&S Consultant

DGDC will engage an Independent E&S Consultant to verify compliance with environmental, social, health and safety (ESHS) performance of the Project, including but not limited to the implementation of the ESCP, implementation of ESMP, BMP, RAP, stakeholder engagement activities, and functioning of the grievance redress mechanism. The Independent Consultant team will include an environmental specialist and a social specialist.

7.1.4 Contractors

The Project will engage one or two Contractors, one for the transmission line network and the other for substation construction. The contractors will be responsible for the detailed design and construction. The Contractors shall be primarily responsible for the implementation and internal monitoring of all environmental and social management measures associated with Project design and construction, develop a Contractor's Environmental and Social Management Plan C-ESMP based on the ESMP of the project, which addresses all applicable construction phase, and revise it as needed in order to obtain approval from Owner's Engineer/DGDC. The Contractor shall have the sole responsibility for all activities on sites under its control for the duration of construction. This includes the activities of all subcontractors, whether employed or contracted directly or indirectly by the Contractor. Accordingly, it shall be the Contractor's responsibility to ensure that all activities are compliant with Project plans, permit and approval conditions, and any other statutory requirements. The Contractors will employ the E&S staff to oversee the Project's E&S performance and ensure that staffing and resources are adequate, commensurate with the magnitude and timing of work and potential E&S risks, submit monthly report to Engineer/DGDC on the status of ESMP implementation, implement corrective actions as instructed by Engineer/DGDC.

The E&S staff of the Transmission Line Contractor shall include an EHS Specialist and a Bird Specialist (with experience in birds). The Grid Station Contractor shall have an EHS Specialist.

7.1.5 Dominica Electricity Services Limited

Dominica Electricity Services Limited (DOMLEC) is responsible for the Project's operation and maintenance (O&M). DOMLEC has 3 Health, Safety and Environment officers (one senior and two junior officers). The staff have experience only managing 11 kV lines, but not the 33 kV and 69 kV lines. Additionally, DOMLEC also has a PR Officer (customer outreach, including health and safety) and a Customer Service Officer (GRM) in its Commercial Department. Component 2 of the Project includes institutional strengthening and capacity-building programs of the DOMLEC.

7.2 Institutional Framework for Implementation of ARAP

Given the commitment of the Government to comply with the Bank's policy, the DGDC has been delegated the authority to act on behalf of the Ministry of Energy to provide support to the Lands Department in

ARAP implementation. A cooperation agreement was signed between DGDC and the Department of Lands and Surveys in November 2019 to formalize the relationship in ARAP implementation for the ongoing project (DGRMP I). The agreement outlines the roles and responsibilities of each party with respect to lands. In DGRMP II, DGDC continues to be responsible for the overall ARAP implementation. The Department of Lands and Surveys will be responsible for the land acquisition and easement, i.e., formal valuation, negotiation with individual PAPs, and compensation payment. Grievances related to land valuation and compensation will be addressed by the Lands Department, while other grievances related to ARAP implementation, such as the impact on livelihoods, will be addressed by DGDC.

DGRMP II includes a TA component to support DOMLEC in operating and managing the 33kV and 69kV transmission lines. DOMLEC workers will have to enter PAPs' properties to access pole structures, overhead transmission lines, and/or underground cables for maintenance. TA component will support DOMLEC to develop/strengthen a land entry protocol, Code of Conduct, and GRM by building on the Electricity Supply Act and the Customer Service Charter.

Please refer to the ARAP for further details.

7.3 Environmental and Social Commitment Plan

DGDC has prepared a stand alone Environmental and Social Commitment Plan (ESCP). A summary of key commitments of the government given below but for the details of each commitment and respective timeframe, please refer to the standalone ESCP available on DGDC's website.

- Quarterly submission of reports on the E&S performance of the project
- Reporting any incidents within 24 hours of the incident
- Maintaining the DGDC with an EHS specialist, a social specialist, and a community liaison officer
- Preparation of monthly reports by the contractor
- Incorporating the ESMP in the bidding documents
- Implementing the Contractors-ESMP, including LMP
- Preparation and implementation of ARAP prior to commencement of any civil work
- Stakeholder engagement and consultations according to SEP
- Maintaining grievance mechanism
- Capacity building of the project staff on World Bank ESF requirements
- Hiring an independent E&S Monitoring Consultant to verify compliance with environmental, social, health and safety performance of the Project

7.4 Grievance Mechanism

DGDC has an established project GRM, which was set up under the on-going project (i.e., DGRMP I). The GRM has been accepting grievances related to RAP implementation and will also be used under the proposed DGRMP II. PAPs can submit grievances by the following channels:

- On-line form: https://www.geodominica.dm/grievance/reporting/
- Email: Allan.toussaint@geodominica.com
- Phone: (767) 448 6178/79; 275 7392
- Address: DGDC, Floors 1&2, 18 Kennedy Avenue, Roseau
- Grievances Mailbox placed at community centres. More grievance mailboxes will be placed in Roseau Valley.

DGDC's GRM is detained in SEP.

8 Stakeholder Engagement and Public Consultations

Details of stakeholder consultations and feedback received from the stakeholders and actions taken or to be taken up by DGDC to address their concerns are described in this chapter.

8.1 Project Stakeholders

The project stakeholders are categorized as:

Affected parties:

Project affected parties are persons, groups, and other entities near the project sites. that are directly influenced (actually or potentially) by the project and/or have been identified as most susceptible to change associated with the project, and who need to be closely engaged in identifying impacts and their significance, as well as in decision-making on mitigation and management measures. For the proposed DGRMP II, affected parties include:

- PAPs, i.e., landowners, tenants, and squatters who will be affected by land acquisition/easement
- Construction workers (mostly local)
- Community members in Corridor of Impact (CoI) who could be affected by civil work (damage to property, noise, dust, traffic, access to properties/schools, etc.)
- Road users, including commuters, taxi/minibus drivers, and truck drivers
- Tourism sector, including tour operators and hotels/lodges
- Roadside business owners, including shops and restaurants

Interested Parties:

Other Interested Parties. Other interested parties are individuals/groups/entities that may not experience direct impacts from the Project but who consider or perceive their interests as being affected by the project and/or who could affect the project and the process of its implementation in some way. For the proposed project, other interested parties include:

- Community/town councils
- General public
- DGDC
- Dominica Electricity Services Ltd. (DOMLEC)
- Other government organizations, such as Department of Lands, Department of Forestry, Environmental Coordinating Unit (ECU), etc.
- NGOs/Civil Society Organizations (CSOs), including National Council of Women, Dominica Council on Aging, and Dominica Association of Persons with Disabilities

Disadvantaged/vulnerable individuals or groups:

Disadvantaged/vulnerable individuals or groups are persons who may be disproportionately impacted or further disadvantaged by the project(s) compared with any other groups due to their vulnerable status, and that may require special engagement efforts to ensure their equal representation in the consultation and decision-making process associated with the project. Within the Project, vulnerable or disadvantaged groups may include but are not limited to the following:

- Landless (tenants and squatters) who are affected by land acquisition/easement,
- Female-headed households
- Disabled
- Elderly
- Migrants

8.2 Consultation Meetings

8.2.1 Previous Consultations

Under the DGRMP, DGDC has carried out a number of stakeholder engagement activities in Laudat, Trafalgar, and Wotten-Waven communities since 2012. The three communities were affected by drilling and construction of geothermal power plant and/or transportation of heavy machinery and equipment. The engagement activities include public consultations, consultations/interviews with community members, and focus group discussions (FGGs) with business owners (tourism lodges and operators). DGDC has been undertaking information outreach through community councils, school visits, media, and social media groups. The main questions/feedback have been on community health and safety, construction impacts, natural hazards, and employment opportunities.

In preparation for the proposed DGRMP II, DGDC initiated FGDs with twelve local councils in Corridor of Impact (CoI) in Roseau Valley and West Coast[13] between May and August 2022 (i.e., Colihaut, Fond Cole, Salisbury, St. Joseph, Mahaut, Roseau, Laudat, Portsmouth, Trafalgar, Canefield, Coulibistrie, and Dublanc). 69 council members (30 men and 39 women) participated in FGDs. The council members were overall supportive of the proposed transmission line network, which was understood to be a part of the ongoing geothermal development. Key questions/feedback include the safety of higher voltage overhead lines, expected economic benefits of the geothermal project, and the planned delivery date of power from the geothermal plant.

8.2.2 First Round of Consultations

In March 2023, DGDC conducted face-to-face public consultations in six communities in CoI, i.e., Portsmouth, Mahaut, Colihaut, St. Joseph, Fond Cole, and Trafalgar. A total of 55 community members (32 men and 23 women) participated in the public consultations. Key questions/feedback raised include the safety of electromagnetic fields/radiation, project design, economic benefits, land acquisition/ compensation, land use restrictions, and employment opportunities.

8.2.3 Second Round of Consultations

The second round of consultations was carried out after the disclosure of the draft E&S instruments to share the findings of ESIA and to obtain their feedback. Two community-level meetings were held on July 26 and 27, 2023 (at Trafalgar and Fond Cole), and a national-level meeting was held on August 1, 2023, in Roseau. 30 people participated in three consultations (18 men and 12 women). There were 178 views of the Facebook live video of the national consultation. Key feedback in these consultations includes

[13] Communities along the major highway were consulted, in anticipation of the extension of transmission line network from Fond Cole to Sugar Loaf (near Portsmouth City in northwest) (FSI). The underground cables would be installed in major highway connecting Roseau and Portsmouth. Originally, FSI was within the scope of DGRMP II but was dropped.

health/safety related to power production/transmission near homes, construction impact on communities and tourism, and economic benefit (see Table 1 for the summary of consultations).

8.3 Feedback from Consultations

Feedback from the consultations was overall supportive of the project from both local communities and government agencies. All participants unanimously agreed that the draft environmental and social reports were very comprehensive and extensively covered all environmental and social aspects, including measures for the protection of wildlife, prevention of pollution, and entitlements for resettlement and rehabilitation assistance. The feedback from the first-and second round consultations is summarized in Table 8.1.

Table 8.1: Feedback from First-Round of Consultations

Stakeholder (Group or Individual)	Dates of Consultations	Summary of Feedback	Response of Project Implementation Team	Follow-up Action(s)/Next Steps	Timetable/ Date to Complete Follow-up Action(s)
Community members in Portsmouth, Mahaut, Colihaut, St. Joseph, Fond Cole, and Trafalgar	March 2023	Concerns about the electromagnetic field.	EMF will be relevant to overhead lines only. WHO and WB-endorsed have exposure limits, and the design will be within those limits. 69kV is very small and way within the limits. For the most part, lines will be away from communities.	Known hazards from electromagnetic fields are accounted for in the design. The project will be audited and held to WB standards.	Considered in project design
		Type of poles to be erected?	Tubular steel poles, designed for 288 km wind. They are safe at a higher voltage and resilient to Category 5 Hurricane.	N/A	Addressed
		Will my electricity bill be cheaper?	The primary purpose is to reduce dependence on diesel and stabilize and reduce the price of electricity.	The power generated by the geothermal plant will be sold to DOMLEC.	O&M phase

Stakeholder (Group or Individual)	Dates of Consultations	Summary of Feedback	Response of Project Implementation Team	Follow-up Action(s)/Next Steps	Timetable/ Date to Complete Follow-up Action(s)
		Can all transmission lines go underground?	33 and 69 kV lines are to dispatch the power to Fond Cole and the north. Having underground and overhead transmissions will ensure continued electricity supply in case of emergency.	It is costly to have all transmission lines underground.	The West Coast alignment to be determined (overhead or underground) in the follow-on investment.
		How deep under the river do you expect to run these lines? Any effect on the species under the river?	The 33 kV line crosses small seasonal streams. The 69 kV doesn't cross any streams. For works under River, directional drilling will be used which will be 3-5 meters below the waterbed.	ESIA to be prepared and implemented	FSI alignment to be determined in the follow-on investment
		ESIA to complete before any work? Can I comment?	Your comments, questions will be used to inform the ESIA and will be included in the final design.	ESIA to be prepared and consulted	National consultation held in August 2023
		Will there be technical people from Dominica understudying and learning so that we will have local people to maintain?	Yes. This has already started with the drilling. So, there are local engineers learning.	Addressed	DGRMP II will also engage local engineers.
		You spoke about high standards of social protection and fairness in compensation. To	We monitor environmental and social safeguards internally, and there also is an	RAP to be prepared and implemented	Draft ARAP prepared and consulted

Stakeholder (Group or Individual)	Dates of Consultations	Summary of Feedback	Response of Project Implementation Team	Follow-up Action(s)/Next Steps	Timetable/ Date to Complete Follow-up Action(s)
		what degree is this being followed?	external audit. All lands acquired, are duly compensated through a Lands Department led process.		
		What happens if people are not compensated?	We do not start construction, unless the people are compensated.	RAP to be prepared and implemented	Draft ARAP to be prepared and consulted
		Given that one is permitted to be within 15m on either side – would you acquire the property there?	It will be a mix of acquisition and easement agreements. The areas with the actual structures will be acquired. Where land use is restricted, an easement will be applied.	RAP to be prepared and implemented	Draft ARAP to be prepared and consulted
Public consultations on E&S tools (national and two local consultations in Trafalgar and Fond Cole)	July/August 2023	The proposed power lines are connected to the Fond Cole substation. This substation already houses a thermal power station and is located close to Roseau. Will the proposed project generate additional noise and pose fire risks??	The proposed development will include adequate noise and fire control measures in the design. There will be less reliance on the existing thermal power station after completion of the project. Hence impacts associated with the existing power plant (e.g. noise) will be reduced.	Addressed	ESMP implementation during the construction and operation phases
		If there is a hurricane, would lines be affected?	The overhead lines will be built to	Communication outreach on safety	SEP implementation during

Stakeholder (Group or Individual)	Dates of Consultations	Summary of Feedback	Response of Project Implementation Team	Follow-up Action(s)/Next Steps	Timetable/ Date to Complete Follow-up Action(s)
			withstand higher than category 5.		construction and operation phases
		Aren't there any hazards because the line passes through the community near Fond Cole?	No, the lines will be in 1.5 metre trenches; buried in conduit.	ESIA prepared and consulted	ESIA implementation during construction phase
		There will be two power lines. One overhead and one underground. Are they working simultaneously, or one is like a back-up??	They always work in parallel. But if one goes down, another takes over the full load without being overloaded.	Addressed	N/A
		What is the impact for the consumers?	The primary purpose is to reduce dependence on diesel and stabilize and reduce the price of electricity.	The power generated by the geothermal plant will be sold to DOMLEC.	O&M phase
		Fond Cole is the distribution hub. Is the noise going to be totally eliminated?	Yes. The noise comes from the diesel generators. Hours of diesel generation will be for shorter.	Addressed	N/A
		Do you compensate for the land where the wire will pass? What if the lines will pass in the centre of land?	Yes. DGDC will minimize the impact. However, if the rest of the land will be unusable, all land will be acquired.	RAP prepared	RAP implementation before construction
		With respect to deforestation, what areas are you planning to replant trees?	This will be done with the support of forestry division.	ESIA prepared	ESIA implementation during construction phase

Stakeholder (Group or Individual)	Dates of Consultations	Summary of Feedback	Response of Project Implementation Team	Follow-up Action(s)/Next Steps	Timetable/ Date to Complete Follow-up Action(s)
		Do you have insurance for the people working (on the project)?	All contractors have to take out insurance for their workers.	LMP prepared	LMP implementation during construction phase
		What will the trenches carry?	Power cables will be in the trenches. The trenches will be about 1.5 metres deep. The community can be affected if they fall into the trenches. Each 200m will take a week of construction. There will be dust, noise, traffic congestion.	ESIA prepared	ESIA implementation during construction phase
		The whole construction impact seems to be underplayed in terms of significance (rated minor). The excavation will be in very busy areas, and people travel to work or tourist sites. Significant inconvenience is expected.	We have noted your comments and note that the construction impact will be significant community health and safety impacts, particularly in the urban areas of Roseau.	Addressed	ESIA/SEP implementation during construction phase
		The workers – about 100 workers, 40% of which are likely to be from overseas. It would be good to see the	About 40 of those workers will be housed in hotels in the local communities, as done in on-going project.	Addressed	LMP implementation during the construction phase

Stakeholder (Group or Individual)	Dates of Consultations	Summary of Feedback	Response of Project Implementation Team	Follow-up Action(s)/Next Steps	Timetable/ Date to Complete Follow-up Action(s)
		availability of such housing.			
		In the GRM, it is stated that a low priority grievance would be given a response time of 5 days, and a high priority would be given a time of 30 days. I am of the opinion that it would be the reverse, but I would like a little clarification on that.	Some of the high-risk grievances require further investigations, and that accounts for the longer time.	Addressed	SEP implementation during construction and operation phases

8.4 Disclosure

The draft E&S instruments, including Non-Technical Summary of ESIA, ESIA, ARAP, SEP and LMP, were disclosed on the DGDC website in the second week of July 2023. The updated E&S instruments will also be disclosed on the DGDC and World Bank's websites.

9 Annexes

Annex 1: Biodiversity Report

1. Biological Environment

The area of influence of the proposed Transmission Line in the Geothermal Risk Mitigation II Project (herinafter referred to as the Project or DGRMII) is dispersed over a geographical area with a varied biological environment. The biological study for the Project is being conducted for two corridors, the GFI and FSI, respectively.

The GFI segment of the 69kV transmissioin line pathway spans a distance of 7.5km (4.7 miles), originating at the geothermal power plant located near the village of Laudat, at an elevation of 576m to 594m (1,889 - 1,949ft) asl, on the lower south-western slopes of Morne Micotrin, and terminates at the Fond Cole Power Station near the coastal zone.

The FSI segment of the transmission line pathway begins at the Fond Cole Power Station and navigates mainly through the dry scrub woodland along the west coast of Dominica, then through limited areas of transitional forest and secondary rainforest before terminating at the Sugarloaf Power Station east of Portsmouth.

The biological environment of the transmission line corridor includes three (3) ecological zones. These zones are: (i) secondary rainforest at mid-elevation, (ii) transitional/semi-evergreen forest, and (iii) dry scrub woodland at lower elevations.

The area of influence (100 meters ~~on~~ spanning both sides of the transmission line) also encompasses active and abandoned agricultural cultivations, freshwater streams, river estuaries, and the coastal zone. Each ecological zone/habitat has its own distinctive assemblage of plants and animal species due to micro-climate variability, topography, and degree of human interference.

The biological environment of the transmission line pathway, inclusive of its area of influence, includes Key Biodiversity Areas (KBAs), viz., habitats of four (4) endangered species, namely, the Red-necked Parrot (*Amazona arausiaca*), Imperial Parrot (*Amazona imperialis)*, Black-capped Petrel (*Pterodroma hasistata)*, and the Mountain Chicken (*Leptodactylus fallax*). Also, the optional underground transmission line option for the FSI segment traverses several freshwater rivers/streams along the west coast.

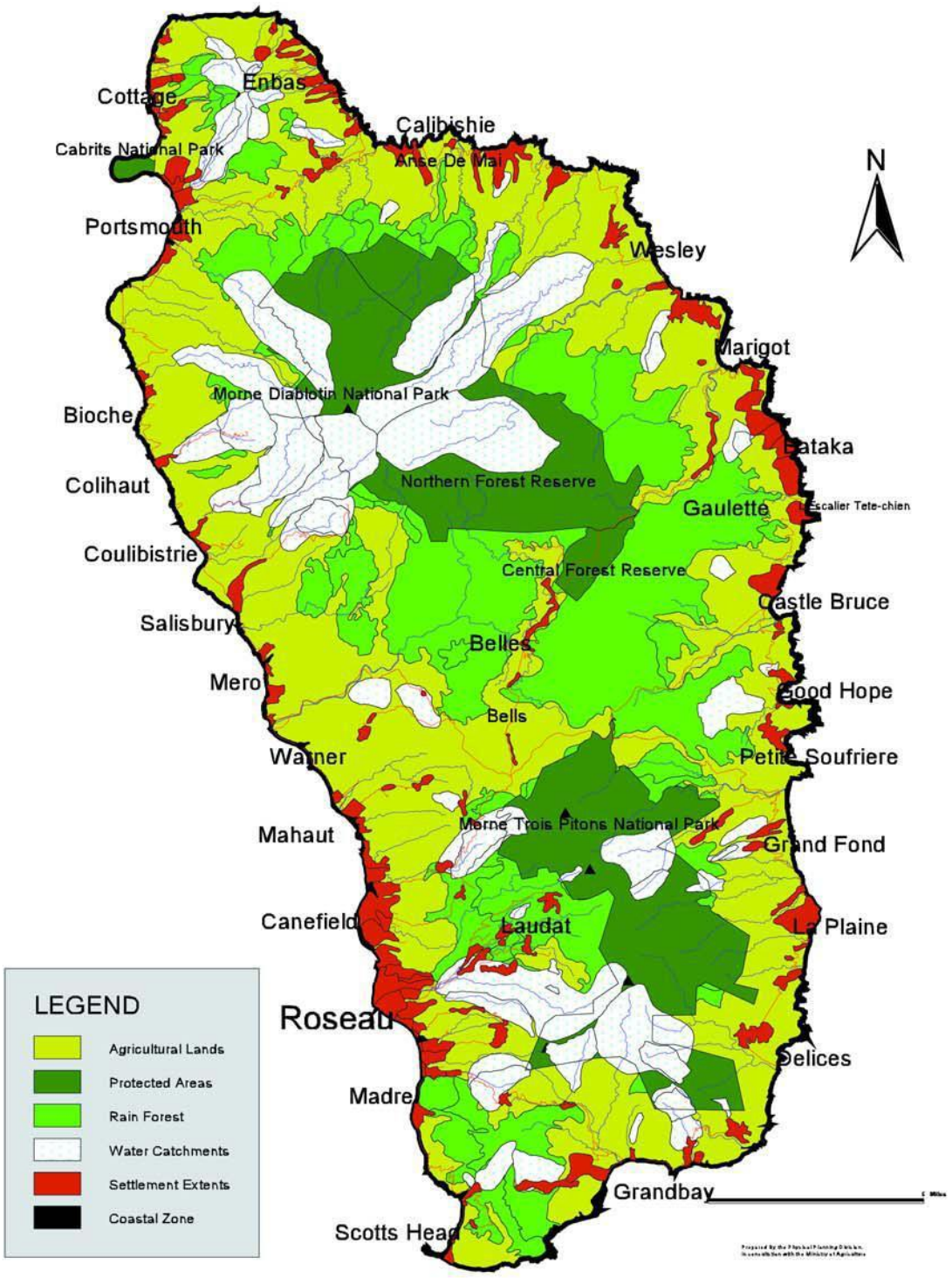


Figure 1: LAND USE MAP OF DOMINICA

1.1 Survey Methodology

Following a review of the available information, a biodiversity baseline assessment of the Corridor of Influence (CoI), of the proposed transmission line and access roads, was undertaken over a three (3) week period during the months of March and April of 2023 (Dry Season), in addition to a one (1) week period during the month of July 2023 (Wet Season). These two distinct phases of the baseline survey allowed for a comparative assessment of the species of flora and fauna documented. Both diurnal and nocturnal surveys were conducted. The assessment comprised field surveys of the terrestrial habitats to include vegetation, birds, mammals, amphibians, reptiles, freshwater fish, and freshwater crustaceans. The possible presence of rare, vulnerable, and endangered plant and animal species were assessed. Attention was paid to any species potentially triggering "critical habitat" definitions. The assessment provided raw data, necessary to determine the status of the overall ecosystem and species diversity of the sites.

1.1.1 Location of surveys

Ecological surveys were undertaken primarily within the designated 100-meter-wide area of influence of the proposed geothermal power transmission line. Locations for eighteen (18) survey plots (9 for GFI and 9 for FSI) were established within the vegetation zones along the GFI and FSI segments of the transmission line corridor. Three survey plots were established in each of the three vegetation zones traversed by the transmission line within the GFI and FSI segments, respectively. Within each vegetation zone, two (2) sample plots/quadrats were established at two (2) separate pole structure locations and one (1) quadrat at proposed road access to respective pole sites.

Six (6) nocturnal survey locations were established within the habitat range of the critically endangered Mountain Chicken (*Leptodactylus fallax)*. The survey locations were situated in river valleys and areas of dry forest traversed by the overhead transmission line. Nocturnal survey points were established within river valleys at Macoucheri, Coulibistrie, and Colihaut, and within the dry scrub forests at Grande Savanne, Bioche, and Grand Chemin. These survey points were within areas where the Mountain Chicken was known to exist and was last observed. The GPS coordinates of each monitoring station were recorded.

To assess the status of aquatic life in the rivers traversed by the optional underground transmission line, survey points were established at bridge crossings on eighteen (18) permanent rivers on the Leeward Coast, from Canefield to Portsmouth. The geographical coordinates of each survey point were recorded.

1.1.2 Survey Methodology for the flora and fauna

Baseline surveys within the area of influence of the transmission line pathway were conducted over a three-week period spanning the months of March and April 2023 (Dry Season), and a one (1) week period in July 2023 (Wet Season)The survey periods coincided with the annual "dry season" and "rainy season" in Dominica. Field assessments of the flora and fauna (terrestrial/aquatic) were undertaken primarily during the day. Limited night-time surveys were undertaken to assess the status of the critically endangered frog or "Mountain Chicken" (*Leptodactylus fallax)* and the endangered Black-capped Petrel *(Pterodroma hasitata).* Study sites (habitats/ecological zones) were accessed via public roads, farm roads, trails, footpaths, rivers, and ravines.

Ecological monitoring quadrats/sample plots measuring twenty (20) meter square, with fixed geographical coordinates, were used to conduct detailed field assessments of the vegetation zones. The twenty (20) meter-square quadrats were also used to assess reptiles and mammals.

Circular survey plots with an approximate fifty (50)-meter radius, were superimposed on the twenty (20) meter square quadrats within the transmission line corridor. These circular fifty (50)-meter survey plots were used for assessing bird species, utilizing a 30-minute point count.

The following general data were recorded at each quadrat:

- Specific location
- Unique identifier (Study Site/Plot number)
- Geographical location using GPS coordinates
- Altitude /elevation and slope characteristics
- Landaus
- Habitat types and structure
- Survey dates
- Weather conditions
- Photographs showing habitat structure and any notable plant and animal species.

Species of flora and fauna encountered were recorded based on their occurrence and relative abundance. Rare or threatened species were identified and recorded. Photographs were used where possible to illustrate animal and plant species, in addition to the biophysical aspects of the habitat. Data gathered and observations made, were recorded in field notebooks.

Anecdotal information regarding the status of the biodiversity, ecology, and habitats within the project's area of influence (i.e., land use, invasive species, sensitive habitat, bushfire-risk) were obtained through discussions with the Forestry Division's field staff and residents within the communities in proximity to transmission line pathway. Other observations of significance were also documented.

Geographic data (i.e., co-ordinates and altitude) were recorded with the use of GPS receiver. The geographic data was downloaded unto a computer and plotted on a digital base map, utilizing GPS-mapping software. Spatial data displayed on the digital base maps, served to illustrate the exact locations of the study sites. The geographical coordinates of each study site/quadrat recorded with the GPS receiver allows for identification of study sites as part of future monitoring activities.

Diurnal surveys of faunal species with a focus on bird species were conducted within the project's area of influence. Species observed within the quadrats/survey plots were identified and recorded. Identification of animal species in the field was done primarily through visual observation. Combinations of aural and visual observations were utilized in identification of birds and frogs. Species of wild fauna encountered within the quadrats were identified, counted, and recorded.

Nocturnal assessments of the fauna were conducted at specific locations within the area of influence of the 69 kV transmission line. Nocturnal survey plots with fixed geographical coordinates and a twenty (20) meter radius were established within the transmission line corridor. Each survey plot was monitored visually and aurally for a period of one (1) hour.

- **Birds / Avifauna**

Point count surveys using a twenty (20)-minute time-based survey at each survey point, was utilized to record all birds seen or heard within a fifty (50) meter radius of the mid-point of the quadrat/survey plot. The survey focused on species diversity and abundance. Observations were made through visual spotting and call identification. Nest trees and important food source/trees for any protected, endangered, and rare species were noted.

- **Reptiles**

Diurnal searches with a focus on the Lesser Antillean Iguana (*Iguana delicatissima)* were undertaken within the survey plots. Species observed were recorded.

- **Mammals**

Survey methodology entailed, recording the presence of individual animals including field marks viz., fecal pellets, tracks, feeding signs, breeding sites or nests.

- **Amphibians**

Nocturnal surveys of the "Mountain Chicken" (*Leptodactylus fallax),* were conducted within the known habitat range of the frog. Survey points were established within river valleys and scrub woodlands traversed by the overhead transmission line on the Leeward Coast. Survey locations were established with GPS coordinates. Each nocturnal survey plot encompassing an area with a twenty (20) meter radius was monitored visually and aurally for a period of one (1) hour. Surveys involved a combination of listening for frog calls and searching within the 20-meter radius of the central point.

- **Freshwater Aquatic Fauna**

The assessment of aquatic species (fish and crustaceans) in eighteen (18) permanent rivers within the study area on the west coast was done through visual observation. A visual survey of fifteen (15) minute duration was done at each bridge crossing. Aquatic species (fish and crustaceans) observed were identified and their relative abundance recorded.

- **Vegetation and Terrestrial Habitats**

Plot-based assessments were used to evaluate the vegetation communities/ecosystems and their boundaries within the transmission line pathway. The plot-based surveys assisted in determining the plant species and their relative abundance within the plot. Particular attention was paid to the dominant, rare, endemic, threatened, invasive, economically important species and sensitive ecosystems. Additional habitat conditions, were recorded for each plot, including the level of modification or disturbance. The vegetation classification system and nomenclature used by ecologists, J. S. Beard, and W. H. Hodge, to describe the vegetation zones and forest types in Dominica, were referenced in identifying forest types and ecological zones along the transmission line pathway.

1.2 General Ecosystem Description

The classification of the ecosystems is based on the microclimatic conditions, elevations, and the presence of plant communities in each area.

1.2.1 Secondary Rain Forest

Secondary Rain Forest occurs above 275 meters (900 feet) elevation in areas previously occupied by Mature Rain Forest and Lower Montane Rain Forest that have experienced disturbance from timber harvesting, shifting agriculture and hurricanes. These areas receive 3,810-6,350 mm (150-250 inches) of rainfall annually. The vegetation is characterized by an abundance of pioneer species, and an assortment of regenerated rain forest species. Typical dominant rain forest species such as chatannyé (*Sloanea spp.),* gommyé (*Dacryodes excelsa)*, and maho cochon (*Sterculia caribaea)* exist but are not abundant. The canopy height is approximately 24 meters (80 feet).

A great extent of the interior forest land, formerly covered with mature rain forest, has been reduced to secondary rain forest by shifting cultivation and unsuccessful estate agriculture. Various stages of degradation can be found, resulting from varying degrees of interference on different soils. Tree-fern brake which are groves of *Cyathea* and *Hemitelia* ferns up to 9 meters (30 ft) in height, seems to result from the most prolonged interference on poorly drained soils. Groves of *Miconia guianensis (a small tree),* are another easily recognisable pioneer community which seems to occur on all soils.

On well drained soils, succession may often begin with a crop of pioneer species of the forest association, such as bwa blan (*Simarouba amara), Lauraceae spp.,* bwa riviere *(Chimarrhis cymose),* la glu (*Sapium caribaeum),* caca wat *(Symplocos martinicensis), and* bwa sisserou *(Pithecellobium jupunba)*. Later stages of succession, developed from the above or initiated directly in forest that has been only damaged by hurricanes or wood-cutters, consist of irregular growth of small or damaged rain forest species, such as mang wouj (*Tovomita plumieri),* chatannyé *(Sloanea spp.),* maho kochon *(Sterculia caribaea)* and cachiman falaise *(Marila racemose),* with pioneer species being mainly bwa kano (*Cecropia peltate),* palmiste *(Euterpe broadwayi),* cré-cré *(Miconia guianensis),* la glu *(Sapium caribaeum),* and fougère (tree fern) *Cyathea* arborea.

By contrast, it should be noted that the Rain Forest proper is a climax plant community which occurs between elevations of 275 - 427 meters (900 - 1,400 ft) within the interior of the island. This forest type receives 3,810 - 5,080 mm (150 - 200 inches) of annual rainfall, with few periods without rain, usually only for a few weeks between April and June. The canopy, 27.5 – 30.5 meters (90 – 110 ft) high, is dominated by *Dacryodes excelsa, and Sloanea spp.* An irregular middle storey which never reaches a height of more than 24 meters (80 ft), comprises of a variety of species including young individuals from the canopy species. Middle storey species include bwa kot (*Tapura latifolia),* bwa blan *(Simarouba amara),* zoranger blan *(Swartzia caribaea),* poix doux *(Inga ingoides), palmiste (Euterpe broadwayi)* ti-citron (*Ilex sideroxyloides)*, and mauricif *(Brysonima martinicensis)*, in addition to numerous lianas, climbers, and epiphytes. A shrub layer is only occasionally present to any noticeable degree. Ferns are rare, and the soil is usually carpeted with *Selaginella flabellata*.

1.2.2 Transitional Forest / Semi-Evergreen Forest

Transitional Forest / Semi-Evergreen Forest is a vegetation type usually found at elevations between 214 -396 meters (700-1300 ft) elevation, mostly on the west and north sides of Dominica. Annual rainfall ranges from 2,540- 3,810 mm (100-150 inches).

It is found within a relatively narrow zone between dry scrub woodland and rain forest. This vegetation type is mainly semi-evergreen. Its floristic composition is made up of a combination of species which includes dry scrub woodland and rainforest species. Much of the Transitional/ Semi-evergreen Forest zone has been cultivated at one time and there are often remnants of cultivation, i.e., coconut and mango. This vegetation type is largely secondary woodland.

The canopy height varies based on the level of disturbance, but it is usually in the range of 18-24 meters (60-80ft) high. Trees and shrub species characteristic of this vegetation type include balata *Manilkara bidentata*, bwa chandelle (*Pachystachys spicata)*, caconier (*Ormosia sp*.), bwa tan (*Brysonima spicata)*, bay (*Pimenta racemose)*, barabara (*Diospyros revoluta)*, galba (*Calophyllum antillanum,)* kokoyé palm (*Syagrus amara)*, l'incense (*Protium attenuatum)*, mille branches (*Margaritaria nobilis),* bwa riviere (*Chimarrhis cymose)*, resinier grande feuille (*Cocoloba latifolia)*, balsa (*Ochroma pyramidale),* bwa blan (*Simarouba amara),* maho piment (*Daphnopsis americana),* cré-cré (*Miconia* spp.), ti feuille (*Myrcia splendens)*, zolivier (*Buchenavia tetraphylla)*, and bwa fou-fou (*Palicourea crocea)*.

1.2.3 Dry Scrub Woodland

Dry Scrub Woodland is the main vegetation type of the seasonally dry lowland areas of the leeward or Caribbean side of Dominica. It is a distinctly xerophytic vegetation which has been extensively disturbed and degraded. It occurs along the west coast from the shoreline up to an elevation of approximately 213-244 meters (700-800 feet) asl. It traverses the main populated regions of the island. It is in the "Rain Shadow". Annual rainfall ranges from 1,270-2,540 mm (50-100 inches).

It is dominated by deciduous trees and shrubs, most of which flower in the dry season (February to June) when they are practically leafless. The dominant trees usually reach a height of 15-18 meters (49-60 ft). The undergrowth forms a dense thicket characterized by a diversity of smaller trees and shrubs, vines, climbers, and herbaceous plants.

Most of the trees in this vegetation zone have small thick leaves which are shed during the annual "Careme" or dry season. The presence of spines on the trunks, branches, and leaves of the plants, is typical of the trees and shrubs in the dry forest. This feature assists the plants to survive in this very dry region by helping to conserve water and by protecting them from grazing animals.

The dominant tree species and shrub species typical of the Dry Scrub Woodland include, naked Indian/gomyé wouj (*Bursera simaruba),* logwood/kanpech (*Haematoxylon campechianum),* savonette (*Lonchocarpus benthamianus),* l'epiné *(Zanthoxylum sp.),* mapou (*Pisonoia sp*.), resinier grande feuille (*Cocoloba latifolia),* bwa ravine (*Calliandra tergemina)*, and bwa kwaib (*Poitea (Sabinea) carinalis)* - an endemic species. The Dry Scrub Woodland is also characterized by the presence of succulents such as the century plant *(Agave caribaeicola)*, and columnar cactus (*Pilosocereus royenii)*.

Grassland and savanna sub-types exist within the scrub woodland zone because of anthropogenic influences resulting in extensive areas dominated by the invasive lemon grass (*Cymbopogon citratus)*. Dry Scrub Woodland, particularly areas overtaken by lemon grass, are prone to annual bushfires.

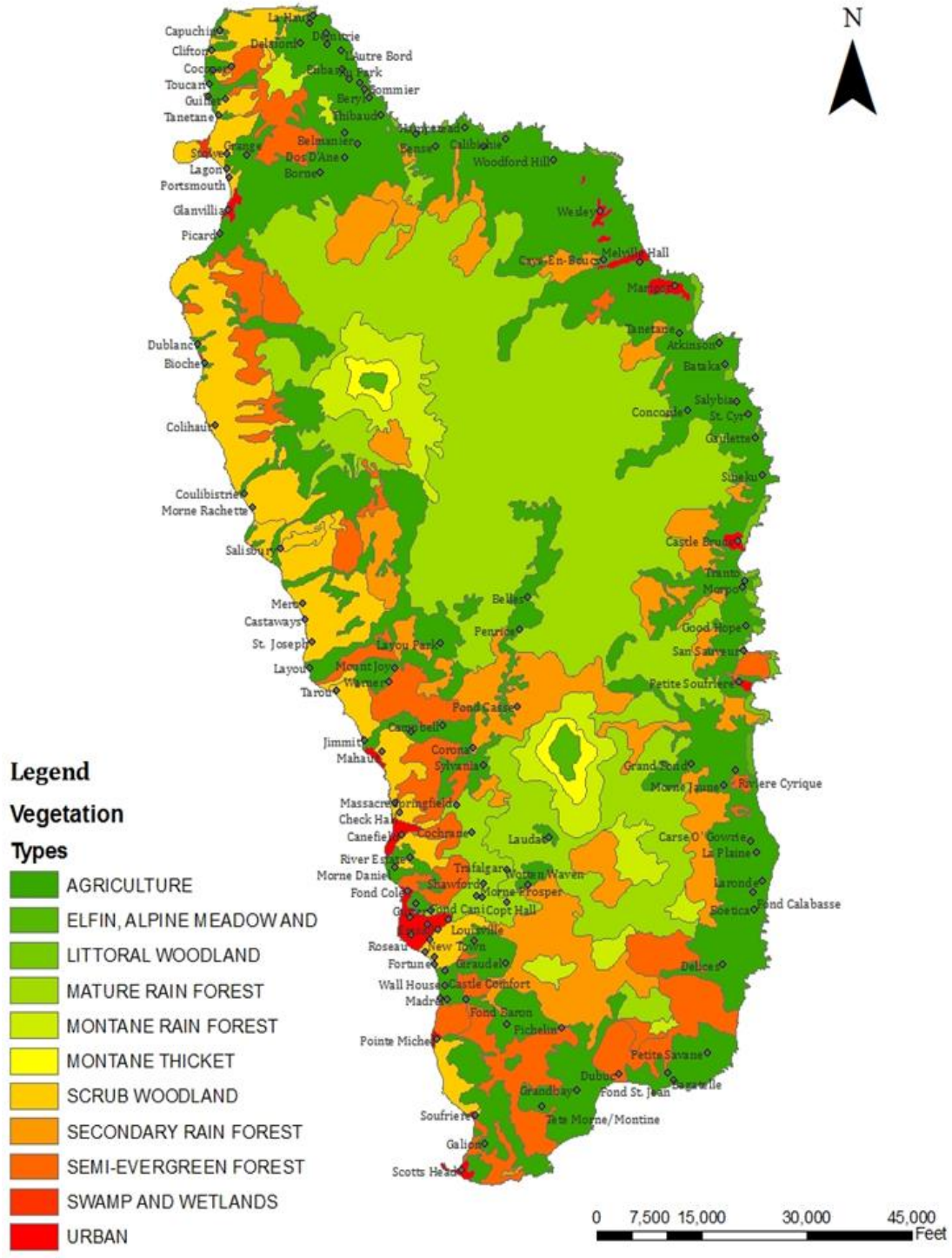


Figure 2: VEGETATION MAP OF DOMINICA

2. GEOTHERMAL PLANT TO FOND COLE POWER STATION OHL (GFI)

The proposed tower locations of the GFI for each ecosystem are presented in the following table.

Table1. Tower Locations and Respective Ecosystems

	Ecosystem Type	**GFI Tower Locations in this ecosystem**	**Surveyed Tower Locations**
1	Secondary Rainforest	17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30	29, 30
2	Transitional/Semi-Evergreen Forest	7, 8, 9, 10, 11, 12, 13, 14, 15, 16,	13, 15
3	Scrub Woodland	1, 2, 3, 4, 5, 6	3, 4

2.1 **Ecosystem 1** - **Secondary Rain Forest**

2.1.1 **Overview of the Ecosystem**

The Secondary Rainforest Ecosystem located on the foothills of Morne Micotrin, west of the village of Laudat, is situated at an elevation of approximately 520 meters (1,706 feet) above sea level. The site is characterized by moderately sloping land, dissected by seasonal watercourses and steep sided, precipitous valleys. The area is highly susceptible to landslides.

The climate is classified as “humid tropical marine with minimal seasonal or diurnal variation. Relative humidity is high in the region of 85%. This ecosystem is within a rainfall zone which receives 5080-6350mm (200-250inches) of rainfall per year. Rainfall occurs throughout the year while intensity is variable. This ecosystem is susceptible to the impacts or hurricanes, tropical storms, and forest clearance for agriculture, housing, and electrical power generation infrastructure.

Current Land use at Surveyed Locations

Current land use in the vicinity of the surveyed sites includes subsistence agriculture (active and abandoned gardens/farms), livestock grazing (sheep), pig farming, and recreational hiking (segment 4 of the Waitukubuli National Trail).

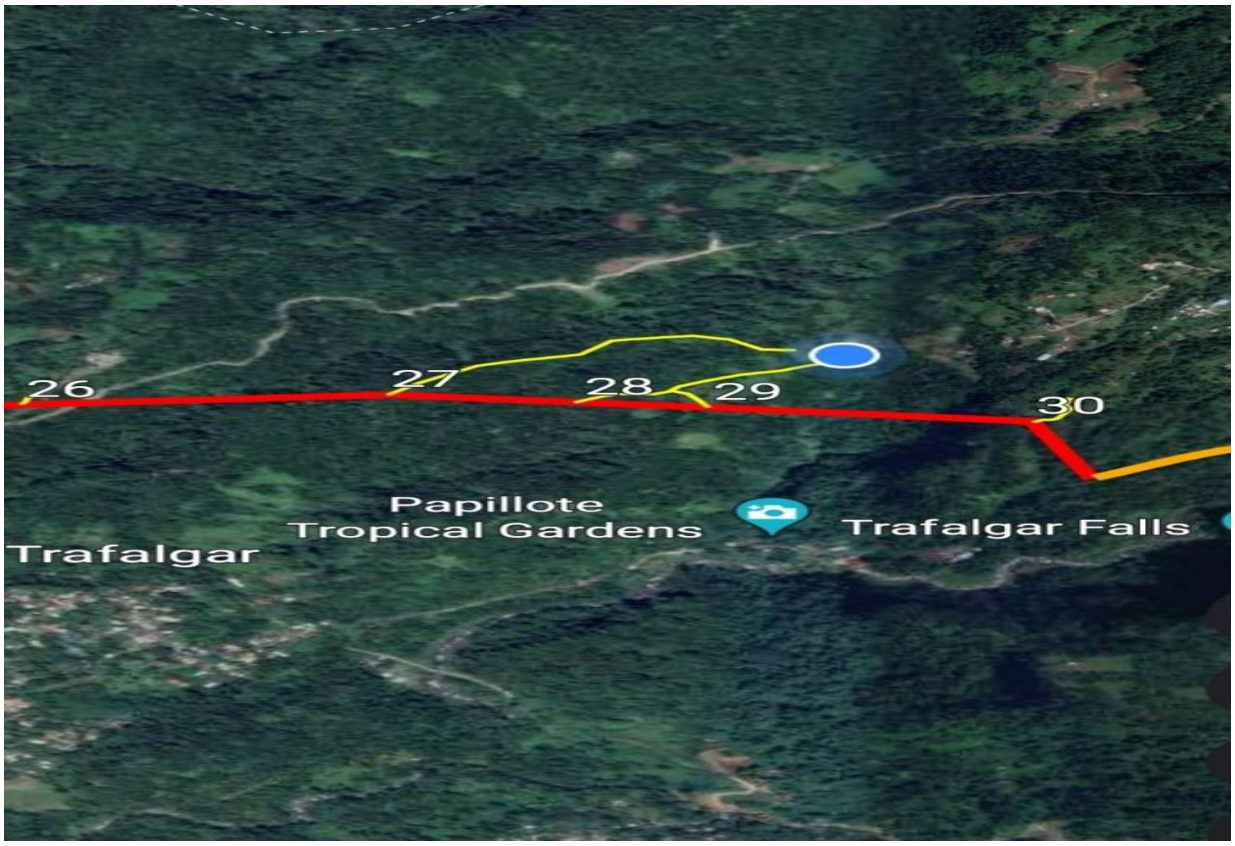


Figure 3: Transmission line pole locations assessed within the secondary rainforest included PS #30 (15^{o}19.856'N 61^{o}20.159'W) and PS #29 (15^{o}19.879'N 61^{o}20.365' W) in addition to road access to PS #29 & PS #28. (15^{o}19.949'N 61^{o}20.296 W)

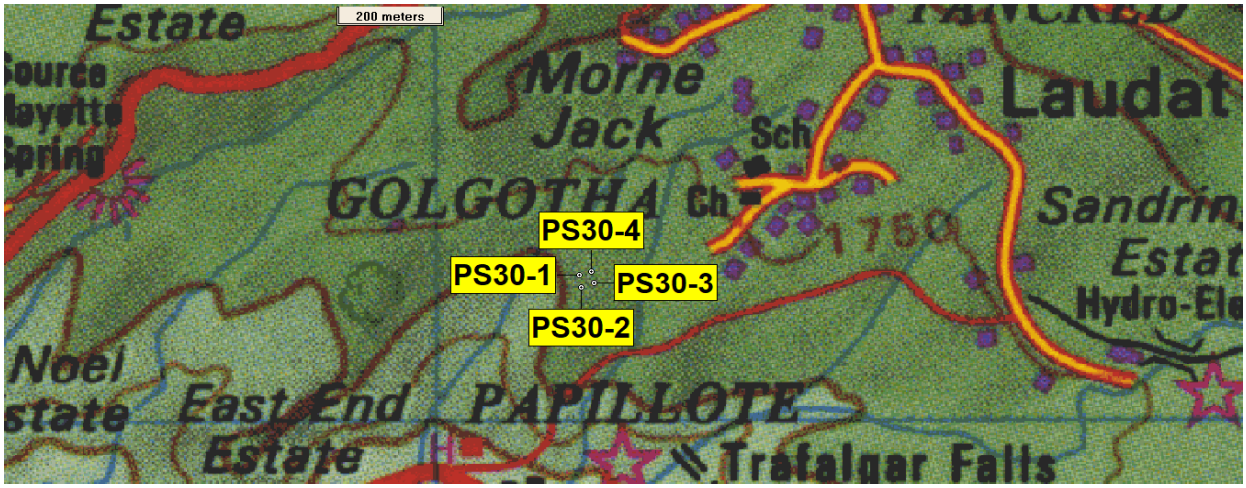


Figure 4. Location of Sample Plot at Pole #30

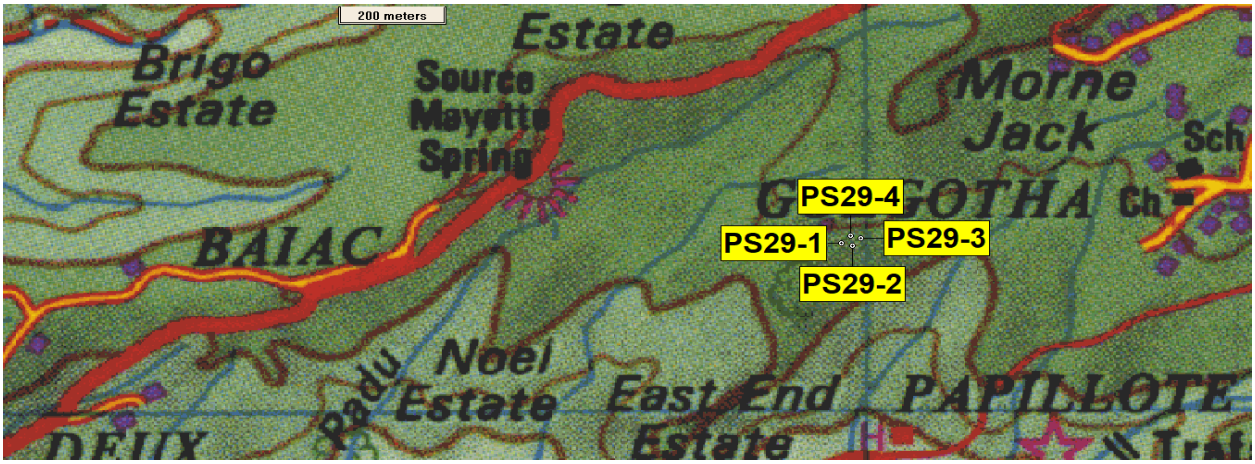


Figure 5: Location of Sample Plot at Pole #29

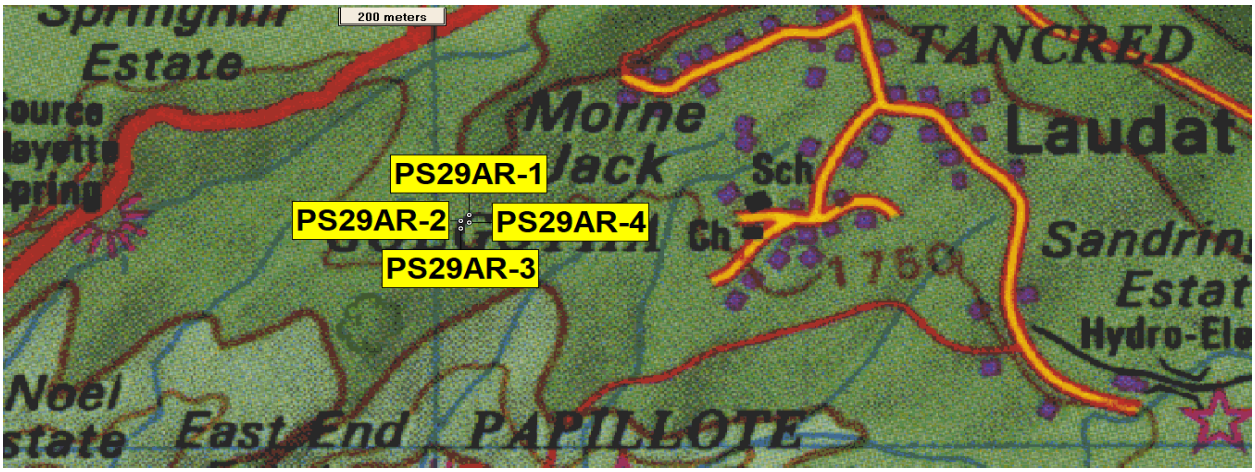


Figure 6: Location of Sample Plot at Proposed Access Road Track to Pole #29 & Pole #28

2..1.2. **Flora**

Mature Rain Forest is the dominant vegetation type at mid-elevations in the interior of Dominica. However, much of the original mature rainforest ecosystem has been extensively disturbed by timber harvesting, agriculture, and tropical weather systems. As a result of these disturbances, large areas of original Mature Rain Forest have been transformed into Secondary Rain Forest. This is particularly the case within the Laudat region.

Currently, the main vegetation community along the transmission line pathway from pole #30 to pole #17 is secondary rainforest at varying stages of succession, Areas of active and abandoned agriculture are common. The ecosystem does not have the typical form, structure, and species composition of the climax mature rain forest. It does not have a clearly defined closed canopy but rather a fragmented canopy 12-24m (40-80ft) tall and an understory stratum 4.5-9m (15-30ft) high. The ground cover is very sparce.

The forest type at Pole #30 is characterized by the prolific growth of pioneer species such as bwa blan (*Simarouba amara),* and bwa kano *(Cecropia schrebriana),* with opportunistic species such as *Lauraceae spp*., pwa doux mawon (*Inga ingoides)*, bwa bandé (*Richeria grandis)*, and bwa sisserou (*Pithecellobium jupunba)* forming the canopy. Typical canopy species such as gommyé (*Dacryodes excelsa) and* chatannyé *(Sloanea* spp.), are present but not dominant. The understory is dominated by balisier (*Heliconia caribaea)*, cré-cré (*Miconia spp*.), wild coffee/café mawon (*Faramea occidentalis)*, tree ferns (*Cyathea sp.* and *Hemitellia sp*.), and maho cochon (*Sterculia caribaea)*. The forest floor consists of selaginella (*Selaginella flabellate)*, blue wax flower (*Psychotria urbaniana)*, and seedling of rain forest tree species. Red-listed/threatened plant species at risk were not recorded in any of the surveyed locations.

The forest in the vicinity of Pole # 29 and on the access track to Pole # 29, appear to have been extensively disturbed. As a result of the open canopy caused by the combined effects of selective forest clearance at these two locations, many adaptable rainforests tree species and pioneer species form the forest canopy. The dominant tree species include bwa kano, *(Cecropia schrebriana),* koko poule (*Cordia elliptica)*, bwa pistolet blanc (*Guarea glabra)*, poix doux mawon (*Inga ingoides)*, lowyé bord de mer (*Endlicheria sericea)*, ti fey (*Frezeria undulata), and chatanyé (Sloanea spp.).*

The understorey, 4.5 – 9m (15-30 feet) tall, forms a dense thicket, occupied by a diversity of plant species comprised mainly of saplings of trees typically found in the canopy and middle stratum. Tree species occurring with the greatest frequency in the understorey include pwa doux mawon (*Inga ingoides),* bwa ti-citron (*Ilex sideroxyloides),* maho cochon (*Sterculia caribaea)* bwa blan (*Simarouba amara)*, bwa pipirie (*Pithecellobium jupunba)*, and laurier caca *(Beilscheria sericea).* Other plant species frequently occurring in the forest understory are *cré*-cré (*Miconia/Conostegia spp.),* balisier (*Heliconia caribaea)*, tree ferns (*Cyathea arborea* and *Hemitelia muricata)*, bwa mal-estomac *(Siparuna glabrescens)*, rambling fern (*Dicranopteris bifida), and* razor-grass (*Sceleria spp.)*.

Within the Secondary Rain Forest ecosystem exist scattered areas of abandoned agricultural lands, and active agricultural cultivations with tree crops, root crops, vegetables, and ornamental flowering shrubs. Most abandoned cultivations have been taken over by secondary forest vegetation and herbaceous species such as balisier (*Heliconia caribaea)*, and capi vine (*Ipomea tiliacea)*, in addition to non-native invasive species, i.e., wild ginger (*Hedychium coronarium),* elephant grass (*Pennisetum purpureum),* and lemon grass (*Cymbopogon citratus)*. Some areas have been maintained as open pasture for livestock grazing.

Figure 7: Secondary Rain Forest at Pole Station #30

Figure 8: Forest Understory at Pole Station #29

Figure 9: Subsistence Farm on Access Track to Pole #29

2.2.3. **Fauna – Dry Season**

Mammals and Reptiles

The mammals recorded included the opossum (*Didelphis marsupialis)* in addition to an unidentified insect-eating bat observed during the nocturnal survey. The agouti (*Dasyprocta leporine)* which is associated with the locality was not observed at the survey locations.

Only one (1) reptile species, the invasive Puerto Rican-Crested Anole (*Anolis cristatellus*) was recorded.

Though not documented during the survey, reptilian species such as the Dominican tree lizard (*Anolis oculatus)*, tree *gecko (Thecadactylus rapicauda),* golden skink (*Mabouya mabouya),* Dominican ground lizard (*Pholidoscelis fuscatus)*, Lesser Antillean iguana (*Iguana delicatissima),* Dominican boa (*Boa constrictor nebulosus)*, black-and-white checkered snake (*Liophis juliae)*, and the worm snake (*Typhlops dominicana),* have previously been recorded in the area.

Birds

A total of eighteen (18) bird species were visually and aurally encountered within the secondary rainforest. (See Table 2 below). The avifauna recorded comprised only resident species. The diversity of birds included parrots, hummingbirds, euphonias, flycatchers, warblers and finches, among other avian species typically associated with secondary rain forest and agricultural cultivations. The presence of the endangered Red-necked parrot (*Amazon*a *arausiaca)* was confirmed through observations of parrots foraging on forest trees. Several other bird species normally associated with the area were not encountered during the field survey.

Globally threatened species of concern within the transmission line's area of influence include the Red-necked Parrot (*Amazona arausiaca),* the Imperial Parrot (*Amazona imperialis)*, and the Black-capped

Petrel or Diablotin (*Pterodroma hasitata).* All three (3) threatened species are listed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species.

During the field surveys, Red-necked Parrots (*Amazona arausiaca),* were observed foraging within the area of influence. The Imperial Parrot (*Amazona imperialis),* though not observed, is reported to utilize the forest and airspace within the region as a migration corridor between the rainforest habitat around the foothills of Morne Watt (Morne Trois Pitons National Park), and habitats in the Central and Northern Forest Reserve.

The nocturnal surveys within the zone of influence at Laudat could not verify the presence of the Black-capped Petrel. However, recent collaborative research has confirmed the presence of the Black-capped Petrel, in the airspace over Laudat, on its flyways to and from nesting grounds near the summit of Morne Micotrin and other mountain summits within the district. The Red-necked Parrot was the only "species at risk" observed.

Table 2. **List of Bird Species Recorded at Pole #29 & Pole #30 (Dry Season)**

Common Name	Scientific Name	IUCN Conservation Status	On-Site Status
Antillean-Crested Hummingbird, Ti-kap	*Orthorhyncus cristatus*	Least concern	Lesser-Antillean Endemic Common Resident Breeder
Bananaquit, Sikiyé, Sikwiyé	*Coereba flaveola*	Least concern	Abundant Resident Breeder
Black-faced Grassquit, Sisi-zèb	*Tiaris bicolor*	Least Concern	Common/Resident Breeder
Black-whiskered Vireo, Chwèk, Chwèk annglé	*Vireo altiloquus*	Least Concern	Common / Resident Breeder
Broad-winged Hawk, Chicken Hawk, Malfini	*Buteo platypterus*	Least Concern	Common/Resident Breeder
Caribbean Elaenia, Siflé, Chwèk Patwa	*Elaenia martinica*	Least Concern	Caribbean Endemic /Abundant Resident Breeder
Lesser-Antillean Flycatcher, Gwo-tèt, Labèl	*Myiarchus oberi*	Least Concern	Lesser-Antillean Endemic/Common Resident Breeder
Green-throated Carib, Foufou vèt	*Eulampis holosericeus*	Least Concern	Caribbean Endemic/Common Resident Breeder
Grey Kingbird, Pipirit	*Tyrannus dominicensis*	Least Concern	Common Resident Breeder
Lesser Antillean Bullfinch, Pennwè, Mwéson	*Loxigilla noctis*	Least Concern	Lesser Antillean Endemic /Common Resident Breeder
Lesser Antillean Saltator, Gwo-bèk	*Saltator albicollis*	Least Concern	Lesser Antillean Endemic /Common Resident Breeder

Purple-throated Carib, Foufou madé	*Eulampis jugularis*	Least Concern	Caribbean/Endemic/Common/ Resident Breeder
Scaly-breasted Thrasher, Gwiv	*Margarops fuscus*	Least Concern	Caribbean Endemic/Common Resident Breeder
House Wren, Wosingyol	*Troglodytes aedon*	Least Concern	Fairly Common Resident Breeder
Yellow Warbler Titin	*Dendroica petechia*	Least Concern	Common/ Resident Breeder
Plumbeous Warbler, Chik-chik, Papya	*Dendroica plumbea*	Least Concern	Endemic/ Common Resident Breeder
Red–necked Parrot, Jaco Parrot	*Amazona arausiaca*	Vulnerable	Dominican Endemic/Common
Blue-hooded Euphonia	*Chlorophonia elegantissima*	Least Concern	Uncommon/ Resident Breeder

2.2.4. **Fauna – Weet Season**

Diurnal and nocturnal biodiversity assessments were conducted at previously established survey plots within the Secondary Rain Forest ecosystem at Pole Station #30 and Pole Station #29, respectively.

Mammals and Reptiles

Mammal species documented included one (1) Opossum (*Didelphis marsupialis*) observed during the nocturnal survey at Pole Station #29. Observation of field marks (animal tracks on the soil surface) in the vicinity of Pole Station #30 confirmed the presence of the Agouti (*Dasyprocta leporina*). Several unidentified insect-eating bats were observed during the nocturnal assessment at both survey locations.

Only one (1) reptile species, the invasive Puerto Rican-Crested Anole (*Anolis cristatellus*) was recorded during the diurnal and nocturnal survey.

Birds

Avian species recorded during the rainy season assessment within the Secondary Rain Forest were like the species recorded during the dry season assessment (See table 3, below). However, Caribbean Elaenias and Bananaquits were the most abundant species. Two (2) Red-necked Parrots (Amazona arausiaca) were recorded at Pole Station # 29. The Mangrove Cuckoo was a notable rainy season addition while the Yellow Warbler, Plumbeous Warbler, and the Lesser Antillean Flycatcher, previously recorded during the dry season were not observed.

The Red-necked Parrot (*Amazona arausiaca*) was the only IUCN Red-listed/threatened species recorded.

Table 3. **List of Bird Species Recorded at Pole #29 & Pole #30 (Rainy Season)**

Common Name	Scientific Name	IUCN Conservation Status	On-Site Status
Antillean-Crested Hummingbird, Ti-kap	*Orthorhyncus cristatus*	Least concern	Lesser-Antillean Endemic Common /Resident Breeder
Bananaquit, Sikiyé, Sikwiyé	*Coereba flaveola*	Least concern	Abundant/ Resident Breeder
Black-whiskered Vireo, Chwèk, Chwèk annglé	*Vireo altiloquus*	Least Concern	Common / Resident Breeder
Broad-winged Hawk, Chicken Hawk, Malfini	*Buteo platypterus*	Least Concern	Common/Resident Breeder

Caribbean Elaenia, Siflé, Chwèk Patwa	*Elaenia martinica*	Least Concern	Caribbean Endemic /Abundant Resident Breeder
Green-throated Carib, Foufou vèt	*Eulampis holosericeus*	Least Concern	Caribbean Endemic/Common Resident Breeder
Grey Kingbird, Pipirit	*Tyrannus dominicensis*	Least Concern	Common Resident Breeder
Lesser Antillean Bullfinch, Pennwè, Mwéson	*Loxigilla noctis*	Least Concern	Lesser Antillean Endemic /Common Resident Breeder
Lesser Antillean Saltator, Gwo-bèk	*Saltator albicollis*	Least Concern	Lesser Antillean Endemic /Common Resident Breeder
Purple-throated Carib, Foufou madé	*Eulampis jugularis*	Least Concern	Caribbean/Endemic/Common/ Resident Breeder
Scaly-breasted Thrasher, Gwiv	*Margarops fuscus*	Least Concern	Caribbean Endemic/Common Resident Breeder
House Wren, Wosingyol	*Troglodytes aedon*	Least Concern	Fairly Common/ Resident Breeder
Red–necked Parrot, Jaco Parrot	*Amazona arausiaca*	Vulnerable	Dominican Endemic/Common
Blue-hooded Euphonia	*Chlorophonia elegantissima*	Least Concern	Uncommon/ Resident Breeder
Mangrove Cuckoo	*Cocccyzus minor*	Least Concern	Common Resident Breeder

2.3 **Ecosystem 2 - Transitional Forest / Semi-Evergreen Forest**

2.3. 1. **Overview of the ecosystem**

The GFI transmission line pathway traverses the transitional forest ecosystem along the top of the Glasgow Ridge. The ridge has a general east west alignment with an elevation of approximately 374 meters (1227 feet) at its highest point. The ridge top is relatively narrow with precipitous slopes on its northern and southern flanks. Stones and boulders are rare. The locality receives approx. 2,540-3,810mm (100-150 inches) of rainfall per annum and is subject to variability in rainfall as result of the annual dry season.

Current Land use

Current land use is limited to subsistence farming, small-scale commercial farming (poultry production/vegetable production), limited human habitation, and recreational hiking. The area is accessed via a farm access road and footpath.

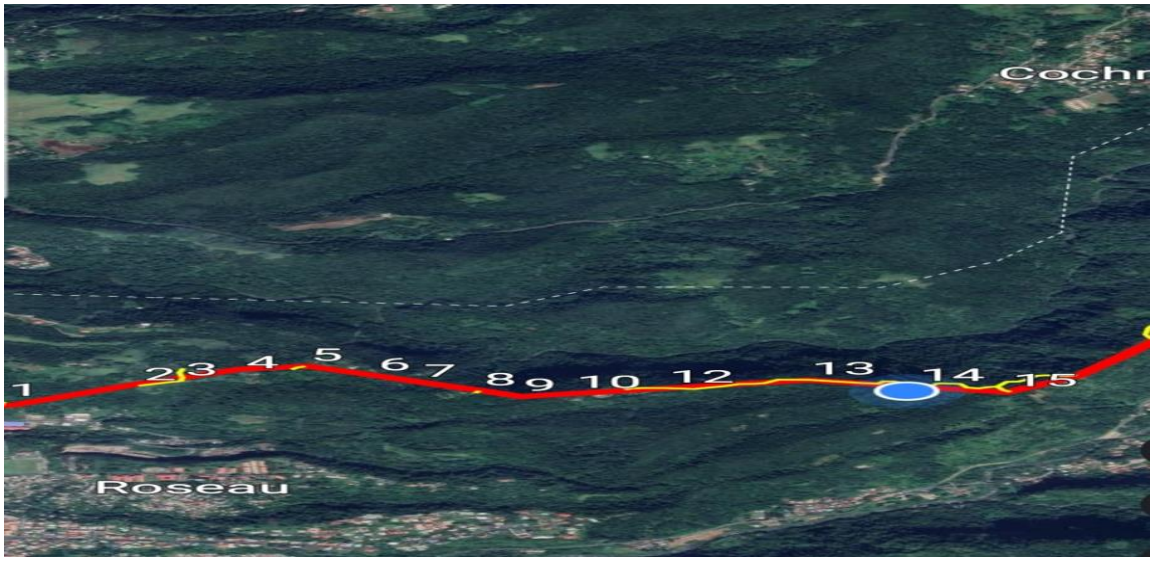


Figure 10: Alignment of the Transmission Line and Pole Locations on the Glasgow Ridge

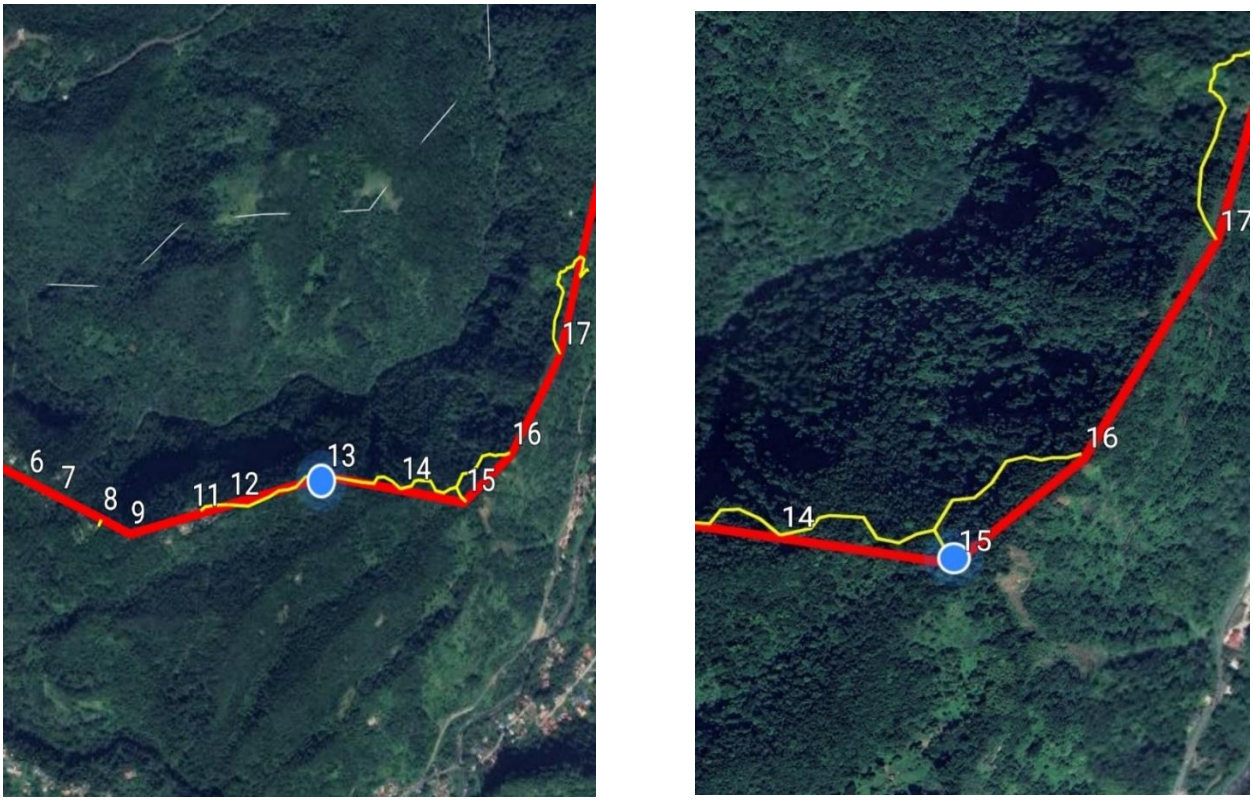


Figure 11: Location of Pole #13 and Pole #15 within the Transitional Forest on Glasgow Ridge

Figure 12: Location of Survey Plot on Access Track to Pole #14 and Pole #15

2.3.2**. Flora**

Based on the species composition, the forest type within the survey area is described as Transitional Forest/Semi-Evergreen Forest. This plant community is intermediate between lowland Dry Scrub Woodland and higher elevation Rain Forest. What currently exist along the transmission line corridor on the Glasgow Ridge is considered secondary Transitional Forest/Semi-Evergreen Forest with pole-wood size trees and few large trees. The original forest was at one time logged or cleared for agriculture and subsequently impacted by hurricanes. The effect of the recent hurricane is evident by the numerous fallen trees on the forest floor, and the prolific growth of razor grass as result of the fragmented canopy. Canopy height is 15 meters (50 feet).

The canopy species are bwa sisserou (*Pithecelobium jupunba)*, bwa tan (*Brysonima spicata)*, ti feuille (*Myrcia splendens)*, zolivier (*Buchenavia tetraphylla)*, bwa blanc (*Simarouba amara)*, bwa dyab (*Licania ternatensis)*, zyé kwab (*Allypohylus racemosus),* and café mawon (*Faramea occidentalis)*. The understory, about 7-9 meters (25-30 feet) high, is dominated by saplings of regenerated canopy species, in addition to balisier (*Heliconia caribaea)*, tree ferns (*Cyathea arborea), and* razor grass *(Scleria latifolia)*. The forest floor is covered by abundant leaf litter. The plant species recorded in the survey plots are similar or identical to the plant species found at the pole locations and access road locations. Areas of lemon grass exist along the transmission line corridor.

There were no species potentially at risk or known red-listed/threatened species at risk that may be affected by the project activities.

Figure 13: Transitional Forest/ Semi-Evergreen near Pole Number #15

Figure 14: Secondary Transitional Forest near Pole #13

2.3.3**. Fauna**

Mammals & Reptiles

Mammal species were not encountered during field surveys of the seasonal forest of the GFI. However anecdotal information confirmed the presence of the opossum (*Didelphis marsupialis)* and the agouti (*Dasyprocta leporine)*. It is expected that most of the native bat species would frequent the area.

Reptiles recorded were the Dominica anole (*Anolis occulatus)* and the Puerto Rico-Crested anole (*Anolis crystatellus).*

Reptilian species such as tree gecko *(Thecadactylus rapicauda),* Dominican racer *(Alsophis antillensis),* golden skink (*Mabuya mabouya)* Lesser Antillean iguana (*Iguana delicatissima),* Dominican boa (*Boa constrictor nebulosus)*, black-and-white checkered snake (*Liophis juliae)*, and the worm snake (*Typhlops dominicana)*, are known to frequent the zone of influence.

There were no known species at risk or red-listed/threatened mammal and reptile species at risk that may be affected by the project activities.

Birds
Several bird species associated with the Seasonal Semi-Evergreen Forest ecosystem were encountered during the field surveys.

Table 4. **List of Bird Species Recorded at Pole #13, Pole #15 and Access Track to Poles #13, #14 & #15**

Common Name	**Scientific Name**	**IUCN Conservation Status**	**On-Site Status**
*Red–necked Parrot, Jaco Parrot	*Amazona arausiaca*	Vulnerable	Dominican Endemic/Common
Antillean-Crested Hummingbird, Ti-kap	*Orthorhyncus cristatus*	Least concern	Lesser-Antillean Endemic Common Resident Breeder
Bananaquit, Sikiyé, Sikwiyé	*Coereba flaveola*	Least concern	Abundant Resident Breeder
Black-faced Grassquit, Sisi-zèb	*Tiaris bicolor*	Least Concern	Common/Resident Breeder
Mangrove Cuckoo, Kou Kou Manyok	*Cocyzus minor*	Least Concern	Common Resident Breeder
Black-whiskered Vireo, Chwèk, Chwèk annglé	*Vireo altiloquus*	Least Concern	Common / Resident Breeder

Broad-winged Hawk, Chicken Hawk, Malfini	*Buteo platypterus*	Least Concern	Common/Resident Breeder
Caribbean Elaenia, Siflé, Chwèk Patwa	*Elaenia martinica*	Least Concern	Caribbean Endemic /Abundant Resident Breeder
Lesser-Antillean Flycatcher, Gwo-tèt, Labèl	*Myiarchus oberi*	least Concern	Lesser-Antillean Endemic/ Common Resident Breeder
Green-throated Carib, Foufou vèt	*Eulampis holosericeus*	Least Concern	Caribbean Endemic/Common Resident Breeder
Grey Kingbird, Pipirit	*Tyrannus dominicensis*	Least Concern	Common Resident Breeder
Lesser Antillean Bullfinch, Pennwè, Mwéson	*Loxigilla noctis*	Least Concern	Lesser Antillean Endemic/Common Resident Breeder
Lesser Antillean Saltator, Gwo-bèk	*Saltator albicollis*	Least Concern	Lesser Antillean Endemic/Common Resident Breeder
Purple-throated Carib, Foufou made	*Eulampis jugularis*	Least Concern	Caribbean Endemic/Common/Resident Breeder
Scaly-breasted Thrasher, Gwiv	*Margarops fuscus*	Least Concern	Caribbean Endemic/Common Resident Breeder
House Wren, Wosingyol	*Troglodytes aedon*	Least Concern	Fairly Common/ Resident Breeder
Yellow Warbler Titin	*Dendroica petechia*	Least Concern	Common /Resident Breeder
Plumbeous Warbler, Chik-chik, Papya	*Dendroica plumbea*	Least Concern	Endemic/ Common Resident Breeder
Blue-hooded Euphonia	*Chlorophonia elegantissima*	Least Concern	Uncommon /Resident Breeder

*The Red-necked Parrot (*Amazona arausiaca)* is the only known species at risk or red-listed/threatened species at risk that may be affected by the project activities.

.

2.4 **Ecosystem 3 - Dry Scrub Woodland**

2.4.1**. Overview of the ecosystem**

The Dry Scrub Woodland ecosystem within the GFI area of influence is located at the western end of the Glasgow ridge, and on the northern and southern slopes east of the Fond Cole Power Station. The top of the ridge situated at an elevation of 261 meters, has a moderate gradient but the southern aspect is steep. Located on the leeward side of the island, the area receives 2,540 mm (100 inches) of rainfall per year. The average daily temperature is about 27^{o}C (81^{o}F). There are no permanent watercourses, but the area is drained by a seasonal ravine. Most of the original scrub forest has been cleared for agriculture and housing. Large areas of invasive lemon grass exist. The xeric vegetation is susceptible to bush fires in the dry season.

Current Land use

Land use comprises subsistence farming, abandoned farms, cattle grazing, residential housing, commercial infrastructure, and industrial infrastructure.

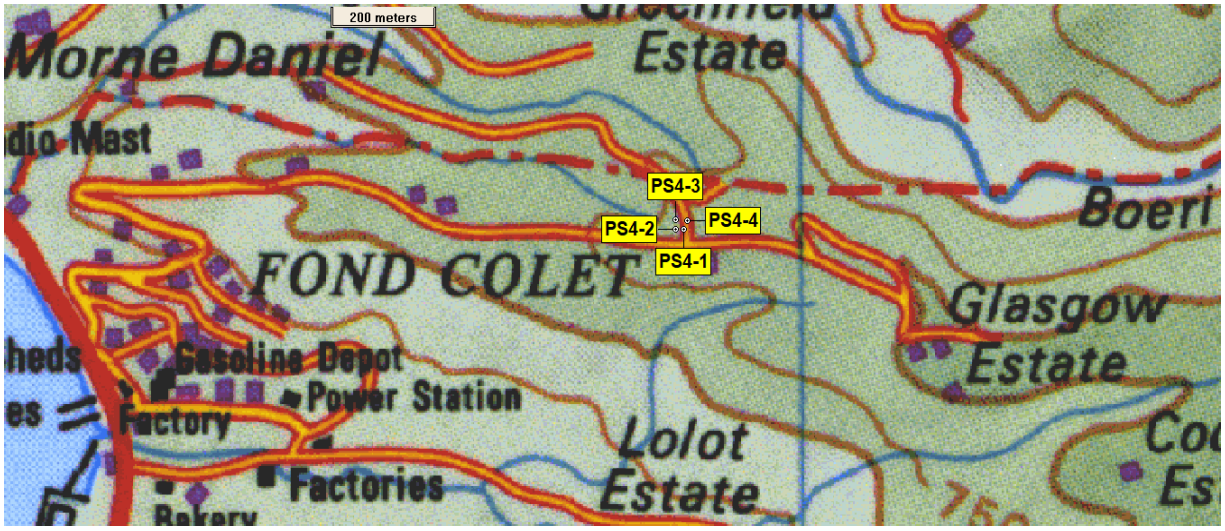


Figure 15: Location of Survey Plot at Pole #4

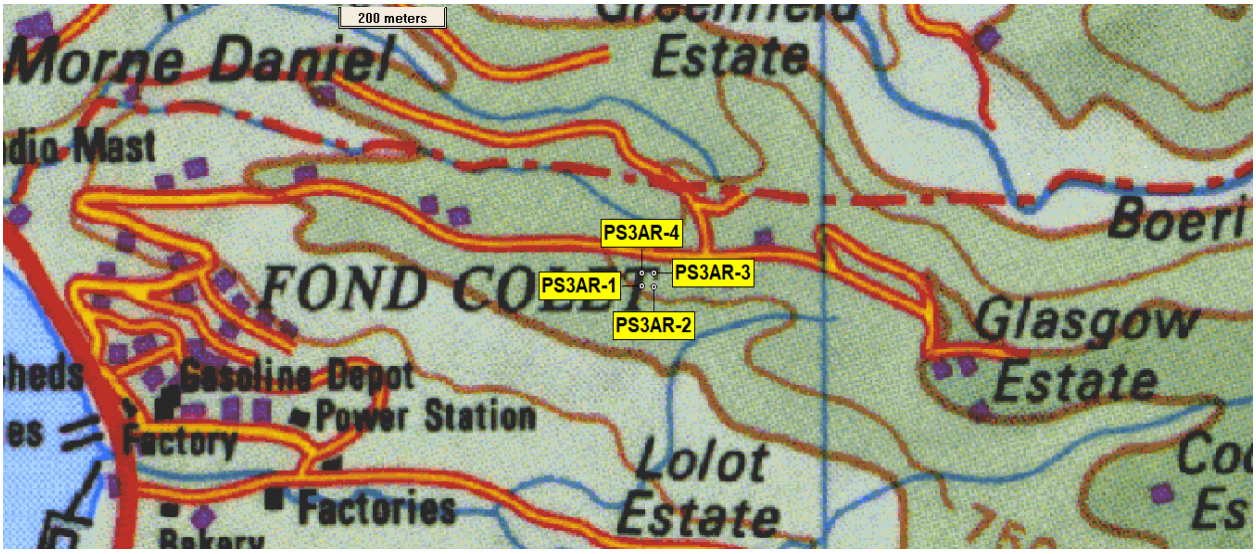


Figure 16: Location of Survey Plot on Access Track to Pole #3 and Pole #2

Figure 17: Modified Dry Scrub Woodland with introduced/naturalized vegetation - Site of Pole #4

Figure 18: Degraded Dry Scrub Woodland on proposed access route to Pole #3 and Pole #2

2.4.2. **Flora**

Secondary Dry Scrub Woodland is the main vegetation type of the seasonally dry lowland areas of the leeward side or west coast of Dominica. This habitat type occurs along the entire length of the west coast and through the main populated regions of Dominica.

This xeric vegetation is dominated by deciduous trees and shrubs most of which flower in the dry season (February to June). This vegetation zone comprises of a mix of deciduous and evergreen species. However, because of human influences the original natural forest within the study area has become extensively degraded.

The existing plant community includes a variety of trees, shrubs, vines, and herbaceous plants some of which are considered weed species. Large areas are occupied by agricultural fruit trees, and invasive lemon grass (*Cymbopogon citratus)* and zing-zing *(Leucanea leucocephala).* Areas of lemon grass, particularly on the south-facing slopes are subjected to annual bush fires in the dry season. The regular fires, dry climate, and shallow porous soil have prevented the areas of grassland and scrub lands from developing into woodland.

Survey plots were established at Pole #4 and on the access track to Pole #3 and Pole #2. The planned assessment at Pole #1 could not be done due to land access issues. Plant species documented within the sample plots at Pole #4 and at the proposed location of the access road to Pole #3 and Pole #2 respectively, included silk cotton, African tulip, gliricidia, pwa doux, albizia, coco poule, laglu, lepiné, saman, zing-zing, calabash, lemon grass, mango, guava, soursop, banana, pineapple, tamarind des Indes.

There were no plant species potentially at risk or any known red-listed/threatened species at risk that may be affected by the project activities.

2.4.3 **Fauna**

Mammals
Mammal species were not documented in the survey area, however, the agouti and manicou in addition to native bat species are known to frequent the locality.

Reptiles
Reptile species observed near the proposed pole locations and access roads, were limited to the Puerto Rico crested anole and the Dominica ground lizard. Other reptilian species such as the tree gecko *(Thecadactylus rapicauda),* house gecko *(Hemidactylus mabouia),* golden skink (*Mabuya mabouya), Lesser* Antillean iguana (*Iguana delicatissima),* Dominican boa (*Boa constrictor nebulosus)*, black-and-white checkered snake (*Liophis juliae)*, kouwès nwé (*Alsophis antillensis),* and the worm snake (*Typhlops dominicana), are known to* frequent the zone of influence.

Birds
Birds observed were species typically found in the Dry Scrub Woodland (See list below)

There were no species potentially at risk or known red-listed/threatened species at risk that may be affected by the project activities.

Table 5. List of Bird Species Recorded at Pole #4 and Access Road to Pole #3 and Pole #2

Common Name	Scientific Name	IUCN Conservation Status	On-Site Status
Antillean-Crested Hummingbird, Ti-kap	*Orthorhyncus cristatus*	Least concern	Lesser-Antillean Endemic Common Resident Breeder
Bananaquit, Sikiyé, Sikwiyé	*Coereba faveola*	Least concern	Abundant Resident Breeder
Black-faced Grass quit, Sisi-zèb	*Tiaris bicolor*	Least Concern	Common/Resident Breeder
Black-whiskered Vireo, Chwèk, Chwèk anglé	*Vireo altiloquus*	Least Concern	Common / Resident Breeder
Caribbean Elaenia, Siflé, Chwèk Patwa	*Elaenia martinica*	Least Concern	Caribbean Endemic /Abundant Resident Breeder
Lesser-Antillean Flycatcher, Gwo-tèt, Labèl	*Myiarchus oberi*	Least Concern	Lesser-Antillean endemic/Common Resident Breeder
Green-throated Carib, Foufou vèt	*Eulampis holosericeus*	Least Concern	Caribbean Endemic/Common Resident Breeder
Grey Kingbird, Pipirit	*Tyrannus dominicensis*	Least Concern	Common Resident Breeder
Lesser Antillean Bullfinch, Pennwè, Mwéson	*Loxigilla noctis*	Least Concern	Lesser Antillean Endemic/Common Resident Breeder
Lesser Antillean Saltator, Gwo-bèk	*Saltator albicollis*	Least Concern	Lesser Antillean Endemic/Common Resident Breeder
Purple-throated Carib, Foufou made	*Eulampis jugularis*	Least Concern	Caribbean Endemic/Common/Resident Breeder
Yellow Warbler Titin	*Dendroica petechia*	Least Concern	Common Resident Breeder