ANNEX 3

RAPID FAUNA AND FLORA ASSESSMENT OF THE PROPERTY FOR THE PROPOSED TROPICAL SUGAR FACTORY, LIONEL TOWN, CLARENDON

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1 Site Description

The property of interest is predominately a sugar cane (*Saccharum officinarum*) field; however, sections of the property were overgrown with vegetation. For the purpose of the study, the property was zoned into two categories: Secondary Forest, and Open Fields and Crops.

Figure 1: The Location of the Project Site; the Area Zoned as Open Fields and Crops (boundary highlighted in yellow) and Secondary Forest (highlighted in green).

1.1 Secondary Forest

The area zoned as Secondary Forest consists of areas with large trees (Figure 3) and areas with buildings (Figure 2). Activities such as small scale subsistence farming, animal husbandry and gathering/drying of castor oil beans (Figure 5) were observed in the area; a charcoal kiln was also observed in the area (Figure 4).

Figure 2: A House Observed on the Property

Figure 3: A Section of the Area on the Property Zoned as Secondary Forest.

Figure 4: Charcoal Kiln Observed in the Area Zoned as Secondary Forest

Figure 5: Castor Oil Beans Harvested in a Bag in the Cane Field and Been Dried at one of the Houses on Property

1.2 Open Field and Crop

The area zoned as Open Fields and Crops consists of mainly sugar cane field (Figure 6). On the boundary of the cane field, earthen canals with water (Figure 7) were observed; it should be noted that the water was black at the time of the visit and had a foul odour. There was also vegetation along the banks of the canals that ran along the boundary of the property.

Figure 6: The Remnant Sugar cane Field located in area zoned as Open Fields and Crops within the project area.

Figure 7: The Canal Located along the Northern Boundary of the Property

Figure 8: Vegetation Along the Canal Located Along the Boundary of the Property

2 Method: Fauna and Flora Assessments

The team conducted an extensive walkthrough of each sample site. The surveys, particularly fauna assessments, were conducted along the trails and footpaths to and within the sample sites. The surveys were carried out from March 29 to April 22, 2025, using the methods outlined in each section below. For each species observed, the name and the perceived dominance using the DAFOR scale (**D**ominant, **A**bundant, **F**requent, **O**ccasional and **R**are) were noted.

2.1 Flora Assessment

The vegetation on site was assessed by utilising a series of randomly distributed transects (100m x 5m each), 5 in total (T1–T5), within the boundaries of the development site (Figure 9). All plant species encountered within each transect were recorded.

Figure 9. The Location of the Transects used for the Flora Assessment.

The common names of most of the species sighted were assigned in situ. Regarding the unknown species, voucher specimens were collected and identified at the University of the West Indies (UWI) Herbarium. All plants were identified at the species level by examining morphological features such as leaf arrangement, leaf pattern, and pattern of branching and

morphology of floral and fruiting structure in conjunction with the use of Flowering Plants of Jamaica (Adams, 1972) and preserved reference specimens of the herbarium.

A total of 87 plant species from 36 families were recorded across the entire project area with relatively high diversity (Table 1). The highest number of species (48) were recorded along T4 and T2 (41), followed by T1 (37) and the lowest number of species recorded in T5 (34) and T3 (30) (Figure 10).

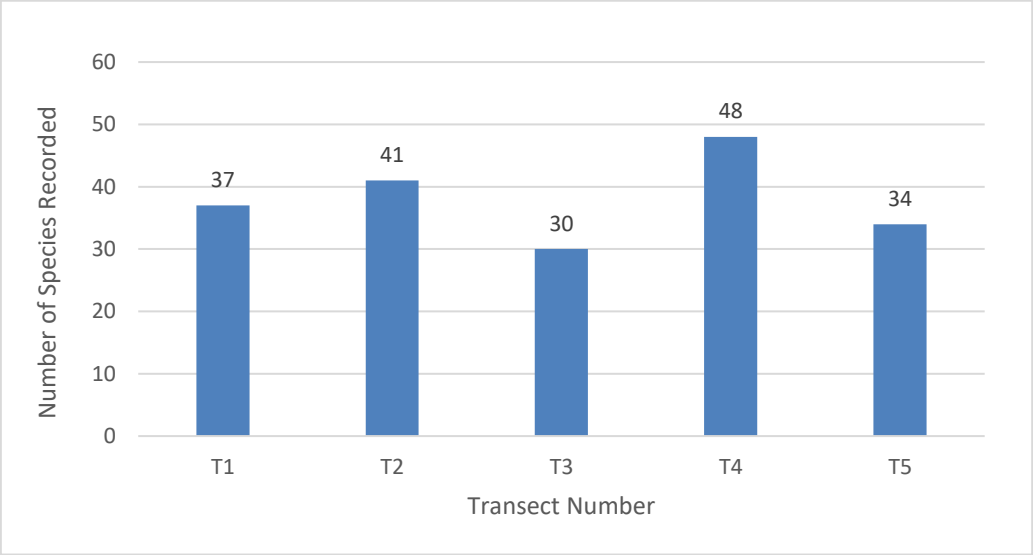

Figure 10. Graph Showing the Number of Plant Species Recorded Across Each Transect.

No endemic plant species were recorded during the assessment of the vegetation on the property. Only 2 species that are classified as Invasive Alien Species (IAS) were recorded within the study area; these were Guinea Grass (*Panicum maximum*) and Lead Tree (*Leucaena leucocephala*). It should be noted that no species with special conservation status (endangered/protected/threatened) were recorded within the study area.

Most plant species encountered during the assessment are described by Adams (1972), as commonly found in thickets, wastelands, and secondary woodlands. Most of the plant species can be classified as plants associated with anthropogenic disturbances, ornamentals, and crops. Transect 4 (T4), the area in which the most plant species were encountered, was heavily influenced by agricultural crops, as people live and do small scale farming within that area (Figure 11).

Figure 11. A Section of the Property, Along T4, that is used for Subsistence Barming; Plants in Photo include: Banana (*Musa sapientum*), June Plum (*Spondias dulcis*) and Cassava (*Manihot esculenta*).

Several pieces of infrastructure (such as building foundations, derelict canals and trails/farm roads) were scattered across this area. There was evidence of past and current agricultural activities (irrigation system and the fact that the land had been furrowed).

Table 1: List of Plant Species Identified along each Transect within the Project Area; Along with the DAFOR Ranking for each Plant Species for the Respective Transect

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Malvaceae	*Abelmoschus esculentus*	Okra	Common in cultivation				R	R
Malvaceae	*Abutilon hulseanum*		Locally common, a weed of waste ground	R		R		
Mimosaceae	*Acacia tortuosa*	Wild Poponax	Locally very common, along the south coast and on some cays, on arid limestone and at salina margins		R			R
Amaranthaceae	*Achyranthes indica*	Devil's Horsewhip	Common as a weed of cultivation and disturbed waste places	F		F		O
Amaranthaceae	*Amaranthus spinosus*	Wild Calaloo	Common as a weed of pastures, lawns and waste places		O			O
Poaceae	*Andropogon citratus*	Fever Grass	Common in cultivation in gardens and along path sides				R	
Annonaceae	*Annona muricata*	Sour Sop	Commonly cultivated				R	
Annonaceae	*Annona squamosa*	Sweet Sop	Commonly cultivated				R	
Polygonaceae	*Antigonon leptopus*	Coralita	Common in cultivation and escaping on to fences and hedges at low elevations	O		F	A	A
Asteraceae	*Bidens pilosa*	Spanish Needle	A common weed of roadsides and waste places	D	O	A		F
Sapindaceae	*Blighia sapida*	Ackee	Commonly cultivated and naturalized			R		
Nyctaginaceae	*Boerhavia coccinea*	Hog Weed	Common, as a weed of rough disturbed pastures, waste places and sand dunes	F				O
Nyctaginaceae	*Boerhavia erecta*		Rather common, a weed of disturbed ground, roadside banks in open areas and river gravel		O	O	R	
Nyctaginaceae	*Bougainvillea peruviana*		Common ornamental				R	
Fabaceae	*Cajanus cajan*	Gungo Pea	Common in cultivation				R	
Asclepiasaceae	*Calotropis procera*	French Cotton	Locally common, in arid sandy or gravely waste places			O		O

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Euphorbiaceae	*Caperonia castaneifolia*		Rather uncommon, in swamps, wet meadows and rice fields	R				
Solanaceae	*Capsicum baccatum*	Bird Pepper					R	
Caesalpiniaceae	*Cassia javanica*	Pink Cassia	Common ornamental				R	
Poaceae	*Chloris barbata*		Very common as a weed along roadsides and in waste places	O	F	A	O	
Sapotaceae	*Chrysophyllum cainito*	Star Apple	Common, mostly along roadsides and in pastures and yards were planted				R	
Vitaceae	*Cissus sicyoides*	Soldier Wiss	Very common, on trees, walls, fences and in thickets			R		
Rutaceae	*Citrus aurantifolia*	Lime	Commonly cultivated				R	
Fabaceae	*Clitoria ternatea*	Blue Pea	Common in cultivation as ornamental, and escaping into waste places	F	O		O	
Arecaceae	*Cocos nucifera*	Coconut	Commonly cultivated				R	R
Commelinaceae	*Commelina diffusa*	Water Grass	A common weed of cultivations, waste places and pastures		O			O
Asteraceae	*Conyza canadensis*	Canada Fleabane	Common on roadside banks and rough pastures	F	O	R	O	F
Boraginaceae	*Cordia dentata*	Duppy Cherry	Locally abundant on gravelly alluvial plains		R			R
Cucurbitaceae	*Cucumis anguria*	Wild Cucumber	Locally common, in rough waste places		O	R		R
Cucurbitaceae	*Cucurbita pepo*	Pumpkin	Commonly cultivated				R	R
Asteraceae	*Cyanthillium cinereum*		Very common, a weed of pastures and waste places	O	R		R	
Fabaceae	*Desmodium incanum*		Common in pastures and on banks			F		
Fabaceae	*Desmodium scorpiurus*		Rather common, a weed of sandy pastures and roadsides and rocky or stony waste ground	O	R			O
Verbenaceae	*Duranta repens*		Common on roadside banks and in thickets, also cultivated for ornament				R	

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Poaceae	*Echinochola colonum*		Widely distributed and locally common in ditches, low-lying open ground and pond margins		O			
Euphorbiaceae	*Euphobia heterophylla*	Japanese Poinsettia	Occasional in central and eastern parishes, a weed of roadside banks and open waste places		R			R
Euphorbiaceae	*Euphorbia hirta*		Very common, a weed of roadsides, waste places, lawns, pastures and cultivated grounds	F	O	O	F	F
Euphorbiaceae	*Euphorbia hypericifolia*		Common and abundant locally as a weed of waste places	O	R	O	O	O
Moraceae	*Ficus benjamina*	Chinese Banyan	Cultivated shade and ornamental tree				R	
Malvaceae	*Gossypium barbadense*	Sea Island Cotton	Annual forms cultivated; perennial forms naturalized in moist sheltered places.				R	
Sterculiaceae	*Guazuma ulmifolia*	Bastard Cedar	Very common along roadsides, in pastures and open secondary woodlands		R	O		R
Boraginaceae	*Heliotropium indicum*	Wild Clary	Common as a weed of pastures, cultivated ground and waste places	F	R		O	
Malvaceae	*Hibiscus sabdariffa*	Sorrel	Common in cultivation				R	
Euphorbiaceae	*Jatropha curcas*	Physic Nut	Frequent, mostly near habitations	O	O			R
Verbenaceae	*Lantana camara*	Wild Sage	Very common in rough pastures, waste places and thickets	O	R	R	O	O
Verbenaceae	*Lantana trifolia*		Common in rough pastures and waste places	R	R			
Lamiaceae	*Leonotis nepetifolia*		Rather common, a weed of fields, roadsides and waste ground	R				
Mimosaceae	*Leucaena leucocephala***	Lead Tree	Common along roadsides and in sandy waste places and thickets	F	O	O	A	O
Cucurbitaceae	*Luffa aegyptiaca*			R				
Malvaceae	*Malachra alceifolia*	Wild Okra	Locally common, mainly in south-eastern parishes, a weed of roadsides and low-lying waste places	R		R		

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Malvaceae	*Malvastrum coromandelianum*		Common weed of cultivated ground, pastures and waste places		O			
Anacardiaceae	*Mangifera indica*	Mango	Cultivated and naturalized				O	
Euphorbiaceae	*Manihot esculenta*	Cassava	Cultivated locally on the heavier soils				R	
Sapindiaceae	*Melicoccus bijugatus*	Guinep	Common along roadsides and in secondary thickets and woodlands				O	R
Convolvulaceae	*Merremia dissecta*	Know You	Cultivated and widely escaped on fences and in thickets and waste grounds	O				
Convolvulaceae	*Merremia umbellata*		Common on fences and in thickets and waste places			O	R	
Rubiaceae	*Morinda citrifolia*	Noni	Locally common in open areas near the sea, cultivated inland				R	
Musaceae	*Musa paradisiaca*	Plantain	Commonly cultivated				R	
Musaceae	*Musa sapientum*	Banana	Commonly cultivated				R	
Poaceae	*Panicum maximum***	Guinea Grass	Very common in rough pastures, ditches and sheltered thickets	D	F	D	D	A
Asteraceae	*Parthenium hysterophorus*	Dog-flea Weed	Common along roadsides and in shady or open waste places	O	R			O
Poaceae	*Paspalum dilatatum*		Introduced and cultivated	F	O		O	
Passifloraceae	*Passiflora foetida*		Common in thickets, hedgerows and waste places	O	R			
Caesalpiniaceae	*Peltophorum linnaei*	Braziletto	Locally common, in coastal areas of the central and western parishes, in thickets and open woodlands on arid limestone		R			
Fabaceae	*Phaseolus lunatus*	Broad Bean	Cultivated at the lower elevations				R	
Portulacaceae	*Portulaca oleracea*	Pussley	Very common, a weed of cultivated ground and waste places	F		O		O
Verbenaceae	*Priva lappulacea*	Velvet Bur	A common weed of cultivations, roadsides and waste places	F	O	R	F	O
Mimosaceae	*Prosopis juliflora*	Cashaw	Locally common, in low pastures in arid areas and on sand and shingle dunes	R	O	R		R

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Myrtaceae	*Psidium guajava*	Guava	Common in pastures and wayside thickets, sometimes cultivated				O	
Commelinaceae	*Rhoeo spathacea*	Mosses in the Bulrushes	Common, on limestone banks and in rocky thickets and woodland margins				O	
Fabaceae	*Rhynchosia minima*		Common in waste places and cultivated land	F		R	F	
Euphorbiaceae	*Ricinus communis*	Castor Oil	Common as cultivated plant and on waste ground	O	R	O	R	R
Acanthaceae	*Ruellia tuberosa*	Duppy Gunshot	Very common in pastures and waste places and on roadside banks		O			O
Poaceae	*Saccharum officinarum*	Sugar Cane	Abundantly cultivated, mostly at low elevations on level ground in deep soils	D	D	D		D
Mimosaceae	*Samanea saman*	Guango	Common in inhabited areas and in old pastures where planted, naturalized in riparian forest and in secondary communities on level ground		R	R	F	
Malvaceae	*Sida acuta*	Broom Weed	Very common in pastures, waste places and cultivations		O			O
Malvaceae	*Sida spinosa*		Common, as a weed of cultivations and in pastures and sandy waste places	F	O	R		O
Solanaceae	*Solanum torvum*	Susumber	Common in woodland clearings, thickets and waste places				O	R
Poaceae	*Sorghum halepense*	Johnson Grass	Locally common, gregarious and forming colonies, a persistent weed of some pastures and stony waste ground	R	R			
Anacardiaceae	*Spondias dulcis*	June Plum	Occasional in cultivation				R	
Poaceae	*Sporobolus pyramidatus*		Locally common, in drier southern coastal areas in salina margins and sandy waste places near the sea		R			
Bignoniaceae	*Tabebuia rosea*	Pink Poui	Cultivated				R	
Caesalpiniaceae	*Tamarindus indica*	Tamarind	Cultivated and naturalized				R	
Asteraceae	*Tithonia diversifolia*	Mexican Sunflower	Locally common, naturalized on roadside banks and in cultivations		R	R		

Family	Scientific Name	Common Name	Range According to Adams, 1972	T1	T2	T3	T4	T5
Asteraceae	*Wedelia gracilis*		Rather common, especially in rough damp low-lying pastures	O	F	O		
Rhamnaceae	*Ziziphus mauritiana*	Coolie Plum	Established and common in some waste places, occasionally forming thickets	O	R			
Poaceae	*Zoysia tenuifolia*		Cultivated for lawns	F				

Key: **- Invasive Alien Species (IAS): Please note: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare).

2.2 Avifauna Assessment

The line transect method was selected for the avifauna assessment, and it entailed walking slowly along the extensive roads and trails networks on the property, noting all the birds seen or heard in the area (Bibby, Jones, and Marsden, 2000). The birds encountered for the first time were added to the list while conducting other assessments in the area.

For the nocturnal birds, the line transect methods were conducted along the roads/trails used for the day surveys. In addition, AudioMoth recorders were used for the nocturnal bird survey (Figure 12). The devices were active from 17:30 to 06:30. The audio files were analysed using the Kaleidoscope Pro software from Wildlife Acoustics.

People encountered in the project area were informally interviewed about the birds they observed, emphasising nocturnal birds on the property.

Reference material used in species identification (pictures and calls) included the Merlin App (Merlin, 2024), Ebird (Fink, et al. 2018), and Bird of the West Indies.

Figure 12: One of the AudioMoth Devices Deployed in the Field for the Assessment of Nocturnal Birds, Frog, Vocal Reptiles and Bats.

Forty-eight (48) species of birds were identified during the assessment, including 7 residents (endemic), 28 residents (non-endemic), 1 introduced and 12 migrants (see Table 2). Of the 7 endemic birds observed in the project, none of the species was viewed as a forest specialist.

Table 2: The Birds Observed During the Assessment of the Project Area.

#	Common Name	Scientific Name	Range	IUCN	Open Field and Crop	Secondary Forest
1	American Kestrel	*Falco sparverius*	*Resident*	LC	R	R
2	American Redstart	*Setophaga ruticilla*	*Migrant*	LC	R	R
3	Antillean Nighthawk	*Chordeiles gundlachii*	*Migrant*	LC	R	R
4	Antillean Palm-Swift	*Tachornis phoenicobia*	*Resident*	LC	O	R
5	Bananaquit	*Coereba flaveola*	*Resident*	LC		R
6	Black-and-white Warbler	*Mniotilta varia*	*Migrant*	LC	R	
7	Black-faced Grassquit	*Melanospiza bicolor*	*Resident*	LC	R	
8	Black-throated Blue Warbler	*Setophaga caerulescens*	*Migrant*	LC	R	
9	Cape May Warbler	*Setophaga tigrina*	*Migrant*	LC	R	
10	Cattle Egret	*Bubulcus ibis*	*Resident*	LC	O	R
11	Cave Swallow	*Petrochelidon fulva*	*Resident*	LC	R	
12	Common Ground Dove	*Columbina passerina*	*Resident*	LC	O	R
13	Common Yellowthroat	*Geothlypis trichas*	*Migrant*	LC	R	R
14	Glossy Ibis	*Plegadis falcinellus*	*Resident*	LC	R	
15	Gray Kingbird	*Tyrannus dominicensis*	*Migrant*	LC	R	R
16	Great Blue Heron	*Ardea herodias*	*Resident*	LC	R	
17	Great Egret	*Ardea alba*	*Resident*	LC	R	
18	Greater Antillean Grackle	*Quiscalus niger*	*Resident*	LC	R	R
19	Greater yellowlegs	*Tringa melanoleuca*	*Migrant*	LC	R	
20	Green Heron	*Butorides virescens*	*Resident*	LC	R	
21	Jamaican Euphonia	*Euphonia jamaica*	*Endemic*	LC		R
22	Jamaican Lizard-Cuckoo	*Coccyzus vetula*	*Endemic*	LC		R
23	Jamaican Mango	*Anthracothorax mango*	*Endemic*	LC		R
24	Jamaican Oriole	*Icterus leucopteryx*	*Resident*	LC		R
25	Jamaican Parakeet	*Eupsittula nana*	*Endemic*	NT		O
26	Jamaican Vireo	*Vireo modestus*	*Endemic*	LC	R	
27	Jamaican Woodpecker	*Melanerpes radiolatus*	*Endemic*	LC		R
28	Killdeer	*Charadrius vociferus*	*Resident*	LC	R	
29	Little Blue Heron	*Egretta caerulea*	*Resident*	LC	R	

#	Common Name	Scientific Name	Range	IUCN	Open Field and Crop	Secondary Forest
30	Loggerhead Kingbird	*Tyrannus caudifasciatus*	*Resident*	LC	R	O
31	Mourning Dove	*Zenaida macroura*	*Resident*	LC	R	
32	Northern Mockingbird	*Mimus polyglottos*	*Resident*	LC	R	R
33	Northern Parula	*Setophaga americana*	*Migrant*	LC	R	
34	Palm Warbler	*Setophaga palmarum*	*Migrant*	LC	R	R
35	Prairie Warbler	*Setophaga discolor*	*Migrant*	LC	R	
36	Red-billed Streamertail	*Trochilus polytmus*	*Endemic*	LC	R	R
37	Rock Pigeon	*Columba livia*	*Resident*	LC	R	
38	Smooth-billed Ani	*Crotophaga ani*	*Resident*	LC	F	O
39	Tricolored Munia	*Lonchura malacca*	*Introduced*	LC	F	
40	Turkey Vulture	Cathartes aura	*Resident*	LC	O	O
41	Vervain Hummingbird	*Mellisuga minima*	*Resident*	LC	R	R
42	White-crowned Pigeon	*Patagioenas leucocephala*	*Resident*	NT		R
43	White-winged Dove	*Zenaida asiatica*	*Resident*	LC	R	O
44	Yellow Warbler	*Setophaga petechia*	*Resident*	LC	R	R
45	Yellow-crowned Night-Heron	*Nyctanassa violacea*	*Resident*	LC	R	
46	Yellow-faced Grassquit	*Tiaris olivaceus*	*Resident*	LC	R	O
47	Yellow-throated Warbler	*Setophaga dominica*	*Migrant*	LC	R	
48	Zenaida Dove	*Zenaida aurita*	*Resident*	LC	R	R

***Please note**: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare). IUCN Rating (LC = Least Concerned, and NT= Near Threatened)

Twelve (12) migrants were identified in the study area, including 8 winter migrants, 2 summer migrants and a Greater Yellowlegs. The winter migrants generally arrive in Jamaica as early as September and begin to depart in April. The winter migrants in the study mainly consist of wood warbler. The summer migrants include the Gray Kingbird and Antillean Nighthawk. The Nighthawks were heard calling during the nocturnal study.

A few wetland birds were observed in the cane field such as the Greater yellowlegs, Great Egret, Cattle Egret, Yellow Crowned Night Heron and Little Blue Heron. The Greater Yellowlegs were encountered in the canal on the property. The Yellow Crowned Night Heron was encountered foraging in the cane field during the nocturnal assessments.

Large flocks of the Tricolored Munia, an introduced species, was observed in the cane field during the study.

Two species with special conservation status, the Jamaican Parakeet and the White-Crowned Pigeon, were recorded in the assessment and are both listed as Near Threatened by the IUCN.

2.3 Herpetology

The amphibian and reptile surveys were conducted across the different microhabitat types within the project area. The habitat search included trees, stone piles, abandoned structures and other debris. All specimens seen were identified, and a DAFOR ranking was assigned to reflect their relative dominance; pictures were taken for further study if necessary.

Herpetofauna which could not be identified in the field were collected and identified using Amphibians and Reptiles of the Caribbean Islands Keys (Caribherp, 2015) and Amphibians and Reptiles of the West Indies (Schwartz & Henderson, 1991).

The AudioMoth devices used for the bird surveys were also used for the amphibians and vocal reptiles survey. The devices were active from 17:30 to 06:30. The audio files were analysed using the Kaleidoscope Pro software from Wildlife Acoustics. The acoustics were identified using expert identification and reference material (Hedges, 2023).

Amphibian. The introduced species included the Lesser Antillean Whistling Frog (*Eleutherodactylus johnstonei)* which was the only amphibian recorded on the property (Table 3**Error! Reference source not found.**). The introduced Cuban Tree Frog (*Osteopilus septentrionalis*) and the Cane Toad (*Rhinella marina*) have been reported in the Lionel Town area, however, they were not encountered on the project site. There was a water channel (earthen canal) on the boundary of the property but there were no signs of amphibians in the waterbody. It is believed that the chemical state of the water in the canal is the reason for no fauna being present in the waterbody.

Table 3: The Amphibians and Reptiles Recorded in the Project Area

#	Type	Family	Scientific Name	Common Name	Range	IUCN Status	Open Fields	Secondary Forest
1	Amphibia	Eleutherodactylidae	*Eleutherodactylus johnstonei*	Lesser Antillean Frog	Introduced	LC	R	O
2	Reptilia	Dactyloidae	*Anolis lineatopus*	Jamaican Brown Anole	Endemic	LC	R	F
3	Reptilia	Dactyloidae	*Anolis grahami*	Jamaican Turquoise Anole	Endemic	LC	R	R
4	Reptilia	Dactyloidae	*Anolis opalinus*	Jamaican Opal-bellied Anole	Endemic	LC		R
5	Reptilia	Dactyloidae	*Anolis sagrei*	Brown Anole	Introduced	LC	R	

Please note: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare). IUCN Rating – LC – Least Concerned, VU – Vulnerable

Reptiles: Four anoles were encountered in the study area. This included 3 endemic Anoles and one introduced species, *Anolis sagrei*. The anoles were mostly observed in the secondary forest. No snakes and galliwasps were observed in the project area. No species listed in the survey are of any special conservation status.

Figure 13: A Jamaican Turquoise Anole

2.4 Invertebrate Assessment

The invertebrate assessment consisted of a series of walkthroughs within the project area and the examination of microhabitats within the project area, these included tree trunks, leaves, dry wood, and sticks. A sweep net was also used to sample insects from the foliage and insects in flight were recorded. The arthropods encountered in the field were identified on the spot; however, arthropods which could not be identified in the area were later identified using Insects

Keys (Triplehorn, Johnson and Borror 2005), iNaturalist App and collections at the University of the West Indies if necessary.

For the nocturnal insects, a light trap (bucket trap) was used to attract and collect specimens in the project area (Figure 14). The species were identified using the reference material stated above. It should be noted that the study is focussed on macro-invertebrates. Micro invertebrates such as micro lepidopterans were not classified.

Figure 14: A Bucket Light Trap used in the Study for the Nocturnal Assessment of Insects.

Twenty-one (21) butterfly species were observed in the study area. Of the 21 species, 19 native and 2 endemic subspecies were identified in the study (Table 4). None of the butterfly species identified is of any special conservation needs.

Table 4: The Butterfly Species Observed During the Assessment of the Area

#	Family	Scientific Names	Common Names	Status	Cane Field	Woodland
1	Crambidae	Spoladea recurvalis	Hawaiian Beet Webworm Moth		O	R
2	Hesperiidae	Burnsius oileus	Tropical checkered skipper	Native	R	R
3	Hesperiidae	Cymaenes tripunctus	three-spotted skipper	Native	R	
4	Lycaenidae	Hemiargus ceraunus	The Hanno Blue	Native	O	
5	Lycaenidae	Leptotes cassius	Cassius Blue	Native	O	O
6	Lycaenidae	Strymon istapa	mallow hairstreak	Native	O	R
7	Noctuidae	Utetheisa ornatrix	Bella Moth	Native	O	
8	Nymphalidae	Agraulis vanillae insularis	Gulf Fritillary	Native	R	R
9	Nymphalidae	Anartia jatrophae	White Peacock	Native	O	R
10	Nymphalidae	Dione vanillae	The Tropical Silverspot	Native	R	
11	Nymphalidae	Dryas iulia delilah	Julia	Endemic subspecies	R	R
12	Nymphalidae	Heliconius charithonia simulator	Zebra butterfly	Endemic subspecies		R
13	Nymphalidae	Junonia evarete	Tropical Buckeye	Native	R	R
14	Nymphalidae	Siproeta stelenes	The Antillean Malachite	Native	R	
15	Pieridae	Anteos maerula	yellow angled sulphur	Native	R	
16	Pieridae	Ascia monuste	Great Southern White; Antillean Great White	Native	O	
17	Pieridae	Eurema elathea	Cramer's Barred Sulphur	Native		R
18	Pieridae	Phoebis sennae	Cloudless Sulphur	Native	R	
19	Pieridae	Pyrisitia lisa	Little yellow	Native	O	
20	Psychidae	Bog worm	Bog worm Moth		O	
21	Satyrinae	Calisto zangis	Jamaican satyr	Native	R	

Please note: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare).

Regarding the arthropods (non-butterfly), there were 40 species (1 millipede, 5 spiders, and 34 insects). The low number of species could be as result of the area being under cultivation for several years.

None of the arthropod species identified is of any special conservation needs.

Table 5: The Arthropods (Non-butterfly) Observed During the Assessment

#	Order	Family	Scientific Names	Common Names	Status	Open Fields	Secondary Forest
1	Araneae	Araneidae	*Argiope trifasciata*	Banded garden spider	Native	O	
2	Araneae	Araneidae	*Gasteracantha cancriformis*	Black Crab spider	Native	R	
3	Araneae	Sparassidae	*Heteropoda venatoria*	Pantropical Huntsman Spider	Native	O	R
4	Araneae	Tetragnathidae	*Leucauge argyra*	Orb weavers	Native	R	
5	Araneae	Cheiracanthiidae	*Cheiracanthium inclusum*	yellow sac spider	Native	R	
6	Blattodea	Blattoidae	*Periplaneta australasiae*	Australian Cockroach	Introduced	F	
7	Blattodea	Blattoidae	*Periplaneta americana*	American Cockroach	Introduced	O	F
8	Blattodea	Pseudophyllodromiidae	*Species 1*			R	
9	Blattodea	Termitidae	*Nasutitermes sp*	Termites, Duck ants Widespread.	Native	R	R
10	Coleoptera	Chrysomelidae	*Disonycha glabrata*	Pigweed Flea Beetle	Native	O	
11	Coleoptera	Cerambycidae	*Oxymerus aculeatus*		Native	R	
12	Coleoptera	Scarabaeidae	*Strategus simson*		Native	R	
13	Diptera	Dolichopodidae	*Condylostylus sp*	Green Fly	Native	R	
14	Diptera	Muscidae	*Musca domestica*	Housefly	Native	R	O
15	Hemiptera	Pyrrhocoridae	*Dysdercus andreae*	Cotton Stainer Bugs	Native	O	
16	Hemiptera	Rhopalidae	*Niesthrea sp*			R	
17	Hempitera	Pentatomidae	*Ascra sp*	Stink bug			R
18	Hempitera	Pentatomidae	*Nezara viridula*	Stink bug	Native	R	
19	Hymenoptera	Apidae	*Apis mellifera*		Native	F	O

#	Order	Family	Scientific Names	Common Names	Status	Open Fields	Secondary Forest
20	Hymenoptera	Formicidae	*Camponotus*	Carpenter and Sugar Ants	Native		**O**
21	Hymenoptera	Formicidae	*Camponotus hannani*	Red Ants	Native	F	
22	Hymenoptera	Vespidae	*Polistes crinitus*	Caribbean Paper Wasp	Native	F	O
23	Hymenoptera	Vespidae	*Polistes major*		Native	O	R
24	Hymenoptera	Xylocopinae	*Xylocopa mordax*		Native	R	
25	Isopetera	Termitidae	*Nasutitermes costalis*	Termites, Duck ants Widespread.	Native	O	O
26	Odonata	Lestidae	*Lestes sp*		Native	R	
27	Odonata	Libellulidae	*Enallagma coecum*	Antillean Bluet	Native		R
28	Odonata	Libellulidae	*Erythemis vesiculosa*	Great Pondhawk	Native	O	R
29	Odonata	Libellulidae	*Erythrodiplax fervida*	Red-mantled Dragonlet	Native	R	
30	Odonata	Libellulidae	*Dythemis rufinervis*	Red Setwing	Native	O	
31	Odonata	Libellulidae	*Erythrodiplax umbrata*	Band-winged Dragonlet	Native	O	R
32	Odonata	Libellulidae	*Erythrodiplax justiniana*	Antillean Dragonlet	Native	R	
33	Odonata	Libellulidae	*Orthemis macrostigma*	Red Dragonfly or Tropical King Skimmers	Native	R	
34	Odonata	Tettigoniidae		Green Katydids		R	
35	Orthoptera	Acrididae	*Abracris flavolineata*		Native	R	
36	Orthoptera	Acrididae	*Orphulella punctata*	Green and Brown Grasshopper	Native	O	
37	Orthoptera	Acrididae	*Schistocerca pallens*		Native	O	
38	Orthoptera	Acrididae	*Schistocerca serialis*	Short-horned Grasshoppers	Native	R	
39	Orthoptera	Gryllidae	*Gryllus assimilis*	Jamaica Field Cricket	Native		O
40	Spirobolida	Rhinocricidae	*Anadenobolus monilicornis*	Yellow-banded millipede	Native	O	

Please note: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare).

Figure 15: Mallow Scrub-Hairstreak (Strymon istapa)

Figure 16: *Oxymerus aculeatus* Observed on the Property

2.5 Bat Study

The bat survey was carried out during the day and at night. During the day all possible bat roosting areas, including manmade structures and trees, were searched. Special emphasis was placed on finding the endemic Jamaican Fig-eating Bat (*Ariteus flavescens)*. The bat survey was also conducted by deploying 2 AudioMoth acoustic detectors and 1 Song meter bat mini recorder (SMB1) bat detector in selected areas on the property for 25 nights (Figure 17). The AudioMothts were configured to start recording before sunset from 17:30 to 06:00. The sample rate was 384 kHz, and the gain was set at medium. The sleep duration was 5 seconds, and the recording duration was 10 seconds. The devices were placed at a height of 3 m. The SMB1 was set to record half hour before sunset and stop at half hour after sunrise (Figure 18).

The Kaleidoscope Pro software from Wildlife Acoustics was used to ID the bat call from both acoustic devices. The software is generally used to cluster and visualise recordings, automatically identify bats, and analyse sound. The bat call library within the software only accounts for 10 of the 21 species found in Jamaica. Other bat calls were obtained from acoustic material from Windsor Research Centre (Koenig 2015), personal library, and from Google as needed.

Figure 17: Location of the Acoustic Recorders used in the Study

Figure 18: SMB1 Bat Recorder Deployed in the Field

Five species of bats were recorded and identified using the Kaleidoscope Pro Analysis Acoustic software (Table 6).

The bat species trophic guild of the detected species includes Frugivores (n=1), and Insectivores (n=4). Insectivorous bats include aerial hunters and other species that glean insects from the vegetation especially from the sugar cane. A few trees that were fruiting were encountered at the time of the study; this is likely where the Jamaica fruit bats forage for food.

There were no endemic bats or bats with special protection or deemed endangered observed/identified. No caves were reported on the property. The endemic Jamaican fig-eating bat (*Ariteus flavescens*) was not observed roosting in the project area or detected in the acoustic study.

Table 6: The Bat Species Identified in the Study

#	Scientific Name	Common Name	Diet	Roost	Foraging Behaviour
1	Artibeus jamaicensis	Jamaican Fruit Bat	Frugivore	Cave, man-made structure, foliage	Fruit Feeder: trees in forested and disturbed area
2	*Molossus milleri*	Pallas' Mastiff Bat	Insectivore	Cave, man-made structures	Open-space, aerial awking
3	Moormops blainvillei	Antillean Ghost-faced Bat	Insectivore	Obligate cave	semi-cluttered space; 4fluttering hunter
4	Pteronotus macleayii	MacLeay's Mustached Bat	Insectivore	Obligate cave	Background-cluttered space; fluttering hunter
5	Pteronotus parnellii	Parnell's Mustached Bat	Insectivore	Obligate cave	Highly cluttered space; fluttering hunter

2.6 Other Fauna

Three mammals were observed while carrying out the fauna study (Table 7).

Table 7: The Mammals Encountered During the Assessment of the Property

#	Order	Family	Scientific Name	Common Name	Range	IUCN Status*	Open Fields	Secondary Forest
1	Carnivora	Herpestidae	*Herpestes auropunctatus*	Indian Mongoose	Introduced	LC		R
2	Carnivora	Felidae	*Felis catus*	Cats	Introduced	LC	R	
3	Artiodactyla	Bovinae	*Bos taurus*	Cow	Introduced	LC		O

Please note: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare).

IUCN Rating – LC – Least Concerned, VU – Vulnerable

Figure 19: Cows Observed on the Property

3 Impact of the Development on Fauna and Flora

- The proposed development footprint will impact flora and fauna, as land clearance will be necessary for the undertaking of the project.
- Vegetation (even in very disturbed areas with low diversity), such as open fields and crop areas, is still actively utilised by fauna as a habitat. Fauna such as birds and herps that were recorded will be temporarily displaced; however, they will more than likely return after the initial phases of the project.

4 Recommendations

- A detailed (large tree assessment) of the larger (more mature trees) located within the area the Secondary Forest of the property boundary should be conducted. This additional information will feed into the conservation management of the property and assist in mitigating the deleterious impacts of the development.
- In instances where possible, some of the larger trees within the sample sites should be retained. This will help to maintain some of the habitat for fauna within the areas.

- The planting of native trees as a part of the landscaping when the development is complete, is encouraged, where possible, throughout the project area to bolster the habitat for fauna.
- A comprehensive assessment of the Secondary Forest within the study area, to determine if Jamaican Fig Eating Bats are roosting within the project area should be conducted. These bats are known to roost in areas close to the project area, therefore making this assessment necessary. This will allow for possible potential impacts the development will have on this species.
- Only a few fauna was observed on in the water in the earthen water channel observed along the boundary of the property. The water was black, and it had a foul odour. A water quality study should be carried out in the waterbody.

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