

# Barbados National Wetland Inventory



Submitted by

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**Implementing Partners:** Fisheries and Environmental Consulting and Walkers Institute for Regenerative Research Education and Design (WIRRED) and Dr. Thérèse Yarde

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## Acronyms and Abbreviations

|               |   |
|---------------|---|
| CBD           | Convention on Biological Diversity  |
| GIS           | Geographic information systems  |
| ICZMP         | Integrated Coastal Zone Management Plan   |
| IUCN          | International Union for Conservation of Nature  |
| NBSAP         | National Biodiversity Strategy and Action Plan  |
| NWI           | National wetland inventory  |
| PDP           | Physical Development Plan   |
| SPAW Protocol | Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region |
| UNCCD         | United Nations Convention to Combat Desertification   |

# Executive summary

## Background

The Contracting Parties to the Ramsar Convention on Wetlands, in Resolution VII.20, have recognised national wetland inventories (NWIs) as an essential foundation for the wise use, management and conservation of wetland. As a result, Parties have been urged to prioritise the preparation of NWIs, with a wetland inventory being defined as “the collection and/or collation of core information for wetland management, including the provision of an information base for specific assessment and monitoring activities” (Ramsar Convention Secretariat 2010).

This document provides the NWI for Barbados. The Ramsar Convention Secretariat has formulated and issued a Framework for Wetland Inventory, which provides guidance on planning, designing and implementing wetlands inventories. The development of this NWI has been informed by the structure and approach presented in the Ramsar Framework.

The principal purpose of this NWI is to characterise the following wetlands of national importance:

- Graeme Hall Swamp
- Chancery Lane wetlands
- Long Pond
- Green Pond

This characterisation is intended to provide a tool for subsequent conservation planning and management, and support fulfilment of obligations under the Ramsar Convention.

A secondary purpose is to provide an inventory of other wetlands in Barbados.

## Inventory Approach and Method

Given the relatively short duration of the project, the overall approach employed was that of rapid assessment for production of a baseline inventory (Ramsar Convention Secretariat, 2006a). This approach aims to, in a short time, gather as much information as possible about a wetland ecosystem, and provides reliable initial information about a defined area of interest, with a focus on overall ecosystem character rather than on details of particular species and habitats.

Based on the above principles, this NWI has involved three main phases:

- Review of existing information and knowledge, via a situational analysis and gap analysis.
- Validation of existing data, and generation of new and additional data, as required and feasible, via ground-truthing, field studies, and drone surveys.
- Storage, management, assessment, analysis, and representation of data using geographic information systems (GIS).

The Ramsar Convention on Wetlands states that “Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life.” (Ramsar Convention Secretariat, 2006b). The Convention takes a wide range of wetland types into consideration under its protective jurisdiction. There are 5 major categories:

- **Marine** (coastal wetlands including coastal lagoons, rocky shores, seagrass beds and coral reefs);
- **Estuarine** (including deltas, tidal marshes and mudflats, and mangrove swamps);
- **Lacustrine** (wetlands associated with lakes);
- **Riverine** (wetlands along rivers and streams);
- **Palustrine** (meaning “marshy” – marshes, swamps and bogs).

For the purposes of this NWI, a nationally important wetland is one which meets at least one of the following five criteria:

1. It plays a critical ecological or hydrological role in the natural functioning of a large wetland system or watershed;
2. It is a significant area for wildlife during a vulnerable period of their life cycles, or functions as a refuge during harsh conditions;
3. It supports more than 1% of the national populations of any native plant or animal taxa;
4. It supports plant or animal communities which are considered endangered or vulnerable at the national and international levels;
5. It is an area, or falls within the boundaries of an area, that is of outstanding historical or cultural significance.

For Barbados, recognising that the country is not known for expansive terrestrial wetlands and freshwater aquatic habitat, nationally important wetlands identified using these criteria have been broadly allocated into three categories as follows:

- 1 **Primary wetlands:** wetlands that meet all of the criteria for a nationally important wetland.
- 2 **Secondary wetlands:** wetlands that meet two to four of the criteria for a nationally important wetland.
- 3 **Tertiary wetlands:** wetlands that meet one of the criteria for a nationally important wetland.

Several policies and laws in Barbados are relevant to wetlands and provide a context within which conservation and sustainable use of Barbados’ wetlands can be pursued.

Based on the criteria, described in Section 1.4, for categorising wetlands of national importance, this assessment has identified 35 nationally important wetlands for inclusion in this first NWI for Barbados. Four are of primary concern, the remainder are categorised as secondary and tertiary. It is suggested that the River Bay North wetland also be considered as a primary wetland.

### **3.1 Primary wetlands**

Extensive descriptions developed according to Ramsar guidelines are provided for the four primary wetlands. They are supported by extensive georeferenced drone mapping of the four areas. Maps showing the extent and location, land tenure, and habitats are included. Other topics covered include: water regime, biodiversity, ecological changes, ecosystem services, human impacts and management.

These wetlands were found to be habitats for significant biodiversity and should be conserved. Apart from Graeme Hall Swamp there is minimal information upon which to base management.

### **3.2 Other wetlands**

In addition to the four nationally significant wetlands characterised above, this inventory has identified an additional 40 secondary and tertiary wetlands, including natural and artificial/engineered wetlands.

Of these secondary and tertiary wetlands, 17 are remnant coastal wetlands or gully outlets, 7 are current or former bird shooting swamps, 6 are agricultural ponds, 4 are recreational or aesthetic ponds and 6 are other miscellaneous types. For the purpose of this NWI, wetlands falling into these four categories have been clustered together for prioritisation and management purposes (see table).

It should be noted that some remnant coastal wetlands and shooting swamps (including former shooting swamps) may on their own individual characteristics not meet the criteria for secondary wetlands. Nonetheless, these sites are deemed to merit management as secondary wetlands due to the overall importance of the wetlands clusters to which they belong.

### **3.3 Conclusions and Recommendations**

The four primary wetlands are considered to be significant repositories of biodiversity for Barbados. As such, it is thought that they should be protected from development and abusive human impacts. All four primary sites are considered to be at risk from a variety of impacts.

All four of the primary sites that have been identified in the Physical Development Plan, draft Physical Development Plan (GoB 2003, GoB 2017) and National Park Development Plan (GoB 1998) are potential category 2 sites in the Barbados System of Open Spaces and Protected Areas (OS2 Conservation Areas). But their boundaries have not been established and they are not gazetted as OS2 areas and thus not officially protected.

Of the four primary wetlands only Graeme Hall Swamp is currently partially protected through private ownership of the Graeme Hall Nature Sanctuary (GHNS) and through the declaration of that area plus an additional area of the GHS as a Ramsar site. This, however, has not protected the site from a variety of abuses including the use of the area as an emergency dump for sewage from the South Coast Sewage Treatment Plant located in GHS.

Furthermore, private ownership does not guarantee protection into the future unless the site is nationally declared.

### Secondary and tertiary wetlands in Barbados

| Secondary wetlands                      |                                | Tertiary wetlands                       |                                     |                               |
|---|--------------------------------|---|-------------------------------------|-------------------------------|
| Remnant coastal wetlands/ gully outlets | Shooting and man-made Swamps   | Agricultural Ponds                      | Recreational and/or aesthetic ponds | Other wetlands                |
| 1. Brandons/ Brighton Beach             | 1. Congo Road Swamp            | 1. Bawdens pond                         | 1. Apes Hill Resort ponds           | 1. Archers Bay pond           |
| 2. Chapman Swamp                        | 2. Foster's Swamp              | 2. Bayfield pond                        | 2. Codrington College Pond          | 2. Bath Park                  |
| 3. Cobblers Cove Wetland                | 3. Golden Grove Swamp          | 3. Half Acre plantation pond            | 3. Heron Bay pond                   | 3. Bath River                 |
| 4. Constitution River Estuary           | 4. Hannays Swamp               | 4. Indian Pond/Redland Plantation ponds | 4. Sandy Lane Golf Course ponds     | 4. Boscobelle wetland network |
| 5. Coral Reef Club                      | 5. Mangrove Swamp (St. Philip) | 5. Kendall Plantation pond              |                                     | 5. Conset Bay Estuary         |
| 6. Gibbes coastal pond                  | 6. Walkers Reserve Wetlands    | 6. Greenland Ponds                      |                                     | 6. Spring Garden Wetland      |
| 7. Heywoods Swamp                       | 7. Woodbourne Shorebird Refuge |   |                                     |                               |
| 8. Holetown Hole                        |                                |   |                                     |                               |
| 9. Holetown Police Station              |                                |   |                                     |                               |
| 10. Lakes Beach Pond coastal ponds      |                                |   |                                     |                               |
| 11. Maxwell/Dover coastal pond          |                                |   |                                     |                               |
| 12. Maycocks                            |                                |   |                                     |                               |
| 13. Queens Fort                         |                                |   |                                     |                               |
| 14. River Bay North                     |                                |   |                                     |                               |
| 15. River Bay South                     |                                |   |                                     |                               |

|                         |  |  |  |  |
|-------------------------|--|--|--|--|
| 16. Silver Sands Lagoon |  |  |  |  |
| 17. Weston Pond         |  |  |  |  |

The five categories of secondary and tertiary wetlands should be the subject of further study and serious consideration for protection at the national level. While they are individually relatively small, collectively they likely form a significant repository of biodiversity for Barbados. In particular, they are all used by overwintering and migratory birds as evidenced by the ebird sightings in the individual accounts and Appendix 1, and provide habitat for native fish and crustacean fauna.

Remnant coastal wetlands/gully outlets are particularly at risk for coastal development. These could be considered collectively as a spatially disaggregated OS 2 Conservation area. They should be protected from further degradation, including concretization/ channelling, rehabilitated to the extent possible and the ecological functionality that has been lost should be restored. The information available on these remnant coastal wetlands/gully outlets is very limited.

Shooting swamps collectively provide a major source of habitat for overwintering and migratory waterbirds (see Ebird records, Burke 2007, Wege et al. 2014). However, shooting still continues in several of them (several others are now used mainly for birding). The St Philip Shooting Swamps and the St Lucy Shooting Swamps are listed as Important Bird Areas by Birdlife International. It is also assumed that the aesthetic and recreational artificial ponds on golf courses, at Heron Bay and at Walkers Reserve are important bird habitats. We know of no studies at these sites except for Walkers Reserve. The owners of these ponds should be informed of the importance of these habitats and encouraged to protect or enhance them. Again, these and the shooting swamps could be considered collectively as a spatially disaggregated OS 2 Conservation area.

Agricultural ponds, of which we believe there are many more than listed in this inventory, also have potential to harbour aquatic biodiversity, again, especially overwintering and migratory waterbirds. However, these ponds are from time to time drained and scraped out to restore depth and accessibility (as has clearly taken place at Bawdens). Thought should be given as to how to work with plantation owners and small farmers to minimise the impact of these management measures on biodiversity.

Overall, information on both habitat and species diversity in wetlands in Barbados is scarce. The most work has been done on Graeme Hall, which has been the site of several studies. Many taxa, however, remain little studied. Much less is known of Long Pond and even less of all the remaining sites. Owing to the presence in Barbados of several active and knowledgeable birders, the bird fauna is perhaps best known. Brachyuran crab diversity is also well known (Parasram et al. 2021), but most other biota remains poorly known. There is a need for a programmatic approach to promoting research on these wetlands to build the knowledge base required for their conservation and sustainable use.

# 1 Introduction

## 1.1 Ramsar Framework for Wetland Inventory and Assessment

The Contracting Parties to the Ramsar Convention on Wetlands, in Resolution VII.20, have recognised national wetland inventories (NWIs) as an essential foundation for the wise use, management and conservation of wetland. As a result, Parties have been urged to prioritise the preparation of NWIs, with a wetland inventory being defined as “the collection and/or collation of core information for wetland management, including the provision of an information base for specific assessment and monitoring activities” (Ramsar Convention Secretariat 2010).

This priority has been reiterated in the most recent Ramsar Strategic Plan (2016 – 2024) which, under Strategic Goal 3 *Wisely Using All Wetlands*, calls for NWIs to be “initiated, completed or updated and disseminated and used for promoting the conservation and effective management of all wetlands” (Ramsar Convention Secretariat, 2016).

The Ramsar Convention Secretariat has formulated and issued a Framework for Wetland Inventory, which provides guidance on planning, designing and implementing wetlands inventories. The development of this NWI has been informed by the structure and approach presented in the Ramsar Framework, and the information presented in the NWI aligns with the core wetland inventory dataset as outlined in the Framework (Table 1).

**Table 1: Core data fields for wetland inventory (Ramsar Convention Secretariat 2010)**

| Revised core wetland inventory fields   |
|---|
| <b>Site Name:</b><br>Official name of site and catchment/other identifiers  |
| <b>Area, boundary and dimensions:</b><br>Site shape, boundaries, area, area of water/wet area length, width, depth  |
| <b>Location:</b><br>Projection system, map coordinates, map centroid, elevation   |
| <b>Geomorphic setting:</b><br>Setting in the landscape/catchment/river basin – including altitude, upper/lower zone of catchment, distance to coast, etc. |
| <b>Biogeographical region</b>   |
| <b>Climate:</b><br>Overview of prevailing climate type, zone, and major features (precipitation, temperature, wind)                                       |
| <b>Soil:</b>  |

|  |
|--|
| Geology, soils and substrates, soil biology  |
| <b>Water regime:</b><br>Water sources (surface and groundwater), inflow/outflow, evaporation, flooding frequency, seasonality and duration, magnitude of flow and/or tidal regime, links with groundwater  |
| <b>Water chemistry:</b><br>Temperature; turbidity; pH; colour; salinity; dissolved gases; dissolved or suspended nutrients; dissolved organic carbon; conductivity   |
| <b>Biota:</b><br>Plant communities, vegetation zones, and structure<br>Animal communities<br>Main species present; population size and proportion where known; seasonality of occurrence, and approximate position in distribution range                                 |
| <b>Land use:</b><br>Local, and in the river basin/coastal zone   |
| <b>Pressures and trends:</b><br>Concerning any of the features listed above and/or concerning ecosystem integrity  |
| <b>Land tenure and administrative authority:</b><br>For the wetland, and for critical parts of the river basin and/or coastal zone   |
| <b>Conservation and management status of the wetland:</b><br>Including legal instruments and social or cultural traditions that influence the management of the wetland; and including protected area categories according to the IUCN system and/or any national system |
| <b>Ecosystem services</b>  |
| <b>Management plans and monitoring programmes:</b><br>In place and planned, within the wetland and in the river basin and/or coastal zone  |

The use of these standardised core data fields means that the NWI also provides a summary description of the ecological character of the four wetlands under consideration. “Ecological character” is defined as “the combination of the ecosystem components, processes, and benefits/services that characterise the wetland at a given point in time”. Given that the goal of wise use of wetlands is to maintain their ecological character, descriptions of ecological character provide a baseline and basis for planning wetland management and conservation. However, when wetlands are already degraded, current description may not be appropriate as a baseline and other information such as prior states or the state of similar wetland elsewhere may be a more appropriate baseline.

## 1.2 Purpose of the Inventory

The principal purpose of this NWI is to characterise the following wetlands of national importance:

- Graeme Hall Swamp
- Chancery Lane wetlands
- Long Pond
- Green Pond

such that this characterisation may provide a tool for subsequent conservation planning and management, and support fulfilment of obligations under the Ramsar Convention.

A secondary purpose is to provide an inventory of other wetlands in Barbados.

### **1.3 Inventory Approach and Method**

Given the relatively short duration of the project, the overall approach employed was that of rapid assessment for production of a baseline inventory (Ramsar Convention Secretariat, 2006a). This approach aims to, in a short time, gather as much information as possible about a wetland ecosystem, and provides reliable initial information about a defined area of interest, with a focus on overall ecosystem character rather than on details of particular species and habitats. Existing data and information are key inputs to the rapid assessment process. Once this information has been reviewed and assessed, a gap analysis determines the need for new and additional field surveys. In cases where detailed quantitative data are not readily available or cannot be generated within the inventory timeframe, qualitative data and information (including expert and local knowledge) are important and effective elements of describing the ecological character of a wetland. For both quantitative and qualitative data, accurate, reliable, accessible, and affordable data management systems are critical for effective wetland inventories.

Based on the above principles, this NWI has involved three main phases:

- Review of existing information and knowledge, via a situational analysis and gap analysis.
- Validation of existing data, and generation of new and additional data, as required and feasible, via ground-truthing, field studies, and drone surveys.
- Storage, management, assessment, analysis, and representation of data using geographic information systems (GIS).

### **1.4 Categorisation of Wetlands**

The Ramsar Convention on Wetlands states that “Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life.” (Ramsar Convention Secretariat, 2006b) The Convention takes a wide range of wetland types into consideration under its protective jurisdiction.

There are 5 major categories:

- **Marine** (coastal wetlands including coastal lagoons, rocky shores, seagrass beds and coral reefs);
- **Estuarine** (including deltas, tidal marshes and mudflats, and mangrove swamps);
- **Lacustrine** (wetlands associated with lakes);
- **Riverine** (wetlands along rivers and streams);
- **Palustrine** (meaning “marshy” – marshes, swamps and bogs).

The Convention provides a list of 42 wetland types which fall under these 5 categories. Beyond these natural wetland categories, the Ramsar Convention also considers human-made wetlands, such as:

- Fish and shrimp ponds,
- Farm ponds,
- Irrigated agricultural land including rice paddies,
- Salt pans,
- Dams,
- Reservoirs,
- Gravel pits,
- Wastewater treatment ponds and
- Canals.

There are numerous types of wetland and they have different biophysical characteristics. It is recommended that wetlands of specific national importance be selected based on predetermined criteria.

In other countries, wetlands are included in national inventories based on the distinctiveness of the wetlands’ geographical and ecological characteristics as well as on their cultural significance.

Australia’s Directory of Important Wetlands provides a valuable model for the NWI for Barbados. This directory was produced through a consultative process between national agencies and resource managers in 1993 and provides guidance notes for identifying nationally important wetlands<sup>1</sup>. Following on this good practice, this NWI for Barbados contains a provisional list of nationally important wetlands, to be reviewed, refined, and updated through consultative partnership. For the purposes of this NWI, a nationally important wetland is one which meets at least one of the following five criteria:

1. It plays a critical ecological or hydrological role in the natural functioning of a large wetland system or watershed.
2. It is a significant area for wildlife during a vulnerable period of their life cycles, or functions as a refuge during harsh conditions.

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<sup>1</sup> <https://www.dcceew.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands#inland>

3. It supports more than 1% of the national populations of any native plant or animal taxa.
4. It supports plant or animal communities which are considered endangered or vulnerable at the national and international levels.
5. It is an area, or falls within the boundaries of an area, that is of outstanding historical or cultural significance.

For Barbados, recognising that the country is not known for expansive terrestrial wetlands and freshwater aquatic habitat, nationally important wetlands identified using these criteria have been broadly allocated into three categories as follows:

1. **Primary wetlands:** wetlands that meet all of the criteria for a nationally important wetland.
2. **Secondary wetlands:** wetlands that meet two to four of the criteria for a nationally important wetland.
3. **Tertiary wetlands:** wetlands that meet one of the criteria for a nationally important wetland.

While the Ramsar Convention defines wetlands to include nearshore coastal marine areas, Barbados' definition does not include these areas, which are covered by the Coastal Zone Management Plan. The Barbados National Biodiversity Strategy and Action Plan defines wetlands as areas where water is the primary factor controlling the environment and the associated plant and animal life. These ecosystems occur where the water table is at or near the surface of the land, or where the land is covered by shallow water. These ecosystems were the focus of this inventory.

## 2 Wetlands in Barbados

### 2.1 Policy and Regulatory Framework

Several policies and laws in Barbados are relevant to wetlands (Table 2).

**Table 2. Policies and laws in Barbados that are relevant to wetlands**

| National Legislation   |  |  |
|--|--|--|
| Law  | Description  | Relevance  |
| Planning and Development and Planning and Development (Amendment) Acts | The Planning and Development Act makes provision for: <ul style="list-style-type: none"> <li>• The orderly and progressive development of land;</li> </ul> | Allows for the compilation of lists of places of natural beauty or natural interest, and for the declaration of protected areas. |

|   |   |  |
|---|---|--|
|   | <ul style="list-style-type: none"> <li>• The grant of permission to develop land;</li> <li>• Powers to regulate land use and development;</li> <li>• Related matters.</li> </ul>  | <p>Allows for the making of orders for the preservation of trees, groups of trees, or woodlands (including mangroves) in any part of Barbados. Provides the basis for the development of physical development plans for all or part of Barbados.</p>   |
| Coastal Zone Management Act               | <p>“An Act to provide for the more effective management of the coastal resources of Barbados, for the conservation and enhancement of those resources and for matters related thereto.”</p>                               | <p>The definition of marine areas includes any “adjoining land of swamp area that forms with any ... submarine area a single ecological entity”</p> <p>The definition of coastal resources includes wetlands associated with the shoreline and marine areas of Barbados.</p> <p>The Act allows for the making of orders to designate marine areas as restricted areas for purposes including preservation or enhancement of natural beauty, protection or rehabilitation of flora and fauna, and promotion of scientific study and research.</p>   |
| Soil Conservation (Scotland District) Act | <p>“An Act to make provision for the improvement and conservation of the soil and for the prevention of damage or deterioration by erosion to land in certain areas of Barbados and for matters connected therewith”.</p> | <p>Long Pond is located in the Scotland District Conservation Area as described in the First Schedule to the Act.</p> <p>The definition of watercourses to encompass streams, rivers, passages, and channels through which water flows includes the .... River which flows into Long Pond and forms part of the Long Pond ecosystem.</p> <p>The Act allows for the making of conservation orders relating to, <i>inter alia</i>, the preservation and protection or the sources, courses, and banks or streams; the control of water; and land use.</p> <p>The Act allows for the making of regulations relating to, <i>inter alia</i>, the use of lands in the Scotland District, and the destruction of or interference with trees, shrubs, plants, or grasses in the Scotland District.</p> |
| Fisheries and Fisheries (Amendment) Acts  | <p>An Act to provide for the management and development of fisheries in Barbados.</p>   | <p>The Act’s definition of fishing includes catching, harvesting, or taking fish and aquatic flora and its geographical scope includes the</p>   |

|  |   |   |
|--|---|---|
|  |   | internal/inland waters of Barbados. Therefore, fishing and related activities in wetlands are regulated by relevant provisions in the Act, e.g., prohibitions on deleterious fishing methods (i.e., use of explosive, poisons, and noxious substances) and on use of certain types of fishing gear. |
| Trees (Preservation) Act                               | An Act to provide for the preservation of trees.  | The Act restricts the killing, felling, uprooting, topping, or lopping of trees, including palm trees and mangroves, over a certain size. It also allows for the issuance of notices for the planting, replanting, maintenance, and protection of trees.  |
| Cultivation of Trees Act                               | An Act promoting the cultivation of trees, and for purposes in connection therewith.  | The Act allows for the use of financial incentives, such as tax contribution payments and tree subsidy payments, to promote the cultivation of trees.   |
| Wild Birds Protection Act                              | An Act relating to the protection of certain wild birds.  | The Act prohibits the killing or wounding of wild birds listed in the associated Schedule. The Schedule includes four species of migratory shorebirds and other migratory bird species known to utilise wetlands in Barbados.   |
| Livestock (Control of Strays) Act                      | An Act to provide for the seizure and impounding of stray livestock and for related manners.  | Unregulated grazing/overgrazing by livestock has been identified as a threat to wetlands considered in this report, in particular Long Pond. This Act allows for the removal and impoundment of stray and trespassing livestock.  |
| Marine Pollution Control Act                           | “An Act to prevent, reduce, and control pollution of the marine environment of Barbados from whatever source.”  | The Act regulates the release of pollutants into the land, water, and airspace of Barbados and its territorial waters.  |
| <b>National Policies, Strategies, Action Plans</b>     |   |   |
| <b>Policy</b>  | <b>Description</b>  | <b>Relevance</b>  |
| National Biodiversity Strategy and Action Plan (NBSAP) | The NBSAP, developed in compliance with obligations as a Party to the Convention on Biological Diversity, sets out targets and priority strategies for conservation | Target 3 ( <i>By 2035, the rate of loss of all of Barbados’ natural habitats, including forests, will be decreased</i> ) and Target 8 ( <i>By 2030, at least 17% of terrestrial and inland water, and</i>   |

|  |   |   |
|--|---|---|
|  | and sustainable management of biodiversity to the year 2035.  | <i>10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are designated within connected systems of protected areas, and plans for effective area-based conservation measures are being developed)</i> are applicable to the management and conservation of the wetlands considered in this report.   |
| Draft Integrated Coastal Zone Management Plan (ICZMP) 2020 | The ICZMP comprises policies, strategies, and standards that provide for the management and conservation of coastal resources.  | All three wetlands considered in this report fall within the Coastal Zone Management Area and the Draft 2020 ICZMP includes some specific provisions for their conservation and management, including:<br>Promoting monitoring of water quality at Long Pond;<br>Enforcing development setbacks for protection of wetlands;<br>Promoting restoration of mangroves and coastal wetlands.<br>The 2020 draft ICZMP contains general recommendations for conservation and restoration of coastal ecosystems, including wetlands. The preparation of this report is directly relevant to one such recommendation, concerning the preparation of habitat health reporting cards.<br>Wetland restoration is recognized in the 2020 draft ICZMP as a strategy for nature-based disaster risk reduction. |
| Physical Development Plan (PDP)                            | Physical Development Plans prepared under the Planning and Development Act “set out prescriptions for the use and development of land which represent the results of an integrated planning process”. | All of the wetlands considered in this report are part of the System of Parks and Open Spaces as described in the 2017 Draft PDP Amendment. <sup>2</sup> Long Pond is located within the Barbados National Park and the associated National Park Heritage Conservation Area. Chancery Lane Wetlands and Graeme Hall Swamp have been designated as Natural Heritage Conservation Areas and are subject to the general policies and development controls applicable to such areas. There are additional   |

<sup>2</sup> The 2017 Draft Amendment is currently in the process of revision and update.

|  |  | policies outlined specifically for the Chancery Lane Wetlands.  |
|--|--|---|
| International Agreements   |  |   |
| Agreement  | Description  | Relevance   |
| Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)   | The mission of the Ramsar Convention is “the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”.  | Barbados has been a Contracting Party to the Ramsar Convention since 2006, and Graeme Hall Swamp is the only designated Ramsar Site, i.e., a wetland of international importance under the Convention.  |
| United Nations Convention on Biological Diversity (CBD)  | The CBD’s three objectives are: <ul style="list-style-type: none"> <li>• The conservation of biological diversity;</li> <li>• The sustainable use of its components; and</li> <li>• The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.</li> </ul>   | Barbados has been a Party to the CBD since 1994. The CBD requires Parties to, <i>inter alia</i> , identify, monitor, sustainably manage, and promote conservation of ecosystems, natural habitats, and biodiversity. There is close collaboration between the CBD and the Ramsar Convention, and the Ramsar Convention acts as the lead partner in implementing provisions of the CBD for wetlands.           |
| United Nations Convention to Combat Desertification (UNCCD)  | The UNCCD aims to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, via long-term integrated strategies that focus simultaneously, in affected areas, on improved productivity of land, and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular at the community level. | Barbados has been Party to the UNCCD since 1997. The UNCCD has set a goal of land degradation neutrality, which refers to a state “where the total area of healthy and productive land and wetlands stabilizes and eventually increases”. <sup>3</sup> Any change from wetlands to other types of land cover (e.g., artificial surfaces, grassland, tree covered areas) is considered to be land degradation. |
| Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (Cartagena Convention), and associated Protocols | The Cartagena Convention provides a regional legal framework for protection and development of the Wider Caribbean Sea and supports establishment of sound regimes for improved management of coastal and marine resources. There are three Protocols to the Cartagena Convention, of which the Protocol Concerning Specially  | Barbados is a Party to both the Cartagena Convention and the SPAW Protocol. The Protocol requires Parties to take measures to ensure the protection and recovery of species listed in Annexes I, II, and III to the Protocol, including species (e.g., red mangrove, white mangrove) known  |

<sup>3</sup> <https://sdg.iisd.org/news/unccd-ramsar-commit-to-land-degradation-neutrality/>

|  |   |  |
|--|---|--|
|  | Protected Areas and Wildlife (SPAW Protocol) is primarily relevant. | to be present in the wetlands considered in this report. |
|--|---|--|

## 2.2 Nationally Important Wetlands

Based on the criteria, described in Section 1.4, for categorising wetlands of national importance, this assessment has identified 35 nationally important wetlands for inclusion in this first NWI for Barbados. They include 4 primary wetlands, 22 secondary wetlands, and 14 tertiary wetlands (Table 3).

**Table 3. Nationally Important Wetlands**

| Critically Important Wetlands | Other Important Wetlands            |   |
|-------------------------------|-------------------------------------|---|
| Primary                       | Secondary                           | Tertiary                                |
| 1. Chancery Lane Wetlands     | 1. Brandons/Brighton Beach wetland  | 1. Apes Hill Resort ponds               |
| 2. Graeme Hall Swamp          | 2. Chapman Swamp                    | 2. Archers Bay pond                     |
| 3. Green Pond                 | 3. Cobblers Cove wetland            | 3. Bath Park pond                       |
| 4. Long Pond                  | 4. Congo Road Swamp                 | 4. Bath River Pond                      |
|                               | 5. Constitution River Estuary       | 5. Bawdens pond                         |
|                               | 6. Coral Reef Club wetland          | 6. Bayfield pond                        |
|                               | 7. Foster's Swamp                   | 7. Codrington College pond              |
|                               | 8. Gibbes coastal pond              | 8. Conset Bay estuary                   |
|                               | 9. Golden Grove Swamp               | 9. Greenland ponds                      |
|                               | 10. Hannays Swamp                   | 10. Half Acre pond                      |
|                               | 11. Heywoods Swamp                  | 11. Indian Pond/Redland Plantation pond |
|                               | 12. Hometown Hole                   | 12. Kendall Plantation pond             |
|                               | 13. Hometown Police Station wetland | 13. Mangrove Swamp (St. Philip)         |
|                               | 14. Lake's Beach coastal pond       | 14. Sandy Lane Golf Course ponds        |
|                               | 15. Maycocks coastal wetland        |   |
|                               | 16. Queen's Fort wetland            |   |
|                               | 17. River Bay North wetlands        |   |

|  |                                 |  |
|--|---------------------------------|--|
|  | 18. River Bay South wetlands    |  |
|  | 19. Silver Sands lagoon         |  |
|  | 20. Spring Garden wetland       |  |
|  | 21. Walkers Reserve wetlands    |  |
|  | 22. Weston Pond                 |  |
|  | 23. Woodbourne Shorebird Refuge |  |

This list identifies sites that are presently relatively conspicuous. However, it must be noted that Barbados had a broad range of natural environments prior to European colonisation including mudflats, mangrove forests and rivers. Remnants of these once lush habitats can be identified in fragmented wetland parcels; special focus must be placed on protecting these natural heritage sites.

In the following site descriptions, all photographs were taken by the authors.



Figure 1. the location of nationally important wetlands

## 3 Primary wetlands

### 3.1 Chancery Lane Swamp

#### 3.1.1 Administrative and Locational Details

##### 3.1.1.1 *Location*

Chancery Lane Swamp is a seasonal wetland, about 3 ha (8 acres) in extent, situated on the south coast of Barbados (13.062477 N, -59.500980 W) at an altitude of 6 - 9 m above sea level (BirdLife International (2022) Important Bird Areas factsheet: Chancery Lane Swamp.)

##### 3.1.1.2 *Area, boundary, and dimensions*



Figure 2. Chancery Lane wetland

**Area:** 96.3 acres / 38.97 hectares

**Length:** 1.09 km

**Width:** 0.57 km

### 3.1.1.3 Biogeographical region

| Regionalisation scheme(s)             | Biogeographic Region |
|---------------------------------------|----------------------|
| Marine Ecoregions of the World (MEOW) | Eastern Caribbean    |
| WWF Terrestrial Ecoregions            | Neotropical          |
| Udvardy's Biogeographical Provinces   | Neotropical          |

### 3.1.1.4 Land tenure and administrative authority



Figure 3. Chancery Lane Swamp land ownership

The wetland is in private ownership. There are a number of private residential properties immediately adjacent to the Chancery Lane wetland area. These properties provide an additional layer of complexity to governance as they are independently managed by their respective owners who may have different interests. However, the core of the wetland is held

in three large properties. Two are privately owned, whilst one is held by the Government of Barbados (GoB).

### 3.1.2 Ecological Character

#### 3.1.2.1 *Summary statement*

Chancery Lane Swamp has been assessed as both an Important Bird Area (<http://datazone.birdlife.org/site/factsheet/chancery-lane-swamp-iba-barbados>) and a Key Biodiversity Area (<https://www.keybiodiversityareas.org/site/factsheet/20512>). The Swamp is known or thought to hold a significant population of three range-restricted species: the green-throated Carib hummingbird (*Eulampis holosericeus*), the Antillean crested hummingbird (*Orthorhyncus cristatus*) and the Barbados bullfinch (*Loxigilla barbadensis*), which is the island's only endemic bird species. It is also known or thought to hold, on a regular basis, at least 1% of a biogeographic population of a congregatory waterbird species, namely the Little Egret (*Egretta garzetta*).

The 2017 draft Amendment to the PDP characterises the Chancery Lane Swamp as follows:

*This ecosystem is of national significance in Barbados as one of two landscapes, the other being Graeme Hall Swamp, that exhibit the diversity of a coastal wetland in a relatively undeveloped state. ... The unique physical condition of this site has left intact one of the most significant shoreline natural dune and beach systems on the island. The significant sand berm on the back beach and the associated dune system behind are relatively rare on the island.*

#### 3.1.2.2 *Geomorphic setting*

The wetland has been characterised as “an irregular mosaic of shallow water, mudflats and grassy areas ... bound by a vegetated berm to seaward, pasture and an inland cliff” (*BirdLife International (2022) Important Bird Areas factsheet: Chancery Lane Swamp*). It is part of a broader ecosystem which encompasses a diverse range of natural habitats, including “a dual escarpment, wetland, dunes and beach complex” (*2017 draft PDP Amendment*).

#### 3.1.2.3 *Climate*

Under the Köppen Climate Classification system, the island of Barbados can be characterised as an **Af** zone, which means it has a tropical rainforest climate. This type of climate is characterized by high temperatures and heavy rainfall, with average temperatures ranging from 22 to 31 degrees Celsius (72 to 88 degrees Fahrenheit) throughout the year.<sup>[1]</sup>

However, the nearest weather station, at The Grantley Adams International Airport, is located 2.7 km north-east of the Chancery Lane Wetland. It records an average annual temperature of 26°C and 1433 mm of rainfall per annum. A significant dry season is also experienced in the area, with 3 months with rainfall levels that fall below 60 mm. Based on the Köppen Climate Classification system, the Chancery Lane site would be classed as an **Aw** or tropical wet and dry climate.

Prevailing winds: ENE

Average Temperature: 28°C

#### 3.1.2.4 *Soil*

Poole & Barker (1983) have classified the geology at Chancery Lane as Marine Beach & Modern Dune Deposits. Areas with marine beach and modern dune deposits are coastal regions where sediment has been deposited by wave and wind action. This marine sediment is stored in the marsh while silt is deposited from surface runoff. However, Vernon and Carol (1965) classified the soil at Chancery Lane as "Shooting Swamp".

#### 3.1.2.5 *Water regime*

Chancery Lane is a seasonal wetland that stores water during the rainy season and retains water into the first half of the dry season. The site is fed by runoff from the Seaview community to the north and the Chancery Lane community to the north-west. Water is also introduced through groundwater outflows from depressions that are situated along the southern face of the escarpment which forms the northern boundary of the wetland. The primary inflow to the site is a grassed drainage channel at the northeast corner of the wetland.

From Google Earth timeline imagery, it is evident that the marsh begins to dry on the eastern side around late September to early November and is driest around March. The water level in the marsh is dependent on the amount of rainfall received for the year.

As the end of the catchment, it is the final point for naturally storing standing freshwater which supports flora and fauna before reaching the shoreline. The marsh plays a crucial role in providing habitat for a range of species, including mangrove plants, waterfowl, fish and crustaceans.

#### 3.1.2.6 *Water chemistry*

No information was found

#### 3.1.2.7 *Ecosystems, habitats, and biodiversity*

The Chancery Lane wetland comprises two IUCN habitat types: mangrove forests and inland wetlands (BirdLife International, 2022, Important Bird Areas factsheet: Chancery Lane Swamp).

The wetland provides an important refuge for migrant and vagrant waterbirds, and a critical feeding ground for Little Egrets (BirdLife International (2022) Important Bird Areas factsheet: Chancery Lane Swamp), while the beach adjoining the wetland (Long Beach) has importance as a turtle nesting area (Barbados Physical Development Plan, Amended 2003). It provides nesting habitat for hawksbill, leatherback and green turtles (Horrocks, 1992).

#### 3.1.2.8 *Habitats*

The habitats in Chancery Lane Swamp are shown in Figure 4.

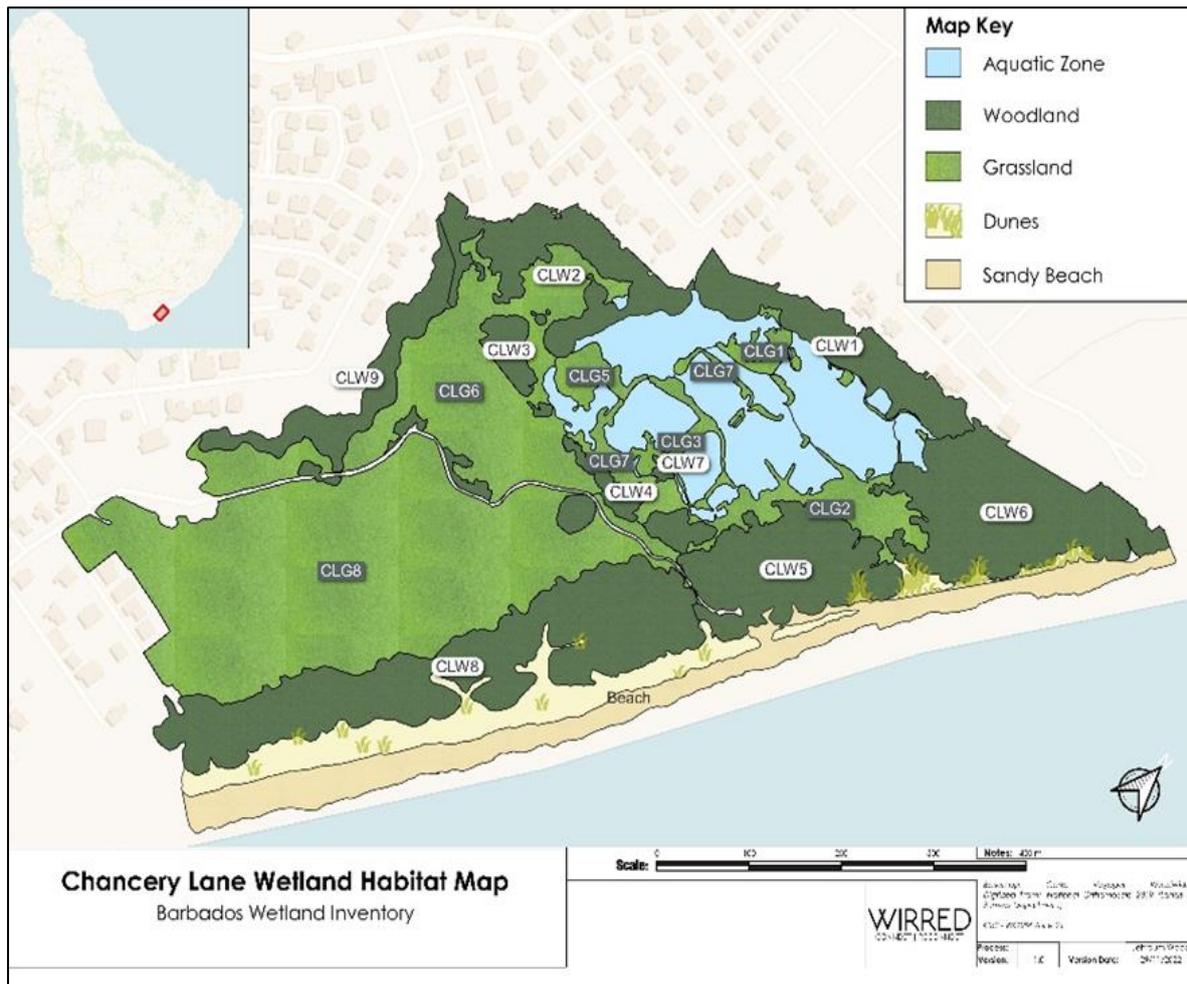


Figure 4. Chancery Lane Swamp habitats

**The aquatic zone:** The Chancery Lane wetland is separated from the Chancery Lane community to the north and north-west by a 10-metre-high escarpment. A marshland has formed at the base of this escarpment, in the shallow depression beneath the cliff edge. The marshland is a settlement area where outflow of surface runoff to the ocean is restricted by a large berm and a broad sandy beach.

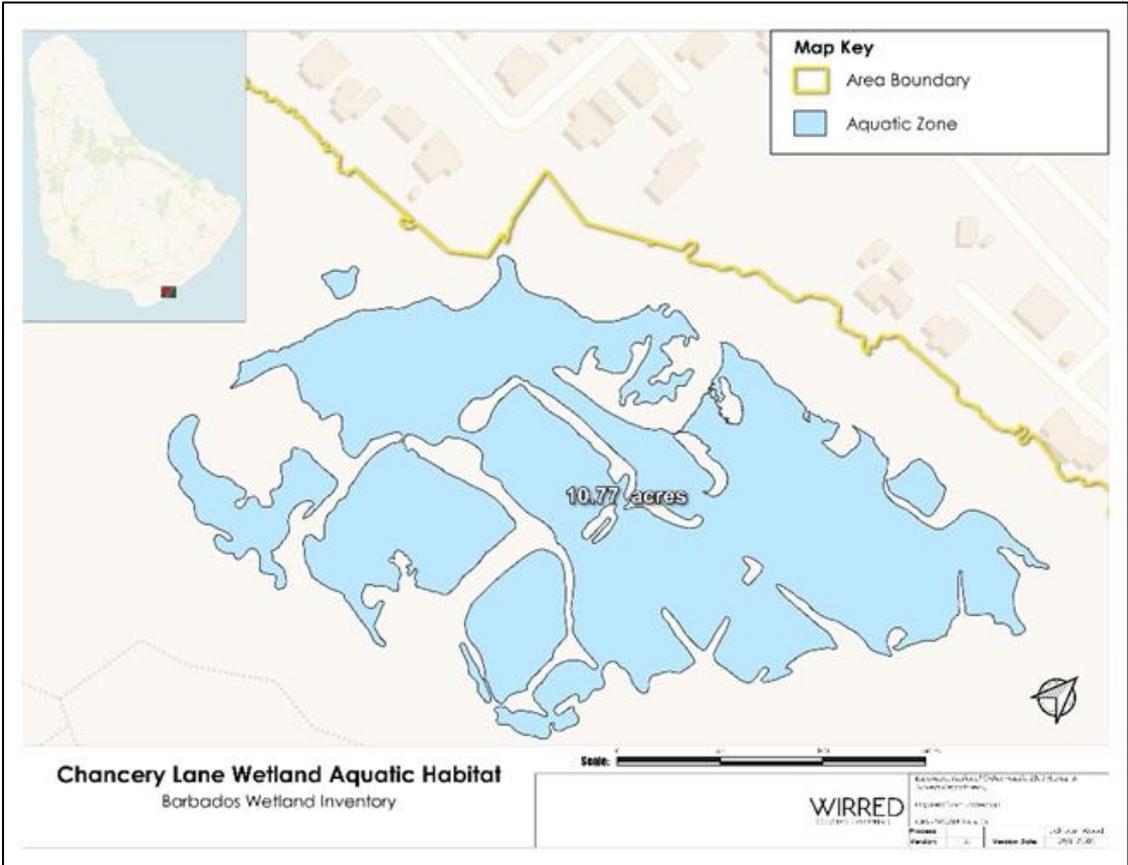


Figure 5. Chancery Lane Swamp marsh habitat



Figure 6. Chancery Lane Swamp habitats

Chancery Lane Wetland is a seasonal freshwater marsh. The marsh fills during the rainy season and retains surface water into the dry season but dries during intense dry periods. Vegetation in the marsh is dominated by seaside samphire (*Sesuvium portulacastrum*) and devil grass (*Cynodon dactylon*).



Figure 7. Chancery Lane Swamp beach habitat

At the edges of the marsh, the dominant ground cover species changes from seaside samphire (*Sesuvium portulacastrum*) and begins to include a varied population of crabgrass (*Sporobolus virginicus*), *Euphorbia medembryanthemifolia* and rattleweed (*Crotalaria retusa*).



Figure 8. Chancery Lane Swamp habitats

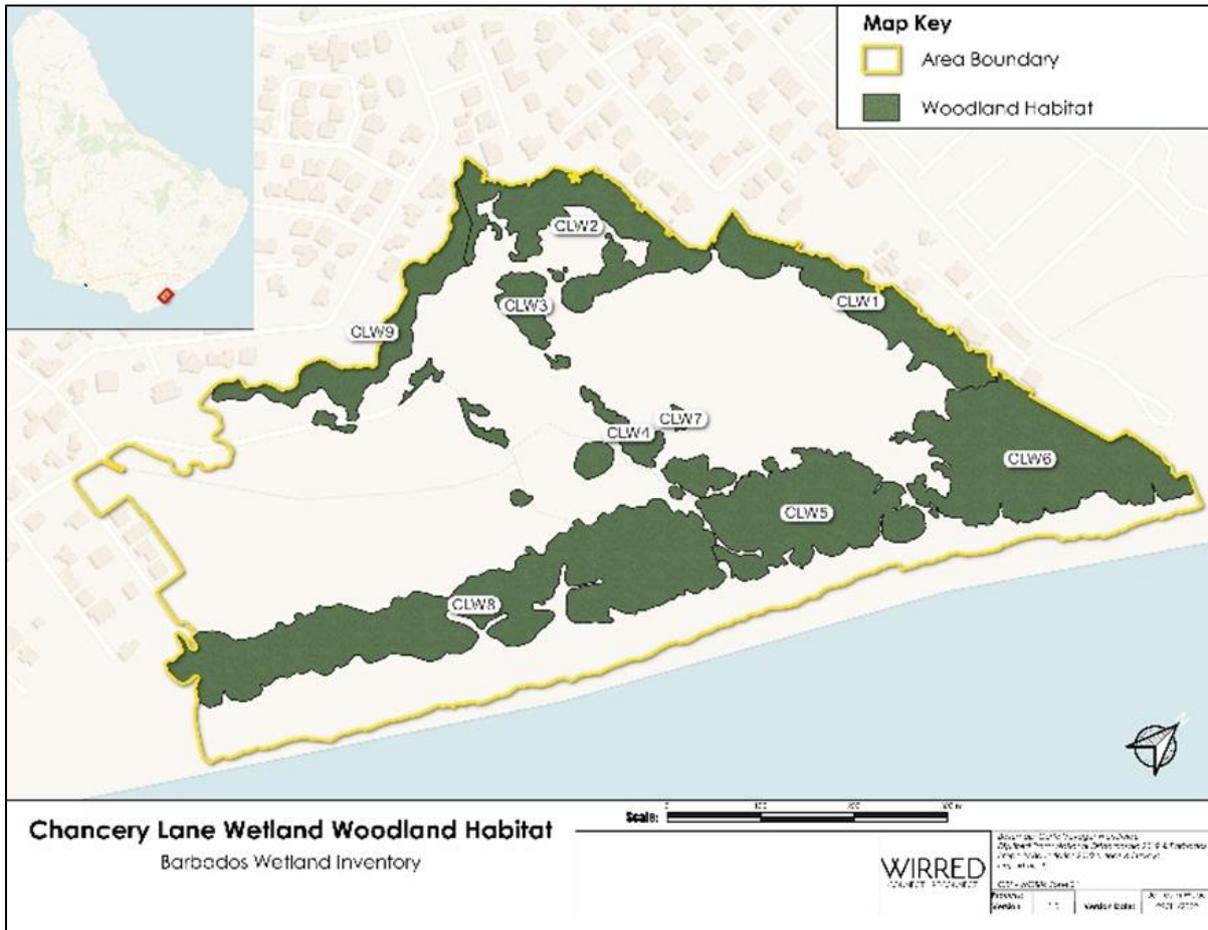


Figure 9. Chancery Lane Swamp woodland. The areas coded CLW are referred to in the text.

**The Northern Woodland:** Along the northern edge of the marshland, a significant portion of the woodland is dominated by button mangrove trees (*Conocarpus erectus*). This northern woodland habitat transitions from a thick button mangrove woodland along the marsh edge, which is interspersed with manchineel trees, to a more diverse array of seaside almond, manchineel, portia, gumbo limbo and bearded fig trees under the cliff. To the northeast, a small portion of this fringing northern woodland supports some white mangrove trees (CLW 1 & 2).





Figure 10. Chancery Lane Swamp woodland

The northern boundary of the Chancery Lane site is transition zone, where habitat changes from wetland to woodland to rocky cliff with caves that provide habitat for bats, and a wide variety of insects, reptiles, and crustaceans.



Figure 11. Chancery Lane Swamp woodland

**The Eastern Zone:** To the eastern edge is dominated by a coastal woodland that is approximately 100m wide, which transitions into an established back-dune habitat and then progresses to a sandy beach habitat that meets the Atlantic Ocean at its furthest extent.



Figure 12. Chancery Lane Swamp eastern zone

The coastal woodland along the east is varied due to the differences in wind exposure, soil moisture retention and anthropogenic use. The woodland includes species like clammy cherry, manchineel, cat's claw blackbeard, seaside almond and bamboo with coconuts, casuarina, seagrape, seaside mahoe and yellow balsam dominating the ecotone between the coastal woodland and the dune habitat. The dune habitat forms a significant part of the Chancery Lane wetland area which is dominated by seagrape (*Coccoloba uvifera*) and *Euphorbia mesembryanthemifolia*.

A wide sandy beach habitat stretches along the entire length of the coastal boundary of the Chancery Lane wetland. Approximately 1 km of beach lies adjacent to the wetland area (Figure 13). This area provides important nesting beach habitat for Barbados' three species of nesting sea turtles.

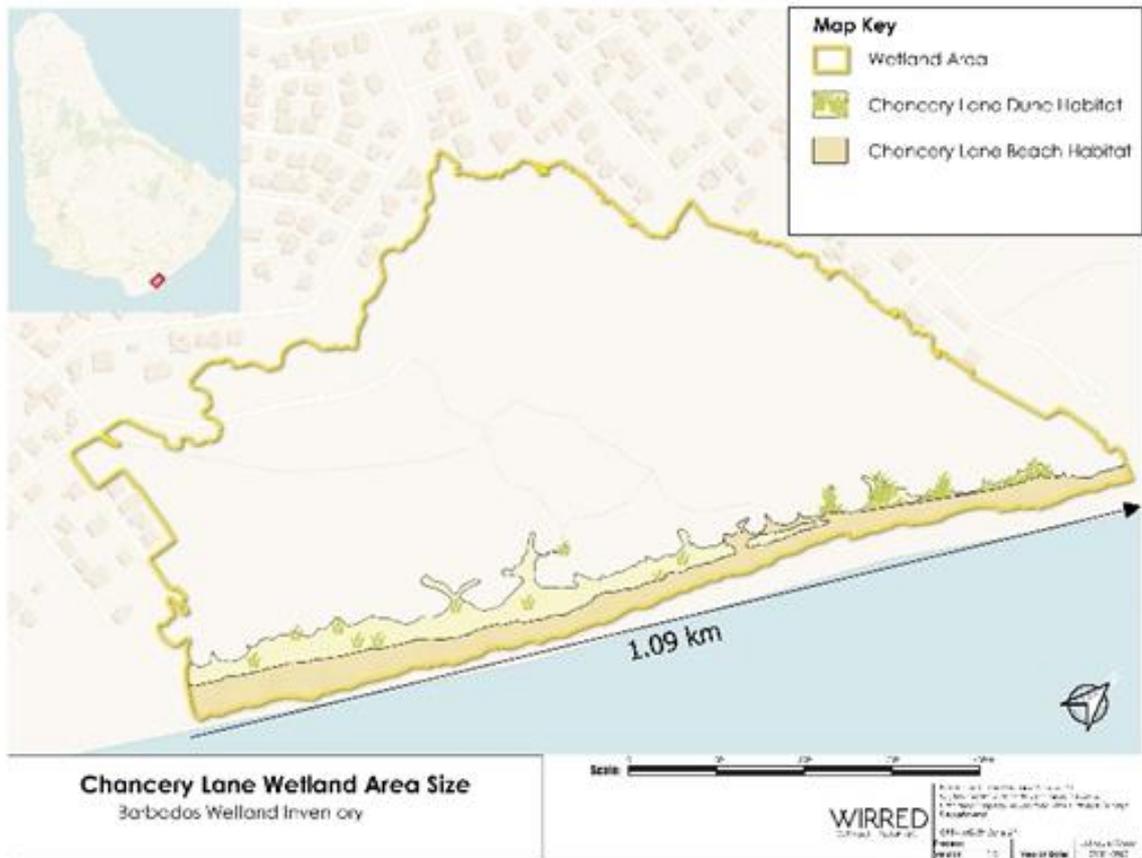


Figure 13. Chancery Lane Swamp dune and beach

**The Southern Zone:** Has a line of emerging woodland (CLW 3,4 & 7), which abuts a significant grassland area (CLG 6 & 8) that is approximately 450m long by 250m wide. This woodland includes similar species composition to the north-western zone of the woodland which fringes the northern boundary.



Figure 13. Chancery Lane Swamp grassland

This grassland (CLG 6 & 8) is made up by a combination of pitted bluestem (*Bothriochloa pertusa*), and crabgrass (*Sporobolus virginicus*). It is used by farmers as a source of feed for

ruminants. The entire grassland area has a sparse scattering of herbaceous plants and shrubs which support pollinators and other microfauna in the area.

**The Western Zone:** The woodland which forms the northern boundary, extends to border the western extent of the Chancery Lane wetland area. (CLW9)

### 3.1.2.9 Biota

Sixteen species of plant have been documented as present in the Chancery Lane wetland (Table 3).

**Table 4. Chancery Lane wetland flora**

| Scientific Name                           | Common Name     | Source/Reference                |
|---|-----------------|---------------------------------|
| <b>Grasses</b>                            |                 |                                 |
| 1. <i>Andropogon pertusus</i>             | Sour grass      | Hutt 1985                       |
| 2. <i>Paspalum distichum</i>              | Knotgrass       | Parasram et al. 2021            |
| 3. <i>Bothriochloa pertusa</i>            | Pitted bluestem | Pers obs                        |
| 4. <i>Sporobolus virginicus</i>           | Crab grass      | Parasram et al. 2021            |
| <b>Trees</b>                              |                 |                                 |
| 1. <i>Casuarina equisetifolia</i>         | Casuarina       | Parasram et al. 2021            |
| 2. <i>Coccoloba uvifera</i>               | Sea grape       | Hutt 1985; Parasram et al. 2021 |
| 3. <i>Conocarpus erectus</i>              | Button mangrove | Hutt 1985                       |
| 4. <i>Blutaparon vermiculare</i>          |                 | Hutt 1985                       |
| 5. <i>Cordia obliqua</i>                  | Clammy cherry   | Pers obs                        |
| 6. <i>Hippomane mancinella</i>            | Manchineel      | Pers obs                        |
| 7. <i>Uncaria tomentosa</i>               | Cat's claw      | Pers obs                        |
| 8. <i>Terminalia catappa</i>              | Seaside almond  | Pers obs                        |
| 9. <i>Thespesia populnea</i>              | Seaside mahoe   | Pers obs                        |
| 10. <i>Euphorbia mesembryanthemifolia</i> | Seaside spurge  | Pers obs                        |
| 11. <i>Impatiens noli-tangere</i>         | Yellow balsam   | Pers obs                        |
| 12. <i>Tabebuia pallida</i>               | Whitewood       | Hutt 1985                       |

Of the 109 species of animals catalogued for the Chancery Lane wetland (Table 4), seven are crustaceans and 102 are birds.

**Table 5. Chancery Lane wetland fauna**

| Scientific name                    | Common name                        | Source/Reference              |
|------------------------------------|------------------------------------|-------------------------------|
| <b>Crustaceans</b>                 |                                    |                               |
| 1. <i>Macrobrachium carcinus</i>   | Crayfish                           | Felix 1991                    |
| 2. <i>Macrobrachium acanthurus</i> | Crayfish                           | Felix 1991                    |
| 3. <i>Macrobrachium faustinum</i>  | Crayfish                           | Felix 1991                    |
| 4. <i>Macrobrachium crenulatum</i> | Crayfish                           | Felix 1991                    |
| 5. <i>Cardisoma guanhumi</i>       | Blue land crab                     | Parasram et al. 2021          |
| 6. <i>Gecarcinus lateralis</i>     | Blackback land crab                | Parasram et al. 2021          |
| 7. <i>Ocyopode quadrata</i>        | Atlantic ghost crab                | Parasram et al. 2021          |
| <b>Birds</b>                       |                                    |                               |
| 1. <i>Botaurus lentiginosus</i>    | American bittern                   | Ebird                         |
| 2. <i>Fulica americana</i>         | American coot                      | Ebird                         |
| 3. <i>Phoenicopterus ruber</i>     | American flamingo                  | Ebird                         |
| 4. <i>Pluvialis dominica</i>       | American golden plover             | Ebird                         |
| 5. <i>Gallinula galeata</i>        | American moorhen, common gallinule | Ebird                         |
| 6. <i>Mareca americana</i>         | American wigeon                    | Ebird                         |
| 7. <i>Orthorhyncus cristatus</i>   | Antillean crested hummingbird      | Birdlife International, Ebird |
| 8. <i>Coereba flaveola</i>         | Bananaquit                         | Ebird                         |
| 9. <i>Hirundo rustica</i>          | Barn swallow                       | Ebird                         |
| 10. <i>Loxigilla barbadensis</i>   | Barbados bullfinch                 | Birdlife International, Ebird |
| 11. <i>Megaceryle alcyon</i>       | Belted kingfisher                  | Ebird                         |
| 12.                                | Black-bellied plover               | Ebird                         |
| 13. <i>Dendrocygna autumnalis</i>  | Black-bellied whistling-duck       | Ebird                         |

|                                     |                           |                  |
|-------------------------------------|---------------------------|------------------|
| 14. <i>Nycticorax nycticorax</i>    | Black-crowned night-heron | Ebird            |
| 15. <i>Melanospiza bicolor</i>      | Black-faced grassquit     | Ebird            |
| 16. <i>Himantopus mexicanus</i>     | Black-necked Stilt        | Ebird            |
| 17. <i>Vireo altiloquus</i>         | Black-whiskered Vireo     | Ebird            |
| 18. <i>Spatula discors</i>          | Blue-winged Teal          | Ebird            |
| 19. <i>Onychoprion anaethetus</i>   | Bridled tern              | Ebird            |
| 20. <i>Pelecanus occidentalis</i>   | Brown pelican             | Ebird            |
| 21. <i>Quiscalus lugubris</i>       | Carib grackle             | Ebird            |
| 22. <i>Elaenia martinica</i>        | Caribbean elaenia         | Ebird            |
| 23. <i>Progne dominicensis</i>      | Caribbean martin          | Ebird            |
| 24. <i>Bubulcus ibis</i>            | Cattle egret              | Ebird            |
| 25. <i>Petrochelidon pyrrhonota</i> | Cliff swallow             | Ebird            |
| 26. <i>Charadrius collaris</i>      | Collared plover           | Ebird            |
| 27. <i>Columbina passerina</i>      | Common ground dove        | Ebird            |
| 28. <i>Sterna hirundo</i>           | Common tern               | Ebird            |
| 29. <i>Zenaida auriculata</i>       | Eared dove                | Ebird            |
| 30. <i>Streptopelia decaocto</i>    | Eurasian collared-dove    | Ebird            |
| 31. <i>Platalea leucorodia</i>      | Eurasian spoonbill        | Ebird            |
| 32. <i>Mareca penelope</i>          | Eurasian wigeon           | Ebird            |
| 33. <i>Plegadis falcinellus</i>     | Glossy ibis               | Ebird            |
| 34. <i>Sicalis luteola</i>          | Grassland yellow-finch    | Ebird            |
| 35. <i>Ardea cinerea</i>            | Grey heron                | Ebird            |
| 36. <i>Tyrannus dominicensis</i>    | Grey kingbird             | Ebird            |
| 37. <i>Ardea herodias</i>           | Great blue heron          | Hutt 1985, Ebird |
| 38. <i>Egretta alba</i>             | Great White egret         | Hutt 1985, Ebird |
| 39. <i>Crotophaga major</i>         | Greater ani               | Ebird            |
| 40. <i>Larus marinus</i>            | Greater black-backed gull | Hutt 1985        |

|                                    |                          |                               |
|------------------------------------|--------------------------|-------------------------------|
| 41. <i>Tringa melanoleuca</i>      | Greater yellowlegs       | Ebird                         |
| 42. <i>Butorides virescens</i>     | Green heron              | Hutt 1985, Ebird              |
| 43. <i>Eulampis holosericeus</i>   | Green-throated Carib     | Birdlife International, Ebird |
| 44. <i>Pluvialis squatarola</i>    | Grey/squealer plover     | Hutt 1985, Ebird              |
| 45. <i>Gelochelidon nilotica</i>   | Gull-billed tern         | Ebird                         |
| 46. <i>Lophodytes cucullatus</i>   | Hooded merganser         | Ebird                         |
| 47. <i>Passer domesticus</i>       | House sparrow            | Ebird                         |
| 48. <i>Limosa haemastica</i>       | Hudsonian godwit         | Ebird                         |
| 49. <i>Leucophaeus atricilla</i>   | Laughing gull            | Ebird                         |
| 50. <i>Caludris minutilla</i>      | Least sandpiper          | Hutt 1985, Ebird              |
| 51. <i>Sternula antillarum</i>     | Least tern               | Ebird                         |
| 52. <i>Larus fuscus</i>            | Lesser Black-backed gull | Ebird                         |
| 53. <i>Aythya affinis</i>          | Lesser scaup             | Ebird                         |
| 54. <i>Tringa flavipes</i>         | Lesser yellowlegs        | Hutt 1985, Ebird              |
| 55. <i>Egretta caerulea</i>        | Little blue heron        | Hutt 1985, Ebird              |
| 56. <i>Egretta garzetta</i>        | Little egret             | Birdlife International, Ebird |
| 57. <i>Limnodromus scolopaceus</i> | Long-billed dowitcher    | Ebird                         |
| 58. <i>Fregata magnificens</i>     | Magnificent frigatebird  | Ebird                         |
| 59. <i>Falco columbarius</i>       | Merlin                   | Ebird                         |
| 60. <i>Anas acuta</i>              | Northern pintail         | Ebird                         |
| 61. <i>Spatula clypeata</i>        | Northern shoveler        | Ebird                         |
| 62. <i>Parkesia noveboracensis</i> | Northern waterthrush     | Ebird                         |
| 63. <i>Amazona amazonica</i>       | Orange-winged parrot     | Ebird                         |
| 64. <i>Pandion haliaetus</i>       | Osprey                   | Ebird                         |
| 65. <i>Calidris melanotos</i>      | Pectoral sandpiper       | Ebird                         |
| 66. <i>Falco peregrinus</i>        | Peregrine falcon         | Ebird                         |
| 67. <i>Podilymbus podiceps</i>     | Pied-billed Grebe        | Ebird                         |

|                                    |                        |                  |
|------------------------------------|------------------------|------------------|
| 68.                                | Red junglefowl         | Ebird            |
| 69. <i>Calidris canutus</i>        | Red knot               | Ebird            |
| 70. <i>Phaethon aethereus</i>      | Red-billed tropicbird  | Ebird            |
| 71.                                | Ringneck plover        | Hutt 1985        |
| 72. <i>Aythya collaris</i>         | Ring-necked duck       | Ebird            |
| 73. <i>Columba livia</i>           | Rock dove              | Ebird            |
| 74. <i>Sterna dougallii</i>        | Roseate tern           | Ebird            |
| 75. <i>Psittacula krameri</i>      | Ring-necked parakeet   | Ebird            |
| 76. <i>Thalasseus maximus</i>      | Royal tern             | Ebird            |
| 77. <i>Oxyura jamaicensis</i>      | Ruddy duck             | Ebird            |
| 78. <i>Arenaria interpres</i>      | Ruddy turnstone        | Ebird            |
| 79. <i>Riparia riparia</i>         | Sand martin            | Ebird            |
| 80. <i>Calidris alba</i>           | Sanderling             | Hutt 1985, Ebird |
| 81. <i>Patagioenas squamosa</i>    | Scaly-naped pigeon     | Ebird            |
| 82. <i>Charadrius semipalmatus</i> | Semipalmated plover    | Ebird            |
| 83. <i>Calidris pusilla</i>        | Semipalmated sandpiper | Hut 1985, Ebird  |
| 84. <i>Molothrus bonariensis</i>   | Shiny cowbird          | Ebird            |
| 85. <i>Limnodromus griseus</i>     | Short-billed Dowitcher | Ebird            |
| 86. <i>Egretta thula</i>           | Snowy egret            | Hutt 1985, Ebird |
| 87. <i>Tringa solitaria</i>        | Solitary sandpiper     | Ebird            |
| 88. <i>Porzana carolina</i>        | Sora                   | Ebird            |
| 89. <i>Actitis macularius</i>      | Spotted sandpiper      | Hutt 1985, Ebird |
| 90. <i>Calidris himantopus</i>     | Stilt sandpiper        | Ebird            |
| 91. <i>Egretta tricolor</i>        | Tricolored heron       | Ebird            |
| 92. <i>Calidris mauri</i>          | Western sandpiper      | Ebird            |
| 93. <i>Numenius phaeopus</i>       | Whimbrel               | Ebird            |
| 94. <i>Calidris fuscicollis</i>    | White rumped sandpiper | Hutt 1985, Ebird |

|                                |                            |                       |
|--------------------------------|----------------------------|-----------------------|
| 95. <i>Tringa semipalmata</i>  | Willet                     | Hutt 1985, Ebird      |
| 96. <i>Charadrius wilsonia</i> | Wilson's plover            | Ebird                 |
| 97. <i>Setophaga petechia</i>  | Yellow warbler             | Hutt 1985, Ebird      |
| 98. <i>Coccyzus americanus</i> | Yellow-billed cuckoo       | Ebird                 |
| 99. <i>Nyctanassa violacea</i> | Yellow-crowned night-heron | Ebird                 |
| 100. <i>Zenaida aurita</i>     | Zenaida dove               | Ebird                 |
| <b>Mammals</b>                 |                            |                       |
| 1. <i>Artibeus jamaicensis</i> | Jamaican fruit-eating bat  | Genoways, et al. 2011 |

The wetland is an important habitat for migratory and vagrant waterbirds and provides a critical feeding ground for the Little Egret, *Egretta garzetta* (BirdLife International (2022) Important Bird Areas factsheet: Chancery Lane Swamp).

#### 3.1.2.10 Changes in ecological character

There are no studies on which to base an evaluation of ecological changes over time.

#### 3.1.2.11 Ecosystem Services and Human Activities

Table 6 provides a non-exhaustive list of the ecosystem services provided by the Chancery Lane wetland.

**Table 6. Chancery Lane ecosystem services**

| Ecosystem Service | Details/Reference   |
|-------------------|---|
| Storm Protection  | Barbados Integrated Coastal Management Plan, 1999   |
| Food production   | Foraging for seagrapes, fatporks and coconuts occurs within the chancery lane wetland. Additional harvesting of hay for livestock fodder within the grassland areas.<br>Livestock grazing.  |
| Cultural Heritage | Chancery Lane wetlands is one of the most notable archaeological sites on the island, with numerous artefacts having been found attesting to early Amerindian presence in Barbados (Bullen and Bullen 1967) and <a href="https://www.caribheritage.org/discover-caribbean-heritage/barbados">https://www.caribheritage.org/discover-caribbean-heritage/barbados</a> |

|                                     |   |
|-------------------------------------|---|
| Aesthetic and sense of place values | “[The Chancery Lane ecosystem] offers one of the most tranquil and accessible sections of coastline and coastal landscape on the south side of the island. For this reason, it has great cultural value as a shore access point.” (GoB 2003). |
| Educational values                  | The Chancery Lane wetland is a significant location for birding in Barbados, and has been described in the draft 2017 Amendment to the Barbados Physical Development Plan as an important recreational and educational resource (GoB 2017).   |
| Nature study pursuits               |   |
| Other recreation and tourism        |   |

### 3.1.2.12 Land use and human activities

Chancery Lane has a complex and fascinating history. Archaeological studies have revealed significant evidence of precolonial settlement in the area, indicating that the wetland was an important resource for indigenous communities. Later, the area was transformed into a plantation, and the wetland was used as a dumping ground for waste from the sugar factories. In the 19th and early 20th centuries, the wetland was turned into a shorebird shooting swamp, where people would come to hunt birds for sport.

Today, the wetland is no longer heavily used and has been recognized in Barbados’ Amended Physical Development Plan (2017) as a Natural Heritage Conservation Area with specific conservation and land use recommendations. While the area is not yet legally designated, the plan provides important recommendations for how to protect and preserve the wetland as a valuable natural habitat for wildlife and a potential site for ecotourism and environmental education.

Several activities occur at the Chancery Lane wetland and the abutting beach. These activities include small-scale apiculture, with beekeepers maintaining hives in the vicinity. Additionally, the area is used for recreation and watersports, particularly kite and wind surfing, along the nearby beach. Foraging for seagrapes, fatporks and coconuts occurs within the Chancery Lane wetland meanwhile artisanal fishing is also practiced in the nearshore.

However, there is evidence of illegal dumping over the cliff edge, which can cause pollution and environmental damage. Recreational off-road driving also occurs in the marshland.

These activities demonstrate the ongoing importance of the area to the community and its role in sustaining local livelihoods. Yet, it is important to note that some of these activities, particularly off-roading and illegal dumping, can have negative impacts on the environment and wildlife in the area, and measures should be taken to mitigate these impacts and promote sustainable practices.

### 3.1.2.13 Pressures and trends

Any commercial or residential development of the wetland, which is in private ownership or adjacent lands, particularly without an adequate buffer zone, is likely to cause degradation of

the wetland (BirdLife International (2022) Important Bird Areas factsheet: Chancery Lane Swamp).

Illegal dumping and off-roading in the marsh can have significant negative impacts on the ecosystem and biodiversity of Chancery Lane wetland. These activities can introduce pollutants and contaminants into the soil and water, which will damage or destroy natural habitats and negatively impact wildlife. The dumping of waste materials, such as construction debris or hazardous chemicals, will cause long-lasting damage to the ecosystem and the surrounding environment, including the nearby ocean and beaches.

Off-roading in the marsh will also cause physical damage to the wetland area, destroying vegetation and compacting the soil. This can alter the natural hydrology of the area, making it more difficult for native plant species to grow and making the area more susceptible to erosion and flooding. Additionally, off-road vehicles will disrupt the natural movements and behaviours of wildlife, disturbing nesting sites, breeding grounds, and feeding areas. Overall, the pressures from illegal dumping and off-roading can have long-lasting and irreversible impacts on the health and biodiversity of Chancery Lane wetland.

### 3.1.3 Conservation and Management

In the 2003 Amendment to the Barbados PDP, the Chancery Lane Ecosystem, including the wetland, was identified as a *Natural Heritage Conservation Area—Land* and as a *Special Study Area*, encompassing environmentally sensitive terrestrial environments. This designation is intended to:

- Conserve and enhance the environmental quality and visual integrity of sites of ecological and geological importance;
- Ensure that new development is compatible with the natural heritage and landscape qualities of these areas;
- Define and protect a functionally connected natural heritage system based on an ecosystem approach.

The 2017 draft Amendment to the PDP maintains Chancery Lane's designation as a *Natural Heritage Conservation Area—Land*. This designation applies to "sensitive or unique ecosystems, both within and outside of the National Park, which require protection from development and intensive recreational development" (2017 draft Amendment to the Barbados PDP).

#### 3.1.3.1 *Management plans and monitoring programmes*

None could be found.

#### 3.1.3.2 *Stakeholder participation in conservation and management*

The Land Conservancy Barbados and the Barbados National Trust have flagged this area as one of importance and conservation interest.

## 3.2 Graeme Hall Swamp

### 3.2.1 Administrative and Locational Details

#### 3.2.1.1 *Location*

Graeme Hall Swamp is located at sea level on the south coast of Barbados (13.072829 N, - 59.577835 W) in the parish of Christ Church (Ramsar Information Sheet).

#### 3.2.1.2 *Area, boundary, and dimensions*

Graeme Hall Swamp has an area of approximately 33.23 ha, and is located at sea level (Ramsar Information Sheet). The swamp contains the largest body of inland water on Barbados, an artificially-created lake with an area of 4.86 ha. In 1997, measured depths in the lake ranged from 0.76 m to 3.18 m, with an average depth between 2.0 to 2.5 m (ARA 1997). In 2006, the average depth of the lake was estimated at 1.32 m, and the maximum depth at 2.71 m (Ramsar Information Sheet).

#### 3.2.1.3 *Biogeographical region*

| Regionalisation scheme(s)             | Biogeographic Region |
|---------------------------------------|----------------------|
| Marine Ecoregions of the World (MEOW) | Eastern Caribbean    |
| WWF Terrestrial Ecoregions            | Neotropical          |
| Udvardy's Biogeographical Provinces   | Neotropical          |

#### 3.2.1.4 *Land tenure and administrative authority*

The western portion of the swamp (13.86 ha) is privately owned by the Graeme Hall Nature Sanctuary. The eastern portion (19.37 ha) is owned by the Government of Barbados and is vested in the Barbados Agricultural Development & Marketing Corporation (BADMC). (Ramsar Information Sheet)

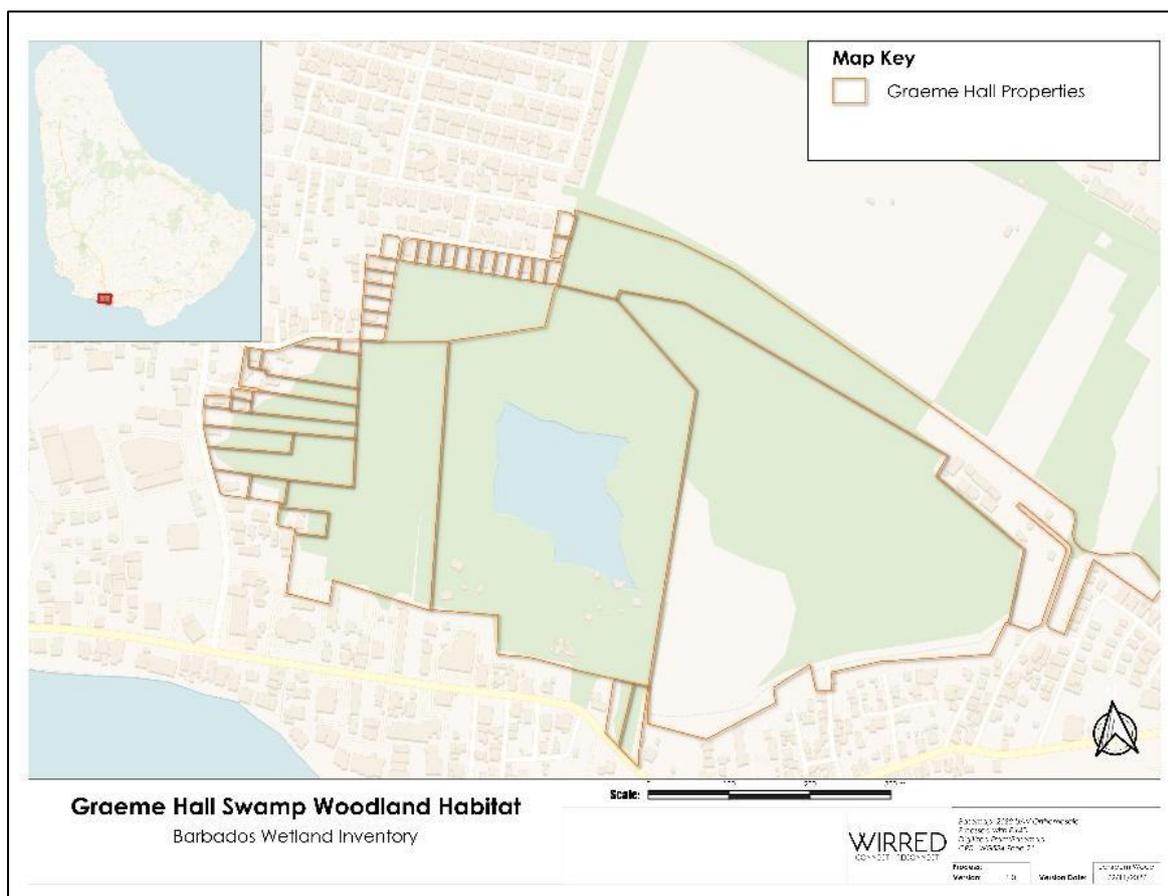


Figure 14. Graeme Hall Swamp land ownership

### 3.2.2 Ecological Character

#### 3.2.2.1 *Summary statement*

In 2005, the Graeme Hall Swamp was designated a Wetland of International Importance under the Ramsar Convention based on the following criteria (Ramsar Convention Secretariat, Ramsar Information Sheet):

- Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region;
- Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities. In particular, reference was made to the presence of the peregrine falcon (*Falco peregrinus*), which is listed in Appendix I of the Convention on International Trade of Endangered Species of Wild Fauna and Flora;
- Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions. The Swamp was described as “home to the widest diversity of resident and migratory birds on the island, including locally threatened species such as

the Caribbean coot (*Fulica caribaea*)<sup>4</sup> and the yellow warbler (*Setophaga petechia*). Additionally the swamp is the oldest nesting colony for the snowy egret (*Egretta thula*) in Barbados, and is the first known breeding colony of little egret (*Egretta garzetta*) to become established in the Americas.

The Swamp incorporates six different Ramsar wetland types:

- Coastal brackish/saline lagoons (Marine/coastal wetlands Ramsar type J)
- Intertidal forested wetlands (Marine/coastal Ramsar type I)
- Freshwater, tree-dominated wetlands (Inland wetlands Ramsar type Xf)
- Shrub-dominated wetlands (Inland wetlands Ramsar type W)
- Water storage area (Human-made wetlands Ramsar type 6)
- Canals and drainage channels, ditches (Human-made wetlands Ramsar type 9)

At the time of its designation as a Ramsar site, Graeme Hall Swamp was the site of the largest remaining area of red mangrove (*Rhizophora mangle*) and white mangrove (*Laguncularia racemosa*) forest on the island.

The swamp provides habitat for many species of migratory shorebirds, including several species which are winter residents of the swamp. It is also home to local breeding populations of some 20 resident bird species, and harbours the highest density of yellow warblers (*Setophaga petechia*) in Barbados.

Graeme Hall Swamp has been assessed as an Important Bird Area (<http://datazone.birdlife.org/site/factsheet/graeme-hall-swamp-iba-barbados/text>) and a Key Biodiversity Area (<https://www.keybiodiversityareas.org/site/factsheet/20513>). The Swamp is known or thought to hold a significant population of four range-restricted species: the green-throated carib hummingbird (*Eulampis holosericeus*), the Antillean crested hummingbird (*Orthorhyncus cristatus*), the Caribbean elaenia (*Elaenia martinica*), and the endemic Barbados bullfinch (*Loxigilla barbadensis*). It is also known or thought to hold, on a regular basis, at least 1% of a biogeographic population of a congregatory waterbird species, namely the little egret (*Egretta garzetta*). As of 2007, Graeme Hall Swamp was the only documented nesting location for little egret in the Western Hemisphere.

The wetlands at Graeme Hall also provide habitat for a variety of fresh and brackish water fish species. Among these have been a number of marine species that, having become isolated from the sea, became breeding residents of the lake (Ramsar Information Sheet).

#### 3.2.2.2 Climate

Under the Köppen Climate Classification system, the island of Barbados can be characterised as an **Af** zone, which means it has a tropical rainforest climate. This type of climate is

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<sup>4</sup> Caribbean coot (*Fulica caribaea*) no longer genetically distinct from American coot (3AOU Classification Committee – North and Middle America Proposal Set 2016-A, Chesser 2016, McNair and Cramer-Burke 2006.

characterized by high temperatures and heavy rainfall, with average temperatures ranging from 22 to 31 degrees Celsius (72 to 88 degrees Fahrenheit) throughout the year<sup>5</sup>.

**Prevailing winds:** ENE

**Average Temperature:** 28 C

### 3.2.2.3 *Soil*

The geology of Graeme Hall Swamp consists of marine beach and modern dune deposits, with coastal montmorillonite clays (Ramsar Information Sheet). The lake bottom consists of a layer of silt varying from 0.3 to 1.7 m. in thickness (ARA, 1997).

### 3.2.2.4 *Water regime*

Graeme Hall Swamp is the central drainage point for a watershed area of approximately 11,000 acres (Ramsar Information Sheet).

The swamp was previously part of a single large ecosystem comprising mangrove wetland, seagrass beds, and shallow nearshore coral reef ecosystems (Ramsar Information Sheet). In the present day, the Graeme Hall Swamp is connected to the sea only by a narrow outlet channel (Lucas 2011), and ecological interaction between the wetland and the nearby coastal waters is negligible (Ramsar Information Sheet). Sluice gates were constructed to manage flow of water between the wetland and the ocean, but these were often non-functional for long periods of time, and frequently blocked by sandbanks (Lucas, 2011). As a result, the normal tidal exchanges between the wetland and the coastal waters were severely restricted, preventing the Graeme Hall Swamp from truly functioning as a coastal wetland and affecting the salinity of the water present in the wetland (Lucas, 2011).

In 2021, work began to replace the sluice gate system with a weir, which is expected to improve the interflow of water between the swamp and the ocean and to restore the swamp's brackish salinity.

### 3.2.2.5 *Water chemistry*

Table 7 presents results of water quality analysis carried out in February 2010 (EEC 2010) and October 2018 (EEC 2019). The 2010 data are based on sampling at 20 points in the Swamp over three consecutive days. The 2018 data are based on samples taken at four points in the Graeme Hall Nature Sanctuary over two consecutive days. The figures in the table represent the average of the results obtained for each parameter over the respective sampling periods.

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<sup>5</sup> <https://climateknowledgeportal.worldbank.org/country/barbados>

**Table 7. Graeme Hall Swamp water quality**

|                              | <b>February 2010</b> | <b>October 2018</b> |
|------------------------------|----------------------|---------------------|
| pH                           | 8.23                 | 8.3                 |
| Nitrates (mg/l)              | 0.15                 | <0.2                |
| Total phosphorus (mg/l)      | 0.4                  | 1.15                |
| Salinity (ppt)               | 1.4                  | 1.0                 |
| TSS (mg/l)                   | 39                   | 39                  |
| Dissolved oxygen (mg/l)      | 4.6                  | 8.0                 |
| BOD (mg/l)                   |                      | 10                  |
| Enterococci (cols/100ml)     | 842                  | 1,187               |
| Faecal coliform (cols/100ml) |                      | 9,500               |
| Chlorophyll-A (mcg/l)        | 33                   | 84                  |
| Turbidity (NTU)              | 12.3                 | 30.7                |

3.2.2.6 Ecosystems, habitats, and biodiversity

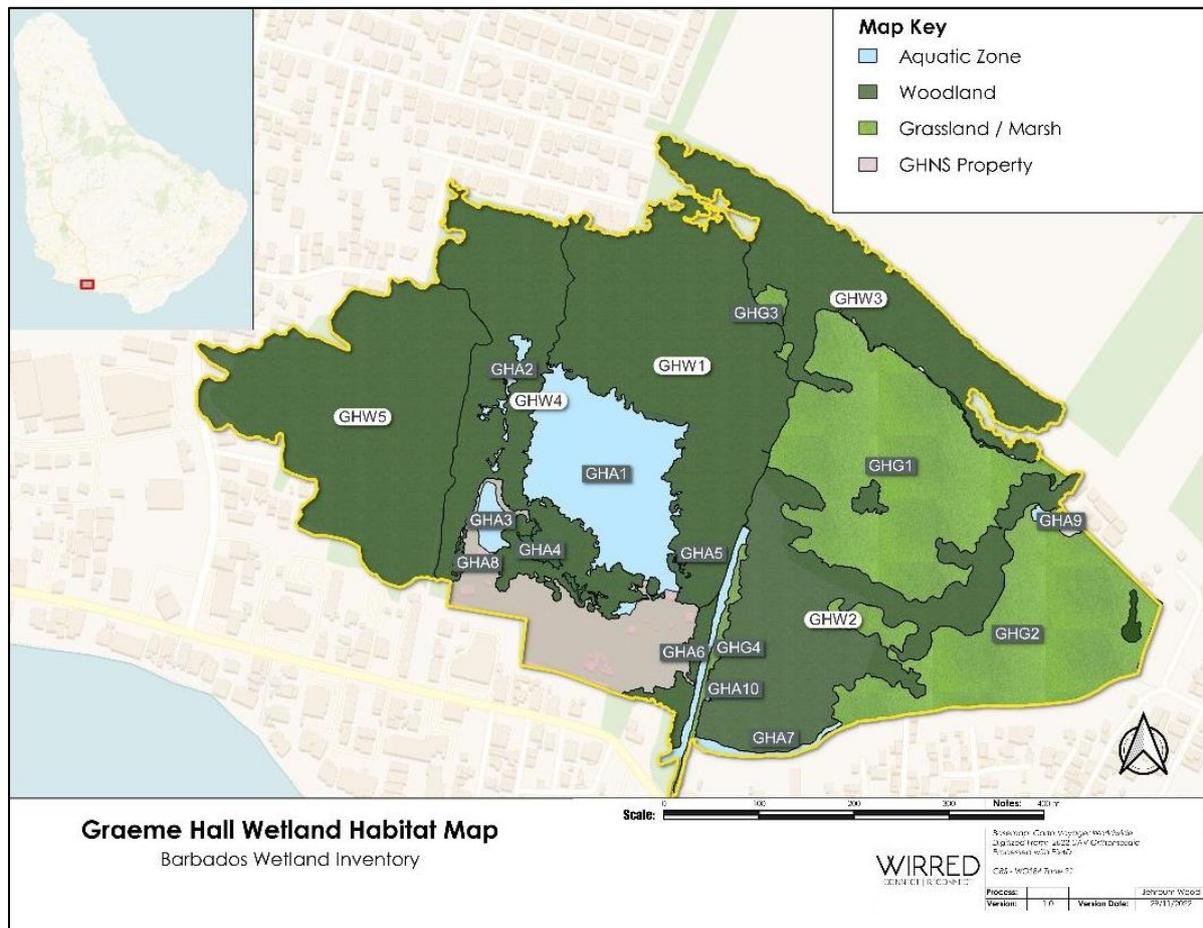


Figure 15. Graeme Hall Swamp habitats. The labels in the figure represent areas that are referred to in the text.

**The lake and other aquatic areas:** The water covered portions of the Graeme Hall Swamp area are depicted in Figure 16. The largest water body is the lagoon in the centre of the GHNS. Adjacent areas to the west of the lagoon are shallow trays. To the east and south of the lagoon are a channel running north-south that bisects the area and culminates in the outlet to the sea. There is another channel that runs to the east of the bisecting one.

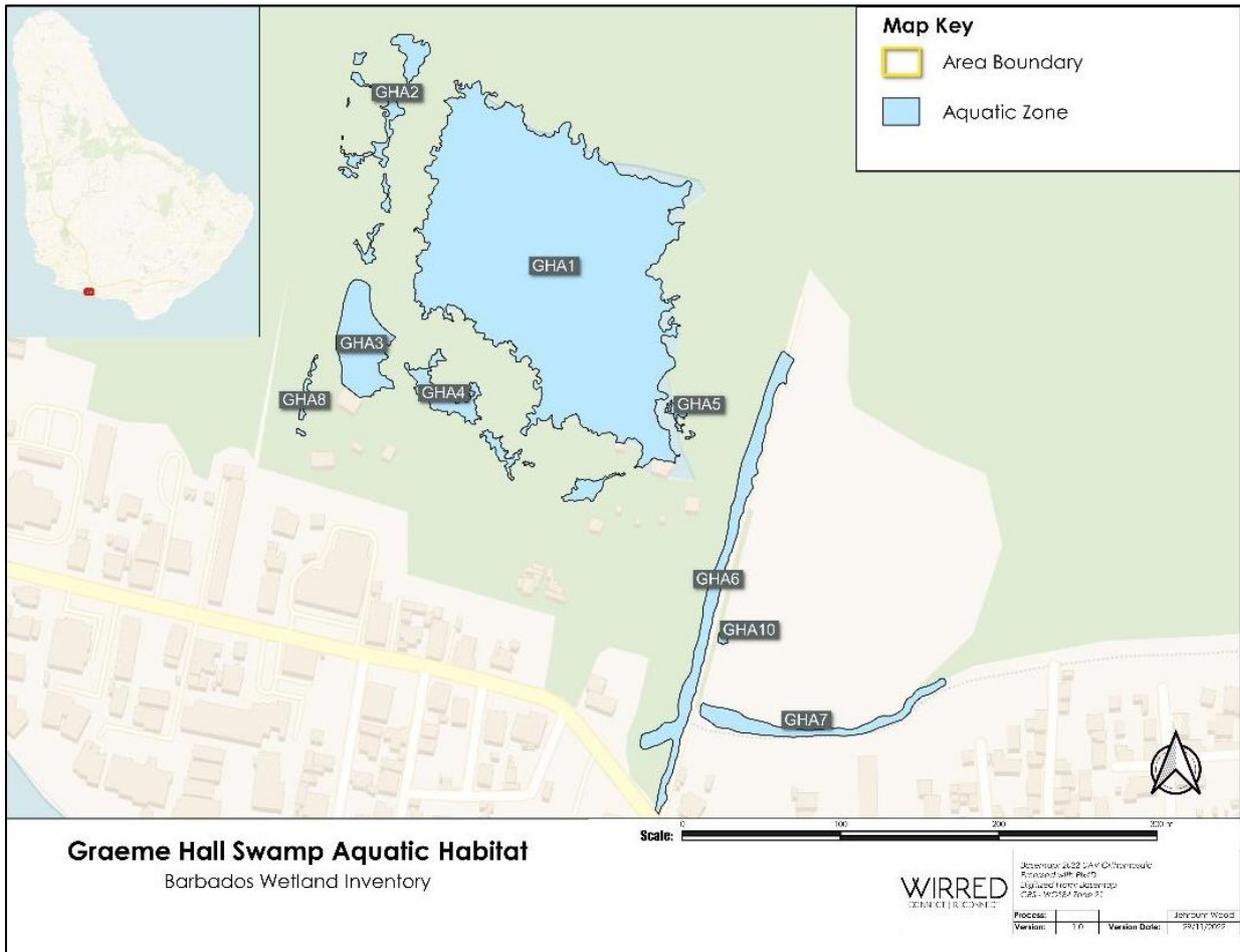


Figure 16. Graeme Hall Swamp aquatic areas. The labels in the figure represent areas that are referred to in the text.



The lake



The bisecting canal



Red mangrove and its prop roots



Lateral canal

Figure 17. Graeme Hall Swamp open water habitats

**Woodlands:** The wooded areas of the Graeme Hall Nature Sanctuary are shown in Figure 18. These are described below.



Figure 18. Graeme Hall Swamp wooded areas. The labels in the figure represent areas that are referred to in the text.

Along the boundaries of the lake, in GHW1, there is a dense tangle of red mangrove (*Rhizophora mangle*) prop roots. This central woodland area is dominated by mature red mangrove trees. It has a dense canopy and a sparse understory.

To the east of the pond and beyond the central woodland, there is an unpaved path which allows access into the dense woodland area. To east of this path, there is a mangrove woodland (GHW2) that is dominated by a dense thicket of white mangrove (*Laguncularia racemosa*) and red mangrove (*Rhizophora mangle*) trees.

The area is seasonally inundated, but some sinkholes that retain surface water and thick canopy cover maintain very humid conditions in the woodland area. Like the central woodland, high moisture, and thick vegetation support a variety of birds and invertebrates in this area.



Along bisecting road



In an inundated area



Along the lateral canal

Figure 19. Graeme Hall Swamp eastern woodland and marsh

To the eastern edge of this woodland, the tree cover becomes fragmented, and humidity and inundation diminishes. The habitat transforms into a grassland marsh in an easterly direction and dries as you reach the easternmost boundary of the Graeme Hall wetland zone. This area is used for mixed crop production.

To the immediate west of the aquatic area, (GHW4) the woodland exists in a predominately inundated area, where red mangrove (*Rhizophora mangle*) trees dominate the area. The northern portion of GHW4 abuts an access road to a residential area and the species composition differs to areas immediately adjacent to the ponds.

Further west, in GHW5, the ecosystem becomes more representative of the typical coastal woodland habitat that can be observed across Barbados. This woodland area includes seaside almond, seaside mahoe and other coastal woodland species. This woodland area extends to Rendezvous main road.



Figure 20. Graeme Hall Swamp western woodland adjacent to Rendezvous Rd.

GHW3 dominates the northernmost portion of the study area. This area of the woodland is less densely populated with vegetation and the habitat has fewer trees which are significantly smaller.

**The Grassland Marsh:** A freshwater marsh is located in the eastern quadrant of the swamp, which contains a large stand of mature white mangroves and a network of man-made drainage canals with lotus and water lilies, water lettuce, and filamentous green algae (Figure 22). The banks of the canals support a dense growth of sedges and strips of grassland. (Ramsar Convention Secretariat, 2006)

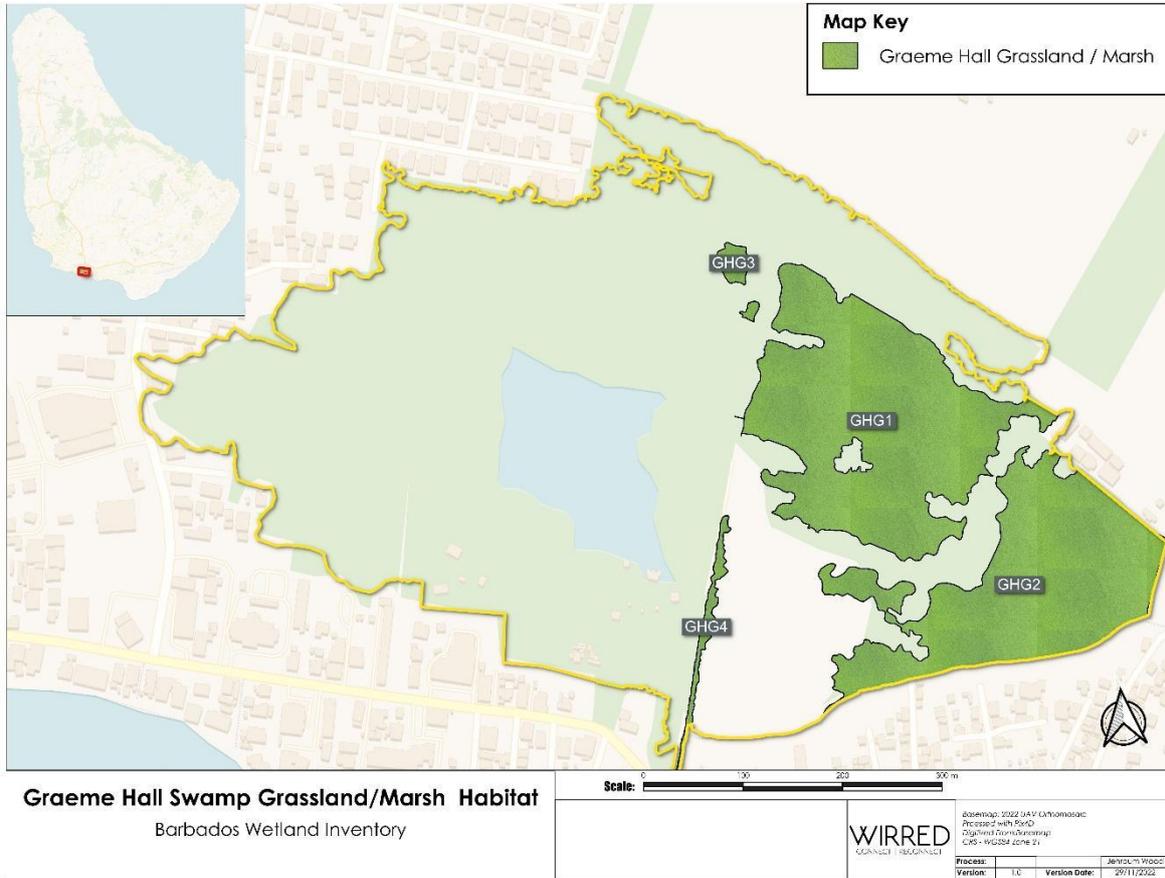


Figure 21. Graeme Hall Swamp grassland marsh areas



South eastern area (GHG 2)



North eastern area (GHG1)

Figure 22. Graeme Hall Swamp grassland marsh areas

### 3.2.2.7 Biota

The documented flora of the Graeme Hall Swamp comprises 33 species, including four species of mangrove at one time but not currently (Table 8).

**Table 8. Graeme Hall Swamp flora**

| Scientific Name                       | Common Name                | Source/Reference                 |
|---------------------------------------|----------------------------|----------------------------------|
| <b>Grasses/herbs</b>                  |                            |                                  |
| 1. <i>Cladium jamaicensis</i>         | Jamaica swamp sawgrass     | EEC 2010                         |
| 2. <i>Eleocharis mutata</i>           | Sedge/Rush                 | Gooding 1974; ARA 1997; EEC 2010 |
| 3. <i>Sporobolus virginicus</i>       | Crab grass                 | Gooding 1974; ARA 1997           |
| 4. <i>Phloxerus vermicularis</i>      | Samphire                   | Gooding 1974; ARA 1997           |
| 5. <i>Eleocharis geniculata</i>       | Grass rush                 | Gooding 1974, ARA 1997           |
| 6. <i>Fimbristylis ferruginea</i>     | Rusty club rush            | Gooding 1974, ARA 1997           |
| 7. <i>Cenchrus echinatus</i>          | Southern sandbur           | ARA 1997                         |
| 8. <i>Cyperus ligularis</i>           | Swamp flatsedge            | ARA 1997                         |
| 9. <i>Conyza lyrata</i>               | Clammy false oxtongue      | ARA 1997                         |
| 10. <i>Ruppia maritima</i>            | Tassel pond weed           | Gooding 1974                     |
| 11. <i>Sagittaria lancifolia</i>      | Arrowhead                  | EEC 2010                         |
| 12. <i>Nymphaea ampla</i>             | Dotleaf waterlily          | EEC 2010                         |
| 13. <i>Pistia straiotes</i>           | Water lettuce              | EEC 2019                         |
| <b>Trees and shrubs</b>               |                            |                                  |
| 14. <i>Terminalia catappa</i>         | Almond                     | ARA 1997                         |
| 15. <i>Pithecellobium unguis-cati</i> | Bread and cheese           | ARA 1997                         |
| 16. <i>Casuarine equisetifolia</i>    | Casuarina                  | ARA 1997                         |
| 17. <i>Cocos nucifera</i>             | Coconut                    | ARA 1997                         |
| 18. <i>Acacia tortuosa</i>            | Twisted acacia             | ARA 1997                         |
| 19. <i>Maclura tinctoria</i>          | Fustic                     | ARA 1997                         |
| 20. <i>Solanum racemosum</i>          | Bitter berry, Canker berry | ARA 1997                         |
| 21. <i>Citharexylum spinosum</i>      | Fiddlewood                 | ARA 1997                         |

|                                  |                        |                        |
|----------------------------------|------------------------|------------------------|
| 22. <i>Asparagus sp.</i>         |                        | ARA 1997               |
| 23. <i>Ziziphus mauritania</i>   | Dunks                  | ARA 1997               |
| 24. <i>Jasminum fluminense</i>   | Brazilian jasmine      | ARA 1997               |
| 25. <i>Tabebuia heterophylla</i> | Whitewood, white cedar | ARA 1997               |
| 26. <i>Rhizophora mangle</i>     | Red mangrove           | ARA 1997; EEC 2010     |
| 27. <i>Laguncularia racemosa</i> | White mangrove         | ARA 1997; EEC 2010     |
| 28. <i>Avicennia nitida</i>      | Black mangrove         | Gooding 1974           |
| 29. <i>Conocarpus erectus</i>    | Button mangrove        | Hutt, n.d.; EEC 2010   |
| 30. <i>Syzygium cumini</i>       | Java plum              | EEC 2019               |
| 31. <i>Ficus citrifolia</i>      | Bearded fig            | EEC 2010               |
| 32. <i>Cordia obliqua</i>        | Clammy cherry          | EEC 2010               |
| <i>Nonvascular plants</i>        |                        |                        |
| 33. <i>Chara sp.</i>             | Hornwort               | Gooding 1974; ARA 1997 |

The documented fauna of the Graeme Hall Swamp (Table 9) includes 6 crustacean species, 10 fish species, 2 arthropod species, 2 reptile species, 3 mammal species, and 114 bird species.

**Table 9. Graeme Hall Swamp fauna**

| Scientific Name                   |                     | Source/Reference               |
|-----------------------------------|---------------------|--------------------------------|
| <b><i>Crustaceans</i></b>         |                     |                                |
| 1. <i>Macrobrachium faustinum</i> |                     | Felix 1991                     |
| 2. <i>Palaemon pandaliformis</i>  |                     | Felix 1991                     |
| 3. <i>Xiphocaris elongata</i>     |                     | Felix 1991                     |
| 4. <i>Uca burgersi</i>            | Fiddler crab        | EEC 2010                       |
| 5. <i>Cardisoma guanhumi</i>      | Blue land crab      | EEC 2010, Parasram et al. 2021 |
| 6. <i>Gecarcinus lateralis</i>    | Blackback land crab | Parasram et al. 2021           |
| <b><i>Fishes</i></b>              |                     |                                |

|                                     |                        |  |
|-------------------------------------|------------------------|--|
| 1. <i>Centropomus undecimalis</i>   | Snook                  | Cattaneo et al. 1987                                     |
| 2. <i>Mugil curema</i>              | White mullet           | Cattaneo et al. 1987                                     |
| 3. <i>Rivulus marmoratus</i>        | Mangrove rivulus       | Cattaneo et al. 1987; Parker and Oxenford 1998; EEC 2019 |
| 4. <i>Poecilia latipinna</i>        | Sailfin molly          | Cattaneo et al. 1987                                     |
| 5. <i>Poecilia sphenops</i>         | Shortfin molly         | Cattaneo et al. 1987; EEC 2019                           |
| 6. <i>Poecilia reticulata</i>       | Guppy                  | Cattaneo et al. 1987; EEC 2019                           |
| 7. <i>Megalops atlanticus</i>       | Atlantic tarpon        | Cattaneo et al. 1987; EEC 2010; EEC 2019                 |
| 8. <i>Cichlasoma bimaculatus</i>    | Black acara            | Cattaneo et al. 1987; EEC 2019                           |
| 9. <i>Cichlasoma octofasciatum</i>  | Jack Dempsey           | Cattaneo et al. 1987; EEC 2019                           |
| 10. <i>Caranx bartholomaei</i>      | Yellow jack            | Cattaneo et al. 1987                                     |
| 11. <i>Ecinostomus sp.</i>          | Mojarra                | Cattaneo et al. 1987                                     |
| 12. <i>Lutjanus apodus</i>          | Schoolmaster           | Cattaneo et al. 1987                                     |
| 13. <i>Polycentrus schomburgkii</i> | Guyana leaf fish       | Cattaneo et al. 1987; EEC 2019                           |
| 14. <i>Oreochromis aureus</i>       | Blue tilapia           | ARA 1997   |
| 15. <i>Oreochromis mossambicus</i>  | Mozambique tilapia     | EEC 2019   |
| 16. <i>Poecilia sp.</i>             | Guppies and mollies    | ARA 1997   |
| 17. <i>Cichlasoma spp.</i>          | Cichlids               | ARA 1997   |
| 18. <i>Gobionellus spp.</i>         | Goby                   | Cattaneo et al. 1987                                     |
| 19. <i>Atherinomous sp.</i>         | Silverside             | Cattaneo et al. 1987                                     |
| 20. <i>Eroteli smaraguds</i>        | Emerald sleeper        | Cattaneo et al. 1987                                     |
| <b>Insects/Arthropods</b>           |                        |  |
| 1. <i>Nephilia clavipes</i>         | Golden silk orb-weaver | GHNS, 2005   |
| 2. <i>Zosis geniculatus</i>         | Grey house spider      | GHNS, 2005   |
| <b>Reptiles</b>                     |                        |  |
| 1. <i>Pseudemys sp.</i>             | Freshwater turtle      | ARA 1997   |
| 2. <i>Ameiva sp.</i>                | Lizard                 | ARA 1997   |
| <b>Birds</b>                        |                        |  |

|     |                               |                               |                 |
|-----|-------------------------------|-------------------------------|-----------------|
| 1.  | <i>Fulica americana</i>       | American coot                 | Ebird           |
| 2.  | <i>Pluvialis dominica</i>     | American golden plover        | EEC 2010        |
| 3.  | <i>Gallinula galeata</i>      | American moorhen              | Ebird           |
| 4.  | <i>Mareca americana</i>       | American wigeon               | Ebird           |
| 5.  | <i>Anhinga anhinga</i>        | Anhinga                       | Ebird, EEC 2010 |
| 6.  | <i>Orthorhyncus cristatus</i> | Antillean crested hummingbird | Ebird, EEC 2010 |
| 7.  | <i>Coereba flaveola</i>       | Bananaquit                    | Ebird, EEC 2010 |
| 8.  | <i>Loxigilla barbadensis</i>  | Barbados bullfinch            | Ebird           |
| 9.  | <i>Hirundo rustica</i>        | Barn swallow                  | Ebird           |
| 10. | <i>Megaceryle alcyon</i>      | Belted kingfisher             | Ebird, EEC 2010 |
| 11. | <i>Cypseloides niger</i>      | Black swift                   | Ebird           |
| 12. | <i>Pluvialis squatarola</i>   | Black-bellied plover          | Ebird           |
| 13. | <i>Dendrocygna autumnalis</i> | Black-bellied whistling duck  | Ebird           |
| 14. | <i>Nycticorax nycticorax</i>  | Black-crowned night heron     | Ebird           |
| 15. | <i>Melanospiza bicolor</i>    | Black-faced grassquit         | Ebird           |
| 16. | <i>Setophaga striata</i>      | Blackpoll warbler             | Ebird           |
| 17. | <i>Setophaga virens</i>       | Black-throated green warbler  | Ebird           |
| 18. | <i>Vireo altiloquus</i>       | Black-whiskered vireo         | Ebird           |
| 19. | <i>Spatula discors</i>        | Blue-winged teal              | Ebird, EEC 2010 |
| 20. | <i>Sula leucogaster</i>       | Brown booby                   | Ebird           |
| 21. | <i>Anous stolidus</i>         | Brown noddy                   | Ebird           |
| 22. | <i>Pelecanus occidentalis</i> | Brown pelican                 | Ebird           |
| 23. | <i>Setophaga tigrina</i>      | Cape May warbler              | Ebird           |
| 24. | <i>Quiscalus lugubris</i>     | Carib grackle                 | Ebird, EEC 2010 |
| 25. | <i>Elaenia martinica</i>      | Caribbean elaenia             | Ebird, EEC 2010 |
| 26. | <i>Progne dominicensis</i>    | Caribbean martin              | Ebird           |
| 27. | <i>Fulica caribaea</i>        | Caribbean coot                | Ebird, EEC 2010 |
| 28. | <i>Bubulcus ibis</i>          | Cattle egret                  | Ebird, EEC 2010 |
| 29. | <i>Columbina passerina</i>    | Common ground dove            | Ebird, EEC 2010 |

|     |                              |                          |                    |
|-----|------------------------------|--------------------------|--------------------|
| 30. | <i>Gallinula chloropus</i>   | Common moorhen           | Ebird, EEC 2010    |
| 31. | <i>Sterna hirundo</i>        | Common tern              | GHNS 2005; Ebird   |
| 32. | <i>Zenaida auriculata</i>    | Eared dove               | Ebird              |
| 33. | <i>Streptopelia decaocto</i> | Eurasian collared dove   | Ebird              |
| 34. | <i>Eulampis holosericeus</i> | Green throated carib     | Ebird              |
| 35. | <i>Tyrannus savana</i>       | Fork-tailed flycatcher   | Ebird              |
| 36. | <i>Dendrocygna bicolor</i>   | Fulvous whistling duck   | ARA 1997           |
| 37. | <i>Plegadis falcinellus</i>  | Glossy ibis              | EEC 2010, EEC 2010 |
| 38. | <i>Dendroica petechia</i>    | Yellow warbler           | EEC 2010           |
| 39. | <i>Sicalis luteola</i>       | Grassland yellow finch   | ARA 1997           |
| 40. | <i>Tyrannus dominicensis</i> | Gray kingbird            | EEC 2010           |
| 41. | <i>Larus maritimus</i>       | Great black-backed gull  | Hutt 1985          |
| 42. | <i>Ardea herodias</i>        | Great blue heron         | EEC 2010           |
| 43. | <i>Casmerodius albus</i>     | Great egret              | Hutt 1985          |
| 44. | <i>Ardea alba</i>            | Great white egret        | EEC 2010, EEC 2010 |
| 45. | <i>Tringa melanoleuca</i>    | Greater yellowlegs       | EEC 2010           |
| 46. | <i>Eulampis holosericeus</i> | Green-backed heron       | EEC 2010           |
| 47. | <i>Anas crecca</i>           | Green-winged Teal        | Ebird              |
| 48. | <i>Butorides virescens</i>   | Green heron              | Ebird, EEC 2010    |
| 49. | <i>Tyrannus dominicensis</i> | Grey kingbird            | EEC 2010           |
| 50. | <i>Setophaga citrina</i>     | Hooded warbler           | Ebird              |
| 51. | <i>Limosa haemastica</i>     | Hudsonian godwit         | Ebird              |
| 52. | <i>Charadrius vociferus</i>  | Killdeer                 | Ebird              |
| 53. | <i>Leucophaeus atricilla</i> | Laughing gull            | Ebird              |
| 54. | <i>Sterna antillarum</i>     | Least tern               | GHNS 2005          |
| 55. | <i>Calidris minutilla</i>    | Least sandpiper          | Ebird, EEC 2010    |
| 56. | <i>Larus fuscus</i>          | Lesser black-backed gull | Ebird              |
| 57. | <i>Tringa flavipes</i>       | Lesser yellowlegs        | Ebird, EEC 2010    |
| 58. | <i>Ixobrychus minutus</i>    | Little bittern           | Ebird              |
| 59. | <i>Egretta caerulea</i>      | Little blue heron        | Ebird              |

|     |                                |                         |                            |
|-----|--------------------------------|-------------------------|----------------------------|
| 60. | <i>Egretta garzetta</i>        | Little egret            | Ebird, EEC 2010            |
| 61. | <i>Fregata magnificens</i>     | Magnificent frigatebird | Ebird, EEC 2010            |
| 62. | <i>Anas platyrhynchos</i>      | Mallard                 | Ebird                      |
| 63. | <i>Falco columbarius</i>       | Merlin                  | Ebird                      |
| 64. | <i>Cairina moschata</i>        | Muscovy duck            | Ebird, EEC 2010            |
| 65. | <i>Setophaga americana</i>     | Northern parula         | Ebird                      |
| 66. | <i>Parkesia noveboracensis</i> | Northern waterthrush    | Hutt 1985; Ebird, EEC 2010 |
| 67. | <i>Amazona amazonica</i>       | Orange-winged parrot    | Ebird                      |
| 68. | <i>Pandion haliaetus</i>       | Osprey                  | Ebird, EEC 2010            |
| 69. | <i>Parula americana</i>        | Parula warbler          | Ebird                      |
| 70. | <i>Calidris melanotos</i>      | Pectoral sandpiper      | Ebird                      |
| 71. | <i>Falco peregrinus</i>        | Peregrine falcon        | Ebird                      |
| 72. | <i>Podylimbus podiceps</i>     | Pied-billed grebe       | Hutt 1985; Ebird           |
| 73. | <i>Protonotaria citrea</i>     | Prothonotary warbler    | Ebird                      |
| 74. | <i>Porphyrio martinica</i>     | Purple gallinule        | Ebird                      |
| 75. | <i>Ardea purpurea</i>          | Purple heron            | Ebird                      |
| 76. | <i>Eulampis jugularis</i>      | Purple-throated carib   | Ebird                      |
| 77. | <i>Gallus gallus</i>           | Red junglefowl          | Ebird                      |
| 78. | <i>Aythya collaris</i>         | Ring-necked duck        | Ebird                      |
| 79. | <i>Columba livia</i>           | Rock dove               | Ebird                      |
| 80. | <i>Sterna dougallii</i>        | Roseate tern            | Ebird                      |
| 81. | <i>Pheucticus ludovicianus</i> | Rose-breasted grosbeak  | Ebird                      |
| 82. | <i>Psittacula krameri</i>      | Ring-necked parakeet    | Ebird                      |
| 83. | <i>Thalasseus maximus</i>      | Royal tern              | Ebird                      |
| 84. | <i>Arenaria interpres</i>      | Ruddy turnstone         | Ebird                      |
| 85. | <i>Calidris pugnax</i>         | Ruff                    | Ebird                      |
| 86. | <i>Calidris alba</i>           | Sanderling              | Ebird                      |
| 87. | <i>Thalasseus sandvicensis</i> | Sandwich tern           | Ebird                      |
| 88. | <i>Columba squamosa</i>        | Scaley-naped pigeon     | Ebird                      |
| 89. | <i>Charadrius semipalmatus</i> | Semipalmated plover     | Ebird                      |

|                |                              |                            |                                     |
|----------------|------------------------------|----------------------------|-------------------------------------|
| 90.            | <i>Calidris pusilla</i>      | Semipalmated sandpiper     | Ebird                               |
| 91.            | <i>Molothrus bonariensis</i> | Shiny cowbird              | EEC 2019                            |
| 92.            | <i>Limnodromus griseus</i>   | Short-billed dowitcher     | Ebird                               |
| 93.            | <i>Rostrhamus sociabilis</i> | Snail kite                 | Ebird                               |
| 94.            | <i>Gallinago gallinago</i>   | Snipe                      | Hutt 1985, EEC 2010                 |
| 95.            | <i>Egretta thula</i>         | Snowy egret                | Ebird, EEC 2010                     |
| 96.            | <i>Tringa solitaria</i>      | Solitary sandpiper         | Ebird, EEC 2010                     |
| 97.            | <i>Porzana carolina</i>      | Sora                       | Ebird, EEC 2010                     |
| 98.            | <i>Actitis macularia</i>     | Spotted sandpiper          | Ebird                               |
| 99.            | <i>Ardeola ralloides</i>     | Squacco heron              | Ebird                               |
| 100.           | <i>Calidris himantopus</i>   | Stilt sandpiper            | Ebird                               |
| 101.           | <i>Piranga rubra</i>         | Summer tanager             | Ebird                               |
| 102.           | <i>Egretta tricolor</i>      | Tricolored heron           | Ebird                               |
| 103.           | <i>Mimus gilvus</i>          | Tropical mockingbird       | Ebird                               |
| 104.           | <i>Egretta gularis</i>       | Western reef-heron         | Ebird                               |
| 105.           | <i>Calidris mauri</i>        | Western sandpiper          | Ebird                               |
| 106.           | <i>Bartramia longicauda</i>  | Upland sandpiper           | Ebird                               |
| 107.           | <i>Numenius phaeopus</i>     | Whimbrel                   | Ebird                               |
| 108.           | <i>Calidris fuscicollis</i>  | White-rumped sandpiper     | Ebird                               |
| 109.           | <i>Tringa semipalmata</i>    | Willet                     | Ebird                               |
| 110.           | <i>Gallinago delicata</i>    | Wilson's snipe             | Hutt 1985; Ebird                    |
| 111.           | <i>Setophaga petechia</i>    | Yellow warbler             | Ebird                               |
| 112.           | <i>Nyctanassa violacea</i>   | Yellow-crowned night heron | Ebird                               |
| 113.           | <i>Amazona ochrocephala</i>  | Yellow-crowned parrot      | Ebird                               |
| 114.           | <i>Zenaida aurita</i>        | Zenaida dove               | Ebird, EEC 2010                     |
| <b>Mammals</b> |                              |                            |                                     |
| 1.             | <i>Chlorocebus sabaeus</i>   | Green monkey               | Ramsar Convention Secretariat 2006a |
| 2.             | <i>Herpestes javanicus</i>   | Mongoose                   | Ramsar Convention Secretariat 2006a |

|    |                             |                          |   |
|----|-----------------------------|--------------------------|---|
| 3. | <i>Artibeus jamaicensis</i> | Jamaican fruiteating bat | Genoways et al. 2011                                      |
| 4. | <i>Noctilio leporinus</i> , | greater fishing bat      | Ramsar Convention Secretariat 2006a, Genoways et al. 2011 |
| 5. | <i>Molossus molossus</i>    | Pallas's mastiff bat     | Genoways et al. 2011                                      |

### 3.2.2.8 Changes in ecological character

A number of factors have caused the naturally brackish swamp ecosystem to become isolated from tidal exchange with the sea (ARA 1997). These include construction of a coastal highway, beach-front development, and significant accretion on sand along the beach (ARA 1997).

The salinity of the wetlands has been significantly affected by the lack of a functional seawater connection. Salinity in the Swamp's bisecting canal was measured at 29-34 ppt in 1986 (EEC, 2010); by 2010, this was reduced to 1.3 ppt (EEC, 2010). Average salinity in the mangrove lake at the Graeme Hall Nature Sanctuary declined from 8.4 ppt in 2002 to 1.9 ppt in 2010 (EEC, 2010).

In 2010, analysis of the benthic community in the lake found an overall low level of biodiversity (EEC 2010). A total of 777 benthic macroinvertebrates comprising 17 taxa (see Table 10) were identified in sediment samples taken at 10 locations within the lake over a two-day period (EEC 2010). Saltwater macroinvertebrate species were entirely absent from these samples, reportedly having been replaced by freshwater species (EEC, 2010). This suggests that the wetland is undergoing transformation to a freshwater body, with corresponding adverse effects on its populations of mangrove (EEC 2019) and brackish water fauna (EEC 2010), which are vulnerable to competition from freshwater species.

**Table 10. Benthic macroinvertebrates found in the Graeme Hall Nature Sanctuary Mangrove Lake (EEC 2010)**

| Taxa                            | Phylum   | Number |
|---------------------------------|----------|--------|
| Tubificoid Naididae spp.        | Annelida | 233    |
| Limnodriloidinae spp.           | Annelida | 1      |
| <i>Limnodrilus hoffmeisteri</i> | Annelida | 3      |
| Naidinae spp.                   | Annelida | 14     |
| <i>Pristina nr. plumaseta</i>   | Annelida | 11     |
| <i>Dero furcata</i>             | Annelida | 1      |
| <i>Dero pectinata</i>           | Annelida | 80     |
| <i>Dero nr. obtusa</i>          | Annelida | 7      |
| <i>Haitia cubensis</i>          | Mollusca | 4      |

|                                 |            |     |
|---------------------------------|------------|-----|
| <i>Pyrgophorus platyrachis</i>  | Mollusca   | 21  |
| <i>Melanooides tuberculatus</i> | Mollusca   | 1   |
| <i>Planorbidae spp.</i>         | Mollusca   | 1   |
| <i>Talitridae spp.</i>          | Arthropoda | 1   |
| <i>Hyalella spp.</i>            | Arthropoda | 12  |
| Chironomidae spp.               | Arthropoda | 12  |
| <i>Chironomus spp.</i>          | Arthropoda | 371 |
| <i>Goeldichironomus spp.</i>    | Arthropoda | 4   |

The lack of regular outflow to the sea is also thought to contribute to overall poor water quality, as evidenced by low oxygen levels, high nutrient concentrations, and pesticides contamination, within the Swamp (EEC 2010).

Recently, work has been undertaken to install a weir, replacing the current system of a sluice gate, as a means of connecting the Swamp to the nearshore coastal waters. It is anticipated that this will serve to facilitate the discharge of stormwater from the wetland and improve tidal exchange with the ocean, thus restoring the Swamp's estuarine condition.

In 2019, a severe decline in fish biodiversity in the mangrove lake was observed (EEC 2019), attributable to poor water quality resulting from the high-volume discharge of untreated sewage into the wetland ecosystem (EEC 2019). The only fish species observed was the Atlantic tarpon. No sign of historically abundant tilapia was observed in the Sanctuary (EEC, 2019).

### 3.2.3 [Ecosystem Services and Human Activities](#)

#### 3.2.3.1 *Main ecosystem services*

Table 11 provides a non-exhaustive list of the ecosystem services provided by the Graeme Hall Swamp.

**Table 11. Graeme Hall Swamp ecosystem services**

| <b>Ecosystem Service</b>                       | <b>Details/Reference</b>  |
|--|---|
| Water purification/waste treatment or dilution | The wetland has been used as an emergency discharge location for sewage from the South Coast Sewage Treatment Plant |
| Flood control, flood storage                   | "The swamp serves as a central drainage point of an 11,000 acre watershed area."                                    |

|                                  |   |
|----------------------------------|---|
|                                  | (Ramsar Information Sheet)  |
| Recreational hunting and fishing | “Social and cultural values have historically included leisure and fishing.” (Ramsar Information Sheet) |
| Nature study pursuits            | The Graeme Hall Swamp is a significant location for birding in Barbados.                                |
| Provisioning                     | Apiculture  |

### 3.2.3.2 Land use and human activities

Between May 2004 and December 2008, the western section of the swamp, which is privately owned by the Graeme Hall Nature Sanctuary, was operated as a nature reserve and eco-tourism centre.

The swamp is surrounded by land that is used for residential, agricultural and commercial purposes (Ramsar Information Sheet).

### 3.2.3.3 Pressures and trends

The obstruction of historical connections to the sea contributes to desalination of the natural brackish swamp water system (EEC 2010, Lucas 2011). Other resulting impacts on water quality include accumulation of nutrients, poor surface and sub-surface water circulation, low oxygen levels and high bacterial counts (ARA, 1997, Ramsar Information Sheet).

Run-off from surrounding lands (which includes agricultural fields and residential and commercial properties) also affects the water quality, and therefore the ecological quality, of the Swamp (Ramsar Information Sheet, EEC 2010). In 2010, chlordane, dieldrin, 4,4'-DDE, heptachlor epoxide, and malathion were detected in a minority of the surface water/sediment samples taken within the Swamp (EEC 2010). The 2019 sampling resulted in no detections for organochlorine or organophosphorus pesticides (EEC 2019).

Periodic emergency discharge of high volumes of untreated sewage into the wetland have been associated with increased levels of nitrogen, ammonia, phosphorus, orthophosphate, bacteria, algae, and total suspended solids in the wetland ecosystem (EEC 2019).

## 3.2.4 Conservation and Management

### 3.2.4.1 Conservation and management status

Graeme Hall Swamp has been designated as a Wetland of International Importance under the Ramsar Convention. In the 2003 Amendment to the PDP, the overall Graeme Hall Swamp, beach, seagrass bed and reef ecosystem was designated as a National Heritage Conservation Area comprising environmentally sensitive marine and terrestrial components (2003 Amendment to the Barbados PDP).

In the 2017 Draft Amendment to the PDP, the Graeme Hall Swamp and Beach were jointly proposed as *Natural Heritage Conservation Areas - Land*, recognising them as a sensitive or

unique ecosystem requiring protection from development and intensive recreational use (2017 draft Amendment to the Barbados PDP).

#### *3.2.4.2 Management plans and monitoring programmes*

In 2010 and 2018, assessments of water quality, mangrove ecosystems, and benthic communities were carried out in the privately-owned Graeme Hall Nature Sanctuary (EEC 2010, EEC 2019).

In 2021 recommendations were made (NEMUS 2021) for the design and implementation of a rehabilitation programme at the Graeme Hall Swamp with the following water quality objectives:

- Restore the water quality of the Swamp to a point where all the indicators are within legal limits, so that the outgoing fresh water does not contain pollutants and contaminated sediments and the connection of sea and swamp can be safely restored (deadline: June 2023);
- Further enhance the water quality of the Swamp via the connection with the sea, restoring its natural salinity fluctuation (ideally between 2 ppt and 35 ppt), thus creating conditions for the mangrove to thrive (deadline: June 2024);
- Reach a point of good ecological status, as measured by both indicators of the Graeme Hall wetland ecological monitoring programme (see below): fish community and mangrove habitat (deadline: June 2025)

Water quality and wetland ecology (fish communities and mangrove habitats) monitoring programmes were also recommended for implementation as part of the South Coast Water Reclamation Project. The importance of interministerial coordination and enforcement was flagged by Lashley (2016).

#### *3.2.4.3 Stakeholder participation in conservation and management*

The western portion of the wetland is owned and managed by the Graeme Hall Nature Sanctuary and was previously operated as a nature resource and eco-tourism venue. Management of the Graeme Hall Nature Sanctuary has advocated for designation of a 240 acre National Park at Graeme Hall (Allard 2019).

The Ministry of Environment and National Beautification and Green and Blue Economy and the Drainage Division of the Ministry of Transport, Works and Water Resources have periodically collaborated on the operation of the sluice gates to allow flow of water between the Swamp and the sea. Other government agencies, including the Ministry of Health and Wellness and the Ministry of Housing, Lands and Maintenance have contributed to infrastructural work intended to improve tidal exchange between the Swamp and the nearshore coastal waters.

In 2022 a petition was circulated by a group of concerned citizens, urging formal designation of the Graeme Hall Swamp as a Natural Heritage Conservation area, to be managed using an ecosystem-based approach. The Land Conservancy Barbados and The Barbados National Trust have identified this as an area of interest for conservation activities.

## 3.3 Long Pond

### 3.3.1 Administrative and Locational Details

#### 3.3.1.1 *Location*

Long Pond is located on the east coast of Barbados (13.251563 N, -59.555386, W) in the parish of St. Andrew, within the boundaries of the Scotland District and the Barbados National Park. A time series of aerial photographs and topographical maps indicate that the location of Long Pond has shifted several times in recent decades. (Charlemagne et al. 2006). The size of the pond has also fluctuated over time (Charlemagne et al. 2006). Over the period 1951 to 1964, Long Pond's surface area decreased by 65,306 m<sup>2</sup> (Charlemagne et al. 2006). The pond's surface area fluctuated over the next 40 years, and in 2004 the recorded surface area reached a historical low of 38,948 m<sup>2</sup> (Charlemagne et al. 2006).

The maximum depth of the pond was recorded, in July 1998, as 170 cm (Alleyne et al. 1999).

#### 3.3.1.2 *Biogeographical region*

| Regionalisation scheme(s)             | Biogeographic Region |
|---------------------------------------|----------------------|
| Marine Ecoregions of the World (MEOW) | Eastern Caribbean    |
| WWF Terrestrial Ecoregions            | Neotropical          |
| Udvardy's Biogeographical Provinces   | Neotropical          |

#### 3.3.1.3 *Area, boundary, and dimensions*

The area defined as the Long Pond wetland is shown in Figure 15.

**Area:** 160.05 acres / 64.7 hectares

**Length:** 0.91 km

**Width:** 0.69 km

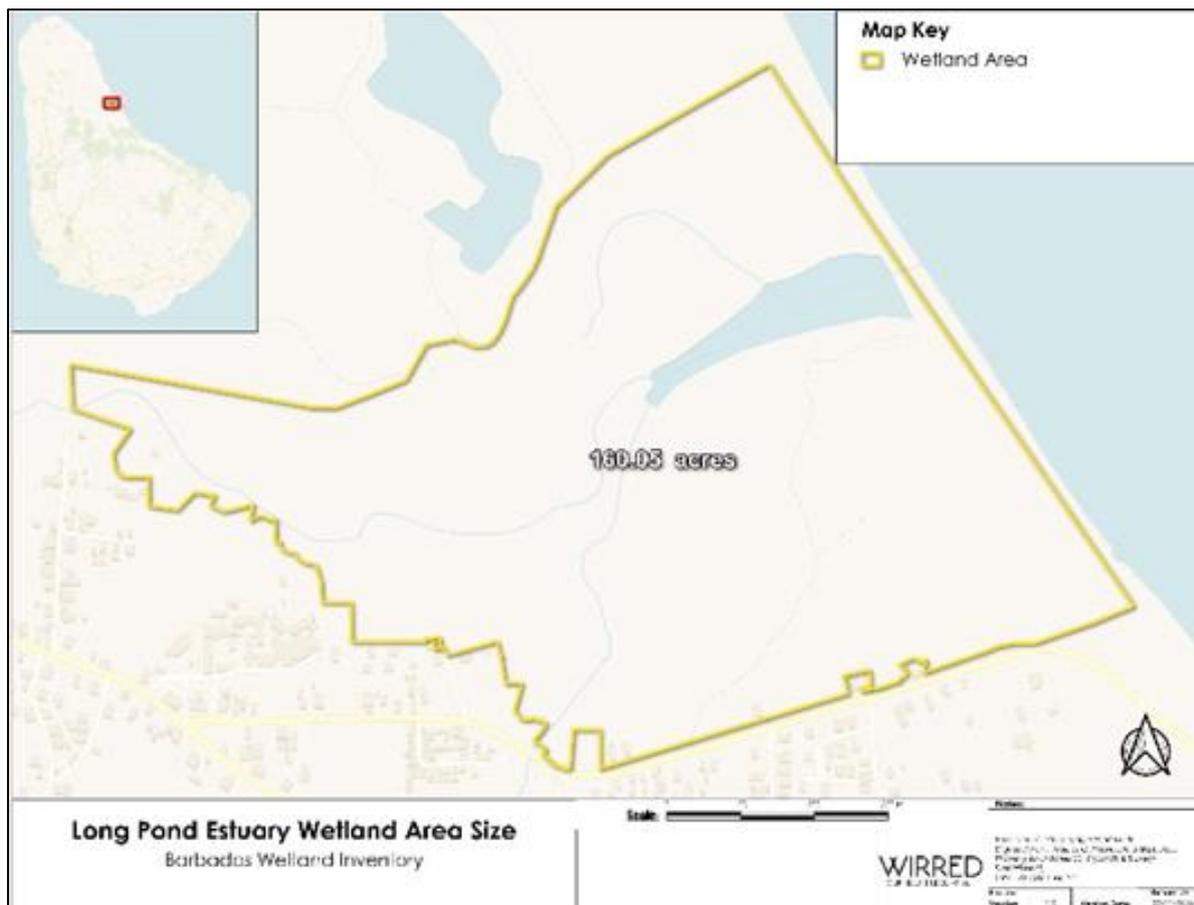


Figure 23. Long Pond wetland

#### 3.3.1.4 *Biographical region*

| Regionalisation scheme(s)             | Biogeographic Region |
|---------------------------------------|----------------------|
| Marine Ecoregions of the World (MEOW) | Eastern Caribbean    |
| WWF Terrestrial Ecoregions            | Neotropical          |
| Udvardy's Biogeographical Provinces   | Neotropical          |

#### 3.3.1.5 *Land tenure and administrative authority*

Land ownership within the Long Pond wetland area is shown in Figure 16.



Figure 24. Long Pond land ownership

### 3.3.2 Ecological Character

#### 3.3.2.1 *Summary statement*

Long Pond is a significant habitat and foraging for migratory birds (Alleyne et al. 1999, Charlemagne et al. 2006). The Long Pond beach and adjoining nearshore area have been recorded as nesting grounds for leatherback turtles (*Dermochelys coriacea*) (Horrocks 1992), assessed as Endangered on the IUCN Red List (Wallace, Tiwari and Girondot 2013), and as foraging grounds for green turtles (*Chelonia mydas*) (Horrocks 1992), assessed as Endangered on the IUCN Red List (Seminoff 2004). The fish fauna in Long Pond are reported to be highly dynamic, changing seasonally throughout the year (Callender 2019). Long Pond is the site of an emergent population of black mangroves (*Avicennia germinans*).

#### 3.3.2.2 *Geomorphic setting*

Long Pond is a coastal estuarine lagoon, surrounded by one of the most complex and extensive sand dune systems on the east coast of the island (A Field Guide to Long Pond, Alleyne et al. 1999).

### 3.3.2.3 Climate

Under the Köppen Climate Classification system, the island of Barbados can be characterised as an **Af** zone, which means it has a tropical rainforest climate. This type of climate is characterized by high temperatures and heavy rainfall, with average temperatures ranging from 22 to 31 degrees Celsius (72 to 88 degrees Fahrenheit) throughout the year<sup>6</sup>.

**Prevailing winds:** ENE

**Average Temperature:** 28 C

### 3.3.2.4 Soil

Upstream, Long Pond occupies an area of river alluvium and terrace deposits; downstream, towards its seaward margin, it occupies an area of marine beach and lime deposits (A Field Guide to Long Pond).

A bathymetric survey in 1999 (Alleyne et al. 1999) found that the bottom of the pond was overlaid by a layer of mud estimated to vary in depth from 15 cm to 45 cm. This mud layer was underlain by a firm substrate of sand and gravel (Alleyne et al. 1999). In the vicinity of the pond's outlet to the sea, the substrate was found to be solely sand (Alleyne et al. 1999)

### 3.3.2.5 Water regime

Long Pond is a seasonally dynamic permanent water body (Alleyne et al. 1999, Charlemagne et al. 2006), fed by the Bruce Vale River to the south and Walkers River to the north.

For most of the year, outflow to the sea is halted by a sandbar across the mouth of the pond (A Field Guide to Long Pond, Callender 2019). In the rainy season months and in severe weather, the sandbar may be breached either by floodwater from upstream or by waves and storm surge from the seaward side, allowing exchange of water between the pond and the sea (A Field Guide to Long Pond, Callender 2019). The influx of stormwater during the rainy season can cause a significant increase in the pond's size before the sand bar is breached (Callender 2019).

Long Pond is fed by two major watercourses the Bruce Vale River and Walkers River. Direct flow to the sea is blocked most of the year by a large sandbar across the mouth of the pond. The dune bar is breached in severe weather by waves/storm surge from the seaward side or by flood waters from upstream (A Field Guide to Long Pond).

Long Pond is a permanent body of water which is fed by the Bruce Vale and Walkers Rivers and their many tributaries, which have seasonal flow (Charlemagne et al., 2006).

This study has shown that the size and path of the pond has fluctuated over the study period. Generally, from 1951 to 1964, there was a significant decrease of 65,306 m<sup>2</sup> of the surface area of the pond. From 1964 to 2004, the surface area of the pond fluctuated with a peak in 1997, and then declined to its lowest level in 2004 of 38,948 m<sup>2</sup> (Charlemagne et al., 2006).

Long Pond drains into the sea for a few months during the rainy season months of May to November. During this time, Long Pond not only has exchange with the sea, but can expand

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<sup>6</sup> <https://climateknowledgeportal.worldbank.org/country/barbados>

drastically in size with the influx of freshwater before the sand bar is breached. For most of the other months of the year, outflow is halted by the sand bar and the waterbody shrinks from the lack of inflowing river water and evaporation (Callender, 2019).

The pond is shallow, < 2 m, and is seasonally dynamic, emptying several times a year when the beach bar is breached by flood waters (Alleyne et al., 1999). The bathymetry of Long Pond when full in July 1998 is shown in Figure 14 of Alleyne et al. (1999). The maximum depth recorded was 170 cm. The depths shown are to the surface of the mud substrate (Alleyne et al., 1999).

### 3.3.2.6 Water chemistry

Table 12 presents results of water quality analysis carried out for Long Pond in 1998 (Alleyne et al. 1999) and in 2019 (Callender 2019).

**Table 12. Long Pond water quality**

|                                  | <b>1998</b>   | <b>2019</b> |
|----------------------------------|---------------|-------------|
| pH                               | 7.1 - 8.2     | 7.26 - 8.29 |
| Temperature (°C)                 | 27 - 35.5     | 28 - 29.4   |
| Salinity (ppt)                   | 4 - 16        | 2 - 9       |
| Dissolved oxygen (mg/l)          | 3.92 - 14.4   |             |
| Faecal streptococci (cols/100ml) | 117 - 230,000 |             |

### 3.3.2.7 Ecosystems, habitats, and biodiversity

In 1998, the following main vegetation types were recorded (Alleyne et al. 1999):

- Dune vegetation
- Casuarina woods
- Grassland areas
- Coconut grove
- Clammy cherry woods.

In recent years an emerging population of black mangrove (*Avicennia germinans*) has been observed at the pond.

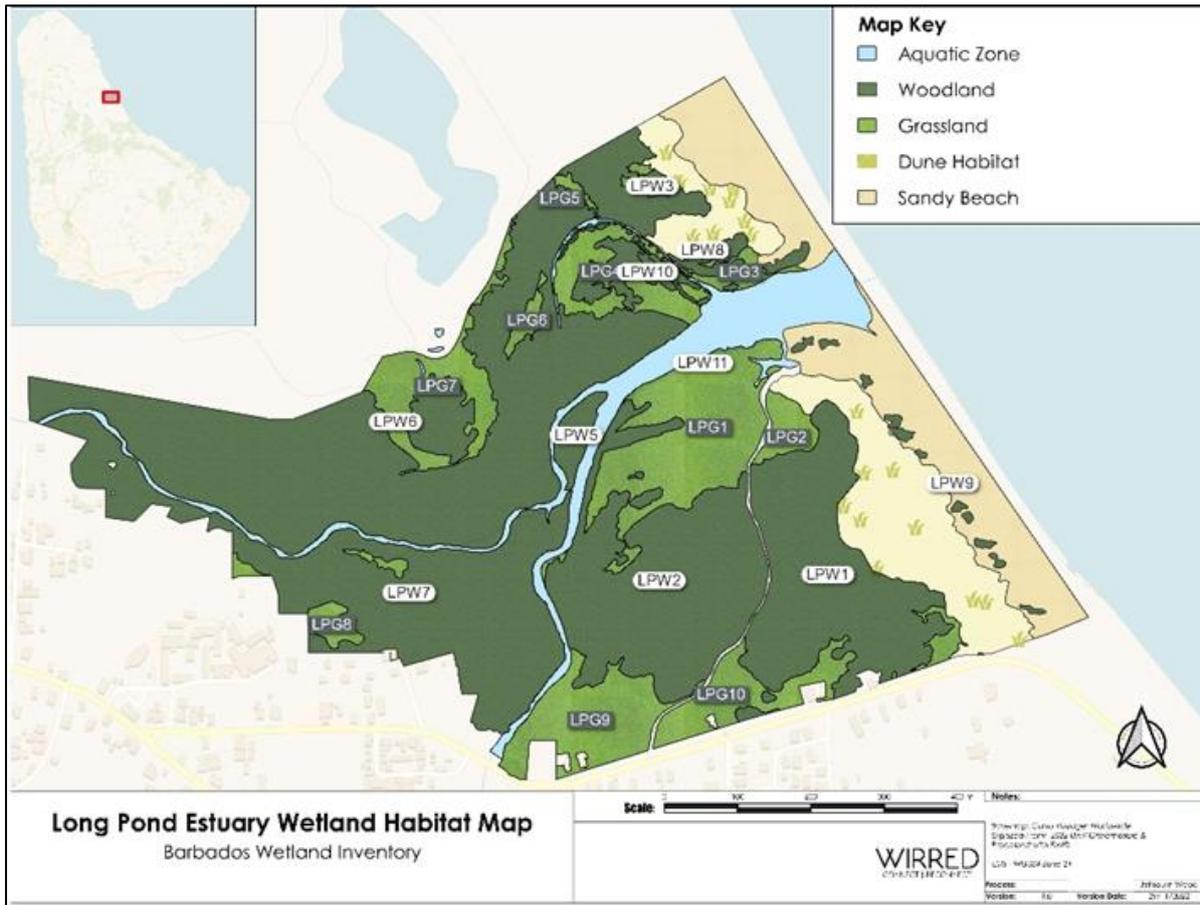


Figure 25. Long Pond area habitats. The labels in the figure represent areas that are referred to in the text.

**The Lagoon:** The lagoon is primarily sand and mud substrate with vegetated banks that are overhung by grass and shrubs for most of the length. There are lateral ponds which fill and empty as water levels change. The northern arm of the lagoon has a steep bank to the north and is overhung by trees and shrubs.





Figure 26. The Long Pond lagoon

**The Northern Woodland:** In the north eastern section of the project area, the woodland is dominated by sea grape (*Coccoloba uvifera*) and casuarina (*Casuarina equisetifolia*). Seaside almond (*Terminalia catappa*), birch gum (*Bursera simaruba*) and sucking bottle (*Paullinia cururu*) are also present.

In the north western section of the project area, abutting Walker's Reserve, this woodland is dominated by quick stick (*Gliricidia sepium*). Other species include river tamarind (*Leucaena leucocephala*), neem (*Azadirachta indica*) and coconut (*Cocos nucifera*).



Figure 27. Long Pond wooded areas

Located in the middle of the project area, the woodland is dominated by clammy cherry (*Cordia obliqua*) and manchineel (*Hippomane mancinella*). Other species include river tamarind (*Leucaena leucocephala*), seaside mahoe (*Thespesia populnea*) and coconut (*Cocos nucifera*). The southern section adjacent to the grassland is covered by love vine (*Cuscuta americana*). Sucking bottle (*Paullinia cururu*) and wild cucumber (*Coccinia grandis*) are also present.



Figure 28. Long Pond wooded area

**The Southern Woodland:** In the south eastern section of the project area adjacent to the Ermy Bourne Highway, the woodland is dominated by sea grape (*Coccoloba uvifera*), manchineel (*Hippomane mancinella*) and clammy cherry (*Cordia obliqua*). Other species include casuarina (*Casuarina equisetifolia*) and pandanus (*Pandanus* sp.). Woodland trees are covered in adventitious vine species such as sucking bottle (*Paullinia cururu*), crab eye vine (*Abrus precatorius*) and wild cucumber (*Coccinia grandis*).



Figure 29. Long Pond wooded area

From the western boundary of the project area moving in an easterly direction the woodland is dominated by clammy cherry (*Cordia obliqua*) which transitions to an ackee (*Melicoccus bijugatus*) and tamarind (*Tamarindus indica*) zone just southwest of the “hole” at Walkers Reserve and north of Walker’s river. Further east, sea grape (*Coccoloba uvifera*) borders the edge of Grassland LPG4 and clammy cherry (*Cordia obliqua*) dominates the woodland west of Walker’s river. Manchineel (*Hippomane mancinella*) and sea grape (*Coccoloba uvifera*) are present further east towards the lagoon. Seaside almond (*Terminalia catappa*) is widespread throughout with higher densities on either side of the Walker’s river bank.

**Floodplain Grassland:** In the middle of the project area between the surrounding woodland and the Long Pond lagoon, there is a large grassland space. The grassland is dominated by pitted bluestem (*Bothriochloa pertusa*), in close proximity to LPW1, zoysia (*Zoysia tenuifolia*) in the middle section and crabgrass (*Sporobolus virginicus*) along the riverbank. Other species include khus khus grass (*Vetiveria zizanioides*), devil grass (*Cynodon dactylon*), green summer grass (*Urochloa subquadrifera*), and buffalo grass (*Stenotaphrum secundatum*).



Figure 30. Long Pond grassland area

**The Dunes:** Coastal scrub plant communities were identified in the dune habitat zone located between the beach and woodland areas. Coastal scrub was dominated by low lying sea grape (*Coccoloba uvifera*) and fat pork (*Chrysobalanus icaco*), forming dense, impenetrable thickets. Other less dominant species included hoop wood (*Dalbergia ecastaphyllum*), french cotton (*Calotropis procera*), dog dumpling/Noni (*Morinda citrifolia*) and seaside sage (*Croton flavens*).



Figure 31. Long Pond dunes

**The Beach:** The area between the dune zone and the high tide line was designated as the beach zone. Goatsfoot yam (*Ipomoea pes-caprae*), seaside bean (*Canavalia rosea*), and crabgrass dominated the coastal zone (*Sporobolus virginicus*). The coastal spurge (*Sesuvium portulacastrum*), *Blutaparon vermiculare*, and seaside samphire are other species (*Euphorbia*

*mesembrianthemifolia*) present. Individual, dispersed, or grouped coconut trees (*Cocos nucifera*) are common, particularly towards the inland margin. ( Mosaic Eco Consult. 2022.)



Figure 32. Long Pond beach

**Coconut Grove:** Coconut groves are here defined as clusters of mature coconut trees (*Cocos nucifera*) that consisted of at least 5 individuals. These clusters are scattered at various locations across the project area mainly between the beach and dune zones ( Mosaic Eco Consult. 2022.)



Figure 33. Coconut grove on the northern section of the Long pond lagoon.

### 3.3.2.8 Biota

Some 35 species of flora (Table 13) have been documented as present at Long Pond.

**Table 13. Long Pond flora**

| Scientific Name                           | Common Name      | Source/Reference             |
|---|------------------|------------------------------|
| <b>Grasses/Herbs</b>                      |                  |                              |
| 1. <i>Blutaparon vermiculare</i>          |                  | Alleyne 1998, Callender 2019 |
| 2. <i>Sphagneticola trilobata</i>         | Carpet daisy     | Hutt 1985, Alleyne 1998      |
| 3. <i>Abrus precatorius</i>               | Crab eye vine    | Alleyne 1998                 |
| 4. <i>Pectis humifusa</i>                 | Duckweed         | Alleyne 1998                 |
| 5. <i>Egletes prostrata</i>               |                  | Alleyne 1998                 |
| 6. <i>Ruellia tuberosa</i>                | Monkey gun       | Hutt 1985                    |
| 7. <i>Catharanthus roseus</i>             | Periwinkle       | Alleyne 1998                 |
| 8. <i>Philoxerus vermicularis</i>         | Samphire         | Callender 2019               |
| 9. <i>Canavalia rosea</i>                 | Sea bean         | Alleyne 1998                 |
| 10. <i>Mallatonia gnaphalodes</i>         | Sea lavender     | Callender 2019               |
| 11. <i>Sesuvium portulacastrum</i>        | Sea purslane     | Callender 2019               |
| 12. <i>Euphorbia mesembrianthemifolia</i> | Seaside spurge   | Alleyne 1998                 |
| 13. <i>Ipomoea pes-caprae</i>             | Seaside yam      | Alleyne 1998                 |
| 14. <i>Crotalaria retusa</i>              | Yellow sweet pea | Alleyne 1998                 |
| <b>Trees and shrubs</b>                   |                  |                              |
| 15. <i>Terminalia catappa</i>             | Almond           | Alleyne 1998                 |
| 16. <i>Avicennia germinans</i>            | Black mangrove   | Personal observation         |
| 17. <i>Pithecollobium unguiscati</i>      | Bread and cheese | Alleyne 1998                 |
| 18. <i>Casuarina equisetifolia</i>        | Casuarina        | Alleyne 1998                 |
| 19. <i>Cordia obliqua</i>                 | Clammy cherry    | Hutt 1985, Alleyne 1998      |
| 20. <i>Cocos nucifera</i>                 | Coconut          | Alleyne 1998                 |
| 21. <i>Pilosocereus royeri</i>            | Columnar cactus  | Alleyne 1998                 |
| 22. <i>Morinda citrifolia</i>             | Dog dumpling     | Alleyne 1998                 |

|                                   |                     |                         |
|-----------------------------------|---------------------|-------------------------|
| 23. <i>Chrysobalanus icaco</i>    | Fat port            | Alleyne 1998            |
| 24. <i>Opuntia dillenii</i>       | Flat hand dildo     | Alleyne 1998            |
| 25. <i>Calotropis procera</i>     | French cotton       | Alleyne 1998            |
| 26. <i>Caesalpinia bonduc</i>     | Horse nicker        | Hutt 1985, Alleyne 1998 |
| 27. <i>Hippomane mancinella</i>   | Manchineel          | Alleyne 1998            |
| 28. <i>Thespesia populnea</i>     | Mahoe anodyne       | Alleyne 1998            |
| 29. <i>Clorodendrum aculeatum</i> | Prickly wild coffee | Alleyne 1998            |
| 30. <i>Leucaena leucocephala</i>  | River tamarind      | Alleyne 1998            |
| 31. <i>Coccoloba uvifera</i>      | Sea grape           | Hutt 1985, Alleyne 1998 |
| 32. <i>Thespesia populnea</i>     | Seaside mahoe       | Alleyne 1998            |
| 33. <i>Croton flavescens</i>      | Seaside sage        | Alleyne 1998            |
| 34. <i>Tabebuia pallida</i>       | Whitewood           | Alleyne 1998            |

There have been 106 species of fauna documented for Long Pond (Table 14), comprising 4 mollusc species, 22 crustaceans, 18 fishes, 2 reptiles, and 60 birds. Parasram et al (2021) identified this pond as a hotspot of semi-terrestrial brachyuran diversity for Barbados.

**Table 14. Long Pond fauna**

| Scientific Name                   | Common Name             | Source/Reference          |
|-----------------------------------|-------------------------|---------------------------|
| <b><i>Molluscs</i></b>            |                         |                           |
| 1. <i>Melanoides tuberculata</i>  | Malaysian trumpet snail | Alleyne 1998              |
| 2. <i>Neritina virginea</i>       | Virgin nerite           | Alleyne 1998              |
| 3. <i>Subulina octona</i>         |                         | Alleyne 1998              |
| 4. <i>Bulimulus guadalupensis</i> |                         | Alleyne 1998              |
| <b><i>Crustaceans</i></b>         |                         |                           |
| 1. <i>Macrobrachium carcinus</i>  | Crayfish                | Felilx 1991, Alleyne 1998 |
| 2. <i>Macrobrachium spp.</i>      | Shrimp                  | Alleyne 1998              |

|               |                                       |                       |                                    |
|---------------|---------------------------------------|-----------------------|------------------------------------|
| 3.            | <i>Macrobrachium acanthurus</i>       |                       | Felix 1991                         |
| 4.            | <i>Macrobrachium faustinum</i>        |                       | Felix 1991                         |
| 5.            | <i>Macrobrachium crenulatum</i>       |                       | Felix 1991                         |
| 6.            | <i>Callinectes boucourti</i>          | Blunttooth swimcrab   | Alleyne 1998, Parasram et al. 2021 |
| 7.            | <i>Callinectes sapidus</i>            | Blue crab             | Alleyne 1998, Parasram et al. 2021 |
| 8.            | <i>Callinectes danae</i>              | Dana swimming crab    | Parasram et al. 2021               |
| 9.            | <i>Callinectes ornatus</i>            | Shellig               | Parasram et al. 2021               |
| 10.           | <i>Cardisoma guanhumi</i>             | Blue land crab        | Parasram et al. 2021               |
| 11.           | <i>Gecarcinus lateralis</i>           | Blackback land crab   | Parasram et al. 2021               |
| 12.           | <i>Gecarcinus ruricola</i>            | Red land crab         | Parasram et al. 2021               |
| 13.           | <i>Goniopsis cruentata</i>            | Mangrove root crab    | Parasram et al. 2021               |
| 14.           | <i>Grapsus grapsus</i>                | Red rock crab         | Parasram et al. 2021               |
| 15.           | <i>Pachygrapsus traverses</i>         | Mottled shore crab    | Parasram et al. 2021               |
| 16.           | <i>Plagusia depressa</i>              | Tidal spray crab      | Parasram et al. 2021               |
| 17.           | <i>Armases ricordi</i>                | Humic marsh crab      | Parasram et al. 2021               |
| 18.           | <i>Armases roberti</i>                | River crab            | Parasram et al. 2021               |
| 19.           | <i>Sesarma (Chiromantes) africana</i> |                       | Parasram et al. 2021               |
| 20.           | <i>Minuca burgersi</i>                | Burger's fiddler crab | Parasram et al. 2021               |
| 21.           | <i>Ocypode quadrata</i>               | Atlantic ghost crab   | Parasram et al. 2021               |
| 22.           | <i>Ucides cordatus</i>                | Mangrove crab         | Parasram et al. 2021               |
| <b>Fishes</b> |                                       |                       |                                    |

|                                     |                        |                              |
|-------------------------------------|------------------------|------------------------------|
| 1. <i>Oreochromis nilotica</i>      | Tilapia                | Alleyne 1998, Calendar 2021  |
| 2. <i>Oreochromis mossambicus</i>   | Mozambique tilapia     | Alleyne 1998                 |
| 3. <i>Awaous tajasica</i>           | River goby             | Alleyne 1998                 |
| 4. <i>Centropomus undecimalis</i>   | Snook                  | Alleyne 1998                 |
| 5. <i>Mugil cephalus</i>            | Striped mullet         | Alleyne 1998                 |
| 6. <i>Eucinostomus melanopterus</i> | Flagfin mojarra        | Alleyne 1998, Callender 2019 |
| 7.                                  | Goby                   | Alleyne 1998                 |
| 8. <i>Gobiomorus dormitory</i>      | Bigmouth sleeper       | Alleyne 1998                 |
| 9. <i>Caranx latus</i>              | Jack                   | Alleyne 1998                 |
| 10. <i>Poecilia reticulata</i>      | Guppy                  | Alleyne 1998, Callender 2019 |
| 11. <i>Poecilia sp.</i>             | Molly                  | Alleyne 1998                 |
| 12. <i>Poecilia sphenops</i>        | Shortfin molly         | Callender 2019               |
| 13. <i>Poecilia latipinna</i>       | Sailfin molly          | Callender 2019               |
| 14. <i>Megalops atlanticus</i>      | Atlantic tarpon        | Callender 2019               |
| 15. <i>Diapterus rhombeus</i>       | Rhombic mojarra        | Callender 2019               |
| 16. <i>Polydactylus oligodon</i>    | Little scale threadfin | Callender 2019               |
| 17. <i>Mugil curema</i>             | White mullet           | Callender 2019               |
| 18. <i>Ctenogobius boleosoma</i>    | Darter goby            | Callender 2019               |
| <b>Reptiles</b>                     |                        |                              |
| 1. <i>Dermochelys coriacea</i>      | Leatherback turtle     | Horrocks 1992                |
| 2. <i>Chelonia mydas</i>            | Green turtle           | Horrocks 1992                |
| 3. <i>Eretmochelys imbricata</i>    | Hawksbill turtle       | J. Horrocks in lit           |

| <b>Birds</b>                     |                                    |                  |
|----------------------------------|------------------------------------|------------------|
| 1. <i>Fulica americana</i>       | American coot                      | Ebird            |
| 2. <i>Gallinula galeata</i>      | American moorhen, Common gallinule | Ebird            |
| 3. <i>Orthorhyncus cristatus</i> | Antillean crested hummingbird      | Ebird            |
| 4. <i>Coereba flaveola</i>       | Bananaquit                         | Ebird            |
| 5. <i>Loxigilla barbadensis</i>  | Barbados bullfinch                 | Ebird            |
| 6. <i>Pluvialis squatarola</i>   | Black-bellied plover, grey plover  | Hutt 1985        |
| 7. <i>Nycticorax nycticorax</i>  | Black-crowned night heron          | Ebird            |
| 8. <i>Melanospiza bicolor</i>    | Black-faced grass quit             | Ebird            |
| 9. <i>Rynchops niger</i>         | Black skimmer                      | Ebird            |
| 10. <i>Cypseloides niger</i>     | Black swift                        | Ebird            |
| 11. <i>Vireo altiloquus</i>      | Black whiskered vireo              | Ebird            |
| 12. <i>Quiscalus lugubris</i>    | Carib grackle                      | Ebird            |
| 13. <i>Elaenia martinica</i>     | Caribbean elaenia                  | Ebird            |
| 14. <i>Progne dominicensis</i>   | Caribbean martin                   | Ebird            |
| 15. <i>Bubulcus ibis</i>         | Cattle egret                       | Ebird            |
| 16. <i>Charadrius collaris</i>   | Collared plover                    | Ebird            |
| 17. <i>Columbina passerina</i>   | Common ground dove                 | Hutt 1985, Ebird |
| 18. <i>Sterna hirundo</i>        | Common tern                        | Ebird            |
| 19. <i>Streptopelia decaocto</i> | Eurasian collared dove             | Ebird            |
| 20. <i>Sicalis luteola</i>       | Grassland yellow finch             | Ebird            |
| 21. <i>Tyrannus dominicensis</i> | Gray kingbird                      | Hutt 1985, Ebird |

|                                  |  |                  |
|----------------------------------|--|------------------|
| 22. <i>Ardea alba</i>            | Great white egret                        | Ebird            |
| 23. <i>Tringa melanoleuca</i>    | Greater yellowlegs                       | Ebird            |
| 24. <i>Butorides virescens</i>   | Green heron                              | Ebird            |
| 25. <i>Eulampis holosericeus</i> | Green throated carib                     | Ebird            |
| 26. <i>Calidris minutilla</i>    | Least sandpiper                          | Ebird            |
| 27. <i>Tringa flavipes</i>       | Lesser yellowlegs                        | Ebird            |
| 28. <i>Egretta caerulea</i>      | Little blue heron                        | Hutt 1985, Ebird |
| 29. <i>Egretta garzetta</i>      | Little egret                             | Ebird            |
| 30. <i>Fregata magnificens</i>   | Magnificent frigatebird                  | Ebird            |
| 31. <i>Anas platyrhynchos</i>    | Mallard                                  | Ebird            |
| 32. <i>Cairina moschata</i>      | Muscovy duck                             | Ebird            |
| 33. <i>Oressochen jubatus</i>    | Orinoco goose                            | Ebird            |
| 34. <i>Pandion haliaetus</i>     | Osprey                                   | Ebird            |
| 35. <i>Calidris melanotos</i>    | Pectoral sandpiper                       | Ebird            |
| 36. <i>Falco peregrinus</i>      | Peregrine falcon                         | Ebird            |
| 37. <i>Podilymbus podiceps</i>   | Pied-billed grebe                        | Ebird            |
| 38. <i>Columba livia</i>         | Rock dove                                | Ebird            |
| 39. <i>Charadrius hiaticula</i>  | Ring-necked plover, Common ringed plover | Hutt 1985        |
| 40. <i>Sterna dougallii</i>      | Roseate tern                             | Ebird            |
| 41. <i>Thalasseus maximus</i>    | Royal tern                               | Ebird            |
| 42. <i>Arenaria interpres</i>    | Ruddy turnstone                          | Ebird            |
| 43. <i>Calidris alba</i>         | Sanderling                               | Hutt 1985, Ebird |

|                                    |                            |                      |
|------------------------------------|----------------------------|----------------------|
| 44. <i>Patagioenas squamosa</i>    | Scaly-naped pigeon         | Ebird                |
| 45. <i>Charadrius semipalmatus</i> | Semipalmated plover        | Hutt 1985, Ebird     |
| 46. <i>Calidris pusilla</i>        | Semipalmated sandpiper     | Hutt 1985, Ebird     |
| 47. <i>Molothrus bonariensis</i>   | Shiny cowbird              | Ebird                |
| 48. <i>Limnodromus griseus</i>     | Short-billed dowitcher     | Ebird                |
| 49. <i>Egretta thula</i>           | Snowy egret                | Ebird                |
| 50. <i>Tringa solitaria</i>        | Solitary sandpiper         | Ebird                |
| 51. <i>Actitis macularius</i>      | Spotted sandpiper          | Hutt 1985, Ebird     |
| 52. <i>Arenaria interpres</i>      | Ruddy Turnstone            | Hutt 1985            |
| 53. <i>Calidris mauri</i>          | Western sandpiper          | Hutt 1985            |
| 54. <i>Numenius phaeopus</i>       | Whimbrel                   | Hutt 1985, Ebird     |
| 55. <i>Calidris fuscicollis</i>    | White-rumped sandpiper     | Ebird                |
| 56. <i>Tringa semipalmata</i>      | Willet                     | Hutt 1985, Ebird     |
| 57. <i>Gallinago delicata</i>      | Wilson's snipe             | Ebird                |
| 58. <i>Nyctanassa violacea</i>     | Yellow-crowned night heron | Ebird                |
| 59. <i>Setophaga petechia</i>      | Yellow warbler             | Ebird                |
| 60. <i>Zenaida aurita</i>          | Zenaida dove               | Ebird                |
| <b>Mammals</b>                     |                            |                      |
| 1. <i>Molossus molossus</i>        | Pallas's mastiff bat       | Genoways et al. 2011 |

### 3.3.2.9 Changes in ecological character

The configuration of Long Pond has changed significantly over the years (Charlemagne et al. 2006). In 1999, water quality analysis found high levels of faecal coliform and streptococci in the Long Pond and the rivers that feed it (Alleyne et al. 1999). This was attributed to disposal of domestic wastewater in pit latrines close to the waterways that feed the pond. Currently a

filter bed has been installed just upstream of the pond, reportedly to treat domestic sewage from the adjacent housing development. Effluent from this filter bed has been observed entering the pond. Information is not available about the effluent quality.

The pond has been modified by planting of trees and grasses, along its northern bank in an attempt to curtail land erosion (Alleyne et al. 1999, Charlemagne et al. 2006).

### 3.3.3 Ecosystem Services and Human Activities

#### 3.3.3.1 *Main ecosystem services*

Table 15 provides a non-exhaustive list of the ecosystem services provided by Long Pond.

**Table 15. Long Pond ecosystem services**

| Ecosystem Service  | Details/Reference                   |
|--|-------------------------------------|
| Food for livestock                                       | Alleyne et al. 1999, Callender 2019 |
| Food for humans (fruit, fish, crabs)                     |                                     |
| Other products and resources, including genetic material |                                     |
| Flood control, flood storage                             |                                     |
| Recreational hunting and fishing                         |                                     |
| Nature study pursuits                                    |                                     |
| Other recreation and tourism                             |                                     |
| Cultural heritage  |                                     |

Long Pond has also historically provided food for humans in the form of fish caught from the pond, but local fishers indicate that, because of sewage contamination, they no longer consume such fish and instead use them as bait for reef fishing (Callender 2019). Land crabs, however, are frequently harvested for consumption. There are also festive crab nights when crabs are harvested.

#### 3.3.3.2 *Land use and human activities*

The pond is surrounded by land that is used or designated for residential and agricultural purposes. Activities recorded in Long Pond and its environs include harvesting or turf, grazing of livestock, sand mining, recreational fishing, picnicking, birding, canoeing, camping,

horseback riding, dune driving, and four-wheel drive expeditions (Alleyne et al. 1999). All these activities result in the area being heavily used.

Sand mining activities associated with Walkers Sand Quarry located to immediate north of the Long Pond Study area are projected to be completed in 2023. Approximately 2.8 acres of sand mining was permitted within the north central study area and completed in 2013. Subsequent restoration of this area was completed in 2015 as part of the larger Walkers Reserve Quarry Restoration Project.

#### *3.3.3.3 Pressures and trends*

One of the principal threats to Long Pond is contamination by domestic wastewater, agricultural runoff, and solid waste (Alleyne et al. 1999, Callender 2019). The pond occasionally discharges large volumes of water into the sea; as a result, contamination in the pond may also adversely affect nearshore marine ecosystems (Alleyne et al. 1999).

Overfishing, particularly of juvenile specimens, is also considered a threat the biodiversity at Long Pond (Callender, 2019). Similarly, crabs may be overexploited (Parasram et al. 2021) but there have been no studies on this.

Historically, extensive illegal sand mining in the dune area north of Long Pond has also been reported (Alleyne et al. 1999).

Sargassum seaweed is a relatively new pressure on the Long Pond Ecosystem. Impacts include increased erosion of the near shore environment, impacts to turtle nesting habitats, water quality impacts resulting from large inundation events and cascading impacts to aquatic habitats.

### 3.3.4 Conservation and Management

#### *3.3.4.1 Conservation and management status*

Long Pond is located within the Barbados National Park, as defined in the 2003 Amendment to the Physical Development Plan and draft 2017 Amendment to the Physical Development Plan. The National Park is considered an IUCN Category V Protected Area, i.e., a lived-in working landscape “where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity” (Phillips 2002).

As part of the National Park Natural Heritage Conservation Area, Long Pond is subject to development principles and policies ‘intended to conserve and enhance the character and quality of the landscape and marine resources in the defined area of the park including all features of natural and cultural heritage, and to restrict activities which would conflict with or are detrimental to the landscape, seascape or environmental qualities that led to the National Park designation” (Draft 2017 PDP Amendment).

#### *3.3.4.2 Management plans and monitoring programmes*

None could be found, other than the National Park Development Plan (GoB 1998). In 1999, an Action Plan for Long Pond and the surrounding watershed was proposed by the consulting

team working on the Barbados Coastal Conservation Programme (Alleyne et al. 1999)(see following section).

#### *3.3.4.3 Stakeholder participation in conservation and management*

In 1999 members of the St. Andrew Parish Independence Committee prepared a proposal in which they positioned themselves as potential community partners for the development and management of Long Pond (Alleyne et al. 1999).

The local community and stakeholder vision for the pond include the following elements (Alleyne et al. 1999):

- Preservation of the area's natural beauty
- Controlled use of the watershed
- Ownership by the community
- Sources of revenue for local people
- A recreational area
- An educational facility.

In 1999, an Action Plan for Long Pond and the surrounding watershed was proposed by the consulting team working on the Barbados Coastal Conservation Programme (Alleyne et al. 1999), with the comprising the following main elements :

- Conduct a watershed awareness campaign targeting residents of the Long Pond watershed and other watershed users;
- Establish a community-based management plan for the area prior to designation of Long Pond as a conservation area;
- Promote community development through the promotion of sustainable economic activity in the area;
- Establish and enforce legislation to control activities, including sewage treatment and solid waste disposal, in the watershed;
- Rehabilitate the Walkers Savannah.

It was noted by the consultants that in order to effectively implement this action plan and manage Long Pond as a conservation area, the issue of legal access and tenure would need to be resolved (Alleyne et al. 1999).

### 3.4 Green Pond

#### 3.4.1 Administrative and Locational Details

##### 3.4.1.1 *Location*

**General Location:** Green Pond is situated on the north-eastern coast of Barbados (13.266882 N, -59.563957 W) in St. Andrew.

##### 3.4.1.2 *Area, boundary, and dimensions*

**Area:** 41.23 acres / 16.68 hectares

**Length:** 416 m

**Width:** 250 m

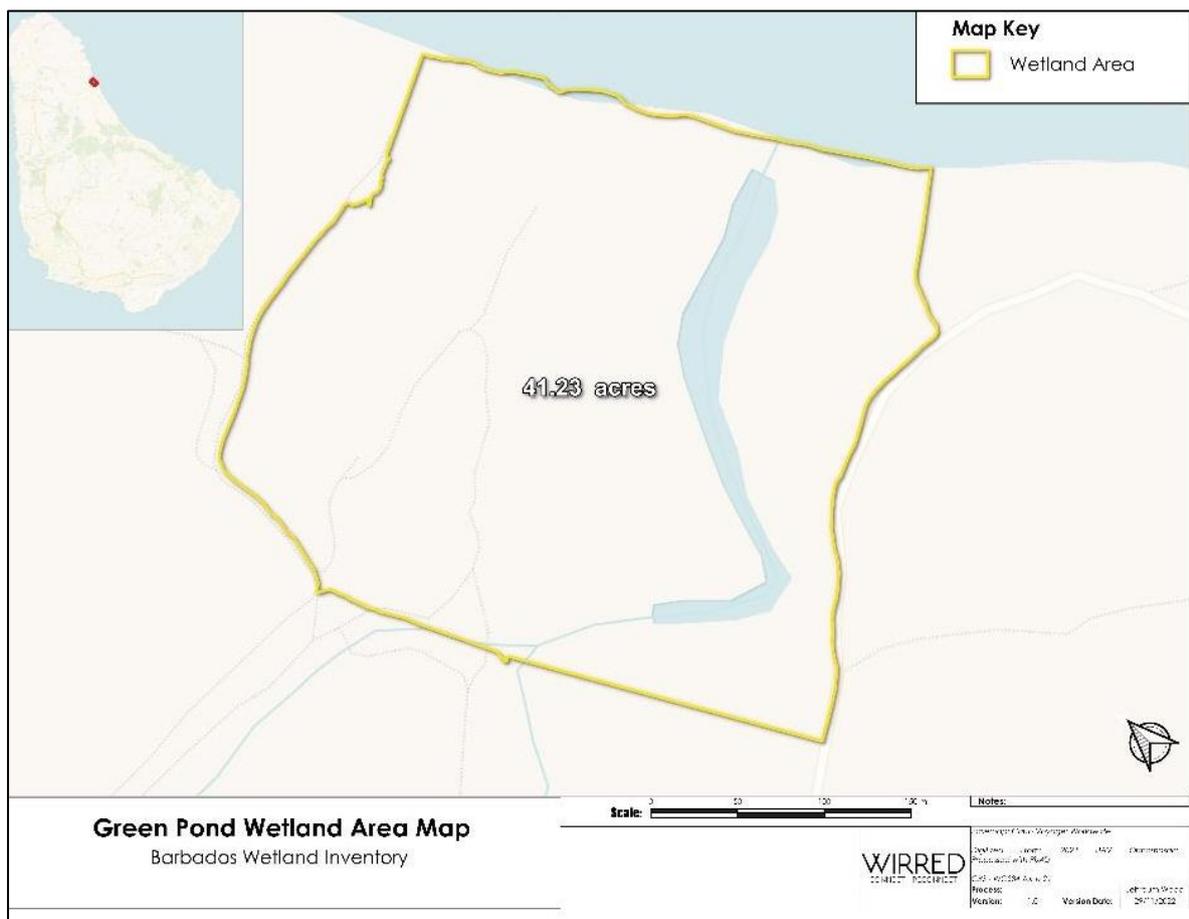


Figure 34. Green Pond location and boundaries

### 3.4.1.3 Biogeographical region

| Regionalisation scheme(s)             | Biogeographic Region |
|---------------------------------------|----------------------|
| Marine Ecoregions of the World (MEOW) | Eastern Caribbean    |
| WWF Terrestrial Ecoregions            | Neotropical          |
| Udvardy's Biogeographical Provinces   | Neotropical          |

### 3.4.1.4 Land tenure and administrative authority

The ownership of land in the Green Pond area can be seen in Figure 35.

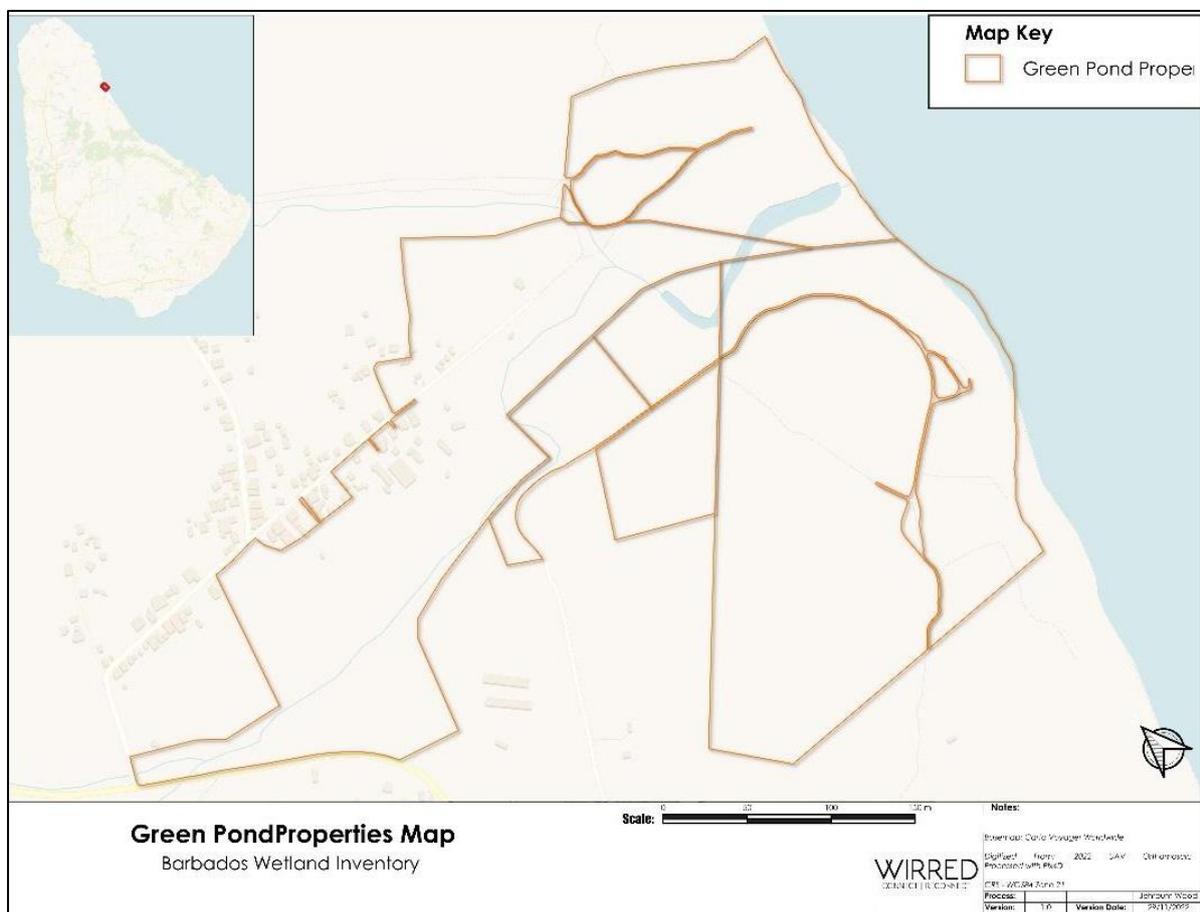


Figure 35. Green Pond land ownership

## 3.4.2 Ecological Character

### 3.4.2.1 *Summary statement*

Green Pond is, like Long Pond, likely to be a significant habitat and foraging area for migratory birds. The beach and adjoining nearshore area have been recorded as nesting grounds for leatherback turtles (*Dermochelys coriacea*) (Horrocks 1992), assessed as Endangered on the IUCN Red List (Wallace, Tiwari and Girondot 2013), and as foraging grounds for green turtles (*Chelonia mydas*) (Horrocks 1992) assessed as Endangered on the IUCN Red List (Seminoff 2004).

### 3.4.2.2 *Geomorphic setting*

Green Pond is a coastal estuarine lagoon, adjacent to an extensive sand dune systems on the east coast of the island. Green Pond is situated 1.8 km north of the Long Pond estuarine lagoon and has a very similar geomorphic setting.

### 3.4.2.3 *Climate*

Under the Köppen Climate Classification system, the island of Barbados can be characterised as an **Af** zone, which means it has a tropical rainforest climate. This type of climate is characterized by high temperatures and heavy rainfall, with average temperatures ranging from 22 to 31 degrees Celsius (72 to 88 degrees Fahrenheit) throughout the year<sup>7</sup>.

**Prevailing winds:** ENE

**Average Temperature:** 28 C

### 3.4.2.4 *Soil*

According to Poole & Barker (1983), the most easterly edge of the Green Pond estuary has Marine Beach & Modern Dune Deposit geology. The majority of the estuary falls within a geologic zone that is described as having River Alluvium & Terrace deposits.

### 3.4.2.5 *Water regime*

Green Pond is fed by watershed number 42, Green Pond, of the Gully Ecosystems Management Study (EPG, PDA, SEMS. 2004).

### 3.4.2.6 *Water chemistry*

No information could be found.

### 3.4.2.7 *Ecosystems, habitats, and biodiversity*

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<sup>7</sup> <https://climateknowledgeportal.worldbank.org/country/barbados>

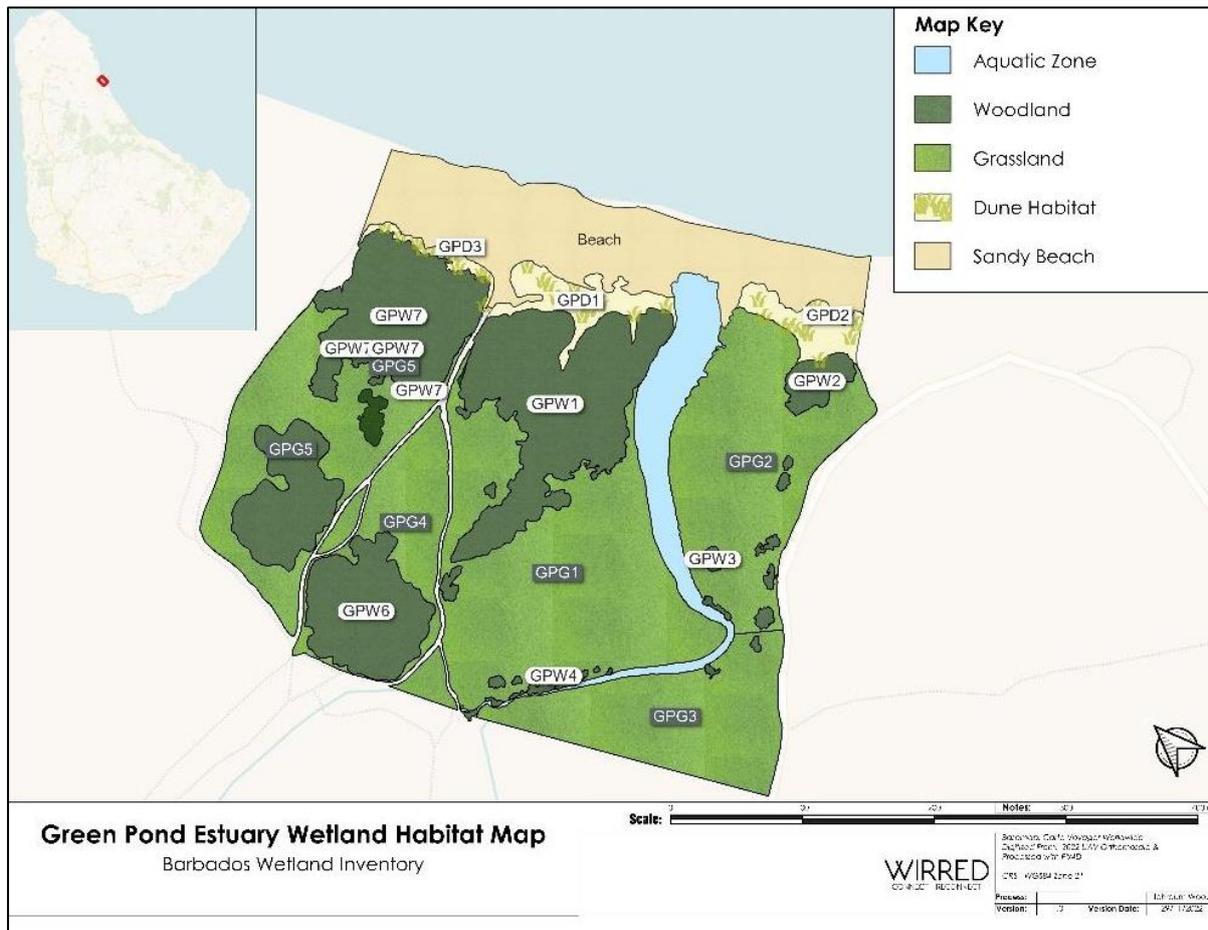


Figure 36. Green Pond habitats. The labels in the figure represent areas that are referred to in the text.

Green Pond is a natural coastal estuarine lagoon located on the east coast of Barbados, in St. Andrew. It is an elongated, shallow body of water that covers an area of approximately 8,134.2 m<sup>2</sup> / 0.81 hectares. The lagoon is surrounded by grassland vegetation and scattered woodland patches, and its waters are separated from the Atlantic Ocean by a sand bar.

The estuary is fed by freshwater streams and runoff from Green River watershed number 42 Gully Ecosystems Management Study (EPG, PDA, SEMS. 2004). This rain-fed freshwater lagoon mixes with saltwater from the ocean when the sandbar is breached from heavy runoff, or when it is over-topped during the rainy season, or when sea levels are high.

**The Aquatic Area:** The estuary lagoon is approximately 0.81 hectares and is a supporting habitat for a variety of coastal and aquatic species including fishes, crabs and birds. The resulting brackish water is highly productive and supports a diverse range of flora and fauna.



Figure 37. Green Pond aquatic habitat





Figure 38. Green Pond habitats

Green Pond is a popular site for birdwatching, with several species of herons, egrets, and shorebirds commonly observed (Ebirds). The lagoon also provides habitat for a variety of aquatic animals, including fishes and crabs.

**The Woodland Areas:** The northern section of the pond is characterized by a transition from broad grassland to sparse patches of coastal tree assemblages, eventually settling into established coastal woodland (GPW1,6 &7). Predominant species in this section include Casuarina trees (*Casuarina equisetifolia*), sea grape (*Cocoloba uvifera*), river tamarind (*Leucaena leucocephala*), seaside mahoe (*Thespesia populnea*) coconut palms (*Cocos nucifera*) and a variety of tropical coastal species.

GPW2,3 & 4 are emergent tree assemblages that provided perches within the grassland area to the south of the estuary.



Figure 39. Green Pond woodland. The labels in the figure represent areas that are referred to in the text.

**The Grassland:** The surrounding vegetation is dominated by grasses and other salt-tolerant plants. The grassland is comprised of crabgrass (*Sporobolus virginicus*) and a variety of other grasses. GPG2, is the grassed expanse to the south of the estuary. This area has tall, thick grassland cover that contains a mixture of Guinea grass (*Megathyrsus maximus*), Livestock grazing is common in this area and disturbs the establishment of shrubs and trees while restricting the height of grasses in some areas. Within this area, GPW2,3 & 4 are interspersed tree and shrub assemblages that attract a variety of faunal species.

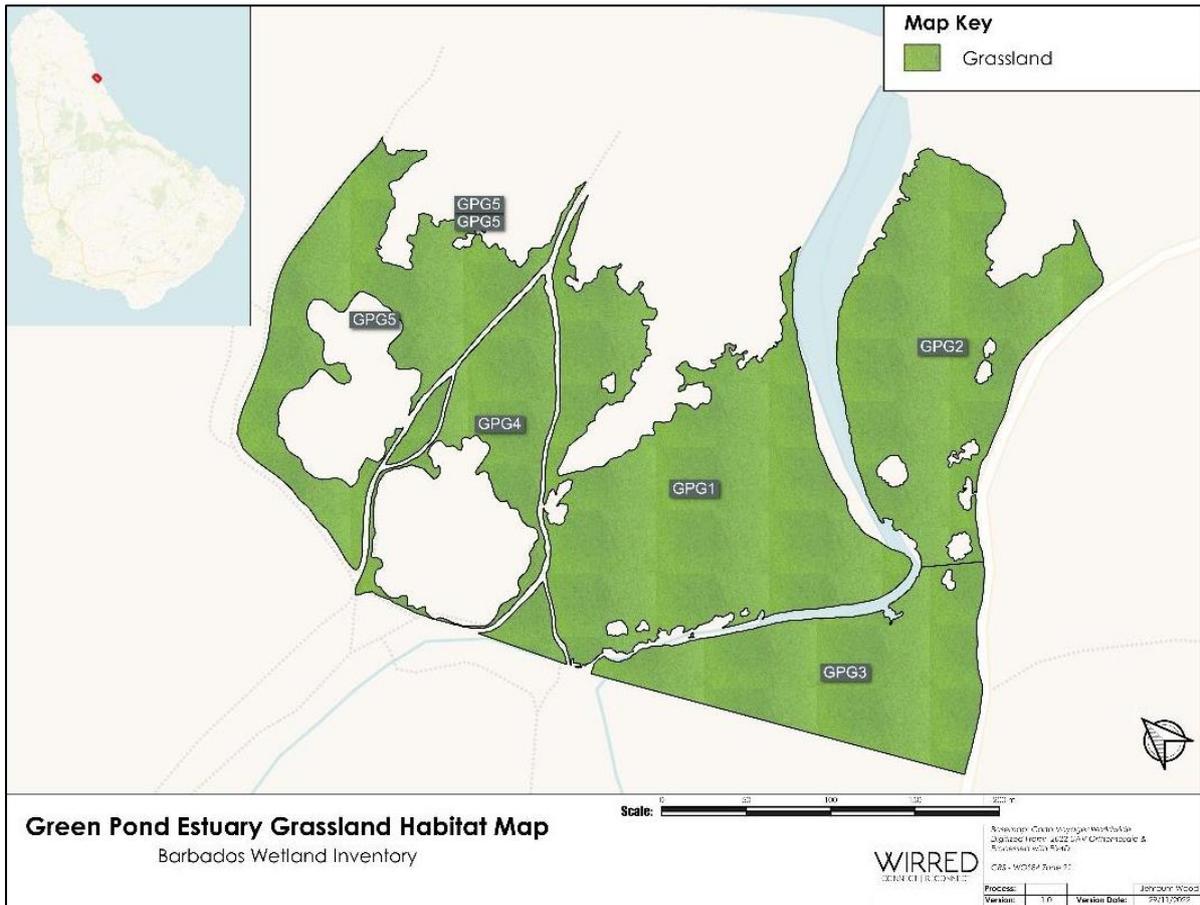


Figure 40. Green Pond grassland. The labels in the figure represent areas that are referred to in the text.



Figure 41. Green Pond grassland

**The Southern Wooded Scrubland:** The southern scrubland habitat can be characterised by a variety of grasses and coastal shrubs including pitted bluestem (*Bothriochloa pertusa*), devil grass (*Cynodon dactylon*), french cotton (*Calotropis procera*) and low lying fat pork (*Chrysobalanus icaco*),

Further south, the habitat transitions from the grassland to a coastal shrubland that covers the southern boundary of the study area. This southern boundary sits at a higher elevation and is bordered by an unpaved road to the adjacent properties. The soil in this area was found to be sandy with clay deposits that create small depressions that hold rainwater and become seasonally inundated.

**The Dune Habitat:** The dune area is located at the most easterly end of the study area. It is a critical ecotone that exists between the coastal woodland and the sandy beach habitat. This habitat includes a variety of species including grasses and shrubs such as goatsfoot yam (*Ipomoea pes-caprae*), seaside bean (*Canavalia rosea*) crabgrass (*Sporobolus virginicus*), *Paspalum distichum*, and sea purslane (*Sesuvium portulacastrum*). The geomorphology in this area is characterized by sandy berms and depressions that are covered with halophytic and xerophytic plants. Beyond the dune habitat is the beach, which is a nesting area for endangered sea turtles and provides feeding habitat for a variety of crabs and shorebirds.

There was only one study of Green Pond which focused on crabs and mentioned plants in passing (Parasram et al. 2021). Three species of plant have been documented as present at Green Pond (Table 16).

**Table 16. Green Pond flora**

| Scientific Name                 | Common Name | Source/Reference     |
|---------------------------------|-------------|----------------------|
| <b>Grasses</b>                  |             |                      |
| 1. <i>Ipomoea pes-caprae</i>    | Seaside yam | Parasram et al. 2021 |
| 2. <i>Paspalum distichum</i>    | Knotgrass   | Parasram et al. 2021 |
| 3. <i>Sporobolus virginicus</i> | Crab grass  | Parasram et al. 2021 |

Four species of crustacean and two species of reptile have been recorded at Green Pond (Table 17). No studies of fishes, insects and arthropods, birds, or mammals were found.

**Table 17. Green Pond fauna**

| Scientific Name                 |                     | Source/Reference     |
|---------------------------------|---------------------|----------------------|
| <b>Crustaceans</b>              |                     |                      |
| 1. <i>Callinectes boucourti</i> |                     | Parasram et al. 2021 |
| 2. <i>Cardisoma guanhumi</i>    | Blue land crab      | Parasram et al. 2021 |
| 3. <i>Gecarcuinus lateralis</i> | Blackback land crab | Parasram et al. 2021 |
| 4. <i>Ocypode quadrata</i>      | Atlantic ghost crab | Parasram et al. 2021 |

| <b>Reptiles</b>                |                    |               |
|--------------------------------|--------------------|---------------|
| 1. <i>Dermochelys coriacea</i> | Leatherback turtle | Horrocks 1992 |
| 2. <i>Chelonia mydas</i>       | Green turtle       | Horrocks 1992 |

#### 3.4.2.8 *Changes in ecological character*

There is no documented information on this topic.

### 3.4.3 Ecosystem Services and Human Activities

#### 3.4.3.1 *Main ecosystem services*

The ecosystem services for this area have not been documented but are likely to be similar to those for Long Pond.

#### 3.4.3.2 *Land use and human activities*

Livestock grazing has been a land use practice in the grassland area at Green Pond for many years. The grassland is characterised by tall grasses, shrubs and wildflowers which provide ample feed for grazing livestock. The livestock, mostly cattle, prevent the growth of mature tree species in some areas.

In addition to grazing, artisanal rod and line fishing is a popular activity on the beach at Green Pond. Local fishermen use non-commercial fishing methods to catch a variety of fish species.

#### 3.4.3.3 *Pressures and trends*

There is no documented information on this topic. Contamination with waste from upstream as well as from the sea has been observed. There are plans for a development in the immediate area of Green Pond. Details are unknown.

Sargassum seaweed is a relatively new pressure on the Green Pond Ecosystem. Impacts include increased erosion of the near shore environment, impacts to turtle nesting habitats, water quality impacts resulting from large inundation events and cascading impacts to aquatic habitats.

### 3.4.4 Conservation and Management

#### 3.4.4.1 *Conservation and management status*

This area is included in a proposed OS2 Conservation area that can be found in the National Park Plan (GoB 1998).

#### 3.4.4.2 *Management plans and monitoring programmes*

No management plans or monitoring programmes could be found.

### 3.4.4.3 Stakeholder participation in conservation and management

The Barbados National Trust and the Land Conservancy Barbados have noted Green Pond as an ecosystem of interest and deserving of closer conservation attention.

## 4 Other wetland areas

In addition to the four nationally significant wetlands characterised above, this inventory has identified an additional 40 secondary and tertiary wetlands, including natural and artificial/engineered wetlands.

Of these secondary and tertiary wetlands, 17 are remnant coastal wetlands or gully outlets, 7 are current or former bird shooting swamps, 6 are agricultural ponds, 4 are recreational or aesthetic ponds and 6 are other miscellaneous types. For the purpose of this NWI, wetlands falling into these four categories have been clustered together for prioritisation and management purposes (Table 18).

**Table 18. Secondary and tertiary wetlands in Barbados**

| Secondary wetlands                      |   | Tertiary wetlands                      |                                     |                               |
|---|---|--|-------------------------------------|-------------------------------|
| Remnant coastal wetlands/ gully outlets | Shooting and man-made Swamps (former and current) | Agricultural Ponds                     | Recreational and/or aesthetic ponds | Other wetlands                |
| 1. Brandons/ Brighton Beach             | 1. Congo Road Swamp                               | 2. Bawdens pond                        | 3. Apes Hill Resort Ponds           | 4. Archers Bay pond           |
| 2. Chapman Swamp                        | 5. Foster's Swamp                                 | 1. Bayfield pond                       | 1. Codrington College Pond          | 1. Bath Park                  |
| 3. Cobblers Cove Wetland                | 6. Golden Grove Swamp                             | 2. Half Acre plantation pond           | 2. Heron Bay pond                   | 2. Bath River                 |
| 4. Constitution River Estuary           | 7. Hannays Swamp                                  | 3. Indian Pond/Redland Plantation pond | 3. Sandy Lane Golf Course Ponds     | 3. Boscobelle Wetland Network |
| 5. Coral Reef Club                      | 8. Mangrove Swamp (St. Philip)                    | 4. Kendall Plantation pond             |                                     | 4. Conset Bay Estuary         |
| 6. Gibbes coastal pond                  | 9. Walkers Reserve Wetlands                       | 5. Greenland Ponds                     |                                     | 5. Spring Garden Wetland      |

|                                    |                                 |  |  |  |
|------------------------------------|---------------------------------|--|--|--|
| 7. Heywoods Swamp                  | 10. Woodbourne Shorebird Refuge |  |  |  |
| 8. Holetown Hole                   |                                 |  |  |  |
| 9. Holetown Police Station         |                                 |  |  |  |
| 10. Lakes Beach Pond coastal ponds |                                 |  |  |  |
| 11. Maxwell/Dover coastal pond     |                                 |  |  |  |
| 12. Maycocks                       |                                 |  |  |  |
| 13. Queens Fort                    |                                 |  |  |  |
| 14. River Bay North                |                                 |  |  |  |
| 15. River Bay South                |                                 |  |  |  |
| 16. Silver Sands Lagoon            |                                 |  |  |  |
| 17. Weston Pond                    |                                 |  |  |  |

In total there are 27 secondary wetlands and 13 tertiary wetlands. To support strategic management, all remnant coastal wetlands and former shooting swamps have been classified as secondary wetlands, and all agricultural ponds and recreational/aesthetic ponds have been classified as tertiary wetlands.

It should be noted that some remnant coastal wetlands and shooting swamps (including former shooting swamps) may on their own individual characteristics not meet the criteria for secondary wetlands. Nonetheless, these sites are deemed to merit management as secondary wetlands due to the overall consolidated importance of the wetlands clusters to which they belong, relative to the following criteria:

- Is a significant area for wildlife during a vulnerable period of their life cycles, or functions as a refuge during harsh conditions;
- Supports more than 1% of the national populations of any native plant or animal taxa;
- Supports plant or animal communities which are considered endangered or vulnerable at the national and international levels.

## 4.1 Secondary wetlands

For the purposes of this inventory, a secondary wetland is defined as a wetland that meets two to four of the criteria for a nationally important wetland. Summary characteristics of the 27 wetlands identified as meeting these criteria are presented below categorised according to Table 18.

### 4.1.1 Remnant coastal wetlands/gully outlets

These occur predominantly on the west coast and for conservation purposes it may be desirable to treat the west coast ones as single unit although they are spatially distinct. They have similar biophysical characteristics. They occur where a gully watershed empties out onto a sandy coastal plain. Initially, most would have been considerably larger with a floodplain that would have become inundated in heavy flows. It should be noted that several of the gully outfalls are now concrete channels, and some have been converted into channels quite recently, e.g. Sandy Lane, One Sandy Lane. These have not been included although the Ramsar list does include canals.

#### 4.1.1.1 *Brandons/Brighton Beach wetland*

**Location:** Brighton, St. Michael (13.117417 N, -59.627156 W).

**Summary description:** This is a remnant coastal mangrove swamp that is separated from the sea by a wide beach and bounded to the east by the Spring Garden Highway (GoB 1995). It is about 300 m in length and comprises about 2 acres. This was a much larger wetland that was planted with trees with the aim of drying it out.

#### **Documented biodiversity:**

Dominant plants (Joseph 2019): *Swietenia mahogany* (*mahagoni*), white mangrove (*Laguncularia racemosa*), *Sporobolus virginicus*, *Paspalum distichum*, almond, *Terminalia catappa*.

Crustaceans (Parasram et al. 2021): *Cardisoma guanhumi*, *Ocypode quadrata*.





Figure 42. Brandons/Brighton Beach wetland

#### 4.1.1.2 Chapman Swamp (St. Lawrence Freshwater Marsh)

**Location:** St. Lawrence, Christ Church (13.068842 N, -59.573548 W).

**Summary description:** This is a coastal wetland swamp with a connection to the sea that is currently blocked (GoB 1995). Two local residents recall that this swamp was mainly open water 20-30 years ago and that children used to play there in the pond, fishing and crabbing. The open connection to the sea would have allowed access to and from the pond for marine fishes typically known to inhabit such areas.

**Water Regime:** This swamp is fed by watercourses coming from the northeast in the area of eastern Graeme Hall and entering the swamp through its eastern end. Water from the swamp enters the sea through a channel at its western end that flows into the bay by St. Lawrence Gap. However, this channel is currently blocked.

**Habitat components:** While this is primarily a freshwater wetland, the opening to the sea, in the past, allowed tidal flushing and created a brackish environment. In the past the centre was open water. It is now almost fully occupied by sedges and swamp grass.

**Documented biodiversity:** No surveys are known for this area.





Figure 44. Chapman Swamp

#### 4.1.1.3 Cobblers Cove Wetland (Goddings Bay)

**Location:** Cobblers Cove, St. Peter (13.1432388 N -59.38363012 W).

**Summary description:** This is a remnant coastal mangrove swamp (GoB 1995, Joseph 2019). The body of water extends about 100 m from Hwy 1 to the beach, where it is separated from the sea by a beachbar which is breached when flood waters come down the watercourse.

**Water regime:** It is the estuary of watershed number 2 of the Gully Ecosystems Management Study (EPG, PDA, SEMS. 2004).

**Habitats:** Both sides of the water body are vertical mad-made walls, so there is only the channel itself. The sides are overhung by trees.

#### **Documented biodiversity:**

Dominant plants (Joseph 2019): *Citharexylum spinosum*, *Cordia obliqua*, *Terminalia catappa*.

Crustaceans (Parasram et al. 2021): *Callinectes sapidus*, *Gecarcinus lateralis*, *Minuca burgersi*.



Figure 45. Cobblers Cove pond

#### 4.1.1.4 Constitution River Estuary

**Location:** Bridgetown, St. Michael

**Summary description:** This wetland area extends about 900 m from Charles Rowe Bridge, Bridge St., Bridgetown (13.096311 N, -59.612807 W) to Constitution Rd. (13.098361 N, -59.607717 W). It has recently (2019) been restored by excavation of the channel and the instalment of boulder revetments along the sides (pers obs). Excavation has allowed seawater to enter and fill the area which is openly connected to the lower Careenage. According to early reports and maps, there was a much larger mangrove swamp that extended to the south in the area of Fairchild St. and River <sup>8</sup>Rd.

**Water Regime:** The 4.1.1.2 The Constitution River is the largest watershed in Barbados (watersheds 22 and 25, EPG, PDA, SEMS. 2004).

**Habitat Components:** As the area is connected directly to the sea its salinity can be expected to vary from that of seawater to fully fresh after receiving floodwaters from rain events.

**Observed Impacts:** The area is contaminated by waste that is brought down the Constitution River by flood waters.

**Documented biodiversity:** The restored revetments have been partially planted with red mangrove, *Rhizophora mangle* (pers obs). White mangrove is also present on the bank (Pers obs). No other information on biota could be found.



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<sup>8</sup> E.g. A Plan of Bridge Town in the Island of Barbadoes 1776  
<http://www.historygallery.com/maps/SouthAmericaMaps/1766BarbadosMED.jpg>



Figure 43. The Constitution River Estuary, Bridgetown

#### 4.1.1.5 Coral Reef Club

**Location:** Porters, St. James (13.11358 N -59.38215 W).

**Summary description:** This is remnant mangrove swamp now incorporated into the managed landscape of a resort hotel (GoB 1995, Joseph 2019). The pond extends about 300 m from Hwy 1 to the beach, where it is separated from the sea by a beachbar which is breached when floodwaters flow down the watercourse. The pond is fed by watershed 12, Lancaster Gully (EPG, PDA, SEMS. 2004).

**Documented biodiversity:** From Joseph (2019) unless otherwise documented.

Dominant plants: *Laguncularia racemose*, *Rhizophora mangle*, *Atriplex cristata*, *Cyanthillium cinereum*, *Duranta erecta*, *Ficus citrifolia*, *Paullinia cururu*, *Petiveria alliacea*, *Laguncularia racemosa*, *Morinda citrifolia*, *Axonopus compressus*, *Thespesia populnea*, *Cocos nucifera*, *Ptychosperma macarthurii*, *Sansevieria hyacinthoides*, *Terminalia catappa* (Joseph 2019)

Crustaceans (Parasram et al 2021): *Cardisoma guanhumi*.

Fishes: Tarpon (*Megalops atlanticus*), Guppy (*Poecilia* sp.).

Birds: Carib grackle (*Quiscalus lugubris*), Bananaquit (*Coereba flaveola sabaeus*), Common ground dove (*Columbina passerine*), Common moorhen (*Gallinula chloropus*), Barbados bullfinch (*Loxigilla barbadensis*).

Mammals: Green monkey (*Chlorocebus sabaeus*).



Figure 46. Coral Reef Club

#### 4.1.1.6 *Gibbes Coastal Pond*

**Location:** Gibbes, St. Peter (13.13526656 N -59.3834314 W).

**Summary description:** Remnant mangrove swamp (GoB 1995, Joseph 2019). This area is currently being channelised with walls on both sides.

**Water regime:** This pond is fed by watershed number 5, Mullins Bay (EPG, PDA, SEMS. 2004).

**Documented biodiversity:**

Dominant plants: *Cocos nucifera*, *Laguncularia racemosa*, *Hippomane mancinella*, *Cordia obliqua*, *Ptychosperma macarthurii* (Joseph 2019).



Figure 47. Gibbes Coastal Pond

#### 4.1.1.7 Heywoods Swamp

**Location:** Heywoods, St. Peter (13.254181 N -59.644353 W).

**Summary description:** This is remnant coastal mangrove wetland (GoB 1995). It extends about 300 m from Hwy 1 to the coast, where it enters the sea through a culvert under Sand St. It is one of the larger remaining coastal wetlands on the west coast having greater lateral extent than any other and covering about 1.5-2.0 ha.

**Water regime:** The area is fed by watershed number 41, Heywoods Gully (EPG, PDA, SEMS. 2004).

**Documented biodiversity:** (Joseph 2019).

Dominant plants: white mangrove (*Laguncularia racemosa*), manchineel (*Hippomane mancinella*), clammy cherry (*Cordia obliqua*), fustic (*Maclura tinctoria*), coconut (*Cocos nucifera*) and river tamarind (*Leucaena leucocephala*)

Fish: Guppy (*Poecilia* sp.).

Birds: cattle egret (*Bulbulcus ibis*), gray kingbird (*Tyrannus dominicensis*), common ground dove (*Columbina passerine*), wood dove (*Zenaida aurita*), bananaquit (*Coereba flaveola*), Barbados bullfinch (*Loxigilla barbadensis*), carib grackle (*Quiscalus lugubris*).

Mammals: green monkey (*Chlorocebus sabaeus*).



Figure 48. Heywoods Swamp

#### 4.1.1.8 Holetown Hole

**Location:** Holetown, St. James (13.18751 N -59.6363 W).

**Summary description:** This is remnant coastal mangrove wetland (GoB 1995, Joseph 2019). It extends from the bridge on Hwy 1 to the beach, where it is separated from the sea by a beach bar that is breached when floodwaters come down the gully.

**Water regime:** It is the estuary of watershed number 14, Portvale Gully (EPG, PDA, SEMS. 2004).

**Documented biodiversity:** From Joseph (2019) unless otherwise documented.

Dominant plants: *Coccinia grandis*, *Coccoloba uvifera*, *Hibiscus tiliaceus*, *Laguncularia racemosa*, *Leucaena leucocephala*, *Morinda citrifolia*, *Myriopus volubilis*, *Pilea microphylla*, *Plumeria alba*, *Quadrella cynophallophora*, *Savannah Axonopus compressus*, *Spermacoce eryngioides*, *Thespesia populnea*, *Cocos nucifera*, *Cordia obliqua*, *Ptychosperma macarthurii*, *Sansevieria hyacinthoides*, , *Hippomane mancinella*, *Terminalia catappa*.

Crustaceans: *Cardisoma guanhumi* (Parasram et al. 2021).

Fishes: Guppy (*Poecilia* sp.), Tilapia (*Oreochromis* sp.).

Birds: common ground dove (*Columbina passerine*), green throated Carib (*Eulampis holosericeus*), common moorhen (*Gallinula chloropus*), Barbados bullfinch (*Loxigilla barbadensis*), carib grackle (*Quiscalus lugubris*), grassland yellow finch (*Sicalis luteola*), wood dove (*Zenaida aurita*).

Mammals: Indian mongoose (*Herpestes javanicus*).



Figure 49. Holetown Hole

#### 4.1.1.9 Holetown Police Station

**Location:** Holetown, St. James (13.11100 N -59.38143 W).

**Summary description:** This is remnant coastal mangrove wetland (Gob 1995, Joseph 2019). It is about 20 by 50 m at the end of a concrete canal that extends west from Hwy 1. It was the site of some restoration excavation and replanting in 2019 (Mahon and Degia 2019).

**Water regime:** This is the estuary of watershed no 15 Seaview Gully (EPG, PDA, SEMS. 2004).

#### **Documented biodiversity:**

Dominant plants: *Chloris barbata*, *Coccoloba uvifera*, *Hippomane mancinella*, *Leucaena leucocephala*, *Thespesia populnea*, *Cordia obliqua*, *Sansevieria hyacinthoides*, *Terminalia catappa*.

Crustaceans (Parasram et al. 2021): *Cardisoma guanhumi*, *Ocypode quadrata*



Figure 50. Holetown Police Station

#### 4.1.1.10 Lakes Beach Pond

**Location:** Lakes, St. Andrew (13.238197, -59.545008).

**Summary description:** This pond forms at the mouth of the Cambridge Gully on the seaside of the Ermy Bourne Highway in the low dunes adjacent to the road. It is about 50 m by 30 m. It is separated from the sea by a beachbar. During flood water events the water cuts a channel across the beach to the sea.

**Water Regime:** The pond is fed by watershed no 53, Cambridge (EPG, PDA, SEMS. 2004).

**Habitat Components:** The pond is surrounded by low dunes to the north and south and open beach to the east. The dunes have typical east coast dune vegetation.

**Observed Impacts:** The pond is impacted by waste from upstream and deposited on the beach from the ocean.

**Documented biodiversity:** None known.



Looking inland from the beach



Looking from the Ermy Bourne Hwy



Side view



Vegetation

Figure 51. Lakes Beach Pond

#### 4.1.1.11 Maxwell Coast Swamp

**Location:** Maxwell Coast Road, Christ Church (13.066530 N -59.561567 W).

**Summary description:** This is an area of low lying land north of Maxwell Beach and Maxwell Coast Rd. It comprises three channels which merge at the southern edge running west to Maxwell coast road, under the road, then south alongside the road and the public parking area to enter the sea by the car park. In total, it comprises about 5 acres. Along the three channels, which are shallow, there are ponds with sedges and swamp grass, as well as wooded depressions with almond, white mangrove and other trees. Otherwise, the channels are mainly populated with river tamarind. Between the channels are grassy fields.

**Water Regime:** This area is probably mostly fed by local runoff and runoff from Hwy 7.

**Habitat Components:** Ponds with sedges and grasses, and waterfilled depressions in the channels that are heavily wooded.

**Observed Impacts:** Waste from the adjacent residential areas and roads. The drainage in this area has been heavily modified by tourism and residential development (as is the case for most coastal ecosystems on the south and west coasts of Barbados)

#### **Documented biodiversity:**

Dominant plants: *Laguncularia racemosa*, *Terminalia catappa* (pers obs).



Aerial view with water channels shown in white



The combined channel before it enters the sea



A ponded area



Wooded depression with standing water

Figure 52. Maxwell Coast Swamp

#### 4.1.1.12 *Maycock's (Hangman's) Wetland*

**Location:** Maycocks, St. Lucy (13.17225456 N -59.38561732 W).

**Summary description:** This is remnant coastal mangrove wetland (Joseph 2019).

The Hangman's Bay Wetland is often referred to as the Maycocks Wetland due to the proximity to its namesake bay located to the north. However, Hangman's Bay is a more accurate description. For the purpose of this report, it will be referred to as the Maycock's Wetland.

The Maycock's wetland is located at the southern end of Hangman's Bay and north of Fryers Well Point. At the southern extent of the Hangman's Bay, a gully system transects the coastal cliffs forming a coastal wetland that is separated from the sea by a beachbar.

**Water Regime:** The Maycocks wetland source waters originate from the connected gully system, watershed number 31, Maycocks, (EPG, PDA, SEMS. 2004).

This area can experience seasonal high wave action events and therefore is likely that some sea water contributes to the hydrology of the wetland during these events. Given the significant prevalence of fine sediments (cement dust) observed in the wetland, some amount of surficial runoff probably originates from the adjacent cement factory.

#### **Habitat Components:**

- Minimal Wetland Vegetation
- Surrounding vegetation consist primarily of seaside mahoe, manchineel, white wood, tourist tree.

#### **Observed Impacts:**

- Fine sediment deposits (cement dust)
- Garbage originating from both terrestrial and marine sources.
- Impacted by fine sediments originating from the adjected cement factory.

**Documented biodiversity:**

Dominant plants: *Rhizophora mangle*, *Swietenia mahagoni*, *Hippomane mancinella*, *Bursera simaruba*, *Coccoloba uvifera*, *Ficus citrifolia*, *Paullinia cururu*, *Leucaena leucocephala*, *Thespesia populnea*, *Hippomane mancinella*, *Sansevieria hyacinthoides*.

Crustaceans (Parasram et al. 2021): *Callinectes bocourti*, *Gecarcinus lateralis*.



Figure 53. Maycock's (Hangman's) Wetland

**4.1.1.13 Queen's Fort**

**Location:** Porters, St. James (13.11518 N -59.38296 W).

**Summary description:** This is remnant coastal mangrove wetland (GoB 1995, Joseph 2019).

**Water regime:** It is fed by watershed number 11, Porters Gully (EPG, PDA, SEMS 2004).

**Documented biodiversity:**

Dominant plants: *Cocos nucifera*, *Cordia sebestena*, *Hippomane mancinella*, *Laguncularia racemose*, *Leucaena leucocephala*, *Morinda citrifolia*, *Pluchea carolinensis*, *Ptychosperma*

*macarthurii*, *Rhizophora mangle*, *Thespesia populnea*. This is the only west coast wetland known to have mature red mangrove.

Crustaceans (Parasram 2021): *Cardisoma guanhumi*, *Gecarcinus lateralis*

Fish: Guppy (*Poecilia* sp.).

Birds: wood dove (*Zenaida aurita*), bananaquit (*Coereba flaveola*), common moorhen (*Gallinula chloropus*), caribbean bullfinch (*Loxigilla barbadensis*), carib grackle (*Quiscalus lugubris*).



Figure 54. Queens Fort with red mangrove

#### 4.1.1.14 River Bay North

**Location:** River Bay, St. Lucy (13.322956 N, -59.596987 W).

**Summary description:** This estuarine pond extends inland about 500 m. It empties into River Bay and is separated from River Bay South by the bay, which is fully marine.

**Water Regime:** This estuary is fed by watershed number 32 River Bay North (EPG, PDA, SEMS 2004). There are periods when it is dry. It is subject to tidal flushing when not blocked by sargassum.

**Habitat Components:** Estuarine pond bordered by shrubs.

**Observed Impacts:** The area is impacted by waste coming down the watercourse, from the ocean and from the public picnic area nearby. Its mouth and often much further inland is often clogged by sargassum seaweed which collects in River Bay.

**Documented biodiversity:** White mangroves were observed along most of the length of the pond, but no studies of the area could be found. Numerous fiddler crab (*Uca* sp.) holes were observed throughout the adjacent muddy areas.



Upstream from the mouth



Downstream at the mouth



Section of the watercourse



Section of the watercourse

Figure 55. River Bay North

#### 4.1.1.15 River Bay South

**Location:** River Bay, St. Lucy (13.321782 N, -59.596167 W).

**Summary description:** This estuarine pond extends inland about 300 m at which point it is blocked by a water main encased in concrete acting as a weir. It empties into River Bay and is separated from River Bay north by the bay, which is fully marine.

**Water Regime:** This estuary is fed by watershed number 33 River Bay South (EPG, PDA, SEMS 2004). There are periods when it is dry. It is subject to tidal flushing when not blocked by sargassum.

**Habitat Components:** The sand/rock river bed is bounded on both sides by high banks.

**Observed Impacts:** The area is impacted by waste coming down the watercourse, from the ocean and from the public picnic area nearby. Its mouth is often clogged by sargassum seaweed which collects in River Bay.

**Documented biodiversity:** No studies of this area could be found.



Looking upstream near mouth



Looking upstream



Looking upstream near mouth

Figure 56. River Bay South

#### 4.1.1.16 *Silver Sands Lagoon*

**Location:** Silver Sands, Christ Church (13.049750 N, -59.514432 W).

**Summary description:** This is a terrestrial outflow with a small coastal lagoon (2,360 m<sup>2</sup> / 0.34 hectares). Tidal action and heavy rainfall events may result in temporary breaches which allow the mixing of fresh and saline waters in this coastal wetland.

**Water Regime:** The lagoon is fed by runoff from the Silver Sands, Ealing Park, Goodland communities to the north and northwest of the coastal lagoon.

The mouth of the stream is inundated year-round, however, the floodplain drains during the dry season.

**Habitat Components:** The mouth of this stream meets the sandbar formed at Silver Sands beach which creates a small lagoon. Close to the mouth of the stream, the northern edge of the coastal lagoon is straddled by a low-lying rocky ledge that is covered with coastal pioneer species like seaside samphire, euphorbia and crab grass.

On the opposite side of the lagoon, there is an emergent coastal dune habitat with the typical species which dominate this region including: goat's foot, fat pork, seaside purslane (*Sesuvium portulacastrum*), seaside spurge (*Euphorbia mesembryanthemum*).

The source of the wetland opens to a floodplain that is seasonally inundated. This lagoon is a shallow flatland that is dominated by a variety of coastal grasses and sea purslane. The lagoon has small patches of coconut trees that are scattered on the northern and southern sides of the lagoon with a border line of casuarina trees to the south west of the lagoon.

**Observed Impacts:** Municipal waste can be observed within and around the lagoon.

**Documented biodiversity:** No studies could be found. Fishing bats have been observed here at night (J. Horrocks, pers.comm.).





Figure 57. Silver Sands Lagoon

#### 4.1.1.17 Weston Pond (Reads Bay)

**Location:** Weston, St. James (13.12582516 N -59.38279492 W).

**Summary description:** Remnant mangrove swamp (GoB 1995, Joseph 2019). This pond extends from Hwy 1 to the beach (about 30 m) where it is separated from the sea by a beachbar that is breached when floodwaters come down the gully.

**Water Regime:** This pond is the estuary of watershed number 8, Read's Bay (EPG, PDA, SEMS 2004).

**Habitat Components:** The pond is surrounded by trees.

**Observed Impacts:** The area is impacted by waste from the gully upstream.

#### **Documented biodiversity:**

Dominant plants: *Hippomane mancinella*, *Cordia obliqua*, *Ptychosperma macarthurii*. (Joseph 2019).

Crustaceans (Parasram et al. 2021): *Cardisoma guanhumi*, *Minuca burgersi*, *Ocypode quadrata*.



Figure 58. Weston Pond (Reads Bay) from Hwy 1 with beachbar in background

#### 4.1.2 Shooting Swamps (former and current)

Wege et al (2014) identify 22 shooting swamps in Barbados. Of these three, Graeme Hall, Chancery Lane and Woodbourne are now protected, some others had closed while seven were considered to be actively used for shooting migratory birds. This section provides information on most of the past and current shooting swamps known to have water in them.

##### 4.1.2.1 *Congo Road Swamp*

**Location:** Congo Road, St. Philip, (13.125251 N, -59.461442 W).

**Summary description:** This is an artificial wetland, previously used as a shooting swamp and now primarily used for birding. The wetland covers approximately 39,553 m<sup>2</sup> / 3.96 hectares and 280 m long and 175 m wide. Its physical form is an irregular mosaic of aquatic areas with raised grassed corridors.

Initially, the swamp was established and maintained as a plantation swamp. It was property of the Congo Plantation and utilised for irrigation.

**Water Regime:** The swamp is inundated year-round but the depth and size fluctuates between wet and dry seasons.

**Habitat Components:** The aquatic area is segmented by raised grassed berms. These berms are maintained to keep the grass low for unimpeded visibility. A building is situated in the centre of the swamp and is used as a vantage point by birders.

The external boundaries of the aquatic area are also fringed by a grassed perimeter. Trees were planted along the northern and eastern edges of the swamp to act as a windbreak and visual barrier. The western and southern edges are abutted by pastureland which is used for agriculture.

The combination of aquatic area, open pasture and contiguous tree-fence provide habitat for a variety of birds. The swamp is a popular site for birders.

**Observed Impacts:** No conspicuous anthropogenic impacts could be observed.

**Documented biodiversity:**

Plants observed: pitted bluestem grass, river tamarind trees

Birds: 91 species (Ebirds, see Appendix 2).



Figure 59. Congo Road Swamp

**4.1.2.2 Foster's Swamp**

**Location:** Fosters, St. Lucy (13.295094 N, -59.634614 W).

**Summary description:** This is a man-made wetland, previously used as a shooting swamp and now primarily used for birding.

**Water regime:** Well water is pumped to maintain water levels through dry season.

**Impacts:** Like all shooting swamps the water and pond substrate is likely to be polluted with lead from shot. Proposed water tariffs may impact the financial feasibility of maintaining wetlands through dry season.

**Documented biodiversity:**

Birds: 92 species (Ebirds, see Appendix 2).

No other studies could be found.



Figure 60. Fosters Swamp

#### 4.1.2.3 *Golden Grove Swamp*

**Location:** Golden Grove, St. Philip (13.157568 N, -59.449437W).

**Summary description:** This is an artificial wetland previously established and maintained as a shooting swamp. Golden Grove Pond has an oval shape and covers 15,889 m<sup>2</sup>/ 1,59 hectares. This site is privately owned and was initially maintained as a plantation pond.

**Water Regime:** The Golden grove pond is a permanent wetland as it retains standing water all year. It is fed by a stream that runs along the northern boundary of the pond and which drains into Culpepper Bay. It is located within Catchment 82 and is supported by surface flow from the northeast.

**Habitat Components:** Like other retired and operational shooting swamps, Golden Grove has an observation building to the centre of the aquatic zone. The pond has commercial agriculture lands to the immediate north with a line of coconut trees marking the boundary line between the pond and the farm land. To the southwest, there is pastureland, and to the west, there is sparse shrubland which separates the pond from a residential property.

**Observed Impacts:** No impacts observed, however, there is strong potential for water quality in the pond to be affected by the surrounding agricultural activities. Like all shooting swamps the water and pond substrate is likely to be polluted with lead from shot.

**Documented biodiversity:**

Birds: 50 species (Ebirds, see Appendix 2)



Figure 61. Golden Grove Swamp

#### 4.1.2.4 *Hannays Swamp*

**Location:** Hannays, St. Lucy (13.303576 N, -59.625478 W).

**Summary description:** This is a man-made wetland, created as a shooting swamp.

**Water regime:** Unknown

**Impacts:** Like all shooting swamps the water and pond substrate is likely to be polluted with lead from shot.

**Documented biodiversity:** No studies could be found.



Pond near entrance



Observation hut overlooking all three ponds



Third pond from hut



Dry middle pond

Figure 62. Hannays Swamp

#### 4.1.2.5 *Mangrove Swamp*

**Location:** Mangrove, St. Philip (13.111220 N, -59.491440 W).

**Summary description:** This is a constructed wetland used as a shooting swamp for migratory birds.

**Water Regime:** Well water is pumped to maintain water levels through dry season.

**Habitat Components:** Open water and shoreline vegetation. Proposed water tariffs may impact the financial feasibility of maintaining wetlands through dry season.

**Observed Impacts:** Like all shooting swamps the water and pond substrate is likely to be polluted with lead from shot.

**Documented biodiversity:** Unknown



Figure 63. Mangrove Swamp

#### 4.1.2.6 *Walkers Reserve Wetlands*

**Location:** Walkers, St. Andrew (13.255365 N, -59.562411 W).

**Summary description:** The two ponds at Walkers Reserve were artificially created in a soon to be disused sand mine. They were created as wildlife habitat and as water supply for the adjacent permaculture initiative.

**Water Regime:** The ponds are rain and groundwater fed.

**Habitat Components:** The ponds have sandy bottoms and are surrounded by shrubs and grasses. There is emergent vegetation along the shoreline.

**Observed Impacts:** Like all shooting swamps the water and pond substrate is likely to be polluted with lead from shot.

**Documented biodiversity:**

Birds: 60 species (Ebird)(Appendix 2).



Figure 64. Walkers Reserve Wetlands

#### 4.1.2.7 *Woodbourne Swamp (Woodbourne Shorebird Refuge)*

**Location:** Woodbourne, St. Philip (13.102248 N, -59.499630 W).

**Summary description:** This is a constructed wetland, formerly used as a shooting swamp, and now operating as a shorebird conservation refuge.

**Water regime:** Unknown.

**Habitats:** Open water ponds with emergent vegetation.

**Impacts:** Like all shooting swamps the water and pond substrate is likely to be polluted with lead from shot.

**Documented biodiversity:**

Birds: 98 species (Ebirds, see Appendix 2 and Wege et al. 2014))



Figure 65. Woodbourne Swamp

## 4.2 Tertiary wetlands

For the purposes of this inventory, a tertiary wetland is defined as a wetland that meets only one of the criteria for a nationally important wetland. Summary characterisations of the 13 wetlands identified as meeting these criteria are presented below.

### 4.2.1 [Agricultural ponds](#)

Many plantations and other industries have ponds for various purposes. In many cases, especially on plantations, these are depressions caused by sinkholes which are collapsed underground caves. There are reportedly 2830 sinkholes in Barbados (Figure 66). Many of these are small, in the order of metres across, but the larger ones often contain water and are used as plantation ponds, e.g. at Hopewell Plantation. There are also many ponds that have been excavated and lined for irrigation and livestock watering purposes. Other ponds are associated with industries such as Mount Gay in St. Peter. These ponds are known to provide habitat for migratory and overwintering birds. Although most are individually small, they collectively provide a significant amount of wetland habitat for biodiversity. Following are description of some of the larger and better known ones.

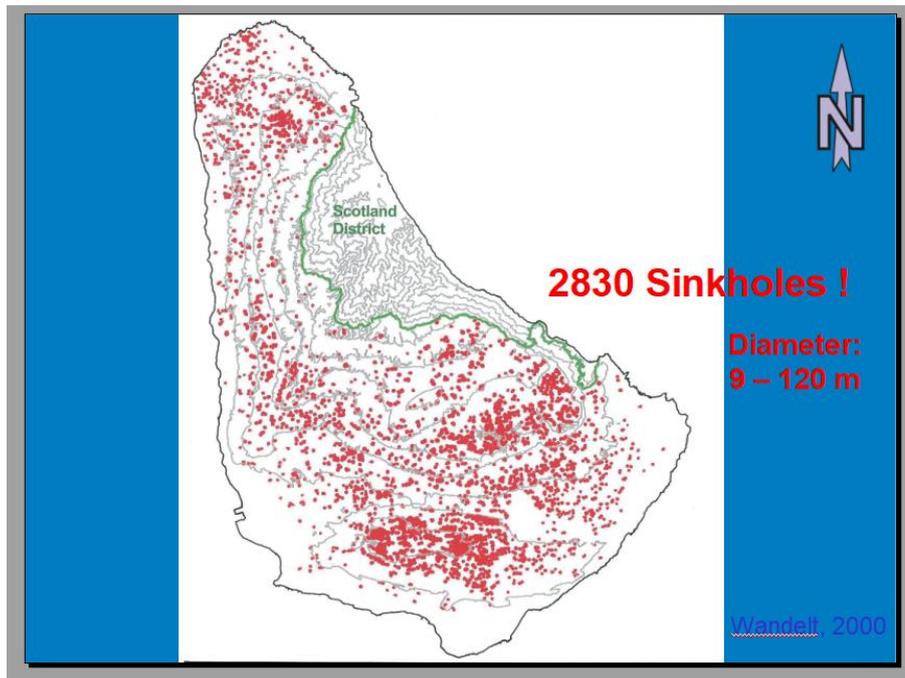


Figure 66. Sinkholes in Barbados (Wandelt, 2000, redrawn by Hans Machel)

#### 4.2.1.1 *Bawdens Pond*

**Location:** Bawdens, St. Andrews, (13.246739 N, -59.582682 W).

**Summary description:** Bawdens Pond is an artificial wetland created for agricultural irrigation purposes. It comprises two ponds connected by a neck.

**Water regime:** Unknown.

**Habitats:** The ponds have at times supported extensive communities of shoreline vegetation but these are removed from time to time.

**Documented biodiversity:**

Crustaceans (Felix, 1991): *Macrobrachium carcinus*, *M. faustinum* and *Xiphocaris elongata*.

No other studies could be found.



Looking west to east. The entrance to the second part of the pond can be seen in the background



Shoreline vegetation

Figure 67. Bawdens Pond

#### 4.2.1.2 Bayfield Pond

**Location:** Bayfield, St. Philip (13.166901 N, -59.452495 W).

**Summary description:** Bayfield Pond is an artificial wetland. The pond is approximately 1548 m<sup>2</sup> with a circular shape. Bayfield Pond's name is derived from the Bayfield community it is in. The Pond is located to the east of Skeetes Bay in St. Phillip. The pond is nestled in the centre of a rural settlement on the ridge that overlooks the Skeetes Bay fish market.

**Water Regime:** The general area has a dispersed array of streams and settling ponds. Bayfield pond can be considered a seasonal pond since it typically remains partially inundated for the majority of the year. However, it may become dry during intense dry periods. Water is channelled into the pond as runoff from adjacent roads and drains as well as captured seasonally through direct rainwater catchment during the wet season.

**Habitat Components:** The pond is heavily populated by water lilies and is bordered by a grass-covered buffer zone. The Western and Northern sides of the grassed area are immediately abutted by a paved road. The grassed area contains pitted bluestem (*Bothriochloa pertusa*) and a range of assorted grasses.

The opposing sides have the same grassed pond edge, however, this side transitions to shrubland with scattered coconut trees, river tamarind (*Leucaena leucocephala*) trees, banana plants and residential properties.

**Observed Impacts:** Municipal litter can be seen in the grasses bordering the pond. Runoff from the roads and residential properties can result in nutrient load and algal blooms.

**Documented biodiversity:**

Crustaceans (Felix, 1991): *Macrobrachium carcinus*, *M. faustinum* and *Atya innocous*;

Birds: 44 species (Ebird, Appendix 2).



Figure 68. Bayfield Pond

#### 4.2.1.3 *Half Acre Pond*

**Location:** Checker Hall, St. Lucy (13.300763 N, -59.614453 W).

**Summary description:** This pond is small and surrounded by trees. It is remote from human habitation.

**Documented biodiversity:**

38 species (Ebird)





Figure 69. Half-Acre Pond

#### 4.2.1.4 *Indian Pond/Redland Plantation ponds*

**Location:** Redland, St. George (13.172192 N, -59.540327 W, 13.173799 N, -59.535004 W, 13.174950 N, -59.533786 W).

**Summary description:** These three ponds are man-made for irrigation and livestock watering purposes.

**Water Regime:** The ponds are rainfed and may dry out at certain times of year.

**Habitat Components:** open water, areas of emergent sedges and grasses

**Observed Impacts:** None known.

**Documented biodiversity:** None found.





Figure 70. Indian Pond

*4.2.1.5 Kendall Plantation Pond / Duck Pond/Yarico Pond*

**Location:** Kendal, St. John (13.156175 N, -59.508541 W).

**Summary description:** Kendall Pond is an old plantation pond.

**Water Regime:** Kendall Plantation Pond is a perennial wetland as it is inundated through both wet and dry seasons.

**Habitat Components:** Open water and emergent shoreline vegetation.

**Observed Impacts:** None.

**Documented biodiversity:** No studies could be found.





Figure 71. Kendall Pond

#### 4.2.1.6 *Greenland Ponds*

**Location:** Greenland, St. Andrew (13.255260 N, -59.580056 W).

**Summary description:** These ponds were created for an experimental aquaculture project. There is one large pond and some smaller ones. The latter could not be found. The former appears to be dry.

**Water Regime:** Rainwater fed

**Habitat Components:** Presently dry with extensive growth of primarily river tamarind around the edges and on the banks and a grass covered centre.

**Observed Impacts:** None seen

**Documented biodiversity:**

Birds: 55 species (Ebird)(Appendix 2).



Figure 72. Greenland main pond

## 4.2.2 Recreational and/or aesthetic ponds

### 4.2.2.1 *Apes Hill Resort Ponds*

**Location:** Apes Hill, St. James (13.220924 N, -59.600176 W, 13.203173 N, -59.590461 W).

**Summary description:** There are man-made ponds on the golf course (number unknown) and a reservoir at Farmers for irrigating the golf course and adjacent properties.

**Water Regime:** The ponds are fed by surface runoff. The reservoir is in the upper reaches of watershed number 14, Portvale (EPG, PDA, SEMS 2004).

**Documented biodiversity:** No studies could be found.



Farmers reservoir looking from the east



Farmers reservoir looking from the south



Farmers reservoir looking from the west

Figure 73. Apes Hill Resort Ponds

### 4.2.2.2 *Codrington College Pond*

**Location:** Codrington College, College Land, St. John (13.174772 N, -59.476068 W).

**Summary description:** This is a man-made pond surrounded by coral stone banks.

**Water Regime:** The pond is fed by a spring.

**Habitat Components:** The pond is about 1 m deep and there are water lilies.

**Biodiversity:** No studies could be found.



Figure 74. Codrington College Pond

#### 4.2.2.3 *Heron Bay Pond*

**Location:** Heron Bay House, St. James (13.196014 N, -59.641339 W).

**Summary description:** This pond is entirely on the Heron Bay property. It is surrounded by lawns and has several areas of vegetated bank.

**Water Regime:** The pond originates in a pool that is reportedly a spring. The water flow varies seasonally. In the dry season the pond may be reduced to a low level. With heavy rain it may overflow its banks and flood adjacent areas. Salinity ranges from fresh at the origin to brackish at the mouth depending on the extent to which the beachbar is breached and the sea can enter.

**Habitat Components:** Open water with considerable submerged aquatic vegetation, vertical banks with some emergent and overhanging vegetation including trees.

**Observed Impacts:** None known.

**Documented biodiversity:** The manager reports that the pond is frequented by grey and white herons, little green herons, numerous red seal coots and a variety of other waterbirds<sup>9</sup>. He also reported that the pond has (or has had) tarpon, snook, mullet and other fishes.

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<sup>9</sup> Timothy O'Neil pers comm.



Aerial view of the pond



The pool upstream of the bridge that is the source of water for the pond



Bridge over upper reaches of the pond



Looking from the bridge towards the sea



The lower end by the sea



The channel where the pond enters the sea

Figure 75. Heron Bay Pond (the dark serpentine shape in the upper left)

#### 4.2.2.4 *Royal Westmoreland Golf Course ponds,*

**Location:** Royal Westmoreland Golf Course, St. James (13.216800 N, -59.623921 W, 13.209184 N, -59.626321 W, 13.206741 N, -59.626878 W, 13.211592 N, -59.630240 W).

**Summary description:** There are four man-made ponds on the Royal Westmoreland Golf Course. Their primary purpose is for water conservation and reuse for irrigation.

**Water Regime:** The ponds are fed by surface runoff.

**Habitat Components:** The ponds are surrounded by the golf course and have emergent shoreline vegetation.

**Observed Impacts:** None

**Documented biodiversity:** No studies could be found but the ponds are known to be frequented by overwintering and migratory birds.



Figure 76. Royal Westmoreland Golf Course pond

#### 4.2.2.5 *Sandy Lane Golf Course Ponds*

**Location:** Sandy Lane Golf Course, St. James (13.182724 N, -59.614844 W, 13.182103 N, -59.622900 W, 13.175780 N, -59.620898 W, 13.174392 N, -59.621338 W, 13.171320 N, -59.621767 W, 13.170114 N, -59.617947 W).

**Summary description:** There are six man-made ponds on the Sandy Lane Golf course. All are on the new Green Monkey course. Their primary purpose is for water conservation and reuse for irrigation.

**Water Regime:** The ponds are fed by surface runoff and by an extensive underground network for water recapture.

**Habitat Components:** The ponds are surrounded by the golf course and have emergent shoreline vegetation.

**Observed Impacts:** None.

**Documented biodiversity:** No studies could be found but the ponds are known to be frequented by overwintering and migratory birds.



Pond in the disused quarry



Pond adjacent to Molyneaux Rd.



Pond on north section



Shoreline vegetation

Figure 77. Sandy Lane Golf Course Ponds

### 4.2.3 [Other wetlands](#)

#### 4.2.3.1 *Archers Bay Pond*

**Location:** Archers Bay, St. Lucy (13.328462 N, -59.630645 W).

**Summary Description:** Archers Bay wetland is located at Archer's Bay, St. Lucy at the terminus of an existing gully system. Archers bay is a north western facing cove, surrounded by high coral limestone cliffs to the west and east, typical of the island's Northern coastline. A small beach, 25 – 30 m in length, exists at the connection of the gully system and the sea. The near shore environment typically experiences high wave energy resulting in the deposition of beach sand at the mouth of the gully system. A small seasonal wetland is formed when resulting surface water flows are prevented from meeting the sea. The cove is accessible via a staircase that descends into the gully system from the west.

**Water Regime:** The source waters originate from the surface water flows within the gully system; watershed number 29, Archers Bay (EPG, PDA, SEMS 2004). This area can experience seasonally high wave action events and therefore it is conceivable that sea water intrusion contributes to the hydrology of the wetland periodically.

The Poole and Barker (1982) Geology of Barbados Map 1:50,000 indicated the presence of a fault along the alignment of the gully. As such, groundwater may also contribute to the hydrology of the wetland system.

Archer's Bay patches of coastal forest survive by their inaccessibility. Archer's Bay gully is home to a rare shrub, *Schaeffera frutescens*, as well as unusual invertebrate fauna.

**Habitat Components:** Pool with sand bottom.

**Observed Impacts:** Garbage originating from both terrestrial and marine sources. Impacts on water quality from chicken farm connected to gully system?

**Documented biodiversity:**

Plants: Surrounding vegetation consist primarily of seaside mahoe, manchineel, white wood, tourist tree.

Crustaceans (Parasram et al. 2021): *Callinectes bocourti*, *Cardisoma guanhumi*, *Gecarcinus lateralis*, *Goniopsis cruentata*.



Pond from above



Pond looking inland into cave



Pond relative to beach

Figure 78. Archers Bay Pond

#### 4.2.3.2 *Bath Park pond*

**Location:** Bath, St. John (13.187098 N, -59.476525 W).

**Summary description:** This pond extends from the road towards the sea.

**Water Regime:** This estuary is fed by watershed 74, Bath Park (EPG, PDA, SEMS 2004).

**Habitat Components:** Shallow sandy substrate with some shoreline vegetation.

**Observed Impacts:** Waste from upstream, from the sea and from the adjacent recreational area.

**Documented biodiversity:** No studies could be found.



Figure 79. Bath Park pond

#### 4.2.3.3 Bath River Estuary

**Location:** Bath, St. John (13.189276 N, -59.477837 W).

**Summary description:**

**Water Regime:** This estuary is fed by watershed 73, Bath River (EPG, PDA, SEMS 2004).

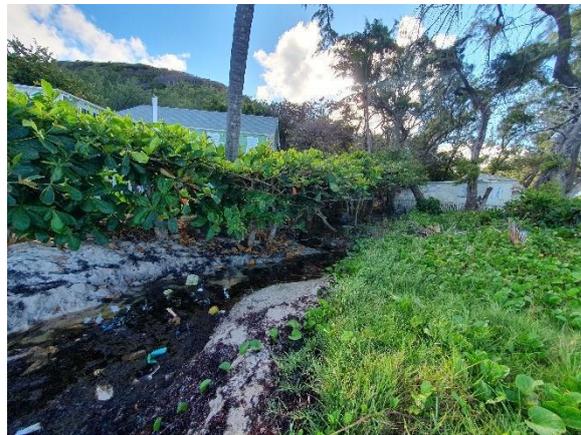
**Habitat Components:** Shallow sandy substrate with some shoreline vegetation.

**Observed Impacts:** Waste from upstream, from the sea and from the adjacent recreational area.

**Documented biodiversity:** No studies could be found.



Looking downstream from the bridge



Looking upstream from mid-beach



Looking downstream from mid-beach

Figure 80. Bath River Estuary

#### 4.2.3.4 Boscobelle Wetland Network

**Location:** Boscobelle, St. Andrew (13.274048 N, -59.569111 W).

**Summary description:** The Boscobelle wetland network is defined as a series of small wetlands located within a contained watershed on the islands northeast coast. The watershed is bounded to the north by the residential community of Boscobelle, to the west by the Upper Coral Terrace near the residential community at Mount Stepney, to the south by Morgan Lewis Plantation and to the east by Morgan Lewis Beach and the Atlantic Ocean. This watershed is most notably the footprint of the 1901 Boscobelle Landslip and therefore is comprised of relatively new landscape features from a geological perspective.

**Water regime:** Similar to the coastal wetlands connected to gully systems, the wetlands within the Boscobel watershed are fed primarily from surface water. Given the history of the watershed, specifically the 1901 landslip, it is conceivable that groundwater seeps may exist within individual drainage valleys. This theory is reinforced by the observation of patches of healthier vegetation along the slopes of the watershed at a time where surrounding vegetation showed signs of stress resulting from the commencement of the dry season. These seeps may provide supplementary water to the wetlands. It is noted that three of the four wetlands typically remain wetted throughout the dry season suggesting the potential of additional sources of water beyond surficial sources.

Pool and Barker (1982) Geology of Barbados Map 1:20,000 identifies this area to be comprised of highly folded and faulted oceanic sediments characteristic of the Morgan Lewis and Murphy Members. The predominant Morgan Lewis Member consists primarily of clay shales interbedded with sandstone and ironstone. The Murphy Member consists of sandstone interbedded with clay shales and ironstone. The area is scattered with several fault boundaries, most notably the Boscobelle Thrust Fault.

The landscape consists of several drainage valleys cascading from the top of the watershed to the coasts. A total of four wetlands were observed within the watershed flatlands within the drainage channels. The wetlands were observed to be formed by the damming of valleys through the construction of historical access roads. The wetlands vary in size to a maximum extent of approximately 1000 m<sup>2</sup> to 2000 m<sup>2</sup>.

**Habitat Components:** These include deep and shallow water environments that are shorebird, wading bird, and waterfowl habitats. Given the remote nature of these wetlands, although minimal in wetted area, they form a larger wetland network. These wetlands provide habitat for migratory birds, specifically those species more sensitive to human interactions. In addition, these wetlands provide habitat connectivity along the east coast with the larger more diverse wetlands located to the south, namely: Green Pond, Walkers Reserve, and Long Pond.

**Observed Impacts:** Minimal Impacts.

**Biodiversity:** Pers ob.

Plants: Surrounding vegetation consist primarily of seaside mahoe, manchineel, white wood, tourist tree, seagrape tree, coconut, organ cactus, clammy cherry. There is wetland vegetation and grasses.

Birds: Observed blue wing teals, common gallinule, snowy egrets and sanderlings at time of site visit.



Pond 2 Boscobelle Wetland Network showing wetland vegetation and habitat.



Pond 3 Boscobelle Wetland Network. Note historical access road blocking valley at right of picture



Flock of Blue Wing Teal arriving at Pond 3.



Pond 3 Boscobelle Wetland Network showing upslope valley.



Greener vegetation within watershed suggesting presence of water seeps.

Figure 81. Boscobelle Wetland Network

#### 4.2.3.5 *Consett Bay Estuary*

**Location:** Consett Bay, St. John (13.179578 N, -59.466048 W).

**Summary description:** Coastal pond at the point where Consett River reaches the flat coastal areas. It lies between the road and the sea form, from which it is separated by a beach across which it flows.

**Water Regime:** The estuary is fed by wetland 75, Consett Bay (EPG, PDA, SEMS 2004). It is flowing year-round, however, water levels fluctuate as rainfall changes between wet and dry season.

**Habitat Components:** Banks of the estuary are populated by a varied array of seaside almond and coconut trees as well as a variety of unidentified grasses.

**Observed Impacts:** Household waste and refuse from the adjacent fish market is sometimes observed in the estuary. In a 2014 mapping (Gosine and Mahon 2014) of the Consett Bay

watershed and its environmental risks, several sources of pollution that would affect this wetland were identified.

**Documented biodiversity:**

Crustaceans: *Cardisoma guanhumi* (Parasram et al. 2021); *Macrobrachium acanthurus*, *M. crenulatum*, *M. faustinum* and *Xiphocaris elongata* (Felix 1991).



Figure 81. Consett Bay Estuary

**4.2.3.6 Spring Garden Wetland**

**Location:** Spring Garden, St. Michael (13.119341 N, -59.626727 W).

**Summary description:** This is a freshwater marsh east of the Mighty Grynner Highway, fed by a natural spring (GoB 1995). It runs along the road with one area extending north, and opens into a broad area at its western end, which is frequently inundated.

The Spring Garden is located in Watershed 24 (EPG, PDA, SEMS 2004). Water levels vary seasonally; it is wet for the majority of the year but dries periodically.

**Documented biodiversity:** No studies could be found. The ponds are covered by water lilies and emergent sedges and grasses.





Figure 82. Spring Garden Wetland

## 5 Conclusions and recommendations

This NWI has identified four wetlands of primary importance and has provided detailed descriptions to the extent possible with available data and information. These are Graeme Hall Swamp, Chancery Lane Swamp, Long Pond and Green Pond. Among the 34 secondary and tertiary wetlands identified in this inventory, one, River Bay North, stands out as having the potential to be considered as a primary wetland.

The four primary wetlands are considered to be significant repositories of biodiversity for Barbados. As such, they should be protected from development and abusive human impacts. All four primary sites are considered to be at risk from a variety of impacts. They have all been identified in the Physical Development Plan, draft Physical Development Plan (GoB 2003, GoB 2017) and National Park Development Plan (GoB 1998) as potential category 2 sites in the Barbados System of Open Spaces and Protected Areas. (OS2 Conservation Areas). However, their boundaries have not been established and they are not gazetted as OS2 areas and thus not officially protected.

Of the four primary wetlands only Graeme Hall Swamp is partially protected through private ownership of the Graeme Hall Nature Sanctuary and through the declaration of that area plus an additional area of the GHS as a Ramsar site. Private ownership, however, does not guarantee protection in the long term. It has not protected the site from a variety of abuses including the use of the area as an emergency dump for sewage from the South Coast Sewage Treatment Plant.

The secondary and tertiary sites were allocated into five categories: Remnant coastal wetlands/gully outlets, shooting swamps, agricultural ponds, aesthetic and recreational ponds, and other wetlands. These lesser wetlands should be the subject of further study and serious consideration for protection at the national level. While they are individually relatively small, collectively they form a significant repository of biodiversity for Barbados. In particular, they are all used by overwintering and migratory birds as evidenced by the ebird sightings in the individual accounts and Appendix 2.

Remnant coastal wetlands/gully outlets are particularly at risk of coastal development, which has already resulted in most of them being severely reduced in area or reduced to concrete channels. Many are known to have played an important role in moderating the quality of water entering the sea. These could be considered collectively as a spatially disaggregated OS 2 Conservation area. They should be protected from further degradation, rehabilitated to the extent possible, and the ecological functionality that has been lost should be restored. The information available of these remnant coastal wetlands/gully outlets is very limited. Much is known only from a handful of studies or from the rapid scoping observations made during this inventory. There is the need to map and study the habitats and biodiversity of these areas.

Shooting swamps collectively provide a major source of habitat for overwintering and migratory waterbirds (see Ebird records, Burke 2007, Wege et al. 2014). However, shooting still continues in several of them, while several others are now used mainly for birding. Unfortunately, shooting swamps are likely to be contaminated with lead the impact to an unknown extent. It is also assumed that the aesthetic and recreational ponds on golf courses, at Heron Bay and at Walkers Reserve are important bird habitats. We know of no studies at these sites except Walkers Reserve. The owners of these ponds should be informed of the importance of these habitats and encouraged to protect or enhance them. Again these and the shooting swamps could be considered collectively as a spatially disaggregated OS 2 Conservation area.

Agricultural ponds, of which we believe there are many more than listed in this inventory, also have potential to harbour aquatic biodiversity, again, especially in relation to overwintering and migratory waterbirds. However, these ponds are from time to time drained and scraped out to restore depth and accessibility (as has clearly taken place at Bawdens). Thought should be given as to how to work with plantation owners and small farmers to minimise the impact of these management measures on biodiversity.

Overall, information on both habitat and species diversity in wetlands in Barbados is scarce. The documentation of biodiversity at these wetland sites has not been systematic, and is based on a variety of small projects and studies. Most work has been done on Graeme Hall which has been the site of several studies. Many taxa, however, remain little studied. Much less is known of Long Pond and even less of all the remaining sites. Owing to the presence in Barbados of several active and knowledgeable birders, the bird fauna is perhaps best known. There is a need for a programmatic approach to promoting research on these wetlands to build the knowledge base required for their conservation and sustainable use.

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# Appendix 1. GIS metadata

## Wetland Inventory GIS Methods Overview

This section outlines the digitisation process and methodology employed to create a comprehensive Geographic Information System (GIS) for the National Wetland Inventory (NWI). The GIS aspect serves as a crucial component in understanding the spatial distribution, characteristics, and classification of wetlands across the island.

This section aims to provide an overview of the data sources, digitisation techniques, and quality control measures implemented to ensure the accuracy and reliability of the GIS data.

### Data Sources and Acquisition:

The GIS data for the NWI was primarily obtained from the following sources:

#### *Secondary Data Sources:*

Secondary data, collected and analyzed by others for different purposes, can be sourced from government reports, academic publications, and online databases. Its use offers advantages like cost-effectiveness and time efficiency. However, researchers must critically assess its reliability, validity, and relevance, and consider potential limitations like varying data collection methods, timeframes, and geographical coverage when incorporating it into their projects.

#### **Secondary Data Acquired:**

##### 1. Existing Vector Data:

Vector files were purchased from the Lands & Surveys department for the primary wetlands. These vector files provide a general understanding of how land use, ownership, and infrastructure interact with the wetland habitats.

##### 2. Existing Raster Data:

Aerial imagery from 2019 was purchased from the Lands and Surveys Department for the Chancery Lane site to supplement orthomosaics that were captured for the other Primary Wetlands. This was necessary because UAV flights are restricted within DJI's No-fly Zone surrounding the airport and clearance was not received to override this restriction

#### **Primary Data Collection:**

##### 1. Orthomosaics from UAV/drone imagery:

Unmanned Aerial Vehicle (UAV) or drone imagery was collected for three sites: Long Pond, Green Pond, and Graeme Hall. The images were processed using Pix4d Mapper to create high resolution orthomosaics.

##### 2. Ground-truthing & GPS Point Capture:

Field surveys were conducted to verify and refine wetland classifications and habitat boundaries derived from remote sensing data. The field survey teams collected GPS coordinates, photographs, and field notes to validate and improve the accuracy of the GIS data.

## Digitisation Process

"Digitising" refers to the process of converting the digital map's features into a structured format that can be used and analyzed within GIS software. Digital maps may already be in a raster image format, but their features are not yet in a format that can be readily manipulated or analyzed, such as vector data. The digitisation process includes the following steps:

1. Image preprocessing:

All maps and aerial images were preprocessed to ensure consistency in spatial resolution and coordinate systems. Images were georeferenced using the UTM Zone 21N coordinate system, based on the WGS84 datum.

2. Vectorisation:

Habitat boundaries and map features were digitised into vector format using QGIS software. This process involved creating polygons for each of the major habitat categories that were observed in the imagery and during the ground-truthing site visits.

## Quality Control and Validation

1. Field data integration:

Ground-truthing data collected during field surveys was used to validate and correct the digitised wetland boundaries and classifications. Discrepancies between the remote sensing-derived wetland data and the field data were resolved by manually adjusting the vector boundaries.

2. Accuracy assessment:

An accuracy assessment was performed to evaluate the overall quality of the GIS data. A random sample of wetland polygons was compared to boundaries from 3 different aerial imagery base maps.

3. Metadata documentation:

Metadata was created for all GIS layers. This metadata provides essential information for users of the NWI GIS data, enabling them to understand the limitations and uncertainties associated with the data.

## GIS Metadata Outline

| General Information  |  |
|----------------------|--|
| Name                 | Document Name                                      |
| Path                 | Source URL   |
| Sidecar Files        | Associated GIS files with dependency relationships |
| Total Size           | Document size mbs/kbs                              |
| Provider Information |  |

|                                   |  |   |
|-----------------------------------|--|---|
| Storage Location                  | Where data is stored in a GIS system. E.g. hard drive, LAN server etc.       |   |
| Encoding                          | Conversion protocol used for data format or coordinate system                |   |
| Geometry                          | The spatial form of a geographic feature. E.g. points, lines, polygons       |   |
| Extent                            | Geographic boundaries of the shapefile                                       |   |
| Feature Count                     | Number of distinct features included in the shapefile                        |   |
| <b>CRS Information</b>            |  |   |
| Name                              | Name of the Coordinate Reference System used for the shapefile.              |   |
| Units                             | Default units used for measurement. E.g. metres, feet, hectares, acres etc.  |   |
| Method                            | Mercator details   |   |
| Celestial Body                    | Earth  |   |
| Accuracy                          | Estimated accuracy relative to in situ measurements.                         |   |
| <b>Identification Information</b> |  |   |
| Identifier                        | Relevant details are provided in the metadata table for each shapefile.      |   |
| Parent Identifier                 |  |   |
| Title                             |  |   |
| Type                              |  |   |
| Language                          |  |   |
| Abstract                          |  |   |
| Categories                        |  |   |
| Keywords                          |  |   |
| <b>Extent Information</b>         |  |   |
| Spatial Extent                    | Relevant details are provided in the metadata table for each shapefile.      |   |
| <b>Access Information</b>         |  |   |
| Fees                              | If necessary. Where can rates and access permission details be sources       |   |
| Licenses                          | National or international intellectual property licenses governing the data. |   |
| Rights                            | Data use allowances.   |   |
| Constraints                       | Data use restrictions.   |   |
| <b>Field Information</b>          |  |   |
| List of Attributes                | Relevant details are provided in the metadata table for each shapefile.      |   |
| Type                              |  |   |
| Length                            |  | Attribute fields are described later in this section. |
| Precision                         |  |   |

|          |  |
|----------|--|
| Comments |  |
|----------|--|

## Wetland Database Structure

| Level | Name                        | File Type    | Description/ Use  |
|-------|-----------------------------|--------------|---|
| 1     | Barbados Wetland Locations  | Point        | Identify the location of different wetland types                                  |
| 2     | Wetland Study Areas         | Polygon      | Polygons encapsulating the study areas for primary wetland sites                  |
| 2     | Wetland Study Areas         | Raster: TIFF | Digital imagery for referencing, observational spatial assessment and digitising. |
| 2     | Study Area Surface Model    | Raster: TIFF | Digital imagery for elevation assessment.   |
| 3     | Wetland Habitat Area Layers | Polygon      | Polygons identifying the spatial extent of discrete habitat regions.              |
| 3     | Wetland Property Layers     | Polygon      | Polygons identifying property boundaries and land ownership.                      |

## Level 1 GIS Data

| Level | Name                       | File Type | Description   |
|-------|----------------------------|-----------|---|
| 1     | Barbados Wetland Locations | Point     | Point data used to identify the location of different local wetlands. |

## 'Barbados Wetland Locations' Shapefile Attribute Fields

| Field     | Type    | Description   |
|-----------|---------|---|
| fid       | Numeric | Unique identifier for each wetland point                  |
| Type      | Text    | Identifies type of wetland referenced                     |
| Size      | Decimal | Identifies estimated/average size of the wetland          |
| Bio-regio | Text    | Identifies naturally defined classification of area       |
| Parish    | Text    | Local address - administrative district of wetland site   |
| Source    | Text    | Identifies the source of water feeding the wetland        |
| Name      | Text    | Name of the wetland referenced                            |
| Origin    | Text    | Identifies if the site is a Natural or Human-made wetland |

|            |      |  |
|------------|------|--|
| Classifica | Text | Type of wetland based on NWI Class-structure |
| Wetland ID | Text | NWI ID Code                                  |
| Address    | Text | Full local address                           |
| Tier       | Text | Primary, Secondary or Tertiary wetland site  |

## Level 2 Data

| Level | Name                             | File Type    | Description /Use  |
|-------|----------------------------------|--------------|---|
| 2     | Wetland Study Areas              | Polygon      | Polygons encapsulating the study areas for primary wetland sites                  |
| 2     | Wetland Study Areas              | Raster: TIFF | Digital imagery for referencing, observational spatial assessment and digitising. |
| 2     | Study Area Digital Surface Model | Raster: TIFF | Digital imagery for elevation assessment.   |

## Barbados Wetland Area Aerial Imagery

| Source                    | Type               | Resolution | Image Date |
|---------------------------|--------------------|------------|------------|
| Land & Surveys Department | Aerial Photography | Unknown    | 2019       |



|   |                             |               |            |
|---|-----------------------------|---------------|------------|
| Graeme Hall   | UAV<br>Orthomosaic          | 3.31 cm/pixel | 2022-12-12 |
|  |                             |               |            |
| Long Pond   | UAV<br>Orthomosaic<br>& DSM | 4.88 cm/pixel | 2022-09-13 |



Green Pond

UAV  
Orthomosaic  
& DSM

2.84cm/pixel

2022-09-16



### Level 3 Data

#### Wetland Site Shapefiles

| Chancery Lane     | Graeme Hall             | Long Pond         | Green Pond        |
|-------------------|-------------------------|-------------------|-------------------|
| Aquatic Habitat   | Aquatic Habitat         | Aquatic Habitat   | Aquatic Habitat   |
| Woodland Habitat  | Woodland Habitat        | Woodland Habitat  | Woodland Habitat  |
| Grassland Habitat | Grassland/Marsh Habitat | Grassland Habitat | Grassland Habitat |
| Dune Habitat      | Properties              | Dune Habitat      | Dune Habitat      |
| Beach Habitat     |                         | Beach Habitat     | Beach Habitat     |
| Properties        |                         | Properties        | Properties        |
|                   |                         |                   |                   |

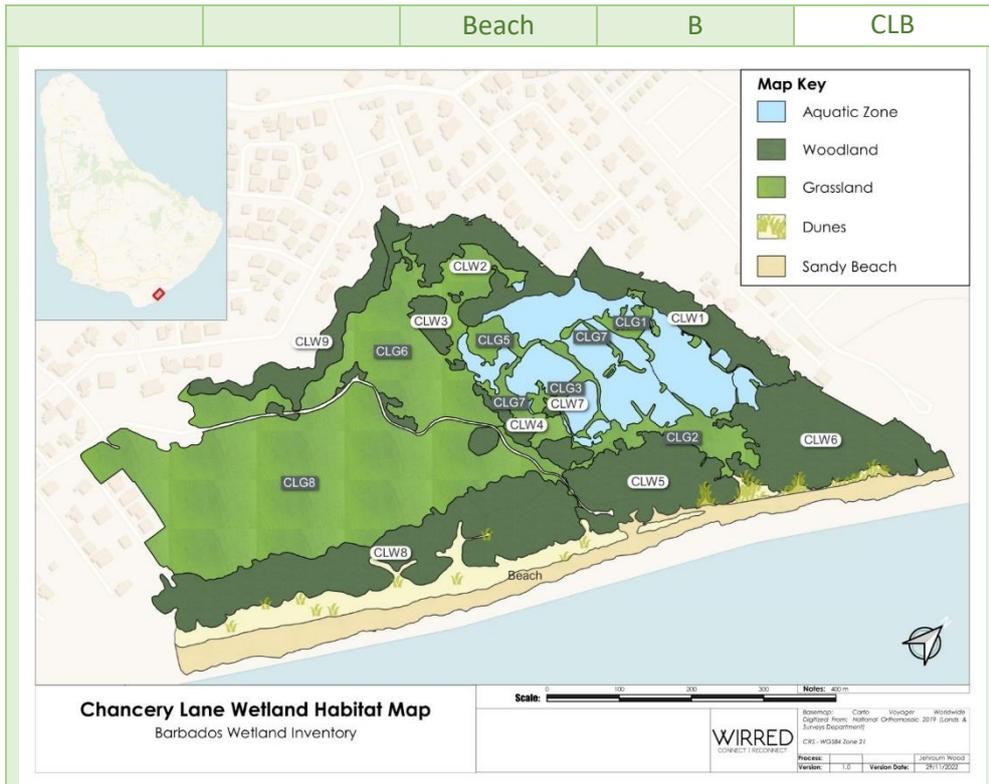
### Barbados Wetland Habitat Shapefile Attribute Table Fields

Each primary wetland is supported by 'level 3 data' which includes shapefiles for each habitat type (identified above). These shapefiles provide an additional layer of information about the existing habitats that include that following attribute fields:

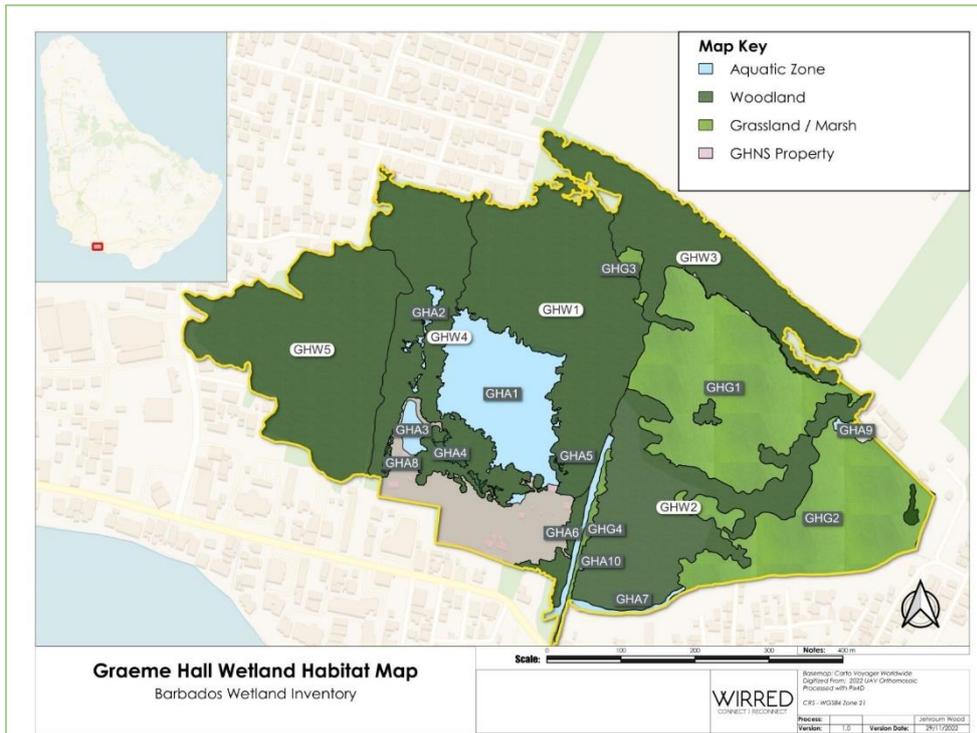
| Fields     | Type    | Description  |
|------------|---------|--|
| id         | Numeric | Unique identifier for each habitat feature                   |
| Habitat    | Text    | Identifies the habitat type for the polygon referenced.      |
| DomSpecies | Text    | Identifies dominant species in the area highlighted.         |
| AddSpecies | Text    | Identifies species of note in the area highlighted.          |
| Area       | Decimal | Total area represented by the polygon referenced.            |
| Hab.Code   | Text    | Unique habitat code for each area the NWI database.          |
| Impacts    | Text    | Identifies impacts of note affecting the habitat referenced. |

Wetland Habitat GIS Code Attribute I.D. Table:

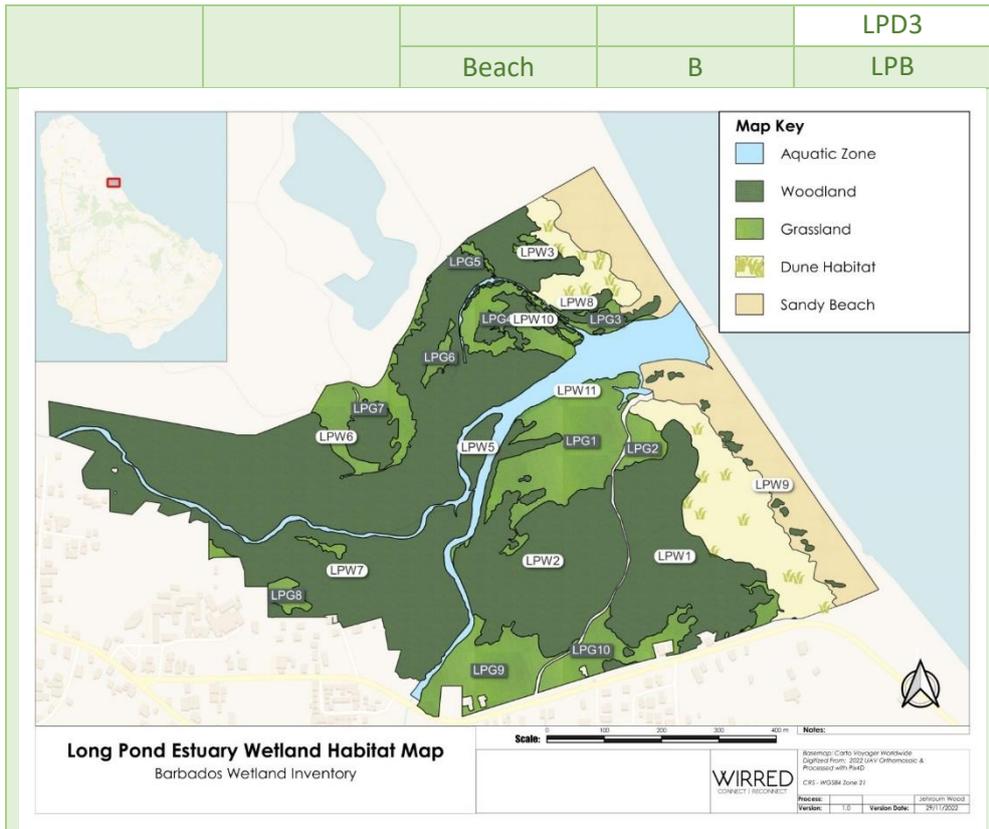
| Wetland Name  | Wetland I.D | Habitat Type | Habitat I.D | Zone I.D |
|---------------|-------------|--------------|-------------|----------|
| Chancery Lane | CL          | Woodland     | W           | CLW1     |
|               |             |              |             | CLW2     |
|               |             |              |             | CLW3     |
|               |             |              |             | CLW4     |
|               |             |              |             | CLW5     |
|               |             |              |             | CLW6     |
|               |             |              |             | CLW7     |
|               |             |              |             | CLW8     |
|               |             |              |             | CLW9     |
|               |             | Grassland    | G           | CLG1     |
|               |             |              |             | CLG2     |
|               |             |              |             | CLG3     |
|               |             |              |             | CLG4     |
|               |             |              |             | CLG5     |
|               |             |              |             | CLG6     |
|               |             |              |             | CLG7     |
|               |             |              |             | CLG8     |
|               |             | Aquatic Area | A           | CLA1     |
|               |             |              |             | CLA2     |
|               |             |              |             | CLA3     |
| CLA4          |             |              |             |          |
| CLA5          |             |              |             |          |
| Dunes         | D           | CLD          |             |          |



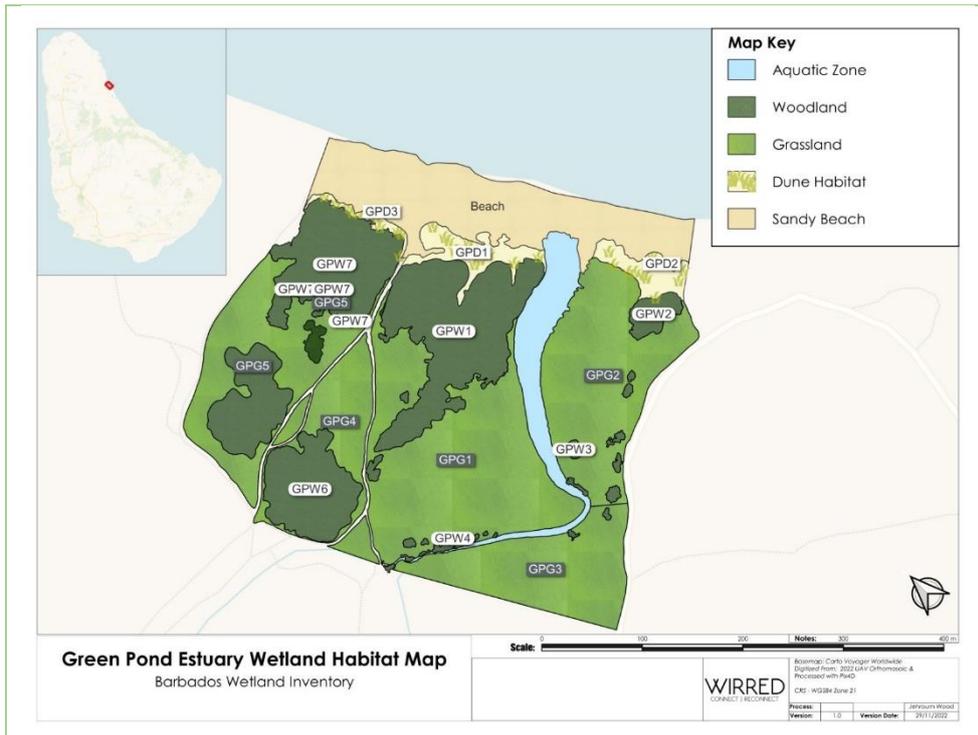
|                    |           | Beach        | B | CLB   |
|--------------------|-----------|--------------|---|-------|
| <b>Graeme Hall</b> | <b>GH</b> | Woodland     | W | GHW1  |
|                    |           |              |   | GHW2  |
|                    |           |              |   | GHW3  |
|                    |           |              |   | GHW4  |
|                    |           |              |   | GHW5  |
|                    |           | Grassland    | G | GHG1  |
|                    |           |              |   | GHG2  |
|                    |           |              |   | GHG3  |
|                    |           |              |   | GHG4  |
|                    |           | Aquatic Area | A | GH A1 |
|                    |           |              |   | GH A2 |
|                    |           |              |   | GH A3 |
|                    |           |              |   | GH A4 |
|                    |           |              |   | GH A5 |
|                    |           |              |   | GH A6 |
|                    |           |              |   | GH A7 |
|                    |           |              |   | GH A8 |
|                    |           |              |   | GH A9 |



|           |              |              |      |      |
|-----------|--------------|--------------|------|------|
| Long Pond | LP           | Woodland     | W    | LPW1 |
|           |              |              |      | LPW2 |
|           |              |              |      | LPW3 |
|           |              |              |      | LPW4 |
|           |              |              |      | LPW5 |
|           |              |              |      | LPW6 |
|           |              |              |      | LPW7 |
|           |              |              |      | LPW8 |
|           |              |              |      | LPW9 |
|           | LP           | Grassland    | G    | LPG1 |
|           |              |              |      | LPG2 |
|           |              |              |      | LPG3 |
|           |              |              |      | LPG4 |
|           |              |              |      | LPG5 |
|           |              |              |      | LPG6 |
|           |              |              |      | LPG7 |
|           |              |              |      | LPG8 |
|           | LP           | Aquatic Area | LP   | LPA1 |
|           |              |              |      | LPA2 |
| LPA3      |              |              |      |      |
| LPA4      |              |              |      |      |
| LP        | Dune Habitat | D            | LPD1 |      |
|           |              |              | LPD2 |      |



|            |    |              |   |      |
|------------|----|--------------|---|------|
| Green Pond | GP | Woodland     | W | GPW1 |
|            |    |              |   | GPW2 |
|            |    |              |   | GPW3 |
|            |    |              |   | GPW4 |
|            |    |              |   | GPW5 |
|            |    |              |   | GPW6 |
|            |    |              |   | GPW7 |
|            |    |              |   | GPW8 |
|            |    | Grassland    | G | GPG1 |
|            |    |              |   | GPG2 |
|            |    |              |   | GPG3 |
|            |    |              |   | GPG4 |
|            |    | Aquatic Area | A | GPA1 |
|            |    |              |   | GPA2 |
|            |    | Dunes        | D | GPD1 |
|            |    |              |   | GPD2 |
| GPD3       |    |              |   |      |
| Beach      | B  | GPB          |   |      |



## Appendix 2. Ebird sightings of birds at secondary and tertiary level wetlands as of January 18<sup>th</sup>, 2023

### Secondary wetlands

#### Bayfield Pond

American Coot  
Antillean Crested Hummingbird  
Bananaquit  
Barbados Bullfinch  
Belted Kingfisher  
Black Swift  
Black-bellied Plover  
Black-bellied Whistling-Duck  
Black-faced Grassquit  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin  
Cattle Egret  
Common Gallinule  
Common Ground Dove  
Eared Dove  
Eurasian Collared-Dove  
Grassland Yellow-Finch  
Gray Kingbird  
Great Egret  
Greater Yellowlegs  
Green Heron  
Green-throated Carib  
Least Sandpiper  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Masked Duck  
Muscovy Duck  
Osprey  
Purple Gallinule  
Rock Pigeon  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper  
Shiny Cowbird  
Snowy Egret  
Solitary Sandpiper  
Sora  
Spotted Sandpiper  
White-rumped Sandpiper  
Wilson's Snipe  
Yellow Warbler

Zenaida Dove

#### Congo Road Swamp

American Golden-Plover  
Antillean Crested Hummingbird  
Bananaquit  
Bank Swallow  
Barbados Bullfinch  
Barn Swallow  
Belted Kingfisher  
Black Swift  
Black-bellied Plover  
Black-bellied Whistling-Duck  
Black-faced Grassquit  
Black-necked Stilt  
Black-whiskered Vireo  
Blue-winged Teal  
Bridled Tern  
Buff-breasted Sandpiper  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin  
Cattle Egret  
Cliff Swallow  
Collared Plover  
Common Gallinule  
Common Ground Dove  
Curlew Sandpiper  
Eared Dove  
Eurasian Collared-Dove  
Eurasian Spoonbill  
Fulvous Whistling-Duck  
Grassland Yellow-Finch  
Gray Heron  
Gray Kingbird  
Gray-hooded Gull  
Great Blue Heron  
Great Egret  
Greater Yellowlegs  
Green Heron  
Green-throated Carib  
Green-winged Teal  
Gull-billed Tern  
Hudsonian Godwit  
Laughing Gull  
Least Sandpiper

Least Tern  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Little Stint  
Long-billed Dowitcher  
Magnificent Frigatebird  
Masked Duck  
Merlin  
Muscovy Duck  
Orange-winged Parrot  
Osprey  
Pacific Golden-Plover  
Pectoral Sandpiper  
Peregrine Falcon  
Pied-billed Grebe  
Red Knot  
Rock Pigeon  
Rose-ringed Parakeet  
Ruddy Turnstone  
Ruff  
Sanderling  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper  
Shiny Cowbird  
Short-billed Dowitcher  
Snail Kite  
Snowy Egret  
Solitary Sandpiper  
Sora  
Spotted Redshank  
Spotted Sandpiper  
Stilt Sandpiper  
Terek Sandpiper  
Tricolored Heron  
Upland Sandpiper  
West Indian Whistling-Duck  
Western Sandpiper  
Whimbrel  
Whiskered Tern  
White-crowned Pigeon  
White-rumped Sandpiper  
Willet  
Wilson's Snipe  
Yellow Warbler  
Zenaida Dove

### Fosters Swamp

American Coot  
American Golden-Plover

American Wigeon  
Antillean Crested Hummingbird  
Bananaquit  
Bank Swallow  
Barbados Bullfinch  
Barn Swallow  
Belted Kingfisher  
Black-bellied Plover  
Black-bellied Whistling-Duck  
Black-crowned Night-Heron  
Black-faced Grassquit  
Black-headed Gull  
Black-necked Stilt  
Blackpoll Warbler  
Black-whiskered Vireo  
Blue-winged Teal  
Bobolink  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin  
Caspian Tern  
Cattle Egret  
Cliff Swallow  
Collared Pratincole  
Common Gallinule  
Common Greenshank  
Common Ground Dove  
Eared Dove  
Eurasian Collared-Dove  
Eurasian Wigeon  
Fork-tailed Flycatcher  
Franklin's Gull  
Fulvous Whistling-Duck  
Glossy Ibis  
Grassland Yellow-Finch  
Gray Heron  
Gray Kingbird  
Great Blue Heron  
Great Egret  
Greater Yellowlegs  
Green Heron  
Green-throated Carib  
Gull-billed Tern  
Hudsonian Godwit  
Killdeer  
Laughing Gull  
Least Bittern  
Least Sandpiper  
Lesser Black-backed Gull  
Lesser Scaup  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret

Little Gull  
Long-billed Dowitcher  
Magnificent Frigatebird  
Masked Duck  
Merlin  
Northern Shoveler  
Osprey  
Pectoral Sandpiper  
Peregrine Falcon  
Purple Gallinule  
Rock Pigeon  
Rose-ringed Parakeet  
Ruddy Turnstone  
Sanderling  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper  
Shiny Cowbird  
Short-billed Dowitcher  
Snowy Egret  
Solitary Sandpiper  
Sora  
Southern Lapwing  
Spotted Sandpiper  
Stilt Sandpiper  
Tricolored Heron  
Upland Sandpiper  
Western Sandpiper  
Whimbrel  
White-rumped Sandpiper  
White-winged Tern  
Willet  
Wilson's Snipe  
Wood Sandpiper  
Yellow Warbler  
Yellow-billed Cuckoo  
Zenaida Dove

### Golden Grove Swamp

American Golden-Plover  
Arctic Tern  
Bananaquit  
Barbados Bullfinch  
Barn Swallow  
Belted Kingfisher  
Black-bellied Whistling-Duck  
Black-faced Grassquit  
Blue-winged Teal  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin

Cattle Egret  
Common Gallinule  
Common Ground Dove  
Eurasian Collared-Dove  
Glossy Ibis  
Gray Kingbird  
Great Blue Heron  
Great Egret  
Greater Yellowlegs  
Green Heron  
Gull-billed Tern  
Hudsonian Godwit  
Killdeer  
Least Sandpiper  
Lesser Scaup  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Magnificent Frigatebird  
Northern Pintail  
Osprey  
Pectoral Sandpiper  
Peregrine Falcon  
Rock Pigeon  
Sanderling  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper  
Shiny Cowbird  
Short-billed Dowitcher  
Snowy Egret  
Solitary Sandpiper  
Spotted Sandpiper  
Stilt Sandpiper  
Western Sandpiper  
White-rumped Sandpiper  
Wilson's Snipe  
Zenaida Dove

### Half Acre Pond

Antillean Crested Hummingbird  
Bananaquit  
Barbados Bullfinch  
Black-bellied Whistling-Duck  
Black-crowned Night-Heron  
Black-faced Grassquit  
Black-whiskered Vireo  
Blue-winged Teal  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin

Cattle Egret  
Common Gallinule  
Common Ground Dove  
Eurasian Collared-Dove  
Glossy Ibis  
Grassland Yellow-Finch  
Gray Kingbird  
Great Egret  
Greater Yellowlegs  
Green Heron  
Green-throated Carib  
Least Sandpiper  
Lesser Scaup  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Osprey  
Peregrine Falcon  
Rose-ringed Parakeet  
Scaly-naped Pigeon  
Shiny Cowbird  
Snowy Egret  
Solitary Sandpiper  
Spotted Sandpiper  
Western Sandpiper  
Yellow Warbler  
Zenaida Dove

### Woodbourne

American Coot  
American Golden-Plover  
American Wigeon  
Anonymous eBird  
Antillean Crested Hummingbird  
Bananaquit  
Bank Swallow  
Barbados Bullfinch  
Barn Swallow  
Belted Kingfisher  
Black-bellied Plover  
Black-bellied Whistling-Duck  
Black-crowned Night-Heron  
Black-faced Grassquit  
Black-whiskered Vireo  
Blue-winged Teal  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin  
Cattle Egret  
Cliff Swallow  
Common Gallinule

Common Greenshank  
Common Ground Dove  
Eurasian Collared-Dove  
Eurasian Spoonbill  
Fulvous Whistling-Duck  
Glossy Ibis  
Grassland Yellow-Finch  
Gray Heron  
Gray Kingbird  
Great Blue Heron  
Great Egret  
Greater Scaup  
Greater Yellowlegs  
Green Heron  
Green-throated Carib  
Green-winged Teal  
Gull-billed Tern  
Hudsonian Godwit  
Killdeer  
Laughing Gull  
Least Sandpiper  
Lesser Scaup  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Little Stint  
Magnificent Frigatebird  
Masked Duck  
Merlin  
Muscovy Duck  
Niels Larsen  
Northern Pintail  
Northern Shoveler  
Northern Waterthrush  
Olivier Langrand  
Osprey  
Palm Warbler  
Patrick Jackson  
Pectoral Sandpiper  
Peregrine Falcon  
Pied-billed Grebe  
Purple Gallinule  
Purple Heron  
Ringed Kingfisher  
Ring-necked Duck  
Rock Pigeon  
Rose-ringed Parakeet  
Ruddy Turnstone  
Ruff  
Sanderling  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper

Shiny Cowbird  
Short-billed Dowitcher  
Snail Kite  
Snowy Egret  
Solitary Sandpiper  
Sora  
Spotted Sandpiper  
Stilt Sandpiper  
Tricolored Heron  
West Indian Whistling-Duck  
Western Sandpiper  
Whimbrel  
White-rumped Sandpiper  
White-winged Tern  
Willet  
Wilson's Snipe  
Yellow Warbler  
Yellow-crowned Night-Heron  
Zenaida Dove

## Tertiary wetlands

### Greenland Ponds

American Coot  
American Wigeon  
Antillean Crested Hummingbird  
Bananaquit  
Barbados Bullfinch  
Barn Swallow  
Belted Kingfisher  
Black-crowned Night-Heron  
Black-faced Grassquit  
Black-necked Stilt  
Black-whiskered Vireo  
Blue-winged Teal  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin  
Cattle Egret  
Common Gallinule  
Common Ground Dove  
Eurasian Collared-Dove  
Eurasian Wigeon  
Grassland Yellow-Finch  
Gray Heron  
Gray Kingbird  
Great Egret  
Greater Yellowlegs  
Green Heron  
Green-throated Carib

Green-winged Teal  
Least Sandpiper  
Lesser Scaup  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Masked Duck  
Northern Pintail  
Northern Waterthrush  
Osprey  
Pied-billed Grebe  
Purple Gallinule  
Ring-necked Duck  
Ruddy Duck  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper  
Shiny Cowbird  
Short-billed Dowitcher  
Snowy Egret  
Solitary Sandpiper  
Sora  
Spotted Sandpiper  
Wilson's Snipe  
Yellow Warbler  
Yellow-billed Cuckoo  
Zenaida Dove

### Walkers Reserve ponds

American Coot  
American Wigeon  
Antillean Crested Hummingbird  
Bananaquit  
Barbados Bullfinch  
Belted Kingfisher  
Black Swift  
Black-bellied Plover  
Black-bellied Whistling-Duck  
Black-faced Grassquit  
Black-necked Stilt  
Black-whiskered Vireo  
Blue-winged Teal  
Carib Grackle  
Caribbean Elaenia  
Caribbean Martin  
Cattle Egret  
Common Gallinule  
Common Ground Dove  
Common Pochard  
Eurasian Collared-Dove  
Eurasian Spoonbill

Eurasian Wigeon  
Fulvous Whistling-Duck  
Grassland Yellow-Finch  
Gray Kingbird  
Great Blue Heron  
Great Egret  
Greater Yellowlegs  
Green Heron  
Green-throated Carib  
Green-winged Teal  
Laughing Gull  
Least Sandpiper  
Lesser Scaup  
Lesser Yellowlegs  
Little Blue Heron  
Little Egret  
Masked Duck  
Osprey  
Peregrine Falcon  
Pied-billed Grebe  
Ring-necked Duck  
Rock Pigeon  
Ruddy Duck  
Ruddy Turnstone  
Sanderling  
Scaly-naped Pigeon  
Semipalmated Plover  
Semipalmated Sandpiper  
Shiny Cowbird  
Short-billed Dowitcher  
Snowy Egret  
Solitary Sandpiper  
Spotted Sandpiper  
Whimbrel  
Wilson's Snipe  
Yellow Warbler  
Zenaida Dove