Soil Sampling and Canopy Cover Assessments for the Barmah-Millewa Forest

Final Project Report

PCB Consulting Pty Ltd

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1. Introduction

The Barmah–Millewa Forest, located on the Murray River, is the largest river red gum forest in Australia, covering 66,000 hectares of floodplain wetlands between Tocumwal, Deniliquin and Echuca. It is an ecological hotspot for native plants, fish, reptiles, amphibians, birds and mammals.

River regulation has reduced the number of small to medium sized flood events. Environmental water has been used in a number of ways to support the health of the forest. Environmental water has been used to build on natural flows to extend the area of inundation or duration of events. Environmental water has also been important for providing refuge in times of drought, or extending flows to allow waterbirds to finish nesting. Environmental water not taken up by the floodplain returns naturally to the river, where it may be used to support watering at downstream sites.

The Goulburn Broken CMA plays an important role in water management for the Barmah component of the Forest, and the NSW Office of Environment & Heritage (OEH) oversees the Millewa component of the Forest. This role includes planning, monitoring and reporting on water related outcomes, including the use of environmental water.

Understorey vegetation monitoring has been undertaken in the Barmah-Millewa Forest over the past 10 years, as funded by the Murray-Darling Basin Authority via NSW OEH, within 72 established sampling quadrat sites located in 11 wetlands within the forest, leading to the collection of a substantial dataset.

Statistical analysis of understory vegetation data is currently being undertaken and interpreted in relation to flood regimes. In addition to the impacts of hydrological regimes, soil properties and canopy shading could also be influencing understory vegetation condition and the nature and diversity of species present.

This project aims to assist with the analysis of vegetation responses to flooding, by investigating soil properties and degree of canopy shading in each of the 72 sentinel quadrats being used by the understorey vegetation monitoring project. The additional assessments are required to explore the influence that these factors may have on understory vegetation and may assist to better understand the linkages between hydrological regime and vegetation condition and make-up.

The project required the collection of soil samples for analysis and canopy cover assessment at each of the 72 quadrat sites located in 11 wetlands within the Barmah-Millewa Forest. PCB Consulting Pty Ltd was contracted to complete the assessments, and worked in collaboration with Out of the Woodlands Environmental Consultancy on the project. The outcomes of this project will provide valuable information as input for consideration within the environmental water planning process to maximise benefits for indigenous plants and associated floodplain ecosystem.

2. Background

2.1. Site context

The Barmah-Millewa Forest is one of six “icon sites” of The Living Murray program managed by the Murray-Darling Basin Authority. The Living Murray is a nationally significant river restoration program that focuses on improving the environment at 'icon sites' along the Murray River. These icon sites were chosen for their high ecological value and for their cultural significance to Indigenous people and the broader community.

The Barmah–Millewa Forest is also part of a Ramsar site (internationally significant wetland) and is on the Directory of Important Wetlands in Australia. It contains the largest area of Moira grass plains in the Basin, which are important as feeding and breeding resources for a diversity of waterbirds.

The vision for the Barmah-Millewa icon site is to maintain and, where practicable, enhance the ecological character of the Barmah–Millewa floodplain (MDBA 2011). There are 4 high-level ecological objectives for the Barmah–Millewa Forest:

- restore the extent and distribution of healthy wetland and floodplain vegetation communities
- provide suitable feeding and breeding habitat for a range of waterbirds, including colonial nesting species
- support successful breeding and recruitment of native fish species
- provide high quality feeding, breeding and nursery habitat for native frogs, turtles and crayfish.

The Barmah-Millewa Forest is managed by the relevant state's National Park authorities - the Barmah National Park in Victoria, jointly managed by Parks Victoria and the Yorta Yorta indigenous nation, and the Murray Valley National Park (Moira, Millewa and Gulpa Creek sections) in NSW by OEH. The Goulburn Broken CMA also plays an important role in water management for Barmah Forest including planning, monitoring and reporting on water related outcomes, including the use of environmental water, whereas OEH performs this role for Millewa Forest.

Water management planning is focussed on protecting and enhancing the ecological values of Barmah-Millwa Forest. The majority of Barmah-Millewa Forest actively floods during high flows in the Murray River as a result of the main river channel narrowing at this point (the Barmah Choke). Flooding is vital for the ongoing health of these environments and the native species they support.

Environmental water is available to use in Barmah and Millewa forests from various environmental water accounts, including one that is specifically provided for the Barmah-Millewa Forest. The various accounts are separately managed by the Commonwealth Environmental Water Holder, the Victorian Environmental Water Holder, and the Murray-Darling Basin Authority (MDBA), with planning and releases coordinated via MDBA. On occasions, other water sources destined for downstream requirements can also be delivered through Barmah-Millewa Forest for the benefit of the floodplain ecology.

Water management is guided by an Environmental Water Management Plan, developed for the Barmah-Millewa Forest as part of its "icon site" status. This overarching plan leads into annual water management proposals and planning that guides specific water management actions for the upcoming (financial) year.

2.2. Landscape Context

The Riverine Plain of New South Wales and Victoria is a very extensive and complex alluvial plain associated with the River Murray and its tributaries which developed following the retreat of the Neogene Sea from the Murray Basin (VRO, 2017). Although the plain is predominantly alluvial in origin, episodes of windblown deposition did occur during arid times.

The Riverine Plain consists essentially of two geological formations. The most extensive and older is the *Shepparton Formation* of late Neogene (Pleistocene), and the Recent *Coonambidgal Formation* (VRO, 2017). The landscape features include plains with small, meandering, leveed stream channels, plains without channels, and plains with lakes and lunettes. Much of the riverine plain landscape is made of older paleo-channels and paleo-plains of ancient rivers (Rosengren, 2016).

The landscape features of the local area around Barmah have been particularly influenced by the Cadell Fault, diverting the course of the Murray River, causing lake development, channel diversion, and avulsion all creating a complex landscape (Rosengren, 2016).

There are no comprehensive soil maps for the main forest areas of the floodplains. However, it is likely that three primary soil types can be found in this area:

- Vertosols – uniform clay profiles that exhibit little, if any, texture changes throughout the profile and crack when dry.
- Dermosols – loamy or sandy loam profiles that exhibit no sharp changes in soil texture but can gradually become more clayey with depth.
- Sodosols & Chromosols– profiles that exhibit a sharp texture change between the topsoil (A) and subsoil (B) horizons. The B horizon of Sodosols are sodic (contains exchangeable sodium levels of more than 6%).

2.3. Canopy Cover

Canopy cover is defined as the proportion of the forest floor covered by the vertical projection of the tree crowns (Korhonen *et al*. 2006).

In this project we are treating foliage projected cover as a measure of the amount of shading present on the forest/woodland floor. That is, we are measuring the foliage projected cover, and not including the shading also caused by the vegetation immediately adjacent to the quadrat (when direct sunlight hits the quadrat at an angle, as it does for most hours of the day).

The Victorian Department of Sustainability and Environment provides a guide to measuring tree canopy cover (DSE 2004). However, unlike the habitat hectares measure of canopy projective foliage cover (which only measures canopy cover which is 80% or more of the benchmark height for the Ecological Vegetation Class) we are here measuring all cover provided by the overstorey, i.e. any woody vegetation other than shrubs, including small saplings.

There are a number of techniques and equipment that can be used to measure canopy cover, with varying degrees of precision and corresponding intensities of resources and effort required to employ them. These include use of an instrument called the Cajanus tube, line intersect sampling, digital photographs, and ocular estimation (Korhonen *et a*l. 2006). For canopy cover to be measured accurately, the measurements would need to be made in exact vertical direction. Measurements made with instruments that have an angle of view (e.g. conventional cameras) usually overestimate the canopy cover percentage because in the images captured through these means the trees arch in towards the centre of the observed area (Korhonen *et al*. 2006), thus, for example capturing more of a trunk's area then would be measured when looking directly from above.

In this project we employed the use of an ‘app’ (smart phone application software), one that was actually initially designed to measure ground cover levels to assist in decisions around stock grazing regimes - 'Canopy Cover Free' app (Healson, 2016).

We found that the app could be used to take an image of the space above, 'reading' the sky, in contrast to the foliage, branches, and trunks. We also employed several other methods to calculate the final percentage cover score. We used the app in combination with photos taken with a camera at ground level, and the experience of the field workers in estimating canopy cover (also referring to the silhouette illustrations provided in the Department of Sustainability and Environment's Vegetation Quality Assessment Manual (DSE 2004).

3. Methodology

Our methodology was based on using the established sampling quadrats for vegetation monitoring. At each of the 11 wetland monitoring sites, there are 2 transects from the wetland radiating outward. Along each transect is 3 – 4 sampling quadrats 20m x 20m, with a defined photo point at one corner of the quadrat.

The soil sample collection and the canopy assessments were undertaken over four days during May 2017. Required scientific permits and licences were applied for from NSW Parks and Victorian Parks.

OEH Licence number: SL101890 valid until 31/5/2018

DELWP Permit number: 10008325 valid until 31/12/2017.

3.1 Soil Sample collection

Representative composite surface soil samples were collected from each quadrat. The composite comprised of a minimum of three 0 – 10cm core-samples and three 10 – 20 cm core samples that were collected from along the diagonal transects across each quadrat, starting from the photo point corner. These three 0 – 10cm core samples were then combined to form one representative composite sample for that quadrat.

In addition to the core soil sample collection, one augur hole was dug around 1m in from the photo point corner on the diagonal transect. Soil profile samples were collected from four depths down the soil profile: 0 – 10cm, 10 – 20cm, 20 – 30 cm, and at approximately 60cm. These augured samples were used for assessment of some soil physical characteristics including texture, soil colour, and soil structural stability. These physical properties and the chemical analysis were used to approximately classify the soil profiles using the Australian Soil Classification System (Isbell, 2016).

The composite surface soil samples from the 0 to 10 cm of the soil profile were sent to CSBP Ltd, an ASPAC certified and NATA certified soil agronomic chemistry laboratory in Western Australia, where the soils were analysed for a range of agronomic soil parameters. In addition the 10 – 20cm core sample composite and the 20 – 30cm augur sample were combined to form a composite 10 – 30cm sample for chemical analysis.

During the soil sampling process, photos (using a phone camera) were taken of the augured soil profile and the ground cover.

3.2 Canopy Cover Assessments

At each quadrat a tape was run out from the corner reference peg at a right angle to mark out two sides (20 metres along two sides) to define the quadrat on the ground. (The diagonal peg had also previously been marked.) For most quadrats the measurement was taken in the two halves of the quadrat: that is, the measurement of canopy cover was made standing in the middle of each half of the quadrat: 10 metres along one side, 5 metres stepped in, then another 10 metres stepped in to measure the other half.

(The quadrats where this more systematic approach was not relevant or useful was where a quadrat was very largely without any canopy and the canopy that was present occurred just on the margin - in such instances an ocular estimation was made.)

The camera (phone), as part of the app deployment, was held horizontally at waist height, so that the face of the phone was pointing upwards, showing the image (of the canopy cover) being

recorded, and the direction of the camera was held to ensure that the image on the screen faithfully represented the canopy occurring within the quadrat.

A second person instructed the app user as to what vegetation was in or out on the edges of the quadrat.

When satisfied that the image on the screen faithfully captured the canopy present within the quadrat, the camera button ' was pressed, and the app provided a figure from which the canopy cover percentage could be derived. Because the app actually measures the paler areas of the image, i.e. the areas not covered by canopy, branches, trunks, etc., to get the actual canopy cover figure, this number was subtracted from 100 (see Figure 1 below). The figures from the two halves were added together, then divided by two, to give the app-estimate of the overall canopy cover percentage for the quadrat.

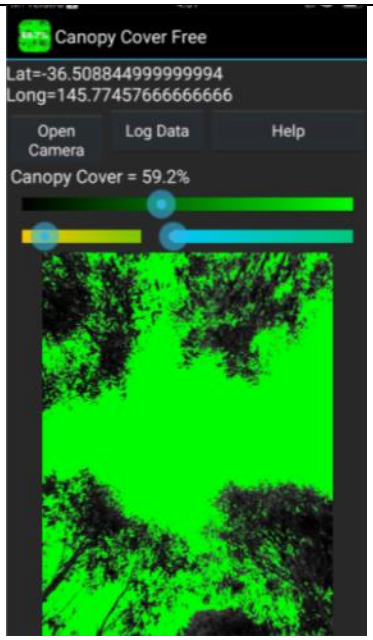

Figure 1: Above (left): Using the Canopy Cover Free App in the field
Above (right): A screen shot from the mobile device showing the detail of this app. Note the Lat/Long recorded and the Canopy Cover %. This app captures the space between the canopy, so the Canopy Cover of this photo recorded is actually 40.8%

The canopy cover percentage figure arrived at came from a combined approach of techniques: use of the app's reading; the canopy cover photo; silhouette diagrams (provided within DSE's Habitat Hectares guide); and the field workers' experience of estimating canopy cover percentages.

The percentage cover figures were rounded off to the nearest 5%.

Finally, the quadrat was inspected again to ensure that the figure accurately represented the situation within the quadrat.

A photo, taken in the middle of each quadrat at ground level was also taken to provide some visual record of the canopy cover occurring within the quadrat.

4. Results

For more detailed descriptions (including photos) of canopy cover results and soil analysis data refer to the appendix section of the report. The table below contains a summary of the results for both soils and canopy cover assessments.

Site 1. Boals Deadwoods

Quadrat No.	Canopy Cover %	Soil types and key features
1.1	15	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al • High P • Low Ca/Mg ratio • High Fe and Mn • Low OC%
1.2	40	Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al • Moderately High P • Low Ca/Mg • High Fe and Mn
1.3	40	Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • High Fe and Mn
2.1	10	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and high Exch Al • Moderate P • Low Ca/Mg ratio • High Fe and Mn • High S
2.2	45	Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al at depth • Moderate P • High OC% • High Fe and Mn
2.3	45	Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and high Exch Al at depth • high P • High Fe and Mn

Site 2. Top Island (Burnt Site)

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – uniform clay soil; greyish brown with mottles; prone to slake – most probably a Vertosol chemical analysis highlights: • Acidic pH and High Exch Al • Moderate P • Low Ca/Mg • High Fe and Mn
1.2	35	Soil type – sandy clay loam surface soil with sandy clay sub soil; greyish brown; prone to slake – most probably a Dermosol chemical analysis highlights: • Acidic pH and High Exch Al • Low P • Low Ca/Mg • High Fe and Mn
1.3	10	Soil Type – uniform sandy loam soil; greyish brown with mottles; prone to slake – most probably a Dermosol Chemical analysis highlights: • Acidic pH and High Exch Al • Low P • Low Ca/Mg • High Fe and Mn • Low OC%
2.1	No canopy cover	Soil type – uniform clay soil; brownish grey with mottles; prone to slake in subsoil – most probably a Vertosol chemical analysis highlights: • Acidic pH and High Exch Al • Moderate P • High S • Low Ca/Mg • High Fe and Mn
2.2	15	Soil Type – uniform sandy clay loam soil; greyish brown with mottles; prone to slake – most probably a Dermosol Chemical analysis highlights: • Acidic pH and High Exch Al • Moderate P • Low Ca/Mg • High Fe and Mn • Low OC%
2.3	25	Soil Type – uniform sandy clay loam soil; greyish brown with mottles; prone to slake in subsoil – most probably a Dermosol Chemical analysis highlights: • Acidic pH and High Exch Al • low P • Low Ca/Mg • High Fe and Mn • Low OC%

Site 3. Top Island (Original Site)

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	20	Soil type – uniform clay soil; brownish grey with mottles; prone to slake in subsoil – most probably a Vertosol chemical analysis highlights: • Acidic pH and High Exch Al% at depth • Moderate P • Low Ca/Mg • High Fe and Mn
1.2	30	Soil type – sandy clay loam surface with light clay subsoil; brownish grey; prone to disperse at depth – most probably a Kurosol Chemical analysis highlights: • Acidic pH and High Exch Al% at depth • Moderate P • High Fe and Mn
1.3	20	Soil type –clay loam surface with light clay subsoil; brownish grey; prone to disperse at depth – most probably a Sodosol Chemical analysis highlights: • Acidic pH and High Exch Al% at depth • Sodic at depth • Moderate P • High Fe and Mn
2.1	40	Soil type – uniform clay soil; brownish grey with mottles; prone to slake in subsoil – most probably a Vertosol chemical analysis highlights: • Acidic pH and High Exch Al% at depth • Moderate P • Low Ca/Mg • High Fe and Mn
2.2	30	Soil type – sandy clay loam surface with light clay subsoil; brownish grey; prone to disperse at depth – most probably a Sodosol Chemical analysis highlights: • Acidic pH and High Exh Al% at depth • Sodic at depth • Moderate P • High Fe and Mn
2.3	15	Soil Type – uniform sandy clay loam soil; brownish grey with mottles; prone to disperse in subsoil – most probably a Dermosol Chemical analysis highlights: • High Exch Al at depth • Sodic at depth • low P • High Fe and Mn • High Fe • Very low OC%

Site 4. Little Rushy Swamp

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – uniform clay soil; greyish yellowish brown with red mottles; prone to disperse at depth– most probably a Vertosol

Quadrat No.	Canopy Cover %	Soil Types and key features
		Chemical Analysis highlights: • Acidic pH and High Exch Al% • High P • High S • Low Ca/Mg ratio • High Fe and Mn • high OC%
1.2	≤5	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn • high OC%
1.3	45	Soil type – uniform clay soil; brownish black; stable– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn • high OC%
2.1	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • Low Ca/Mg ratio • High Fe and Mn
2.2	≤5	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • high P • Low Ca/Mg ratio • High Fe and Mn
2.3	50	Soil type – uniform clay soil; brownish black; stable– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al at depth • Moderate P • Low Ca/Mg ratio • High Fe and Mn

Site 5. Top Lake

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol

Quadrat No.	Canopy Cover %	Soil Types and key features
		Chemical Analysis highlights: • Acidic pH and High exch Al% • High P • Low Ca/Mg ratio • High Fe and Mn
1.2	15	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn
1.3	35	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Fe and Mn • High OC%
2.1	20	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake – most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • High P • Low Ca/Mg ratio • High Fe and Mn
2.2	50	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High S • Low Ca/Mg ratio • High Fe and Mn
2.3	45	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% at depth • Moderate P • Low Ca/Mg ratio • High Fe and Mn

Site 6. Steamer Plain

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P

Quadrat No.	Canopy Cover %	Soil Types and key features
		• High S • Low Ca/Mg ratio • High Fe and Mn
1.2	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High S • Low Ca/Mg ratio • High Fe and Mn
1.3	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn
1.4	50	Soil type – sandy clay loam surface soil over a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn
2.1	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn • Low OC%
2.2	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderately high P • Low Ca/Mg ratio • High Fe and Mn
2.3	25	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • Sodic at depth • High Fe and Mn

Quadrat No.	Canopy Cover %	Soil Types and key features
2.4	50	Soil type – clay loam surface soil over a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH • Moderate P • Sodic at depth • High S • High Fe and Mn • High OC%

Site 7. Walthours Swamp

Quadrat No.	Canopy Cover %	Soil Types and key features
1.0	≤5	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Fe and Mn
1.1	15	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • Low Ca/Mg ratio • High Fe and Mn
1.2	30	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderately high P • High Fe and Mn
1.3	20	Soil type – fine sandy clay loam topsoil with clay loam subsoil and sandy loam at depth – most probably a Dermosol Chemical Analysis highlights: • high P • High Fe and Mn
2.0	30	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • High S • Low Ca/Mg ratio • High Fe and Mn
2.1	30	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al%

Quadrat No.	Canopy Cover %	Soil Types and key features
		• Moderate P • High S • Low Ca/Mg ratio • High Fe and Mn
2.2	25	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • low P • Low Ca/Mg ratio • High Fe and Mn • Low OC%
2.3	20	Soil type – fine sandy clay loam topsoil with sandy clay loam subsoil and sandy loam at depth – most probably a Dermosol Chemical Analysis highlights: • high P • High Fe and Mn

Site 8. Reed Beds Swamp

Quadrat No.	Canopy Cover %	Soil Types and key features
1.0	No canopy cover	Soil type – uniform clay soil; brownish black with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High S • Low Ca/Mg ratio • High Fe and Mn • High OC%
1.1	60	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • High Fe and Mn
1.2	45	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • High P • High Fe and Mn • High OC%
1.3	45	Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Sodosol Chemical Analysis highlights: • Acidic pH • Moderate P • Sodic at depth

Quadrat No.	Canopy Cover %	Soil Types and key features
		• High Fe and Mn
2.0	No canopy cover	Soil type – uniform clay soil; brownish black with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • High S • Low Ca/Mg ratio • High Fe and Mn
2.1	50	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% at depth • Moderate P • High Fe and Mn • High OC%
2.2	35	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Low P • High Fe and Mn
2.3	30	Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Sodosol Chemical Analysis highlights: • Moderate P • Sodic at depth • High Fe and Mn

Site 9. Black Gate Lagoon

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – sandy loam surface soil with a light clay subsoil; brownish black; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Moderate P • High S • High OC% • Low Ca/Mg • High Fe and Mn
1.2	35	Soil type – fine sandy clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • Low Ca/Mg • Low S • Low OC% • High Fe and Mn

Quadrat No.	Canopy Cover %	Soil Types and key features
1.3	25	Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Sodosol Chemical Analysis highlights: • Moderate P • Sodic at depth • High Fe and Mn
2.1	≤5	Soil type – sandy loam surface soil with a light clay subsoil; brownish black; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Moderate P • High OC% • Low Ca/Mg • High Fe and Mn
2.2	40	Soil type – fine sandy clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • Low Ca/Mg • Low S • High Fe and Mn
2.3	10	Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Sodosol Chemical Analysis highlights: • Moderate P • Sodic at depth • High Fe and Mn

Site 10. Duck Swamp

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – uniform clay soil; brownish black with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • High P • High Fe and Mn
1.2	5	Soil type – uniform clay soil; brownish black with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • High Fe and Mn
1.3	35	Soil type – sandy clay with a sandy loam subsoil; brownish grey with red mottles; prone to disperse– most probably a Dermosol Chemical Analysis highlights: • Very High P • High Fe and Mn

Quadrat No.	Canopy Cover %	Soil Types and key features
2.1	<1 (effectively no canopy cover)	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • High Fe and Mn • High OC%
2.2	5	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • High Fe and Mn
2.3	10	Soil type – sandy clay loam with a clay sand subsoil on course sand; grayish brown; prone to slake– most probably a Dermosol Chemical Analysis highlights: • High P • High Fe and Mn

Site 11. Algaboia Plain

Quadrat No.	Canopy Cover %	Soil Types and key features
1.1	No canopy cover	Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • High P • Low Ca/Mg • High Fe and Mn • Low OC%
1.2	35	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg • High Fe and Mn
1.3	40	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Fe and Mn
2.1	≤5	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH and High Exch Al% • Moderate P • High Fe and Mn

Quadrat No.	Canopy Cover %	Soil Types and key features
2.2	45	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Fe and Mn
2.3	40	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Fe and Mn

5. Discussion

5.1 Canopy Cover

Shadowing effects (resulting in lower light conditions) on the ground layer vegetation is not just due to the canopy immediately overhead, but also the surrounding treed, or taller (including reeds), vegetation. Given that across the daylight hours the ambient light reaching the ground layer comes mostly not from an 'idealised Sun at its zenith above the canopy', but, rather, for many more hours from sunlight slanting through the adjacent canopies, the structure and density of the forest or woodland immediately surrounding a quadrat, particularly to the east, north, and west of the patch is as significant, if not more, than the amount of light coming directly from above.

Given this, it is appreciated/understood the difficulty, and complexity, of the accurate measurement of the amount of light that reaches any one patch of ground, not just through any one day, but across the days, and across the years. On this matter, it must be remembered that the measurements made in the current work are a snapshot in time, and that the canopy cover will vary over time - to a greater or lesser extent.

Along any one transect, the canopy cover measurements were often highly variable, and not necessarily in a standard gradient (i.e. increasingly closed, as could be presumed when ascending from the wetland floor) along the transect from the wetland, i.e. higher, towards the outer part of the wetland.

Historically, i.e. pre-European settlement of Australia, the cover of a mature woodland canopy was in the range of 10 to 30% (Lindenmayer *et al*. 2005). Most of the results of the canopy cover assessment carried out within these quadrats sit within a relatively narrow band across this percentage (i.e. 10 to 50 %), while many quadrats had canopy cover percentages higher than 30% (particularly in those with 40% cover), typically the result of overly dense eucalypt regeneration post timber-getting and post river-regulation having altered natural hydrology to encourage thickets of tree colonisation on previously unsuitable terrain. The highest recorded canopy cover within the 72 quadrats sampled was 60 % - and that was at only one quadrat (1.1 at Reed Beds Swamp) - the next highest percentage cover was 50% (at four quadrats across three wetlands containing numerous younger trees).

Perhaps as important as examining the overall percentage canopy cover figure within any one quadrat, it should be understood that the quadrats can be generally characterised as having a patchy canopy cover - i.e. there were relatively few with an even, or consistent, canopy cover (and vegetation structure) across the quadrat (see canopy cover photos in Table 1). The overstorey structure that we see now is, again, a result of the historical land- and resource-use across this wider floodplain landscape; the cutting-down of trees and the removal of timber, and stock grazing, over more than a hundred years (Colloff 2014; chapters 6&7). So, although, in this assessment, a quadrat may have had, say, a 30 or 40% cover overall, this cover may have been unevenly distributed across the quadrat area, with a concentration of shading in one area of the quadrat and other parts of the quadrat being quite open.

While it was not within the scope of this project to measure the amount of ground timber in the quadrats, general observations and descriptions were made (see results Table 2 in the appendix). In some quadrats, it should be noted, the amount of ground timber was significantly high, at least in

some parts of the quadrat. In such instances there was a substantial suppressing effect on ground layer vegetation.

5.2 Discussion of methods

While use of the app and the canopy cover photos was considered useful in arriving at an overall canopy cover percentage figure, certain caveats or limitations should be considered. These are discussed below.

Due to a lack of height, combined with distance from the camera, shorter River Red Gum saplings were often not captured in the photo taken by the app (these should then be included in the final cover figure through visual estimation). On this matter it should be noted that the app worked best when the canopy was tall, i.e. of the order of 20 metres high or taller.

It is important to be aware of possible overlap in the photos taken in each of the two halves. We therefore found it useful to have two people present - one to deploy the app, the other to direct the app holder where the 'edges' of the photo should be.

While, in most quadrats, the measure with the app was made in two halves of the quadrat, there were some instances where the canopy cover photo was only of one within the quadrat, due to the nature and distribution of the canopy vegetation. This, for instance, was what occurred at quadrat 2.3 at Duck Swamp. This was a largely open quadrat, with one bushy River Red Gum sapling situated in the middle of the quadrat. Had the photo been taken within both of the two halves, this sapling would have been counted in both photos, therefore giving an overly high percentage cover figure. This quadrat was an illustration of where it was necessary to be not too rigid in the general method, and to be adaptive, when approaching the technique of canopy cover measurement within any one quadrat.

Due to the app's limitations in differentiating shades of white to blue, sunlight reflecting off surfaces, such as a tree trunk, or part thereof, was not be picked up by the app as a solid, and not counted as cover. This should be noted when considering the canopy cover percentage figure given by the app.

In poor light the contrast between the canopy and the background sky may not be absolute, and this reduces the app's ability to fully measure the canopy cover.

Note that the canopy cover photo gives a distorted image of the canopy that is actually present, due to the somewhat 'fish-eye' image produced by the camera. Trunks, branches, and foliage bend in the image. Only a composite image of a large number of point pictures taken across the canopy could provide a truly accurate representation of the canopy occurring within the quadrat. This is one of the limitations of the technique of broad photographic representation, as alluded to in Korhonen *et al*. (2006).

Although the primary aim was to take the app photo at the middle of each half of the quadrat, sometimes it was necessary to shift one's position slightly, e.g. where one came up against the trunk of a large tree. In such an instance standing close to a trunk could give a distorted impression of the canopy cover, with the trunk taking up most of the photo. Moving away, say a metre or two, meant the reading better represented the amount of cover occurring overhead.

It was felt that using this app was most useful when there was an even spread of canopy cover. It was also useful when there was at least a cover of, say, 20% in one half of a quadrat. When the quadrat canopy cover was of the order of less than 10% it was considered that a pure visual estimation was more useful and accurate than using the app.

5.3 Soil Assessments

This discussion section will focus on soil properties that could be influencing vegetation responses. Nitrogen (Ammonium and Nitrate forms) and Potassium are not discussed but were included in the chemical analysis.

Soil Type

The Grey/Black Vertosol soil types exhibit some cracking characteristic when dry. The soil surface is very sticky when wet and can form a thin crust when dry. These soils at this site do not seem to be self-mulching or only weakly self-mulching, instead exhibiting a more coarse blocky structure. These soils tend to be occurring closer into the wetland – quadrat 1 and/or 2. They will tend to be slow draining providing prolonged periods of waterlogging for plants.

The Sodosol soil type tended to be greyish or brown soils with a lighter texture in the topsoil that do not crack when dry, but tend to set hard. The surface soil tends to be a sandy loam or a sandy clay loam, with a clear texture change to a light clay or medium clay subsoil, and very poorly structured. This soil type tends to occurs in the transition zones immediately around the wetlands in the lower parts of the landscape – quadrat 2 or 3. These soils are also very poorly drained, with a hard setting surface soil, creating difficult conditions for plant establishment.

The Chromosol soil type includes greyish or brown soils with a clay loam or sandy clay loam surface soil that does not crack when dry but will tend to set hard. These soils do have a clear or abrupt texture change in the B horizon often with a medium clay subsoil.

The Dermosol soil type are brown soils with a sandy loam or clay loam surface with no clear or abrupt texture change in the B horizon. These soils tend to be well structured and well drained.

Both the Chromosol and the Dermosol tend to occur on slightly higher ground and further out from the wetland – Quadrat 3 or 4. The lighter texture topsoil of these soil types can dry out quickly after rain or flooding favouring shorter season vegetation types.

Organic Carbon:

The majority of quadrats had organic carbon percentages (OC%) above 2%. Seven out of the 72 quadrats sampled had organic carbon level of less than 2%. Site 3 (Top Island Original Site) quadrat 2.3 had the lowest levels with only 0.86%. Interestingly the vegetation in this quadrat is quite different from most other quadrats, in that it is dominated by small annual species (a mix of native and exotic).

Organic Carbon levels below 2% greatly decrease the degree of aggregation in soils and result in poor soil structure issues such as hard-setting, crusting, and a low porosity for water, air and root growth. Quadrats with less than 2% OC% typically had lower levels of ground cover and were typically located further out from the wetland – quadrat 2 or 3.

Five quadrats had soil organic carbon percentages of greater than 5%. Site 9 (Black Gate Lagoon) quadrat 1.1 had the highest levels with 5.42%. These quadrats were typically closer into the wetland – quadrat 1 or 2 - and had much higher levels of soil cover.

Fertility – Phosphorus and Sulphur

The majority of quadrats had surprisingly high levels of phosphorus (P) for native forests. Fifteen out of the 72 quadrats sampled had Colwell P levels of above 50 mg/kg. This would be considered a

moderately high level of P in agricultural soils for pasture production. The highest level was found at site 10 (Duck Lagoon) quadrat 1.3 with 132 mg/kg. These higher levels of P would tend to encourage weed growth and discourage the formation of soil mycorrhizal associations.

Potential sources of P in the forest could be wild horses, pigs, and soil carrying high P levels in the flood waters. In the case of Site 10 (Ducks Lagoon) there are no known wild horse issues and pigs are considered uncommon. However, there have been general observations of rabbit issues previously at this site. Elderidge *et al* (2017) found that rabbit grazing is associated with higher levels of soil P. So, it is possible rabbits may be contributing to the high P level found at site 10.

Site 2 (Top Island Burnt Site) quadrat 1.3 had the lowest P level of 16mg/kg. Low levels of P would be more typically expected in native forest sites. Native species generally prefer low P levels.

Sulphur is an essential element for vegetation growth and is particularly important for legumes and the process of nitrogen fixation. Eleven out of the 72 quadrats had high levels of sulphur (more than 15mg/kg). Site 8 (Reed Beds Swamp) quadrat 1.0 had the highest level with 25.7 mg/kg. Site 8 quadrat 1.3 had the lowest level with 4.4mg/kg. Typically the quadrats with higher levels of sulphur were closer into the wetland – quadrat 1 or 2 and generally are associated with higher levels of organic carbon.

pH and Exchangable Al%

All sites were considered acidic which is typical for soils in the region. The only exceptions in the 0 – 10cm samples were site 3 (Top Island Original Site) quadrat 2.3 with a pH in water of 6.6; site 7 (Wathours Lagoon) quadrat 1.3 with a pH in water of 6.8, and site 10 (Duck Lagoon) quadrat 1.3 with a pH in water of 7.5. Soils are considered strongly acidic when pH in $CaCl_2$ is less than 4.8 and pH in water is less than 5.5.

In addition, sixteen out of the 72 quadrats had high levels of Exchangeable Aluminium (Exch. Al above 5%) in the 0 – 10 cm sample. Site 9 (Black Gate Lagoon) quadrat 1.2 had the highest level with 12.5%. Thirty five out of the 72 quadrats had high levels of exchangeable Al (above 5%) in the 10 – 30 cm sample. Again, site 9 (Black Gate Lagoon) quadrat 1.2 had the highest level with 20%.

High Aluminium levels can affect plant root growth and particularly affect germination and early vigour of plants. High Aluminium levels can also affect the availability of nutrients for plant uptake, particularly P, N and Ca. However, native species are considered more tolerant of acid soil conditions and high exchangeable aluminium.

ESP and Ca/Mg ratio

Exchangeable sodium greatly affects soil structural stability. Soils with an ESP (exchangeable sodium percentage) of more than 6% are classed as sodic and are more likely to disperse when wet. This can result in poor soil structure issues such as hard-setting, crusting, and low porosity for water, air and root growth.

Nine of the 72 quadrats had ESPs of 6 or more in the 10 – 30cm sample. Site 3 (Top Island Original Site) quadrat 3 had the highest level with 16.95%. Typically sodic soils were found further out from the wetland – quadrat 2 and 3.

Calcium/Magnesium ratio levels below 2 also greatly affect soil structural stability and soil is likely to disperse when wet. This can result in poor soil structure issues such as hard-setting, crusting, low porosity for water, air and root growth.

The majority of quadrats had Ca/Mg ratio of less than 2 in the 0 – 10cm sample. There were 17 exceptions with Ca/Mg of more than 2 most of these were found further out from the wetland – quadrat 2 or 3. In the 10 – 30cm sample there was only one exception – site 7 (Wathours Lagoon) quadrat 1.3 – all other quadrats had Ca/Mg ratios of less than 2. This was very evident in the sampling process, with extremely hard set subsoils. This creates a very difficult environment for root growth and penetration through the soil profile with very low porosity for water and air.

Iron and Manganese

All quadrats had very high levels of iron and manganese, particularly in the surface soil samples. Generally the levels of iron and manganese significantly reduced in the 10 – 30 cm sample. Also the levels of iron and manganese reduce with distance from the wetland, with quadrat 1 generally recording higher levels than quadrat 2 and 3, except at site 1, 4, 6, and 11.

The wetting and drying cycles of these flooded soils will be associated with a chemical reduction of the iron in waterlogged conditions and then an oxidation of the iron as the soil dries, converting the iron into insoluble iron oxides. This process overtime produces the brightly coloured red streaks and mottles seen in these soils. These are the coalescing particles of iron oxides that can overtime clog soil pores and interfere with natural drainage.

Overtime the wetting and drying cycles can lead to cemented zones that restrict root and water movement and this process can also have implications for acid sulphate soil formation (McFarlane, 1999). However, organic compounds released from the decomposition of Eucalypt leaves can mobilise iron in soil enabling iron to be leached out of the root zone (McFarlane, 1999).

High levels of manganese can occur in acidic soils, however its impact on plants is highly dependent on soil factors such as microbial activity, temperature and waterlogging. The tolerances of plants to Mn toxicity is highly variable and there appears to be little consistency or pattern (Uren, 1999).

Salinity

Salinity levels were all well below critical levels. Soil salinity levels are measured using electrical conductivity (EC), high electrical conductivity indicate high salt concentrations in the soil sample. The electrical conductivity of a saturated soil extract (ECe) is used to determine the impact on plants. Soil is classed as saline if the ECe is 4dS/m or more. Salinity levels are considered satisfactory for plants if the ECe is under 1.8dS/m. The effects, even on highly sensitive species, are negligible at this level. All quadrats had ECe levels under 1.8dS/m.

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8. Appendix

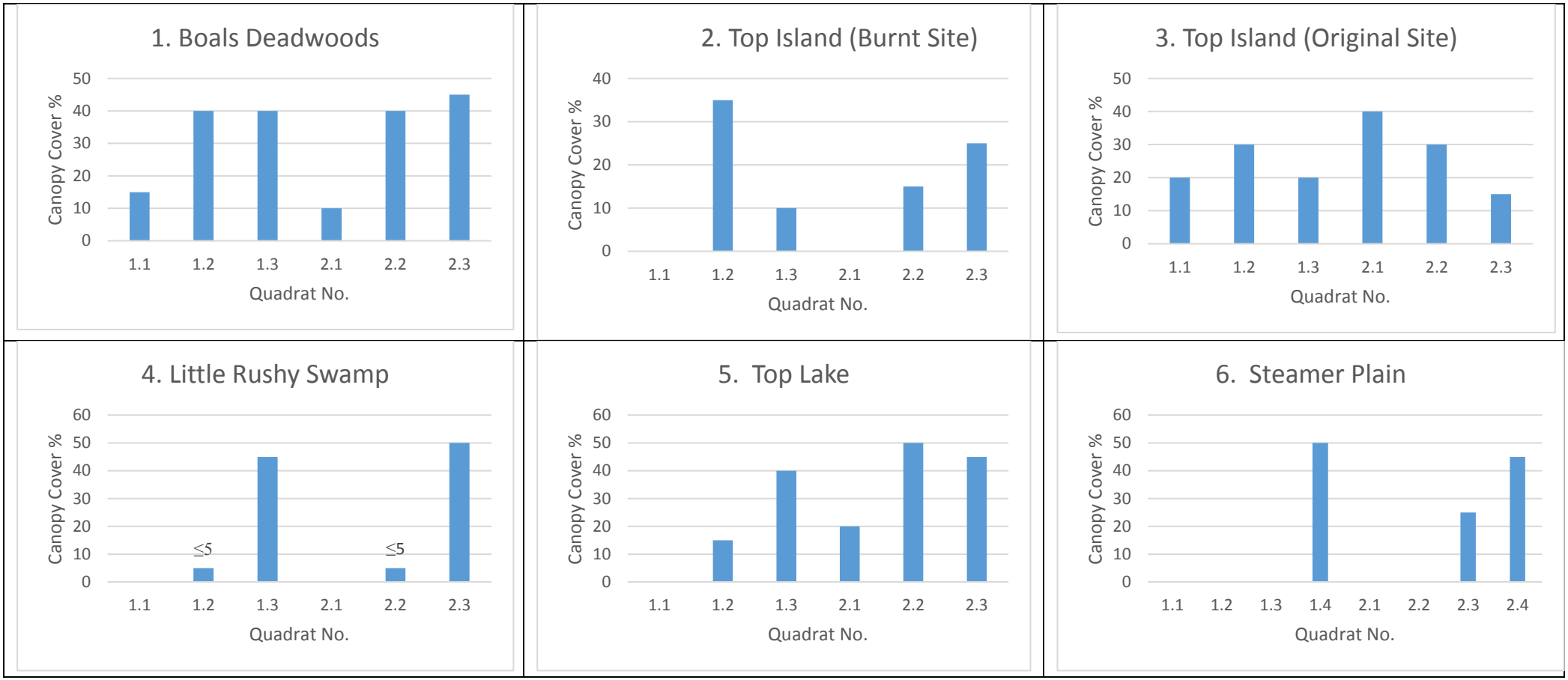
8.1 Canopy Cover Results

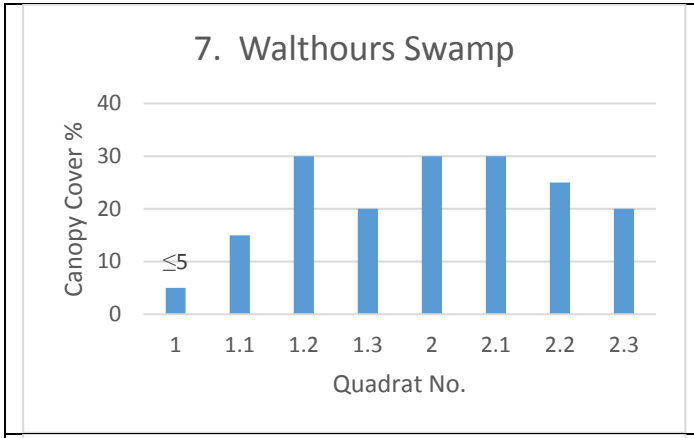
Canopy cover percentages recorded for each quadrat are presented as graphs in Table 1, and are included with canopy cover and ground cover photos in Table 2. Word descriptions of the vegetation within, and surrounding, each quadrat, are given in Table 3.

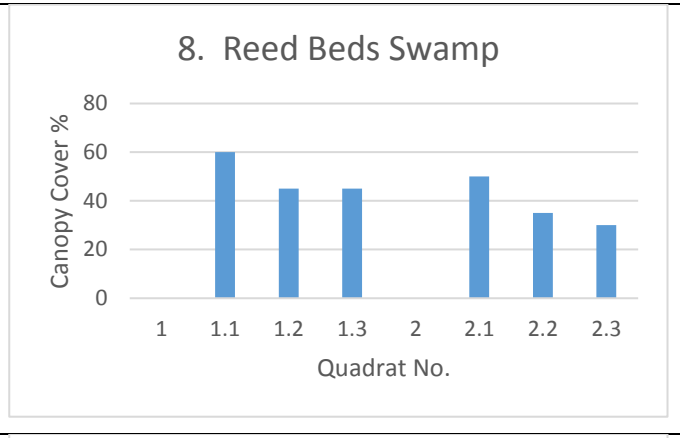
Note that the canopy cover photos are indicative only, and are not the basis on which the percentage cover figures were derived.

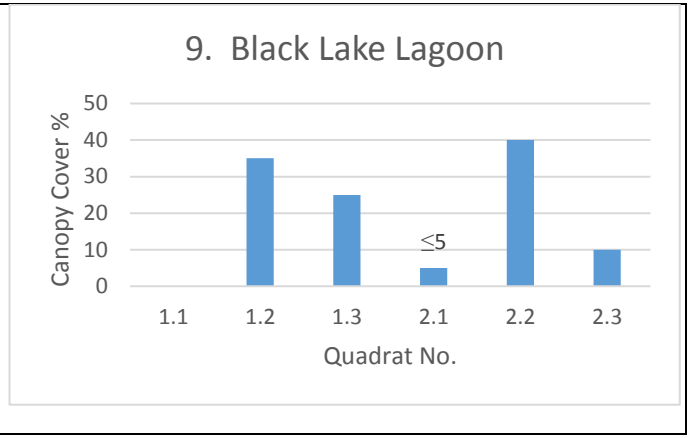
TABLE 1: CANOPY COVER PERCENTAGES FOR EACH SITE

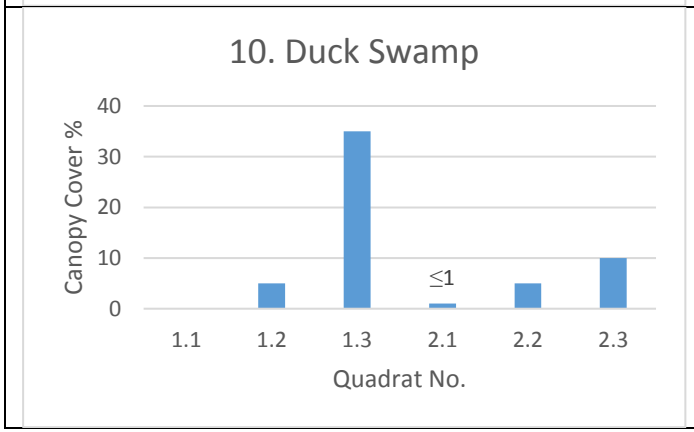
Below are the results from the canopy cover percentages assessment for each quadrat for all sites.




7. Walthours Swamp
Canopy Cover %
40
30
20
10
0
≤5
1
1.1
1.2
1.3
2
2.1
2.2
2.3
Quadrat No.


8. Reed Beds Swamp
Canopy Cover %
80
60
40
20
0
1
1.1
1.2
1.3
2
2.1
2.2
2.3
Quadrat No.


9. Black Lake Lagoon
Canopy Cover %
50
40
30
20
10
0
≤5
1.1
1.2
1.3
2.1
2.2
2.3
Quadrat No.


10. Duck Swamp
Canopy Cover %
40
30
20
10
0
≤1
1.1
1.2
1.3
2.1
2.2
2.3
Quadrat No.

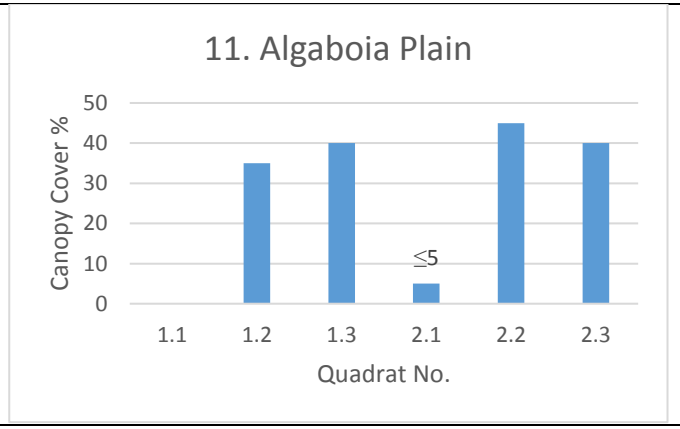

11. Algaboia Plain
Canopy Cover %
50
40
30
20
10
0
≤5
1.1
1.2
1.3
2.1
2.2
2.3
Quadrat No.

TABLE 2: CANOPY COVER AND SOIL RESULTS

Below are the results from the canopy cover and a summary of the soil assessment for all sites. This table also includes the photos taken at each site

Site 1. Boals Deadwoods

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	15	Patchy cover of saplings, and the presence of dense Giant Rush and Cumbungi, made canopy cover photo difficult to take			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al • High P • Low Ca/Mg ratio • High Mn • High Fe • Low OC%
1.2	40				Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al • Moderately High P • Low Ca/Mg • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.3	40				Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • High Mn • High Fe
2.1	10				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al • Moderate P • Low Ca/Mg ratio • High Mn • High Fe • High S

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.2	45				Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al at depth • Moderate P • High OC% • High Mn • High Fe
2.3	45				Soil type - uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • high Exch Al at depth • high P • High Mn • High Fe

Site 2. Top Island (Burnt Site)

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	NA			Soil type – uniform clay soil; greyish brown with mottles; prone to slake – most probably a Vertosol chemical analysis highlights: • Acidic pH • High Exch Al • Moderate P • Low Ca/Mg • High Mn • High Fe
1.2	35				Soil type – sandy clay loam surface soil with sandy clay sub soil; greyish brown; prone to slake – most probably a Dermosol chemical analysis highlights: • Acidic pH • High Exch Al • Low P • Low Ca/Mg • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.3	10				Soil Type – uniform sandy loam soil; greyish brown with mottles; prone to slake – most probably a Dermosol Chemical analysis highlights: • Acidic pH • High Exch Al • Low P • Low Ca/Mg • High Mn • High Fe • Low OC%
2.1	No canopy cover	**N/A**			Soil type – uniform clay soil; brownish grey with mottles; prone to slake in subsoil – most probably a Vertosol chemical analysis highlights: • Acidic pH • High Exch Al • Moderate P • High S • Low Ca/Mg • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.2	15				Soil Type – uniform sandy clay loam soil; greyish brown with mottles; prone to slake – most probably a Dermosol Chemical analysis highlights: • Acidic pH • High Exch Al • Moderate P • Low Ca/Mg • High Mn • High Fe • Low OC%
2.3	25				Soil Type – uniform sandy clay loam soil; greyish brown with mottles; prone to slake in subsoil – most probably a Dermosol Chemical analysis highlights: • Acidic pH • High Exch Al • low P • Low Ca/Mg • High Mn • High Fe • Low OC%

Site 3. Top Island (Original Site)

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	20				Soil type – uniform clay soil; brownish grey with mottles; prone to slake in subsoil – most probably a Vertosol chemical analysis highlights: • Acidic pH • High Exch Al% at depth • Moderate P • Low Ca/Mg • High Mn • High Fe
1.2	30				Soil type – sandy clay loam surface with light clay subsoil; brownish grey; prone to disperse at depth – most probably a Kurosol Chemical analysis highlights: • Acidic pH • High Exh Al% at depth • Moderate P • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.3	20				Soil type –clay loam surface with light clay subsoil; brownish grey; prone to disperse at depth – most probably a Sodosol Chemical analysis highlights: • Acidic pH • High Exh Al% at depth • Sodic at depth • Moderate P • High Mn • High Fe
2.1	40				Soil type – uniform clay soil; brownish grey with mottles; prone to slake in subsoil – most probably a Vertosol chemical analysis highlights: • Acidic pH • High Exch Al% at depth • Moderate P • Low Ca/Mg • High Mn • High Fe
2.2	30				Soil type – sandy clay loam surface with light clay subsoil; brownish grey; prone to disperse at depth – most probably a Sodosol Chemical analysis highlights: • Acidic pH • High Exh Al at depth • Sodic at depth • Moderate P • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.3	15				Soil Type – uniform sandy clay loam soil; brownish grey with mottles; prone to disperse in subsoil – most probably a Dermosol Chemical analysis highlights: • High Exch Al at depth • Sodic at depth • low P • High Mn • High Fe • Very low OC%

Site 4. Little Rushy Swamp

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	N/A			Soil type – uniform clay soil; greyish yellowish brown with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • High P • High S • Low Ca/Mg ratio • High Mn • High Fe • high OC%

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.2	≤5	Canopy cover photo not taken due to very minor canopy incursion on fringe of quadrat			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe • high OC%
1.3	45				Soil type – uniform clay soil; brownish black; stable– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe • high OC%

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.1	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • Low Ca/Mg ratio • High Mn • High Fe
2.2	≤5	Canopy cover photo not taken due to very minor canopy incursion on fringe of quadrat			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • high P • Low Ca/Mg ratio • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.3	50				Soil type – uniform clay soil; brownish black; stable– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al at depth • Moderate P • Low Ca/Mg ratio • High Mn • High Fe

Site 5. Top Lake

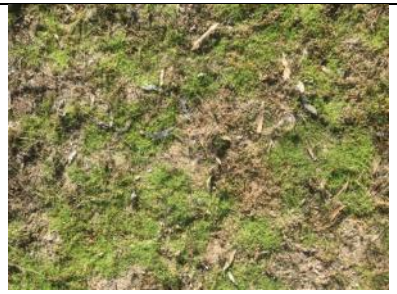
Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High exch Al • High P • Low Ca/Mg ratio • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.2	15				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe
1.3	35				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Mn • High Fe • High OC%
2.1	20				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake – most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • High P • Low Ca/Mg ratio • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.2	50				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe
2.3	45				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% at depth • Moderate P • Low Ca/Mg ratio • High Mn • High Fe

Site 6. Steamer Plain

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe
1.2	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.3	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe
1.4	50				Soil type – sandy clay loam surface soil over a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe
2.1	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe • Low OC%

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.2	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderately high P • Low Ca/Mg ratio • High Mn • High Fe
2.3	25				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • Sodic at depth • High Mn • High Fe
2.4	50				Soil type – clay loam surface soil over a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH • Moderate P • Sodic at depth • High S • High Mn

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
					• High Fe • High OC%

Site 7. Walthours Swamp

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.0	≤5	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg ratio • High Mn • High Fe
1.1	15				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • Low Ca/Mg ratio • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.2	30				Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderately high P • High Mn • High Fe
1.3	20	 NB. This photo does not pick up the red gum saplings on this quadrat			Soil type – fine sandy clay loam topsoil with clay loam subsoil and sandy loam at depth – most probably a Dermosol Chemical Analysis highlights: • high P • High Mn • High Fe
2.0	30		**No photo taken**		Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.1	30				Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe
2.2	25				Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • low P • Low Ca/Mg ratio • High Mn • High Fe • Low OC%
2.3	20				Soil type – fine sandy clay loam topsoil with sandy clay loam subsoil and sandy loam at depth – most probably a Dermosol Chemical Analysis highlights: • high P • High Mn • High Fe

8. Reed Beds Swamp

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.0	No canopy cover	N/A	No photo taken		Soil type – uniform clay soil; brownish black with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe • High OC%
1.1	60				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High Mn • High Fe
1.2	45				Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • High P • High Mn • High Fe • High OC%

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.3	45				Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Sodosol Chemical Analysis highlights: • Acidic pH • Moderate P • Sodic at depth • High Mn • High Fe
2.0	No canopy cover	N/A	No photo taken		Soil type – uniform clay soil; brownish black with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High S • Low Ca/Mg ratio • High Mn • High Fe • High S
2.1	50				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% at depth • Moderate P • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
					• High OC%
2.2	35				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Low P • High Mn • High Fe
2.3	30				Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to slake at depth– most probably a Sodosol Chemical Analysis highlights: • Moderate P • Sodic at depth • High Mn • High Fe

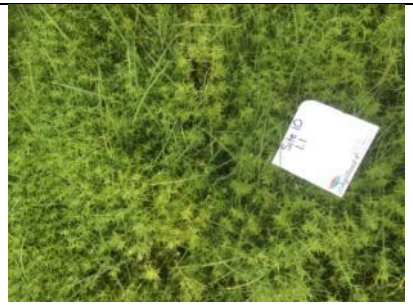
9. Black Gate Lagoon

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	N/A			Soil type – sandy loam surface soil with a light clay subsoil; brownish black; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Moderate P • High S • High OC% • Low Ca/Mg • High Mn • High Fe
1.2	35				Soil type – fine sandy clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • Low Ca/Mg • Low S • Low OC% • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.3	25				Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Sodosol Chemical Analysis highlights: • Moderate P • Sodic at depth • High Mn • High Fe
2.1	≤5	Canopy cover photo not taken due to very minor canopy incursion on fringe of quadrat	No photo taken		Soil type – sandy loam surface soil with a light clay subsoil; brownish black; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Moderate P • High OC% • Low Ca/Mg • High Mn • High Fe
2.2	40				Soil type – fine sandy clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Chromosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • Low Ca/Mg • Low S • High Mn

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
					• High Fe
2.3	10				Soil type – clay loam surface soil with a light clay subsoil; brownish grey with red mottles; prone to disperse at depth– most probably a Sodosol Chemical Analysis highlights: • Moderate P • Sodic at depth • High Mn • High Fe

10. Duck Swamp

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	N/A			Soil type – uniform clay soil; brownish black with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • High P • High Mn • High Fe
1.2	5				Soil type – uniform clay soil; brownish black with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • High Mn • High Fe
1.3	35				Soil type – sandy clay with a sandy loam subsoil; brownish grey with red mottles; prone to disperse– most probably a Dermosol Chemical Analysis highlights: • Very High P • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.1	<1 (effectively no canopy cover)	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High Mn • High Fe • High OC%
2.2	5				Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High P • High Mn • High Fe
2.3	10				Soil type – sandy clay loam with a clay sand subsoil on course sand; grayish brown; prone to slake– most probably a Dermosol Chemical Analysis highlights: • High P • High Mn • High Fe

11. Algaboia Plain

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
1.1	No canopy cover	N/A			Soil type – uniform clay soil; brownish grey with red mottles; prone to disperse at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • High P • Low Ca/Mg • High Mn • High Fe • Low OC%
1.2	35		**NA**	**NA**	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • Low Ca/Mg • High Mn • High Fe
1.3	40		No photo taken	No photo taken	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Mn • High Fe

Quadrat No.	Canopy Cover %	Canopy Cover photo	Ground Cover photo	Soil Profile photo	Soil Type and key features
2.1	≤5	Canopy cover photo not taken due to very minor canopy incursion on fringe of quadrat	No photo taken	No photo taken	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • High Exch Al% • Moderate P • High Mn • High Fe
2.2	45		No photo taken	No photo taken	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Mn • High Fe
2.3	40		No photo taken	No photo taken	Soil type – uniform clay soil; brownish grey with red mottles; prone to slake at depth– most probably a Vertosol Chemical Analysis highlights: • Acidic pH • Moderate P • High Mn • High Fe

TABLE 3: CANOPY COVER QUADRAT DESCRIPTIONS

Site 1. Boals Deadwoods Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	15	Half a dozen moderate-sized saplings; a few small saplings; overall very open; tall forest on two sides
1.2	40	One big tree; open cover of small saplings; parts of crowns of adjoining trees; a little fallen timber; surrounded by moderately dense tall forest
1.3	40	Reasonably even distribution of tall thin trees; sparse cover of straggly saplings; surrounded by tall moderately dense forest; numerous small fallen timber
2.1	10	Open area of Giant Rush in one half
2.2	40	Canopies of two large trees mostly within quadrat; about 10 small saplings; a couple of large pieces of fallen timber
2.3	45	A reasonable scattering of tall, narrow trees; a little fallen timber

Site 2. Top Island (Burnt Site) Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	No canopy cover	-
1.2	35	Moderately open surroundings, particularly towards wetland
1.3	10	Very largely open; some dead wood; one moderate-sized sapling; two small saplings
2.1	No canopy cover	-
2.2	15	Sparse moderate-sized saplings; small patch of small saplings
2.3	25	Patchy; some moderate-sized trees; a lot of small poles

3. Top Island (Original Site) Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	20	Half of the quadrat with no canopy cover; a group of tall saplings; tall dead stag; surrounded by fairly dense, but not tall, forest
1.2	30	Fallen timber; scattered moderate-sized trees; tall moderately-open trees surrounding, more open towards 1.3
1.3	20	Scattered moderate-sized trees; group of scattered very small saplings

2.1	40	Fallen timber; large saplings; small to moderate-sized trees
2.2	30	
2.3	15	

4. Little Rushy Swamp Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	No canopy cover	Giant Rush
1.2	≤5	Very open on two sides; forest on the other two sides (with a little gap in between)
1.3	45	A few small to moderate-sized trees; moderate amount of ground timber; many large saplings
2.1	No canopy cover	-
2.2	≤5	
2.3	50	Four tall, moderate-sized trees; patchy scattering of saplings

5. Top Lake Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	No canopy cover	-
1.2	15	Very largely open; a couple of small to moderate-sized trees; a few large saplings; some ground timber
1.3	40	Several moderate-sized trees
2.1	20	One moderately-large tree; two small saplings; largely open surrounding vegetation
2.2	50	Open towards 2.1; scattered tall moderate-sized trees; a block of fallen timber
2.3	45	Half a dozen tall, small to moderate-sized trees; a few saplings; a little ground timber; surrounding forest moderately dense, moderately tall; largish open patches

6. Steamer Plain Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments

1.1	No canopy cover	-
1.2	No canopy cover	-
1.3	No canopy cover	-
1.4	50	Many stems; fairly even cover and structure/tree size; thick adjacent vegetation cover
2.1	No canopy cover	-
2.2	No canopy cover	-
2.3	25	Half of quadrat entirely open; quadrat on the edge of dense forest
2.4	45	Moderately dense forest surrounding

7. Walthours Swamp Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.0	≤5	Giant Rush and Cumbungi; part of quadrat of small to moderate-sized trees; open on all sides
1.1	15	Part of quadrat of two moderate-sized trees; approximately 10 saplings; dead stag; two large logs; moderately open on all sides
1.2	30	Parts of the canopies of two small to moderate-sized trees; approximately two dozen small saplings; small amount of ground timber
1.3	20	Two small to moderate-sized trees; a corner of saplings; fairly open quarter to half of quadrat; some ground timber; fairly open all around
2.0	30	One small to moderate-sized tree; approximately two dozen saplings; fallen-over sapling sprouting upwards; very little ground timber
2.1	30	A couple of small to moderate-sized trees; two large saplings; approximately a dozen small saplings; one stag; a couple of logs
2.2	25	Two moderate-sized trees; approximately 10 saplings; half of quadrat largely open; little ground timber; moderately open on all sides
2.3	20	Approximately half a dozen small to moderate-sized trees; about 20 saplings; large amount of ground timber

8. Reed Beds Swamp Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.0	No canopy cover	-
1.1	60	One large old tree in quadrat bending in to quadrat; high density of small trees on other half; small amount of small ground timber
1.2	45	Clump of moderate-sized trees; one large dead tree; small group of saplings

1.3	45	Canopies of two moderately-large trees; a few small trees; effectively no fallen timber; fairly open on all sides
2.0	No canopy cover	-
2.1	50	Mostly evenly scattered small trees; moderate amount of fallen timber; fairly dense forest on three sides
2.2	35	A few moderately-sized trees; a few small trees; some ground timber; moderately dense forest on all sides
2.3	30	A scattering of moderate-sized trees; fairly large open corner of the quadrat; a couple of large logs; fairly open woodland on three sides of the quadrat, moderately dense on the other side

9. Black Gate Lagoon Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	No canopy cover	Small branches of one small stag towards one corner; a large log; Giant Rush
1.2	35	Four small to moderately-sized trees; part canopies of two moderately-sized trees; a few tall saplings; half a dozen very small saplings; moderate amount of ground timber concentrated towards one edge of the quadrat
1.3	25	Two moderately-large trees; one moderate-sized and two small trees; a little ground timber; half a dozen Golden Spray shrubs; moderately open on all sides outside the quadrat
2.1	≤5	Two overhanging branches from adjacent trees; moderate amount of fallen timber concentrated towards one corner; Giant Rush and Azolla
2.2	40	Part canopies of two large adjacent trees; two moderately-sized trees; three small trees; a little ground timber; scattered shrubs of Golden Spray
2.3	10	Most of canopy of one moderate-sized tree in one corner; parts of canopies of two adjoining moderate-sized trees; a little ground timber; fairly open on all sides

10. Duck Swamp Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	No canopy cover	-
1.2	5	Two saplings and one fairly narrow stag; a little ground timber; very open on three sides, dense sapling regeneration on the west side
1.3	35	Fairly even spread of 'bushy' tall saplings; one fairly narrow stag; moderate amount of medium-sized ground timber, mostly concentrated in one area; surrounded by similar sapling vegetation, more open to the north
2.1	<1	Effectively no canopy cover - tiny part of the branches of an immediately adjacent stag; large fallen tree; one small sapling

2.2	5	Multi-stemmed sapling in one corner; three tall thin stags; a little fallen timber; very open on all sides
2.3	10	Two largish saplings; big stag on one edge; moderate amount of ground timber, concentrated in one corner; dense saplings on three sides outside the quadrat, fairly open to the west

11. Algaboia Plain Canopy Cover Comments

Quadrat No.	Canopy Cover %	Comments
1.1	No canopy cover	Open all around
1.2	35	Two big trees on the periphery; approximately 20 moderately-large saplings across one corner; one long log; fine ground timber across one corner
1.3	40	Part canopies of one large, and one moderate-sized, tree; a few small to moderate-sized trees; half a dozen saplings; ground timber thick across one corner
2.1	≤5	One large sapling in one corner; half a dozen very small saplings
2.2	45	Part canopy of one large tree, and one large tree (mostly with dieback); half a dozen tall saplings; small amount of fallen timber, mostly within one corner
2.3	40	Two large trees (with broken canopies); two multi-stemmed saplings; one quite tall thin tree; a concentration of ground timber in two corners

8.2 Soil Assessments - Field Descriptions Data

Site 1 Boals Deadwoods

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	Vertosol	Quadrat 3	Texture	Structural Stability	Colour	Vertosol
0 – 10 cm	Light Clay	Slaked	10YR ¾ Dark Brown			Light clay	stable	10YR ¾ Dark Brown	
10 – 20 cm	light Clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	slaked	10YR 5/2 Greyish yellow brown Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 5/2 Greyish yellow brown Mottle:5YR 5/8 bright reddish brown	
60 cm	light medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 2				vertosol	Quadrat 2				verstosol
0 – 10 cm	light clay	slaked	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
10 – 20 cm	light clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	slight dispersion	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
60cm	light medium clay	slight dispersion	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slight dispersion	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

10 – 20cm	light medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slight dispersion	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slight dispersion	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

Site 2 Top Island (burnt site)

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	dermosol	Quadrat 3	Texture	Structural Stability	Colour	dermosol
0 – 10 cm	Sandy loam	Partially Slaked	10YR 4/2 Greyish yellowish brown			Sandy clay loam	stable	7.5YR 6/2 Greyish brown Mottle:5YR 5/8 bright reddish brown	
10 – 20 cm	Sandy loam	partially slaked	10YR 5/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			sandy loam	stable	10YR 5/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	Sandy loam	slight dispersion	7.5YR 5/2 Greyish brown Mottle:5YR 5/8 bright reddish brown			sandy clay loam	slaked	7.5YR 5/2 Greyish yellow brown Mottle:5YR 5/8 bright reddish brown	
60 cm	sandy loam	slaked	7.5YR 6/2 Greyish brown Mottle:5YR 5/8 bright reddish brown			sandy clay	slaked	7.5YR 6/2 Greyish brown Mottle:5YR 5/8 bright reddish brown	
Quadrat 2				dermosol	Quadrat 2				dermosol
0 – 10 cm	sandy clay loam	stable	7.5YR 5/2 Greyish brown Mottle:5YR 5/8 bright reddish brown			sandy clay loam	stable	7.5YR 5/2 Greyish brown Mottle:5YR 5/8 bright reddish brown	
10 – 20 cm	sandy clay	slaked	7.5YR 5/2 Greyish brown			sandy clay loam	slaked	7.5YR 5/2 Greyish brown	
20 – 30 cm	sandy clay	slaked	7.5YR 5/2 Greyish brown			sandy clay loam	slightly dispersed	7.5YR 5/2 Greyish brown	
60cm	sandy clay	dispersed	7.5YR 5/2 Greyish brown			sandy clay loam	dispersed	7.5YR 5/2 Greyish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	slaked	7.5YR 5/2 Greyish brown Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	light clay	slaked	7.5YR 5/2 Greyish brown Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 4/2 Greyish brown Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	slaked	7.5YR 5/2 Greyish brown			light clay	slaked	7.5YR 4/2 Greyish brown	

			Mottle:5YR 5/8 bright reddish brown					Mottle:5YR 5/8 bright reddish brown	

Site 3 Top Island (original site)

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	sodosol	Quadrat 3	Texture	Structural Stability	Colour	dermosol
0 – 10 cm	clay loam	Stable	7.5YR 5/1 brownish grey			sandy clay loam	stable	7.5YR 4/1 brownish grey	
10 – 20 cm	light Clay	stable	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			sandy loam	slaked	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			sandy loam	dispersed	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
60 cm	medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	dispersed	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 2				Kurosol	Quadrat 2				sodosol
0 – 10 cm	sandy clay loam	stable	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			sandy clay loam	stable	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
10 – 20 cm	light clay	stable	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	slaked	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
60cm	light clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	dispersed	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	light clay	slaked	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	slaked	7.5YR 5/1 brownish grey			light	slaked	7.5YR 5/1 brownish grey	

			Mottle:5YR 5/8 bright reddish brown			clay		Mottle:5YR 5/8 bright reddish brown	

Site 4 Little Rushy Swamp

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	vertosol	Quadrat 3	Texture	Structural Stability	Colour	vertosol
0 – 10 cm	Light Clay	Stable	10YR 3/1 brownish black			Light clay	stable	10YR 3/1 brownish black	
10 – 20 cm	medium clay	stable	10YR 3/2 Brownish black			light clay	slaked	10YR 3/2 Brownish black	
20 – 30 cm	medium clay	stable	10YR 4/2 Greyish yellow brown			light clay	slaked	10YR 4/2 Greyish yellow brown	
60 cm	medium clay	slaked	10YR 4/1 Brownish Grey			medium clay	slaked	10YR 3/2 Brownish black	
Quadrat 2				vertosol	Quadrat 2				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 Brownish Grey			light clay	stable	10YR 4/1 Brownish Grey	
10 – 20 cm	light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
60cm	medium clay	slight dispersion	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			medium clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light clay	stable	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

20 – 30 cm	medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

Site 5 Top Lake

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	vertosol	Quadrat 3	Texture	Structural Stability	Colour	vertosol
0 – 10 cm	Light Clay	Stable	10YR 3/2 brownish black			Light clay	stable	10YR 4/1 brownish grey	
10 – 20 cm	light medium clay	slaked	10YR 3/2 Brownish black			light clay	slaked	10YR 4/2 Greyish yellow brown	
20 – 30 cm	medium clay	slaked	10YR 3/2 Brownish black			light medium clay	slaked	10YR 4/2 Greyish yellow brown	
60 cm	medium clay	slaked	10YR 3/1 Brownish black			medium clay	slaked	10YR 4/1 Brownish grey	
Quadrat 2				vertosol	Quadrat 2				vertosol
0 – 10 cm	light clay	stable	10YR 4/2 Greyish yellowish brown			light clay	stable	10YR 4/1 Brownish Grey	
10 – 20 cm	light clay	stable	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	10YR 4/1 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	slaked	10YR 4/1 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/1 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
60cm	light medium clay	slaked	10YR 4/1 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			medium clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			light clay	stable	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	light clay	stable	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	slaked	10YR 4/1 Brownish Grey			light clay	slaked	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	

			Mottle:5YR 5/8 bright reddish brown						

Site 6 Steamer Plain

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 4	Texture	Structural Stability	Colour	chromosol	Quadrat 4	Texture	Structural stability	Colour	chromosol
0 – 10 cm	Clay Loam	stable	10YR 4/1 brownish grey			Clay loam		10YR 4/1 brownish grey	
10 – 20 cm	Light clay	stable	10YR 5/1 brownish grey			Light clay		10YR 5/1 brownish grey	
20 – 30 cm	Light clay	stable	10YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown			Light clay		10YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
60cm	Medium Clay	slightly dispersed	10YR 5/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay		10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown	
Quadrat 3	Texture	Structural Stability	Colour	Vertosol	Quadrat 3	Texture	Structural Stability	Colour	Vertosol
0 – 10 cm	Light Clay	Slaked	10YR 4/1 brownish grey			Light clay	stable	10YR 4/1 brownish grey	
10 – 20 cm	light medium clay	slaked	10YR 4/1 Brownish grey			light medium clay	slaked	10YR 4/1 brownish grey	
20 – 30 cm	light medium clay	slaked	10YR 4/2 Greyish yellowish brown			light medium clay	slaked	10YR 4/2 Greyish yellow brown	
60 cm	medium clay	dispersed	10YR 4/2 Greyish yellowish brown			light medium clay	slightly dispersed	10YR 4/2 Greyish yellow brown	
Quadrat 2				vertosol	Quadrat 2				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 brownish Grey			light clay	stable	10YR 4/1 Brownish Grey	
10 – 20 cm	light medium clay	stable	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	stable	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	slightly dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slightly dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	

60cm	medium clay	dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			medium clay	dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 brownish Grey			light clay	stable	10YR 4/1 Brownish Grey	
10 – 20cm	light medium clay	dispersed	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	dispersed	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 5/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	

Site 7 Wathours Lagoon

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	dermosol	Quadrat 3	Texture	Structural Stability	Colour	dermosol
0 – 10 cm	fine sandy clay loam	N/A	10YR 3/1 Brownish black			fine sandy clay loam	stable	10YR 3/1 Brownish black	
10 – 20 cm	Clay loam		10YR 3/1 Brownish black			sandy clay loam	stable	10YR 3/1 Brownish black	
20 – 30 cm	clay loam		10YR 3/1 Brownish black			sandy clay loam	dispersed	10YR 3/1 Brownish black	
60 cm	sandy loam		10YR 5/2 Greyish yellow brown			sandy loam	slaked	10YR 5/2 Greyish yellow brown	
Quadrat 2				vertosol	Quadrat 2				vertosol
0 – 10 cm	clay loam	stable	10YR 4/1 brownish grey			light clay	stable	10YR 4/1 brownish grey	
10 – 20 cm	light clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
20 – 30 cm	light clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
60cm	light medium clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 brownish grey			light clay	stable	10 YR 4/1 brownish grey	
10 – 20cm	light clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
20 – 30 cm	light clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
60cm	light medium clay	dispersed	10YR 4/1 brownish grey			light medium clay	slaked	10YR 4/1 brownish grey	
Quadrat 0				vertosol	Quadrat 0				vertosol
0 – 10 cm	Light clay	slightly dispersed	10YR 4/1 brownish grey			light clay	stable	10YR 4/1 brownish grey	

10 – 20 cm	Light clay	dispersed	10YR 5/1 brownish grey			light medium clay	slaked	10YR 5/1 brownish grey	
20 – 30 cm	light clay	dispersed	10YR 5/1 brownish grey			light medium clay	slaked	10YR 5/1 brownish grey	

Site 8 Reed Beds Swamp

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	sodosol	Quadrat 3	Texture	Structural Stability	Colour	chromosol
0 – 10 cm	clay loam	stable	10YR 4/1 Brownish grey			clay loam	stable	10YR 4/1 Brownish grey	
10 – 20 cm	light clay	slaked	10YR 4/1 Brownish grey			light clay	stable	10YR 4/1 Brownish grey	
20 – 30 cm	light clay	slaked	10YR 4/1 Brownish grey			light clay	stable	10YR 4/1 Brownish grey	
60 cm	light clay	slaked	10YR 4/1 brownish Grey			light clay	dispersed	10YR 4/1 Brownish grey	
Quadrat 2				chromosol	Quadrat 2				chromosol
0 – 10 cm	clay loam	stable	10YR 4/1 brownish grey			clay loam	stable	10YR 4/1 brownish grey	
10 – 20 cm	light clay	stable	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
20 – 30 cm	light clay	stable	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
60cm	light clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 brownish grey			light clay	stable	10 YR 4/1 brownish grey	
10 – 20cm	light clay	stable	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
20 – 30 cm	light clay	slaked	10YR 4/1 brownish grey			light clay	slaked	10YR 4/1 brownish grey	
60cm	light clay	slaked	10YR 4/1 brownish grey			light clay	dispersed	10YR 4/1 brownish grey	
Quadrat 0				vertosol	Quadrat 0				vertosol
0 – 10 cm	Light clay	stable	10YR 3/1 brownish black			light clay	stable	10YR 3/1 brownish black	

10 – 20 cm	Light medium clay	slaked	10YR 4/1 brownish grey			light medium clay	dispersed	10YR 4/1 brownish grey	
20 – 30 cm	light medium clay	dispersed	10YR 4/1 brownish grey			light medium clay	dispersed	10YR 4/1 brownish grey	

Site 9 Black Gate Lagoon

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	sodosol	Quadrat 3	Texture	Structural Stability	Colour	sodosol
0 – 10 cm	Clay loam	Stable	10YR 3/1 brownish black			clay loam	stable	10YR 3/1 brownish black	
10 – 20 cm	light medium clay	slaked	10YR 4/1 Brownish grey			light medium clay	stable	10YR 4/1 Brownish grey	
20 – 30 cm	light medium clay	dispersed	10YR 4/1 Brownish grey			light medium clay	dispersed	10YR 4/1 Brownish grey	
60 cm	light medium clay	slightly dispersed	10YR 4/2 Greyish yellow brown			light medium clay	slightly dispersed	10YR 4/2 Greyish yellow brown	
Quadrat 2				chromosol	Quadrat 2				chromosol
0 – 10 cm	fine sandy clay loam	stable	10YR 4/1 brownish Grey			fine sandy clay loam	stable	10YR 4/1 Brownish Grey	
10 – 20 cm	light clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light clay	dispersed	10YR 5/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
60cm	light medium clay	slightly dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	dispersed	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				chromosol	Quadrat 1				chromosol
0 – 10 cm	sandy loam	stable	10YR 4/2 Greyish yellowish brown Mottle:5YR 5/8 bright reddish brown			sandy loam	stable	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	light medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

20 – 30 cm	light medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

Site 10 Duck Swamp

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	dermosol	Quadrat 3	Texture	Structural Stability	Colour	dermosol
0 – 10 cm	sandy clay	Stable	7.5YR 4/2 greyish brown			sandy clay loam	stable	7.5YR 4/2 greyish brown	
10 – 20 cm	loamy sand	slightly dispersed	7.5YR 4/2 greyish brown			clayey sand	slaked	7.5YR 6/2 brownish grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	loamy sand	dispersed	7.5YR 4/2 greyish brown			loamy sand	slaked	7.5YR 6/2 brownish grey Mottle:5YR 5/8 bright reddish brown	
60 cm	sandy clay	dispersed	7.5YR 6/2 greyish brown Mottle:5YR 5/8 bright reddish brown			coarse sand	slaked	7.5YR 6/2 brownish grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 2				vertosol	Quadrat 2				chromosol
0 – 10 cm	light clay	stable	7.5YR 3/2 brownish black			sandy clay loam	stable	7.5YR 3/1 brownish black	
10 – 20 cm	light medium clay	dispersed	7.5YR 3/2 brownish black			light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	slaked	7.5YR 3/1 brownish black Mottle:5YR 5/8 bright reddish brown			light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
60cm	light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	7.5YR 3/1 brownish black Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 3/1 brownish black Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	

20 – 30 cm	light medium clay	dispersed	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown			light clay	slaked	7.5YR 4/1 brownish grey Mottle:5YR 5/8 bright reddish brown	

Site 11 Algaboia Plain

Transect 1				Soil Profile Classification	Transect 2				Soil Profile Classification
Quadrat 3	Texture	Structural Stability	Colour	vertosol	Quadrat 3	Texture	Structural Stability	Colour	vertosol
0 – 10 cm	light Clay	Stable	10YR 4/1 brownish grey			light clay	stable	10YR 4/1 brownish grey	
10 – 20 cm	light medium clay	stable	10YR 4/1 Brownish grey			light medium clay	slaked	10YR 4/1 Brownish grey	
20 – 30 cm	light medium clay	slaked	10YR 4/1 Brownish grey			light medium clay	slaked	10YR 4/1 Brownish grey	
60 cm	light medium clay	slaked	10YR 4/1 Brownish grey			light medium clay	slaked	10YR 4/1 Brownish grey	
Quadrat 2				vertosol	Quadrat 2				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 brownish Grey			light clay	stable	10YR 4/1 Brownish Grey	
10 – 20 cm	light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
60cm	light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown	
Quadrat 1				vertosol	Quadrat 1				vertosol
0 – 10 cm	light clay	stable	10YR 4/1 brownish Grey Mottle:5YR 5/8 bright reddish brown			light clay	stable	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
10 – 20cm	light medium clay	slaked	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	
20 – 30 cm	light medium clay	dispersed	10YR 4/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown			light medium clay	slaked	10YR 5/1 Brownish Grey Mottle:5YR 5/8 bright reddish brown	

8.3 Soil chemical Analysis data

Soil Chemical Analysis Data – 0 – 10cm Samples

Site 1 Boals Deadwood

Phosphorus Colwell	Potassium Colwell	Sulphur	Organic Carbon	Conductivity	pH Level (CaCl2)	pH Level (H2O)	DTPA Copper	DTPA Iron	DTPA Manganese	DTPA Zinc	Exc. Aluminium	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	sum of cations	Exch Al%	ESP	Ca/Mg	Quadrat
mg/Kg	mg/Kg	mg/Kg	%	dS/m	pH	pH	mg/Kg	mg/Kg	mg/Kg	mg/Kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g					
60	204	9.6	1.82	0.032	4.2	5.2	3.36	384.34	36.55	2.80	1.346	5.01	3.38	0.43	0.17	10.336	13.02245	1.644737	1.482249	1.1
55	173	8.4	3.27	0.038	4.0	5.2	2.63	426.87	52.99	2.72	0.928	5.82	3.87	0.38	0.20	11.198	8.287194	1.786033	1.503876	1.2
40	208	18.1	3.55	0.046	4.0	5.1	2.58	431.14	29.06	3.52	1.121	6.31	4.45	0.54	0.17	12.591	8.903185	1.350171	1.417978	2.1
79	238	10.9	4.77	0.051	4.4	5.5	1.64	445.17	27.57	3.01	0.312	11.15	4.59	0.47	0.19	16.712	1.866922	1.136908	2.429194	1.3
72	242	11.5	4.78	0.048	4.5	5.6	2.56	432.68	41.09	3.40	0.249	11.43	4.29	0.52	0.18	16.669	1.493791	1.079849	2.664336	2.3
48	236	13.1	5.02	0.041	4.3	5.3	2.07	421.72	42.57	3.05	0.436	9.59	4.37	0.50	0.23	15.126	2.882454	1.520561	2.194508	2.2

Site 2 Top Island (burnt site)

44	227	13.6	2.50	0.061	4.1	5.0	2.25	364.82	89.12	2.89	0.802	5.11	3.00	0.49	0.12	9.522	8.4226	1.260239	1.703333	1.1
21	155	9.1	3.06	0.029	4.2	5.4	1.65	281.10	44.20	2.03	0.589	3.50	2.31	0.30	0.15	6.849	8.599796	2.190101	1.515152	1.2
16	123	6.0	1.64	0.020	4.4	5.6	0.79	176.25	27.99	1.09	0.218	1.95	1.05	0.18	0.06	3.458	6.304222	1.735107	1.857143	1.3
33	219	21.3	3.67	0.087	4.0	4.8	2.19	402.63	46.89	3.14	0.967	5.64	3.22	0.48	0.14	10.447	9.256246	1.340098	1.751553	2.1
30	118	7.1	1.18	0.017	4.5	5.6	1.00	246.25	42.57	1.13	0.431	1.86	0.99	0.19	0.08	3.551	12.13743	2.252887	1.878788	2.2
14	120	5.2	1.24	0.017	4.2	5.4	1.03	206.70	25.86	0.89	0.468	1.76	1.33	0.21	0.07	3.838	12.19385	1.823867	1.323308	2.3

Site 3 Top Island (original site)

39	173	15.1	3.70	0.051	4.1	5.1	2.67	439.71	60.65	2.61	0.558	5.91	2.99	0.35	0.11	9.918	5.626134	1.109095	1.976589	1.1
25	217	12.2	4.39	0.054	4.3	5.4	1.61	321.27	51.45	1.91	0.224	6.53	3.03	0.43	0.15	10.364	2.161328	1.447318	2.155116	1.2
32	183	8.5	4.34	0.049	4.4	5.7	1.63	352.15	70.22	1.19	0.491	6.11	4.34	0.34	0.63	11.911	4.12224	5.289228	1.407834	1.3
27	165	13.1	4.51	0.060	4.3	5.6	2.26	369.42	39.89	2.37	0.200	6.97	3.63	0.35	0.18	11.33	1.765225	1.588703	1.92011	2.1
24	220	11.4	4.15	0.049	4.6	5.7	2.25	338.57	37.05	1.88	0.181	7.05	3.88	0.46	0.20	11.771	1.537677	1.699091	1.81701	2.2
11	90	6.3	0.86	0.098	6.0	6.6	1.06	144.06	24.00	0.42	0.049	5.21	2.38	0.16	0.48	8.279	0.591859	5.797802	2.189076	2.3

Site 4 Little Rushy Swamp

52	435	15.2	4.95	0.070	4.1	5.3	2.43	353.92	30.97	2.61	0.449	10.31	6.43	0.99	0.33	18.509	0.024258	1.782916	1.603421	1.1
44	363	10.2	4.73	0.053	4.3	5.4	2.62	340.64	47.75	2.23	0.367	9.06	5.69	0.86	0.27	16.247	0.022589	1.661845	1.592267	1.2
26	349	8.7	4.59	0.054	4.4	5.6	2.32	336.84	42.42	1.70	0.351	13.09	7.88	0.82	0.26	22.401	0.015669	1.160662	1.661168	1.3
56	370	9.4	2.75	0.066	4.3	5.3	2.30	269.51	49.29	1.17	0.691	9.50	6.87	0.84	0.30	18.201	0.037965	1.648261	1.382824	2.1
61	412	7.9	3.89	0.058	4.3	5.4	2.03	314.10	48.86	1.53	0.465	8.72	5.41	1.01	0.26	15.865	0.02931	1.638828	1.61183	2.2
33	431	4.9	4.23	0.038	4.4	5.7	2.03	354.58	50.60	2.39	0.575	11.73	6.27	1.02	0.25	19.845	0.028975	1.259763	1.870813	2.3

Site 5 Top Lake

75	285	11.7	2.85	0.043	4.0	5.1	3.94	566.10	101.61	3.25	1.005	6.08	3.91	0.62	0.14	11.755	0.085496	1.190983	1.554987	1.1
38	244	12.4	3.57	0.038	4.3	5.4	2.33	389.91	38.77	1.88	0.523	6.30	4.14	0.48	0.16	11.603	0.045075	1.378954	1.521739	1.2
36	317	8.9	4.92	0.064	4.4	5.4	2.09	383.19	53.83	2.14	0.337	14.36	6.55	0.71	0.25	22.207	0.015175	1.125771	2.192366	1.3
66	254	6.2	2.20	0.028	4.2	5.4	2.62	325.10	63.00	1.61	0.779	5.47	3.70	0.52	0.14	10.609	0.073428	1.319634	1.478378	2.1
36	250	15.4	4.31	0.057	4.1	5.2	2.41	377.87	54.17	1.89	0.558	8.20	4.72	0.57	0.17	14.218	0.039246	1.195667	1.737288	2.2
45	312	7.3	4.18	0.054	4.2	5.4	1.93	329.56	41.84	1.29	0.714	8.70	6.36	0.72	0.23	16.724	0.042693	1.375269	1.367925	2.3

Site 6 Steamer Plain

Phosphorus Colwell	Potassium Colwell	Sulphur	Organic Carbon	Conductivity	pH Level (CaCl2)	pH Level (H2O)	DTPA Copper	DTPA Iron	DTPA Manganese	DTPA Zinc	Exc. Aluminium	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	sum of cations	Exch Al%	ESP	Ca/Mg	Quadrat
mg/Kg	mg/Kg	mg/Kg	%	dS/m	pH	pH	mg/Kg	mg/Kg	mg/Kg	mg/Kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g					
28	213	18.9	3.54	0.063	4.0	4.9	2.04	388.25	67.33	1.88	0.877	5.90	3.57	0.47	0.16	10.977	0.079894	1.457593	1.652661	1.1
39	227	20.6	3.89	0.076	4.2	5.1	1.96	371.44	59.22	1.95	0.522	7.12	4.04	0.54	0.14	12.362	0.042226	1.132503	1.762376	1.2
35	264	12.4	2.84	0.044	4.4	5.4	2.82	328.90	81.56	1.81	0.500	7.28	4.58	0.61	0.15	13.12	0.03811	1.143293	1.58952	1.3
16	260	7.2	3.58	0.034	4.5	5.7	1.73	267.13	27.28	1.19	0.242	6.07	3.09	0.55	0.12	10.072	0.024027	1.191422	1.964401	1.4
46	181	7.9	2.03	0.020	4.5	5.8	2.55	369.41	65.04	1.68	0.179	5.53	3.32	0.37	0.10	9.499	0.018844	1.052742	1.665663	2.1
49	197	14.7	2.87	0.028	4.3	5.4	3.05	380.60	55.54	2.02	0.382	6.51	3.80	0.43	0.13	11.252	0.03395	1.15535	1.713158	2.2
43	265	12.1	3.08	0.030	4.3	5.4	2.67	358.35	58.08	2.02	0.534	5.63	3.66	0.57	0.13	10.524	0.050741	1.235272	1.538251	2.3
30	379	20.1	5.10	0.056	4.5	5.5	1.79	386.89	67.78	2.36	0.211	8.98	3.99	0.85	0.22	14.251	0.014806	1.543751	2.250627	2.4

Site 7 Wathours Lagoon

39	180	13.6	3.49	0.044	4.1	5.3	4.33	644.94	79.00	3.95	0.920	6.02	4.26	0.43	0.23	11.86	7.757167	1.939292	1.413146	1.1
35	227	4.7	3.28	0.039	4.6	5.7	1.77	328.20	55.67	2.23	0.161	8.52	3.84	0.45	0.17	13.141	1.225173	1.293661	2.21875	1.2
69	348	4.7	3.37	0.085	6.2	6.8	0.93	245.88	32.41	1.37	0.029	13.13	2.17	0.84	0.27	16.439	0.17641	1.642436	6.050691	1.3
33	184	15.3	3.06	0.047	4.1	5.2	4.82	637.92	102.74	4.15	1.117	5.83	4.10	0.41	0.24	11.697	9.549457	2.051808	1.421951	2.0
32	184	15.6	3.21	0.046	4.0	5.3	3.92	560.70	54.13	3.29	0.964	5.19	3.95	0.40	0.16	10.664	9.03976	1.500375	1.313924	2.1
21	217	5.2	1.99	0.030	4.5	5.7	1.98	250.98	31.77	1.17	0.231	4.61	2.94	0.43	0.13	8.341	2.769452	1.558566	1.568027	2.2
49	275	4.6	2.12	0.043	5.8	6.7	1.30	64.19	26.57	2.31	0.026	11.23	1.84	0.61	0.09	13.796	0.18846	0.652363	6.103261	2.3

Site 8 Reed Beds Swamp

44	329	25.7	5.14	0.088	4.2	5.2	3.73	628.56	41.85	6.33	0.741	7.42	4.33	0.76	0.17	13.421	5.521198	1.266672	1.713626	1.0
48	231	6.7	4.25	0.031	4.2	5.4	1.67	346.78	30.48	2.28	1.191	5.01	3.42	0.49	0.22	10.331	11.52841	2.129513	1.464912	1.1
59	239	12.5	5.25	0.052	4.9	5.8	1.79	371.88	87.98	7.33	0.088	24.27	5.50	0.50	0.34	30.698	0.286664	1.107564	4.412727	1.2
28	141	4.4	4.42	0.021	4.6	5.9	1.36	342.92	43.48	2.59	0.191	7.44	3.46	0.27	0.35	11.711	1.630945	2.988643	2.150289	1.3
33	253	17.9	4.05	0.043	4.2	5.3	3.59	626.22	32.56	4.45	0.694	5.64	3.35	0.60	0.13	10.414	6.664106	1.24832	1.683582	2.0
33	348	11.2	4.91	0.042	4.1	5.3	2.92	604.26	54.29	3.95	0.616	7.26	4.28	0.76	0.23	13.146	4.685836	1.749582	1.696262	2.1
24	236	6.0	4.77	0.029	4.6	5.7	1.95	455.04	60.48	3.70	0.200	7.62	3.45	0.46	0.25	11.98	1.669449	2.086811	2.208696	2.2
41	244	5.5	4.54	0.034	4.7	5.8	1.42	343.57	43.00	3.49	0.117	10.24	3.69	0.51	0.26	14.817	0.789634	1.754741	2.775068	2.3

Site 9 Black Gate Lagoon

39	349	22.1	5.42	0.130	4.5	5.5	3.59	625.14	186.48	5.18	0.188	15.36	7.83	0.86	0.51	24.748	0.759657	2.060773	1.961686	1.1
28	186	5.1	1.80	0.022	4.3	5.4	1.21	324.24	40.07	1.45	0.949	3.01	2.88	0.36	0.18	7.379	12.86082	2.439355	1.045139	1.2
43	332	5.5	4.70	0.057	4.7	6.0	1.70	361.44	72.59	2.95	0.113	11.58	6.91	0.71	0.60	19.913	0.567468	3.013107	1.675832	1.3
44	304	14.7	5.38	0.083	4.7	5.7	5.43	599.40	156.85	2.82	0.244	13.29	7.72	0.82	0.40	22.474	1.085699	1.779834	1.721503	2.1
34	228	8.7	3.54	0.049	4.3	5.5	1.84	457.74	65.12	2.52	0.449	6.36	3.89	0.47	0.19	11.359	3.952813	1.672682	1.634961	2.2
18	289	6.5	4.04	0.057	5.1	6.2	1.53	167.29	50.45	2.54	0.041	10.83	6.14	0.63	0.73	18.371	0.223178	3.973654	1.763844	2.3

Site 10 Duck Swamp

52	316	10.0	3.59	0.045	4.2	5.5	2.83	644.40	78.61	5.24	1.089	5.85	3.41	0.66	0.27	11.279	9.655111	2.393829	1.715543	1.1
65	432	7.5	4.28	0.058	4.6	5.5	2.55	422.10	55.69	3.89	0.263	11.51	4.95	0.97	0.37	18.063	1.456015	2.048386	2.325253	1.2
132	578	9.3	3.01	0.108	6.7	7.5	0.81	122.85	15.93	3.02	0.066	18.12	3.88	1.42	0.12	23.606	0.27959	0.508345	4.670103	1.3
38	255	6.4	2.33	0.036	4.0	5.2	1.16	308.23	57.31	1.18	0.817	6.01	4.23	0.56	0.29	11.907	6.86151	2.435542	1.420804	2.1
79	315	8.3	3.99	0.075	4.6	5.7	2.44	400.86	82.35	4.41	0.411	9.17	4.43	0.69	0.32	15.021	2.736169	2.130351	2.069977	2.2
87	539	6.0	3.98	0.078	5.5	6.5	1.44	248.58	31.57	4.07	0.045	14.58	4.15	1.28	0.13	20.185	0.222938	0.644043	3.513253	2.3

Site 11 Algaboia Plain

Phosphorus Colwell	Potassium Colwell	Sulphur	Organic Carbon	Conductivity	pH Level (CaCl2)	pH Level (H2O)	DTPA Copper	DTPA Iron	DTPA Manganese	DTPA Zinc	Exc. Aluminium	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	Sum of Cations	Exch Al%	ESP	Ca/Mg	Quadrat
mg/Kg	mg/Kg	mg/Kg	%	dS/m	pH	pH	mg/Kg	mg/Kg	mg/Kg	mg/Kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g					
43	298	8.4	2.67	0.045	4.0	5.3	4.71	607.32	83.86	3.34	0.901	6.66	4.74	0.64	0.19	13.131	6.861625	1.446958	1.405063	2.1
38	275	7.8	3.49	0.037	4.2	5.5	4.40	511.20	52.58	3.46	0.470	9.19	6.44	0.63	0.24	16.97	2.769593	1.41426	1.427019	2.2
34	202	5.2	2.33	0.032	4.1	5.5	3.56	516.06	34.54	2.09	0.846	7.45	6.53	0.45	0.25	15.526	5.448924	1.610202	1.140888	2.3
51	275	7.9	2.01	0.038	4.1	5.3	5.00	531.72	74.07	2.98	0.963	7.35	5.34	0.61	0.21	14.473	6.653769	1.450978	1.376404	1.1
37	299	9.6	3.19	0.039	4.2	5.5	4.03	521.28	58.41	2.79	0.547	8.17	5.88	0.67	0.21	15.477	3.534277	1.356852	1.389456	1.2
36	282	13.5	4.40	0.063	4.3	5.3	4.24	540.36	55.01	3.71	0.425	10.12	6.10	0.61	0.27	17.525	2.425107	1.540656	1.659016	1.3

Soil Chemical Analysis Data – 10 – 30cm samples

Site 1 Boals Deadwoods

Quadrat	Conductivity	pH Level (CaCl2)	pH Level (H2O)	DTPA Copper	DTPA Iron	DTPA Manganese	DTPA Zinc	Exc. Aluminium	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	Aluminium CaCl2	sum of cations	Exch Al%	ESP	Ca/Mg
	dS/m	pH	pH	mg/Kg	mg/Kg	mg/Kg	mg/Kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	mg/Kg				
1.1	0.029	4.0	5.3	3.41	330.47	32.58	2.33	1.267	4.98	4.20	0.40	0.17	2.89	11.017	11.50041	1.54307	1.185714
1.2	0.033	4.1	5.3	2.68	325.64	39.07	1.82	0.804	4.85	4.69	0.30	0.28	1.78	10.924	7.359941	2.563164	1.034115
1.3	0.032	4.4	5.6	3.47	428.94	33.95	2.72	0.492	6.00	4.43	0.47	0.21	0.68	11.602	4.240648	1.810033	1.354402
2.1	0.031	4.0	5.2	2.29	295.47	28.75	1.84	1.169	5.50	4.49	0.41	0.15	2.68	11.719	9.975254	1.279973	1.224944
2.2	0.027	4.1	5.4	2.86	420.60	32.45	2.28	0.864	4.87	3.71	0.39	0.16	1.63	9.994	8.645187	1.600961	1.312668
2.3	0.043	4.1	5.2	2.96	369.78	41.86	2.35	0.764	5.77	4.17	0.57	0.21	1.63	11.484	6.652734	1.828631	1.383693

Site 2 Top Island (Burnt Site)

1.1	0.044	4.0	5.0	3.25	281.34	79.72	1.93	0.940	4.98	3.54	0.36	0.13	2.85	9.95	9.447236	1.306533	1.40678
1.2	0.014	4.3	5.7	1.79	207.44	31.55	0.83	0.511	2.65	2.14	0.19	0.16	1.85	5.651	9.042647	2.831357	1.238318
1.3	0.012	4.6	5.9	0.85	109.80	12.92	0.37	0.248	1.80	1.52	0.20	0.06	0.73	3.828	6.478579	1.567398	1.184211
2.1	0.019	4.2	5.3	3.21	311.41	55.84	1.73	0.808	4.57	3.25	0.34	0.10	2.42	9.068	8.910454	1.102779	1.406154
2.2	0.011	4.3	5.7	1.20	162.36	31.67	0.50	0.375	1.51	1.34	0.13	0.10	2.24	3.455	10.85384	2.894356	1.126866
2.3	0.011	4.2	5.5	1.12	180.27	27.27	0.55	0.463	1.63	1.50	0.21	0.08	2.74	3.883	11.92377	2.060263	1.086667

Site 3 Top Island (original site)

1.1	0.022	4.1	5.3	2.49	305.74	74.83	1.28	0.593	4.20	3.30	0.26	0.11	1.61	8.463	7.006972	1.299775	1.272727
1.2	0.023	4.0	5.4	1.78	305.55	28.39	0.73	0.776	3.26	3.14	0.27	0.26	2.60	7.706	10.07008	3.373994	1.038217
1.3	0.066	4.0	5.5	1.60	275.95	21.12	0.38	1.674	5.28	7.77	0.40	1.95	3.09	17.074	9.804381	11.42087	0.679537
2.1	0.020	4.0	5.1	2.77	317.39	63.97	1.28	0.732	4.12	2.98	0.29	0.11	2.46	8.232	8.892128	1.336249	1.38255
2.2	0.025	4.1	5.6	1.53	289.98	10.20	0.63	0.804	2.51	3.23	0.18	0.63	3.23	7.354	10.93283	8.566766	0.77709
2.3	0.025	4.3	6.1	0.74	75.43	5.79	0.16	0.366	1.19	1.46	0.07	0.63	1.94	3.716	9.8493	16.95371	0.815068

Site 4 Little Rushy Swamp

Quadrat	Conductivity	pH Level (CaCl2)	pH Level (H2O)	DTPA Copper	DTPA Iron	DTPA Manganese	DTPA Zinc	Exc. Aluminium	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	Aluminium CaCl2	sum of cations	Exch Al%	ESP	Ca/Mg
	dS/m	pH	pH	mg/Kg	mg/Kg	mg/Kg	mg/Kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	mg/Kg				
1.2	0.022	4.6	6.0	2.63	204.90	44.65	0.89	0.404	8.74	6.69	0.64	0.28	0.56	16.754	2.411364	1.671243	1.306428
1.3	0.022	4.3	5.5	2.55	242.52	77.74	0.88	0.613	6.75	5.00	0.65	0.18	1.15	13.193	4.646403	1.36436	1.35
1.4	0.028	4.1	5.5	1.82	277.47	17.55	0.63	1.515	8.04	8.65	0.65	0.47	3.11	19.325	7.839586	2.432083	0.92948
2.1	0.028	4.3	5.6	2.60	203.58	69.21	0.68	0.530	9.21	7.17	0.72	0.29	1.05	17.92	2.957589	1.618304	1.284519
2.2	0.024	4.2	5.3	2.54	243.78	84.42	0.83	0.416	6.89	5.26	0.71	0.21	0.71	13.486	3.08468	1.55717	1.309886
2.3	0.022	4.2	5.4	2.14	249.79	14.60	0.72	1.021	5.04	5.60	0.56	0.24	2.05	12.461	8.193564	1.926009	0.9

Site 5 Top Lake

1.1	0.022	4.0	5.2	2.64	266.90	63.38	0.89	1.257	6.81	5.05	0.63	0.15	2.58	13.897	9.045118	1.07937	1.348515
1.2	0.015	4.3	5.6	2.54	259.29	31.14	0.75	0.537	4.77	4.17	0.38	0.16	1.12	10.017	5.360886	1.597285	1.143885
1.3	0.034	4.4	5.7	2.16	211.64	18.82	0.75	0.566	11.41	8.39	0.82	0.44	0.78	21.626	2.61722	2.034588	1.359952
2.1	0.014	4.2	5.5	2.47	280.03	65.01	0.84	0.794	5.99	4.51	0.49	0.14	1.66	11.924	6.658839	1.174103	1.32816
2.2	0.019	4.3	5.6	2.47	293.80	46.21	0.94	0.751	6.73	5.70	0.60	0.19	1.04	13.971	5.375421	1.35996	1.180702
2.3	0.031	4.1	5.4	1.92	287.76	34.93	1.00	1.320	6.41	8.16	0.66	0.37	2.59	16.92	7.801418	2.186761	0.785539

Site 6 Steamer Plain

1.1	0.026	4.4	5.7	2.92	277.60	75.38	1.05	0.219	5.12	3.83	0.41	0.17	0.20	9.749	2.246384	1.743769	1.336815
1.2	0.031	4.5	5.5	2.93	276.73	71.42	1.04	0.185	6.71	4.55	0.50	0.15	< 0.20	12.095	1.529558	1.240182	1.474725
1.3	0.032	4.4	5.8	3.09	238.07	69.02	1.17	0.147	7.58	5.10	0.56	0.18	< 0.20	13.567	1.083511	1.326749	1.486275
1.4	0.089	5.9	6.5	2.16	257.75	28.78	0.76	0.055	9.24	4.54	0.48	0.26	< 0.20	14.575	0.377358	1.783877	2.035242
2.1	0.012	4.3	5.6	3.24	240.02	102.19	0.89	0.522	5.79	4.35	0.46	0.10	0.40	11.222	4.651577	0.891107	1.331034
2.2	0.022	4.3	5.4	2.92	271.29	97.32	1.39	0.427	5.57	4.04	0.44	0.11	0.65	10.587	4.033248	1.03901	1.378713
2.3	0.019	4.0	5.4	2.99	258.28	50.02	1.07	0.715	4.20	3.38	0.46	0.12	1.75	8.875	8.056338	1.352113	1.242604
2.4	0.022	4.3	5.5	1.59	266.36	21.70	0.73	0.465	2.77	2.69	0.35	0.18	2.37	6.455	7.203718	2.788536	1.02974

Site 7 Wathours Lagoon

1.0	0.025	4.3	5.6	2.52	243.34	107.40	1.17	0.687	6.49	5.37	0.50	0.22	1.14	13.267	5.178262	1.65825	1.208566
1.1	0.022	4.3	5.6	2.74	319.63	43.85	1.29	0.684	5.42	5.14	0.31	0.30	1.53	11.854	5.770204	2.530791	1.054475
1.2	0.020	4.6	5.9	2.02	201.79	27.94	0.66	0.287	5.31	4.76	0.30	0.27	0.51	10.927	2.626521	2.470944	1.115546
1.3	0.157	7.3	8.3	1.15	85.88	11.92	0.58	0.055	21.62	4.08	0.45	1.67	< 0.20	27.875	0.197309	5.991031	5.29902
2.0	0.021	4.0	5.3	2.26	298.92	71.40	0.89	1.128	5.53	5.73	0.38	0.27	2.55	13.038	8.651634	2.07087	0.965096
2.1	0.015	4.3	5.5	2.56	305.64	38.09	0.99	0.845	4.25	4.56	0.24	0.18	2.12	10.075	8.387097	1.7866	0.932018
2.2	0.019	4.4	5.8	1.90	183.43	22.21	0.51	0.341	3.88	3.62	0.32	0.20	1.21	8.361	4.07846	2.392058	1.071823
2.3	0.018	6.0	7.0	0.77	70.01	11.22	0.67	0.090	6.03	2.07	0.42	0.11	0.21	8.72	1.03211	1.261468	2.913043

Site 8 Reed Beds Swamp

Quadrat	Conductivity	pH Level (CaCl2)	pH Level (H2O)	DTPA Copper	DTPA Iron	DTPA Manganese	DTPA Zinc	Exc. Aluminium	Exc. Calcium	Exc. Magnesium	Exc. Potassium	Exc. Sodium	Aluminium CaCl2	sum of cations	Exch Al%	ESP	Ca/Mg
	dS/m	pH	pH	mg/Kg	mg/Kg	mg/Kg	mg/Kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	mg/Kg				
1.0	0.031	4.4	5.4	2.22	355.70	27.22	1.51	0.720	6.10	4.58	0.40	0.16	1.50	11.96	6.020067	1.337793	1.331878
1.1	0.028	4.0	5.3	1.98	346.81	9.79	0.99	1.382	2.89	3.79	0.35	0.25	5.11	8.662	15.95474	2.886169	0.762533
1.2	0.049	4.7	5.9	1.39	304.78	12.27	1.49	0.197	5.43	4.04	0.41	0.44	0.56	10.517	1.873158	4.183703	1.344059
1.3	0.042	4.7	6.4	0.86	210.41	4.71	0.55	0.312	2.70	2.86	0.18	1.05	0.81	7.102	4.393129	14.78457	0.944056
2.0	0.030	4.3	5.4	2.55	375.96	37.83	1.51	0.661	5.18	3.89	0.36	0.17	1.35	10.261	6.441867	1.656759	1.33162
2.1	0.032	4.3	5.3	2.26	383.09	26.08	1.85	1.019	5.66	4.46	0.58	0.21	2.36	11.929	8.542208	1.760416	1.269058
2.2	0.025	4.9	6.1	1.33	217.42	11.80	0.98	0.146	4.78	3.44	0.38	0.21	0.42	8.956	1.630192	2.344797	1.389535
2.3	0.040	4.9	6.2	1.02	246.01	10.60	1.08	0.135	4.55	3.32	0.28	0.49	0.33	8.775	1.538462	5.584046	1.370482

Site 9 Black Gate Lagoon

1.1	0.025	4.2	5.6	2.09	183.75	48.09	0.45	0.646	10.50	7.36	0.40	0.20	1.12	19.106	3.381137	1.046792	1.42663
1.2	0.017	4.0	5.5	1.33	273.57	16.26	0.92	1.815	2.10	4.23	0.23	0.30	7.68	8.675	20.92219	3.458213	0.496454
1.3	0.078	4.5	5.8	1.51	221.31	9.88	0.61	0.436	6.48	9.53	0.52	1.34	0.89	18.306	2.381733	7.320004	0.679958
2.1	0.031	4.6	5.8	2.58	219.46	51.27	0.47	0.220	11.42	7.66	0.61	0.20	0.40	20.11	1.093983	0.99453	1.490862
2.2	0.021	4.2	5.6	1.36	285.44	37.53	1.09	0.888	4.27	4.88	0.38	0.30	2.13	10.718	8.285128	2.79903	0.875
2.3	0.059	4.9	6.3	1.24	119.87	10.03	0.37	0.075	6.81	10.99	0.40	1.47	0.27	19.745	0.379843	7.444923	0.619654

Site 10 Duck Swamp

1.1	0.025	4.1	5.3	1.53	347.30	48.68	1.24	0.856	4.71	4.48	0.47	0.22	2.47	10.736	7.973174	2.04918	1.051339
1.2	0.033	4.4	5.8	1.84	264.25	28.23	1.26	0.595	7.13	7.34	0.58	0.46	0.90	16.105	3.694505	2.856256	0.97139
1.3	0.027	5.4	6.4	0.54	130.95	5.10	0.63	0.067	2.82	1.73	0.37	0.06	0.25	5.047	1.327521	1.188825	1.630058
2.1	0.020	4.2	5.5	1.68	238.51	111.06	1.08	0.555	5.80	4.78	0.60	0.24	1.51	11.975	4.634656	2.004175	1.213389
2.2	0.030	4.4	5.8	1.94	264.78	52.68	1.07	0.513	6.34	6.28	0.55	0.43	0.79	14.113	3.634947	3.046836	1.009554
2.3	0.023	5.1	6.2	1.06	140.66	14.96	0.71	0.071	4.95	2.34	0.56	0.08	< 0.20	8.001	0.887389	0.999875	2.115385

Site 11 Algaboia Plain

1.1	0.020	4.2	5.6	2.44	239.88	45.24	0.98	0.745	7.74	6.28	0.48	0.21	1.10	15.455	4.820446	1.358784	1.232484
1.2	0.033	4.1	5.4	3.11	311.10	38.92	1.70	0.883	7.24	6.76	0.61	0.27	1.46	15.763	5.601726	1.712872	1.071006
1.3	0.033	4.3	5.7	2.87	299.67	24.83	1.36	0.468	8.67	7.54	0.53	0.33	0.42	17.538	2.668491	1.881628	1.149867
2.1	0.023	4.1	5.3	3.10	293.40	65.83	1.29	0.992	6.10	5.15	0.52	0.17	2.10	12.932	7.670894	1.314569	1.184466
2.2	0.027	4.1	5.4	2.54	262.77	38.87	1.33	0.787	8.04	6.97	0.59	0.29	1.34	16.677	4.719074	1.738922	1.153515
2.3	0.029	4.0	5.4	2.24	278.23	21.89	0.91	1.641	7.55	7.47	0.39	0.35	2.30	17.401	9.430493	2.011379	1.01071