



TYPHONIUM SURVEY REPORT

Wurrumiyanga, NT

Prepared for:

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Photo on front cover: Eucalypt woodland in survey area. All photos in this report were taken by Connect Environmental.

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1 Introduction

1.1 Background

Connect Environmental was engaged by the Northern Territory (NT) Department of Infrastructure, Planning and Logistics (DIPL) to conduct a survey for threatened species in the *Typhonium* genus near Wurrumiyanga on Bathurst Island, NT. The survey will inform the environmental assessment process for a proposed residential subdivision which includes:

- Municipal infrastructure (roads and stormwater)
- Utilities infrastructure (water, sewer, power, telecommunications)
- Residential dwelling (typical remote public housing) – proposed 75 residential lots.

DIPL previously commissioned a terrestrial biodiversity assessment of the subdivision area shown in **Figure 1** in early 2022. That survey detected 651 *Typhonium* plants within the subdivision area (EcOz, 2022). Six plant samples were genetically analysed and were all subsequently confirmed to be *T. mirabile* (EcOz, 2022; P. Sapo, pers. comm. 24 February 2023).

Using those results, DIPL commissioned a second survey to determine the abundance and distribution of threatened *Typhonium* species in the surrounding area. That second survey is the subject of this report and will inform the subsequent impact assessment.

For context on potential target species, the *Typhonium* species that have been recorded from the Tiwi Islands are listed in **Table 1**. Additional species that occur in the western top end (mainland) though not on the Tiwi Islands are listed in **Table 2**. Based on this, the results of the previous survey (mentioned above) and previous experience on the Tiwi Islands, it was expected that the target species would be *Typhonium mirabile* and/or *T. jonesii*. Both species are listed as Endangered under the national *Environment Protection and Biodiversity Conservation Act 1999* and the *NT Territory Parks and Wildlife Conservation Act 1976*.

Table 1 Typhonium species recorded on the Tiwi Islands (as per the NT Flora Atlas (December 2022))

Species	Habitat (as described in Flora NT (NTH, 2013))	Distribution	No. records on Tiwi Islands ¹	Conservation status (NT / national)
<i>Typhonium cochleare</i>	Typically in sandy soils in <i>Eucalyptus</i> open forest. Also, occasionally in monsoon vine thicket on granite outcrops. Soils may sometimes be seasonally waterlogged but are usually well drained.	Widespread across the northern Top End though not recorded in the greater Darwin area.	1	Least concern / not listed
<i>Typhonium flagelliforme</i>	Usually associated with rainforest.	Across the top end.	253	Least concern / not listed
<i>Typhonium jonesii</i>	<i>Eucalyptus tetradonta</i> - <i>E. miniata</i> - <i>C. nesophila</i> dominated open forest on deep, well drained sandy soils supporting a relatively sparse grass layer.	Tiwi Islands only	669	Endangered / endangered

¹ This does not include results of Connect Environmental's survey on Melville Island from 2021.

Species	Habitat (as described in Flora NT (NTH, 2013))	Distribution	No. records on Tiwi Islands ¹	Conservation status (NT / national)
<i>Typhonium mirabile</i>	<i>Eucalyptus tetradonta</i> - <i>E. miniata</i> - <i>C. nesophila</i> dominated open forest on deeper well drained sandy or sometimes stony soils supporting a relatively sparse grass layer. Soils are deeper, red-brown kandosols.	Tiwi Islands only.	210	Endangered / endangered

Table 2 Other *Typhonium* species not recorded on the Tiwi Islands though do occur in the western top end

Species	Habitat (as described in Flora NT)	Distribution	Conservation status (NT / national)
<i>Typhonium johnsonianum</i>	Mixed woodland on poorly drained sandy soils.	Known from a few localities in the Darwin - Litchfield NP area	Data deficient / not listed
<i>Typhonium praetermissum</i>	<i>Eucalyptus miniata</i> woodland on well drained soils, often on plateau margins where there is less grass competition.	Endemic to the Darwin region, where known from Darwin suburbs and the nearby rural area	Vulnerable / not listed
<i>Typhonium russell-smithii</i>	Grows in <i>Eucalyptus</i> open forest in coarse-textured, well drained soils.	Across the top end.	Least concern / not listed
<i>Typhonium</i> sp. Charles Darwin	Recorded growing amongst fallen timber in sheltered positions in leaf-litter in <i>E. miniata</i> / <i>E. tetradonta</i> / <i>E. chlorostachys</i> shrubby woodland and in <i>C. polycarpa</i> , <i>M. dealbata</i> woodland with <i>P. nonda</i> , <i>S. lucida</i> and <i>E. trisetia</i> .	Known from the Darwin Area and Cobourg Peninsula.	Not evaluated / not listed
<i>Typhonium</i> sp. Cobourg	In <i>Eucalyptus miniata</i> - <i>E. tetradonta</i> open forest with <i>Sorghum</i> ; on plateau surface, deep red loam.	Known from Cox and Cobourg peninsulas	Data deficient / not listed
<i>Typhonium</i> sp. Cox Peninsula	-	Known from Middle Arm and Cox Peninsula	Not evaluated / not listed
<i>Typhonium taylorii</i>	<i>Melaleuca nervosa</i> woodland on seasonally saturated sandy substrates.	Restricted to the floodplains of the Howard River and its tributaries and a creek system on the nearby Shoal Bay Reserve.	Endangered / endangered

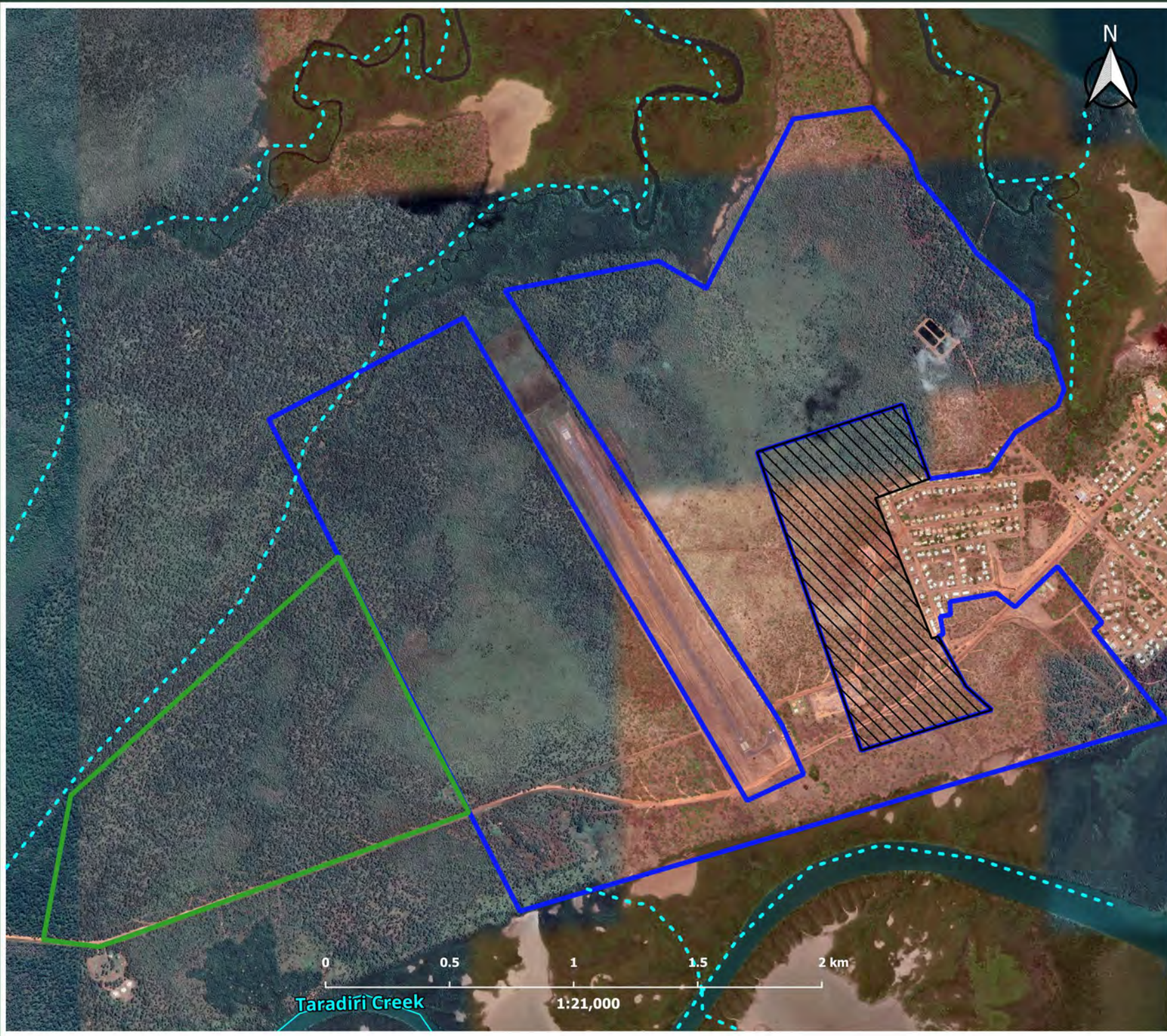







Figure 1
-
Survey area location and layout

- Key
-  Survey area 1
 -  Survey area 2
 -  Previously surveyed subdivision area
 -  Streams (DEPWS, 2019)
 -  Minor drainage (DEPWS, 2019)

Background - Google Satellite / Google Maps



Client: DIPL
 Date: 5 April 2023
 Geodatum: GDA94 / MGA Z52
 Author: M. Proos



1.2 Approach

The survey approach involved three phases: (1) survey preparation, (2) the on-ground field survey and (3) data analysis and reporting, as described in the following sections. As part of the data analysis, a total of seven *Typhonium* samples were sent for genetic analysis to confirm their species identity, as recommended by the NT Department of Environment, Parks and Water Security (DEPWS).

1.3 Assumptions, Exclusions and Limitations

Assumptions, exclusions and limitations for the survey are stated in **Table 3**.

Table 3 Assumptions, exclusions and limitations

Assumptions / Exclusions / Limitations
The survey was limited to the survey areas delineated and provided by DIPL.
In line with the approach taken for the previous survey within the subdivision area in early 2022, this survey focused on areas of high likelihood of <i>Typhonium</i> as modelled by the NT Government. However, where plants were detected within these areas, some further survey was conducted to delineate that 'patch' ² . In addition, where an area of habitat was encountered that appeared unlikely to support the target species (e.g., a swamp), survey transects were not continued.

1.4 Permits and Permissions

The following permits were obtained for the survey:

- Work permit from the Tiwi Land Council for all personnel involved (numbers WOC(N)00125) and WOC(N)00142).
- *Typhonium* sample collection permit from the NT Parks and Wildlife Service (no. 72422).
- Export permit to send the *Typhonium* samples to an interstate laboratory, obtained from the NT Parks and Wildlife Service (no. 72579). The Queensland Government Department of Environment and Science confirmed that a permit or license was not required to import the specimens into Queensland.

² A patch was generally considered to be a small area (~0.25 ha) where five or more plants were detected.

2 Survey Methodology

The survey methodology was based on the *Northern Territory guidelines for targeted surveys of threatened and significant plant species; Supplement 1: Typhonium field surveys* (Bickerton *et al.*, 2020), as described in the following sections. For consistency, it also generally followed the approach used in the previous survey within the proposed subdivision area (EcOz, 2022).

2.1 Objectives and Timing

The objectives of the survey were to:

1. Survey areas of high likelihood of occurrence of the species.
2. Where detected, determine the abundance and distribution of individuals within that area.

Typhonium jonesii and *T. mirabile* are detectable during the wet season only and are surveyed ideally during January or February (Bickerton *et al.*, 2020). They are cryptic species due to their small size (i.e., leaves to 8 cm), and individuals can be scattered, sparsely distributed, or highly clustered (Bickerton *et al.*, 2020). As such, the survey was conducted using an approach that optimised detection.

The survey was conducted in two parts:

1. 23 January to 3 February 2023 (survey area 1 in **Figure 4**).
2. 13 to 17 March 2023 (survey area 2 in **Figure 4**).

Visibility of individuals was generally satisfactory, though where ground layer vegetation was dense and there was a reduction in effective visibility, the pace of searching slowed and width of transects reduced.

2.2 Survey Area and Method

Mapping of potential habitat for *Typhonium* on the Tiwi Islands was provided by the NT Government and used to inform the approach for the survey. The model categorises 'high' and 'moderate' potential to occur with the remainder expected to be 'low' potential.

Two survey areas were delineated. Survey area number 1 was the focus of the original scope of works. It has a total area of approximately 520 ha, of which approximately 230 ha comprises 'high' likelihood habitat (measured by outlining congregations of 'high' patches). Survey area 2 was delineated after the survey was completed in survey area 1 with the intent of mapping adjoining patches of *Typhonium* detected on the western side of survey area. Most of the 'high' likelihood area within survey area 2 was surveyed within the allocated timeframe.

Within each survey area, the survey was divided into three phases, based on the modelling:

1. Phase 1: All general areas modelled as high suitability were surveyed to remain consistent with the previous survey conducted within the proposed subdivision area, except where unsuitable habitat occurred (e.g., inundated melaleuca wetlands). A two-step approach was used in these areas:
 - a. Firstly, transects were walked 15 m apart searching for individuals. Lines spaced 15 m apart were created in a GIS and uploaded to the GPS's or GPS-enabled field tablets to aid in transect spacing accuracy when in the field. It was expected that the effective transect width was 1-5 m, subject to the density of ground vegetation.
 - b. Where individuals were detected during phase 1a, the distance between transects was reduced to approximately 5 m to determine the abundance and distribution of individuals in that area. This was continued for ~20 m beyond the last detected individual.

2. Phase 2: Where a patch of individuals was detected close to the edge of the modelled high potential habitat, the survey would continue outside these areas until no further patches were detected or individuals were not (or infrequently) detected.
3. Phase 3: A random meander survey was conducted in some areas not modelled as high potential. These areas were not surveyed in detail under the assumptions that either no or very few individuals would be detected, based on advice from the NT Herbarium (pers. Comm. N. Cuff, 5 March 2021).

Several small 'high' likelihood areas were inaccessible because of inundation (i.e., swamp) or a creek that was unable to be crossed in the north-west corner of the survey area 1. The swampy areas were not expected to constitute suitable habitat for the target *Typhonium* species (i.e., *T. mirabile* or *T. jonesii*) based on their reported habitats (NTH, 2013; DoE, 2014) and experience of the surveyors. However, another *Typhonium* species was detected within swampy habitats elsewhere. It was concluded as being likely to be *T. flagelliforme*, which is listed as Least Concern under the NT *Territory Parks and Wildlife Conservation Act 1976*. This species was not surveyed and mapped.

2.3 Identification of *Typhonium* species

The target species morphological characteristics were studied prior to the survey by all ecologists. Several ecologists were also experienced in surveying for these and other *Typhonium* species. During the surveys, numerous detected individuals were viewed by all team members, particularly when unusual leaf forms were observed.

In addition, molecular samples were collected from seven *Typhonium* plants to verify the conclusions made by the field team. Samples were sent to the Australian Tropical Herbarium at James Cook University for analysis. All but one samples were expected to be *T. mirabile* with one assumed as potentially being *T. flagelliforme*.

2.4 Survey Team and Equipment

The survey team consisted of Mihkel Proos, Nick Volpe, Amit Rotenberg, David van den Hoek and Kym Brennan with assistance from the Tiwi Rangers. Each surveyor carried a GPS-enabled field tablet or GPS with georeferenced maps or shapefiles. Where a *Typhonium* plant was detected, a single marker was placed on the GPS field device. Photos were also taken of numerous plants.

2.5 Limitations

It is likely that some individuals were not detected within the survey area. However, given the survey methodology, which was conducted in accordance with guidance provided by the NT Herbarium, it is unlikely that additional significant 'patches' were not detected.

3 Results

A total of 8,450 individual *Typhonium* plants were detected, comprising 7,291 individuals within survey area 1 and 1,159 individuals in survey area 2. All individuals were expected to be *Typhonium mirabile*. These results do not include those individuals concluded as being *T. flagelliforme*. Photos of assumed *T. mirabile* individuals are in **Figure 2** and **Figure 3**.

The results of the plant sample genetic tests are shown in **Table 4**. All but one individual was concluded as being *T. mirabile*. Sample 1097 was concluded as being *T. flagelliforme*. This sample was taken from a plant adjacent to a saturated / boggy area to verify the conclusion made during the field survey that it was *T. flagelliforme*.



Figure 2 Individuals assumed to be *Typhonium mirabile*



Figure 3 Individual assumed to be *Typhonium mirabile*

Table 4 Results of *Typhonium* plant sample genetic test

Sample number	Genetic test conclusion of species
1158	<i>Typhonium mirabile</i>
1140	<i>Typhonium mirabile</i>
1098	<i>Typhonium mirabile</i>
1175	<i>Typhonium mirabile</i>
1164	<i>Typhonium mirabile</i>
1097	<i>Typhonium flagelliforme</i>
1136	<i>Typhonium mirabile</i>

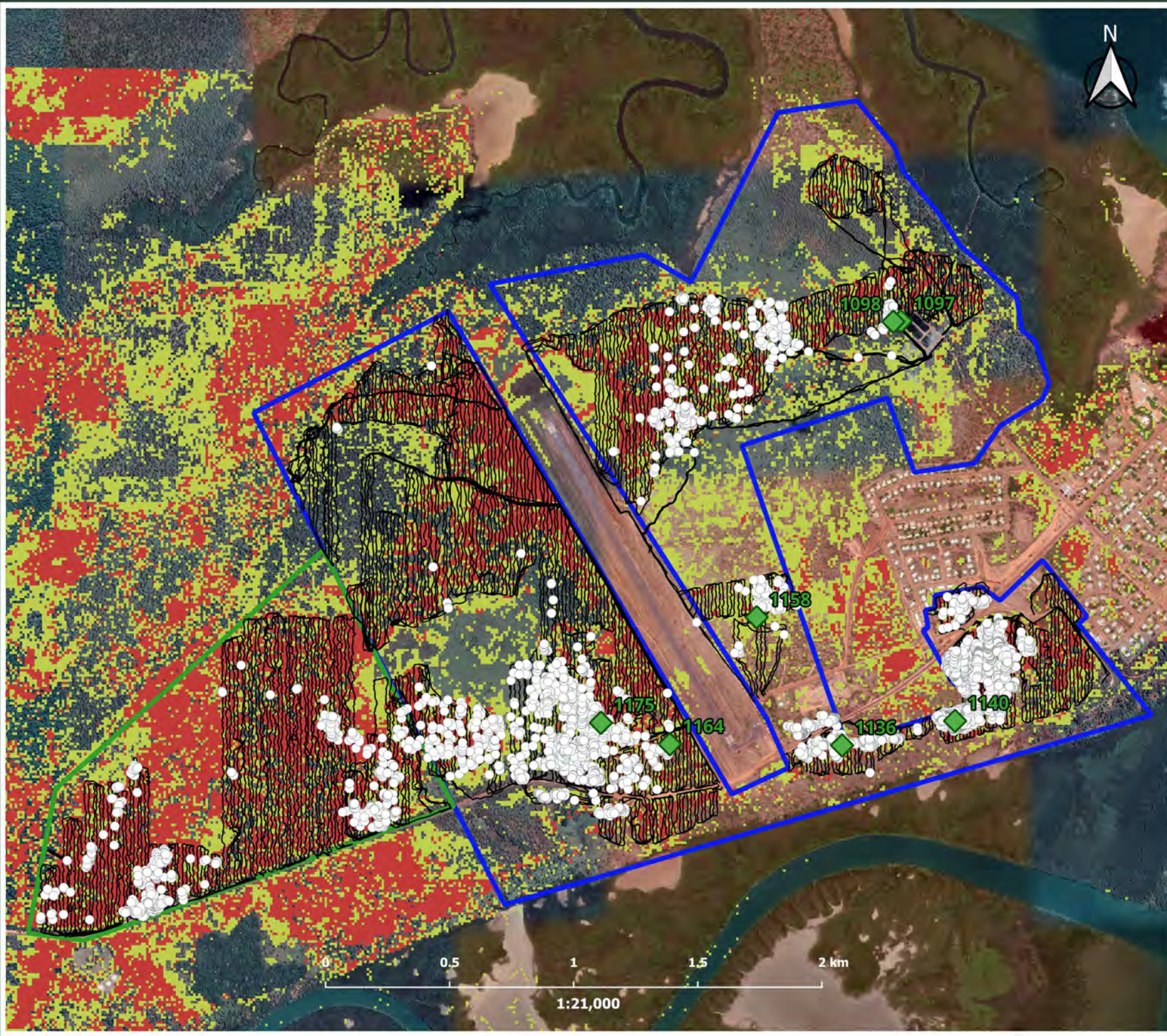


Figure 4
Typhonium survey effort and results

- Key
- Typhonium individual
 - ◆ Typhonium sample collected
 - ▭ Survey area 1
 - ▭ Survey area 2
 - Survey track
 - NT Govt Typhonium distribution model - High
 - NT Govt Typhonium distribution model - Moderate
- Background - Google Satellite

Client: DIPL
 Date: 13 June 2023
 Geodatum: GDA94 / MGA Z52 (A4)
 Author: M. Proos



4 References

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