



DEPARTMENT OF LAND RESOURCE MANAGEMENT

Potential Land for Long-term Sustainable Food Production

Soil and Water Suitability Assessment

2nd Edition
October 2014

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EXECUTIVE SUMMARY

The Northern Territory Government's vision for economic development identifies agribusiness as a priority opportunity to realise the potential in the north. Our land and water resources are a crucial economic enabler for this activity. Understanding these resources and the capability of its use is critical to realising the Northern Territory's drive to Develop the North. The NT Government has already undertaken significant work to develop a solid understanding of the soil and water capability of the Territory. This report provides essential baseline information that underpins the Northern Territory Government's *Framing the Future Strategic Plan*, in particular its Prosperous Economy vision.

This investigation is the second version of the most comprehensive broad scale assessment undertaken of the soils, landforms and groundwater resources of the Northern Territory and their suitability for various pastoral and agricultural land uses. The study integrates broad scale soil, landform and water resource mapping with climate conditions such as rainfall as well as general agronomic requirements of crops.

The inclusion of a newly discovered groundwater formation, *Florina*, and additional groundwater investigations across the Northern Territory have redefined some of the aquifer boundaries used in the initial report and account for the majority of differences between this and the first version of this report.

This investigation has identified regions and local areas where further detailed land and water investigations could take place. In some regions this has already occurred. In other areas where this information is not yet available, this report will assist the targeting of further land and water assessment investment. New funding provided by the Northern Territory Government from 2014-2018 is already being used to further understand the land and water resources of some of these areas, and the suitability of these resources for intensive forms of agriculture.

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1. INTRODUCTION

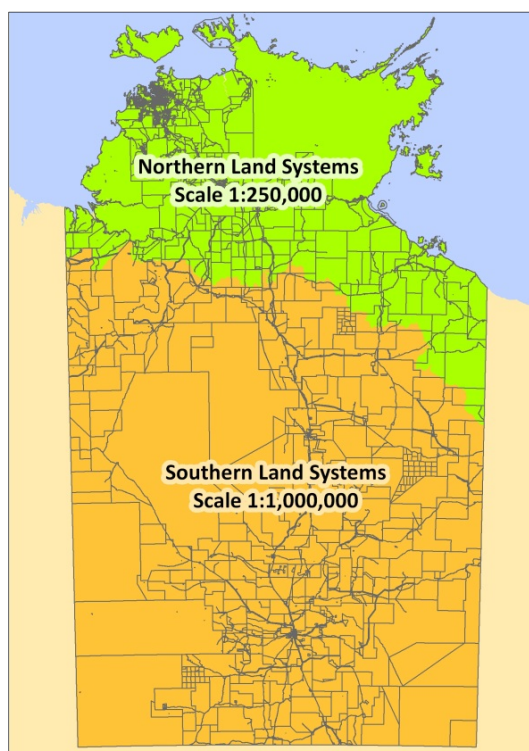
This report was compiled in response to the Department of Land Resource Management's Strategic Plan 2013-17, specifically targeting Objective 2; *Enable Economic Growth through the allocation of natural resource assets for best and sustainable use – Determine potential for agricultural development through the collection and assessment of land, soil, vegetation and water information.* The information integrates soil and water resources with commodity requirements to identify areas with potential for development.

The initial version of this report was the first of its kind across the entire Northern Territory to integrate existing data on soil and water resources with climate conditions such as rainfall and also agronomic information such as growing periods. Similar studies, such as those undertaken by the Northern Australia Land and Water Taskforce, investigated the potential for agriculture but did not consider multiple parameters.

This second edition report was initiated after a review identified that a new dataset for Groundwater Resources was available, and created a requirement to update the analysis. Land System, Landscape Classes, Gridded Monthly Rainfall data and the requirements identified by expert local agronomists for different cropping types have not changed in the three years since the initial report. These aspects of the study have not been updated.

As with the previous edition, this report integrates soil and land resource information together with rainfall, groundwater availability and climatic and agronomic conditions. It is a desktop GIS analysis of existing broad scale land, water and climate data with expert input from local agronomists, soil landscape scientists and hydro geologists. It does not consider additional factors such as land tenure, Native Title, accessibility by road or rail, skilled workers/employment, travel time from existing economic centres and other anthropological factors.

The study uses a combination of different methodologies to determine areas suitable for different types of food production. While some of these data, such as rainfall averages, have appeared to fit well with the knowledge of local agronomists and past trials, some have not. In such cases both methodologies have been presented in the Discussion.



The broad scale land system information is intended for Northern Territory wide and regional assessments, and is not appropriate for detailed planning. These land system datasets essentially highlight areas where more detailed information is required. In some areas detailed information is available but in others, broad scale information is only available.

The land assessment is based on two different spatial datasets. In the northern part of the Northern Territory, the assessment is based on 1:250,000 land system information. In the central and southern areas, the assessment is based on 1:1,000,000 information. The extent of these datasets is presented on Figure 1.

Groundwater assessment is based on 1:2,000,000 dataset, Northern Territory Groundwater – Aquifers. This is the only dataset that has been updated since the initial report.

Figure 1: The extent of the two broad scale land system spatial datasets across the Northern Territory

2. DATA REQUIREMENTS

2.1 Crop Types and Resource Requirements

Consideration of crop types and their resource requirements were discussed at a workshop held between officers of the Department of Primary Industry and Fisheries (DPIF) and Department of Land Resource Management (DLRM) in 2011. Discussions focused on the climatic, water and soil requirements for a number of crop types. These requirements formed the basis for the analysis of soil and water resource data held by DLRM, as well as Climate Average data obtained from the Bureau of Meteorology (BoM). Confirmation with DPIF staff have indicated the resource requirements for different crop types have not changed since 2011.

The methodology determines the spatial extents of water, soils and landscape suitability for each crop type independently and then intersecting them, to highlight where climatic, water and soil-landscape characteristics match crop requirements. Agreed classes of crop type requirements are presented in Table 1.

Some aspects of crop requirements were and still are difficult to assess due to the lack of available data. In these instances, a surrogate has been utilised and included groundwater salinity, aquifer sustainability and aspects of land system information in the southern region. An example of this is the absence of detailed soil information in the land systems of the southern region. Landscape information was used as a surrogate to inform the suitability of land for improved pasture.

The **red text** in Table 1 indicates where a surrogate has been used in the absence of detailed information.

	Result Maps	WATER			SOIL							LANDSCAPE	
Resource Criteria:		Irrigated (ML/ha/yr)	Rainfall (mm per month) for dry land Agriculture	Growing period in months	Depth	pH	Rock Outcrop	Slope	Well Drained	Soils Case	Horticultural Rating 1-10 *		
Dataset Source:		BoM - Gridded Mean and Monthly Rainfall			DLRM - Land Systems Northern NT 1:250,000 (reference tables: Idealised Soils and Landscape Descriptions)					created for this report	DLRM - Land Systems Southern NT 1:1,000,000	DLRM - Land Systems Northern NT 1:250,000	DLRM - Land Systems Southern NT 1:1,000,000
Crop Type: Native Pastures	10		>120mm (Dec-Mar total)	≥ 4								Use Suitable Landscape Classes only <i>(Described in this report Chapter 3.4)</i>	
Improved Pastures	11		>85mm (each month for Dec-Mar)	≥ 4	≥ 40cm	4.5 - 7.5		≤ 2%		2			
Forage Crops	12		Dec 130-210mm Jan 165-292mm Feb 177-305mm Mar 125-235mm	4	≥ 90cm	4.5 - 8.0	≤ 10%	≤ 2%	Yes	1			
Field Crops (Rainfed)	12		Dec 130-210mm Jan 165-292mm Feb 177-305mm Mar 125-235mm	4	≥ 90cm	4.5 - 8.0	≤ 10%	≤ 2%	Yes	1			
Field Crops (Irrigated)	13-15, 19	≥ 8		6	≥ 90cm	4.5 - 8.0	≤ 10%	≤ 2%	Yes	1	≥ 8		
Horticulture Annual Crops	16-19	3 - 5+		1.5 - 7	≥ 40cm	4.5 - 8.0	≤ 10%	≤ 2%	No	3	≥ 8		
Horticulture Perennial Crops	13-15, 19	3 - 20+		12	≥ 90cm	4.5 - 8.0	≤ 10%	≤ 2%	Yes	1	≥ 8		

Table 1: Crop requirements and sources of data following consultation with agronomists and soil landscape scientists.

Red Text surrogate used in absence of detailed information.

* **Horticultural Rating 1-10:** where 1 is least likely to have horticultural soils (ie mostly steep and rugged landforms or dunefields); and 10 is most likely to have horticultural soils (ie level to gently undulating landforms with adequate soil depth for agriculture).

3. METHODOLOGY

3.1 Rainfall

Bureau of Meteorology (BoM) Gridded Mean Monthly Rainfall, based on a 30 year period from 1961 to 1990, was used to determine areas in the Northern Territory where rainfall characteristics over the prescribed growing period met the crop requirements. A review of the BoM data revealed the data has not changed, i.e. the data is still based on the same 30 year period, from 1961 to 1990, as the first edition of this report. The preliminary data generated are illustrated in Maps 1-3. These maps have not changed since the first edition.

Map 1

Native pasture requires a total rainfall of 120mm or more over a 4 month period. The growth period of native pastures can be up to 6 months in the wetter areas of the Northern Territory. GIS analysis was used to determine these areas by summing the average monthly rainfall from December to March. The results were reviewed by DPIF pastoral agronomists familiar with the various pastoral regions.

Map 2

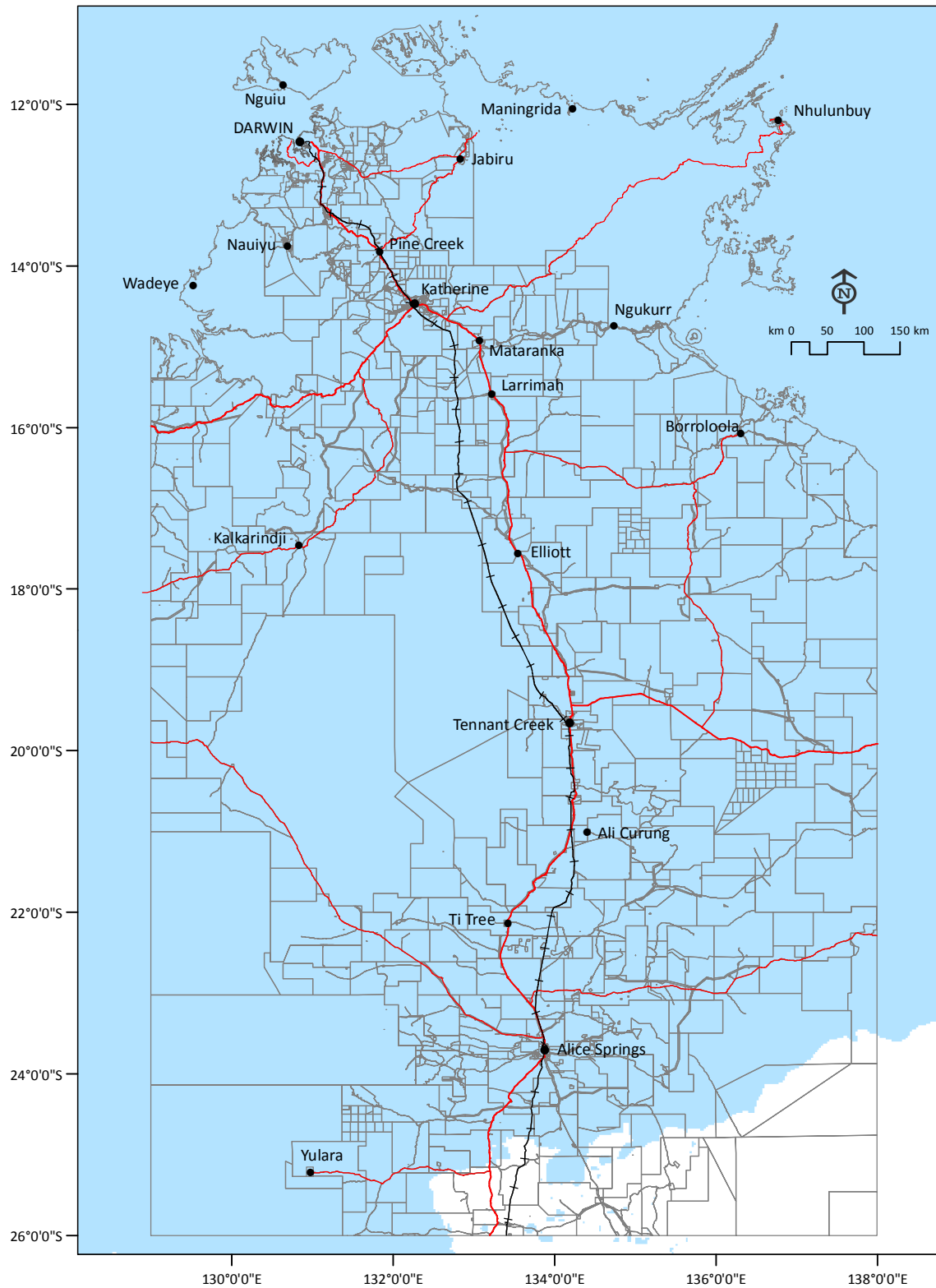
Improved pasture requires in excess of 85mm rainfall in each month for the growing period, December to March inclusive. The growth period of improved pastures can be up to 6 months in the wetter areas of the Northern Territory. This is a different approach to native pastures where total rainfall over the growing period was used.

Map 3

Field Crops (rainfed) and Forage Crops used a different method to establish the areas where rainfall would be suitable. There are lower as well as upper limits to the amount of rainfall required. The reason for the upper limit is, while these crops will grow in conditions with higher rainfall, rain at harvest time leads to issues such as mould reducing grain quality and yield. It was also determined that during the four month growing period the crop had different requirements for crop preparation, establishment (tilling, sowing etc.), growing and harvesting.

Map 1 Rainfall Requirements for Native Pasture

Areas in the NT where rainfall in Dec, Jan, Feb and Mar totals 120mm or more.



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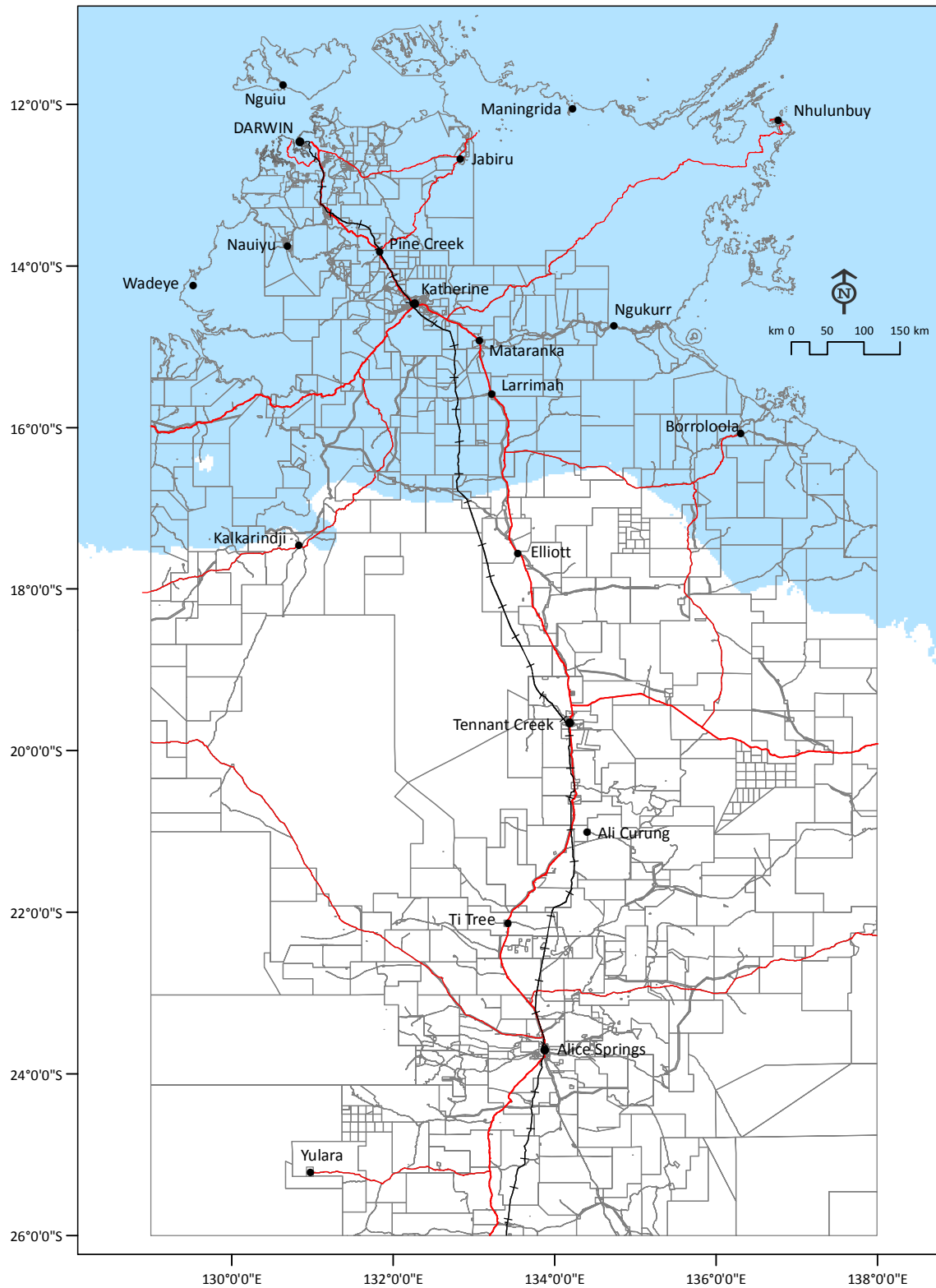
This map must be read with the report:
Potential Land for Long-term Sustainable Food Production; Soil and Water Suitability Assessment, 2nd Edition 2014.
 Dept Land Resource Management (DLRM)

Data Source -
 Mean monthly and mean annual rainfall:
 Bureau of Meteorology
 Roads, Rail, Parcels, Towns: DLPE

- Suitable Rainfall
Dec to Mar total > 120mm
- Unsuitable Rainfall
Dec to Mar total < 120mm

Map 2 Rainfall Requirements for Improved Pasture

Areas in the NT where rainfall in Dec, Jan, Feb and Mar exceeds 85mm in each month.



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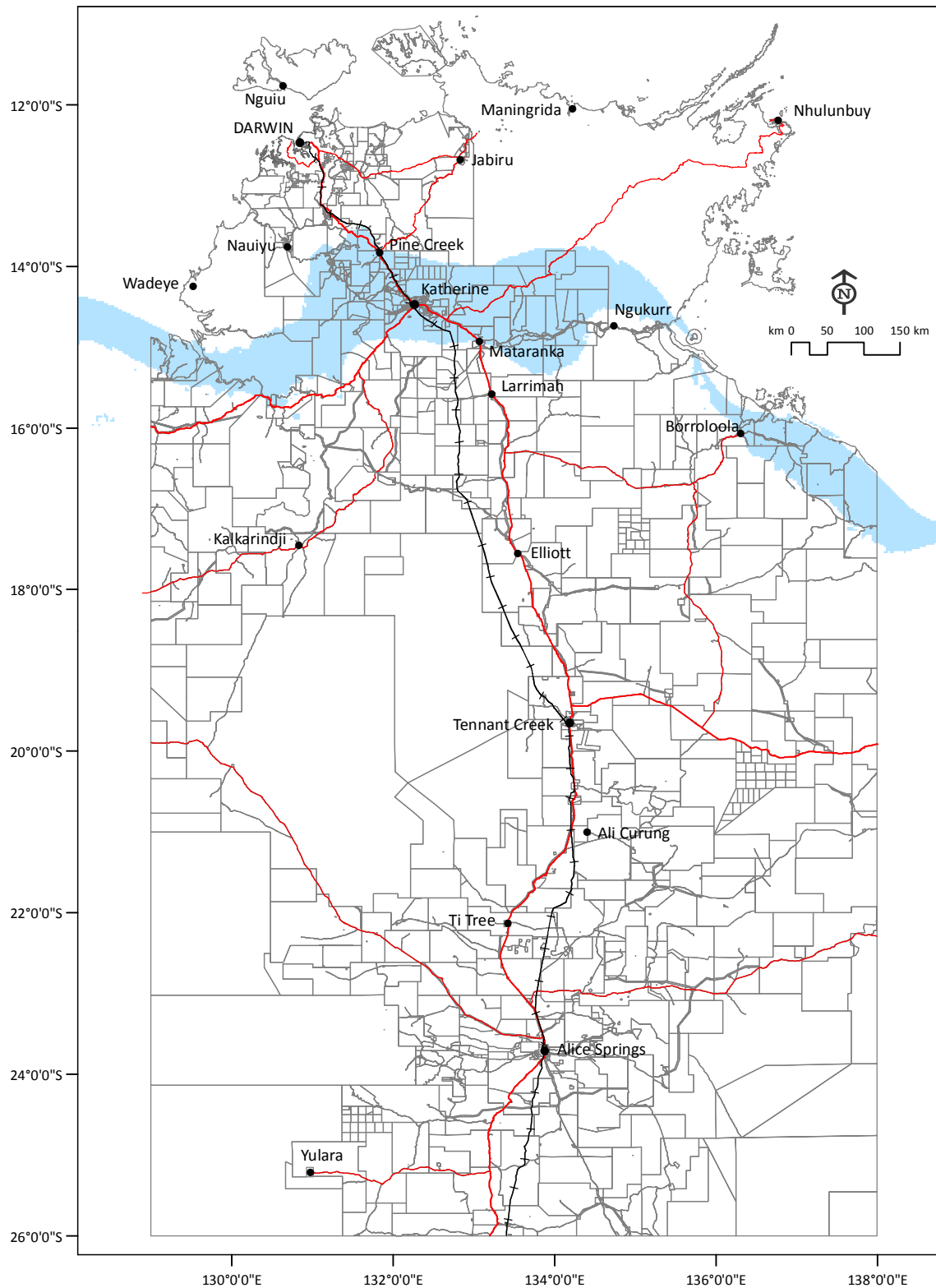
This map must be read with the report:
Potential Land for Long-term Sustainable Food Production; Soil and Water Suitability Assessment, 2nd Edition 2014.
 Dept Land Resource Management (DLRM)

Data Source -
 Mean monthly and mean annual rainfall:
 Bureau of Meteorology
 Roads, Rail, Parcels, Towns: DLPE

- Suitable Rainfall
Dec, Jan, Feb and Mar > 85mm
- Unsuitable Rainfall
Dec, Jan, Feb and Mar < 85mm

Map 3 Rainfall Requirements for Field Crops (Rainfed) and Forage Crops



Areas in the NT where monthly rainfall averages are: Dec 130-210mm, Jan 165-292mm, Feb 177-305mm, Mar 125-235mm.



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*Potential Land for Long-term Sustainable
 Food Production; Soil and Water Suitability
 Assessment, 2nd Edition 2014.*
 Dept Land Resource Management (DLRM)

Data Source -
 Mean monthly and mean annual rainfall:
 Bureau of Meteorology
 Roads, Rail, Parcels, Towns: DLPE

 Suitable Rainfall - Monthly average:
 Dec: 130 - 210mm Jan: 165 - 292mm
 Feb: 177 - 305mm Mar: 125 - 235mm
 Unsuitable Rainfall

3.2 Groundwater

Crop irrigation requirements posed a more complex issue. Table 1 states the irrigation requirements in terms of megalitres per hectare per year, however DLRM did not have such a dataset in 2011 and still does not. Data used specifically for the purpose of this study was derived from Northern Territory Groundwater Aquifers, a 1:2,000,000 dataset (Tickell, 2014). Specifically, the attribute Actual Yield Category was reclassified into four classes; shown in Table 2. A map showing the preliminary data generated is presented in Map 4.

Actual Yield Category	Irrigation Potential
0.05 - 0.5 L/s	Nil Possibility of Irrigation
0.5 - 2.5 L/s and 0.5 - 5.0 L/s	Limited or Localised Irrigation
5.0 - 10.0 L/s, 2.5 - 20.0 L/s and 10.0 - 30.0 L/s	Small Scale Irrigation
5.0 - 50.0 L/s and 5.0 - 100.0 L/s	Broad Scale Irrigation

Table 2: Reclassification of NT Aquifers dataset into Irrigation Potential

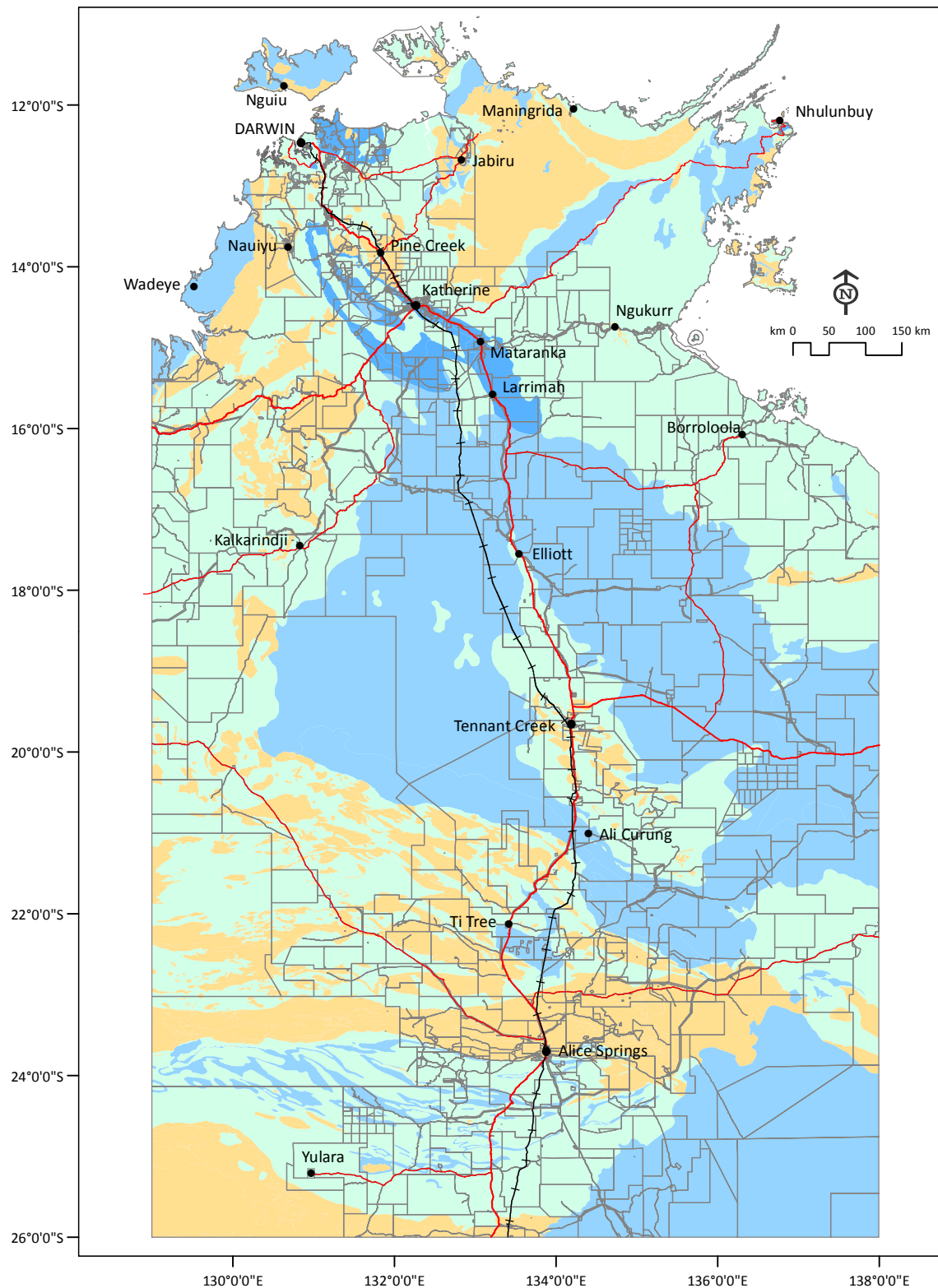
The Actual Yield category of the data does not include, nor should it be inferred to include, an assessment of the sustainability of that resource. Areas already under intensive horticultural use in the Northern Territory are managed within Water Control Districts and Water Allocation Planning Areas as defined under the *Water Act* and should be considered prior to any large scale development occurring to ensure water supplies are sustainable into the future.

Map 4

Irrigation Potential was used as a substitute for ML/ha/yr to indicate only where there may be potential for irrigation. Growing period was not used in conjunction with Irrigation Potential as irrigation could occur at any time of the year, unlike rainfall which had to be reliable for a continuous growing period.

There are some significant differences between the groundwater data used in 2011 and this report. These differences are attributed to investigation work for the Great Artesian Basin, Ooloo and Florina formations, Berry Springs and the Koolpinyah Dolomite area, east of Darwin. In all of these areas realignment of existing formation has occurred, however in the Ooloo area, the discovery of a new formation, *Florina*, has been added to the groundwater aquifers dataset.

Map 4 Irrigation Potential – Groundwater Resources Not Including Soil



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 Assessment, 2nd Edition 2104.*
 Dept Land Resource Management (DLRM)

Data Source -
 NT Groundwater Aquifers 1:2,000,000: DLRM
 Roads, Rail, Parcels, Towns: DLPE

- Broad scale irrigation potential
- Small scale irrigation potential
- Limited/Localised irrigation potential
- Nil irrigation potential

3.3 Soil

Crop requirements, with regard to soil-landscape conditions, were the basis for interrogation of the spatial dataset *Land Systems of the Northern Part of the NT* for field crops, improved pasture and annual horticulture. For analysis purposes, these were termed Soils Case 1, 2 and 3.

Table 3 below is a subset of the information presented in Table 1, summarising crop requirements for soil cases 1 and 3. Soil case 2 was not used in the analysis for Improved Pasture and therefore is not shown here.

Soil Case	Land Use	Soil Depth	Soil pH	Rock Outcrop	Slope	Drainage
Case 1	Field Crops	> 90cm	4.5 - 8.0	<= 10%	<= 2%	Well
Case 3	Annual Horticulture	> 40cm	4.5 - 8.0	<= 10%	<= 2%	

Table 3: Soil-landscape requirements for Field Crops, Improved Pasture and Annual Horticulture.

The *Land Systems of the Northern Part of the Northern Territory* is a complex dataset consisting of a spatial layer with two related tables. One of the related tables formed the basis of the Northern Territory's contribution to Land and Soil Resources in Northern Australia, CSIRO 2009, which was originally known within DLRM, and the first issue of this report, as Descriptors NAAg (Northern Australia Agriculture) and has recently been renamed to Landform Descriptions.

The relationship between the tables and the spatial data is shown in Diagram 1.

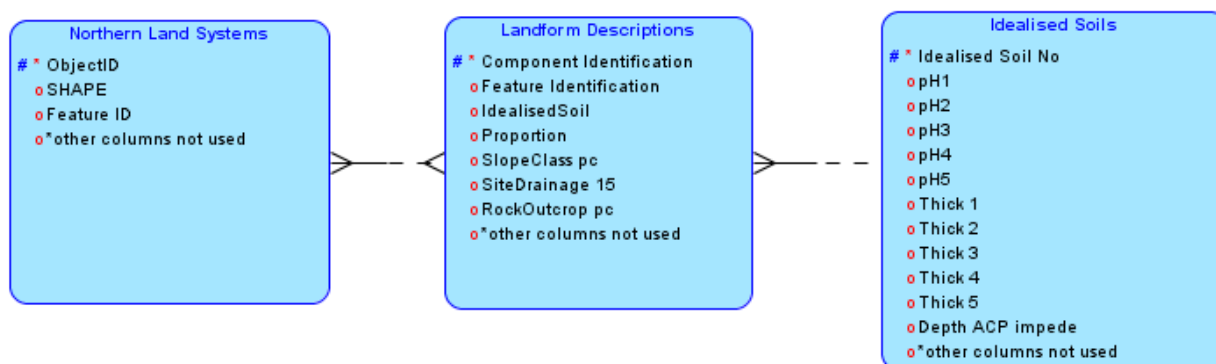


Diagram 1: - Entity Relationship Diagram - *Land Systems of the Northern Part of the NT*

The Idealised Soils Table contained several soil property fields, some of which were used for the analysis. The available pre-classified fields did not contain the pH range required (4.5 to 8), and so idealised soils were classified from Layer pH (or Horizon pH) and thickness. This process was significant in that appropriate soil pH was deemed to be 4.5 to 8 for every horizon present within the first 40cm of soil depth. The horizon thickness for each Idealised Soil vary greatly and so the method for classifying which Idealised Soils were suitable was scrutinised in a spreadsheet, and then taken back into GIS to match with the remaining soil characteristic, Depth to Impedance.

The selection of suitable Idealised Soils was then used to select corresponding records from the *Landform Description* table. Landform Description also contains data on Rock Outcrop, Slope, Drainage and the proportion of each Idealised Soil found within each Land System. The original selection from Idealised soils was then narrowed down to match the criteria required from Landform Description for each of the two Soils Cases described above. A summary table of the total

proportion of the Land System suitable for Agriculture was calculated, so that the Land Systems could be mapped thematically by the amount of suitable soils likely to be available.

Map 5

Soils Case 1 was used for Field crops (both irrigated and rainfed), Forage Crops and Horticultural Perennials.

Whilst **Soils Case 2** was intended for use in Improved Pastures, it was removed from analysis in favour of the use of Landscape classes (see 3.4 Landscape) which was also used for Native Pastures.

Landscape classes were not intersected with soils, as soils are essentially a subset of landscape class.

Map 6

Soils Case 3 was used for Horticultural Annuals.

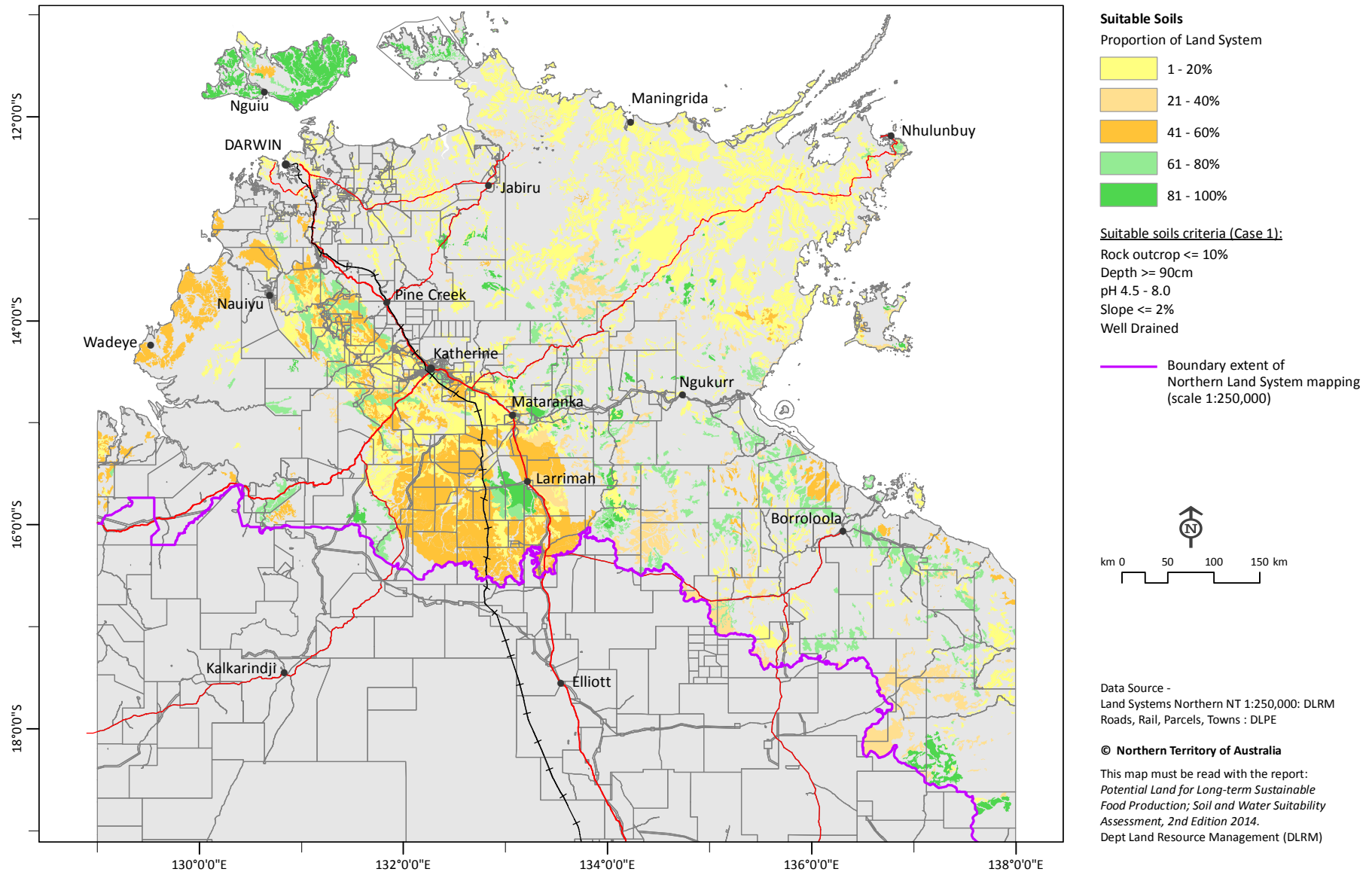
The use of these Soils Cases was only appropriate in the northern part of the NT where DLRM has readily available data and proportions of soils within Land Systems.

Map 7

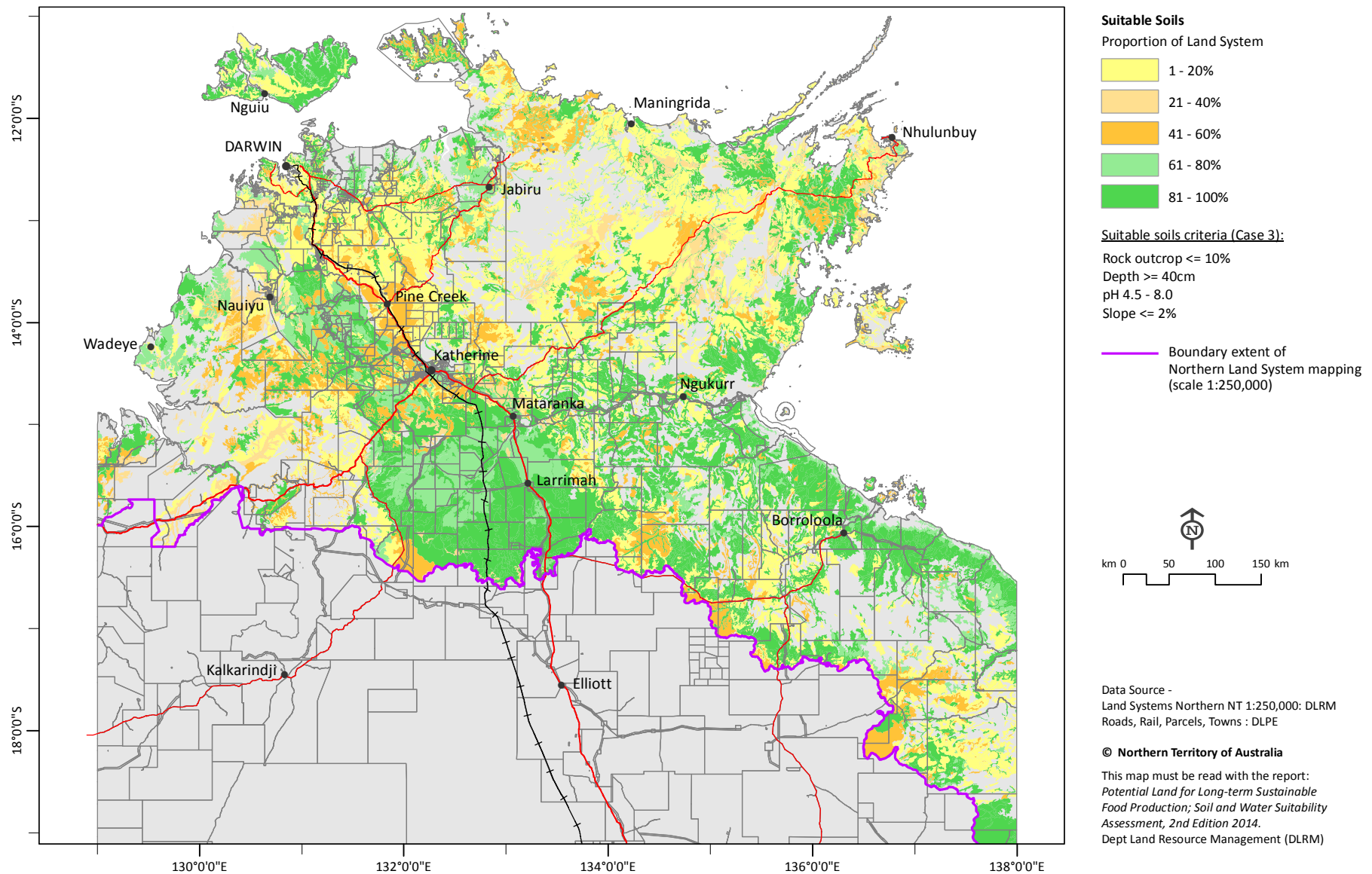
Unlike the northern land system spatial dataset, the southern land systems currently does not contain detailed soil information as an attribute. A Horticultural Rating was allocated to each land system based on soil and landscape descriptions in the original land system descriptions. Horticultural Ratings from Land Systems of the Southern Part of the NT were used for Irrigated Field Crops, and Horticultural Annuals and Perennials.

Criteria used to define Horticulture Rating ≥ 8 is described in Table 1.

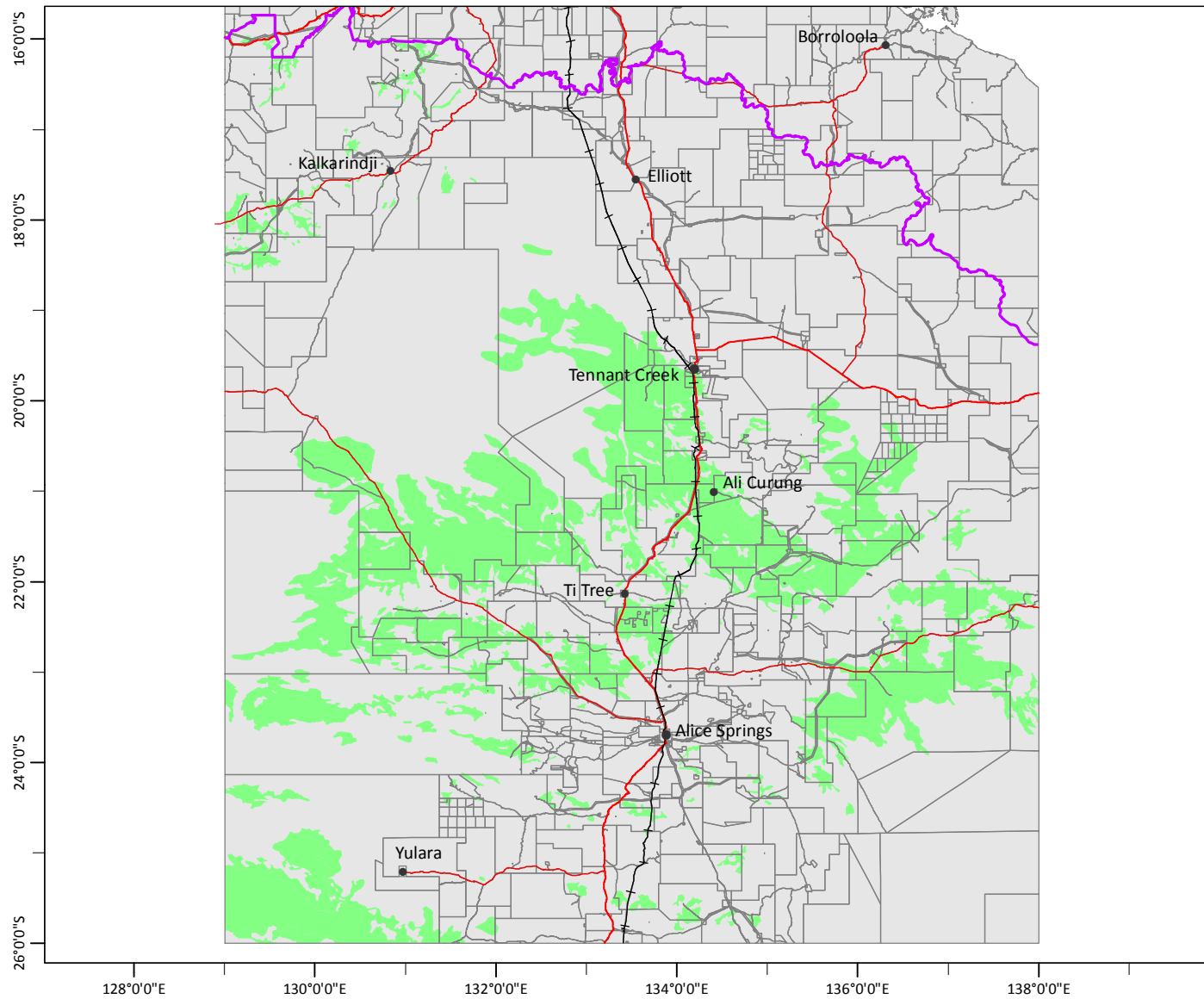
Map 5 Soils Case 1 – Northern Region: Soils suitable for Field Crops (Rainfed and Irrigated), Forage Crops and Perennial Horticulture



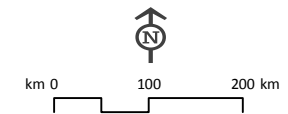
Map 6 Soils Case 3 – Northern Region: Soils suitable for Annual Horticulture



Map 7 Southern Region: Soils suitable for Horticulture



- Suitable areas
Horticultural Rating 8+
- Boundary extent of
Southern Land System mapping
(scale 1:1,000,000)



Data Source -
Land Systems Southern NT 1:1,000,000: DLRM
Roads, Rail, Parcels, Towns : DLPE

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3.4 Landscape

Map 8

Both Native and Improved Pasture suitability was determined using landscape information.

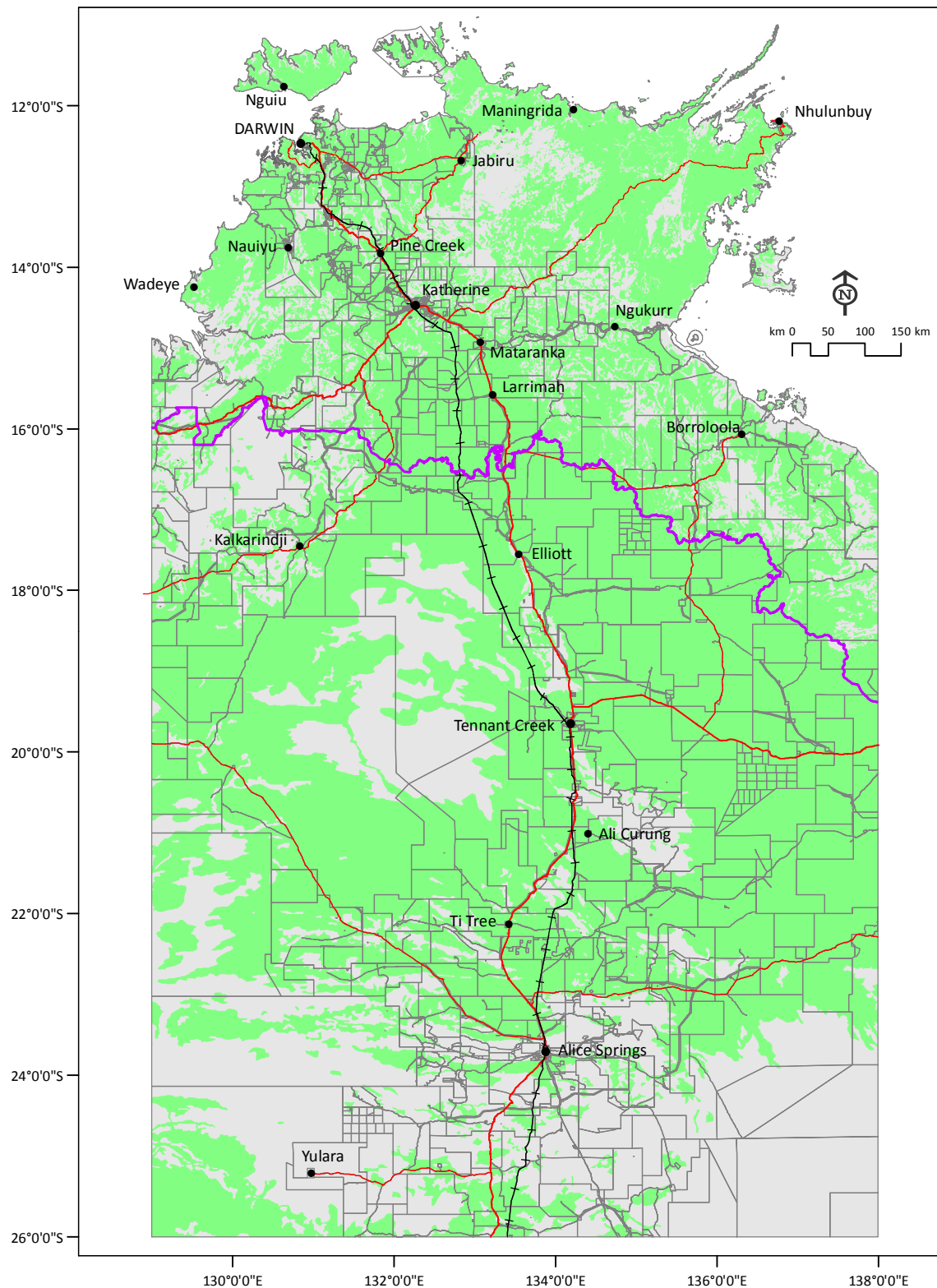
Landscape classes were available in both the Land Systems of the Northern Part of the NT and Land Systems of the Southern Part of the NT. These were used for consistency in analysis. Landscape classes were reclassified into two values; Suitable and Unsuitable.

Suitable Landscape Classes	Unsuitable Landscape Classes
Alluvial floodplains	Basalt hills
Basalt plains and rises	Coastal dunes
Clay plains	Desert dunefields
Coastal floodplains	Granite hills
Desert sandplains	Granite ranges
Elevated plateau surfaces	Lateritic plateaux
Granite plains and rises	Limestone hills
Lateritic plains and rises	Rugged quartz sandstone plateaux and hills
Limestone plains and rises	Salt pans
Sandstone plains and rises	Sandstone hills
	Sandstone ranges
	Tidal flats

Table 4 – Suitable and Unsuitable Landscape Classes for Native and Improved Pasture

Map 8 shows significant differences to the 2011 version of this map. This is a result of an error in the original analysis, in which the landscape class Desert Sandplains was included in the suitability table but inadvertently omitted from the map. The result is a larger area where native pasture, in particular, could be suitable.

Map 8 Suitable Landscapes for Native and Improved Pasture



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 Dept Land Resource Management (DLRM)

Data Source -
 Land Systems Northern NT 1:250,000: DLRM
 Land Systems Southern NT 1:1,000,000: DLRM
 Roads, Rail, Parcels, Towns: DLPE

- Areas that have a suitable landform class
- Boundary between Northern (1:250k) and Southern (1:1mill) Land System mapping

3.5 Intersection of Rainfall, Soil and Groundwater

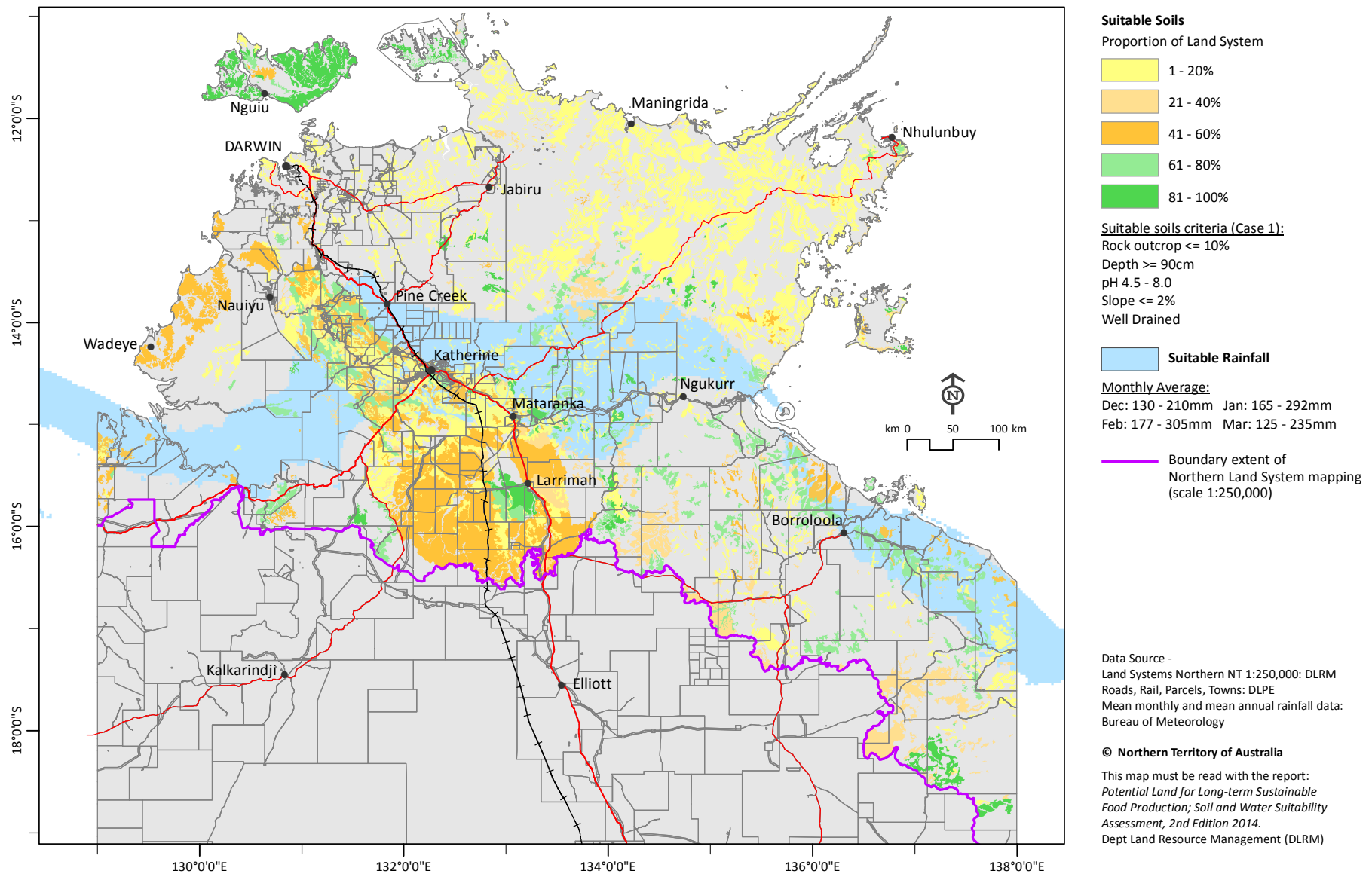
Map 9

Areas suitable for Rainfed Field and Forage crops were determined by intersecting the corresponding rainfall suitability with Soils Case 1. (Refer to Table 1 for criteria)

Southern region data was not used as the footprint of suitable rainfall for Rainfed Field and Forage crops excluded all areas in the southern region. Maps are coloured thematically depicting the proportion of the Land System with suitable soils and rainfall suitability.

Similarly, the method of intersecting rainfall and suitable landscapes, soils (both Northern and Southern) and irrigation potential was also used to produce maps for Irrigated Field Crops, Perennial Horticulture and Annual Horticultural.

Map 9 Northern Region: Rainfall and Soil Suitability Overlay



3.6 Aquifer Salinity

The original methodology intended to utilise Aquifer Salinity to exclude areas unsuitable for agricultural production. DLRM has quite an extensive dataset of bore Total Dissolved Solids (TDS) values within its Hydstra database; however bores have not been attributed to aquifers. This is not a significant issue in areas where only a single water yielding aquifer is likely to occur, but it is a significant problem where aquifers overlap. Nonetheless, an attempt was made to interpolate TDS values of bores using the known location of aquifers as break lines. Inverse Distance Weighting was used with a power of 4, search radius 0.5 degrees and output cell size of 0.02 degrees.

This map is presented in Appendix A.

4. RESULTS

Suitable land for a number of food producing land uses are displayed in a series of maps and are presented under two general headings:

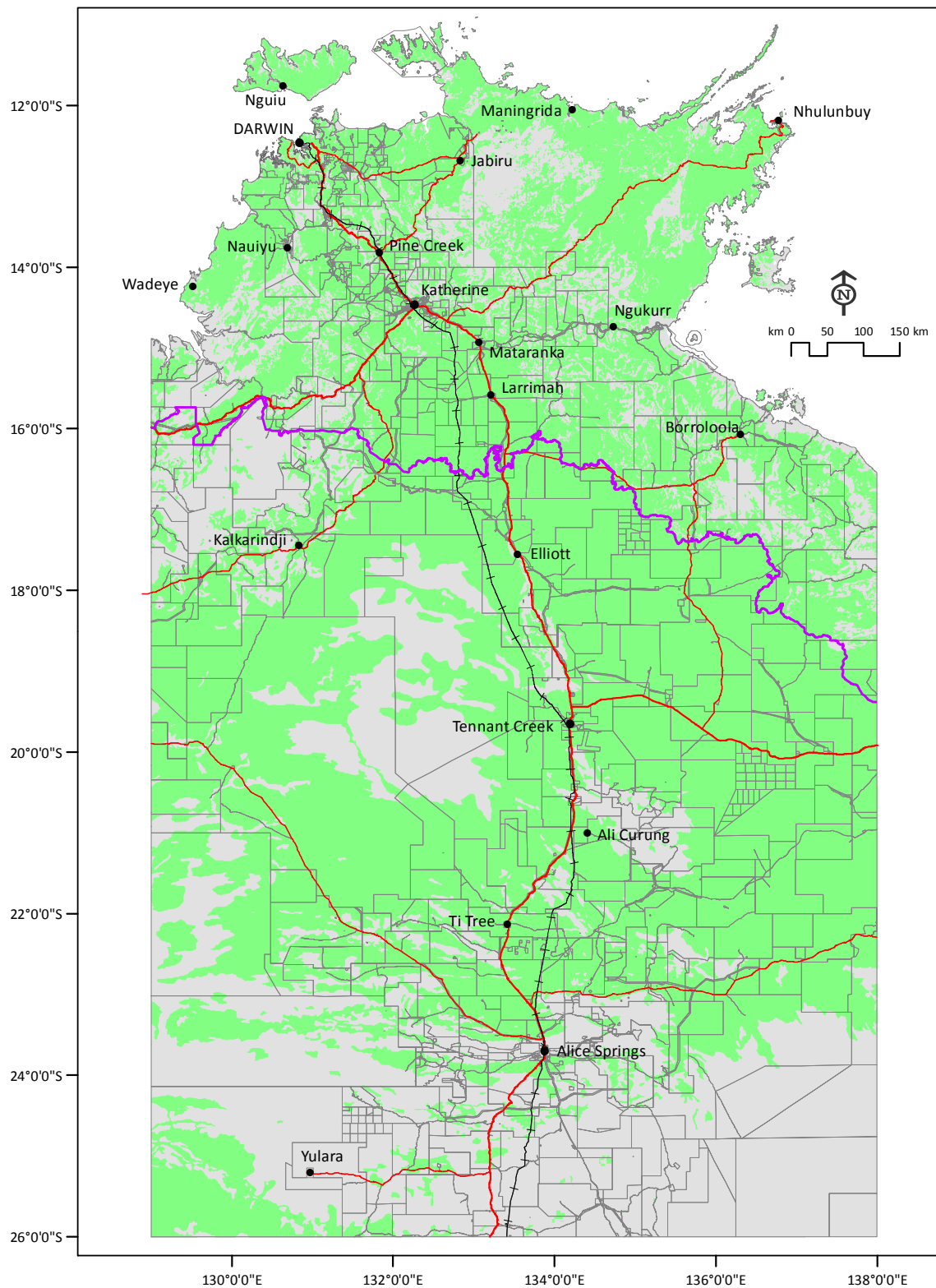
- 4.1 Pasture Suitability, Maps 10 - 11
- 4.2 Field Crops and Irrigated Horticulture, Maps 12 - 19

4.1 Pasture Suitability

Suitable landscape classes were intersected with the rainfall requirements for Native Pasture and Improved Pasture to produce two suitability maps.

- Map 10 Native Pasture Suitability
- Map 11 Northern Region - Improved Pasture Suitability

Map 10 Native Pasture Suitability



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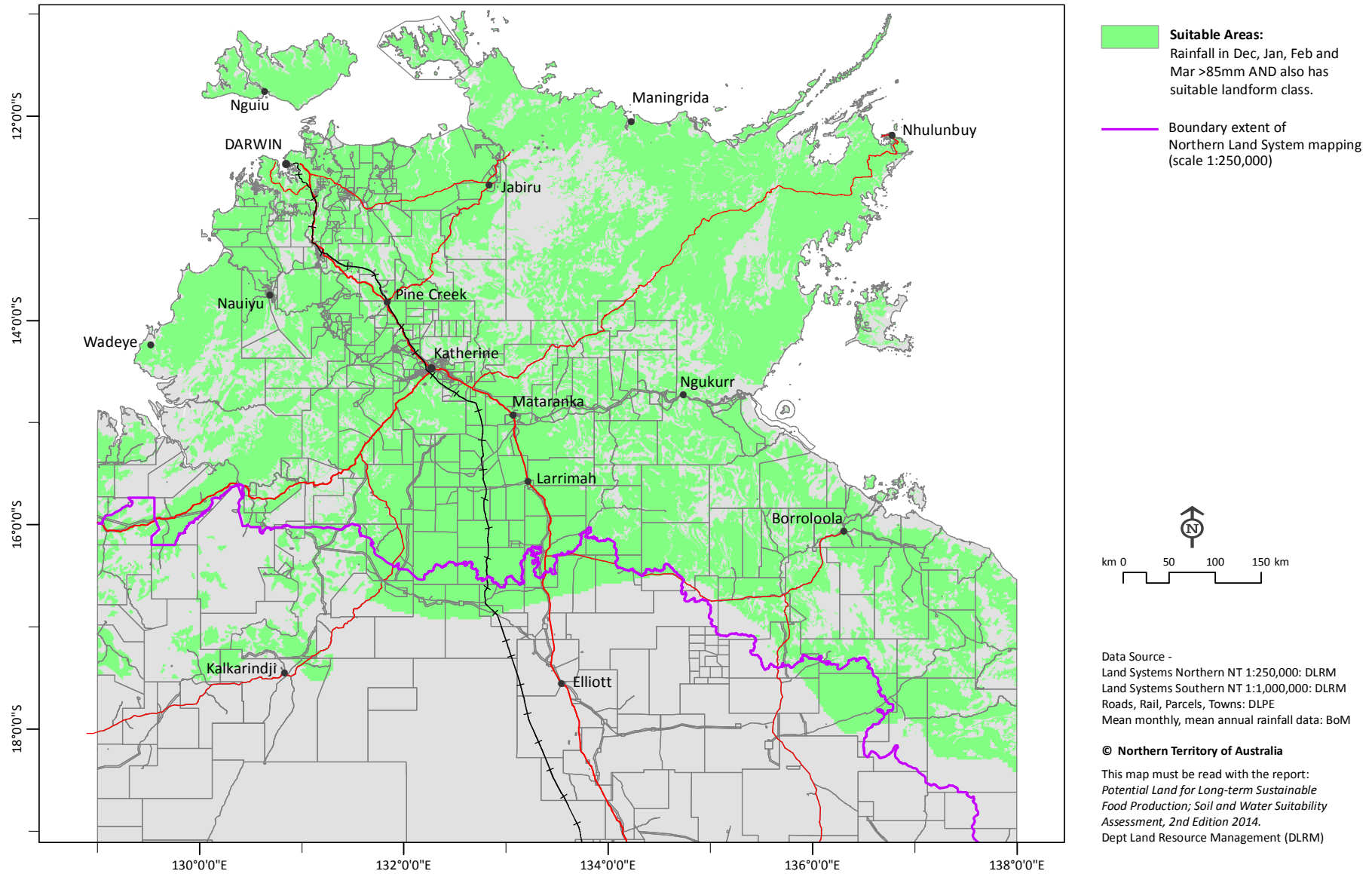
This map must be read with the report:
Identification of Potential Land for Long-term Sustainable Food Production; Identification of Soil and Water Resources, 2nd Edition.
 Dept Land Resource Management (DLRM)

Data Source -
 Land Systems Northern Part NT 1:250,000: DLRM
 Land Systems Southern Part NT 1:1,000,000: DLRM
 Roads, Rail, Parcels, Towns: DLPE
 Mean monthly, mean annual rainfall data: BoM

Suitable Areas:
 Rainfall Dec to Mar total >120mm
 AND also has suitable landform class

Boundary between Northern (1:250k) and Southern (1:1mill) Land System mapping

Map 11 Northern Region: Improved Pasture Suitability



4.2 Field Crops and Irrigated Agriculture

Suitability maps for Field Crops (Irrigated), Annual and Perennial Horticulture have been split into the northern and southern regions, and also by irrigation potential.

Refer to Table 1 for all data criteria.

Northern Region

Intersection of Northern Land Systems Soils Case 1 (Map 5) and Suitable Rainfall (Map 3)

Map 12 Rainfall and Suitable Soils for Rainfed Forage and Rainfed Field Crops

Intersection of Northern Land Systems Soils Case 1 (Map 5) and Groundwater Aquifers potential irrigation classes (Map 4).

Map 13 Field Crops (Irrigated) and Perennial Horticulture - Broad Scale Irrigation Suitability

Map 14 Field Crops (Irrigated) and Perennial Horticulture - Small Scale Irrigation Suitability

Map 15 Field Crops (Irrigated) and Perennial Horticulture - Limited or Localised Irrigation Suitability

Intersection of Northern Land Systems Soils Case 3 (Map 6) and Groundwater Aquifers potential irrigation classes (Map 4).

Map 16 Annual Horticulture - Broad Scale Irrigation Suitability

Map 17 Annual Horticulture - Small Scale Irrigation Suitability

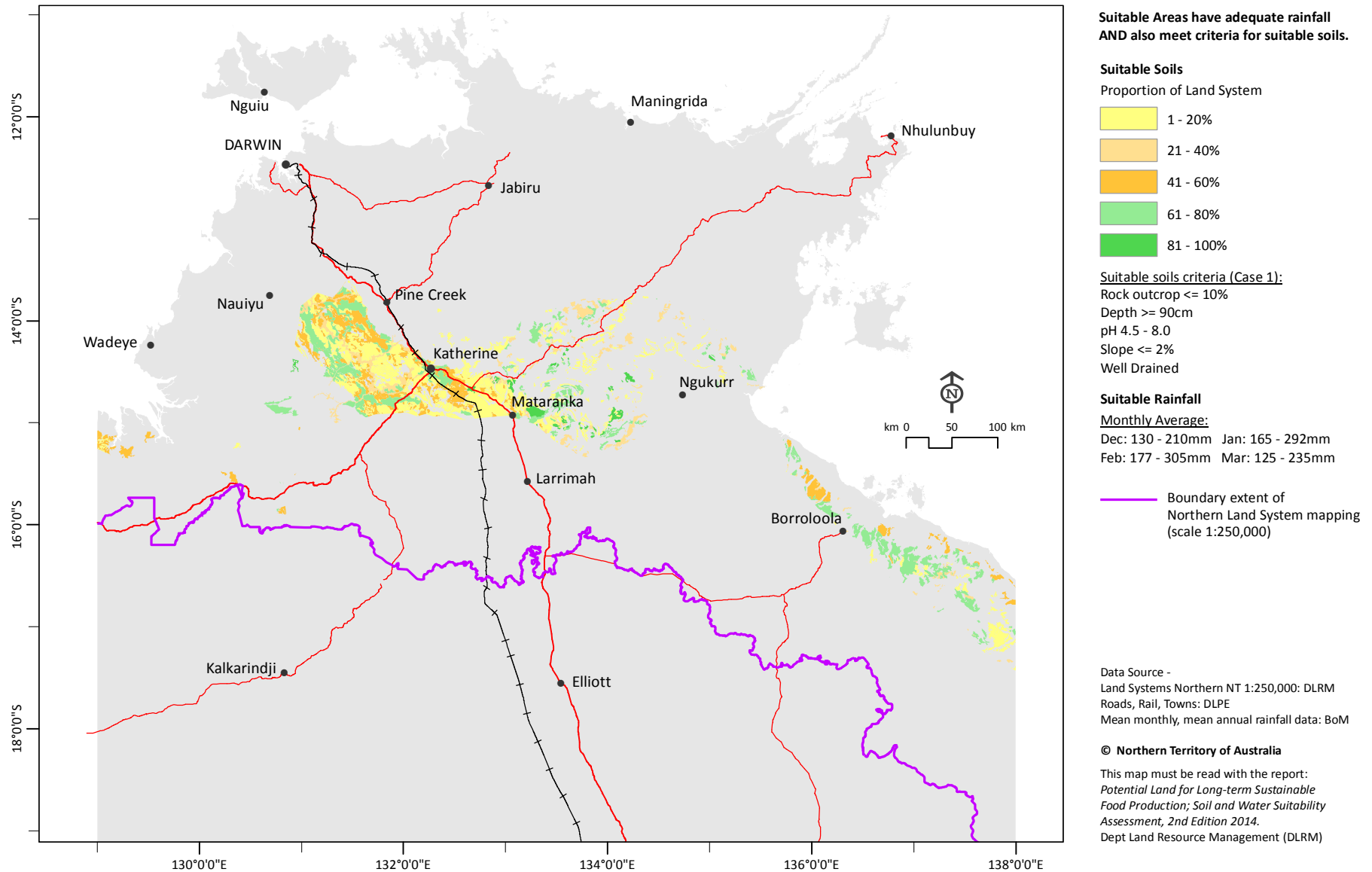
Map 18 Annual Horticulture - Limited or Localised Irrigation Suitability

Southern Region

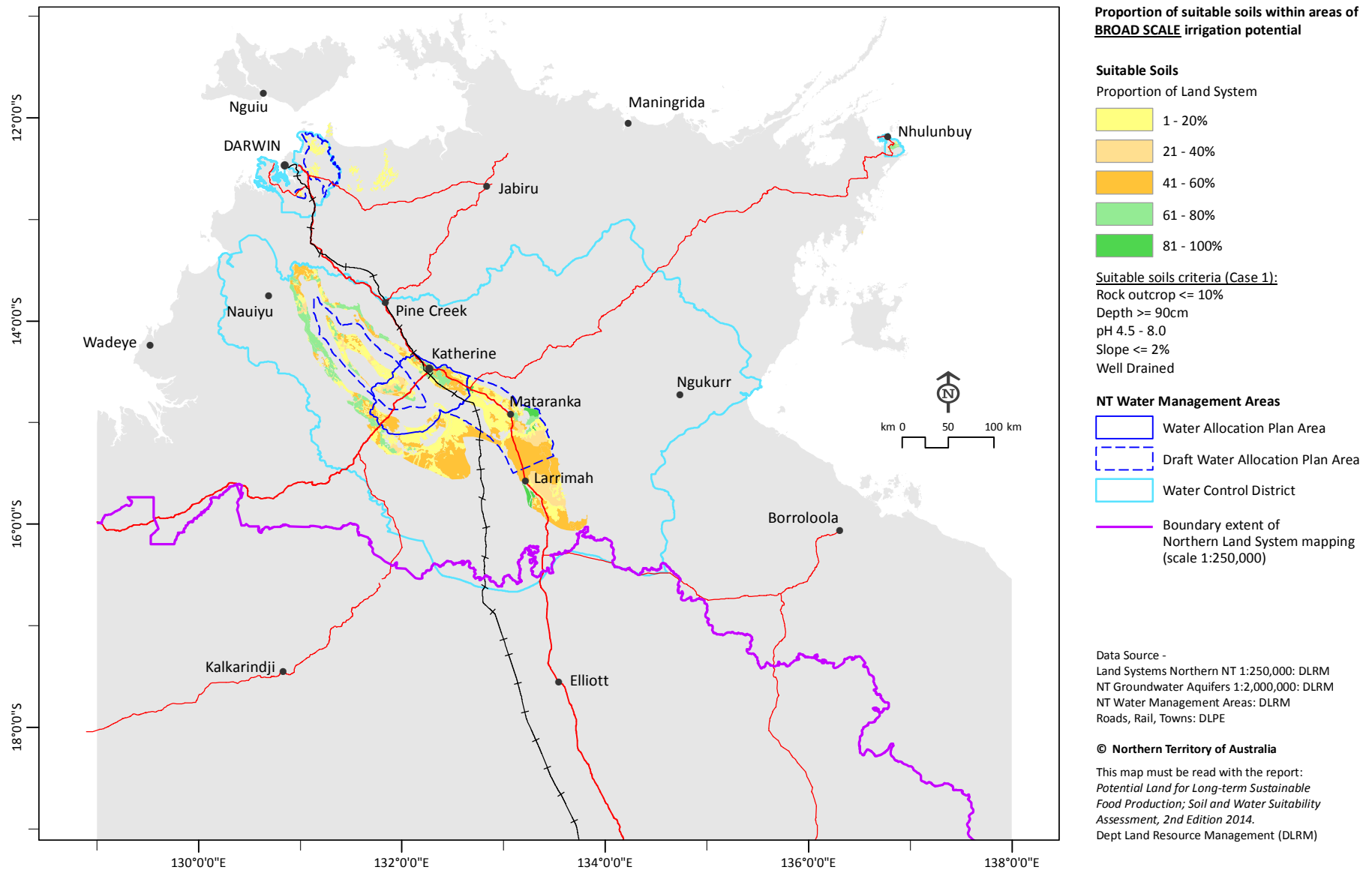
Intersection of Southern Land Systems where Horticulture Rating is ≥ 8 (Map 7) and Groundwater Aquifers potential irrigation classes (Map 4).

Map 19 Field Crops (Irrigated) and Annual and Perennial Horticulture

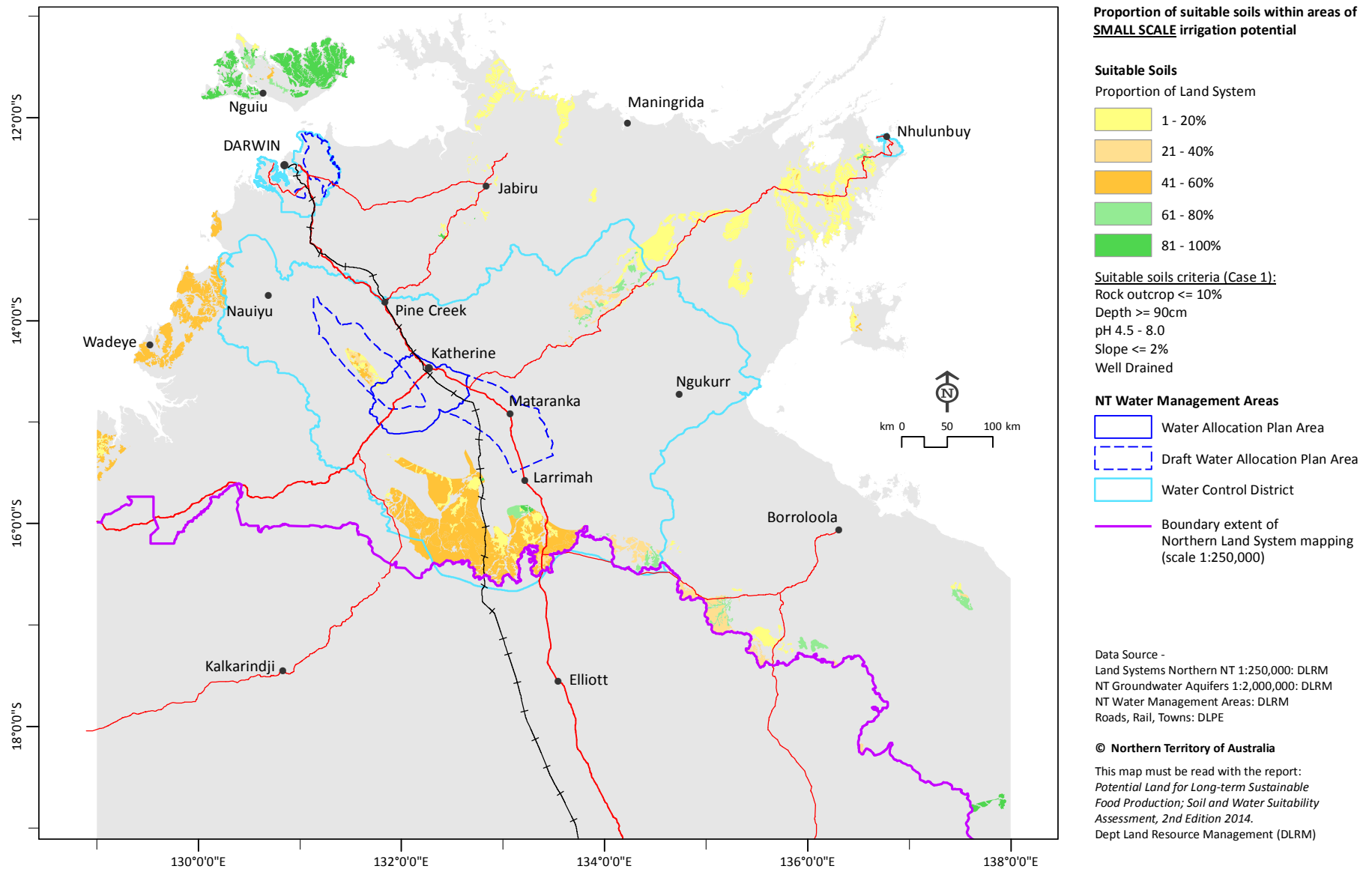
Map 12 Northern Region: Rainfall and Suitable Soils for Rainfed Forage and Field Crops



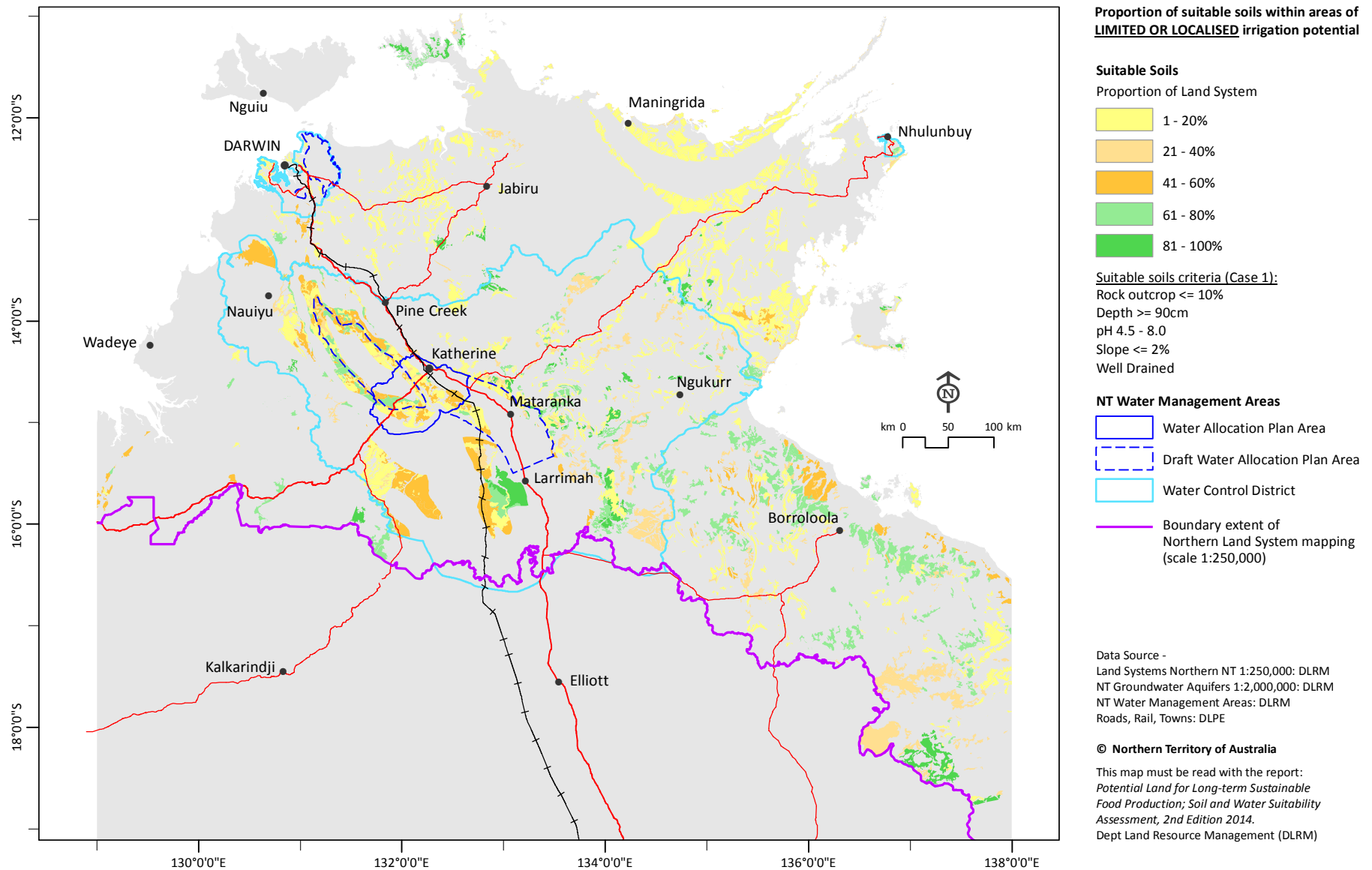
Map 13 Northern Region: Field Crops (Irrigated) and Perennial Horticulture - Broad Scale Irrigation Suitability



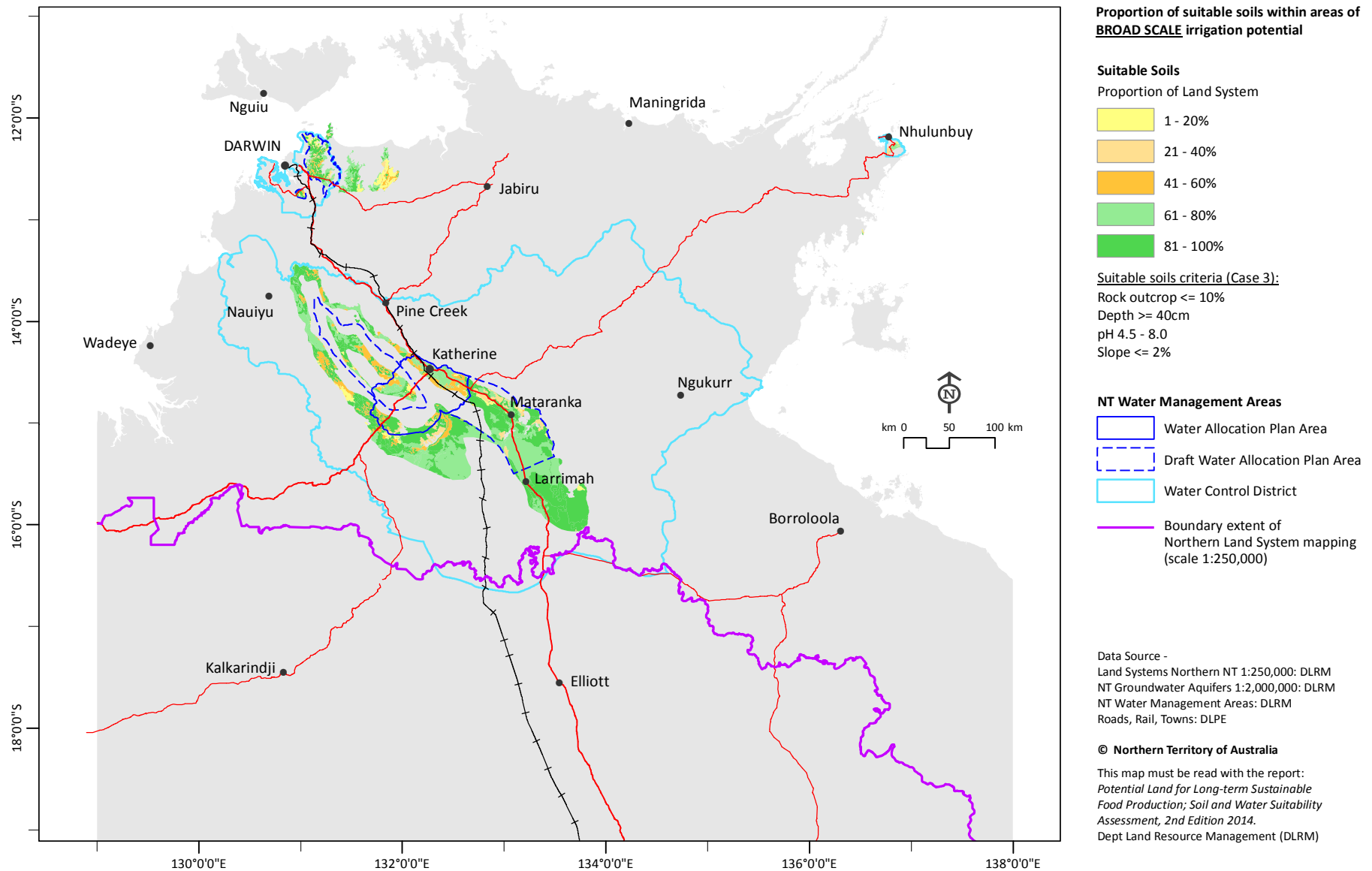
Map 14 Northern Region: Field Crops (Irrigated) and Perennial Horticulture - Small Scale Irrigation Suitability



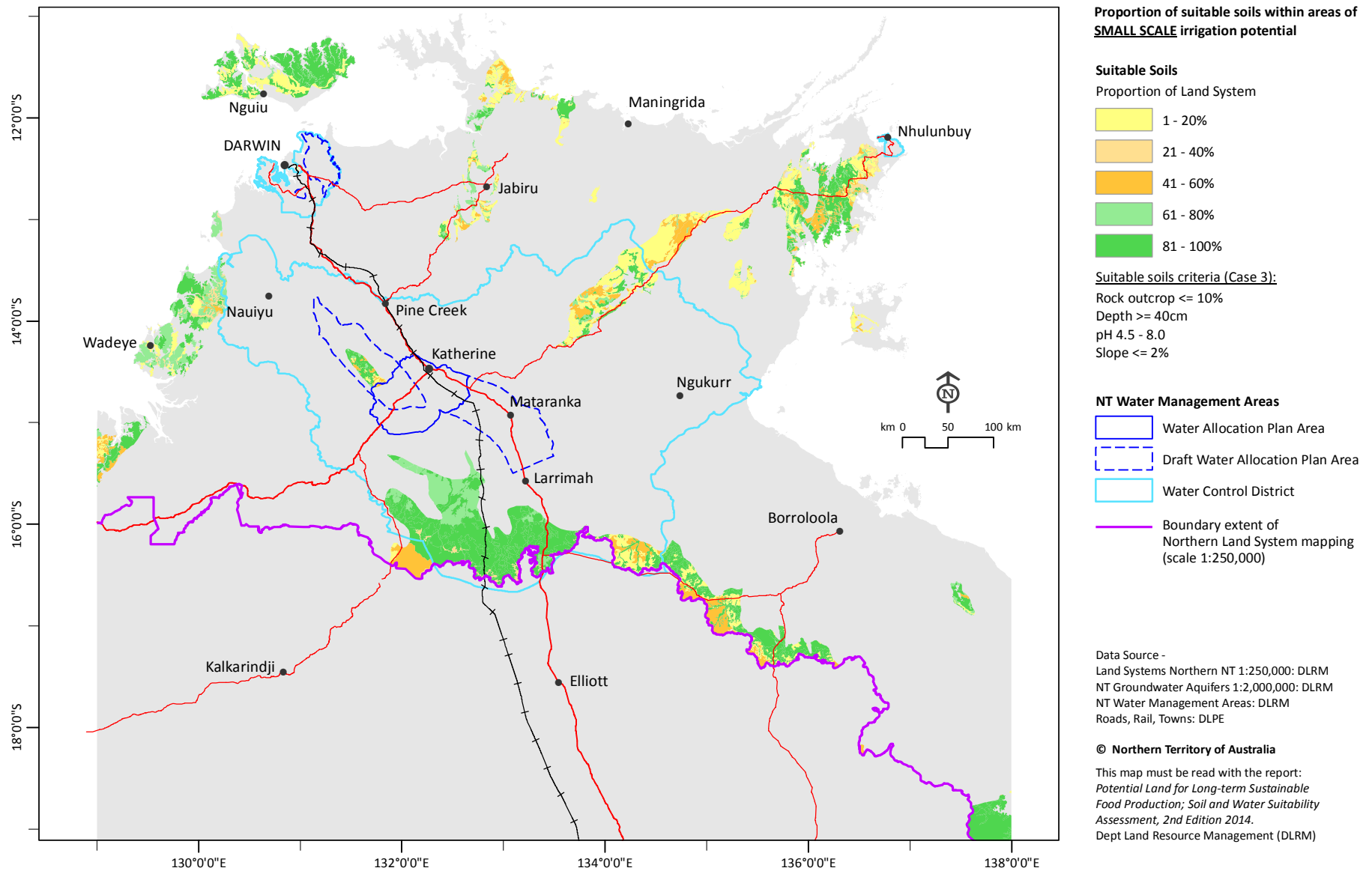
Map 15 Northern Region: Field Crops (Irrigated) and Perennial Horticulture - Limited or Localised Irrigation Suitability



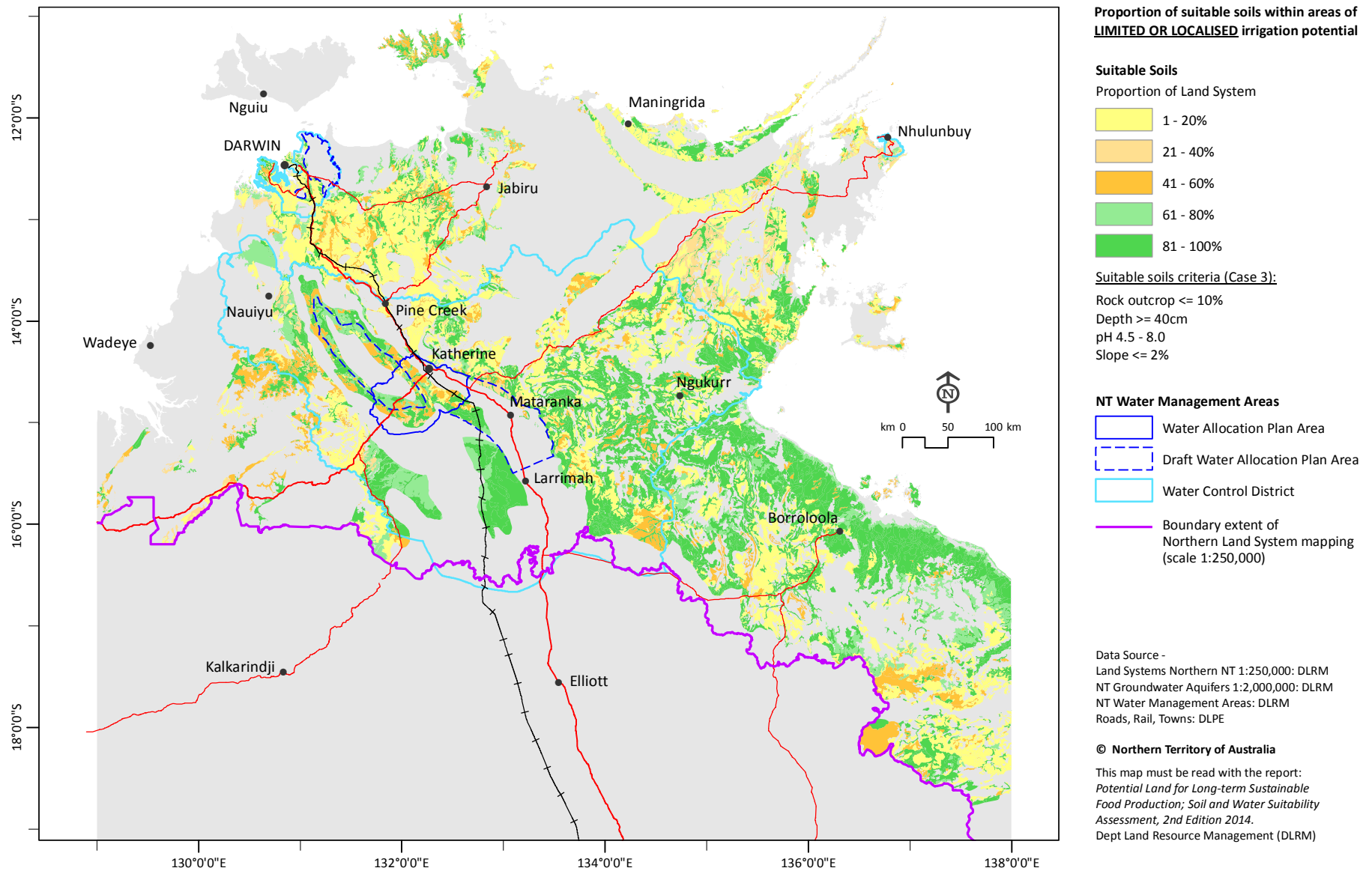
Map 16 Northern Region: Annual Horticulture - Broad Scale Irrigation Suitability



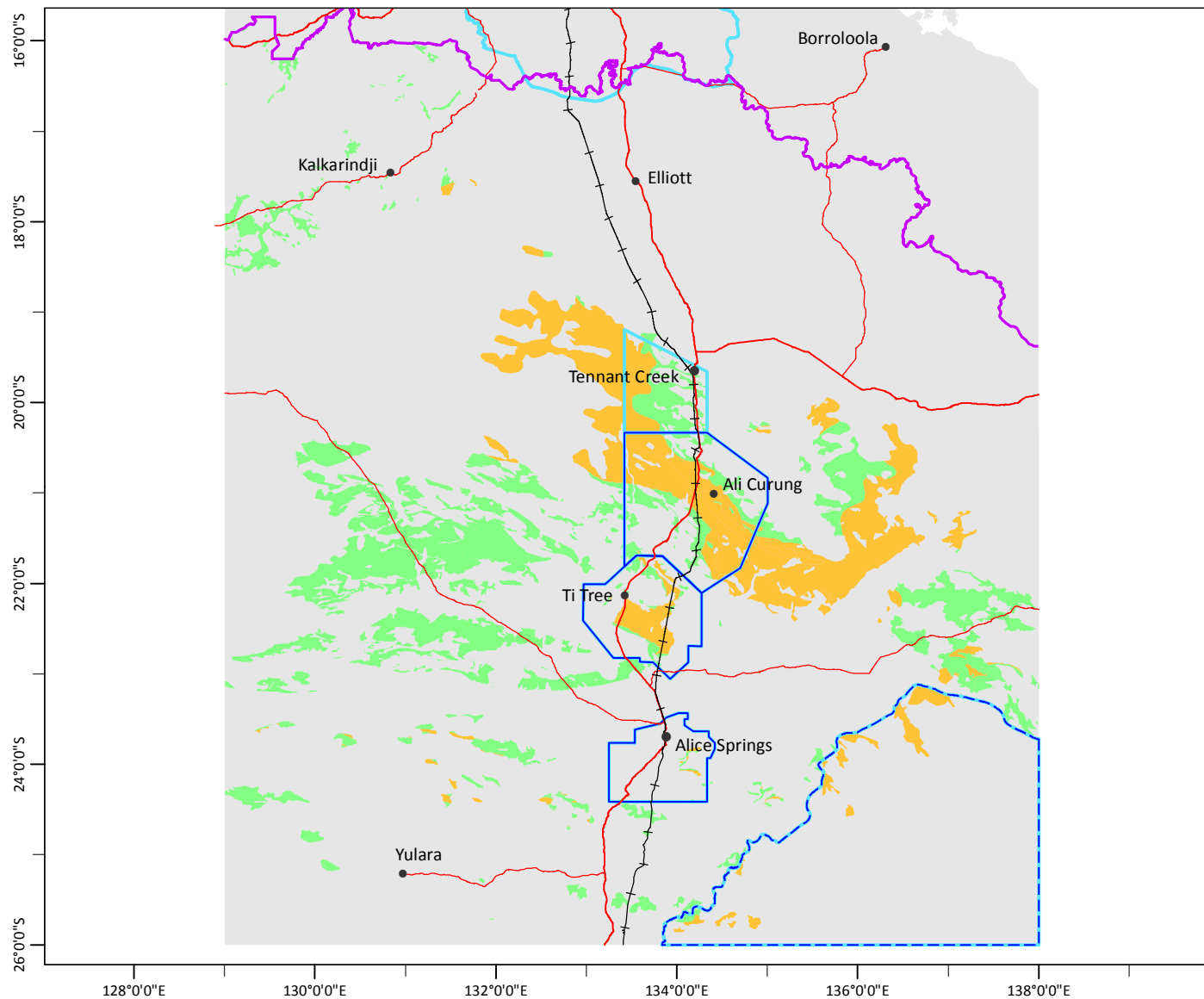
Map 17 Northern Region: Annual Horticulture - Small Scale Irrigation Suitability



Map 18 Northern Region: Annual Horticulture - Limited or Localised Irrigation Suitability



Map 19 Southern Region: Field Crops (Irrigated) and Annual and Perennial Horticulture

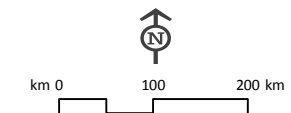


**Suitable soils within areas of Horticulture
Rating >=8 and also irrigation potential for**

- Small Scale Irrigation
- Limited or Localised Irrigation

NT Water Management Areas

- Water Allocation Plan Area
- Draft Water Allocation Plan Area
- Water Control District
- Boundary extent of Southern Land System mapping (scale 1:1,000,000)



Data Source -
 Land Systems Southern Part NT 1:1,000,000: DLRM
 NT Groundwater Aquifers 1:2,000,000: DLRM
 NT Water Management Areas: DLRM
 Roads, Rail, Towns : DLPE

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 Food Production; Soil and Water Suitability
 Assessment, 2nd Edition 2014.*
 Dept Land Resource Management (DLRM)

5. DISCUSSION

5.1 Limitations of the Study

5.1.1 Soil Landscape Data Limitations

The spatial data used in this analysis is broad scale and in some areas interim mapping has been drafted which is yet to be field verified. The maps produced must therefore be used strictly according to surveyed mapping scale. At the time of publication, the Tiwi Islands were undergoing extensive soil and landscape field investigations. This data was not available for analysis. Maps 13-18 should be used with caution in the Tiwi Islands.

Any plans to pursue agricultural or horticultural development should involve further detailed investigations using local scale datasets. When identifying suitable areas on a localised scale, mapping and data of a more detailed scale is required. However, this level of detail is not available consistently across the entire Northern Territory.

In some areas, such as the greater Darwin and Katherine Daly regions, more detailed land resource information, predominantly 1:25,000 and 1:50,000 respectively is available; however, in most regions this level of information does not currently exist. It is important to note that the scale of soil information required for an intensive agricultural development is generally at least 1:10,000.

5.1.2 Groundwater Resources and Irrigation Potential

Reclassified Actual Yield from the Northern Territory Groundwater Aquifers (1:2,000,000) dataset was used as a substitute for the availability of groundwater resources across the Northern Territory. This data is only indicative of the availability of water and does not include an analysis of other issues such as the sustainability of the water supply or salinity.

Water Control Districts and Water Allocation Planning Areas are managed under the *Water Act* and should be considered prior to any large scale development occurring to ensure water supplies are sustainable into the future. NT water management areas displayed on maps 12 – 19 are current as at September 2014.

The discovery of the Florina Formation in the Daly area now indicates there is potential for Small Scale Irrigation where as previously this area had been classified as Limited or Localised Irrigation Suitability.

At the time of publication, the Tiwi Islands were undergoing extensive water investigations. This data was not available for the analysis used in this report. Maps 13-18 should be used with caution in the Tiwi Islands.

5.1.3 Rainfall

The rainfall information used was Gridded Mean Monthly Rainfall from the Bureau of Meteorology. Although it may not be the best indicator of reliability as it is a 30-year average and not percentiles; the DPIF agronomists determined that for pastures a single good season is all that is required to establish the pasture. Forage and field crops however could be susceptible to poor rainfall years and may benefit from in-depth analysis of rainfall percentiles.

Preliminary analysis of Rainfall Percentiles have not produced results with any more confidence than the previous method which utilised averages.

5.2 Land Suitability

5.2.1 Native Pasture Suitability

Map 10 Rainfall suitability covered the majority of the Northern Territory. Native pastures were determined to be limited by suitable landscapes.

The suitability area has now been redefined with the inclusion of the landscape class Desert Sandplains, which was erroneously omitted from the mapping in the 2011 report.

5.2.2 Improved Pasture Suitability

Map 11 Improved pasture is limited by both rainfall and also landscape class. The rainfall suitability extends south as far as Kalkarindji, Top Springs, Dunmarra and Benmara with landscape limiting suitability north of these locations.

The omission of Desert Sandplains in the original mapping has not affected the Improved Pasture suitability mapping significantly, as the bulk of the Desert Sandplain landscapes occurred in areas with insufficient rainfall for improved pasture.

5.2.3 Forage and Rainfed Field Crops Suitability

Map 12 Suitability for forage and rainfed field crops is generally restricted to the Daly Region and some areas in the vicinity of Borroloola. It would appear that the limiting factors are rainfall as in both cases soil suitability extends to the north and south of the suitable areas. To the south, rainfall is too low to establish and grow the crops and to the north rainfall is too high and extends beyond the growing season making harvesting difficult.

5.2.4 Northern Region: Field Crops (Irrigated) and Horticulture (Perennial) Suitability

Maps 13 – 15 Three maps have been produced for Field Crops (irrigated) and Perennial Horticulture showing areas of suitable soils for (i) broad scale, (ii) small scale and (iii) limited/localised irrigation potential.

Again the Katherine Daly Region stands out as having potential for broad scale irrigation potential. This is supported by existing published information.

The inclusion of the Florina Formation in the Daly area has resulted in an additional small area now classified as suitable for small scale irrigation, although the proportion of suitable Land Systems in this area is small.

Northern Territory Water Management Areas have also been displayed on these maps as an indicator of the knowledge and effort already in place to map and manage this resource. Areas with broad scale irrigation potential and suitable soils would be the most favourable areas for large scale commercial development.

Areas of small scale irrigation potential have been identified on the Tiwi Islands, Wadeye and the region between Dry River and Daly Waters. These areas stand out as having both suitable soils and the potential for small scale irrigation. They are potentially suitable for smaller commercial horticultural operations.

Limited/localised Irrigation Potential can be found throughout the remainder of the Top End. Although most of these areas have low percentages of suitable soils within Land Systems there are some areas that could potentially support local production around Borroloola, Benmara Station and the outer areas of the Katherine Daly Region. Broad and small scale commercial production is unlikely to be sustainable however there would likely be sufficient resources to supply local communities.

5.2.5 Northern Region: Horticulture (Annual) Suitability

Maps 16 – 18 As with Field Crops (irrigated) and Horticulture Perennial, three maps have been produced for Annual Horticulture in the Top End: (i) broad scale, (ii) small scale and (iii) limited/localised irrigation potential.

As with the horticulture perennials, annuals are suited to the Katherine Daly Region with the potential for broad scale irrigation. In addition, areas to the east of Darwin are also suitable for Perennial Horticulture most likely as a direct result of Annual Horticulture being suited to shallower soils; as little as 40 cm compared to perennials which require a minimum of 90 cm.

Areas suitable for Annual Horticulture with small scale irrigation have been identified on the Tiwi Islands, Wadeye, south between Gapuwiyak and Yirrkala, Bulman and Dry River, and areas south east of Daly Waters.

The localised/limited irrigation potential shows a much greater extent of suitability, particularly east of Mataranka; however, given the irrigation potential is limited/localised, investigation for the sustainability of the water resources would be required to determine how feasible such a venture would be. It is unlikely that broad scale commercial production would be feasible in these areas but there may be some opportunity for small or local scale development around Borroloola, Ngukurr, Numbulwar and Ramingining.

5.2.6 Southern Region: Field Crops (Irrigated) and Horticulture (Annual and Perennial) Suitability

Map 19 Detailed spatial data with appropriate attribution in the southern region is limited. Horticulture Ratings were derived by experts in DLRM and DPIF with local knowledge in soil-landscapes, crop requirements and groundwater. There is little information on soil depth, pH or other factors which were used in the northern region assessment. The southern map therefore only shows these areas with the derived irrigation potential and some form of potential horticulture capability.

Based on the existing information, the southern region has no broad scale irrigation potential, only small scale and limited/localised potential. Areas of irrigated field crops and small scale irrigation potential occur in the vicinity of Three Ways, Ali Curung and Ti Tree. Limited irrigation potential is scattered across the rest of the southern region. Yuendumu has a large area of suitable land that could be further explored.

5.2.7 Aquifer Salinity

Appendix A. Aquifer salinity was not used in the analysis. As can be seen from the map in Appendix A, salinity varies greatly in the Northern Territory. Not all areas have water quality data records in an accessible spatial format and may be displayed as “TDS Insufficient Data”. Any proposals to utilise groundwater resources should be assessed for salinity.

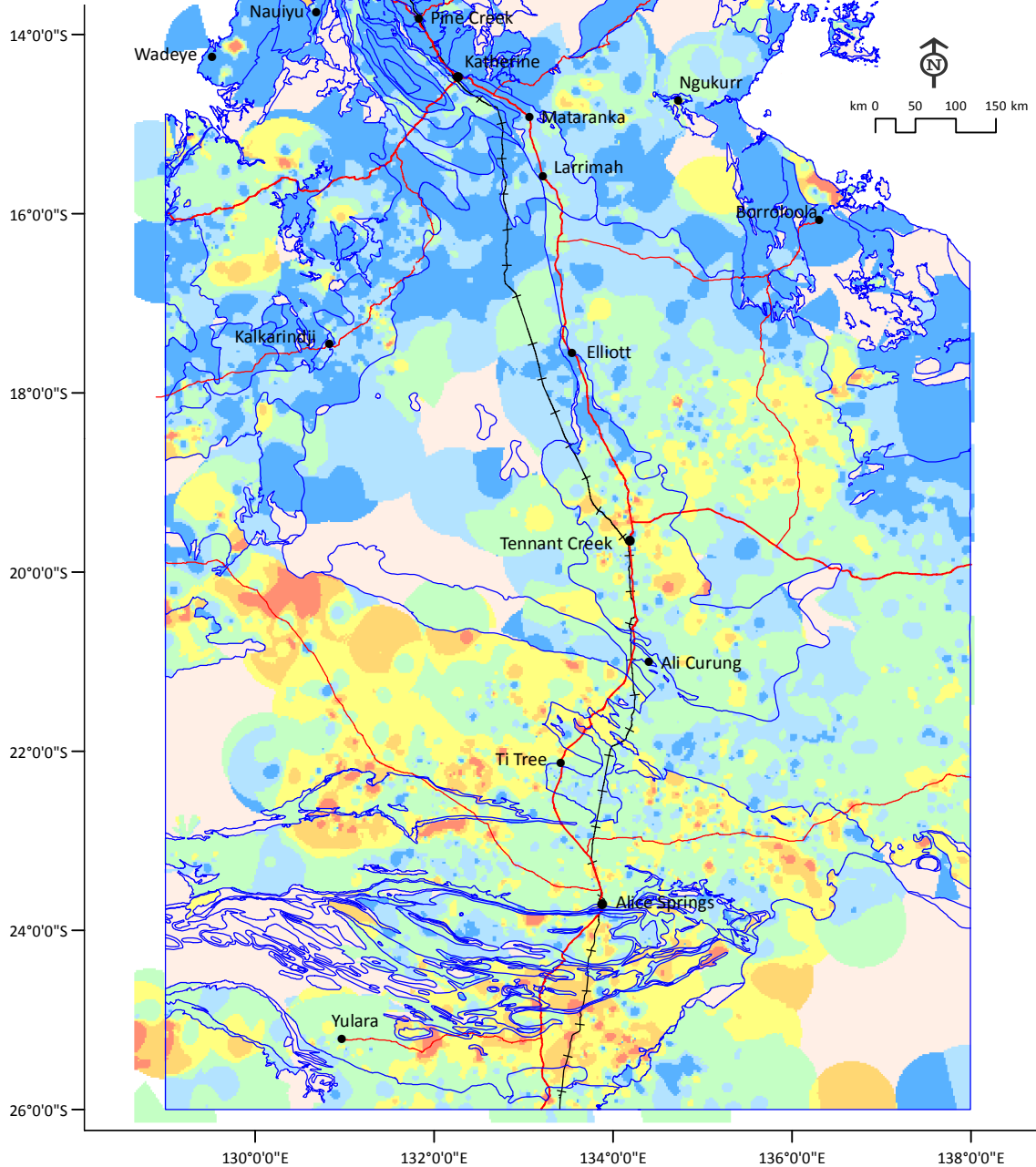
6. REFERENCES

To find out more about the spatial datasets used in this report please view the Metadata records. Where DLRM is the custodian, the spatial datasets are available to the public using the Creative Commons Attribution [license](#). The metadata link for this updated 2014 project has not changed.

Type	Date	Details	More Information
Spatial & Ref	Oct, 2014	Pascoe-Bell A., Green C., Lynch B., Hill J., Tickell S.J. (DLRM) and Cameron A., Smith S. (DPIF) <i>Potential Land for Long-term Sustainable Food Production. Soil and Water Suitability Assessment, 2nd Edition. Oct 2014</i> Department of Land Resource Management. Palmerston, NT	Metadata Report
Spatial & Ref	Sept, 2011	Pascoe-Bell A., Lynch B., Hill J., Green C., Tickell S.J. (DNRETAS) and Cameron A., Smith S. (DoR) <i>Identification of Suitable Land for Sustainable Food Production in the NT. Identification of Soil and Water Resources.</i> Natural Resources Division, Department of Natural Resources, Environment, The Arts and Sport. Palmerston, NT	Metadata Report
Spatial	Nov, 2012	Lynch, B. <i>Land Systems of the Northern Part of the NT 1:250,000</i> Department of Land Resource Management, NT	Metadata
Spatial	Oct, 2013	Lynch, B. <i>Land Systems of the Southern Part of the NT 1:1,000,000</i> Department of Land Resource Management, NT	Metadata
Spatial & Ref	Sept, 2014	Tickell, S.J. <i>Northern Territory Groundwater - Aquifers 1:2,000,000</i> Department of Land Resource Management, NT	Metadata Report
Spatial	Sept, 2014	<i>Hydrological Information of the Northern Territory</i> Department of Land Resource Management, Palmerston, NT. Also refer to DLRM Water Resources NT: Water Data Portal	Metadata
Spatial	Feb, 2013	<i>Northern Territory Water Management Areas</i> Department of Land Resource Management, NT	Metadata
Spatial	1961-1990	<i>Mean monthly and mean annual rainfall data</i> Bureau of Meteorology, Australian Government	Metadata
Spatial	Oct, 2014	<i>Land Parcels - Digital Cadastral Database of the NT</i> Department of Lands, Planning and the Environment (DLPE)	Metadata
Spatial	Oct, 2014	<i>Road Centrelines, Railways - Digital Cadastral Database of the NT</i> Department of Lands, Planning and the Environment (DLPE)	Metadata
Spatial	Oct, 2014	<i>Town locations - Place Names Register</i> Department of Lands, Planning and the Environment (DLPE)	Metadata
Ref	2009	National Committee on Soil and Terrain <i>Australian Soil and Land Survey Field Handbook</i> Third Edition, CSIRO Publishing, Collingwood, Victoria	CSIRO
Ref	1985	Williams, J. Day, K.J. Isbell, R.F. and Reddy, S.J. <i>Soils and climate. In: Muchow, R.C. (1985), Agro-research for the semi-arid tropics.</i> University of Queensland Press: St. Lucia	

Appendix A - Aquifer Salinity

Interpolation of TDS (Total Dissolved Solids) values from Bore samples.
 Interpolation Method : IDW
 Output cell size: 0.02 deg
 Power: 4
 Search Radius: 0.5 deg
 Breaklines: NT Aquifers
 No attempt has been made to assign bores to an aquifer in regions where there are multiple aquifers.



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 Dept Land Resource Management (DLRM)

