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Hunter Councils

MAPPING

IMPORTANT AGRICULTURAL LANDS

IN THE LOWER HUNTER REGION OF NSW

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Table of Contents

Table of Figures

List of Tables

Executive Summary

As part of the Australian Government's sustainable population strategy, the Sustainable Regional Development (SRD) program is being undertaken to protect matters of national environmental significance in selected high growth regions across Australia. The rapidly developing Lower Hunter region of NSW is the focus of the Department's current work.

This study was commissioned as part of the SRD program to address a key information gap in the Lower Hunter regarding Important Agricultural Lands (IAL). Accordingly, it has mapped and assessed IAL across the entirety of the region, including the Newcastle, Lake Macquarie, Maitland, Cessnock and Port Stephens Local government Areas.

In total, over 70 individuals and organisations with relevant agricultural interests in the study area, or technical expertise pertaining to the project's mapping and analysis processes, were consulted. This included engaging local farming interests, relevant industry associations, technical specialists and government agency staff through a variety of methods.

A Technical Working Group (TWG) was also formed comprising representatives from Federal Government, State Government, local councils, and the various agricultural industries in the region.

The study found that Lower Hunter region of NSW has a range of natural resources and climatic conditions which support a wide variety of agricultural enterprises. The region is noted for its complex rural economy largely based around intensive poultry farming, viticulture, livestock grazing and protected, broadacre and cultivated cropping, but it is increasingly diversifying into a range of specialist, high value and boutique occupations that occupy smaller parcels of land and provide higher returns per hectare.

Despite its relatively small size, the region has an established international reputation for wine making and a thriving tourism industry associated with it. It is the third largest supplier of turf, and produces 10% of eggs, 10% of chicken meat, 9% of turkeys, and 3.3% of vegetables produced in NSW. The history of agriculture in the region demonstrates that it is a highly diverse and adaptable sector which has the potential to continue to supply regional, State and global markets into the future and to value add to the region's economy.

This study found that some 13.5% of the Lower Hunter region has been identified as highly Important Agricultural Land. As a result of historical settlement patterns, a significant proportion of these occur in the Cessnock, Maitland and Port Stephens Local Government Areas. It is noted that while the most highly fertile lands in this category have a natural protection against urban development (as they occur on flood prone lands) they are nevertheless highly exposed to impacts from encroachment and changed biophysical conditions associated with urban development.

The key challenge for the Lower Hunter is maintaining and improving agricultural productivity and diversification in response to changing climate and markets, and in the face of increasing development pressures, encroachment impacts and competition for lands.

As the region continues to grow and develop, a suite of approaches will be required to minimise land use conflicts, and the gradual fragmentation and loss of its IAL.

Key recommendations for consideration in the Australian Government's Strategic Assessment process and the NSW Government's regional planning process for the Lower Hunter follow:

1. Consideration of the Lower Hunter IAL mapping by relevant Australian, State, regional and local government planning instruments (including assessments of State and Regionally Significant Developments) to seek to preserve this non-renewable resource for future generations.

2. Identification and implementation of a strategic response to the proposed future planning scenarios and their impacts on agricultural lands in the three LGAs of Maitland, Port Stephens and Cessnock. These contain 93% of the identified IAL in the region and have the potential to be reduced by at least 17% under current proposals.
3. Further investigation of opportunities for protecting the more contiguous patches of IAL available in the western and northern sections of the region. The historical settlement patterns and future development pressures occurring in the coastal LGAs of Lake Macquarie and Newcastle heighten the importance of these areas as they have the potential to facilitate buffering from encroachment, capitalise on the sustainability (industrial ecology) opportunities available through co-location of industries, and may increase the ability to take advantage of carbon farming, biobanking, corridor maintenance and other biodiversity conservation opportunities.
4. Protection of other lands available for agricultural activities (as depicted in the beef cattle industry maps) as they are considered important for the ongoing viability of agriculture in the region. This will ensure there are adequate lands available to allow the agricultural sector to continue to adapt to future economic pressures, market opportunities and climate change impacts.
5. The continued accommodation of poultry farming and protected cropping industries which are dependent upon local planning regimes rather than the important biophysical lands as they significantly contribute to the regional economy and have continued to expand over the last ten years.

1 Introduction

1.1 Project Background

The Department of Sustainability, Environment, Water, Population and Communities (the Department) is responsible for implementing the Australian Government's policies to protect our environment and heritage, and to promote a sustainable way of life.

As part of the Government's sustainable population strategy, the Sustainable Regional Development (SRD) program is being undertaken to protect matters of national environmental significance in selected high growth regions across Australia. The rapidly developing Lower Hunter region of NSW is the focus of the Department's current work.

The process has two main stages. First, the Australian and NSW governments will work together to identify key knowledge gaps and scientific research to inform sustainability planning for the Lower Hunter region. This work will complement and inform the NSW government's review of the NSW Lower Hunter Regional Strategy and Lower Hunter Regional Conservation Plan. Once this review is complete, the second stage will be to undertake a Strategic Assessment of proposed urban development and related infrastructure corridors.

As part of the SRD program activities, and to address a key knowledge gap identified by Local, State and Australian governments, the HCCREMS team at Hunter Councils Inc. was commissioned in late 2012 to map and assess Important Agricultural Lands (IAL) in the Lower Hunter region.

The project required a number of key deliverables:

1. Sourcing, collation and analysis of the best available agricultural data from Federal, State and Local Government Authorities, the Hunter & Central Rivers Catchment Management Authority and the Hunter & Central Coast Regional Environmental Management Strategy (HCCREMS).
2. Mapping of IAL utilising the methodology approved by the NSW Government.
3. Organisation and facilitation of up to five (5) structured workshops with stakeholders (including local farmers) in each LGA as relevant.
4. Preparation of a report that presents the findings of the study and provides recommendations relating to potential threats and measures to protect IAL.

The findings of this work are contained in the following report.

1.2 Study Region

The study area encompasses the entire Lower Hunter region of NSW including the Cessnock, Lake Macquarie, Maitland, Newcastle, and Port Stephens Local Government Areas (LGAs). See Figure 1.

Figure 1: Map of the Study Area

2 Project Methods

2.1 Research and Analysis

Preliminary research was undertaken to review a range of previous approaches to agricultural lands mapping projects in NSW including:

- The Draft Strategic Land Use Plan – Upper Hunter (2012) by the Department of Planning and Infrastructure (DP&I)
- The Agricultural Land Classification Study – Taree Shire (2000) by NSW Agriculture
- The Mid-North Coast Farmland Mapping Project (2008) by the Department of Planning (DoP), Department of Environment & Climate Change (DECC), Department of Primary Industries (DPI).

However, DPI's "*Identifying Important Agricultural Industry Lands in NSW: An interim draft guide on how to report and locate lands for specific agricultural industries (2012)*" formed the basis of the Lower Hunter IAL mapping project in line with contract specifications. The methodology is also consistent with the mapping undertaken for the Upper Hunter region and enables the alignment of outputs between the two study areas.

Desktop research was also undertaken into the various agricultural industries active in the Lower Hunter using a range of data sources. In particular, the Australian Bureau of Statistics (ABS) Agricultural Census data (2001, 2006 and 2011) was utilised to identify the key agricultural industries and trends in the Lower Hunter and the significance of these activities to the greater Hunter region, and NSW.

The ABS data provided detailed information on the area utilised by different agricultural enterprises, annual production tonnages, and the wholesale value of the agricultural commodities reported at each Agricultural Census.

There are a number of well recognised limitations associated with the use of the ABS data (and by extension the DPI agricultural data) and these are discussed in Appendix 4. However, despite the limitations, the data provides the most consistent, extensive, and comparable information on agricultural production value data across NSW and is widely referenced by Federal and State agencies.

Additional information was sought from DPI's Agricultural Land Use Planning website, relevant agricultural industry associations and subsidiary industry bodies (such as tourism) to gain a broader picture of the scale, flow on values and regional significance of the various agricultural activities.

The determination of the region's key agricultural industries involved:

1. Consideration of the economic significance of an industry to the Lower Hunter as well as their importance for the broader Hunter region/state utilising ABS statistics. Factors included:
    i. the annual value of local production by that sector
    ii. the land size utilised by the industry
    iii. how widespread it is in a region (how many growers / graziers)
    iv. its relative significance in terms of local agricultural output, flow on values (e.g. regional processing and employment) and its regional, national or international significance.

2. Consideration of industry studies and statistics, particularly in relation to flow on values.
3. Corroboration of the above through industry intelligence gathered from local industry experts.

See Section 3 of this report for further detail (Appendix 4 provides details on the stated limitations of the ABS statistics utilised in this activity).

The final research activity involved defining the characteristics (biophysical and industry parameters) of lands which best support the key agricultural industries identified through analysis of industry information, reviewing the parameters applied to similar industries in the Upper Hunter, and undertaking detailed consultations with the Technical Working Group (TWG) members, local agronomists and industry technical officers.

2.2 Consultation

Effective engagement and consultation with both technical and industry experts was an important component of this project in order to:

1. Engage and inform stakeholders regarding the project's purpose and to provide opportunities for input and guidance.
2. Access data and knowledge regarding local context, industry and land use challenges, flow-on economic values of key agricultural industries, and emerging trends in the region.
3. Confirm and validate the mapping products and recommendations arising from the project.

In total, over 70 individuals and organisations with relevant agricultural interests in the study area, or technical expertise pertaining to the project's mapping and analysis processes, were consulted. This included engaging local farming interests, relevant industry associations, technical specialists and government agency staff through a variety of methods described as follows.

Establishment and Facilitation of Technical Working Group

A Technical Working Group (TWG) was formed in the early stages of the project comprising representatives from Federal Government, State Government, local councils, and the various agricultural industries in the region. The TWG assisted with:

- confirming the importance (scale and value) of agricultural industries
- provision of industry information to assist with confirming the appropriate biophysical requirements of agricultural lands
- confirming the planning restrictions operating on agricultural lands (and likely to affect agricultural lands into the future)
- understanding the impacts and issues facing agriculture in the region.

The experience and local knowledge of the TWG stakeholders was invaluable throughout the project, especially when it came to evaluating the integrity of the spatial data inputs and the validity of the model outputs. Details of the TWG members are located in Appendix 2.

Targeted Meetings, Interviews and Small Group Workshops

Approximately 15 targeted meetings and 35 individual interviews were conducted to provide maximum flexibility for the involvement of the region's key stakeholders and technical specialists. These included:

- A workshop with agronomists, beef and cropping farmers and representatives from the Livestock Pest and Health Authority.
- Five separate meetings with the Strategic Planners, Economic Development Officers and/or Environmental Managers of each of the Lower Hunter Councils.
- Seven meetings and telephone interviews with Department of Primary Industries agronomists and extension officers for a variety of industries.
- Meetings and liaison with representatives/specialists from relevant state agencies – NSW Office of Environment & Heritage, Department Planning & Infrastructure, Department of Primary Industries, and Hunter Central Rivers Catchment Management Authority
- A meeting with representatives from the NSW Farmers - Beef Cattle industry group and three interviews with Policy Advisors from the relevant Divisions of NSW Farmers.
- Telephone interviews/surveys with representatives from each of the key agricultural industry bodies and associations, and interviews with key local farmers recommended by the TWG.
- Liaison with data/GIS specialists and officers of councils and state government departments, and the University of Newcastle.

In particular, regular advice and input was sought from relevant DPI staff members who were involved in either the NSW agricultural lands mapping pilot or the Upper Hunter agricultural mapping project.

Briefing Sessions

Senior management from the councils of the Lower Hunter were provided with regular briefings on progress with the project between November 2012 and May 2013 in the following forums:

- Monthly meetings of the General Managers.
- Quarterly meetings of the Directors of Planning & Environment for the HCCREMS member Councils.

Industry Association Meeting

Dedicated meetings were held with members of industry associations where required. In particular, direct engagement with the Hunter Valley Wine Industry Association (HVWIA) Executive Board was requested of the Project Team. The Association had played an active role in Agricultural Lands Mapping project in the Upper Hunter in 2012, and as a result of that process, negotiated with the NSW Minister to formally acknowledge and map the Upper and Lower Hunter vineyards districts as "important industry clusters" to be protected from potential coal seam gas development.

The HVWIA were concerned that the Lower Hunter Study was going to re-map, or re-litigate the cluster agreement negotiated with the NSW Minister following the Upper Hunter Study. This issue, along with a discussion of the process and the projected deliverables of the Lower Hunter Project, was undertaken at an Association Board meeting in April 2013, and the following outcomes agreed:

- That it was appropriate for the Project to recognise viticulture a key agricultural industry in the Lower Hunter, and the HVWIA would provide the team with the latest research and data which they had commissioned on the value of the industry to the local and regional economy.
- That the biophysical attributes associated with viticulture, and to be applied in the modelling and mapping activities of the Lower Hunter project, were appropriate.
- That the Viticulture Industry Cluster identified in the Upper Hunter Pilot Study would be explicitly acknowledged in the Lower Hunter IAL project reports and mapping.

Consultation Outcomes

The extensive project consultation processes provided the Project Team with a significant amount of guidance and information that assisted with the development of maps representative of the landforms and conditions that facilitate the production of the key agricultural commodities in the Lower Hunter.

The TWG members and DPI staff in particular provided valuable input into the confirmation of biophysical parameters and industry criteria for mapping, and review of the final mapping products and project report.

2.3 Mapping and Modelling

Once biophysical parameters were confirmed for the key agricultural industries in the region by the TWG and project stakeholders (see Section 4), data was collated and multi-criteria analysis spatial modeling undertaken utilising both the MCAS-S software package (Multi-Criteria Assessment Shell for Spatial decision support) and Esri (ArcGIS v10). Summary detail on these processes follows.

Spatial Data Collation

An initial audit was undertaken of all Geographic Information System (GIS) datasets maintained by Hunter Council's Environment Division, SEWPaC, DPI and the Hunter Central Coast Catchment Management Authority. Results revealed the majority of required datasets were readily available from these sources. The Project team engaged with State agencies and industry associations to source the remainder.

The datasets of Land and Soil Capability 2012 and Inherent Soil Fertility 2012 were unable to be supplied by the NSW Government, as staff from the NSW Office of Environment and Heritage (OEH) advised that these datasets, which were utilised in the Upper Hunter agricultural lands mapping project undertaken by DPI, were currently "Cabinet in Confidence" and could not be released for use until the Cabinet process was completed. As a result, the Land Capability and Soil Fertility maps included in the NSW Atlas (developed by DIPNR) were utilised as the 'best available' datasets.

A list of available rasters and potential vector layers was compiled and where available, metadata information was recorded. The collation of a stocktake list enabled the:

- quantification of the potential pool of datasets that could be utilised during the modelling process
- identification of any information gaps or issues with data sources which required further searches to remedy
- clarification of the effort required to prepare any new datasets to assist with the scheduling of subsequent meetings and workshops.

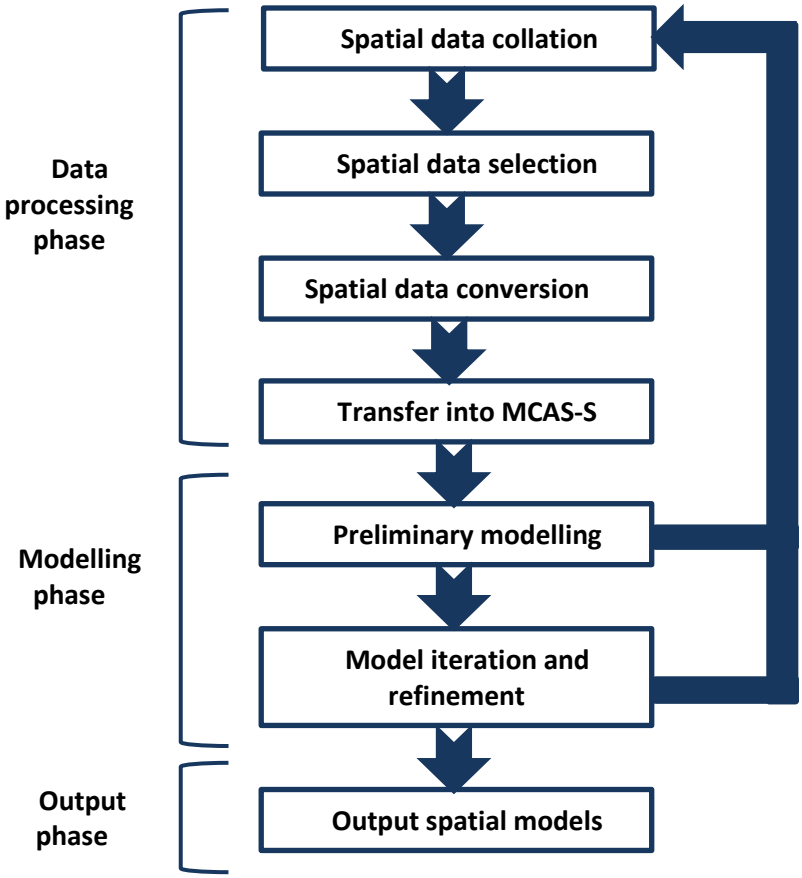
This data collation process was repeated several times as new datasets were identified through the TWG and wider stakeholder consultation process. In some cases, datasets had to be tracked back to their original source to ensure the quality and currency of the data. Details of the datasets utilised are included in Appendix 3.

MCAS-S Modelling Methodology

Modelling activities were firstly undertaken in the MCAS-S software package as this tool enables fast visualisation of the numerous spatial datasets utilised. MCAS-S was useful in assisting the Project Team, the TWG, and stakeholders to visualise quickly the impact of changing various biophysical criteria.

The modelling process was implemented in three broad steps including a data processing phase (collation, variable selection, data conversion and input into MCAS), a modelling phase (preliminary modelling followed by iteration and refinement) and an output phase (production of maps and summaries). The workflow for the MCAS-S modelling is outlined in Figure 2.

Figure 2: MCAS-S Modelling Workflow.



Spatial Data Selection

It was necessary to select a subset of available datasets for initial processing into MCAS-S format to have enough layers to commence the preliminary modelling phase.

GIS vector datasets, included polygon, line and point layers, often contain many tabled variables (or fields). Hence it was not only necessary to identify the spatial filename but also the key field of interest for each layer. Unfortunately, metadata on the layer fields was often missing or incomplete requiring additional investigation to correctly identify definitions and confirm what the data was representing. Data selection was repeated at various stages throughout the stakeholder consultation phase as new layers were identified.

Spatial Data Conversion

All MCAS-S projects must conform to a common spatial-reference (ABARES 2011) and the pre-existing HCRCMA rasters were already generated on a 100 x 100m grid with a standard map coordinate system (i.e. GDA94 NSW Lamberts Conformal Conic projection). To ensure compatibility within existing MCAS-S data, all additional data processing adhered to the same standardised format. Accordingly all raster datasets utilised in the modelling process were created with the same grid scale regardless of the original vector spatial resolution. The 100 x 100m grid was considered to be an adequate scale for the development of the IAL models with the added benefit of ensuring rapid on screen visualisation in MCAS-S with considerable time saving during the interactive iteration and interrogation of the models.

The data conversion was primarily implemented using Esri. Source vectors were initially clipped to the IAL study area boundary and where necessary re-projected to the standard map projection. Vectors were converted to rasters using a standard template grid.

Preliminary Modelling

Preliminary MCAS-S spatial models were prepared for each of the six key agricultural industries (discussed in Section 3) for presentation to the TWG, enabling discussion and visual review and confirmation of all of the biophysical criteria determined for the creation of the final mapping products.

Construction of the preliminary classification models was based on the methodology utilised in the NSW Government's Review of the "*Identifying Important Agricultural Industry Lands in NSW: An interim draft guide on how to report and locate lands for specific agricultural industries (2012)"* (Kovac, Goodburn and Briggs 2012) which relied primarily on environmental (biophysical) inputs. The Local Environmental Planning zones of the Lower Hunter were also included in this study.

The development of these preliminary models assisted with the modelling process, and was useful for:

- Ensuring all datasets could interact seamlessly and that the data directories were adequately structured.
- Identifying any unforeseen information gaps or errors within the spatial layers which were subsequently corrected prior to the second TWG meeting.
- Providing the TWG with insight into the typical structure of an MCAS-S model and how the MCAS-S modelling process works.
- Facilitating the TWG model interaction process by providing draft material for immediate evaluation and discussion.

Model Iteration and Refinement

Utilising the preliminary MCAS-S models, the TWG quickly and effectively evaluated the outputs and critically reviewed the input variables to determine if they were "fit for purpose". Preliminary models were initially presented as wall-mounted hardcopy A0 printouts with model vectors overlaid on SPOT5 satellite imagery. Stakeholders reviewed these preliminary models in detail during the workshop. This approach was well received by the TWG as it enabled them to place the model printouts in context with their local understanding of the region.

During the course of the workshops the MCAS-S models were also presented as a slide show with summarised lists of input datasets and field thresholds. A live interaction session was organised to enable stakeholders to modify model inputs and interactively test and view the results of different alternative scenarios.

During this stage a number of new datasets were collated, processed and introduced into the appropriate MCAS-S models (such as LGA specific flood modelling data to identify lands suitable for stock refugia). The iteration and refinement process occurred through the consultation phase with some models requiring up to 5 different versions before being finalised.

At the end of the iteration and refinement phase the list of spatial datasets was reduced down to 20 spatial layers in the final MCAS-S models. Appendix 3 provides a summary of these datasets and in which model they were used. The final classification models developed were consistently presence/absence models and not weighted/ranking models, on the advice of the TWG and DPI representatives.

Esri Conversion, Final Product Development

The final project outputs were modelled within the Esri (ArcGIS v10) software package. Modelling within this platform allowed for the fine scale detail within the datasets to be analysed, and the resultant line work and shapes are a more accurate reflection of the input datasets.

The selection of datasets and criteria used in the final Esri models were taken from the MCAS-S process, with the project team ensuring the criteria determined by the TWG was applied (please see Tables 6 and 7 for confirmation of the criteria included in each model produced).

The criteria mapped for each of the six models were applied in stages to allow for re-analysis of the models at each stage. Both current (LEPs) and future planning scenario datasets (i.e. the Lower Hunter Regional Strategy and individual council Settlement Strategies) were applied to the models enabling the identification of areas of important lands that are potentially at risk of being rezoned and unavailable for future agricultural activities, or for identification of developments that may impact on current practises.

The final models outputs were mapped over textured satellite imagery with navigation overlays including town locations and local government area boundaries.

3 Agriculture in the Lower Hunter

Agriculture has played an important part in the Lower Hunter region's development from very early in European settlement. Initially, sheep and cattle grazing were the dominant industries, along with wheat crops. However, it soon became apparent that the highly erodible soils in much of the region were not suitable for sheep, and rainfall was too high to sustain wheat cropping (Archer, 2007). Throughout the late 19th century and during the 20th century the region supported cattle (first as beef and then beef/dairy) and lucerne for hay (until 1970 the variety of lucerne grown in Australia was called "Hunter River") (Burley, 1962; Maze 1934; Schwarzweller, 1982). Additionally, important, highly fertile, alluvial lowlands occurring in the Lower and Central Hunter have traditionally supported intensive farming practices. Indeed, the fertility and depth of soil has enabled it to be exploited continually for the past 185 years (Archer 2007).

While the Lower Hunter region currently comprises a very small percentage (0.2%) of the area used for agriculture in NSW it nevertheless provides a significant contribution to NSW production of many agricultural commodities. The region has a well established reputation for wine growing and related tourism and supports a diverse range of agribusinesses including intensive poultry farming, livestock grazing, and protected, broadacre and cultivated cropping. Additionally, the region is increasingly diversifying into specialist or boutique industries that occupy smaller parcels of land and provide higher returns per hectare.

The temperate climate, reliable rainfall and water sources and variety of soil types make it well suited to agriculture. Significant additional advantages also result from a combination of the Lower Hunter's other natural resources, infrastructure and access to markets.

The most productive and highest value intensive cropping lands in the Lower Hunter are in the alluvial floodplains along the Hunter River and Maitland and Port Stephens LGAs. These naturally fertile lands are highly suitable for intensive cultivation. Lands suitable for grazing and less intensive agriculture typically occur on adjoining lands and the lower slopes with access to water.

Determining the key agribusinesses in the Lower Hunter region required collating and analysing information collected from various sources including, the Australian Bureau of Statistics (ABS), The NSW Department of Primary Industries (DPI), independent research institutes and the various agricultural sectors.

A review of the ABS Agricultural Census 2010-11 confirmed the wide variety of agricultural commodities produced in the region. These are detailed in Table 1 below and provide an indication of the versatility of the Lower Hunter landscape and its ability to support a variety of agricultural activities.

Table 1: The range of agricultural commodities produced in the Lower Hunter Region, as reported by the Australian Bureau of Statistics: 2010-11 Agricultural Census.

Broadacre Agriculture	Orchard Fruits	Livestock	Vegetables
Pasture cut for hay	Oranges	Meat chickens	Vegetables for seed
Cereal cut for hay	Lemons	Layers (chickens)	Asparagus
Other crops for hay	Limes	Meat cattle	Beans
Wheat for grain	Mandarins	Dairy cattle	Broccoli
Oats for grain	Grapefruit	Sheep	Capsicums
Barley for grain	Apricots	Pigs	Carrots
Sorghum for grain	Cherries	Buffaloes	Cauliflowers
Maize for grain	Nectarines	Deer	Melons
Other cereals for grain	Olives	Goats	Peas
Canola	Peaches	Horses	Potatoes
Protected crops	Plums	Ducks	Pumpkins
Herbs	Apples	Turkeys	Sweet corn
Lettuce	Pears	**Plantation fruits**	**Nurseries outdoor**
Mushrooms	Almonds	Bananas	
Tomatoes	Macadamias	**Grapevines**	**Cut flowers outdoor**
Nurseries	Pecans	Grapes for wine	
Cut flowers	Avocados	Grapes for table	**Cultivated Turf**
Raspberries	Custard apples		
Strawberries	Mangoes		

Table 2 provides the wholesale value of agricultural commodities as reported to the 2010-11 ABS Agricultural Census. The Census collected data on the area used for agriculture, production tonnages and number of businesses in addition to the wholesale commodity value, but each commodity was reported slightly differently, with wholesale value providing the only reasonably consistent measure across all industries (Please see Appendix 4 for comprehensive data provided by the 2010-11 ABS Agricultural Census). The agricultural values of each industry provided in Table 2 describe the NSW commodity value, Lower Hunter commodity value, and the value of the various commodities to each of the LGAs in the Lower Hunter Region. This provides a reasonable understanding of the LGA location and scale of the various industries throughout the study area.

Table 2: estimated wholesale value of agricultural commodities in the Lower Hunter region as reported by the ABS Agricultural Census 2010-11.

Commodity	Value in NSW ($m)	Value in Lower Hunter ($m)	% Lower Hunter to NSW	Cessnock		Lake Macquarie		Maitland		Newcastle		Port Stephens	
				Value ($m)	% Cessnock to Lower Hunter	Value ($m)	% Lake Macquarie to Lower Hunter	Value ($m)	% Maitland to Lower Hunter	Value ($m)	% Newcastle to Lower Hunter	Value ($m)	% Port Stephens to Lower Hunter
Meat chickens	686	66.1	9.6%	16.2	24.5%	13	19.7%	13.4	20.3%	0.0	0.0%	23.5	35.6%
Eggs produced for human consumption	193.8	18.2	9.4%	2.0	11.0%	11.9	65.4%	0	0.0%	0.0	0.0%	4.3	23.6%
Beef cattle	1,616.1	9.8	0.6%	2.5	25.5%	0.4	4.1%	3.8	38.8%	0.3	3.1%	2.8	28.6%
Protected crops (vegetables, nurseries & cut flowers, berries)	249.1	6.3	2.5%	0.0	0.0%	1.9	30.2%	0.0	0.0%	0.1	1.6%	4.3	68.3%
Whole milk	504.7	4.5	0.9%	0.1	2.2%	0.0	0.0%	2.5	55.6%	0.0	0.0%	1.9	42.2%
Cultivated turf	81.7	3.2	3.9%	0.0	0.0%	0.0	0.0%	3.0	93.8%	0.0	0.0%	0.2	6.3%
Broadacre agriculture	7,502.6	2.9	0.0%	0.2	6.9%	0.5	17.2%	1.5	51.7%	0.1	3.4%	0.6	20.7%
Grapevines value	142.7	2.5	1.8%	2.5	100.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Vegetables	173.5	1.4	0.8%	0.0	0.0%	0.0	0.0%	1.4	100.0%	0.0	0.0%	0.0	0.0%
Nurseries & cut flowers outdoor	149.4	0.9	0.6%	0.1	11.1%	0.5	55.6%	0.0	0.0%	0.0	0.0%	0.3	33.3%
Orchard fruits & nuts	331.2	0.4	0.1%	0.3	75.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.1	25.0%
Total value	11630.8	116.2		23.9		28.2		25.6		0.5		38	

When considering the wholesale commodity value of the various industries, it is clear that:

Poultry (both eggs and meat) production in the Lower Hunter is significant to NSW. The region is producing close to 10% of all the State's chicken meat and eggs, making it the third largest production region in NSW (NSW Parliamentary Research Service, July 2012).

Furthermore, a report conducted in 1999 for the Councils of the Lower Hunter region estimated the industry provided some $18 million return to farmers, with processing, feed and filleted products estimated at $100 million.

Lower Hunter poultry farming represents 60% of the Hunter region's egg production and 40% of the chicken meat production.

Cultivated turf is generating a wholesale value to the region of some $3.2 million. The Lower Hunter is the third largest supplier of turf in NSW and produces approximately 4% of the total values to the state. Lower Hunter turf farms also occupy 3.9% of the total area of farmed turf in NSW.

A 2006 report conducted for Horticulture Australia Ltd and the Turf Producers of Australia determined there were (at that time) some 225 farms nationally producing 4918 ha of turf valued (retail) at $235.7 million per annum. Given the relatively small land area used by this industry, and the percentage of value generated in the Lower Hunter region, this industry is significant.

Viticulture in the Lower Hunter is producing some $2.5 million in wholesale grape value which equates to 1.8% of the NSW industry. The industry occupies 3.7% of the NSW land area for viticulture and has 9.7% of the NSW wine industry enterprises. When this data is coupled with industry generated data relating to the retail value of wine production, and the value of the wine tourism industry, the importance of viticulture to the region becomes clear.

The Hunter Valley Vineyard Association has engaged the Hunter Valley Research Foundation (HVRF) both in 2010 and 2013 to conduct an economic assessment of the viticulture industry in the region. The 2010 study found:

- Total regional wine production was estimated at approximately 25.4 million litres.
- Wine sales were estimated to total 24.3 million litres, valued at close to $203 million. Domestic sales are estimated to account for 72% of all sales.
- About one third of all sales occurred at the cellar door. Of the exported wine, half was sold to Europe with the remaining bulk markets being USA and Asia.

The 2013 study found that:

- The Hunter is the 6th largest tourism region in Australia.
- The Hunter is the second largest source of tourism output for NSW.
- The value of the total economic output arising from the wine tourism industry in 2011-12 is estimated at $491.3 million.
- There has been a significant decrease in the production of grapes from the viticulture industry, and the increased value of the associated wine tourism sector. Wine grape production reductions are believed to be influenced by drought conditions (2009) or increased rain conditions (2011) forcing some of the smaller boutique growers to reduce or lose their harvests. The increased wine tourism industry has added significant value to the Cessnock LGA, but is increasing pressure and land use conflicts to the LAG (discussed further in Section 7.3).

The ABS wholesale value statistics do not identify any of the remaining agricultural commodities as significant to the NSW production, but the following is noted:

Protected cropping in the region is producing some 2.5% of the NSW industry value. This market share is expected to increase as many Council Planners in the region have noted an increase in industry activity since the last ABS Agricultural Census. Port Stephens Council has specifically noted the increase in mushroom greenhouses and has recently approved the development of a 16ha greenhouse to produce 8,000 tonnes of tomatoes and capsicums per annum (pers. comm. Port Stephens Council).

Beef cattle production is providing a wholesale value of almost $10 million to the region, and although this is a relatively low percentage of the cattle production in NSW, this activity is one of the few occurring in all five Local Government Areas (LGA) in the Lower Hunter. It is noted that the diversity in topography and climatic conditions within the Lower Hunter study area creates a suitable environment for beef enterprises to operate as part of a mixed farming system with rotational cropping and grazing.

Broadacre agriculture activities are occurring throughout all five LGAs and reportedly producing some $2.9 million in wholesale value. When compared to the broadacre agricultural production in the central western and northern regions of NSW, the Lower Hunter production is hardly significant, but when considering that local agriculture supports the beef cattle (and other) livestock industries, and in some councils is providing over 20% of the agricultural value to their LGA, this industry is key to the ongoing agricultural viability of the region.

In addition, the Lower Hunter produces:

- 9.6% of the State's turkeys
- 3.3% of the State's outdoor intensive vegetable production
- 3.3% of the State's olives
- 2.6% of the State's horse studs

In relation to the whole of the Hunter region, the Lower Hunter produces:

- 100% of the cut flowers
- 100% of the tomatoes
- 81% of undercover nursery output
- 89% of the lettuce
- 71% of mushrooms
- 60% of eggs
- 40% of chicken meat

Further to above assessment a number of trends in the agricultural sector have been noted during an assessment of the 2001, 2006 and 2010 Agricultural Census' and interviews with industry groups.

- The Poultry industry has historically increased in the Lower Hunter since 2001. It is noted that Port Stephens and Maitland LGAs are now producing the largest portion of chicken meat, where historically this was Lake Macquarie. Indications from Council planners are that the poultry industry is beginning to reduce as farms are relocating (reportedly to the Central Tablelands). It is believed that a primary cause of this reduction is due to residential development encroachment (pers. comm. Port Stephens Council and Maitland City Council).
- The agricultural activities in the Lower Hunter are extremely adaptable, with many farms changing the primary agricultural commodity they produce based on either economic drivers

or climatic conditions. Examples in the region include, the turf growers currently utilising lands historically cultivated for vegetables, and beef cattle farmers focussing on production of Lucerne and other high value crops in times of high rainfall (e.g. 2006) given the lucrative returns in comparison to beef farming (pers. Comm. TWG).

- The dairy industry in the Lower Hunter has significantly reduced over the last 10 years, with all dairy operations ceasing in the Maitland LGA after the last ABS Agricultural Census data was collected. This was primarily driven by the market for dairy products and economies of scale, but the region could quickly re-commence dairy farming if the economies relating to dairy farming changed (pers. comm. NSW DPI).
- The agricultural sector in the Lower Hunter is highly adaptable and has improved farming practices and utilised new technology as it is developed so that production rates have increased considerably when compared to those experienced in the 1960s and 70s (pers. comm. NSW Farmers Cattle Committee).
- The agricultural sector is a "price taker" not a "price setter". This supply arrangement has driven agricultural industries to improve practices and increase yields to remain economically viable. Although from a farming perspective, this is not an ideal arrangement, it has created a highly diverse and adaptable agricultural sector that can continue to supply commodities to the local, State and global markets and add value to the region's economy.

Additional data on the Lower Hunter agricultural sector was provided in the "*2008-09 Newcastle and Hunter Region"* report produced by the Hunter Valley Research Foundation (HVRF). The report provides statistics on the employment in agricultural activities in the Lower Hunter (from 2006); details are included in Tables 3 and 4.

Table 3: Number of agricultural, forestry and fishing businesses in local government areas in the Lower Hunter region in specified employment size ranges, June 2006; Source: HVRF Newcastle and Hunter Region 2008-09.

Local Government Area	Non-employing*	Employing							Total
		1-4	5-19	20-49	50-99	100-199	200+	Total employing	
Cessnock	252	45	12	6	3	-	3	69	321
Lake Macquarie	183	21	18	-	-	-	-	39	228
Maitland	453	69	24	9	-	3	-	105	558
Newcastle	153	21	9	-	-	-	-	30	183
Port Stephens	285	54	21	6	3	-	-	84	372
Total Lower Hunter	**1,326**	**210**	**84**	**21**	**6**	**3**	**3**	**327**	**1,662**

* Non-Employing businesses are owner operated that do not employ any additional staff.

Details of the industry employment figures are included in Table 4.

Table 4: Employment in agriculture, Lower Hunter, 1996 and 2006. Source: HVRF Newcastle and Hunter Region 2008-09

Agricultural Industry	1996	2006	% change	% Sector total 2006
Agriculture, forestry and fishing undefined	16	17	6%	1.0%
Agriculture, undefined	232	53	-77%	3.0%
Dairy cattle farming	146	56	-62%	3.2%
Grain, sheep and beef farming	173	311	80%	17.5%
Horticulture and fruit growing	446	367	-18%	20.7%
Hunting and trapping	11	0	-100%	0.0%
Other crop growing	31	49	58%	2.8%
Other livestock framing	90	81	-10%	4.6%
Poultry farming	432	681	58%	38.3%
Services to agriculture	100	162	62%	9.1%
Total agriculture	**1,677**	**1,777**	**6%**	**100.0%**

The HVRF Employment figures identify a historical pattern of adaptation and diversification within the agricultural industry in the Lower Hunter. Employment in the agricultural sector increased by 6% overall between 1996 and 2006, despite significant fluctuations within individual sectors (62% reduction in dairy farming jobs, 58% rise in poultry industry employment).

Although the ABS Agricultural Census provides details on the wholesale value of agricultural commodities in the Lower Hunter, it is recognised the economic value of the agricultural sector far exceeds this value when coupled with the value of employment, service and supply industries, retail and hospitality industries and tourism.

Despite the diversity of agricultural production as evidenced by the wholesale commodity values, tonnages, area farmed, No. agricultural enterprises, reported industry flow-on values and apparent significance to the region or the State, the following agricultural industries were determined as 'Key' in the Lower Hunter are:

- Poultry (meat chickens and eggs)
- Cultivated turf
- Viticulture
- Protected cropping (nurseries, cut flowers, vegetables and berry fruits)
- Beef cattle
- Broadacre cropping

4 Mapping of Important Agricultural Lands in the Lower Hunter

For the purposes of this project, IAL is defined as:

> *"Land that is capable of sustained use for agricultural activity, with appropriate management practices, and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the region".*

The biophysical attributes of the IAL lands represent the most capable, fertile and productive agricultural lands in the region, and support the range of agricultural industries operating successfully in the Lower Hunter. These lands provide for an adaptive range of agribusinesses that can respond to changing climate, market forces and socio-economic conditions into the future.

It should be noted that the key agricultural industries of protected cropping and poultry farming were not included in the IAL definition, as these industries can be located on any lands that local planning regimes/zoning permit, as they typically operate within built structures such as green houses and poultry sheds, and only minimal biophysical parameters (such as slope and restricted proximity to watercourses) apply. Regardless, these industries provide significant value to the Lower Hunter and should be actively protected in planning legislation.

4.1 Defining the Biophysical Parameters of Important Agricultural Lands

Research was conducted into the industry characteristics and biophysical parameters which provide the optimal conditions to produce the various key agricultural commodities.

A summary of these is detailed below, and included in Table 5.

Cultivated turf

Due to the continued cultivation required for this industry – well drained lands with either high soil fertility, or the ability to readily hold and release nutrients, are required. Similarly, flat lands (little to no slope) are preferable.

Cultivated turf requires ready access to water sources as it is an industry that relies heavily on frequent irrigation. As such the cultivated turf industry is reliant on favourable weather conditions. In times of drought where water restrictions are imposed, this industry is heavily affected with a report by Haydu *et al* (2008) identifying an industry-wide downturn of 13% during the 2002-2006 drought. Given the biophysical requirements, cultivated turf farming is typically undertaken on highly fertile river flats.

Broadacre cropping

Broadacre cropping ideally requires moderately high fertile soils and moderate to high rainfall, or ready access to natural water. The type and size of machinery required to harvest crops limits the degree of slope that can be used for cultivated crops (as opposed to pasture crops).

Viticulture

Viticulture is able to be supported on most classes of agricultural land although the richest, most fertile alluvial soils are not ideal as prolific vine growth in wet years contributes to disease problems as the lack of aeration between the vines provides conditions suitable for disease and mould to prosper (Archer, 2007).

Viticulture also requires ready access to water, with the industry preferring rainfall levels between 700mm - 750mm per annum. Additionally, the viticulture industry is heavily affected when

temperatures area below -6 degrees Celsius (frost days) and cause direct physical damage to the vascular systems of young leaves and buds, which in turn inhibits fruit development and energy storage during the subsequent growing season. The timing of frost events is also significant with bud burst generally occurring around the 1st and 2nd weeks of September. Frosts occurring in October and November are of particular concern due to their impact on new growth. Interrogation of the available data indicates that the threshold temperature is not likely to occur in any part of the Lower Hunter, although microclimatic conditions need to be taken into account (HCCREMS, 2009).

Beef cattle

The beef cattle industry can be operated on lands with a diversity of biophysical conditions. While fertile land is ideal for producing high quality grazing pastures, it is often flood prone, requiring adjacent higher pastures to provide refuge for animals during flood events. Cattle grazing is an agricultural activity that has a large tolerance for conditions and land capability, meaning that cattle grazing activities can occur on lower fertile soils, with a wide variety of slope conditions.

Poultry (meat chickens and eggs)

Poultry farming, whether to produce meat or eggs, is considered a designated development under Schedule 3 of the Environmental Planning and Assessment Regulation 2000 and heavily controlled from a planning context.

The majority of poultry farming activities in the Lower Hunter region occur in sheds where farmers can readily control the climate (temperature and humidity) and biosecurity issues associated with the industry.

Given the indoor nature of this industry, locating farms is not dependent on land capability, fertility or proximity to natural water, and strict planning controls govern where farms can be located. The poultry industry is not suitable for inclusion in the biophysical mapping IAL's, as this industry can be located on lands other than what is traditionally considered "agricultural land".

Protected cropping (nurseries, cut flowers, vegetables and berry fruits)

As discussed in the poultry industry section, protected cropping is an indoor activity and does not rely on land capability, fertility or proximity to natural water. The strict planning controls of Local Environment Plans govern where farms can be located in the Lower Hunter.

Given the indoor nature of the protected cropping industry it is not suitable for inclusion in the biophysical mapping of IAL's, as this industry can be located on lands other than what is traditionally considered "agricultural land".

Other Agricultural Industries

When considering the variety of other agricultural industries operating in the Lower Hunter it is worth noting that the biophysical parameters of the key agricultural industries also support all other industries, as outlined below.

- The biophysical parameters suitable for cultivated turf also match the biophysical parameters for outdoor vegetable production, cut flowers and nurseries.
- The biophysical parameters suitable for viticulture also match the biophysical parameters suitable of fruit and nut orchards and plantation fruits.
- The biophysical parameters suitable for beef cattle farming also match the biophysical parameters suitable for other livestock farming.
- The biophysical parameters suitable for broad acre cropping also match the biophysical parameters suitable for dairy farming.

As such the IAL's mapped in this study essentially support the range of agricultural industries reported (by the ABS) as operating in the Lower Hunter region.

Table 5: Biophysical parameters utilised in determining "most suitable" lands for key agricultural industries.

Biophysical Parameters	Important Agricultural Lands (IAL)			Other Key Agricultural Industries		
	Cultivated turf	Broadacre crops	Viticulture	Beef cattle	Poultry	Protected crops
Land capability	Class 1 Class 2 Class 3	Class 1 Class 2 Class 3 Class 4	Class 1 Class 2 Class 3 Class 4	Class 1 Class 2 Class 3 Class 4 Class 5	NA	NA
Soil fertility	High (5) Moderate-High (4)	High (5) Moderate-High (4) Moderate (3)	Moderate-High (4) Moderate (3) Moderate-Low (2)	High (5) Moderate-High (4) Moderate (3) Moderate-Low (2)	NA	NA
Slope	<6 degrees	≤10 degrees	4-10 degrees	≤18 degrees	<6 degrees	<6 degrees
Acid sulphate soils	NA*	NA*	NA*	NA*	NA	NA
Temperature	NA	NA	NA**	NA	NA	NA
Rainfall	NA****	NA****	NA****	NA****	NA****	NA****
Flood level	NA	NA	NA	NA***	> 1 in 100yr level	> 1 in 100yr level
Natural streams	NA	NA	NA	NA	Exclude streams and a buffer of 100m	NA
Large wetlands	NA	NA	NA	NA	Exclude all features and buffer of 3km#	NA
Water availability	NA*****	NA*****	NA*****	NA*****	NA	NA

Notes on the biophysical mapping products included in Table 5:

* Indicates that acid sulfate soils are not included in the model as they do not exclude any activity occurring on these lands. This information was considered in the mapping project where acid sulfate soil risk was high (Risk greater than 3).

** Temperature was raised as a potential limiting factor if it dropped below -6 degrees Celsius in spring (growing months). A review of the Bureau of Meteorology data for the past 30 years did not find any evidence temperatures dropped into this range, and there was no discernible temperature differential across the study area, so temperature was not mapped.

*** Beef cattle farming requires, in some locations, lands above the 1 in 100 year flood level to enable stock to relocate during floods. The flood level does not preclude cattle farming, but was considered in the project.

**** Rainfall was not specifically mapped as the entire study area receives greater than 700mm / year. This is double the rate mapped in the Upper Hunter study, and without any variation across the region, does not assist in differentiating suitability of lands for agricultural activities.

***** Water availability was considered in the study, but the majority of the Lower Hunter is within 2km of alluvium, rivers or ground water, so mapping of this variable was not conducted. It was noted that the north-west section of Cessnock does not have ready access to natural water, but the viticulture industry has had a water pipeline installed which provides constant access to water for the area.

To meet biosecurity obligations, planning authorities require the poultry industry to adhere to best management practices which require any new development to be located a minimum distance of 100m from watercourses and 3km from large wetlands that support waterfowl populations (Poultry Meat Industry Committee, (2012). *Best Practice Management for Meat Chicken Production in NSW: Manual 1 – Site Selection & Development*, Department of Primary Industries).

During the course of this project the NSW Government's Strategic Regional Land Use policy was released, which introduced the Biophysical Strategic Agricultural Land (BSAL) assessment. The BSAL criterion includes lands with land and soil capability classes 1, 2 and 3 and inherent soil fertility of moderately high to high.

If this criteria was applied in the Lower Hunter, only the highly restricted lands identified as most suitable for cultivated turf (almost exclusively occurring in the Maitland and Port Stephens LGAs) be recognised as important, this would equate to only 7,318 ha (only 1.7% of the Lower Hunter's total area) of predominantly flood prone land which is exposed to some of the highest development pressures in the region.

4.2 Local and State Planning Constraints

To fully determine the extent of the available IAL across the region, it was necessary to map the restrictions on land activity imposed by the current planning regimes and the future planning scenarios. Table 6 details the planning restrictions applied in the development of the final mapping products.

Table 6: Constraints datasets utilised to restrict the lands identified as available in the biophysical mapping activity.

Planning Constraint Parameters	Important Agricultural Lands (IAL)			Other Key Agricultural Industries		
	Cultivated turf	Broadacre crops	Viticulture	Beef cattle	Poultry	Protected crops
LEP zones for each Local Council Area Legend *CCC* – Cessnock *LMCC* – Lake Macquarie *MSC* – Maitland *CoN* – Newcastle *PSC* – Port Stephens	Allowable in the following zones: *CCC* – RU2, RU4 *LMCC* – RU2, RU4 *MCC* – RU1, RU2 *CoN* – E4 *PSC* –RU1, RU2	Allowable in the following zones: *CCC* –RU2, RU3, RU4 *LMCC* –RU2, RU3, RU4, RU6, E3, E4 *MCC* – E2, E3, RU1, RU2 *CoN* – E2, E3, E4, *PSC* – RU1, RU2	Allowable in the following zones: *CCC* – RU2, RU3, RU4 *LMCC* – E3, RU2, RU4 *MCC* – RU1, RU2 *CoN* – E4 *PSC* – RU1, RU2	Allowable in the following zones: *CCC* –RU2, RU3, RU4 *LMCC* –RU2, RU3, RU4, RU6, E3, E4 *MCC* – E2, E3, RU1, RU2 *CoN* – E2, E3, E4 *PSC* – RU1, RU2	Allowable in the following zones: *CCC* – RU2 *LMCC* – RU2 *MCC* – RU1 *CoN* – NA *PSC* – RU1, RU2	Allowable in the following zones: *CCC* – RU2, RU4 *LMCC* – RU2, RU3, RU4, RU6, E3, E4 *MCC* – RU1, RU2 *CoN* – E4 *PSC* – RU1, RU2
Future planning scenarios (as included in the Lower Hunter Regional Strategy & Council Settlement Strategies)	Agriculture is currently allowed, but future planning scenarios indicate land zoning changes that may restrict this land use.	Agriculture is currently allowed, but future planning scenarios indicate land zoning changes that may restrict this land use.	Agriculture is currently allowed, but future planning scenarios indicate land zoning changes that may restrict this land use.	Agriculture is currently allowed, but future planning scenarios indicate land zoning changes that may restrict this land use.	Agriculture is currently allowed, but future planning scenarios indicate land zoning changes that may restrict this land use.	Agriculture is currently allowed, but future planning scenarios indicate land zoning changes that may restrict this land use.
National parks	Excluded activity	Excluded activity	Excluded activity	Excluded activity	Excluded activity	Excluded activity
State forest	Excluded activity	Allowable with consent in CCC and LMCC*	Allowable with consent in CCC*	Allowable with consent in CCC and LMCC*	Excluded activity	Allowable with consent in LMCC*

* Please note: agricultural activities are permissible in some State Forests in some LGAs, subject to appropriate consents and licences. Where this is the case, State forests have been mapped; however this represents very limited land areas (14ha throughout the region).

As this study required a strategic, sub-regional assessment of agricultural lands - site specific planning controls (such as Local Development Control Plans) have not been included in the constraints layers. It is acknowledged that the practical area that can be utilised for agriculture will

be a little less that that mapped due to the requirements of these detailed planning controls (eg setbacks from roads and streams).

4.3 Final Mapping Products

A series of final mapping products have been produced to provide visual presentations of the various agricultural land categories depicting categories of land considered most important for supporting current and future agricultural activities in the Lower Hunter.

The maps produced (Figures 3-16) identify the extent of land considered as encompassing the optimal biophysical conditions for a particular agricultural industry or regionally IAL, and the sub-set of these lands that allow agricultural pursuits under present local planning regimes. This may or may not coincide with the area currently used by that industry. Therefore, the maps display the hypothetical, most suitable extent of lands available for the industry (or the agricultural sector).

List of Maps

Map 1: CULTIVATED TURF (including outdoor vegetables, nurseries and cut flowers). This map depicts the extent of lands comprising the optimal biophysical conditions for cultivated turf and the outdoor production of vegetables, cut flowers and nursery plants and also depicts the extent of lands available under current planning regimes.

Map 2: CULTIVATED TURF (including outdoor vegetables, nurseries and cut flowers). This map depicts the extent of lands comprising the optimal biophysical conditions for cultivated turf and the outdoor production of vegetables, cut flowers and nursery plants and also depicts the extent of lands available under current planning regimes and future planning scenarios.

Map 3: BROADACRE AGRICULTURE (including dairy cattle). This map depicts the extent of lands comprising the optimal biophysical conditions for broadacre agriculture and dairy farming and also depicts the extent of lands available under current planning regimes.

Map 4: BROADACRE AGRICULTURE (including dairy cattle). This map depicts the extent of lands comprising the optimal biophysical conditions for broadacre agriculture and dairy farming and also depicts the extent of lands available under current planning regimes and future planning scenarios.

Map 5: VITICULTURE (including fruit and nut orchards). This map depicts the extent of lands comprising the optimal biophysical conditions for viticulture and fruit and nut orchards and also depicts the extent of lands available under current planning regimes.

Map 6: VITICULTURE (including fruit and nut orchards). This map depicts the extent of lands comprising the optimal biophysical conditions for viticulture and fruit and nut orchards and also depicts the extent of lands available under current planning regimes and future planning scenarios.

Map 7: BEEF CATTLE (including other livestock grazing). This map depicts the extent of lands comprising the optimal biophysical conditions for beef and other livestock grazing and also depicts the extent of lands available under current planning regimes.

Map 8: BEEF CATTLE (including other livestock grazing). This map depicts the extent of lands comprising the optimal biophysical conditions for beef and other livestock grazing and also depicts the extent of lands available under current planning regimes and future planning scenarios.

Map 9: POULTRY FARMING (including meat chickens and egg production and other poultry). This map depicts the extent of lands for which poultry farming is allowed under the Local Environment Plans, with consideration for industry specific biosecurity constraints.

Map 10: POULTRY FARMING (including meat chickens and egg production and other poultry). This map depicts extent of lands for which poultry farming is allowed under the Local Environment Plans, with consideration for industry specific biosecurity constraints and also displays future planning scenarios.

Map 11: PROTECTED CROPPING**.** This map depicts extent of lands for which protected cropping is allowed under the Local Environment Plans.

Map 12: PROTECTED CROPPING**.** This map depicts the extent of lands for which protected cropping is allowed under the Local Environment Plans, in the Lower Hunter and also displays future planning scenarios.

Map 13: IMPORTANT AGRICULTURAL LANDS. This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture the region.

Map 14: IMPORTANT AGRICULTURAL LANDS. This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture the region. The map also displays the future planning scenarios.

Figure 3: Map 1: CULTIVATED TURF (including outdoor vegetables, nurseries and cut flowers) depicting the extent of lands available under current planning regimes.

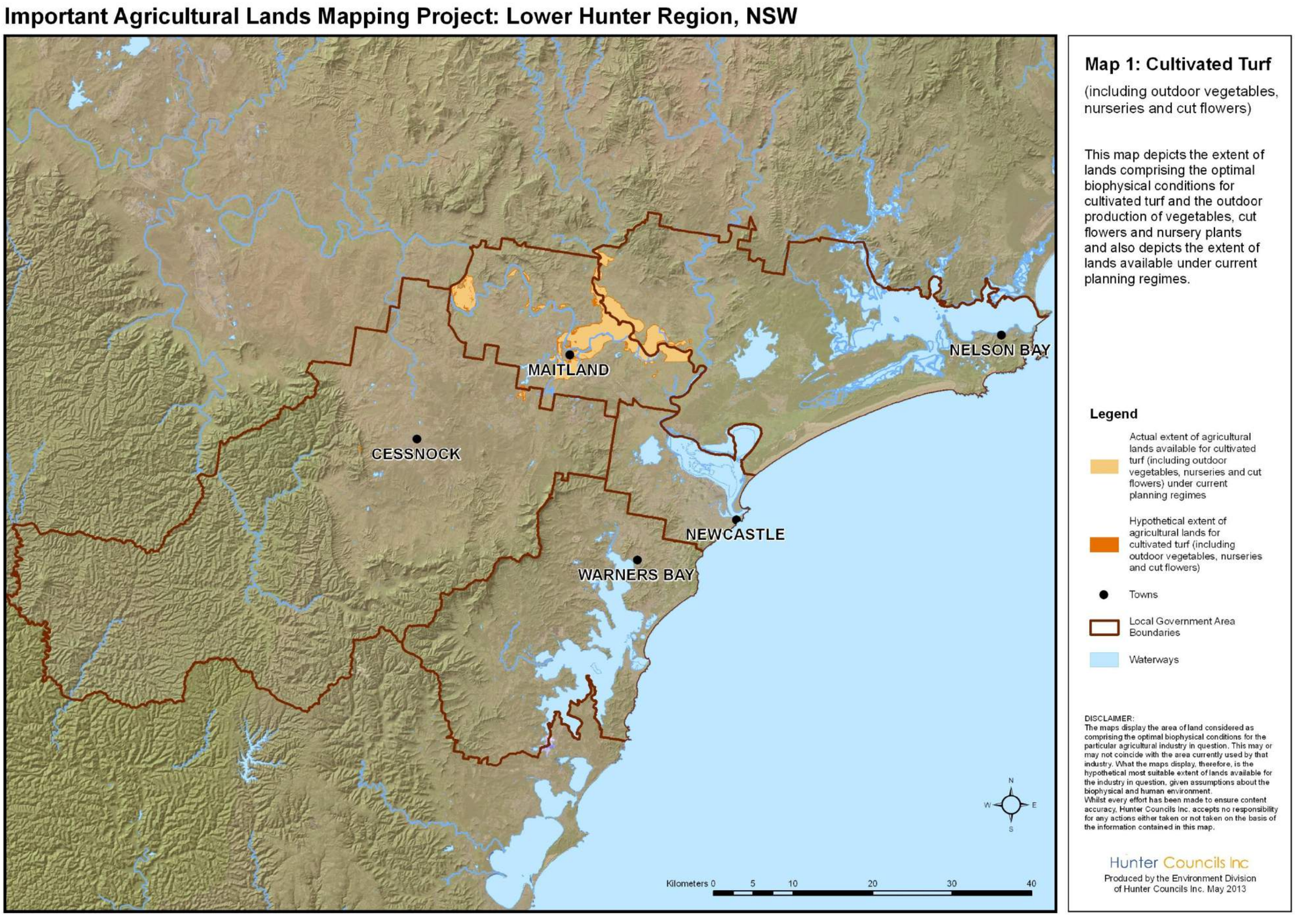


Figure 4: Map 2: CULTIVATED TURF (including outdoor vegetables, nurseries and cut flowers) depicting the extent of lands available under current planning regimes and future planning scenarios.

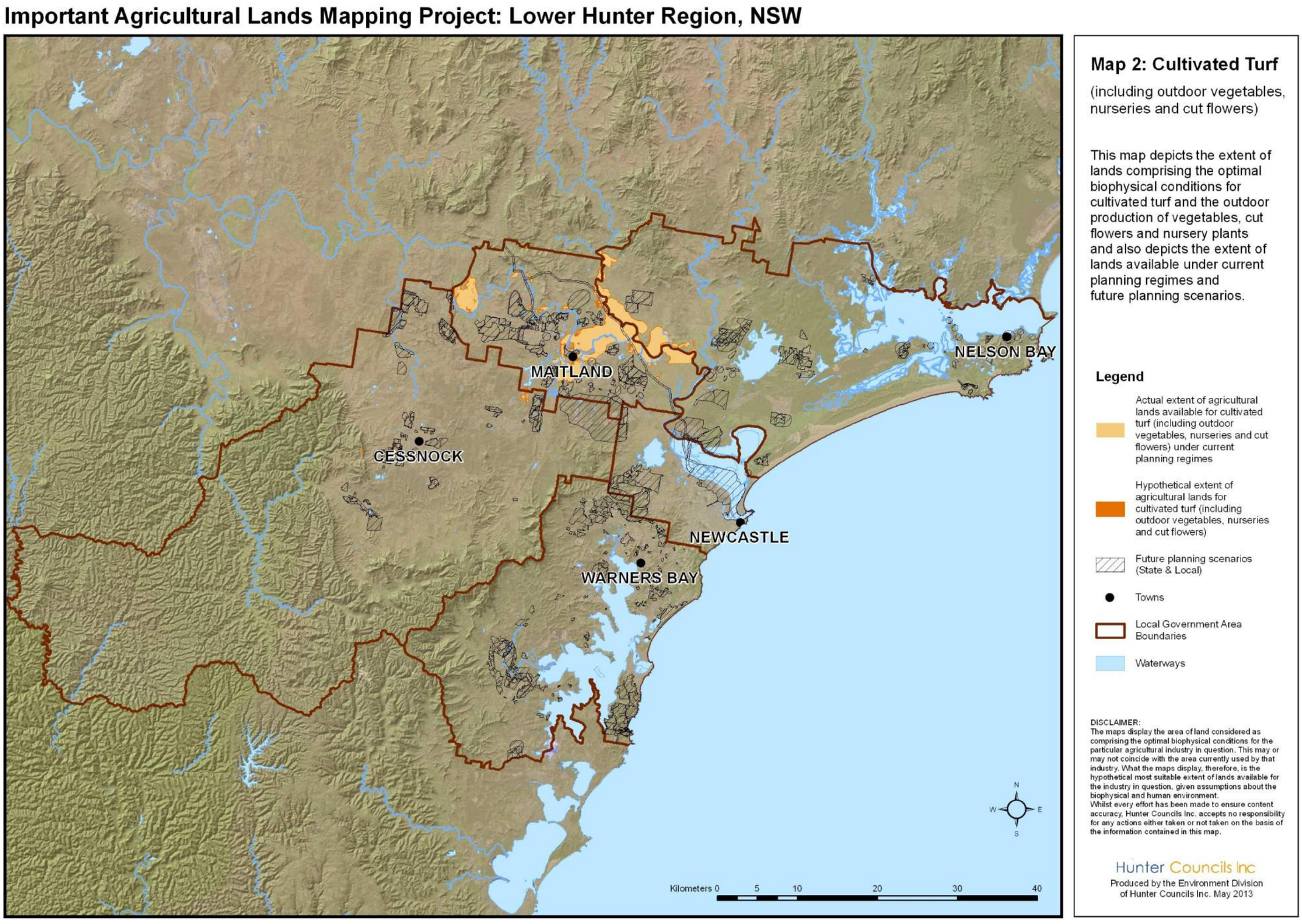


Figure 5: Map 3: BROADACRE AGRICULTURE (including dairy cattle) depicting the extent of lands available under current planning regimes.

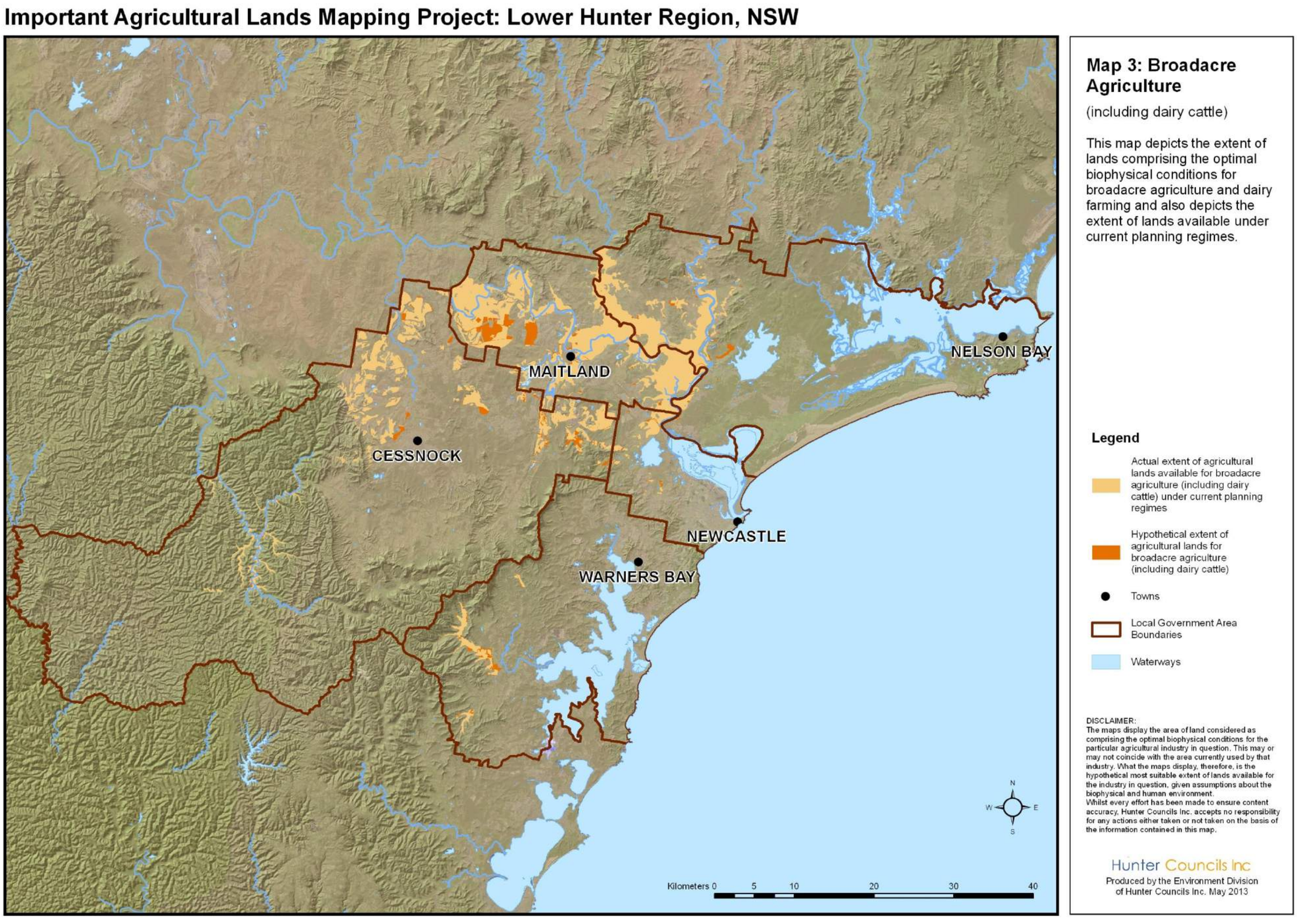


Figure 6: Map 4: BROADACRE AGRICULTURE (including dairy cattle) depicting the extent of lands available under current planning regimes and future planning scenarios.

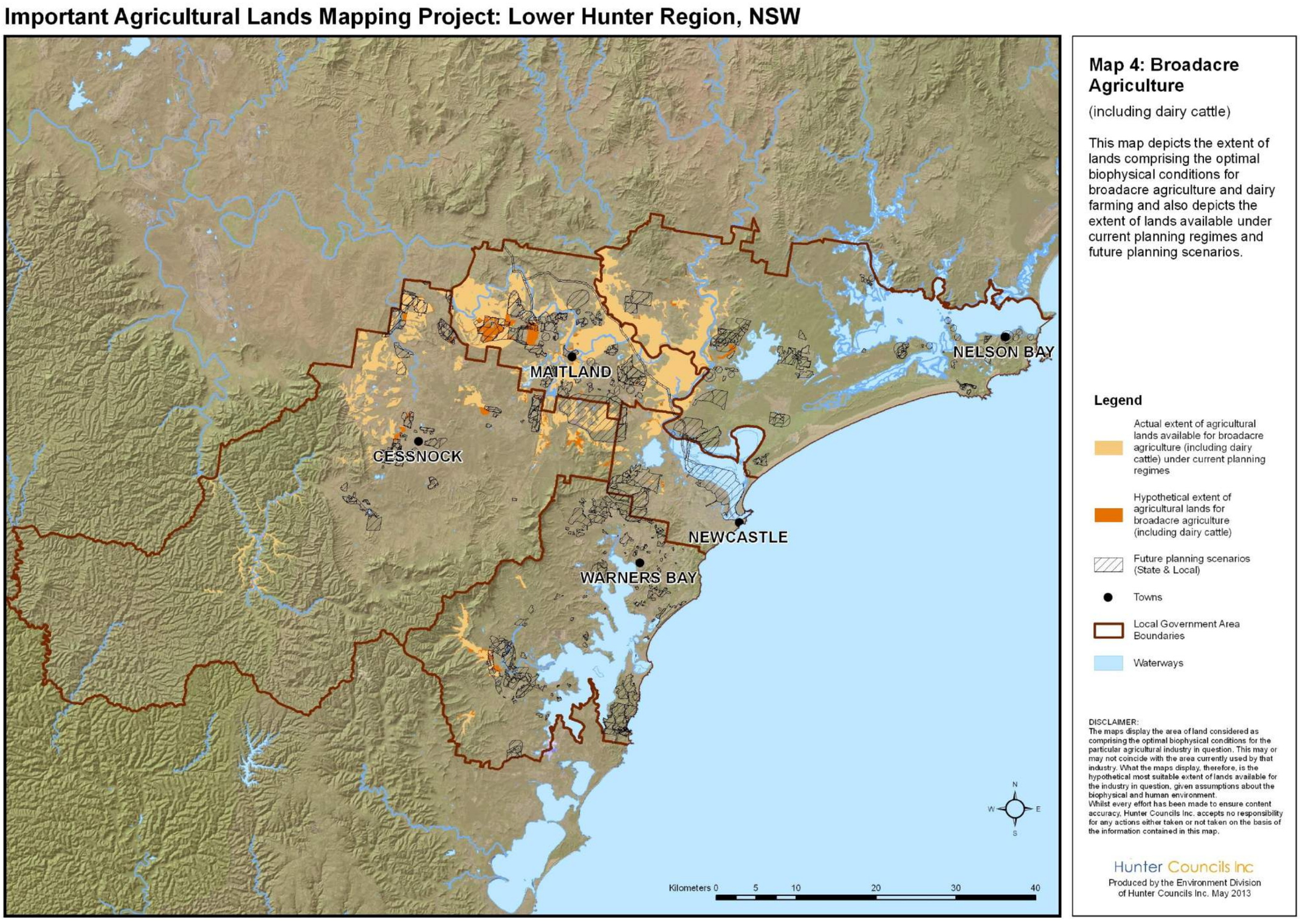


Figure 7: Map 5: VITICULTURE (including fruit and nut orchards) depicting the extent of lands available under current planning regimes.

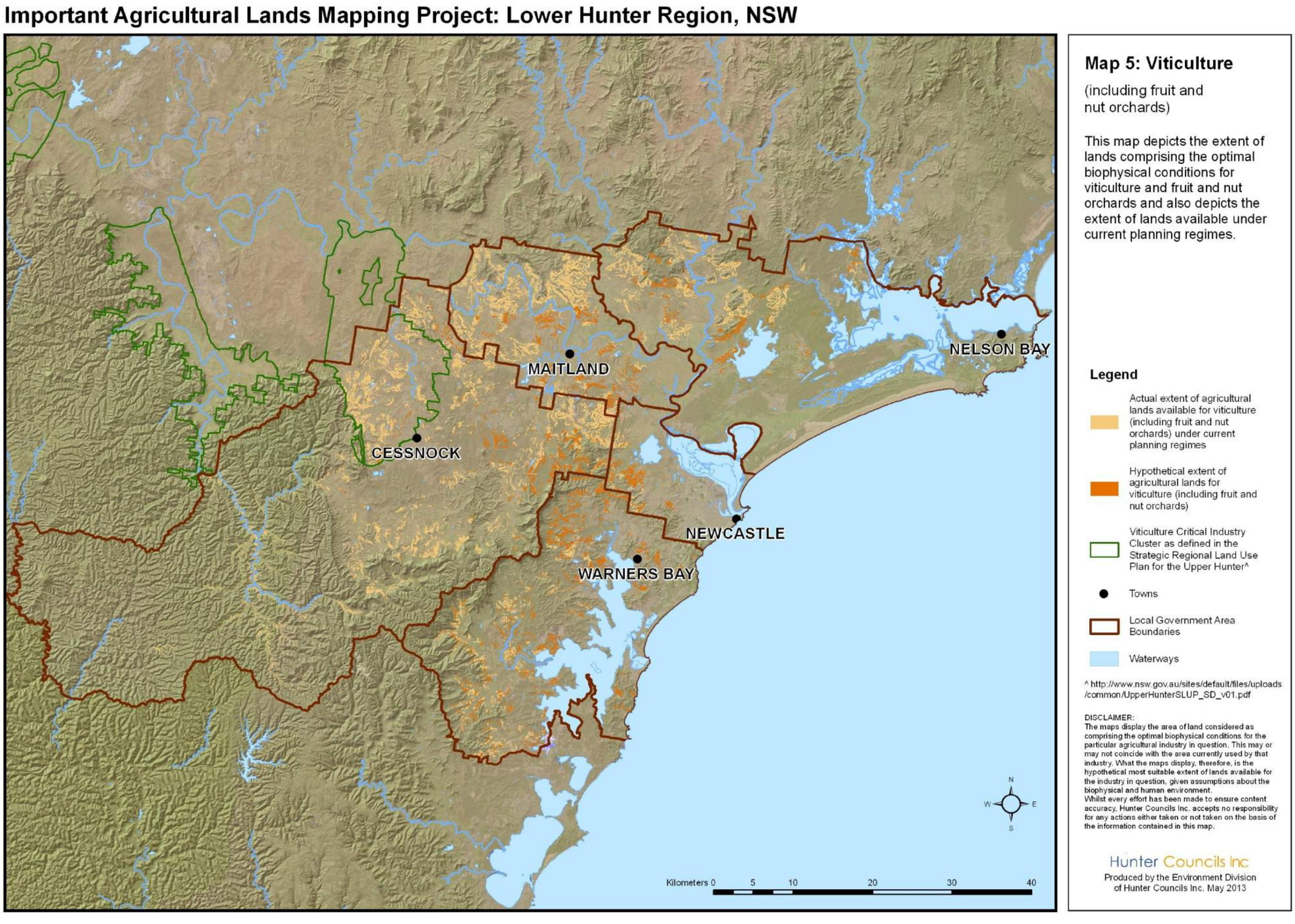
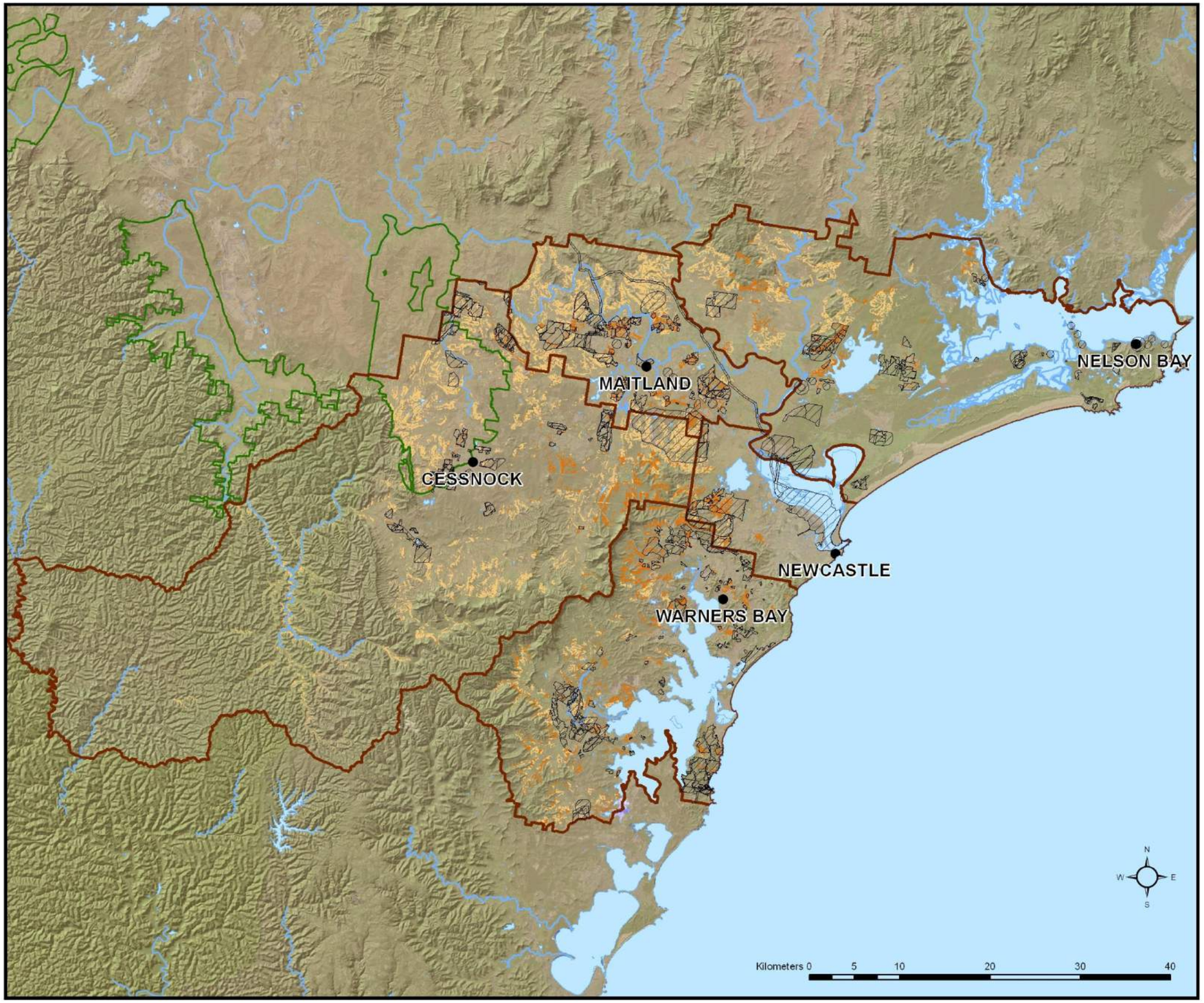


Figure 8: Map 6: VITICULTURE (including fruit and nut orchards) depicting the extent of lands available under current planning regimes and future planning scenarios.

Important Agricultural Lands Mapping Project: Lower Hunter Region, NSW



Map 6: Viticulture

(including fruit and nut orchards)

This map depicts the extent of lands comprising the optimal biophysical conditions for viticulture and fruit and nut orchards and also depicts the extent of lands available under current planning regimes and future planning scenarios.

Legend

- Actual extent of agricultural lands available for viticulture (including fruit and nut orchards) under current planning regimes
- Hypothetical extent of agricultural lands for viticulture (including fruit and nut orchards)
- Viticulture Critical Industry Cluster as defined in the Strategic Regional Land Use Plan for the Upper Hunter^
- Future planning scenarios (State & Local)
- Towns
- Local Government Area Boundaries
- Waterways

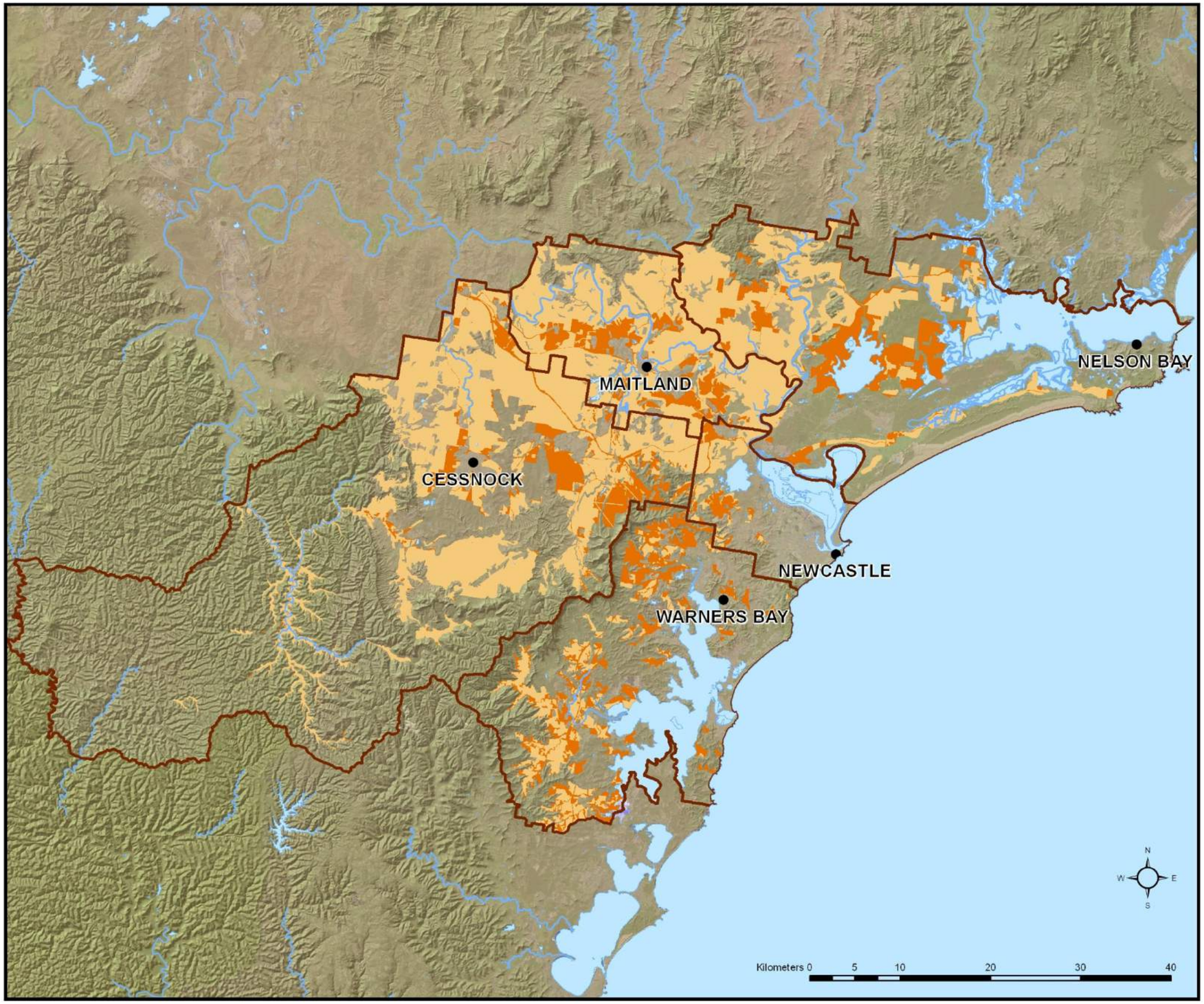
^ http://www.nsw.gov.au/sites/default/files/uploads/common/UpperHunterSLUP_SD_v01.pdf

DISCLAIMER:
The maps display the area of land considered as comprising the optimal biophysical conditions for the particular agricultural industry in question. This may or may not coincide with the area currently used by that industry. What the maps display, therefore, is the hypothetical most suitable extent of lands available for the industry in question, given assumptions about the biophysical and human environment.
Whilst every effort has been made to ensure content accuracy, Hunter Councils Inc. accepts no responsibility for any actions either taken or not taken on the basis of the information contained in this map.

Hunter Councils Inc
Produced by the Environment Division of Hunter Councils Inc. May 2013

Figure 9: Map 7: BEEF CATTLE (including other livestock grazing) depicting the extent of lands available under current planning regimes.

Important Agricultural Lands Mapping Project: Lower Hunter Region, NSW



Map 7: Beef Cattle

(including other livestock grazing)

This map depicts the extent of lands comprising the optimal biophysical conditions for beef cattle and other livestock grazing and also depicts the extent of lands available under current planning regimes.

Legend

- Actual extent of agricultural lands available for beef cattle (including other livestock grazing) under current planning regimes
- Hypothetical extent of agricultural lands for beef cattle (including other livestock grazing)
- Towns
- Local Government Area Boundaries
- Waterways

DISCLAIMER:
The maps display the area of land considered as comprising the optimal biophysical conditions for the particular agricultural industry in question. This may or may not coincide with the area currently used by that industry. What the maps display, therefore, is the hypothetical most suitable extent of lands available for the industry in question, given assumptions about the biophysical and human environment.
Whilst every effort has been made to ensure content accuracy, Hunter Councils Inc. accepts no responsibility for any actions either taken or not taken on the basis of the information contained in this map.

Hunter Councils Inc
Produced by the Environment Division of Hunter Councils Inc. May 2013

Figure 10: Map 8: BEEF CATTLE (including other livestock grazing) depicting the extent of lands available under current planning regimes and future planning scenarios.

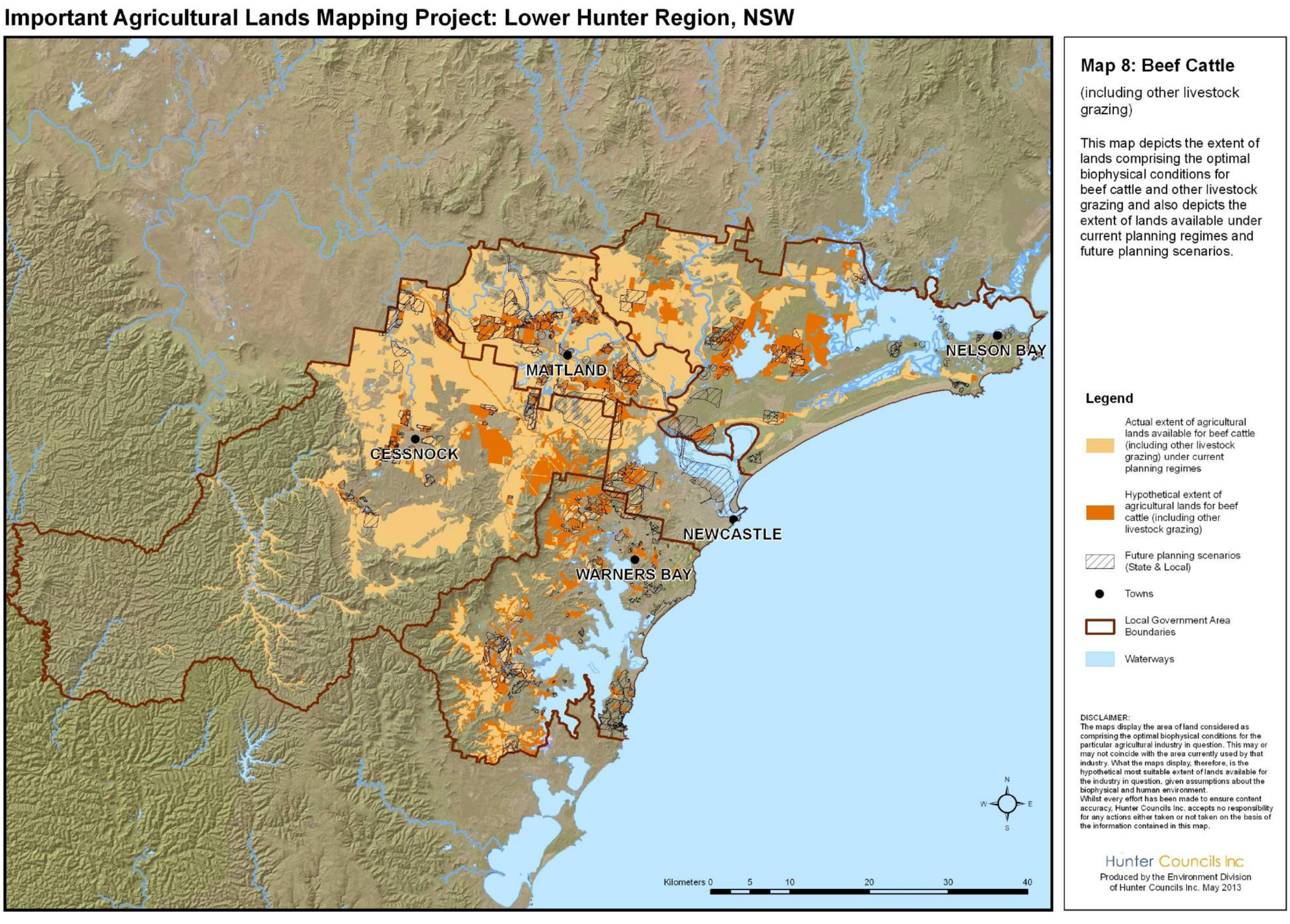


Figure 11: Map 9: POULTRY (including meat chickens and egg production and other poultry) depicting the extent of lands available under current planning regimes.

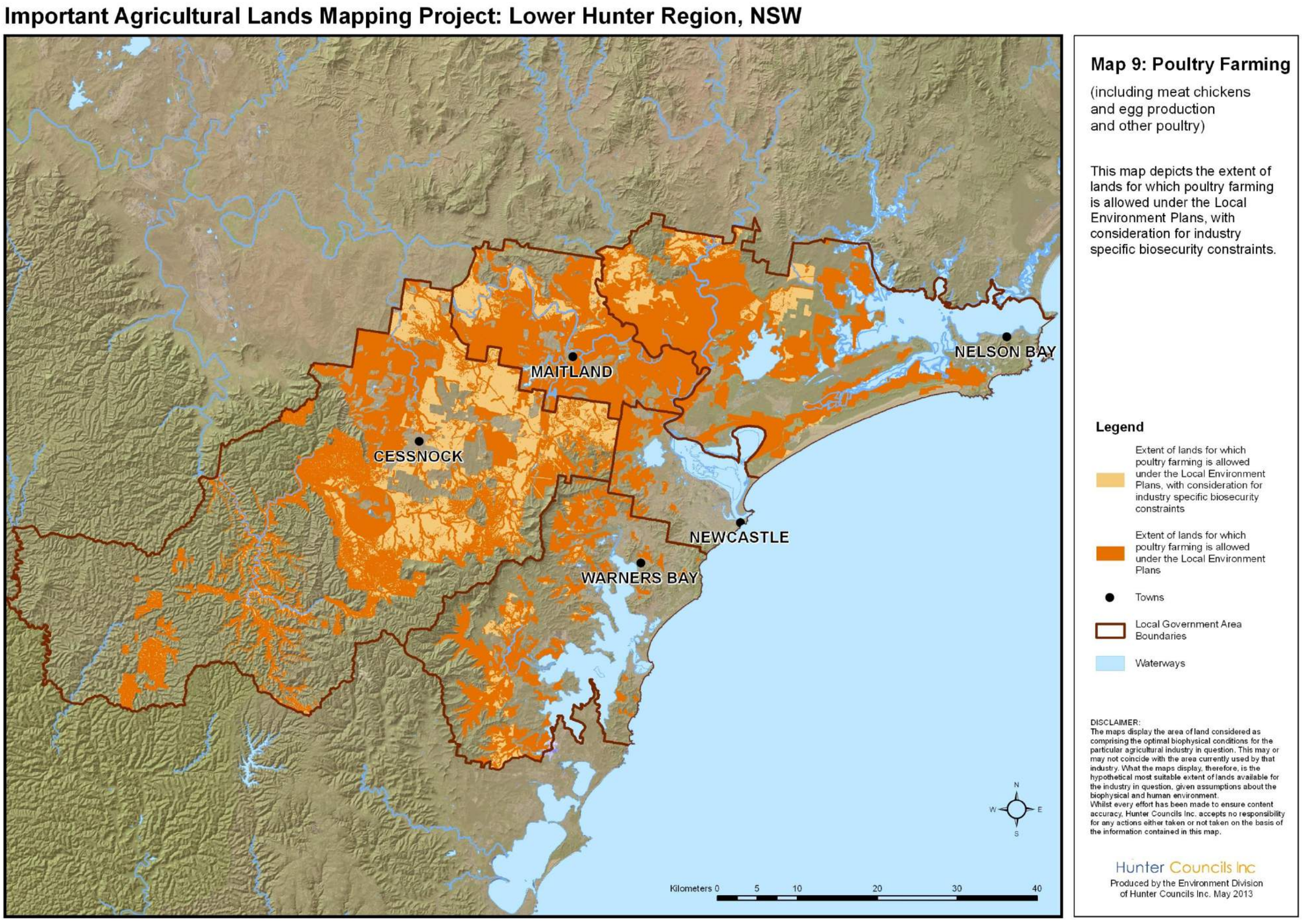


Figure 12: Map 10: POULTRY (including meat chickens and egg production and other poultry) depicting the extent of lands available under current planning regimes and future planning scenarios.

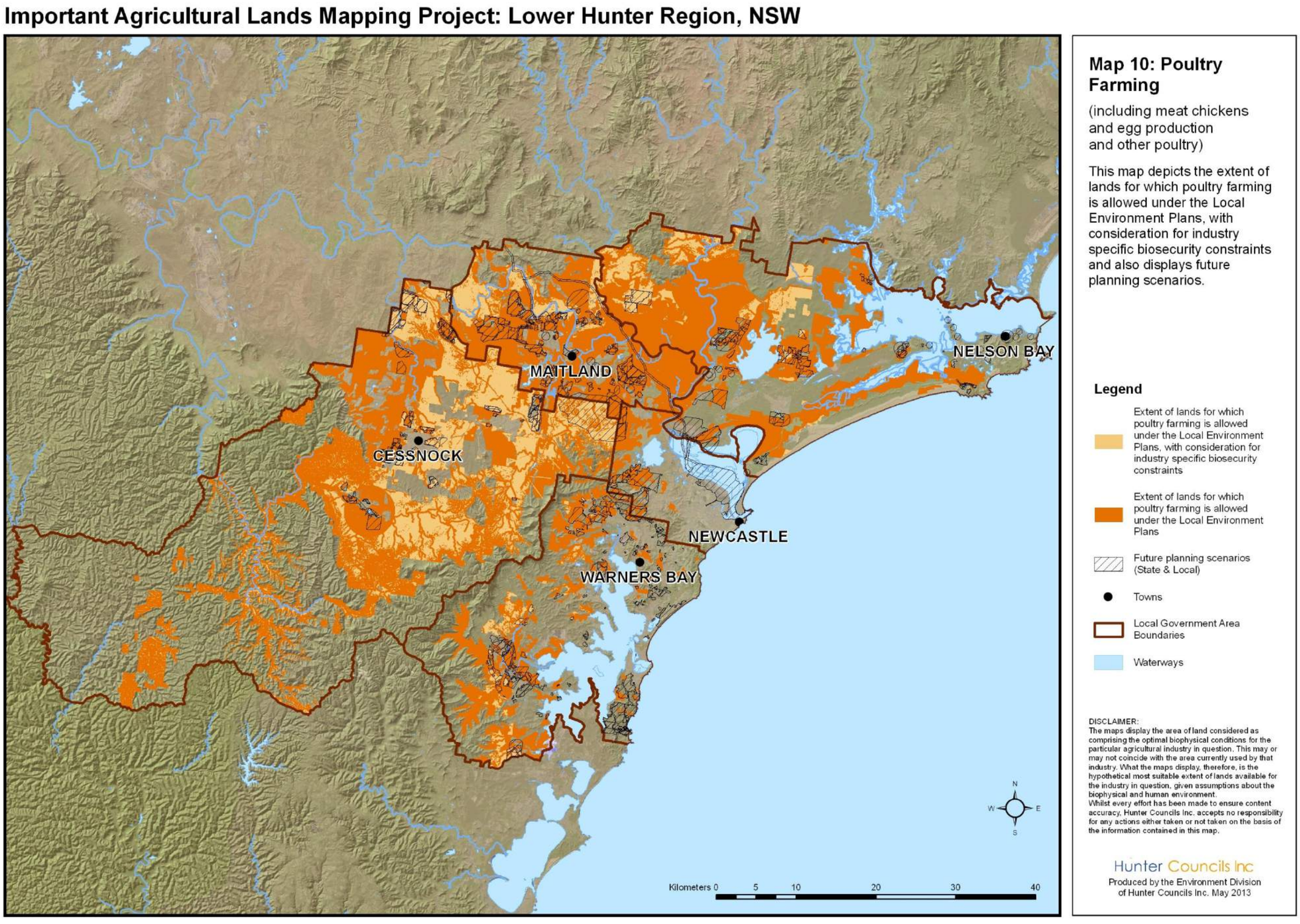


Figure 13: Map 11: PROTECTED CROPPING depicting the extent of lands available under current planning regimes.

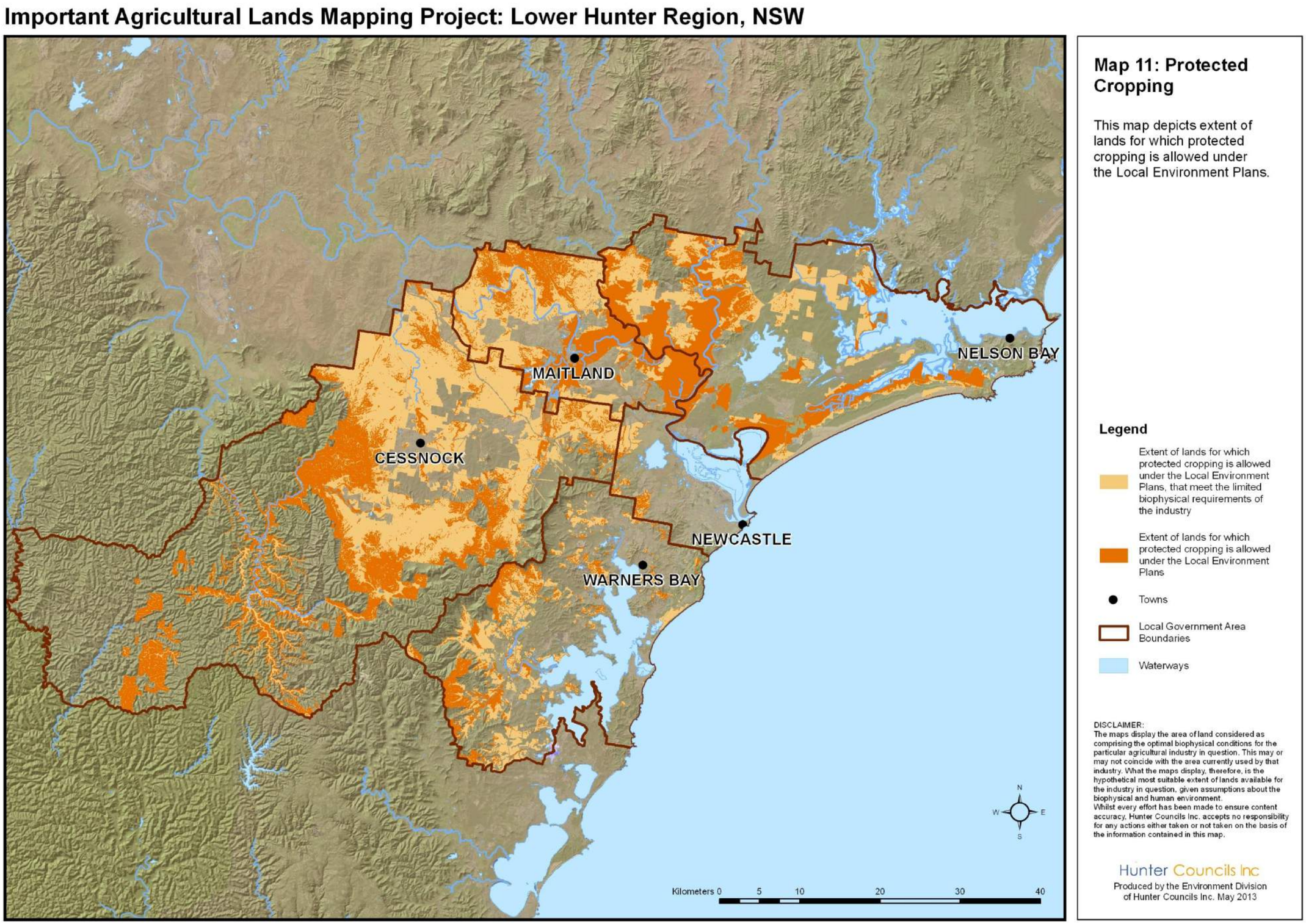


Figure 14: Map 12: PROTECTED CROPPING depicting the extent of lands available under current planning regimes and future planning scenarios.

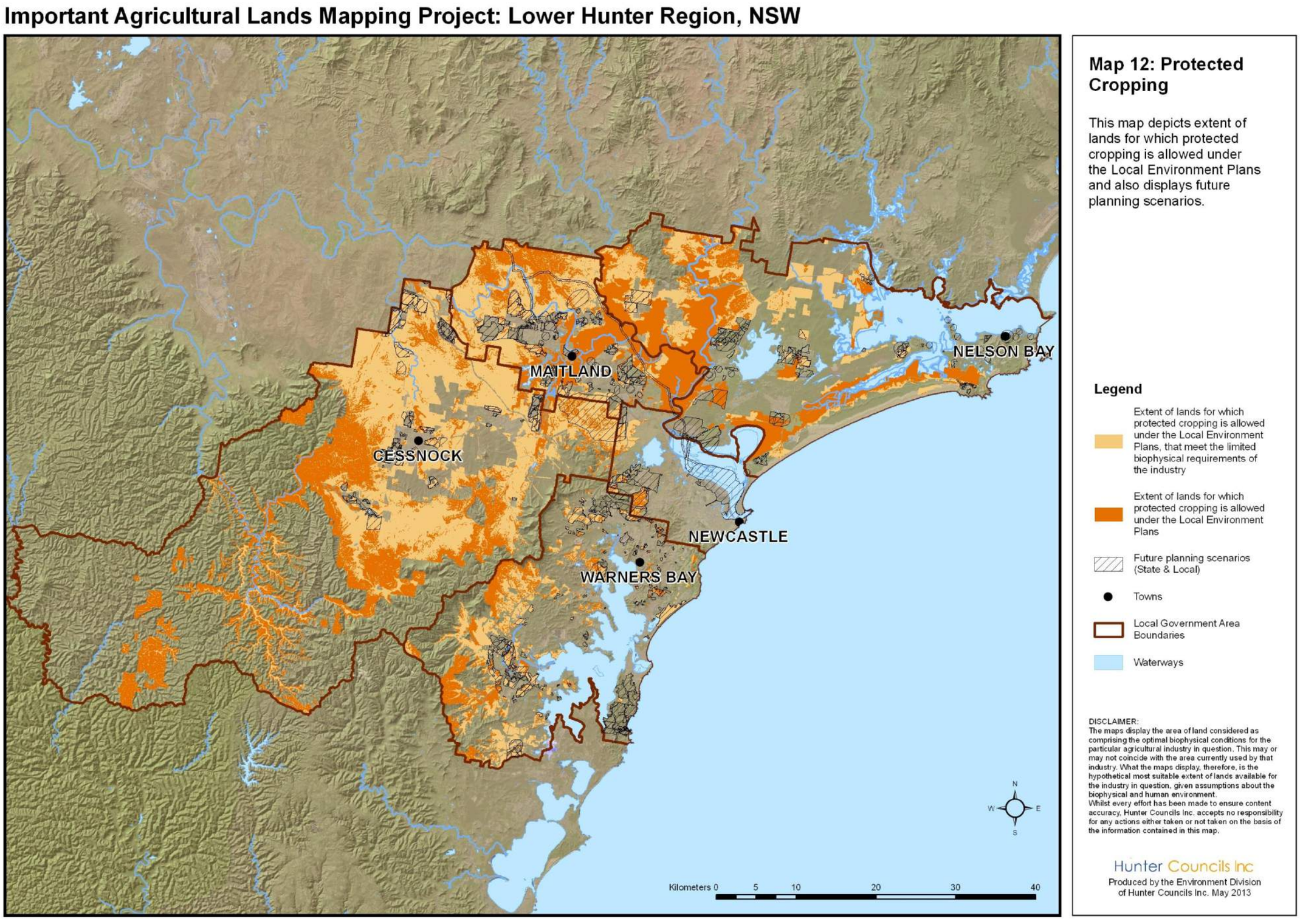


Figure 15: Map 13: IMPORTANT AGRICULTURAL LANDS depicting the extent of lands available under current planning regimes.

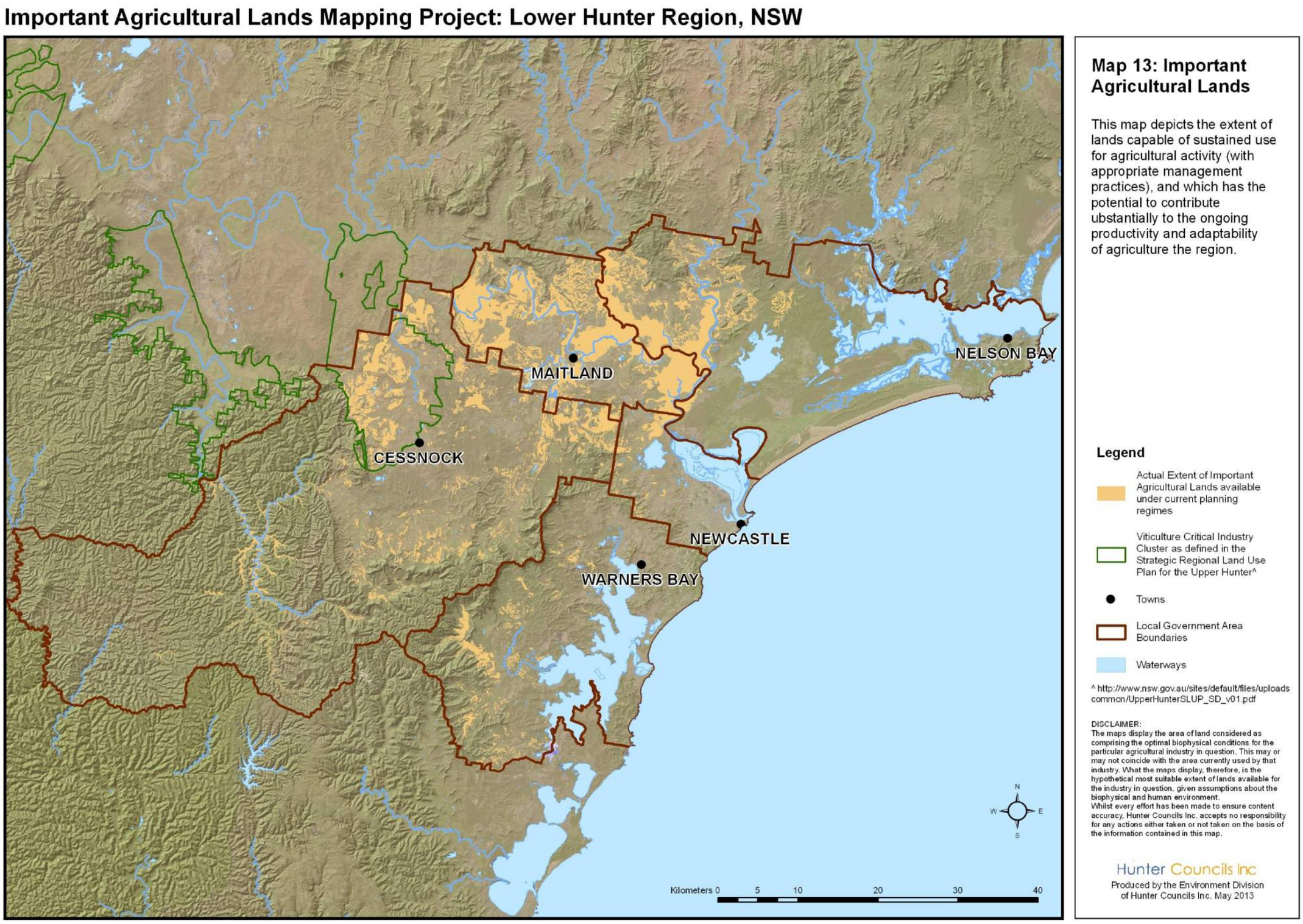
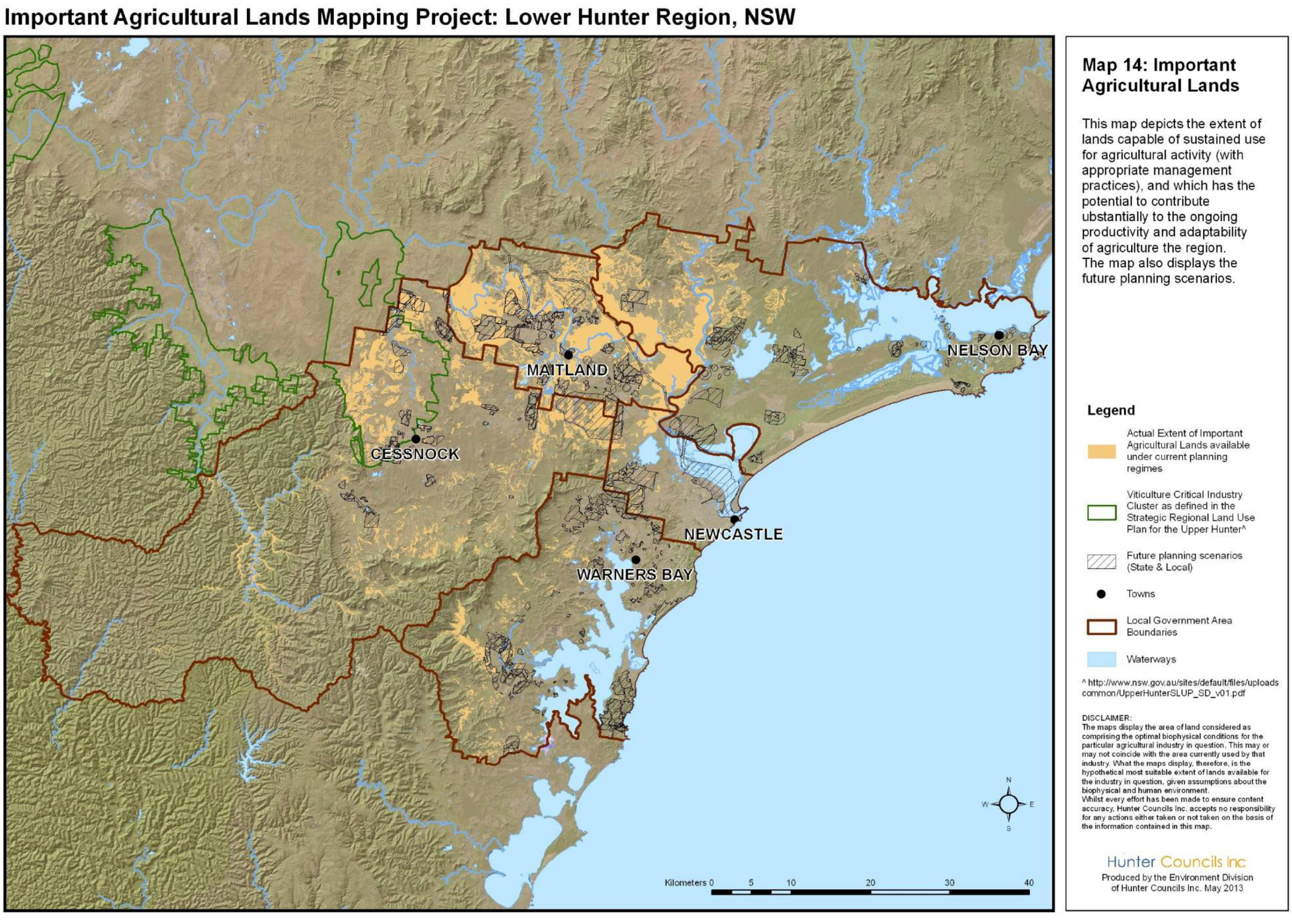


Figure 16: Map 14: IMPORTANT AGRICULTURAL LANDS depicting the extent of lands available under current planning regimes and future planning scenarios.



Despite intensive settlement in the region, some 75% of agricultural lands remain available particularly in the western and northern areas of the region. Table 7 provides details on the extent of lands available for each industry and the extent of lands which may be impacted by future planning scenarios in the region.

Table 7: Analysis of the extent of IAL and future planning scenarios

		Cessnock	Lake Macquarie	Maitland	Newcastle	Port Stephens	Lower Hunter
	LGA Area (ha)	196,148	75,602	39,193	21,473	97,205	429,621
Cultivated turf and vegetables	Extent of land meeting the biophysical requirements (ha)	42	-	5,504	-	2,015	7,562
	Extent available for agriculture (ha) under current zoning	31	-	5,322	-	1,966	7,318
	% Area reduced by current zoning	26.2%	-	3.3%	-	2.4%	3.2%
	Extent of lands available under the future planning scenarios (ha)	31	-	5,102	-	1,964	7,096
	% area potentially further impacted by future planning scenarios	0.0%	-	4.1%	-	0.1%	3.0%
Broadacre agriculture and dairy farming	Extent of land meeting the biophysical requirements (ha)	9,310	1240	14,859	922	6,325	32,657
	Extent available for agriculture (ha) under current zoning	8,463	972	13,533	817	5,992	29,776
	% Area reduced by current zoning	9.1%	21.6%	8.9%	11.4%	5.3%	8.8%
	Extent of lands available under the future planning scenarios (ha)	6,784	846	12,171	776	5,967	26,542
	% area potentially further impacted by future planning scenarios	19.8%	13.0%	10.1%	5.0%	0.4%	10.9%
Viticulture and fruit and nut orchards	Extent of land meeting the biophysical requirements (ha)	11,951	5251	6,537	888	4,469	29,096
	Extent available for agriculture (ha) under current zoning	10,221	1952	5,170	342	3,145	20,830
	% Area reduced by current zoning	14.5%	62.8%	20.9%	61.5%	29.6%	28.4%
	Extent of lands available under the future planning scenarios (ha)	8,914	1706	4,131	129	3,025	17,904
	% area potentially further impacted by future planning scenarios	12.8%	12.6%	20.1%	62.3%	3.8%	14.0%

		Cessnock	Lake Macquarie	Maitland	Newcastle	Port Stephens	Lower Hunter
Beef cattle and other livestock grazing	Extent of land meeting the biophysical requirements (ha)	51,706	16,863	28,727	3,665	29,123	130,083
	Extent available for agriculture (ha) under current zoning	43,541	7,412	23,555	2,330	20,312	97,151
	% Area reduced by current zoning	15.8%	56.0%	18.0%	36.4%	30.3%	25.3%
	Extent of lands available under the future planning scenarios (ha)	39,347	5,661	19,967	1,639	19,113	85,727
	% area potentially further impacted by future planning scenarios	9.6%	23.6%	15.2%	29.7%	5.9%	11.8%
Protected cropping	Extent of land meeting the biophysical requirements (ha)	66,135	31,724	20,390	5,437	45,208	168,894
	Extent available for agriculture (ha) under current zoning	45,785	9613	13,701	1,003	13,634	83,737
	% Area reduced by current zoning	30.8%	69.7%	32.8%	81.6%	69.8%	50.4%
	Extent of lands available under the future planning scenarios (ha)	41,369	7,414	10,935	514	12,542	72,775
	% area potentially further impacted by future planning scenarios	9.6%	22.9%	20.2%	48.8%	8.0%	13.1%
Poultry	Extent of land meeting the biophysical requirements (ha)	51,825	18,502	15,785	1,279	15,160	102,550
	Extent available for agriculture (ha) under current zoning	26,452	2,039	3,918	-	6,105	38,514
	% Area reduced by current zoning	49.0%	89.0%	75.2%	-	59.7%	62.4%
	Extent of lands available under the future planning scenarios (ha)	23,007	1,605	3,630	-	5,408	33,649
	% area potentially further impacted by future planning scenarios	13.0%	21.3%	7.4%	-	11.4%	12.6%

		Cessnock	Lake Macquarie	Maitland	Newcastle	Port Stephens	Lower Hunter
Important Agricultural Lands (IAL)	Extent of IAL (ha)	18,714	2,923	24,024	1,158	11,102	57,923
	Extent of IAL available under the future planning scenarios (ha)	15,728	2,551	21,403	904	10955	51,541
	% Agricultural area potentially further impacted by future planning scenarios	16.0%	12.7%	10.9%	22.0%	1.3%	11.0%

Turf and Vegetables are produced on the most productive of all the agricultural lands in the region, comprising only 7,562 ha (1.7% of the region). These lands are naturally protected from development as they are located on flood prone lands along the Hunter River in Maitland and Port Stephen's LGAs.

Future planning scenarios indicate the potential for a further, relatively small reduction (4.1%) in its extent in Maitland, but more importantly, the likelihood of a reasonably significant increase in encroachment pressures in both Maitland and Port Stephens LGAs as indicated in Map 1 (see Figures 3 and 4).

Broadacre & Dairy industries occur on land that is effectively an extension to lands that support the turf industry and are considered important. These lands are the second most productive in the region and approximately 50% of these are in the Maitland LGA (13,533 ha) but they are also found in Cessnock (8,463 ha) and Port Stephen's LGAs (5,992 ha). Some 10.9% of these lands (over 3,234 ha) may be further removed by future planning scenarios across the entire region, including 19.8% of Cessnock LGA's current extent (see Figures 5 and 6).

Viticulture, Fruit and Nuts are generally grown on productive, but somewhat less fertile lands that are also considered important in the region. One third of this land type in the Lower Hunter occurs in Cessnock with the remainder split between Maitland, Lake Macquarie and Port Stephens LGAs. Under the future planning scenarios some 2,900 ha could potentially be removed, with 44.7% of these lands being in the Cessnock LGA, where currently 100% of the industry activity is located. Some 51% of lands that could support these industries have already been removed due to historical settlement patterns in the coastal LGAs. As a logical extension to these patterns a further reduction of 19.8% of suitable lands in these LGAs may occur. This heightens the importance of protecting a contiguous area of viticulture and fruit and nut orchards in the western sector of the region (see Figures 7 and 8).

Beef Cattle The importance of land suitable for livestock grazing lies in its ability to extend and support mixed farming practices of the lands already discussed. Across the region, 25% of the available extent of these lands has already been reduced and a further 11.8% of the remainder is potentially impacted under future planning scenarios. Like viticulture, protection of suitable livestock grazing lands in the western area of the region is important due to the increasing development pressures on the coastal councils (see Figures 9 and 10).

The agriculture industries of *poultry farming* (see Figures 11 and 12) and *protected cropping* (see Figures 13 and 14) are under significant development pressures as locating these operations is mainly dependent upon the local planning regimes. Continued urban expansion into areas encroaching on existing operations may reduce their viability and potential to increase production.

Current development pressures are following historical settlement patterns along the coastal LGAs of the region and are likely to further constrain the future availability of IAL in these LGAs. This trend increases the importance of protecting the larger contiguous patches of IAL still available in the western and northern parts of the region.

5 Conclusion and Recommendations

The Lower Hunter is well suited to agricultural production because of its temperate, climate, reliable rainfall and water sources, and the variety of soil types. Significant additional advantages also result from a combination of the Lower Hunter's other natural resources, infrastructure and access to markets.

The region is noted for its complex rural economy largely based around intensive poultry farming, viticulture, livestock grazing and protected, broadacre and cultivated cropping, but it is increasingly diversifying into a range of specialist, high value and boutique occupations that occupy smaller parcels of land and provide higher returns per hectare.

Agriculture occurs on approximately 13.6% of the land in the region and provides a significant contribution to the NSW production of agricultural commodities and the Lower Hunter economy. The region has a well established reputation for wine growing and related tourism and supports a diverse range of agribusinesses. It produces 10% of poultry meats, 10% of eggs, 9% of turkeys, 4% of cultivated turf, 3.3% of outdoor vegetables, 3.3% of olives and 2.5% of protected crop outputs in the State.

Agriculture in the Lower Hunter has also had a long history of being extremely adaptable, with many farms changing the predominant commodity produced based on economic drivers, climatic conditions and/or technical innovations and advances.

The Lower Hunter is also geographically well located to both Sydney and export ports, potentially making it highly competitive in response to any significant increases in transport costs into the future.

The sustainable protection and management of agricultural lands in the Lower Hunter is complex and challenging. As the region continues to grow and develop, a suite of approaches will be required to ensure that the reduction of existing IAL is avoided and the deleterious impacts of conflicting land uses and encroachment are minimised.

The key issue for the Lower Hunter centres on maintaining and improving agricultural productivity whilst also supporting the development of other industries that are competing for the same, or adjacent, lands to reduce land use conflicts and the gradual fragmentation and loss of the relatively limited and non-renewable agricultural land resource.

Key challenges include (in no particular order):

1. **Maintaining suitable range of lands capable of supporting the agricultural sector into the future.**

   Whilst this project has mapped IAL lands, the remaining agricultural lands nevertheless have their own important values, which include:

   - supporting a range of farming enterprises, that do not rely on highly fertile lands (such as livestock grazing), ensuring that the IAL lands are utilised for the most suitable farming practices
   - ensuring sufficient availability of suitable lands for future growth, diversification and adaptation of the agricultural sector enabling it to respond to changing climate and market forces, particularly in the western and northern areas of the region
   - important biodiversity, catchment, scenic and cultural values.

2. Loss of lands

- The Lower Hunter region is experiencing significant growth and development pressures. Local and Regional Planning Strategies which need to accommodate anticipated growth and developments in the region appear likely to impact on IAL. These strategies, if implemented, have the potential to reduce the extent of the already reasonably restricted IAL (see Table 7), thus increasing pressures associated with fragmentation and encroachment in every LGA.
- Current State Environment Planning Policies (SEPPS) included in the Environmental Planning and Assessment Act (EP&A Act) are actively locating certain development types onto rural lands, these are (i) *Housing for Seniors or People with a Disability SEPP (2004)* - suggesting that aged care facilities should be located in rural zones outside of the main urban areas; and (ii) *SEPP 15 Rural Land Sharing Communities* – allowing increased residential development on rural agricultural lands, if the development was to provide housing for community agricultural purposes. Details included in the "A New Planning System for NSW" White Paper, which is set to replace the EP&A Act, indicate these SEPPs will be reviewed. The proposed legislation seeks to adopt a whole of government strategic planning process and to streamline development and assessment approvals. To ensure no further loss or compromise of IAL in the Lower Hunter, it will be critical that they are identified and acknowledged as "significant" in the Regional Growth Plan and fully protected in the sub-regional and local delivery plans.
- A trend towards the subdivision of agricultural lands into rural lifestyle blocks (20-100 ha) and the expansion of some notable agribusinesses into highly successful tourism and recreational enterprises is also compromising the ongoing availability of IAL.
- In recent years, the NSW government and Federal government have introduced a number of initiatives (Carbon Farming Initiative and NSW Bio Banking) as well as encouraging a range of conservation plans and initiatives to protect biological diversity, which may further restrict the extent of lands available for agricultural activities. Although many of these initiatives can offer secondary benefits through actively protecting and managing biodiversity resources, they also clearly restrict future clearing for production purposes.
- The increasing urbanisation of the Lower Hunter and the rise in land prices is placing greater pressures on the agricultural sector and creating uncertainty in relation agricultural investment. According to many farmers and stakeholders interviewed, land values in the Lower Hunter are increasingly linked to their development potential, and no longer to the production value of land. As farming community's age and landholders consider how to provide financial security for the next generation, the ability to secure an immediate financial gain through land sub-division and sale is becoming an increasingly pragmatic response to the pressures faced through expanding urban and peri-urban environments into traditional agricultural areas. In addition, the increase in urbanisation and/or rural lifestyle blocks in traditional rural areas has anecdotally created an increase in the costs of local goods and services, with many service merchants (e.g. fencing contractors) capitalising on larger populations and market opportunities.

3. Resource extraction (Coal Seam Gas and Coal Mining)

- The contribution resource extraction industries provide to the regional, State and National economies is significant and is placing an ever increasing pressure to expand operations into traditional agricultural lands in the Lower Hunter. Rural industries and local communities in the Hunter have been highly vocal about their concerns with the

expanding coal seam gas exploration, coal mining and pipeline developments in the region, as evidenced by:

- The concerns voiced by a large number of land owners consulted in this study
- Media coverage of the issues in the region over the last 3 years in particular
- The establishment of community advocacy groups such as the Hunter Valley Protection Alliance and the Fullerton Cove Resident's Action Group
- The high profile and highly organised advocacy activities of the Hunter Valley vigneron and equine industries.

Their concerns include the perceived marginalisation of farmlands as a result. Concerns over the impacts of these activities on land and water contamination, land use practices, air quality, human health, noise, and rural amenity only heighten the sensitivity of this issue.

4. Encroachment on land

A range of encroachment pressures on agricultural lands in the Lower Hunter are occurring as a result of increasing urban expansion and development, and are impacting on the long term viability of some industries. This includes:

- Increased land fragmentation reduces the ability to increase or sometimes even maintain agricultural operations of a sufficient scale to remain economically viable.
- Increased pressure on water supply (anecdotally farmers have noted this can sometimes decrease landholder's rights to draw water directly from rivers and aquifers).
- Increased development on boundaries of IAL can also change the local hydrology and infrastructure, increasing runoff and potentially local flooding, as well as water pollution.
- A challenge for developers, councils and existing agricultural operations is to equitably assign appropriate costs and management responsibilities for road maintenance to service agricultural operations.
- New residential and commercial developments located on lands above flood plains supporting agricultural operations can marginalise the available local lands able to be used by livestock farmers for animal and equipment refuge during flood periods.
- Increased subdivision of lands into lifestyle blocks (20-100 ha) has reportedly increased the trend towards absentee ownership which can exacerbate pest weeds and animals and the land management burden of surrounding property owners.
- Increased intolerance of urban and rural-residential residents for the noise, odour, light (at night) and dust pollution from adjacent and heavy vehicle movements, of established agricultural operations.

Key recommendations for consideration in the Australian Government's Strategic Assessment process and the NSW Government's regional planning process for the Lower Hunter follow:

1. Consideration of the Lower Hunter IAL mapping by relevant Australian, State, regional and local government planning instruments (including assessments of State and Regionally Significant Developments) to seek to preserve this non-renewable resource for future generations
2. Identification and implementation of a strategic response to the proposed future planning scenarios and their impacts on the three LGAs (Maitland, Port Stephens and Cessnock). These contain 93% of the identified IAL in the region and have the potential to be reduced by 17% under current proposals.

3. Further investigation of opportunities for protecting the more contiguous patches of IAL available in the western and northern sections of the region. The historical settlement patterns and future development pressures occurring in the coastal LGAS of Lake Macquarie and Newcastle heighten the importance of these areas as they have the potential to facilitate buffering from encroachment, capitalise on the sustainability opportunities available through co-location of industries, and may increase the ability to take advantage of carbon farming, biobanking, corridor maintenance and other biodiversity conservation opportunities.
4. Protection of other lands available for agricultural activities (as depicted in the beef cattle industry maps) as they are considered important for the ongoing viability of agriculture in the region. This will ensure there are adequate lands available to allow the agricultural sector to continue to adapt to future economic pressures, market opportunities and climate change impacts.
5. The continued accommodation of poultry farming and protected cropping industries which are dependent upon local planning regimes rather than the important biophysical lands as they significantly contribute to the regional economy and have continued to expand over the last ten years.

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Appendix 1 – NSW DPI Important Agricultural Lands Mapping Methodology

A copy of DPI's "*Identifying Important Agricultural Industry Lands in NSW: An interim draft guide on how to report and locate lands for specific agricultural industries (2012)"* can be found at:

www.dpi.nsw.gov.au/publications

Appendix 2 – Technical Working Group Materials

Please refer to included CD for electronic copies of the materials provided to the Technical Working Group to enable them to advise on the project.

Technical Working Group Members

Name	Job Title and Organisation
Ms Wendy Goodburn	Resource Management Officer, NSW Department of Primary Industries
Mr Bob Doyle	Grazier and Agricultural Consultant
Mr Gary Oakey	Team Leader Regional , NSW Department of Planning & Infrastructure
Mr Grant Alderson	Strategic Land use Planner, Lake Macquarie City Council
Mr Neil Griffiths	District Agronomist/Technical Specialist, NSW DPI
Mr Josh Ford	Strategic Town Planner, Maitland City Council
Mr Ian Turnbull	Executive Manager - Natural Environment Planning, Cessnock Council
Ms Kerry Kempton	Technical Specialist – Dairy, NSW Department of Primary Industries
Mr J Badgery-Parker	Greenhouse industry specialist, NSW Department of Primary Industries
Mr David Hook	Chairman: Hunter Valley Wine Industry Assoc. Viticulture Sub Committee
Mr David Raison	Industry Development Officer, Turfgrowers Association of NSW Inc.
Mr Byron Stein	Poultry Livestock Officer, NSW Department of Primary Industries
Mr Selby Green	NSW Farmers' Representative, Beef Cattle & Broadacre Cropping
Ms Jenn Warner	Officer, NSW Department of Primary Industries
Ms Dianne Blair	Regional Sustainability Planning, SEWPaC
Mr Paul Keighley	Regional Sustainability Planning, SEWPaC
Dr Russell Turner	Spatial Analyst

Appendix 3 – Data and Modelling

Included in Appendix 3

- Definitions of the planning and biophysical parameters utilised in determining "most suitable" lands for key agricultural industries
- Summary of spatial layers utilised in the MCAS-S models.
- MCAS-S Modelling Software outputs and evaluation
- Metadata associated with the various data layers utilised in the study

Definitions of the planning and biophysical parameters utilised in determining "most suitable" lands for key agricultural industries.

Parameter	Definition
Zone Descriptions	As described in the Standard LEP produced by Planning NSW. **E2 – Environmental Conservation** - This zone is for areas with high ecological, scientific, cultural or aesthetic values outside national parks and nature reserves. The zone provides the highest level of protection, management and restoration for such lands whilst allowing uses compatible with those values. It is anticipated that many councils will generally have limited areas displaying the characteristics suitable for the application of the E2 zone. Areas where a broader range of uses is required (whilst retaining environmental protection) may be more appropriately zoned E3 Environmental Management. **E3 – Environmental Management** - This zone is for land where there are special ecological, scientific, cultural or aesthetic attributes or environmental hazards/processes that require careful consideration/management and for uses compatible with these values. **E4 – Environmental Living** - This zone is for land with special environmental or scenic values, and accommodates low impact residential development. As with the E3 zone, any development is to be well located and designed so that it does not have an adverse effect on the environmental qualities of the land. **RU1 – Primary Production** – This zone is for land that encourages sustainable primary industry production by maintaining and enhancing the natural resource base, encourages diversity in primary industry enterprises and systems appropriate for the area; minimises the fragmentation and alienation of resource lands; and minimises conflict between land uses within this zone and land uses within adjoining zones. **RU2 – Rural Landscape** – This zone is for land that encourages sustainable primary industry production by maintaining and enhancing the natural resource base; maintains the rural landscape character of the land; and provides for a range of compatible land uses, including extensive agriculture. **RU3 – Forestry** – This zone is for land that enables development for forestry purposes, and developments that are compatible with forestry land uses. **RU4 – Primary Production Small Lots** – This zone is for land that enables sustainable primary industry and other compatible land uses; and encourages diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature; and minimises conflict between land uses within this zone and land uses within adjoining zones. **RU6 – Transition Between Rural and Other Land Uses** – This zone is for land that protects and maintains land that provides a transition between rural and other land uses of varying intensities or environmental sensitivities, and minimises conflict between land uses within this zone and land uses within adjoining zones
Land capability	Based on the DIPNR Land Capability Mapping 1988 **Land suitable for regular cultivation** ***Class 1 – No special soil conservation works or practices*** – Land suitable for a wide variety of uses. Where soils are fertile, this is land with the highest potential for agriculture, and may be cultivated for vegetable and fruit production, cereal and other grain crop, energy crops, fodder and forage crops, and sugar can in specific areas. Includes "prime agricultural land". ***Class 2 – Soil conservation practices such as strip cropping, conservation tillage and adequate crop rotation*** – Usually gently sloping land suitable for a wide variety of agricultural uses. Has a high potential for production of crops on fertile soils similar to Class 1, but increasing limitations to production due to site conditions. N Includes "prime agricultural land". ***Class 3 – Structural soil conservation works such as graded banks, waterways and diversion banks, together with soil conservation practices such as conservation tillage and adequate crop rotation*** – Sloping land suitable for cropping on a rotational basis. Generally used for the production of the same type of crops as listed for Class 1, although productivity will vary

Parameter	Definition
	depending on soil fertility. Individual yields may be the same for classes 1 and 2, but increasing restrictions due to the erosion hazard will reduce the total yield over time. Soil erosion problems are often severe. Generally fair to good agricultural land. **Suitable for grazing with occasional cultivation** ***Class 4 – Soil conservation practices such as pasture improvement, stock control, application of fertiliser and minimal cultivation for the establishment or re-establishment of permanent pasture.*** – Land not suitable for cultivation on a regular basis owing to limitations of slope gradient, soil erosion, shallowness or rockiness, climate or a combination of these factors. Comprises the better classes of grazing land of the State and can be cultivated for an occasional crop, particularly a fodder crop, or pasture renewal. Not suited to the range of agricultural uses listed for Classes 1-3. If used for hobby farms, adequate provision should be made for water supply, effluent disposal, and selection of safe building sites and access roads. ***Class 5 – Structural soil conservation works such as absorption banks, diversion banks and contour ripping, together with the practices as in Class 4*** – Land not suitable for cultivation on a regular basis owing to considerable limitations of slope gradient, soil erosion, shallowness or rockiness, climate, or a combination of these factors. Soil erosion problems are often severe. Production is generally lower than for grazing lands in Class 4. Can be cultivated for an occasional crop, particularly a fodder crop for pasture renewal. Not suited to the range of agricultural uses listed for Class1-3. If used for hobby farms adequate provision should be made for water supply, effluent disposal, and selection of safe building sites and access roads. Other land classes of 6, 7, 8, U, M and sub classes of c and d exist. Details are not included as these classes are not mapped.
Soil fertility	**Soil fertility relates to the soil's ability to support plant life. The soils which are found in potentially agricultural parts of NSW have been grouped into five fertility groups.** **Group 1** – includes soils which due to their poor physical and/or chemical status only support limited plant growth. The maximum agricultural use of these soils is sparse grazing. **Group 2** – includes soils with low fertilities, such that generally only plants suited to grazing can be supported. Large inputs of fertilizers are required to make the soil usable for arable purposes. **Group 3** – soils have low to moderate fertilities and usually require fertilizer and/or have some physical restrictions for arable use. **Group 4** – soils have high level of fertility in their virgin state, but this fertility is significantly reduced after only a few years of cultivation. **Group 5** – soils have high fertility and these soils generally require treatment with chemical fertilizers after several years of cultivation.
Slope	The slope dataset was developed based on a 25m DEM dataset and provides an indication of the landform throughout the study area.
Temperature	Of the agricultural industries mapped, only viticulture expressed the need for the consideration of a temperature parameter (minimum Spring temperatures less than -6oC). A review of the minimum temperature data and the potential number of frost days (below -5oC) from the Bureau of Meteorology indicated there is no variation throughout our study area. As such this data layer was not included in the final mapping products.
Rainfall	Average annual rainfall throughout the Lower Hunter region is in excess of 700mm/yr (based on Bureau of Meteorology data). As this is double the minimum rainfall requirement for all

Parameter	Definition
	industries, and there is no variation throughout the study area, this data layer was not included in the final mapping product.
Acid Sulphate Soils (risk)	A review of the Acid Sulfate Soil risk data has determined there are areas within the study area that are considered High risk, but this does not necessarily preclude agricultural activities on these lands. It does indicate where disturbance of lands may create an environmental issue. As this is not a factor that specifically precludes any agricultural activity, it has not been included in the final mapping product, but is included as an overlay to clearly identify areas where this may be a problem for any activity (agricultural or otherwise).
Flood level	Flood levels depicted in the final mapping products have been derived from flood modelling conducted by each Local Government Authority included in the study area. Areas depict the 1 in 100 year flood levels – this is a general planning criteria for the allowance of certain developments and activities.

Summary of spatial layers utilised in the MCAS-S models.

Item	Raster filename	Description	Models Generated					
			Poultry	Beef Cattle	Broadacre crops	Viticulture Fruit & Nuts	Protected Crops	Cultivated Turf & Vegetables
1	HCR_NationalParks_PA	National Parks	Yes	Yes	Yes	Yes	Yes	Yes
2	HCR_StateForests_PA	State Forest	Yes	Yes	Yes	Yes	Yes	Yes
3	HCR_LGAs	LGA boundaries	Yes	Yes	Yes	Yes	Yes	Yes
4	HCR_waterbodies_PA	Water bodies	Yes	Yes	Yes	Yes	Yes	Yes
5	HCR_Wetland_Proximity	Distance from wetlands	Yes	No	No	No	No	No
6	HCR_WetlandsSEPP14_Prox	Distance from SEPP14 wetlands	Yes	No	No	No	No	No
7	HCR_LSC_Fertility2	Soil fertility	No	Yes	Yes	Yes	No	Yes
8	HCR_AcidSoils2	Acid soil risk	No	No	Yes*	Yes*	No	Yes*
9	IAL_LEP_PS_New	LEP zones - Port Stephens	Yes	Yes	Yes	Yes	Yes	Yes
10	IAL_LEP_LM_New	LEP zones - Lake Macquarie	Yes	Yes	Yes	Yes	Yes	Yes
11	IAL_LEP_LZN_2	LEP zones - CC, Maitland & NC	Yes	Yes	Yes	Yes	Yes	Yes
12	IAL_LandCap3	Land Capability class	Yes	Yes	Yes	Yes	Yes	Yes
13	IAL_Spr_MinTemp	Spring Minimum Temperature	No	No	No	Yes*	No	No
14	IAL_Slope2	Slope	Yes	Yes	Yes	Yes	Yes	Yes
15	IAL_StreamBuff100m	Streamorder 2+ buffered 100m	Yes	No	No	No	No	No
16	IAL_Floodlevel_CC	Max flood level - Cessnock	Yes	No	No	No	No**	No
17	IAL_Floodlevel_New	Max flood level - Newcastle	Yes	No	No	No	No**	No
18	IAL_Floodlevel_LM	Max flood level - Lake Mac	Yes	No	No	No	No**	No
19	IAL_Floodlevel_PS	Max flood level - Port Stephens	Yes	No	No	No	No**	No
20	IAL_Floodlevel_ML	Max flood level - Maitland	Yes	No	No	No	No**	No

* Please note that these datasets were later removed from the final models as they were not influencing the ability for agricultural activities to be undertaken on lands.

** Please note these datasets were added to the final models.

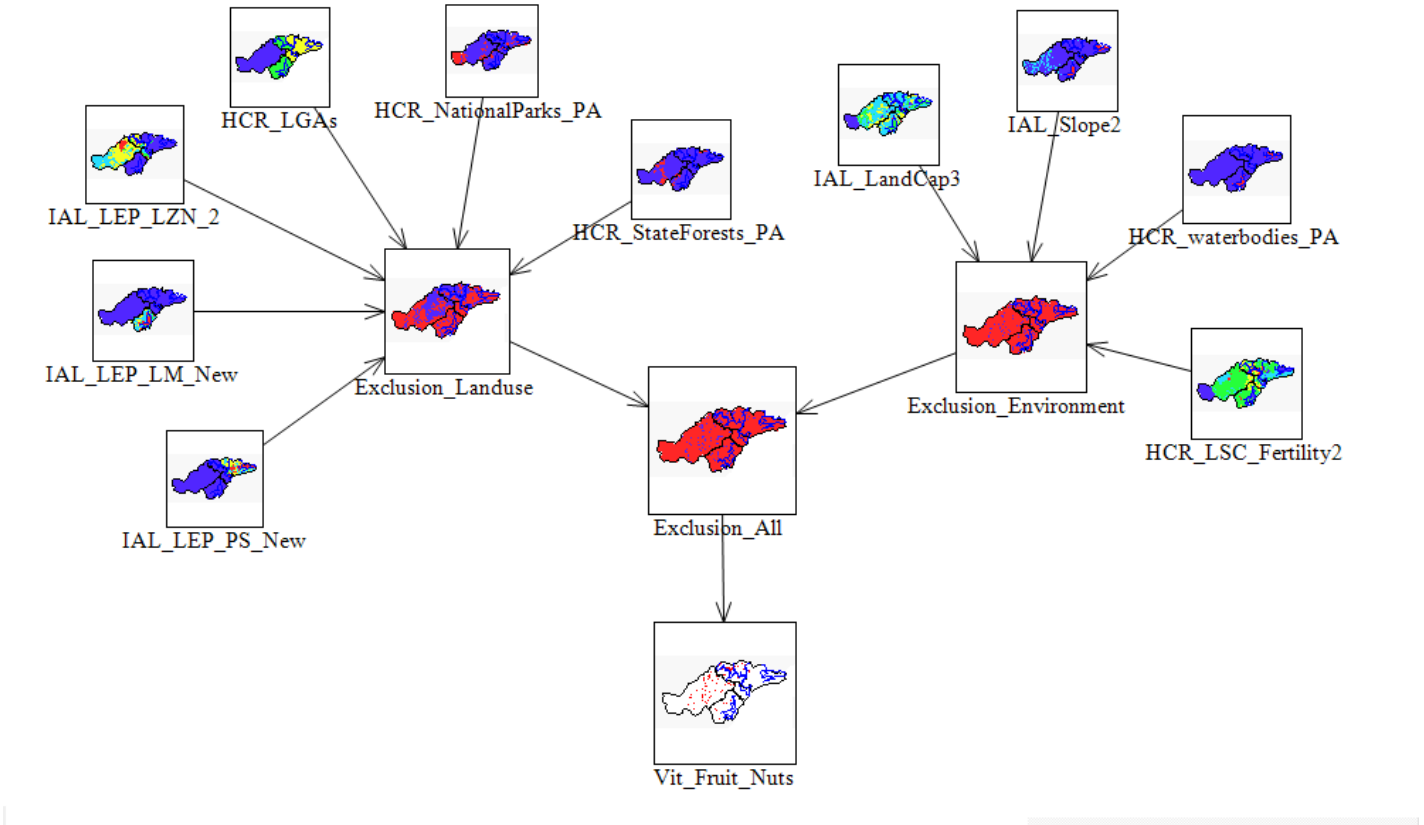
MCAS-S Process Discussion & Evaluation

Following is further technical detail on the MCAS-S model and an example of the display outputs provided by the modelling software. An evaluation of the MCAS-S software is also provided.

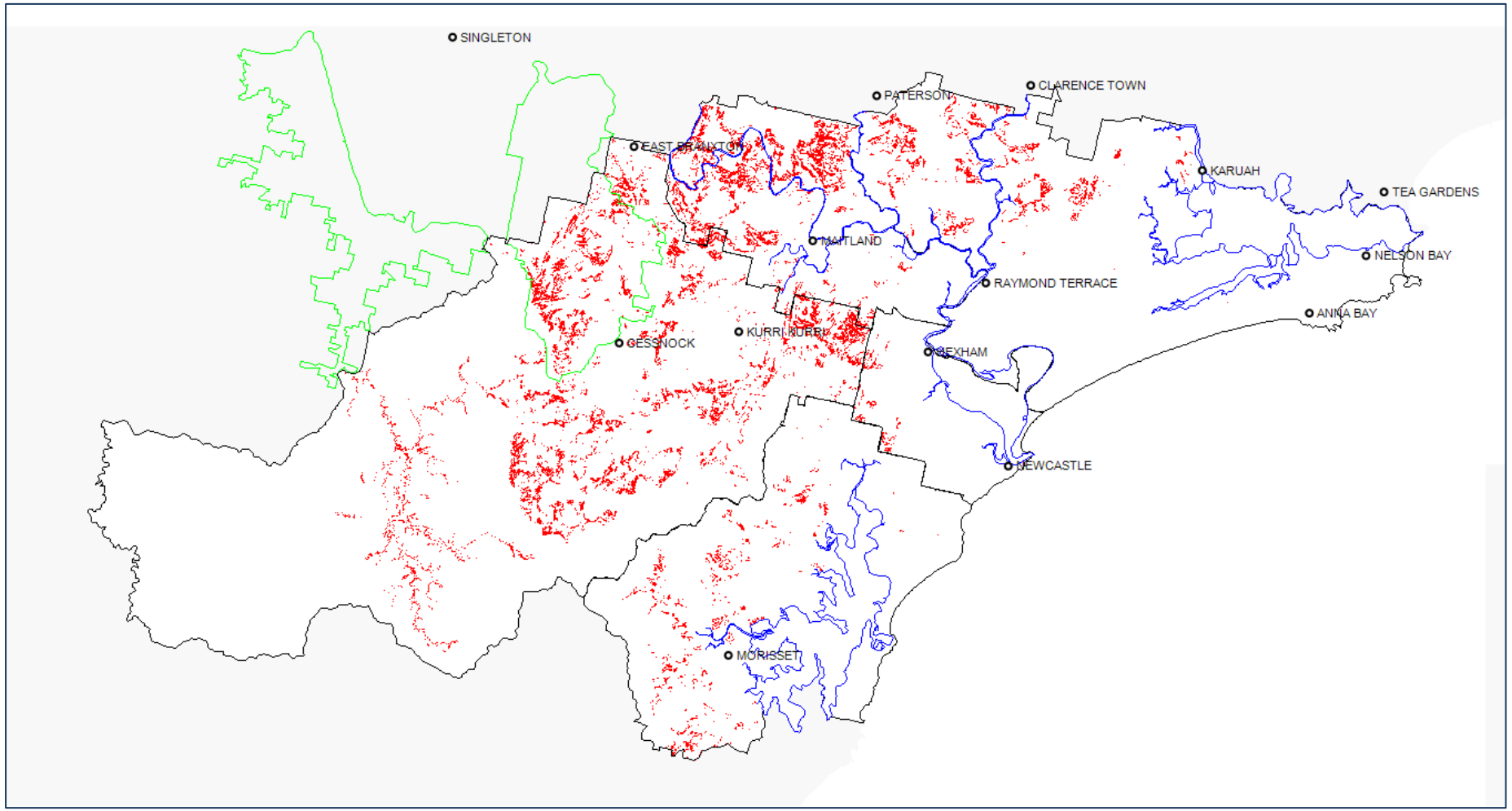
MCAS-S Outputs

The MCAS-S process provided a number of process flowcharts and mapping layers based on all the data layers utilised. Following is an example of the process flowchart and map product produced for the viticulture industry.

Model process flowchart to develop the MCAS-S display model identifying available lands for viticulture, Fruit & Nuts in the Lower Hunter



Final MCAS-S model identifying available lands for viticulture, Fruit & Nuts in the Lower Hunter



Please note: The "Viticulture" cluster group negotiated through the Upper Hunter study is identified by the green line. Waterways are depicted by the blue lines. Red-shaded areas indicate available lands (not restricted by LEP zones), that match the biophysical criteria included in Table 6.

Evaluation of MCAS-S

The use and application of the MCAS-S tool was an addition to Project Brief and the methodology previously used by the NSW Department of Primary Industries to map IAL. The following observations are provided in relation to the benefits and restrictions associated with its use:

- The provision of preliminary models in MCAS-S format assisted in explaining the mapping and modelling process to the TWG and project stakeholders, clearly articulating/displaying the criteria and parameters used, and encouraging discussion and debate.
- MCAS-S proved to be very valuable during the consultation and iterative modelling activities. In particular, it provided a rapid visual evaluation of available data which enabled stakeholders (particularly the technical specialists) and the project team to judge the value of individual spatial datasets (fit for purpose), accelerate the evaluation of various alternative scenarios, and assess the level of confidence in the models.
- For this project, MCAS-S was utilised most effectively with technical specialists, familiar with the biophysical inputs for key agricultural industries and their contribution to land capability mapping processes. Non-technical stakeholders were able to take advantage of only a very limited range of the program's capabilities. Traditional spatial products and overlays in ArcGIS proved to be more effective for this audience (satellite imagery backdrop for context etc) and are able to be produced far more cost effectively.
- The strengths of MCAS-S as a display tool is tempered by its ability to produce appropriate quality vector files for use in final product development and fine scales. MCAS-S outputs utilise a grid system (i.e. 100 x 100m) that outputs rasters, and therefore subsequent vectors appear jagged or blocky at high resolution. This is not necessarily an issue at a regional scale but it could create problems if the dataset is utilised at a smaller scale for other local purposes. The limited ability to manipulate vector shapes is also a draw back when considering the production of high quality mapping products requiring a number of differing display elements.
- MCAS-S also requires considerable investment in time, GIS skills and expenditure to prepare spatial data for input due to the need to consistently convert all data into appropriate MCAS-S formats.

Data utilised in the Esri ArcGIS modelling process

Land Capability for NSW (1989)

This data was prepared by the Soil Conservation Service, and was released by the New South Wales Department of Land and Water Conservation in 1989. As discussed in section 2.3.1., the more current Land and Soil Capability mapping was not able to be utilised in this project.

This dataset classifies land into 8 standard classes, based on an assessment of the biophysical characteristics of the land, the extent to which these will limit a particular type of land use and the technology available for land management. The classification has a hierarchical sequence, ranging from land with the greatest potential for agricultural or pastoral use, to that which is entirely unsuitable for either.

Mapping exclusions include National and State Parks, State Forests, restricted water supply catchments, lands set aside for soil conservation management and urban zonings. The data is at a scale of 1:100000.

Land Capability data was used to determine which lands that were suitable for each of the models, see table *Summary of spatial layers utilised in the MCAS-S models* (in this Appendix) for details on how the classification was applied to each model.

NSW Soil Coverage (2002)

NSW Department of Infrastructure, Planning and Natural Resources is the custodian of this dataset. The NSW Soil Coverage map is a collation of various soil landscape maps across NSW. This is at a scale of 1:100000.

Fertility classes are assigned to each soil type within the dataset and form the basis of the analysis of fertility within the modelling. See Table *Summary of spatial layers utilised in the MCAS-S models* (in this Appendix) for details on how the fertility classes were utilised in each model.

Slope (2010)

Hunter Councils Inc. is the custodian for this dataset. Slope was derived from a Digital Elevation Model of the Hunter Region. This dataset has a resolution of 25 metres.

Some industries are limited to the slope that they can operate on due to considerations such as machinery access.

Flood Levels (Various)

Five datasets for flood level data was supplied by each of the councils within the study area. The data represent either flood prone lands, or the 1% AEP level (annual exceedances probability of being equalled or exceeded in any 1 year period), or 1 in 100 year flood event. These are the data datasets that council utilise when determining the impact of flood events for planning activities such as development approvals.

The five datasets have various scales, all at finer resolution than the 1:100000 scale of the final IAL analysis.

Flood levels were used to exclude lands from the Poultry Farming and Protected Crops models.

Wetlands of New South Wales (2003)

The NSW National Parks and Wildlife Service is the custodian for the Wetlands of New South Wales data. The scale for this dataset is 1:250000

All features were utilised to exclude lands within the analysis.

Features within this dataset with RAMSAR, SEPP14, and DIWA values were selected and had a 3km buffer applied. Lands within this buffer were excluded from the Poultry Farming model.

Stream Order

The Hunter and Central Rivers Catchment Management Authority provided stream order data for the use within this project. The scale of this dataset is 1:100000.

This data represents creeks and rivers, and is attributed with 'stream order' classification. Stream Ordering is a process whereby streams are described according to a hierarchy of orders of magnitude within a catchment, enabling the drainage network to be subdivided into individual lengths. Stream ordering commences with 1st order streams at the top of the catchment. Two 1st order streams join to produce a 2nd order stream and two 2nd order streams join to produce a 3rd order and so on down the catchment. This classification system is designed to describe the size and volume of a waterway.

Lands within 100 metres of streams of 3rd order and above were excluded from the Poultry Farming model.

Planning Data (2012/2013)

The NSW Department of Planning provided Local Environmental Planning datasets for the study area. Parcel zoning was utilised to identify available lands for the specific industries.

Draft Local Environmental Planning (Various)

As some of the planning data within the study area was out of date, the most up to date Local Environmental Planning datasets was obtained. Parcel zoning was utilised to identify available lands for the specific industries.

Lower Hunter Regional Strategy – Proposed Urban Lands (2006)

The Department of Planning and Infrastructure is the custodian for the Proposed Urban Lands.

This dataset was produced for the Lower Hunter Regional Strategy and identifies lands that were identified as strategic areas for urban development. Proposed freight hubs and proposed conservation areas are also included in this dataset. As this would affect the zoning, areas identified within this dataset were analysed as part of the 'future planning scenarios', to show where IAL could be affected.

Future Urban Areas (2013)

New South Wales Department of Planning and Infrastructure is the custodian for the Future Urban Areas data.

The data identifies lands that have been identified as areas for urban development. As this would affect the zoning, areas identified as future urban areas were analysed as part of the future planning scenarios, to show where IAL could be affected.

Future Planning Strategies (Various)

Data supporting planning and settlement strategies were provided from councils within the study area. These datasets illustrate areas where developments and changes of zoning may occur. Areas where changes could affect agriculture zoning were analysed as part of the future planning scenarios, to show where IAL could be affected.

Appendix 4 – ABS Statistical Limitations

Included in Appendix 4

- Discussion of the limitations to the ABS data (provided by ABS)
- Raw data table of the ABS statistics related to the Lower Hunter Region.

It is recognised that there are a number of limitations associated with the use of the ABS data (and by extension the DPI agricultural data), these limitations include, but are not limited to:

1. The latest available data at the time of the study was from the 2010-11 agricultural census and changes are likely to have occurring all variables assessed.
2. The ABS value data is based on the wholesale price of the agricultural commodity and does not take into account the processing or on-sale of the product (e.g. the value of grapevines includes only the wholesale value of the grapes at the farm gate, not the value of wine sales).
3. Additionally, the ABS identified an estimated 'value of agricultural production' by multiplying the estimated quantity of each commodity type as recorded in the Agricultural Census by the average unit value of that commodity (farm gate values for unprocessed commodities). The figures do not show the actual value the farmer receives for particular products (e.g. by selling directly or value adding) or the retail value of food and fibre products. Nor does it show the flow-on contribution of agriculture to the broader economy (e.g. food processing or manufacturing industries). It also excludes any value for horses.
4. The agricultural employment data similarly only shows the direct on-farm employment as recorded in the Population Census conducted as a June 2006. The employment data has inherent errors due to employment being reported as employment will often occur in Local Government Area's (LGA) different to the LGA where people live (leading to significant margins of error).

Additional ABS explanatory notes associated with the 2011 Agricultural Commodities Census

- Price information refers to the average unit value of a given commodity realised in the market place. Price information for livestock slaughtering and wool is obtained from Australian Bureau of Statistics (ABS) collections. Price information for other commodities is obtained from non-ABS sources, including marketing authorities and industry sources.
- Quantity data for most crops have been collected from the 2011 Agricultural Census. Remaining commodity data (livestock disposals and livestock products excluding eggs) are obtained from other ABS collections, with some information from non-ABS sources, and continue to be comparable across time.
- Where data for individual states or territories have been suppressed for reasons of confidentiality, they have been included in relevant totals.
- Where data have been rounded, discrepancies may occur between sums of the component items and totals.
- The estimates for pig slaughtering in 2008-09 and 2009-10 shown in this publication have been revised due to new pricing information becoming available after the previous publication date.
- Care should be taken when comparing estimates over time as not all categories directly align between years. For example, a greater range of commodity items was collected for the 2010-11 Agricultural Census in comparison to the previous 2009-10 Agricultural Resource Management (ARMS) collection. In ARMS years, when commodities are not separately collected, they are included in 'other crops' or 'other livestock' totals. Further information is available upon request.
- The method of collection of relevant prices and the costs of marketing for agricultural commodities varies considerably between states and between commodities. Where a

statutory authority handles marketing of the whole or a portion of a product, data are usually obtained from this source. Information is also obtained from marketing reports, wholesalers, brokers and auctioneers. For all commodities, values are in respect of production during the year (or season) irrespective of when payments are made. For that portion of production not marketed (e.g. hay grown on farm for own use), estimates are made from the best available information and, in general, are calculated on a local value basis.

- The Agricultural Census is conducted once every five years, with the Agricultural and Resource Management Survey (ARMS) and the Agricultural Survey (AS) conducted between Censuses. The main objective of the Agricultural Census is to provide benchmark information on the agriculture sector for small geographic areas. The 2010-11 Agricultural Census provides estimates for a range of agricultural commodity items, including broadacre cropping, horticultural production, livestock and land preparation. Care should be taken when comparing estimates over time as not all categories directly align between years. For example, a greater range of commodity items was collected for the 2010-11 Agricultural Census in comparison to the previous 2009-10 ARMS. Commodity information for the 2009-10 ARMS year is included where possible.
- Agricultural water use data collected as part of the 2010-11 Agricultural Census will be released in Water Use on Australian Farms (cat. no. 4618.0). Data related to the gross and local values of production of major agricultural commodities for all states will be released in Value of Agricultural Commodities Produced, Australia (cat. no. 7503.0).
- Where figures have been rounded, discrepancies may occur between sums of the component items and totals.
- Statistics on area and production of crops relate, in the main, to crops sown during the year ended 30 June. Statistics of perennial crops relate to the position at 30 June and the production during the year ended on that date, or fruit set by that date.
- Livestock slaughtering and livestock products, including milk and wool data, and poultry slaughtering are no longer included in this publication. Further information can be found in the publication Livestock Products, Australia (cat. no. 7215.0).
- In some cases respondents have provided a zero estimate for closing stock numbers, in this instance there may be no estimate of value but an estimate of count will be shown, caution should be used in interpreting cells in which this occurs
- The industry classification used in this publication is the 2006 version of the Australian and New Zealand Standard Industrial Classification (ANZSIC). Prior to the 2005-06 issue of this publication, estimates were based on the ANZSIC 1993 edition. ANZSIC 2006 was developed to provide a more contemporary industrial classification system taking into account issues such as changes in the structure and composition of the economy, changing user demands and compatibility with major international classification standards. For more information, please refer to Australian and New Zealand Standard Industrial Classification (ANZSIC), 2006 (cat. no. 1292.0).
- Since 2005-06, the ABS has used an economic statistics units model on the ABS' Business Register (ABSBR) to describe the characteristics of businesses and the structural relationships between related businesses. The units model is used within large and diverse business groups to define reporting units that can provide data to the ABS at a suitable level. The ABSBR is based on the Australian Business Register (ABR) which is administered and maintained by the Australian Taxation Office (ATO).

- Respondents to the 2010-11 Agricultural Census were businesses undertaking agricultural activity drawn from the ABS Business Register.
- The scope of the 2010-11 Agricultural Census included all businesses undertaking agricultural activity recorded on the ABS Business Register (ABSBR) above a minimum size cut-off of $5,000.
- The measure of size was based on the ABS' Estimated Value of Agricultural Operations (EVAO) or a derived value based on Business Activity Statement (BAS) turnover if EVAO was not available.
- While the ABSBR does not include all agricultural businesses in Australia, it provides improved coverage from the former ABS maintained Agricultural Survey frame, as most businesses and organisations in Australia need to obtain an Australian Business Number (ABN) from the ATO for their business operations. The ABR based register is also more up-to-date as it excludes agricultural businesses with cancelled ABNs and incorporates regularly updated information on agricultural businesses from the ABR and ATO.
- For the 2010-11 Agricultural Census, a response rate of 88% was achieved from an in-scope population of approximately 165,000 agricultural businesses. This was the first agricultural collection to use an e-form, and the e-form achieved a take up of 11%.
- The estimates in this publication are based on information obtained from the agricultural businesses that responded to the Agricultural Census. However, since not all of the businesses that were selected provided data, the estimates are subject to sampling variability; that is, they may differ from the figures that would have been produced if all businesses had provided data. One measure of the likely difference is given by the standard error (SE) which indicates the extent to which an estimate might vary by chance because only a sample was taken or had responded. There are about two chances in three that a 'sample' estimate will differ by less than one SE from the figure that would have been obtained if all businesses had responded, and about nineteen chances in twenty that the difference will be less than two SEs.
- In this publication, 'sampling' variability of the estimates is measured by the relative standard error (RSE) which is obtained by expressing the SE as a percentage of the estimate to which it refers.
- Most published national estimates have RSEs less than 5%. For some states with limited production of certain commodities, RSEs are greater than 10%. Estimates that have an estimated RSE between 10% and 25% are annotated with the symbol '^'. These estimates should be used with caution as they are subject to sampling variability too high for some purposes. Estimates with an RSE between 25% and 50% are annotated with the symbol '*', indicating that the estimate should be used with caution as it is subject to sampling variability too high for most practical purposes. Estimates with an RSE greater than 50% are annotated with the symbol '**' indicating that the sampling variability causes the estimates to be considered too unreliable for general use. Separate indication of the RSEs of all estimates is available on request.

Agricultural Commodities in the Lower Hunter Region (Source ABS: 2010-11 Agricultural Commodities Census)

	New South Wales (estimate)	Hunter Region (estimate)	Lower Hunter (estimate)	% Hunter - NSW	% Lower Hunter - NSW	% Lower Hunter - Hunter	Cessnock (C)		Lake Macquarie (C)		Maitland (C)		Newcastle (C)		Port Stephens (A)	
							Est.	% Cessnock - Lower Hunter	Est.	% Lake Macquarie - Lower Hunter	Est.	% Maitland - Lower Hunter	Est.	% Newcastle to Lower Hunter	Est.	% Port Stephens - Lower Hunter
Broadacre Agriculture																
Total Broadacre Agriculture																
Total Area (ha)	6,115,331	29,579	2,438	0.5%	0.0%	8.2%	342	14.0%	479	19.6%	1,023	42.0%	84	0.0%	510	20.9%
Total Production (t)	16,317,568	112,976	10,782	0.7%	0.1%	9.5%	325	3.0%	1,270	11.8%	6,319	58.6%	498	4.6%	2,370	22.0%
Total Value ($m)	7,502.6	37.1	2.9	0.5%	0.0%	7.8%	0.2	6.9%	0.5	17.2%	1.5	51.7%	0.1	3.4%	0.6	20.7%
Total Businesses (No.)	30,700	824	114	2.7%	0.4%	13.8%	12	10.5%	3	2.6%	73	64.0%	2	1.8%	24	21.1%
Cultivated Turf																
Cultivated turf																
Cultivated turf - Area (ha)	2,556	101	100	4.0%	3.9%	99.0%	0	0.0%	0	0.0%	93	93.0%	0	0.0%	7	7.0%
Cultivated turf - Value ($)	81.7	3.2	3.2	3.9%	3.9%	100.0%	0.0	0.0%	0.0	0.0%	3.0	93.8%	0.0	0.0%	0.2	6.3%
Cultivated turf - No. Businesses (No.)	127	9	8	7.1%	6.3%	88.9%	0	0.0%	0	0.0%	7	87.5%	0	0.0%	1	12.5%
Protected Crops (Vegetables, Nurseries & Cut flowers, Berries)																
Total Protected Crops (Vegetables, Nurseries & Cut flowers, Berries)																
Total Area (ha)	2,569	22	13	0.9%	0.5%	61.0%	2	15.3%	4	29.0%	2	14.8%	0	1.0%	5	38.6%
Total Production (t)	82,147	1,093	818	1.3%	1.0%	74.9%	27	3.3%	0	0.0%	23	2.8%	0	0.0%	769	93.9%
Total Value ($m)	249.1	7.9	6.3	3.2%	2.5%	79.7%	0.0	0.0%	1.9	30.2%	0.0	0.0%	0.1	1.6%	4.3	68.3%
Total Businesses (No.)	1,192	54	33	4.5%	2.8%	61.1%	4	12.1%	10	30.3%	3	9.1%	2	6.1%	14	42.4%
Grapevines																
Total Grapevines																
Total Area (ha)	43,448	3,510	1,594	8.1%	3.7%	45.4%	1,582	99.2%	1	0.1%	5	0.3%	0	0.0%	6	0.4%
Total Production (t)	463,113	16,344	8,336	3.5%	1.8%	51.0%	8,301	99.6%	1	0.0%	3	0.0%	0	0.0%	31	0.4%
Total Value ($m)	142.7	5.0	2.5	3.5%	1.8%	50.0%	2.5	100.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total Businesses (No.)	1,587	266	144	16.8%	9.1%	54.1%	140	97.2%	1	0.7%	2	1.4%	0	0.0%	1	0.7%
Poultry (Chickens & Eggs)																
Poultry (Chicken and eggs)																
Layers (no.)	4,397,898	719,751	392,682	16.4%	8.9%	54.6%	69,834	17.8%	238,564	60.8%	154	0.0%	0	0.0%	84,130	21.4%
Hen egg production for human consumption (dozens)	90,614,405	14,198,626	8,541,505	15.7%	9.4%	60.2%	955,717	11.2%	5,564,218	65.1%	691	0.0%	0	0.0%	2,020,879	23.7%
Eggs produced for human consumption - Value ($)	193.8	30.4	18.2	15.7%	9.4%	59.9%	2.0	11.0%	11.9	65.4%	0.0	0.0%	0.0	0.0%	4.3	23.6%
Total Businesses - Layers (No.)	789	80	26	10.1%	3.3%	32.5%	9	0.0%	3	11.5%	5	19.2%	0	0.0%	9	34.6%
Meat chickens (no.)	29,558,392	5,284,760	2,579,036	17.9%	8.7%	48.8%	660,060	25.6%	140,795	5.5%	725,886	28.1%	0	0.0%	1,052,295	40.8%
Meat Chickens - Total value ($)	686.0	122.4	66.1	17.8%	9.6%	54.0%	16.2	24.5%	13.0	19.7%	13.4	20.3%	0.0	0.0%	23.5	35.6%
Total Businesses - Meat Chickens (No.)	264	63	27	23.9%	10.2%	42.9%	6	0.0%	1	3.7%	6	22.2%	0	0.0%	14	51.9%
Beef Cattle																
Total (no.)	5,383,931	430,502	28,733	8.0%	0.5%	6.7%	8,854	30.8%	1,345	4.7%	9,973	34.7%	955	3.3%	7,606	26.5%
Meat Cattle - Total value ($)	1,616.1	147.0	9.8	9.1%	0.6%	6.7%	2.5	25.5%	0.4	4.1%	3.8	38.8%	0.3	3.1%	2.8	28.6%
Total Businesses (No.)	27,166	2,551	428	9.4%	1.6%	16.8%	158	36.9%	26	6.1%	143	33.4%	10	2.3%	91	21.3%

	New South Wales (estimate)	Hunter Region (estimate)	Lower Hunter (estimate)	% Hunter - NSW	% Lower Hunter - NSW	% Lower Hunter - Hunter	Cessnock (C)		Lake Macquarie (C)		Maitland (C)		Newcastle (C)		Port Stephens (A)	
							Est.	% Cessnock - Lower Hunter	Est.	% Lake Macquarie - Lower Hunter	Est.	% Maitland - Lower Hunter	Est.	% Newcastle to Lower Hunter	Est.	% Port Stephens - Lower Hunter
Other Livestock																
Livestock - Dairy Cattle																
Dairy cattle - Total (no.)	325,821	44,377	2,951	13.6%	0.9%	6.6%	145	4.9%	0	0.0%	1,638	55.5%	0	0.0%	1,168	39.6%
Whole milk - Value ($)	504.7	70.7	4.5	14.0%	0.9%	6.4%	0.1	2.2%	0.0	0.0%	2.5	55.6%	0.0	0.0%	1.9	42.2%
Total Businesses - Dairy Cattle (No.)	1,501	203	22	13.5%	1.5%	10.8%	5	22.7%	0	0.0%	8	36.4%	0	0.0%	9	40.9%
Livestock - Sheep																
Total sheep (no.)	26,824,697	197,356	1,128	0.7%	0.0%	0.6%	151	13.4%	6	0.5%	782	69.3%	12	1.1%	177	15.7%
Sheep - Total value ($)	609.8	3.9	0.0	0.6%	0.0%	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total Businesses - Sheep (No.)	16,416	328	38	2.0%	0.2%	11.6%	11	28.9%	1	2.6%	18	47.4%	1	2.6%	7	18.4%
Livestock - Pigs																
Pigs - Total (no.)	486,178	549	51	0.1%	0.0%	9.3%	12	23.5%	0	0.0%	12	23.5%	16	31.4%	11	21.6%
Pigs - Total value ($)	166.2	0.2	0.0	0.1%	0.0%	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total Businesses - Pigs (No.)	742	40	8	5.4%	1.1%	20.0%	1	12.5%	0	0.0%	5	62.5%	1	12.5%	1	12.5%
Livestock - Buffaloes																
Buffaloes (no.)	102	27	10	26.5%	9.8%	37.0%	0	0.0%	0	0.0%	5	50.0%	0	0.0%	5	50.0%
Total Businesses - Buffaloes (No.)	415	58	14	14.0%	3.4%	24.1%	6	42.9%	1	7.1%	3	21.4%	0	0.0%	4	28.6%
Livestock - Deer																
Deer (no.)	8,393	132	75	1.6%	0.9%	56.8%	39	52.0%	0	0.0%	36	48.0%	0	0.0%	0	0.0%
Total Businesses - Deer (No.)	478	59	14	12.3%	2.9%	23.7%	7	50.0%	1	7.1%	3	21.4%	0	0.0%	3	21.4%
Livestock - Goats																
Goats (no.)	287,984	5,364	523	1.9%	0.2%	9.8%	442	84.5%	56	10.7%	16	3.1%	1	0.2%	8	1.5%
Goats - Total value ($)	6.0	0.2	0.0	3.3%	0.0%	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total Businesses - Goats (No.)	1,313	126	22	9.6%	1.7%	17.5%	8	36.4%	3	13.6%	5	22.7%	1	4.5%	5	22.7%
Livestock - Horses																
Horses - Stud (no.)	33,632	10,709	881	31.8%	2.6%	8.2%	357	40.5%	99	11.2%	208	23.6%	0	0.0%	217	24.6%
Total Businesses - Horses Studs (No.)	2,448	335	75	13.7%	3.1%	22.4%	23	30.7%	10	13.3%	20	26.7%	0	0.0%	22	29.3%
Horses - Other (no.)	53,679	7,293	1,181	13.6%	2.2%	16.2%	355	30.1%	130	11.0%	424	35.9%	14	1.2%	258	21.8%
Total Businesses - Horses Other (No.)	10,660	1,250	206	11.7%	1.9%	16.5%	80	38.8%	19	9.2%	55	26.7%	4	1.9%	48	23.3%
Livestock - Other Livestock																
All other livestock (no.)	146,156	9,047	174	6.2%	0.1%	1.9%	53	30.5%	26	14.9%	93	53.4%	0	0.0%	2	1.1%
Total Businesses - Other Livestock (No.)	1,897	147	29	7.7%	1.5%	19.7%	14	48.3%	4	13.8%	7	24.1%	0	0.0%	4	13.8%
Livestock - Other Poultry																
Ducks (no.)	393,808	1,565	1,508	0.4%	0.4%	96.4%	1,463	97.0%	0	0.0%	30	2.0%	0	0.0%	15	1.0%
Total Businesses - Ducks (No.)	146	19	6	13.0%	4.1%	31.6%	3	50.0%	0	0.0%	2	33.3%	0	0.0%	1	16.7%
Turkeys (no.)	913,772	135,684	86,900	14.8%	9.5%	64.0%	52,276	60.2%	7,213	8.3%	14,427	16.6%	0	0.0%	12,984	14.9%
Total Businesses - Turkeys (No.)	115	25	12	21.7%	10.4%	48.0%	5	41.7%	1	8.3%	3	25.0%	0	0.0%	3	25.0%
All other poultry (no.)	2,560,825	607,826	587,225	23.7%	22.9%	96.6%	109,207	18.6%	330,840	56.3%	25	0.0%	0	0.0%	147,153	25.1%
Total Businesses - Other Poultry (No.)	156	29	10	18.6%	6.4%	34.5%	5	50.0%	3	30.0%	1	10.0%	0	0.0%	1	10.0%

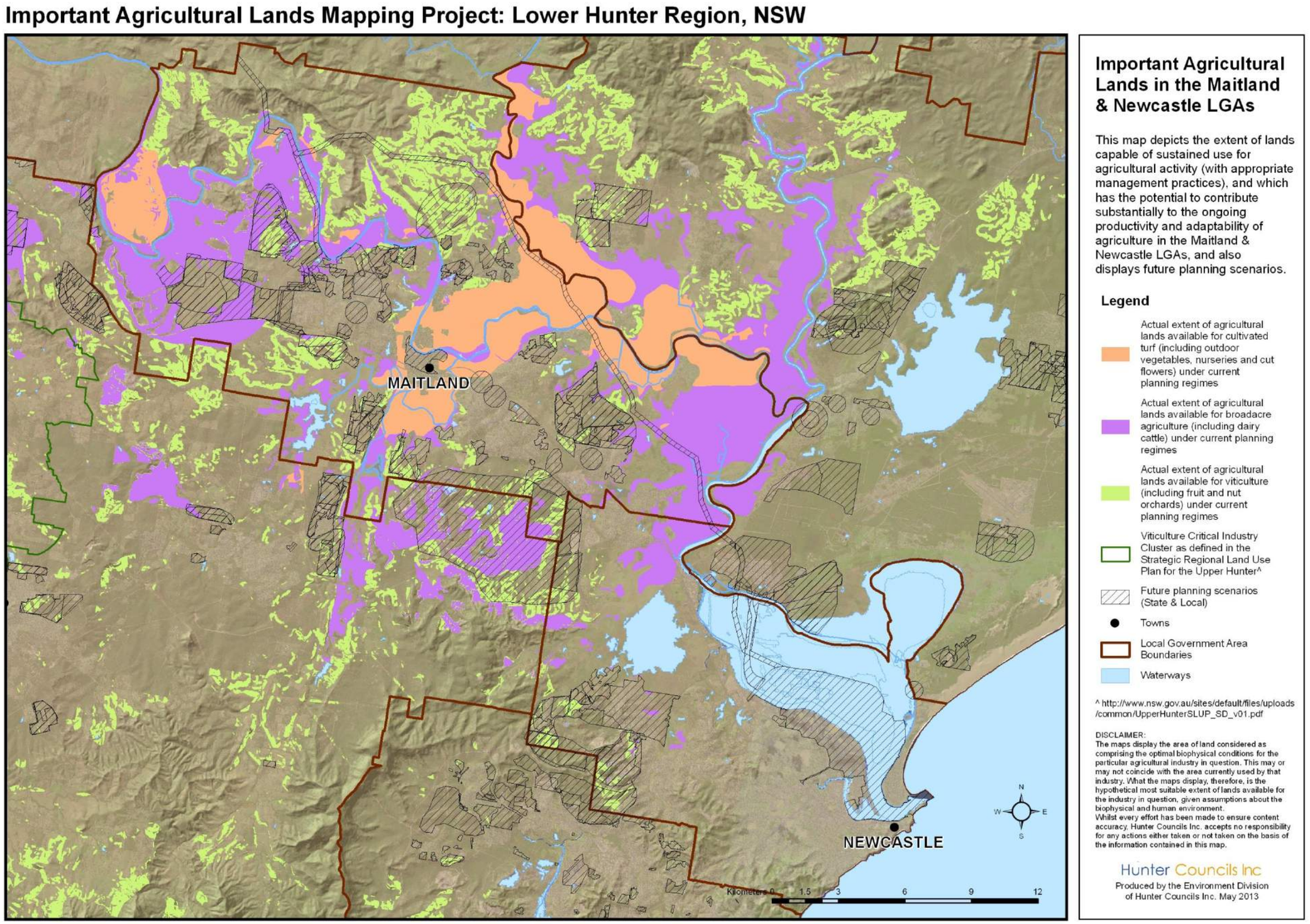
	New South Wales (estimate)	Hunter Region (estimate)	Lower Hunter (estimate)	% Hunter - NSW	% Lower Hunter - NSW	% Lower Hunter - Hunter	Cessnock (C)		Lake Macquarie (C)		Maitland (C)		Newcastle (C)		Port Stephens (A)	
							Est.	% Cessnock - Lower Hunter	Est.	% Lake Macquarie - Lower Hunter	Est.	% Maitland - Lower Hunter	Est.	% Newcastle to Lower Hunter	Est.	% Port Stephens - Lower Hunter
Fruit & Nuts (Orchards)																
Plantation fruit - Bananas																
Bananas - Total area (ha)	1,237	2	2	0.2%	0.2%	100.0%	0	0.0%	2	100.0%	0	0.0%	0	0.0%	0	0.0%
Bananas - Production (t)	11,780	37	37	0.3%	0.3%	100.0%	0	0.0%	37	100.0%	0	0.0%	0	0.0%	0	0.0%
Bananas - Value ($)	18.8	0.1	0.1	0.5%	0.5%	100.0%	0.0	0.0%	0.1	100.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total Businesses - Bananas (No.)	230	1	1	0.4%	0.4%	100.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Orchard Fruits & Nuts																
Total No. Trees	13,428,152	228,180	38,765	1.7%	0.3%	17.0%	21,552	55.6%	269	0.7%	7,728	19.9%	0	0.0%	9,216	23.8%
Total Production (t)	264,606	2,057	273	0.8%	0.1%	13.3%	138	50.4%	40	14.7%	10	3.7%	0	0.0%	85	31.2%
Total Value ($m)	331.2	3.7	0.4	1.1%	0.1%	10.8%	0.3	75.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.1	25.0%
Total Businesses - Fruits & Nuts (No.)	5,293	269	127	5.1%	2.4%	47.2%	44	34.6%	7	5.5%	29	22.8%	0	0.0%	47	37.0%
Vegetables																
Vegetables																
Total Area (ha)	11,124	246	172	2.2%	1.5%	69.9%	15	8.7%	0	0.0%	153	89.0%	0	0.0%	4	2.3%
Total Production (t)	252,057	3,168	2,412	1.3%	1.0%	76.1%	13	0.5%	0	0.0%	2,366	98.1%	0	0.0%	33	1.4%
Total Value ($m)	173.5	2.0	1.4	1.2%	0.8%	70.0%	0.0	0.0%	0.0	0.0%	1.4	100.0%	0.0	0.0%	0.0	0.0%
Total Businesses - Vegetables (No.)	1,438	75	47	5.2%	3.3%	62.7%	3	6.4%	0	0.0%	29	61.7%	0	0.0%	15	31.9%
Nurseries & Cut Flowers Outdoor																
Total Nurseries & Cut flowers Outdoor																
Total Area (ha)	1,800	36	9	2.0%	0.5%	25.0%	1	11.1%	5	55.6%	0	0.0%	0	0.0%	3	33.3%
Total Value ($m)	149.4	3.0	0.9	2.0%	0.6%	30.0%	0.1	11.1%	0.5	55.6%	0.0	0.0%	0.0	0.0%	0.3	33.3%
Total Businesses Nurseries & Cut Flowers Outdoor (No.)	729	29	13	4.0%	1.8%	44.8%	2	15.4%	5	38.5%	0	0.0%	2	15.4%	4	30.8%

Appendix 5 – Additional Maps

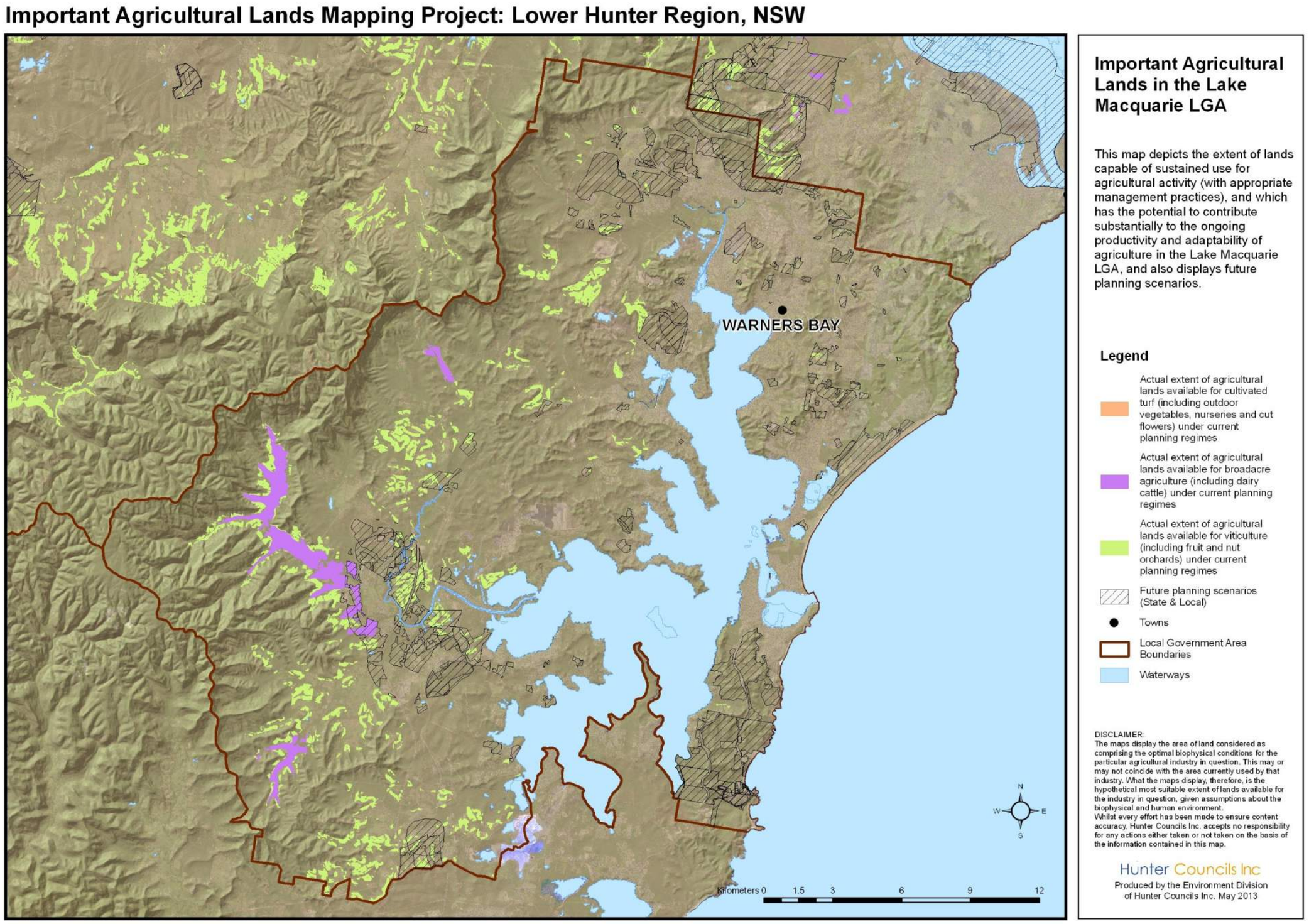
Included in Appendix 5

- **MAP: Maitland & Newcastle: Important Agricultural Lands –** This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the Maitland & Newcastle LGAs, and also displays future planning scenarios.
- **MAP: Lake Macquarie: Important Agricultural Lands –** This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the Lake Macquarie LGA, and also displays future planning scenarios.
- **MAP: Cessnock: Important Agricultural Lands –** This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the Cessnock LGA, and also displays future planning scenarios.
- **MAP: Port Stephens: Important Agricultural Lands –** This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the Port Stephens LGA, and also displays future planning scenarios.
- **MAP: Lower Hunter: Important Agricultural Lands –** This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the region, and also displays future planning scenarios.

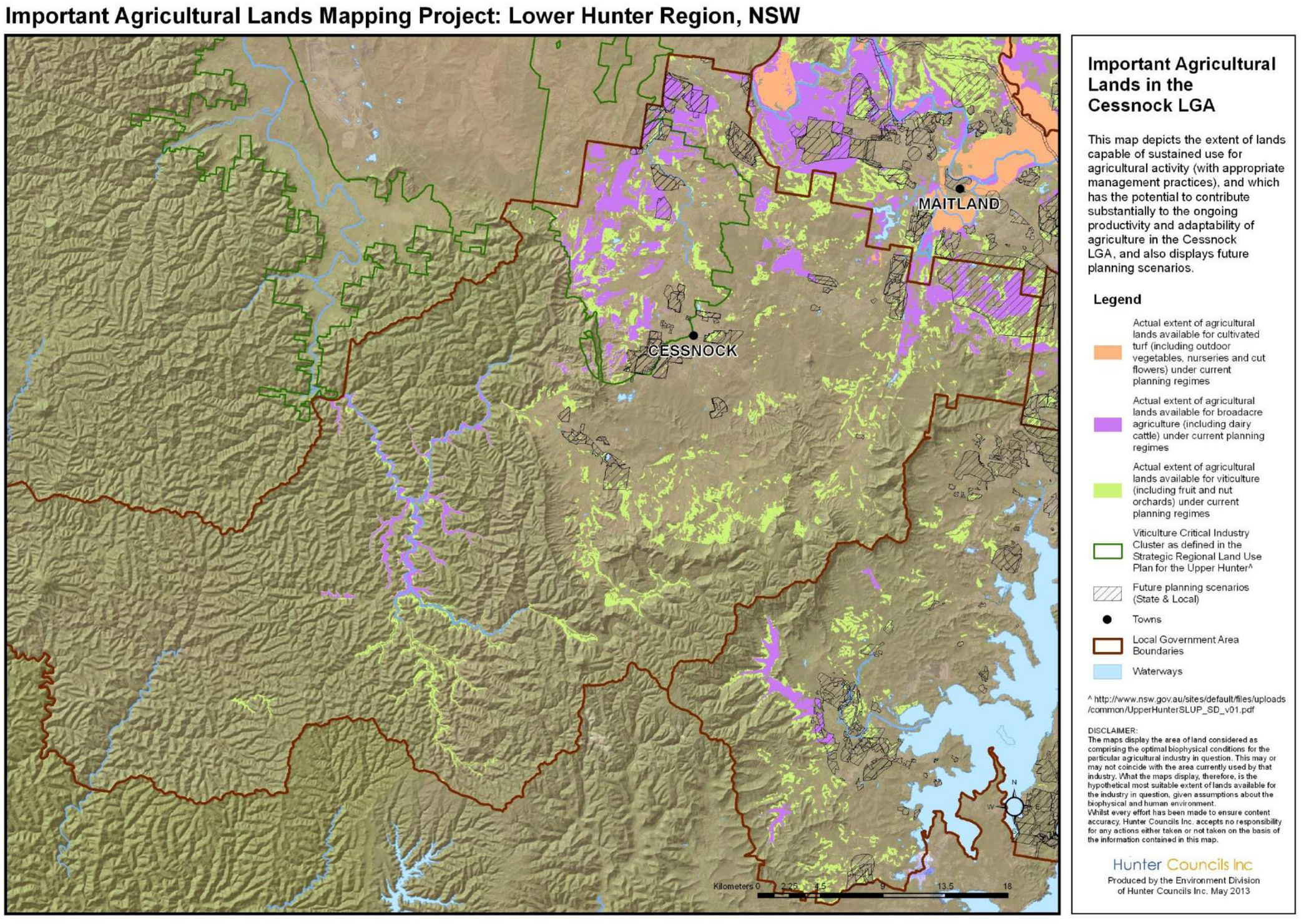
MAP: Important Agricultural Lands in Maitland and Newcastle LGAs.



MAP: Important Agricultural Lands in the Lake Macquarie LGA.

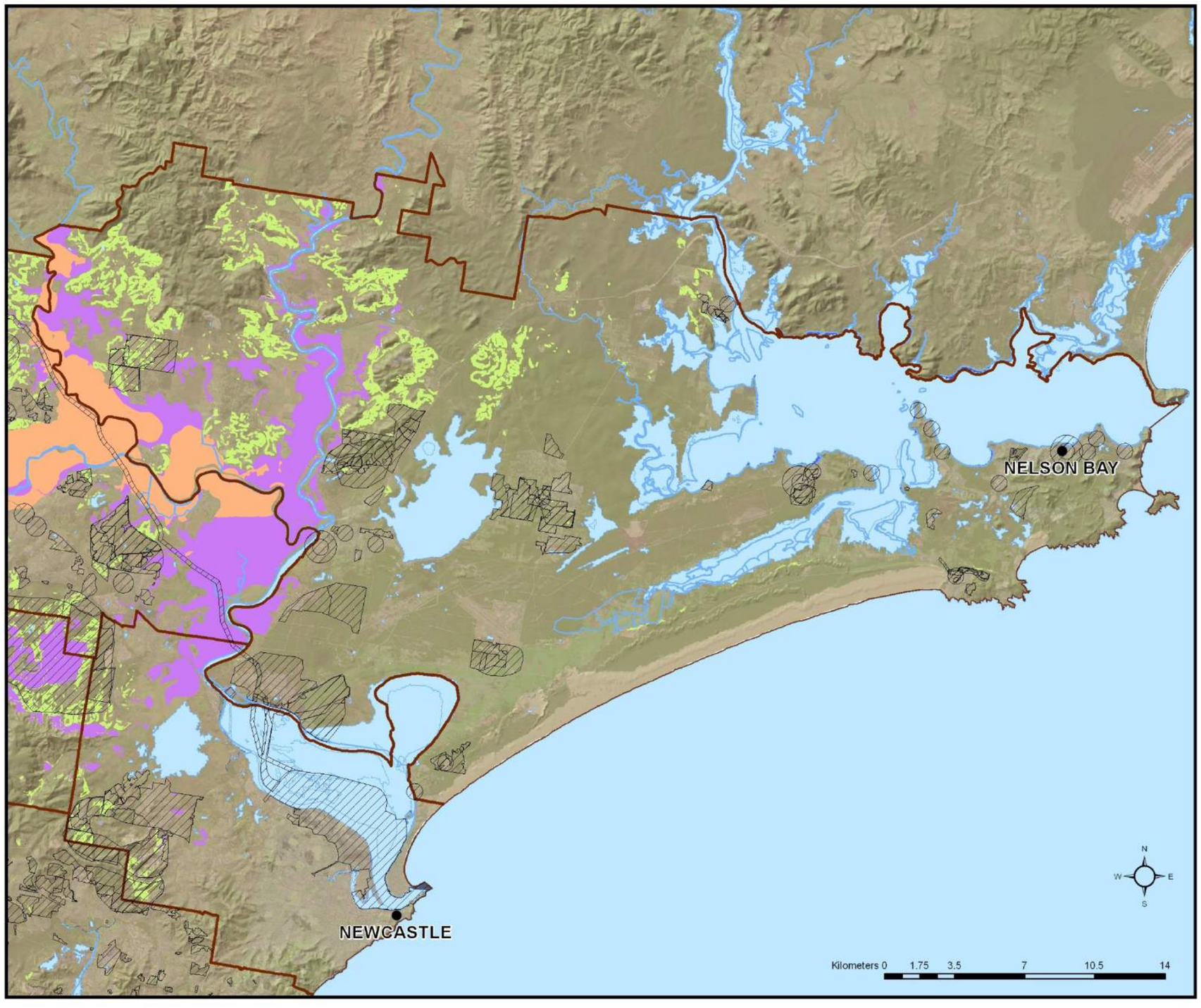


MAP: Important Agricultural Lands in the Cessnock LGA.



MAP: Important Agricultural Lands in the Port Stephens LGA.

Important Agricultural Lands Mapping Project: Lower Hunter Region, NSW



Important Agricultural Lands in the Port Stephens LGA

This map depicts the extent of lands capable of sustained use for agricultural activity (with appropriate management practices), and which has the potential to contribute substantially to the ongoing productivity and adaptability of agriculture in the Port Stephens LGA, and also displays future planning scenarios.

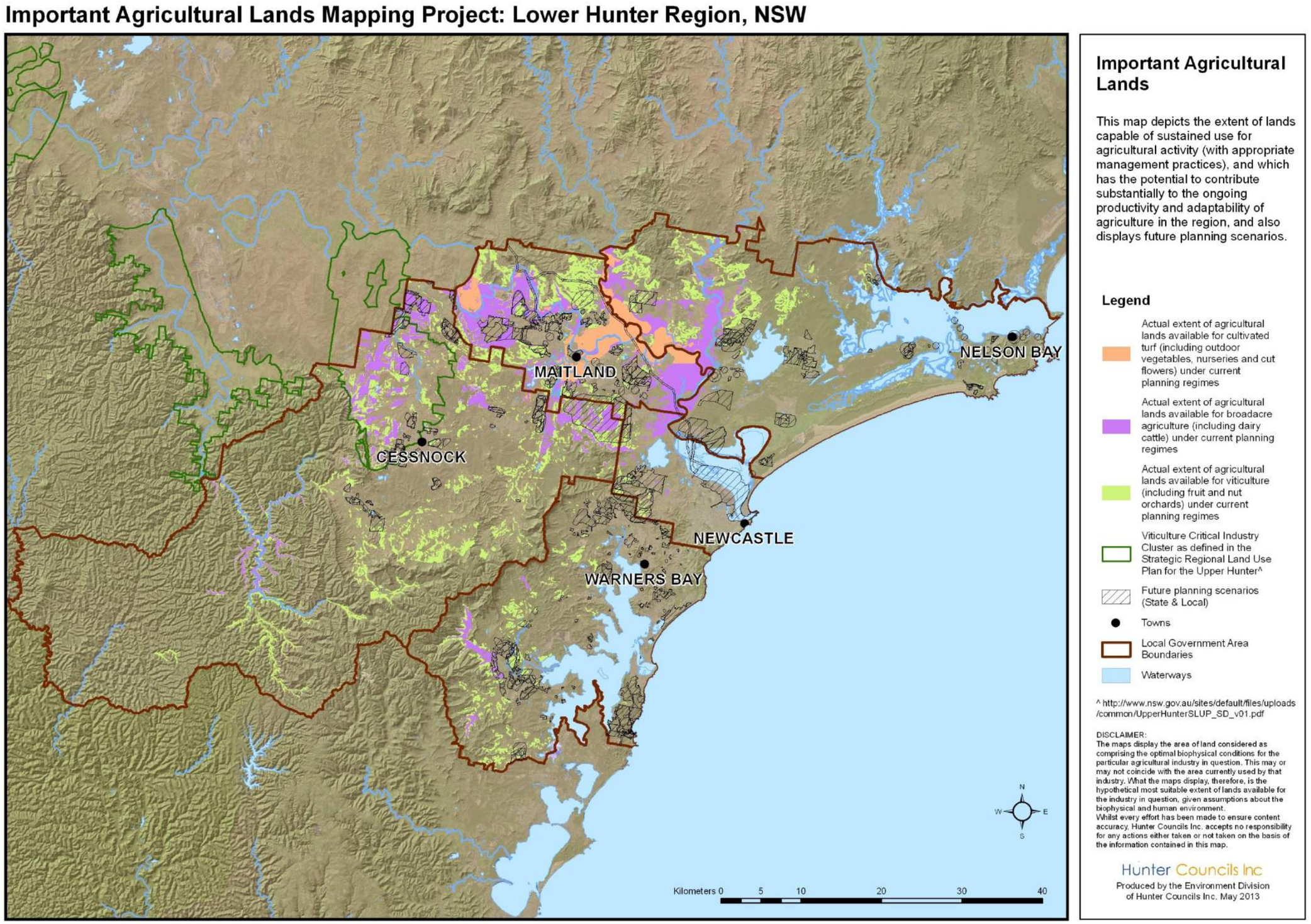
Legend

- Actual extent of agricultural lands available for cultivated turf (including outdoor vegetables, nurseries and cut flowers) under current planning regimes
- Actual extent of agricultural lands available for broadacre agriculture (including dairy cattle) under current planning regimes
- Actual extent of agricultural lands available for viticulture (including fruit and nut orchards) under current planning regimes
- Future planning scenarios (State & Local)
- Towns
- Local Government Area Boundaries
- Waterways

DISCLAIMER:
The maps display the area of land considered as comprising the optimal biophysical conditions for the particular agricultural industry in question. This may or may not coincide with the area currently used by that industry. What the maps display, therefore, is the hypothetical most suitable extent of lands available for the industry in question, given assumptions about the biophysical and human environment.
Whilst every effort has been made to ensure content accuracy, Hunter Councils Inc. accepts no responsibility for any actions either taken or not taken on the basis of the information contained in this map.

Hunter Councils Inc
Produced by the Environment Division of Hunter Councils Inc. May 2013

MAP: Important Agricultural Lands in the Lower Hunter region.



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