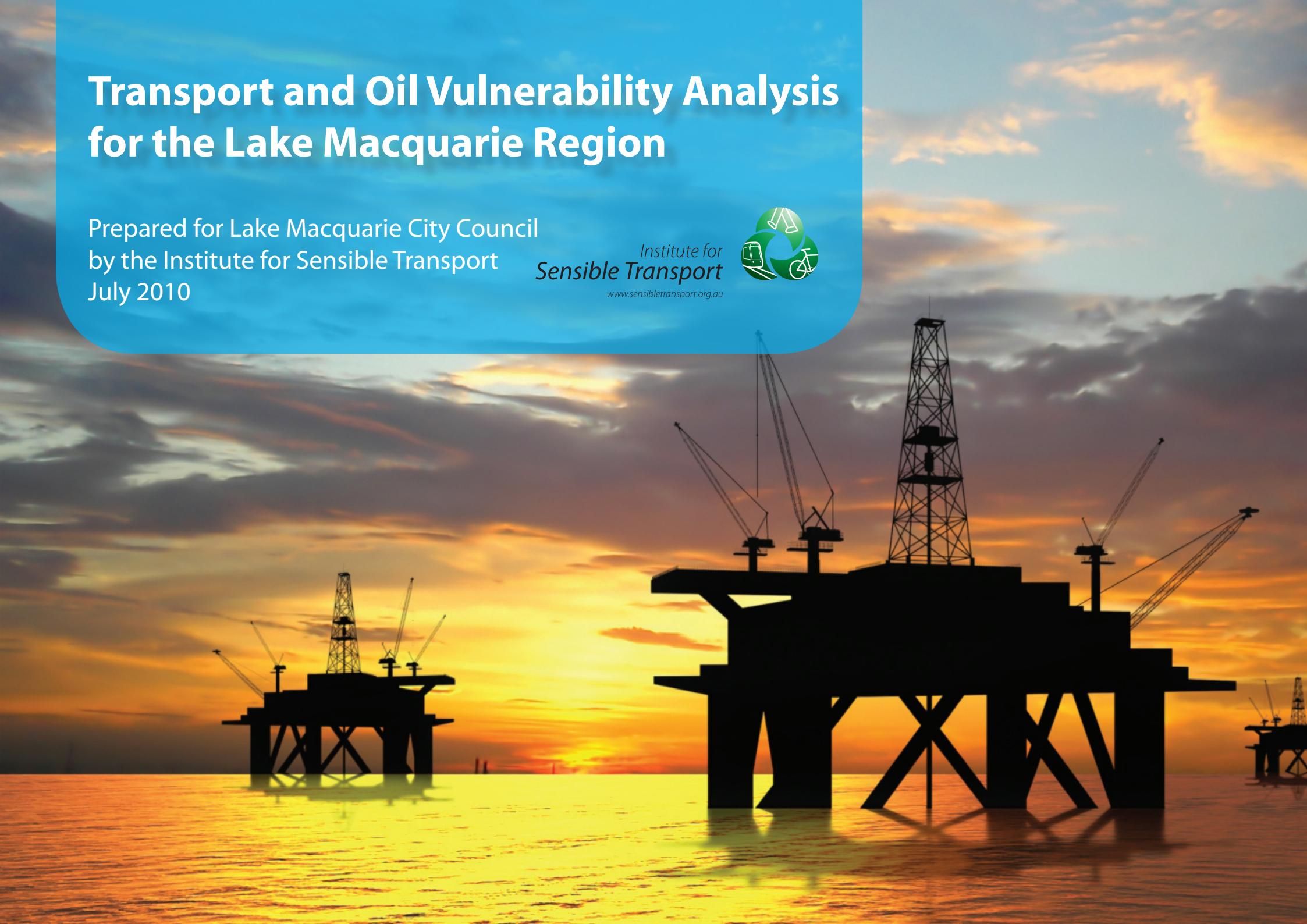# Transport and Oil Vulnerability Analysis for the Lake Macquarie Region

Prepared for Lake Macquarie City Council
by the Institute for Sensible Transport
July 2010

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www.sensibletransport.org.au

Contents

1 Introduction

Concern over the future availability of oil is increasing. Peak oil describes a period of maximum oil production. Beyond this point, less oil is available each year. A growing number of petroleum experts and commentators are arguing that peak oil has been reached or is imminent (Energy Watch Group, 2007; UK Industry Taskforce on Peak Oil and Energy Security, 2010). Planning for a future of less oil, turning around decades of growing consumption and the policies that underpin this growth requires the focused attention of government.

In 2006/07, a Senate committee conducted an extensive inquiry into the effect peak oil may have on Australia's future oil supply:

The committee considers that more needs to be done to reduce Australia's oil dependency in the long term. This is desirable not only because of peak oil concerns, but also for other reasons – to mitigate greenhouse gas emissions; to mitigate the costs of the expected long term decline in Australia's net oil self-sufficiency; and to mitigate the risks of supply disruptions as oil production becomes concentrated in a declining number of major oil-producing countries, some of which are politically unstable.

Future Fuel Price Projections

A quantitative approach to economic modelling of future Australian petrol prices was undertaken by the CSIRO led *Future Fuels Forum* in 2008. The scenarios developed by the Future Fuels Forum when modelled by CSIRO led to a range of prices in the period to 2030 from $1/litre (reference case) to as high as $8/litre in a scenario with a near-term peak in oil production and a slow technology response (Figure 1).
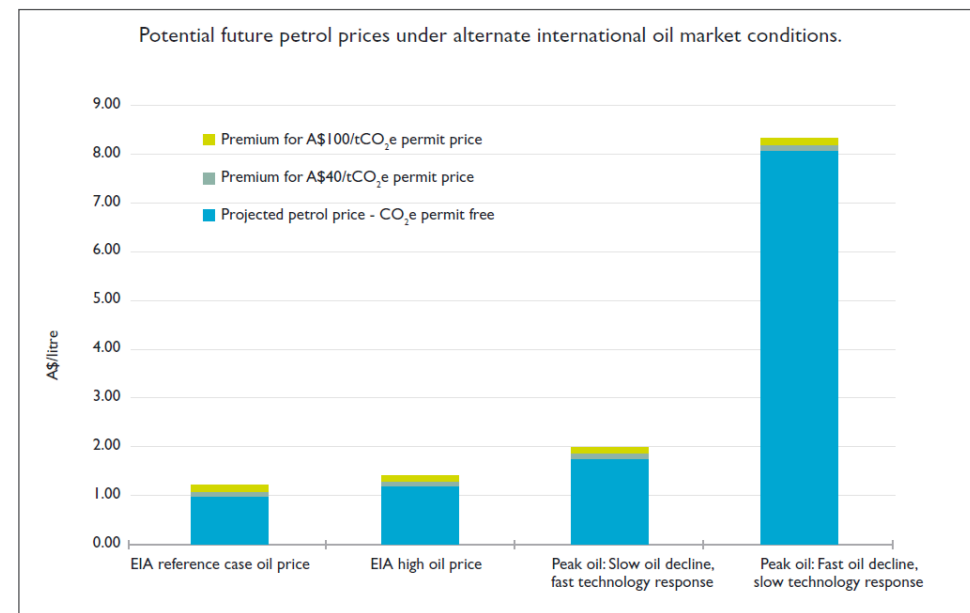
Figure 1: Petrol Price Projections by the Future Fuels Forum. Source: CSIRO, 2008

The global financial crisis has demonstrated how sensitive oil prices are, both to the available supply and also variations in demand, with the rapid fall in the price of oil late in 2008 surprising many analysts. In weak economic periods, oil prices may again fall sharply, while at times of relative economic strength oil prices will rise strongly once spare supply capacity is reduced.

In general then, as oil becomes scarce, prices are likely to become more volatile and this is likely to have significant economic and social impacts. Those with the least economic resources and greatest dependency on car use are likely to be the first to experience the impacts of this fuel price volatility. The production and transport of food has become heavily dependent on oil and therefore any threat to the availability of oil has food security implications.

2 Methodology

This report assesses oil vulnerability by focusing on transport and income patterns across the Lake Macquarie local government area (LGA). An index is developed that blends important indicators of car dependence with income for each of the approximately 300 ABS collection districts in the Lake Macquarie LGA. A collection district comprises around 200 households. The data for the development of this *Transport Vulnerability Index* are derived from the following ABS datasets for each collection district:

1. The proportion of residents indicating they used their car to get to work on Census day 2006
2. Car ownership per capita
3. SEIFA Index – a measure of economic resources relative to other areas of Australia.

The transport vulnerability index indirectly touches upon food security issues via its use of the SEIFA index, but doesn't directly assess the availability of local food production or proximity (within walking/cycling distance) to food distribution centres.

Journey to work data for the Lake Macquarie LGA (Figure 2) shows a heavy reliance on the private automobile. Just over eight in 10 residents indicate they drove to work on Census day 2006. This is higher than the NSW average of 71%. When compared to the rest of NSW, public transport is less likely to be used by Lake Macquarie residents than in other parts of NSW, although the skewing affect of Sydney will have a major impact on the NSW average, having approximately 63% of the total population.
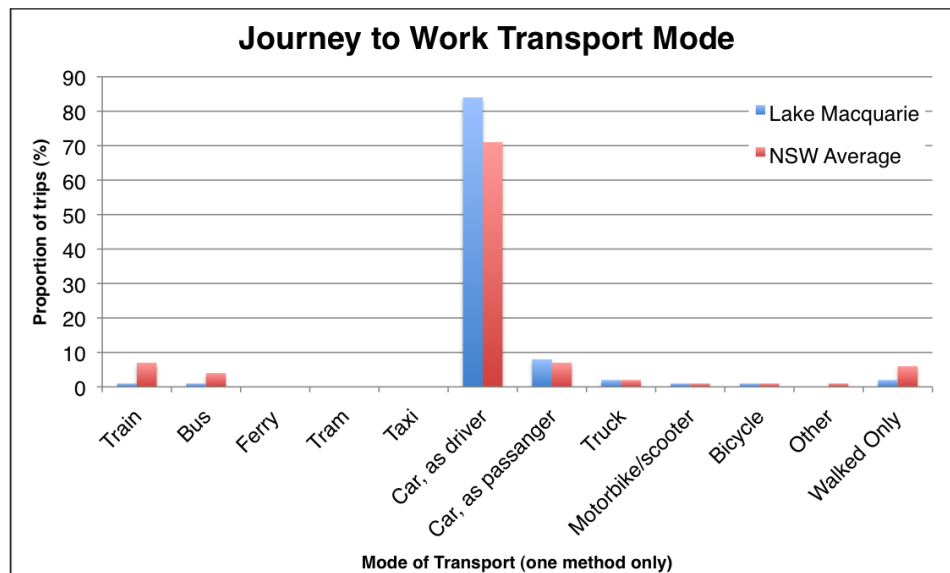
In NSW, journeys to work account for some 20% of total trips (NSW Transport Data Centre, 2007). As shown in Figure 3, all purpose trips (e.g. trips to shops, visiting friends) for Lake Macquarie residents show a lower level of dependence on the car than for commuting, from just below 60% to slightly above 80%. A greater proportion of trips are completed as a car passenger for all purpose journeys than for commuting. Walking accounts for 10% of all trips, considerably higher than for commuting trips.

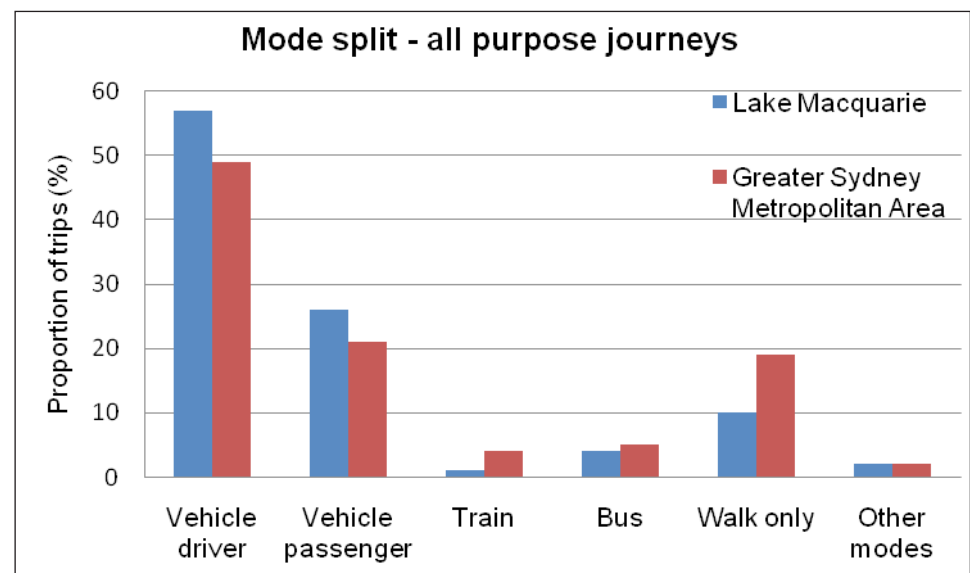Figure 2: Journey to work mode Source: ABS 2006 Census

Figure 3: Mode split – all purpose journeys Source: NSW Transport Data Centre

All purpose journeys for Lake Macquarie continue to show greater levels of dependence on car use compared to the Greater Sydney average.

Figure 4 illustrates the relative distance travelled by each mode of transport within the Lake Macquarie LGA compared to the Sydney Greater Metropolitan Area (SGMA). Lake Macquarie residents travel more by car, reflecting a lower density land use pattern and less public transport accessibility than more heavily urbanised environments. Just under two-thirds of all kilometres travelled by Lake Macquarie residents are as a car driver, compared to 60% for the SGMA average. A further one-quarter of kilometres travelled by Lake Macquarie residents are as a passenger of a motor vehicle (21% for the SGMA average).

Table 1 highlights the distances travelled by Lake Macquarie residents (as a proportion) by different modes of transport and compares this with the SGMA.

Mode	Lake Macquarie LGA	Sydney Greater Metropolitan Area (SGMA)
Vehicle driver	64%	60%
Vehicle passenger	26%	21%
Train	6%	10%
Bus	2%	4%
Walk only	2%	2%
Walk-linked	1%	1%
Other modes	0%	2%

Table 1: Distance travelled, as a proportion of total kilometres by different modes
Source: NSW Transport Data Centre (2007)

Figure 4: Proportion travelled by each mode Source: NSW Transport Data Centre (2007)

4 Oil Vulnerability Index

Introduction

A quantitative assessment of oil vulnerability has been developed based on ABS 2006 Census data for the Lake Macquarie LGA. This index has been mapped to show the spatial variation in oil vulnerability ranking.

The ranking quantifies the relative vulnerability of communities to a long-term decline in the availability and affordability of oil and conventional petroleum fuel products. The index has not been designed to measure the vulnerability to a short-term oil shock, but rather to indicate the areas of greatest need for long-term planning and investment to reduce reliance on oil and create more liveable, resilient communities.

The ABS data used as the basis of the index include the number of motor vehicles per household, journey to work patterns and economic resources.

1. Cars per capita

The total number of vehicles at private dwellings was calculated and divided by the normal resident population to give a figure of '*Cars per capita*' in each collection district. This is more robust than using for example a 'percentage of households with three or more cars' as that may say more about the average household size than it does about the number of cars relative to the number of people.

2. Journey to Work

Scores were assigned to each journey to work mode, with the percentage of respondents for each mode multiplied by the score for that mode to give an average score for each collection district. The more oil dependent the mode of transport, the higher the score.

While data are only available from the Census for *Journey to Work*, this is expected to be a good proxy for reliance on cars for all trips as well. For example, the areas with best access to public transport can be expected to rank highest in using it both for journey to work and all trips, even if the percentage use changes significantly. The '*Cars per capita*' component also helps diversify the oil vulnerability assessment to give a stronger indication of reliance on cars for '*All Trips*' rather than just '*Journey to Work*'.

3. Index of Economic Resources (SEIFA)

Based on Census data, the ABS produces four different measures of social and economic well-being. For this oil vulnerability assessment, the *SEIFA Index of Economic Resources* has been used to provide a measure of a community's ability to afford access to oil in a supply-constrained future.

Using this index does not take into account the changing patterns of employment which may accompany an era of oil depletion and which may render some currently strong economic regions relatively less well off in the future.

It should also be noted that the SEIFA index actually uses the '*No Car*' response in the Census as a measure of disadvantage, whereas from the perspective of oil vulnerability assessment this may indicate relative advantage as a result of lifestyle decisions about where to live and work etc. However, the 'No Car' response is only one of 15 variables used to generate the *Index of Economic Resources* so the affect on the outcome is unlikely to be significant.

Weighting of Components

Oil vulnerability has been assessed by weighting the above components as follows:
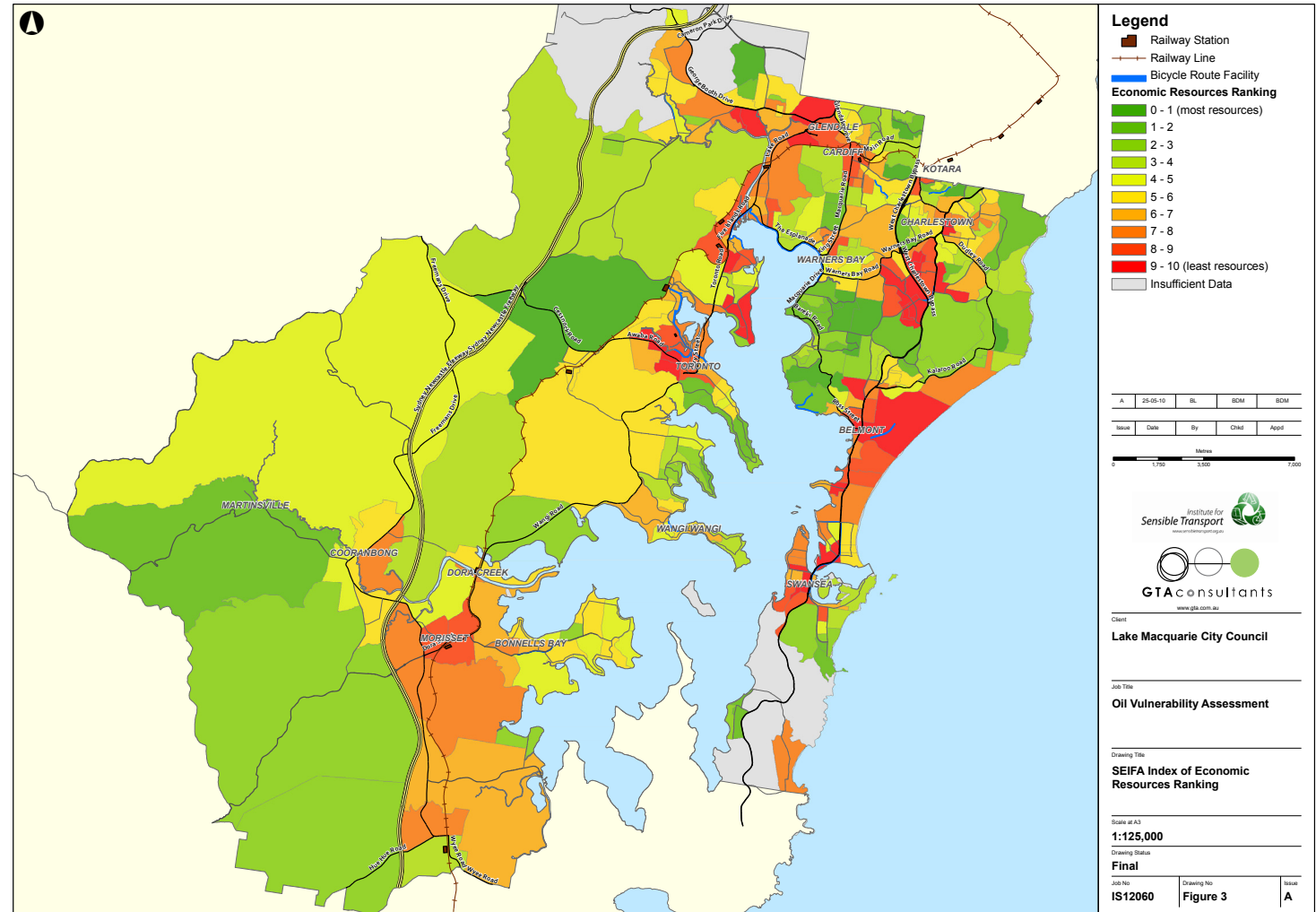
- 60% transport factors
  - 50% Cars per Capita (30% of total)
  - 50% Journey to Work score (30% of total)
- 40% economic factors
  - 100% Index of Economic Resources (SEIFA, 40% of total)

Maps of the three individual components, as well as a composite map that combines each individual rating (*the oil vulnerability index*) are shown below, along with an analysis.

Economic Resources Ranking

The Economic Resources Ranking (Map 1) is derived from composite Census variables including income, employment and housing. The areas in Map 1 below with the highest ranking for economic resources include Caves Beach, areas around Valentine, Mt Hutton and Coal Point. Areas with the least economic resources include Belmont, Windale, Glendale, Toronto and Morisset. Insufficient data prevented the ABS from developing a SEIFA rating in some northern CDs. See Appendix One for further information.

Legend

- Railway Station
- Railway Line
- Bicycle Route Facility

Economic Resources Ranking

- 0 - 1 (most resources)
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (least resources)
- Insufficient Data

A	25-05-10	BL	BDM	BDM
Issue	Date	By	Chkd	Appd

Metres

0   1,750   3,500   7,000

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Job Title
Oil Vulnerability Assessment

Drawing Title
SEIFA Index of Economic Resources Ranking

Scale at A3
1:125,000

Drawing Status
Final

Job No	Drawing No	Issue
IS12060	Figure 3	A

Map 1: Relative economic resource distribution across the Lake Macquarie LGA Source: ABS Census 2006

Cars per capita Ranking

Areas with a high ranking in cars per capita (Map 2) are predominantly characterised as low population density areas such as to the south a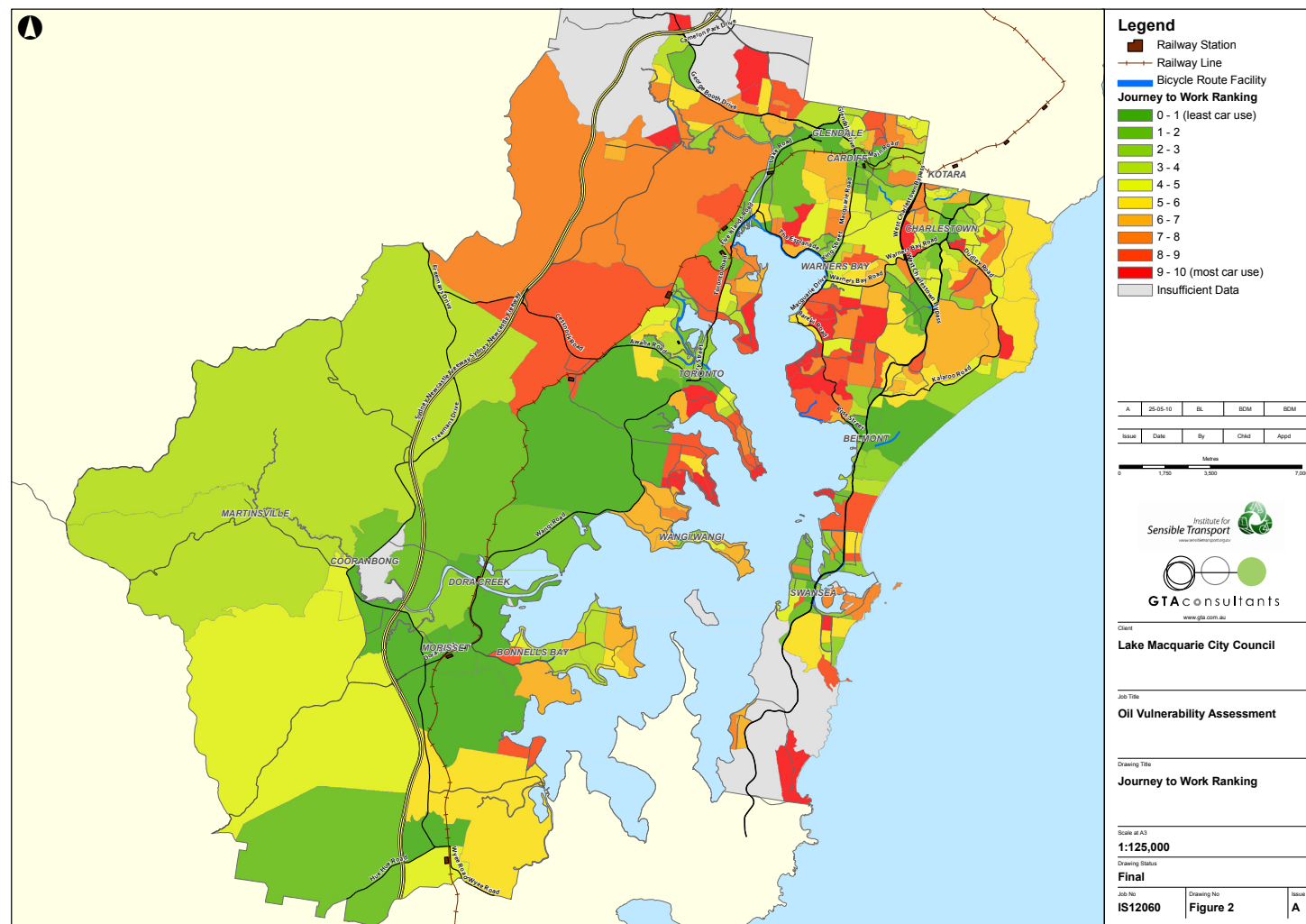nd north east of Martinsville and economically resource rich areas like Valentine and Coal Point. Areas with a low cars per capita ranking include Belmont, Toronto and Morisset. This could be a combination of these areas having lower economic resources and greater access to transport options other than private vehicles.

Legend

- ⬛ Railway Station
- ┼ Railway Line
- ▬ Bicycle Route Facility

Cars per Capita Ranking
- 0 - 1 (least cars per capita)
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (most cars per capita)
- Insufficient Data

A	25-05-10	BL	BDM	BDM
Issue	Date	By	Chkd	Appd

Metres
0   1,750   3,500   7,000

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Job Title
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Drawing Title
Cars per Capita Ranking

Scale at A3
1:125,000

Drawing Status
Final

Job No	Drawing No	Issue
IS12060	**Figure 1**	**A**

Map 2: Relative cars per capita ranking across the Lake Macquarie LGA Source: ABS Census 2006

Journey to Work Ranking

Map 3 illustrates differences within the Lake Macquarie LGA in the proportion of trips to work by car. More built up areas in the north indicate high car use, possibly reflecting travel to Newcastle, as an employment hub. Many parts of the more rural south have lower levels of car use for work journeys, possibly indicating a higher level of farm/home-based occupations. Not surprisingly, economically resource rich areas, such as Coal Point and Valentine have high car use while less economically resourced areas such as Glendale and Belmont have low car use.

Legend

- Railway Station
- Railway Line
- Bicycle Route Facility

Journey to Work Ranking

- 0 - 1 (least car use)
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10 (most car use)
- Insufficient Data

A	25-05-10	BL	BDM	BDM
Issue	Date	By	Chkd	Appd

Metres

0   1,750   3,500   7,000

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Job Title
Oil Vulnerability Assessment

Drawing Title
Journey to Work Ranking

Scale at A3
1:125,000

Drawing Status
Final

Job No	Drawing No	Issue
IS12060	**Figure 2**	**A**

Map 3: Relative journey to work by car ranking across the Lake Macquarie LGA Source: ABS Census 2006

Oil Vulnerability Ranking

The oil vulnerability ranking shown in Map 4 is a combination of the rankings displayed in the previous maps. While areas such as Coal Point and Wangi Wangi display high levels of oil vulnerability, they also rank highly in terms of economic resources and therefore will be most able to cope with fluctuations in the price of oil. On the other hand, areas such as Bolton Point, Edgeworth and Holmesville have high levels of oil vulnerability and some of the lowest levels of economic resources. These communities are particularly vulnerable as they are presumably less capable of absorbing rises in the price of fuel. Given their reduced capacity to adapt by themselves, it could be argued that these areas should be considered the highest priority for local government initiatives to reduce oil vulnerability.
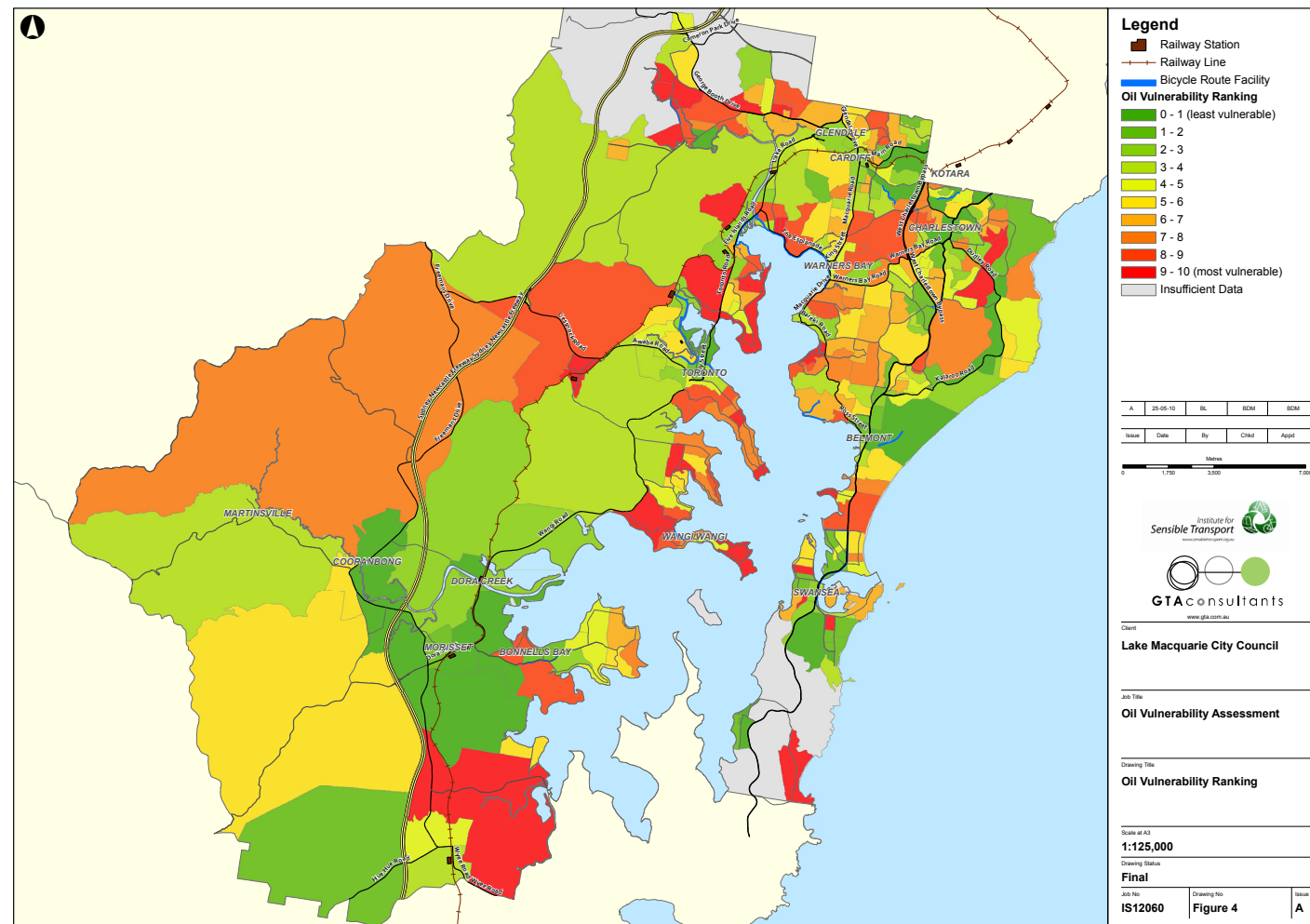
Map 4: Relative oil vulnerability ranking across the Lake Macquarie LGA Source: ABS Census 2006

5 Recommendations

The development of a less oil dependent community requires the implementation of a wide set of initiatives, deployed well before the period of maximum oil production. This is due to the very long lead times that are involved in reconfiguring our transport systems and land use planning to function effectively without major oil imports.

The following high level recommendations are focused on reducing the long term vulnerability of the Lake Macquarie community and economy to rising, fluctuating oil prices:

- Consolidate development around sustainable transport nodes, such as train stations and bus interchanges. Such development should have a variety of uses, including residential and commercial as well as the service/community/recreational sector. Focusing development in such a manner will reduce travel distances and increase the ease to which people can make trips by public transport, walking and cycling.

- Advocate to state and federal government for greater levels of investment in public transport infrastructure and services, especially in areas displaying high levels of oil vulnerability.

- Commit to higher levels of investment in bicycle infrastructure, such as on road lanes and off road shared paths, to encourage short distance car journeys to be transferred to bicycle.

- Undertake a food security analysis to investigate the exposure of the Lake Macquarie community to food insecurity related to a future oil scarcity event/period.

6 Conclusion

This report has identified the level of oil vulnerability within the Lake Macquarie LGA. It has done this by combining data collected as part of the ABS Census related to car ownership and use and economic resources. Variation within the LGA has been ranked and the spatial variation illustrated using maps of the city.

The results of this exercise reveal a mixed pattern across the LGA, with variations in car and economic resources. Oil vulnerability maps of large urban areas surrounding capital cities such as Sydney or Melbourne show a strong spatial pattern of low vulnerability in the centre and high vulnerability in outer areas. The Lake Macquarie region does not have such a strong spatial pattern. Rather, pockets of high vulnerability are interspersed with areas of *relative* resilience. The implications of this are two-fold; firstly, there is a role for government in focusing appropriate investment in areas of high vulnerability to boost resilience to volatile oil prices. Secondly, the development of a number of activity centres across the region would enhance Lake Macquarie's long-term resilience to peak oil and provide greater equity of access for key services.

7 References

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8 Appendix One –
Why is a SEIFA score not created
for every Collection District (CD)?

The following information is provided by the ABS to explain why a
SEIFA score is not provided for each CD

It is not always meaningful to give a CD a score. For example, the CD may be an airport or a large office block, with no-one actually residing in the area. In addition, there may be very few people in the area, or only a few who responded to the Census questions. If there are only a few people or responses, then it becomes difficult to calculate a reliable score. Additionally, those who did respond may not be representative of the area as a whole. Confidentiality issues can also arise when there are only a few people in an area.

Taken from www.abs.gov.au

Areas were not given a score if they fell into one of the following categories:

- No usual residents (which accounted for 49% of excluded CDs);
- Number of people was ten or fewer (which accounted for another 13% of excluded CDs);
- Number of employed was five or fewer;
- Proportion of people not responding to the following Census questions (as appropriate) was 70% or more: occupation, labour force status, type educational institution, or non-school qualifications;
- Proportion of people in households for which equivalised household income could not be calculated was 70% or more.
- Number of occupied private dwellings was five or fewer;
- Proportion of people residing in non-private dwellings was 80% or more; or The area was classified as off-shore, shipping or migratory.

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