



## CONTENTS

Introduction .....	3
Methods .....	3
Data sources .....	3
Mapping.....	4
Maps .....	5
Municipal Waste and Effluent .....	5
Farm Effluent.....	8
Industrial Effluent.....	12
Total Waste and Effluent .....	15
Summary.....	16
Municipal Waste and Effluent .....	16
Farm Effluent.....	16
Industrial Effluent.....	16
Total Waste and Effluent .....	16
Information Gaps.....	16
Municipal Waste and Effluent .....	16
Industrial Effluent.....	16
References.....	17
Appendix I. Municipal waste and effluent .....	18
Appendix II. Farm effluent .....	20
Appendix III. Industrial Effluent.....	22
Appendix IV. Total effluent and waste.....	24

## **INTRODUCTION**

This report presents a set of data as maps and tables, showing the amounts and locations of potential energy that can be derived from municipal, farm and some industrial wastes and effluents as at 2005.

The resources included are major sources of biomass wastes derived from:

- municipal solid waste
- municipal biosolids
- dairy farm effluent
- pig farm effluent
- poultry farm waste
- dairy factory effluent
- meat processing effluent

These resources are not comprehensive of all effluents available. They represent the major sources of effluents only.

This report provides a summary of data, as it is known at the time of writing. Forward predictions based on drivers such as population and stock numbers were not attempted due to large areas of uncertainty.

## **METHODS**

### **Data sources**

Data was derived from a variety of sources, principally from summary data prepared for the Bioenergy Options for New Zealand study (Hall and Gifford, 2008).

The data was entered into spreadsheets, on a regional basis, with the following zones used:

- Northland
- Auckland
- CNI (Central North Island, includes Waikato and Bay of Plenty)
- East Coast
- Hawke's Bay
- SNI (Southern North Island, includes Taranaki, Manawatu, Wellington and Wairarapa)
- Nelson
- Marlborough (includes Tasman)
- West Coast
- Canterbury
- Otago/Southland

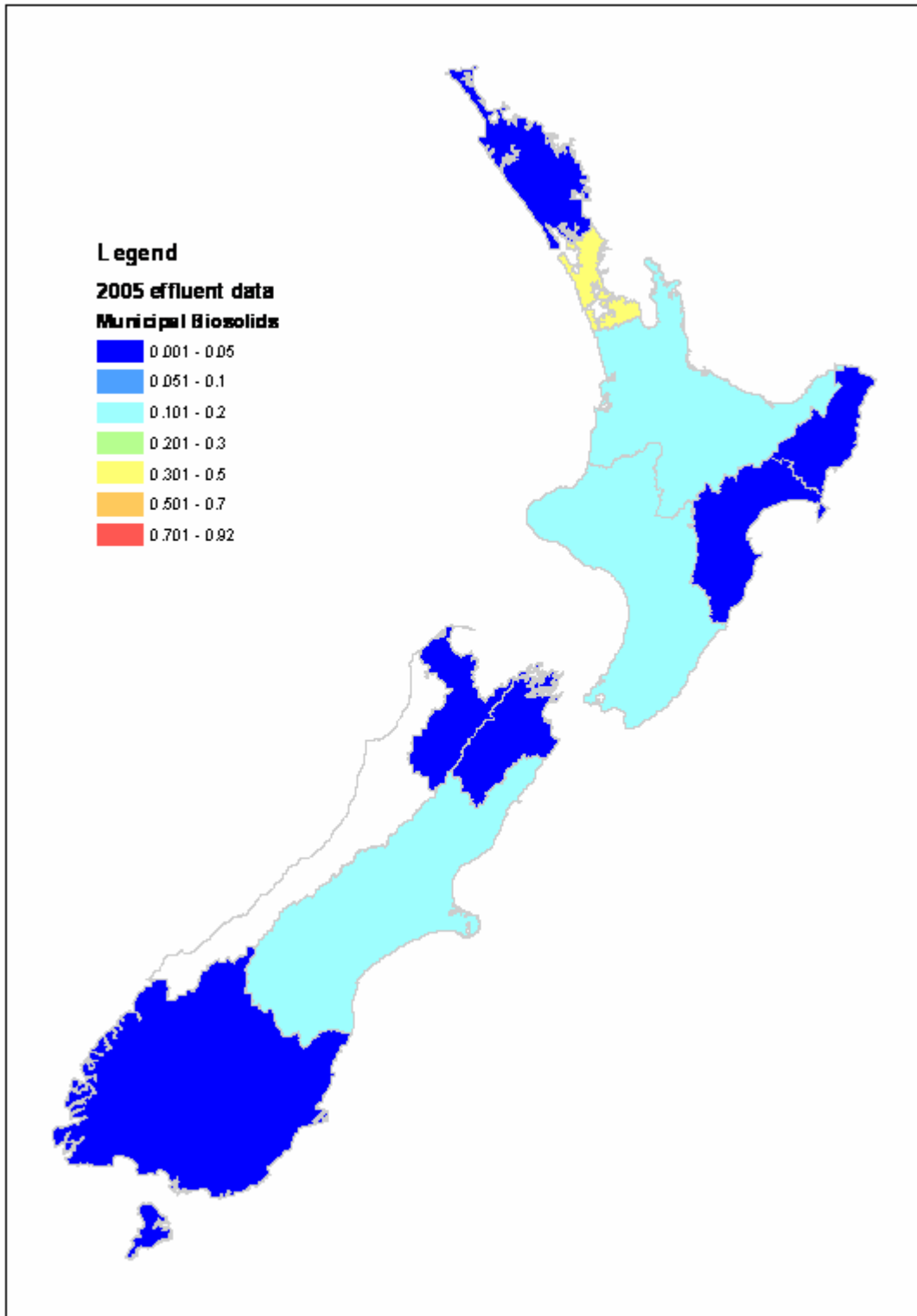
## **Mapping**

Mapping was done in ARC GIS, based on the data presented in the appended tables.

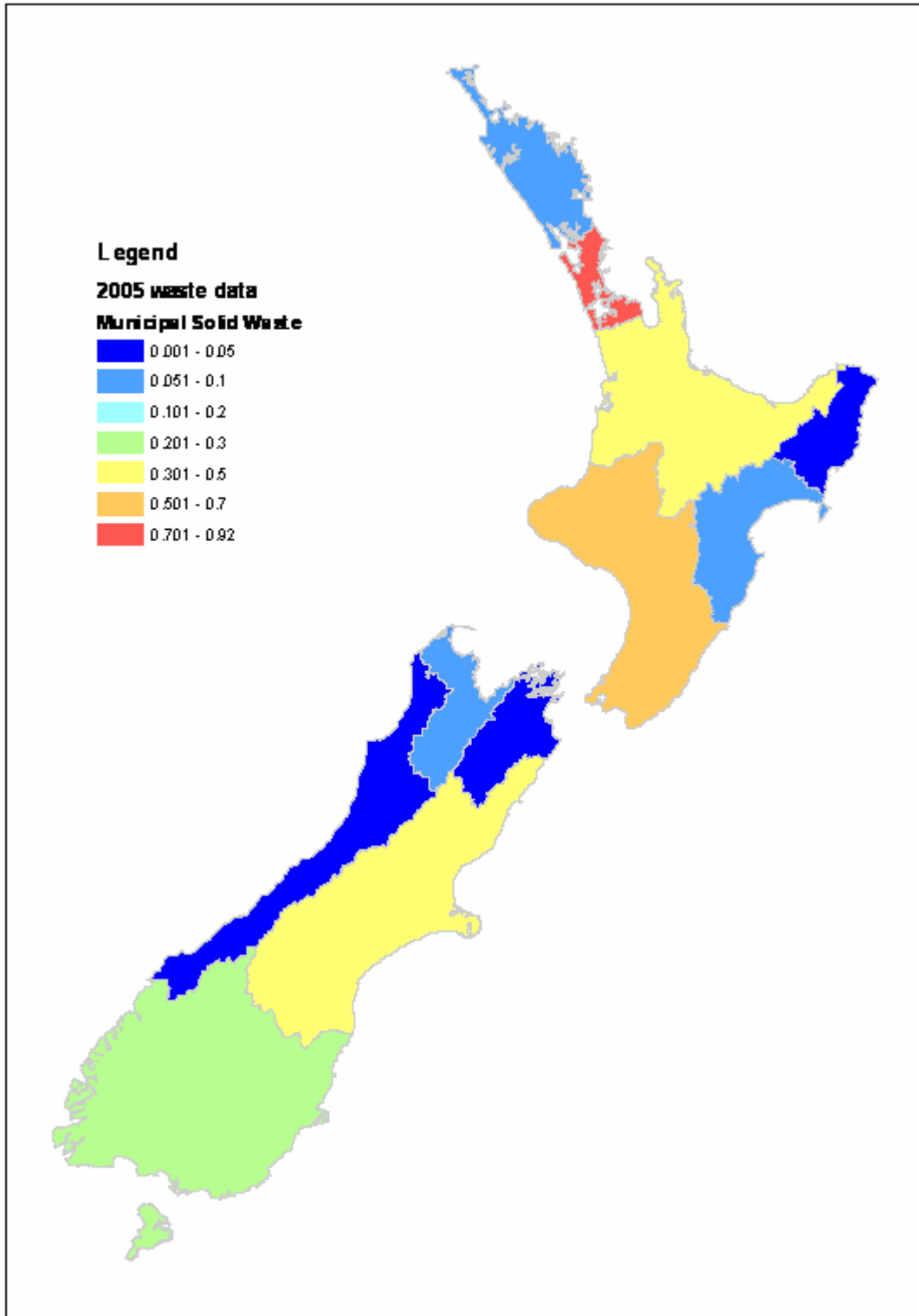
The energy available was derived by calculating the amount of biogas that could be created from anaerobic digestion of the wastes available. The energy is express as petajoules (PJ) per annum for a region.

# MAPS

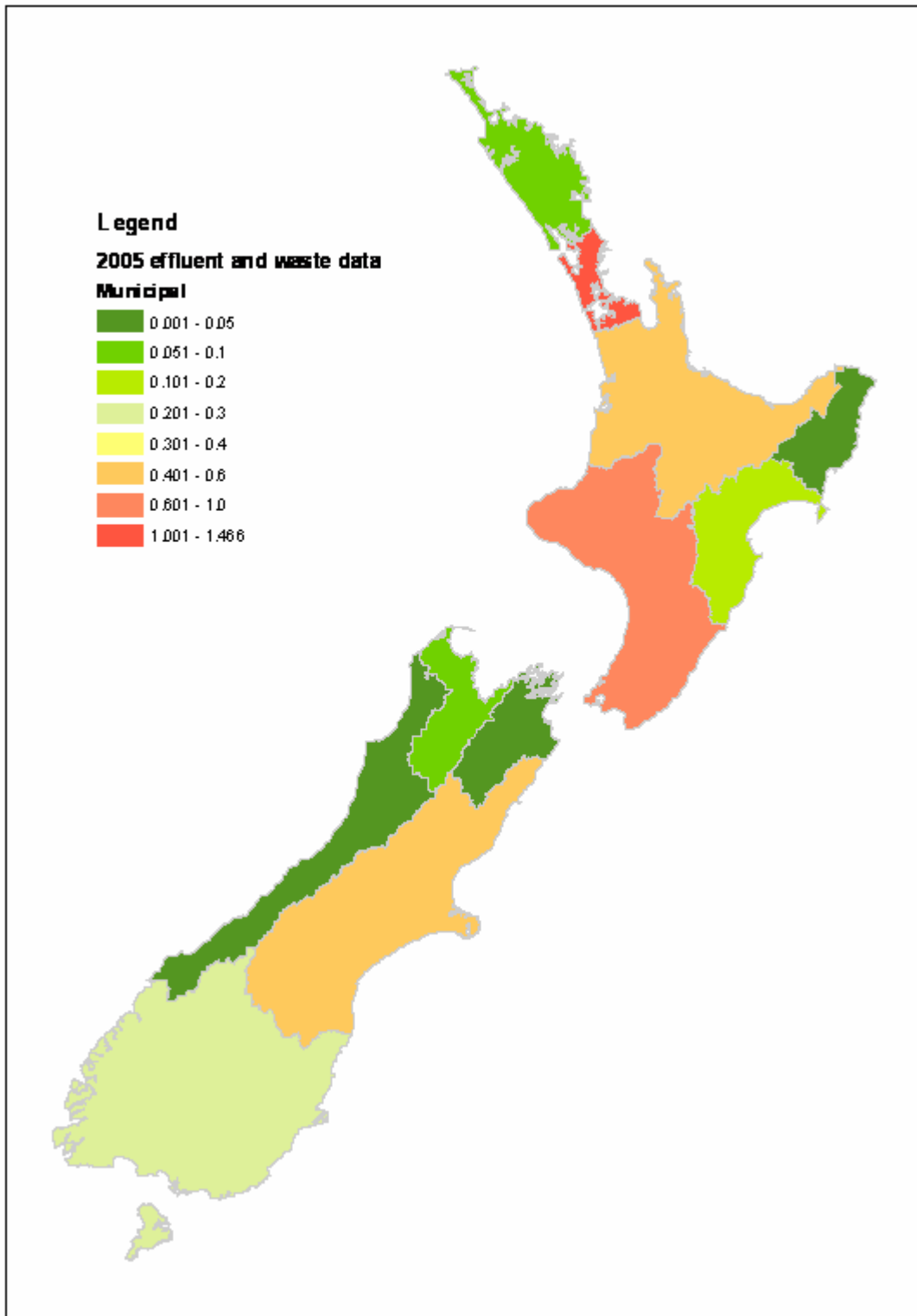
## Municipal Waste and Effluent



Map 1. Municipal biosolids, 2005, PJ per annum by region

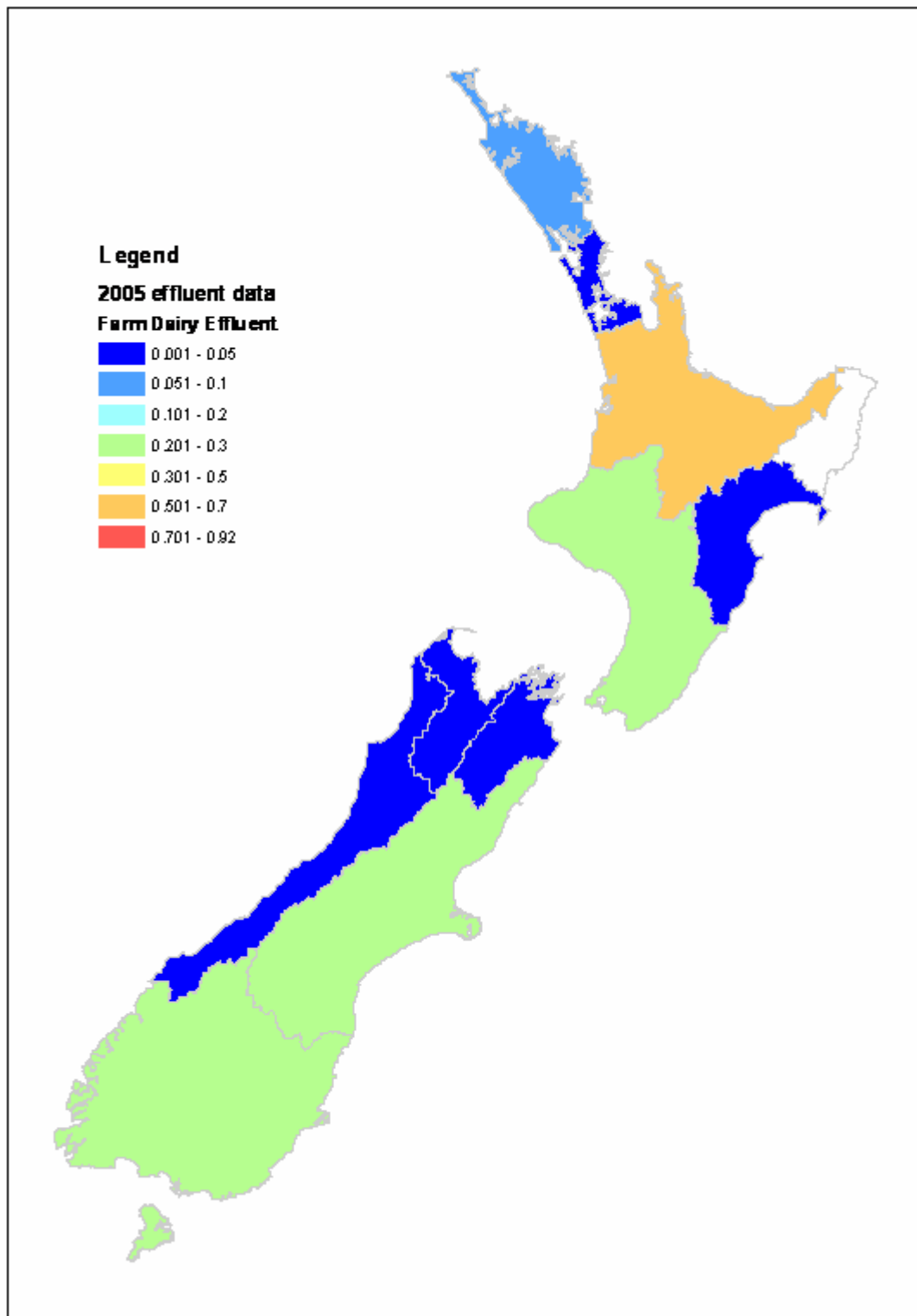


**Map 2. Municipal solid waste, 2005, PJ per annum by region**

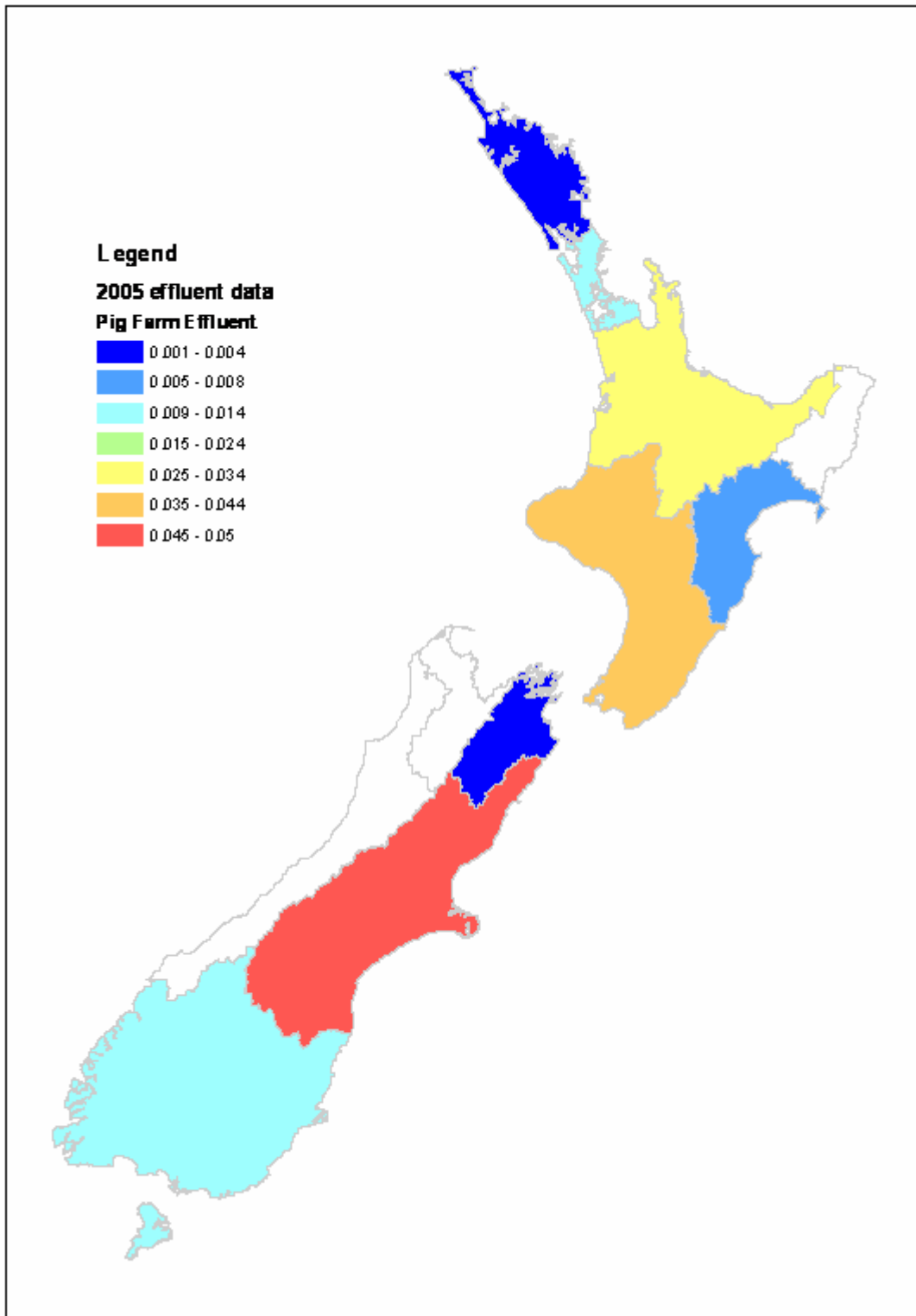


**Map 3. Total municipal waste and effluent, 2005, PJ per annum by region**

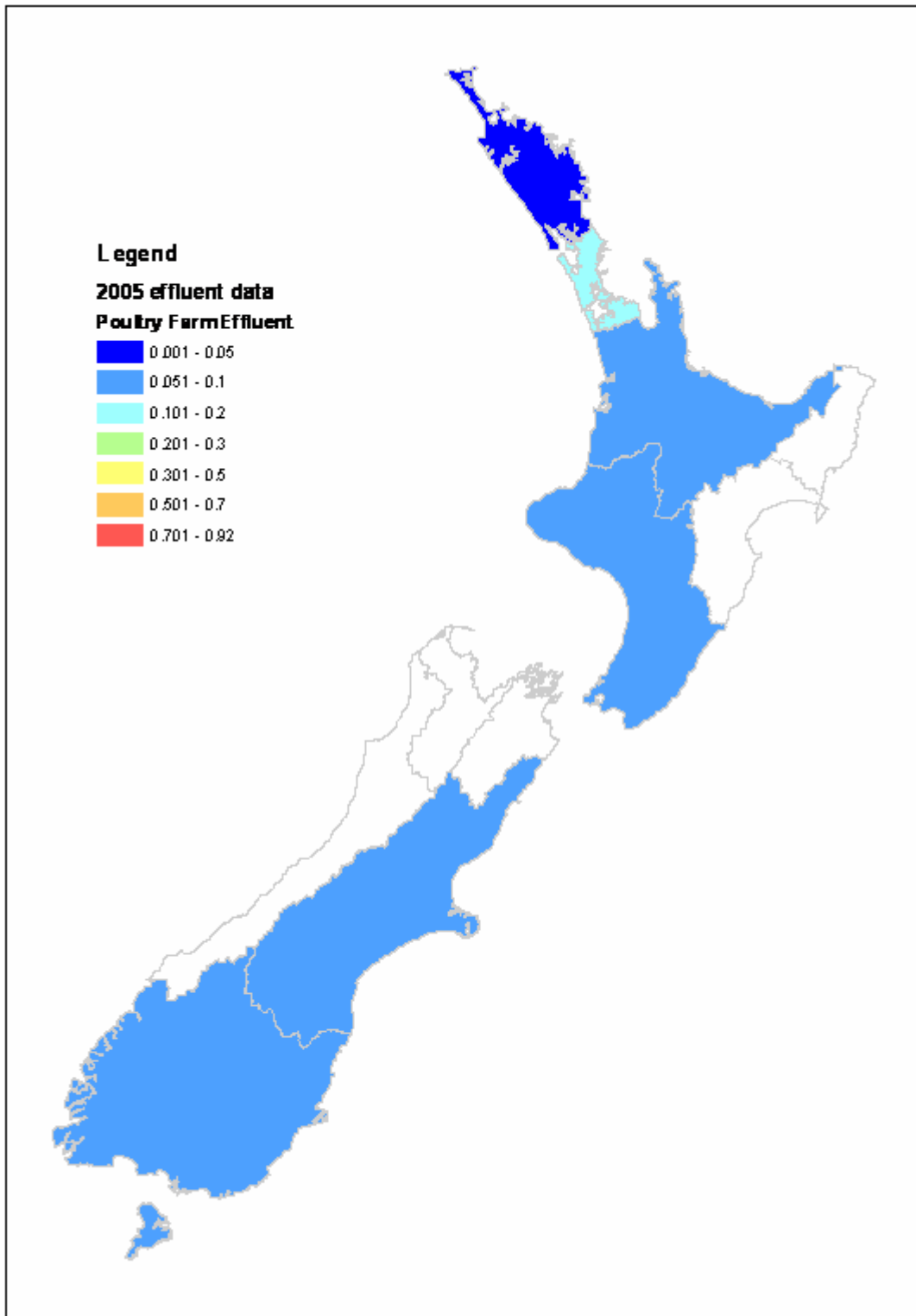
## Farm Effluent



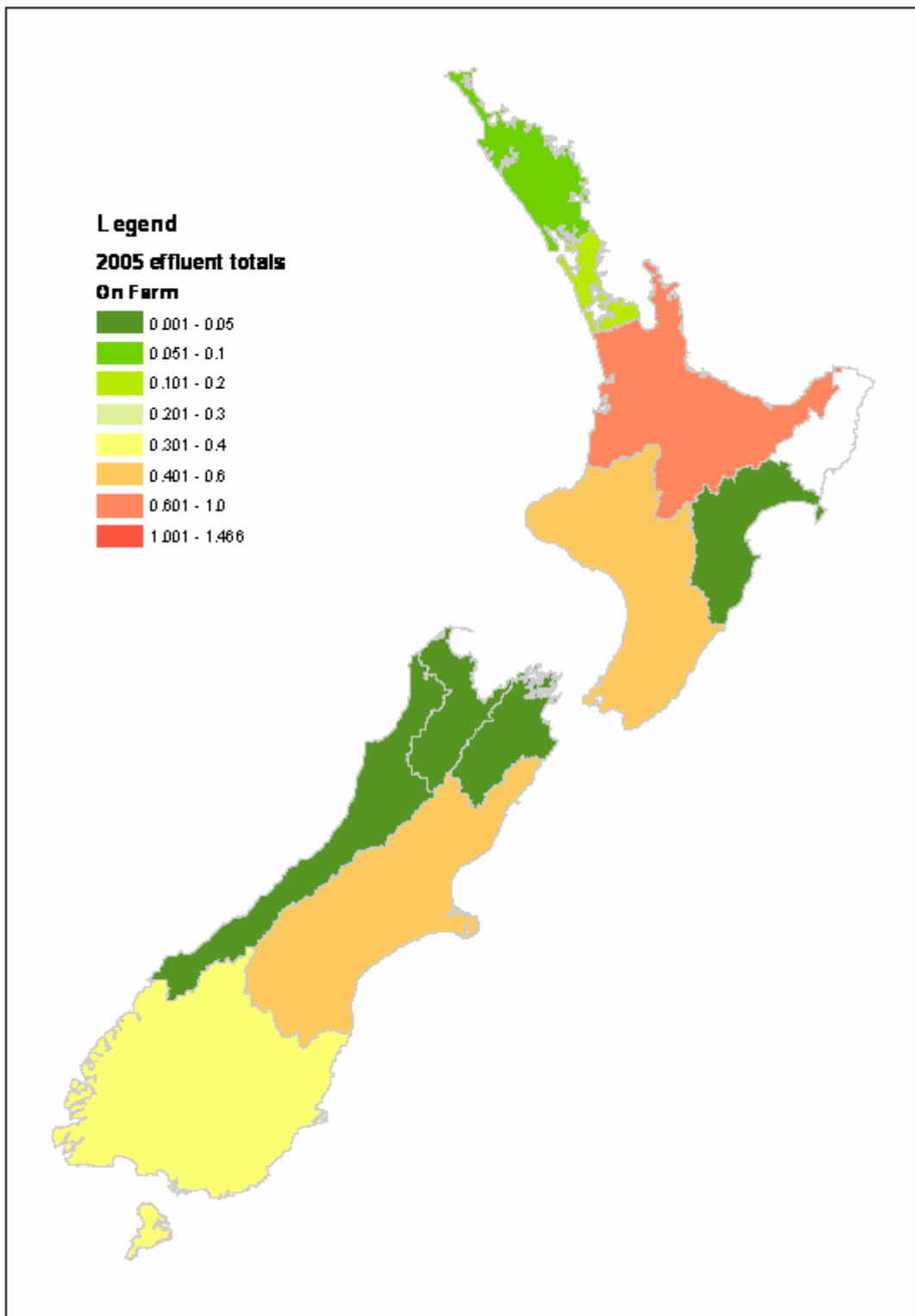
Map 4. Dairy farm effluent, 2005, PJ per annum by region



Map 5. Pig farm effluent, 2005, PJ per annum by region

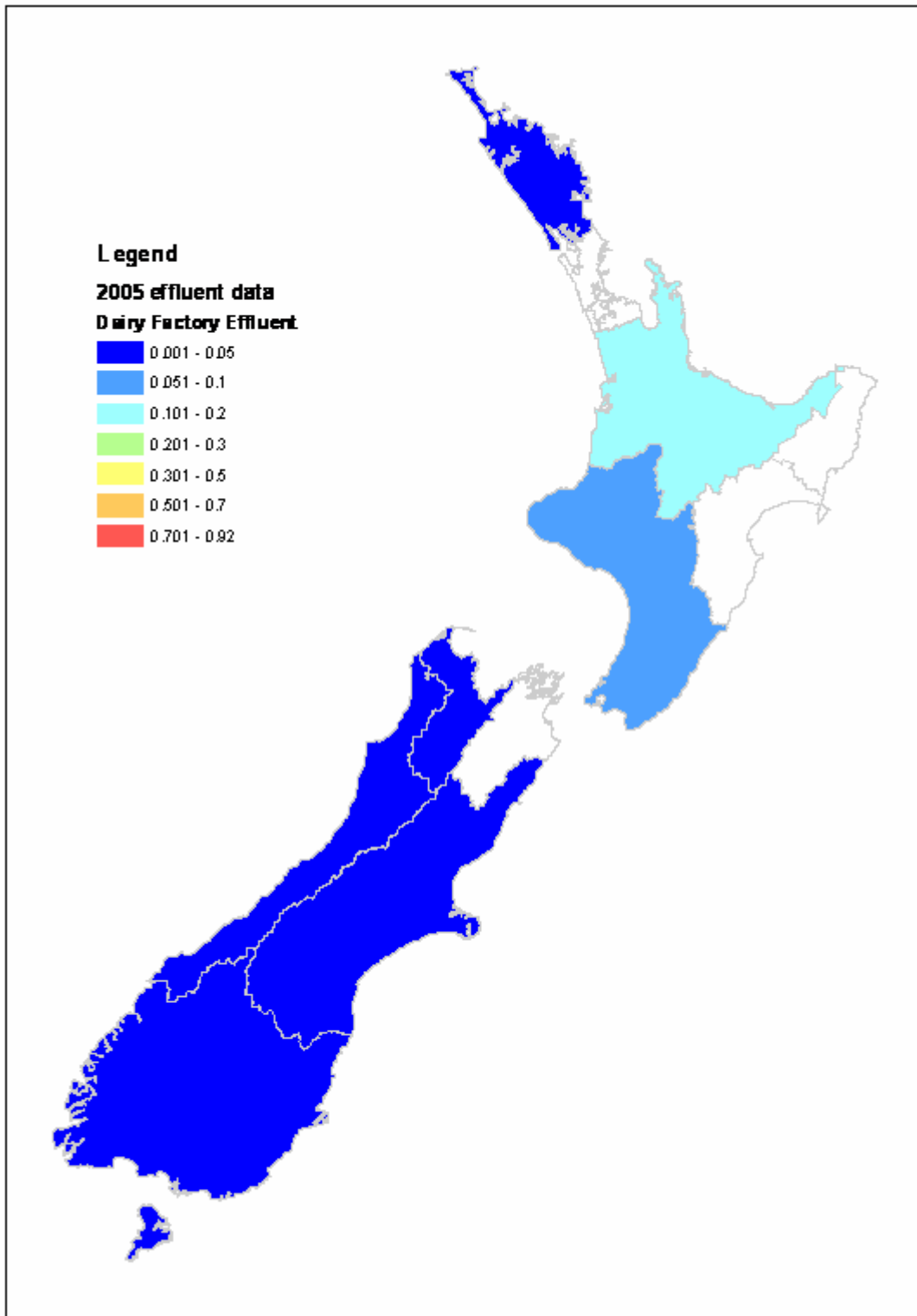


Map 6. Poultry farm effluent, 2005, PJ per annum by region

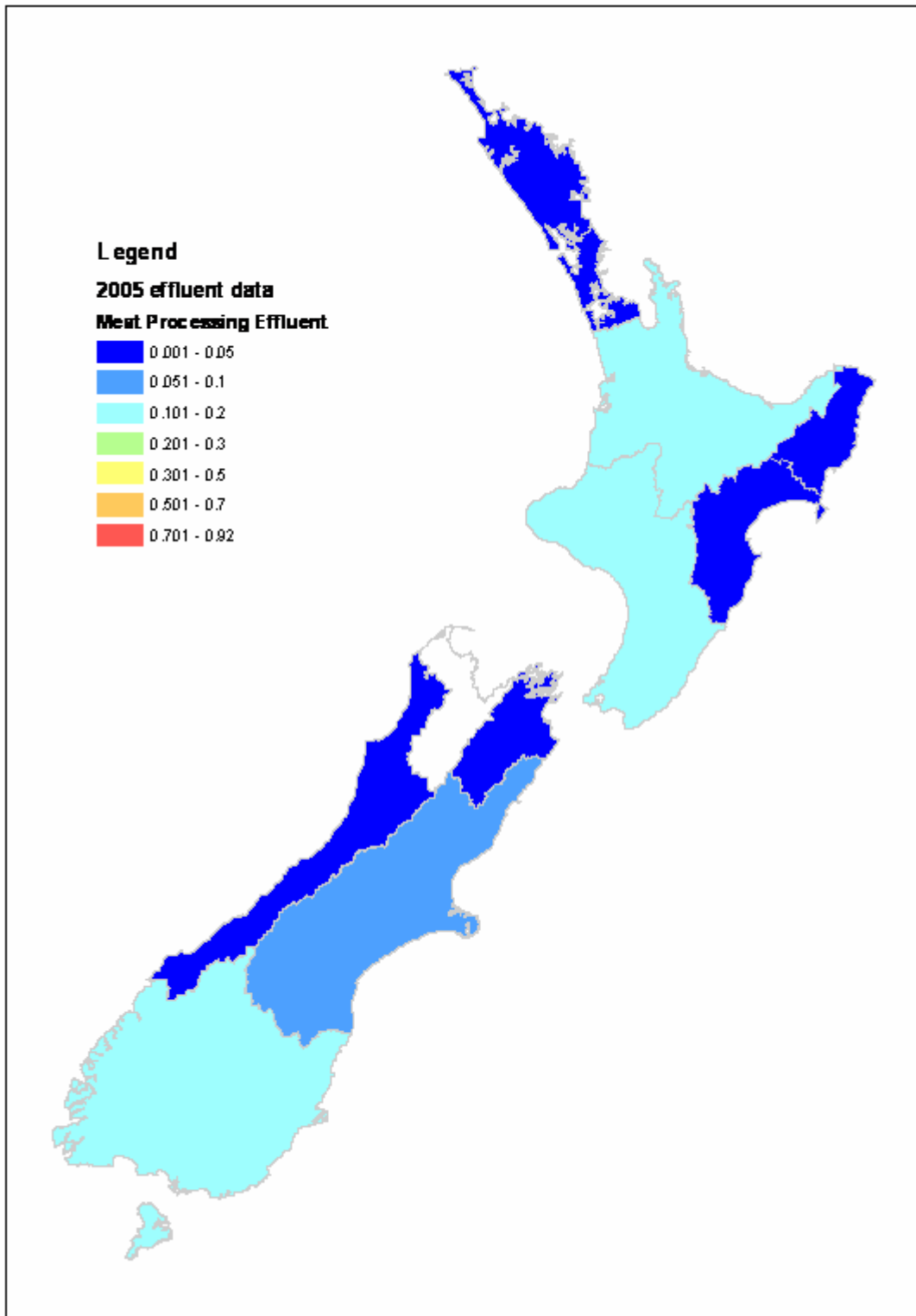


**Map 7. Total farm effluent, 2005, PJ per annum by region**

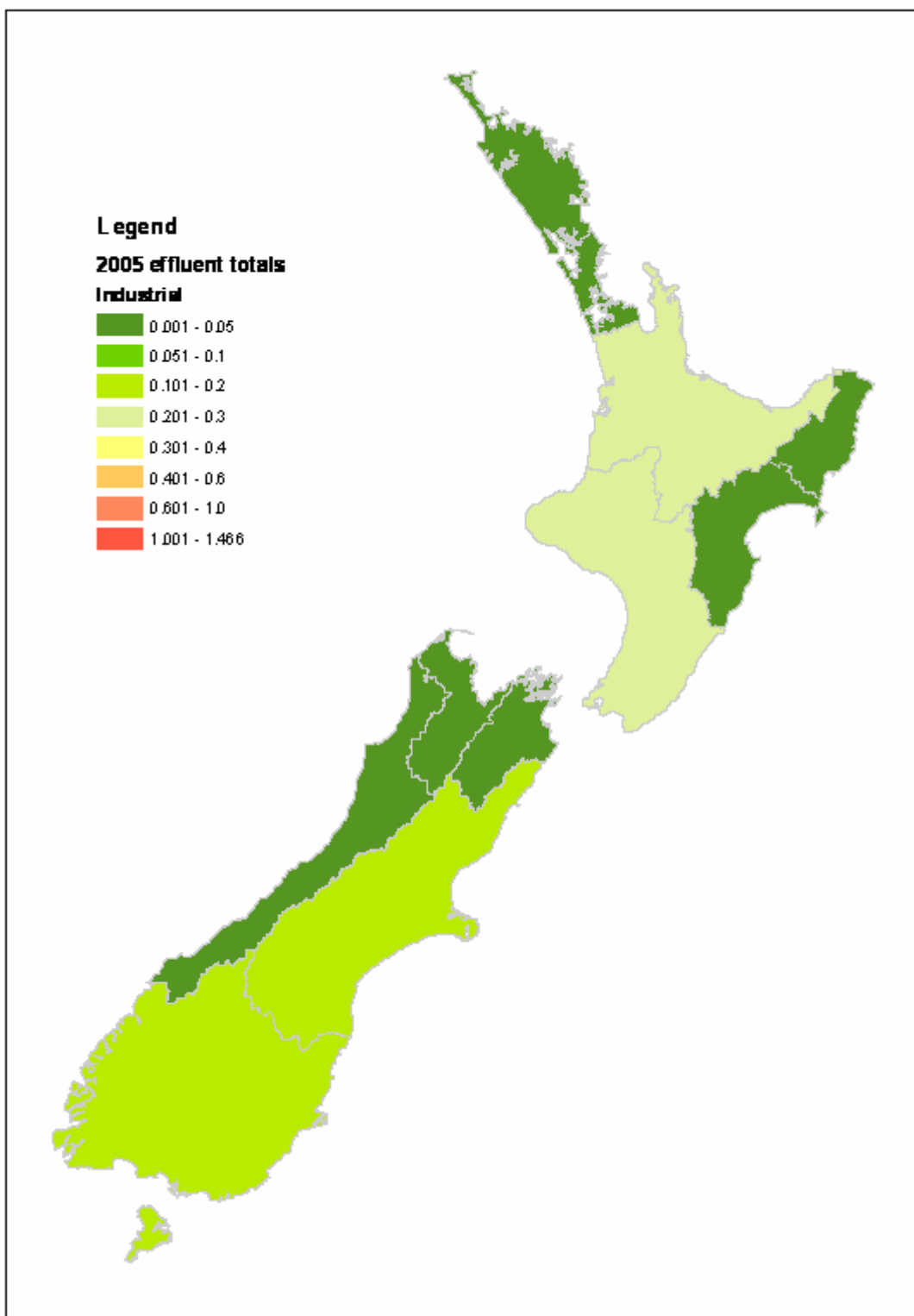
## Industrial Effluent



Map 8. Dairy factory effluent, 2005, PJ per annum by region

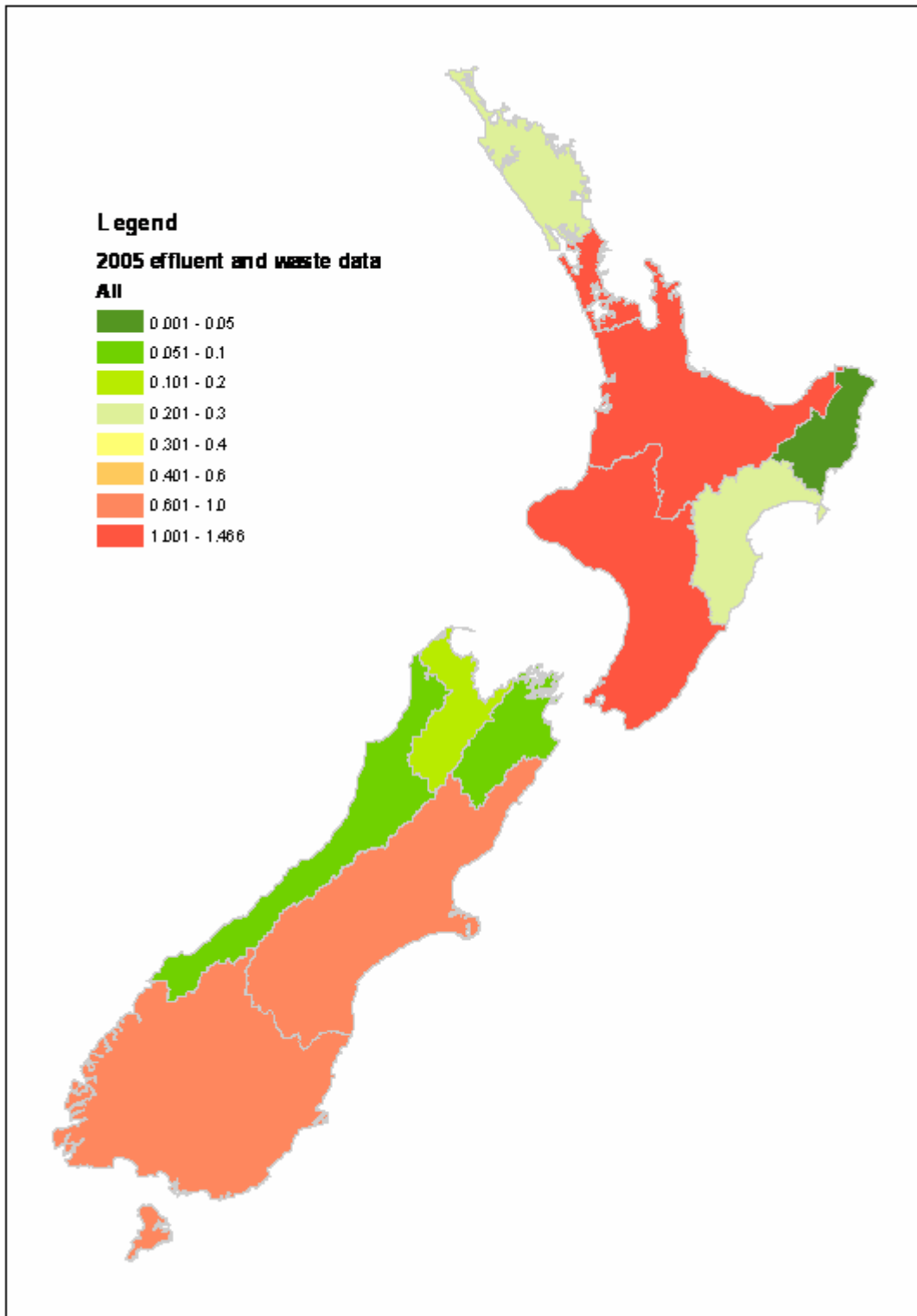


Map 9. Meat processing effluent, 2005, PJ per annum by region



**Map 10. Total industrial (dairy and meat processing) effluent, 2005, PJ per annum by region**

## Total Waste and Effluent



Map 11. All wastes and effluents, 2005, PJ per annum by region

## **SUMMARY**

### **Municipal Waste and Effluent**

Municipal solid waste includes municipal bio-solids and solid wastes. It is the single largest waste stream with 3.7 PJ of potential energy. This is over 50% of the total potential energy available nationally from all wastes and effluents.

### **Farm Effluent**

Farm effluents are 31% of the national waste and effluent energy potential. Dairy farms produce 70% of all farm effluents. Due to the extensive nature of dairy farming the resource tends to be dispersed. Piggery and poultry effluents have greater point source concentrations due to the intensive nature of the farming. Most of the farm effluents are produced in Central North Island (30%), Southern North Island (19%), Canterbury (19%) and Otago/Southland (16%).

### **Industrial Effluent**

Dairy and meat processing effluent contributes 15% to the national waste and effluent energy potential, with a split of 62% from meat and 38% from dairy. The resource is concentrated at large point sources (slaughterhouses and dairy factories), making it potentially more viable for energy production. The regions with the greatest resource of dairy and meat processing effluent are the Central North Island (30%) and Southern North Island (24%).

### **Total Waste and Effluent**

The potential energy resource from all wastes and effluents is approximately 6.9 PJ, or just over 1% of consumer energy (491.6 PJ for 2005).

Auckland, Central North Island and Southern North Island all contribute 21% to the total waste and effluents produced. The north island as a whole contributes 70% to the total.

## **INFORMATION GAPS**

### **Municipal Waste and Effluent**

The potential for obtaining putrescible municipal solid waste as a separate component of the municipal waste stream is limited due to the difficulties in separation and associated costs.

### **Industrial Effluent**

Other industrial biomass waste streams, particularly food processing such as fish, fruit and milling are not included in this study due to lack of data.

## REFERENCES

Hall P and Gifford G (2008). Bioenergy Options for New Zealand. Situation analysis – Biomass resources and conversion technologies.

Saggar S, Giltrap D, Forgie V, Renquist R. (2007). Review of Agricultural Resources. Report prepared for Bioenergy Options Programme.

Evanson T and Hall P (2007) Resource assessment of Municipal Wood Waste – green waste and untreated wood waste. Report prepared for Bioenergy Options Programme.

Thiele J. T. 2007. Bioenergy Resource assessment: Municipal biosolids and effluent and dairy factory, meat processing and wool processing waste.

## APPENDIX I. MUNICIPAL WASTE AND EFFLUENT

**Table I.i. Municipal bio-solids, 2005**

	<b>PJ per annum</b>
Northland	0.01
Auckland	0.36
CNI	0.11
Gisborne	0.01
Hawke's Bay	0.03
SNI	0.17
<b>Total North Island</b>	<b>0.69</b>
Nelson	0.02
Marlborough	0.01
West Coast	-
Canterbury	0.12
Otago/Southland	0.04
<b>Total South Island</b>	<b>0.19</b>
<b>Total New Zealand</b>	<b>0.88</b>

**Table I.ii. Municipal solid waste, 2005**

	<b>PJ per annum</b>
Northland	0.09
Auckland	0.92
CNI	0.36
Gisborne	0.03
Hawke's Bay	0.10
SNI	0.66
<b>Total North Island</b>	<b>2.16</b>
Nelson	0.07
Marlborough	0.03
West Coast	0.02
Canterbury	0.32
Otago/Southland	0.25
<b>Total South Island</b>	<b>0.69</b>
<b>Total New Zealand</b>	<b>2.85</b>

**Table I.iii. Total municipal waste and effluent, 2005**

	<b>PJ per annum</b>
Northland	0.10
Auckland	1.28
CNI	0.47
Gisborne	0.04
Hawke's Bay	0.13
SNI	0.83
<b>Total North Island</b>	<b>2.85</b>
Nelson	0.09
Marlborough	0.04
West Coast	0.02
Canterbury	0.44
Otago/Southland	0.29
<b>Total South Island</b>	<b>0.88</b>
<b>Total New Zealand</b>	<b>3.73</b>

## APPENDIX II. FARM EFFLUENT

**Table II.i. Dairy farm effluent, 2005**

	<b>PJ per annum</b>
Northland	0.08
Auckland	0.02
CNI	0.54
Gisborne	-
Hawke's Bay	0.03
SNI	0.27
<b>Total North Island</b>	<b>0.94</b>
Nelson	0.02
Marlborough	0.01
West Coast	0.04
Canterbury	0.27
Otago/Southland	0.24
<b>Total South Island</b>	<b>0.58</b>
<b>Total New Zealand</b>	<b>1.52</b>

**Table II.ii. Pig farm effluent, 2005**

	<b>PJ per annum</b>
Northland	0.003
Auckland	0.01
CNI	0.034
Gisborne	-
Hawke's Bay	0.004
SNI	0.036
<b>Total North Island</b>	<b>0.087</b>
Nelson	-
Marlborough	0.003
West Coast	-
Canterbury	0.05
Otago/Southland	0.01
<b>Total South Island</b>	<b>0.063</b>
<b>Total New Zealand</b>	<b>0.15</b>

**Table II.iii. Poultry farm effluent, 2005**

	<b>PJ per annum</b>
Northland	0.01
Auckland	0.11
CNI	0.09
Gisborne	-
Hawke's Bay	-
SNI	0.10
<b>Total North Island</b>	<b>0.31</b>
Nelson	-
Marlborough	-
West Coast	-
Canterbury	0.10
Otago/Southland	0.10
<b>Total South Island</b>	<b>0.20</b>
<b>Total New Zealand</b>	<b>0.51</b>

**Table II.iv. Total farm effluent, 2005**

	<b>PJ per annum</b>
Northland	0.09
Auckland	0.14
CNI	0.66
Gisborne	-
Hawke's Bay	0.03
SNI	0.41
<b>Total North Island</b>	<b>1.34</b>
Nelson	0.02
Malborough	0.01
West Coast	0.04
Canterbury	0.42
Otago / Southland	0.35
<b>Total South Island</b>	<b>0.84</b>
<b>Total New Zealand</b>	<b>2.18</b>

## APPENDIX III. INDUSTRIAL EFFLUENT

**Table III.i. Dairy Factory effluent**

	<b>PJ per annum</b>
Northland	0.03
Auckland	-
CNI	0.18
Gisborne	-
Hawke's Bay	-
SNI	0.09
<b>Total North Island</b>	<b>0.30</b>
Nelson	0.001
Marlborough	-
West Coast	0.01
Canterbury	0.05
Otago/Southland	0.04
<b>Total South Island</b>	<b>0.10</b>
<b>Total New Zealand</b>	<b>0.40</b>

**Table III.ii. Meat processing effluent**

	<b>PJ per annum</b>
Northland	0.03
Auckland	0.02
CNI	0.15
Gisborne	0.01
Hawke's Bay	0.05
SNI	0.16
<b>Total North Island</b>	<b>0.42</b>
Nelson	0.01
Marlborough	0.01
West Coast	0.01
Canterbury	0.10
Otago/Southland	0.11
<b>Total South Island</b>	<b>0.24</b>
<b>Total New Zealand</b>	<b>0.66</b>

**Table III. iii. Total industrial effluent**

	<b>PJ per annum</b>
Northland	0.06
Auckland	0.02
CNI	0.33
Gisborne	0.01
Hawke's Bay	0.05
SNI	0.25
<b>Total North Island</b>	<b>0.72</b>
Nelson	0.01
Marlborough	0.01
West Coast	0.02
Canterbury	0.15
Otago/Southland	0.15
<b>Total South Island</b>	<b>0.34</b>
<b>Total New Zealand</b>	<b>1.06</b>

## APPENDIX IV. TOTAL EFFLUENT AND WASTE

Table IV.i. Total Wastes and Effluents, 2005

	<b>PJ per annum</b>
Northland	0.25
Auckland	1.44
CNI	1.46
Gisborne	0.05
Hawke's Bay	0.21
SNI	1.49
<b>Total North Island</b>	<b>4.91</b>
Nelson	0.12
Marlborough	0.06
West Coast	0.08
Canterbury	1.01
Otago/Southland	0.79
<b>Total South Island</b>	<b>2.06</b>
<b>Total New Zealand</b>	<b>6.97</b>