Post-apartheid Apartheid:

Measuring changes in residential segregation in Port Elizabeth, South Africa, from 1996-2011

Full thesis submitted in fulfilment for the degree of

MASTERS OF SCIENCE

RHODES UNIVERSITY

By

Luveshni Odayar

Supervisor: Professor R.C. Fox

ABSTRACT

Racial segregation and inequality were the prime objectives of the colonial and apartheid spatial planning policies that governed the spatial development of the South African urban landscape. Since South Africa's democratic transition after 1994, efforts have been made by government to facilitate racial integration and transform the apartheid urban fabric. Research into post-apartheid segregation is crucial to assess the success of governmental actions enacted thus far, while informing future spatial planning strategies. Most studies of these processes have relied solely on dichotomous indices to measure the extent of segregation between two groups. Few have utilized multi-group indices, which are more suited to investigating changes in multi-ethnic cases. Furthermore, the segregation indices used are typically aspatial.

This study investigates the extent to which the segregationist legacy prevails in Port Elizabeth, a place widely considered to be the founding city of urban racial segregation. It also aims to investigate the impact of geographical scale on segregation. Theil's multi-group Entropy Index and Duncan and Duncan's Dissimilarity Index were derived from racial population data from the 1996, 2001 and 2011 National Censuses, and GIS was used to map changes in racial diversity both at tract level and across a range of geographical scales. To generate a more holistic understanding of the observed trends, statistical tests were performed to relate the observed patterns to socio-economic determinants, and feedback from the relevant government department was obtained.

The results from the entropy indices reveal that segregation levels in Port Elizabeth–have declined but still remain high: 84.6 % (1996), 79.2 % (2001) to 71.5 % (2011). This is a similar

trend to those found in Cape Town and Johannesburg. The integration that did occur was characterized by one-way patterns of movement into former-White areas; this was predominantly confined to the Indian population, and to a lesser extent, the Coloured population. The vast majority of the African population remains confined to their former designated location areas. The White population remains the most segregated group, despite most of the racial integration occurring in former-White areas. Interview results and statistical tests revealed that persisting racial discrepancies in socio-economic factors (income, employment and education) can be considered major drivers influencing the observed trends in racial integration and persisting desegregation, as well as self-segregation.

Key Words: Segregation, Post-apartheid, South Africa, Port Elizabeth, Entropy Index, Scale

TABLE OF CONTENTS

ABSTRACT i

TABLE OF CONTENTS iii

LIST OF TABLES viii

LIST OF FIGURES ix

ACKNOWLEDGEMENTS xiii

GLOSSARY xiv

CHAPTER 1: INTRODUCTION 1

1.1. Background, Context and Motivation 1

1.2. Research Aim and Objectives 5

1.3. Structure of the Thesis 6

CHAPTER 2: THEORETICAL UNDERPINNINGS AND METHODOLOGICAL APPROCHES OF SEGREGATION STUDIES 8

2.1 Introduction 8

2.2. Defining Residential Segregation 9

2.3. Theoretical Models of Segregation 10

2.3.1. Place Stratification 10

2.3.2. Spatial Assimilation 11

2.3.3. Heterolocalism 11

2.3.4. Ethnic Enclaves and Ethnic Ghettos 12

2.4. Quantitative Measurement of Segregation 13

2.5. The Dimensions of Distributive Segregation 15

2.6. Segregation Indices 17

2.6.1. The Dissimilarity Index 18
2.6.2. The Entropy Index 21
2.6.3. Comparing the Dissimilarity and Entropy Indices 26
2.6.4. Application of the Entropy Index in Racial Segregation Studies 30
2.6.5. Limitations of Segregation Indices 31
2.7. Using GIS to Enhance Segregation Studies 32
2.8. Segregation and Scale 33
2.8.1. Theoretical Importance of Considering Scale in Segregation Studies 33
2.8.2. Approaches to investigating the geographic scale of segregation 34
2.8.3. The Segregation Profile 34
2.9. Conclusion 38

CHAPTER 3: OVERVIEW OF SEGREGATION RESEARCH 39
3.1. Introduction 39
3.2. The Nature of Residential Segregation Studies: The USA Context 39
3.2.1. Overview of Segregation Research 39
3.2.2. Classical Segregation Research 40
3.2.3. Contemporary Segregation Research 41
3.2.4. Spatial and Temporal Trends 41
3.2.5. The Causes of Racial Segregation 43
3.2.5.1. Endogenous Causes 43
3.2.5.1 (a). Differences in socio-economic status 43
3.2.5.1 (b). Racial Preference 45
3.2.5.2. Exogenous Causes 47
3.2.5.2 (a). Discrimination in Housing Markets 47

3.2.5.2 (b). Social Engineering through Spatial Planning Policies 48
3.2.6. The Consequences of Racial Segregation 48
3.2.6.1. Poverty Concentration 49
3.2.6.2 Impacts on Life Chances 51
3.2.6.2 (a.) Qualitative Research 51
3.2.6.2 (b). Empirical Research 52
3.3. Segregation Research Outside of the USA 53
3.4. Segregation Research in Post-Apartheid South Africa 55
3.5. Conclusion 61

CHAPTER 4: RACIAL SEGREGATION IN SOUTH AFRICA 63
4.1. Introduction 63
4.2. Historical Overview of South African Governance 63
4.3. Racial Segregation before Apartheid 68
4.4. Segregation during Apartheid 74
4.5. The Emerging Post-Apartheid City in South Africa 79
4.6. Conclusion 85

CHAPTER 5: STUDY AREA 86
5.1. Locality and Demographics 86
5.2. The Introduction of Informal Segregation in Colonial Port Elizabeth 90
5.3. Municipal Steps towards Implementing the Formal Spatial Segregation of the African Population 95
5.3.1. Efforts to Establish a Formal Fingo location 95
5.3.2. The Development of the Native Strangers' Location 97

5.3.3. The Expansion of Port Elizabeth's Locations 99
5.4. Segregation during the Union Period (1910 -1948) 104
5.5. Segregation during the Apartheid Era (1948-1994) 107
5.7. Conclusion 112

CHAPTER 6: METHODOLOGY 113
6.1. Introduction 113
6.2. The South African Census Data 113
6.3. Objective 1: Define appropriate study area boundaries for each of the census periods being investigated 116
6.4. Objective 2: Map the racial distribution of Port Elizabeth's population from 1996 to 2011 117
6.5. Objective 3: Measure the changes in racial segregation in Port Elizabeth from 1996 to 2011 using a multi-group index 117
6.6. Objective 4: Measure the changes in racial segregation from 1996 to 2011, using a multi-group index, across different geographic scales to develop a segregation profile for Port Elizabeth 118
6.7. Objective 5: Investigate the changes in racial diversity across geographical scales for selected areas in Port Elizabeth 119
6.8. Objective 6: Measure the changes in racial segregation between the specific race groups in Port Elizabeth from 1996 to 2011 using dichotomous indices 121
6.9. Objective 7: Investigate the relationship between race and various socio-economic variables to determine possible constraints to achieving racial integration 121
6.10. Objective 8: Conduct interviews with relevant government persons involved in spatial planning to contribute further understanding of the processes governing the spatial dynamics of Port Elizabeth 127
6.10. Conclusion 128

CHAPTER 7: RESULTS 129

7.1. Introduction 129

7.2. Objective 1 Results: Defining the study areas 129

7.3. Objective 2 Results: The racial distribution of Port Elizabeth's population from 1996 to 2011 130

7.3.1. Analytical Observations 130

7.3.2. Related Interview Responses 130

7.4. Measurement of Segregation for Port Elizabeth from 1996 to 2011 140

7.4.1 Racial Diversity at Tract Level 140

7.4.1.(a). Analytical Observations 140

7.4.1. (b). Related Interview Responses 141

7.4.2. Racial Segregation at Tract Level 145

7.4.2.(a). Analytical Observations 145

5.3.2.(b). Related Interview Responses 147

7.5. Measurement of Segregation at Different Geographic Scales for the City 147

7.6. The Relationship between Racial Diversity and Geographic Scale for Selected Sub Places in Port Elizabeth 166

7.7. Measurement of Segregation with Dichotomous Measures 172

7.8. Relating Segregation to Contributing Socio-economic Factors 178

7.9 Conclusion 179

CHAPTER 8: DISCUSSION AND CONCLUSION 181

8.1. Introduction 181

8.2. Post-Apartheid Racial Segregation in Port Elizabeth 181

8.3. Scalar Nature of Racial Segregation 184

8.4. Factors Limiting Racial Integration 186

8.5. Research Limitations 187

8.6. Recommendations for Potential Future Studies 187

REFERENCES 189

APPENDIX A: INTERVIEW SCHEDULE 206

LIST OF TABLES

Table 2.1: Recommended segregation index for calculating each of the segregation dimensions 15

Table 2.2: Worked example of the Dissimilarity Index 20

Table 2.3: Worked example of Theil's entropy index 24

Table 2.4: Weighted diversity (h) values 25

Table 2.5: Final segregation (H) calculation 25

Table 2.6: Reardon and Firebaugh's (2002) evaluation and comparison of two segregation indices 28

Table 4.1: Examples of government sectors categorized as 'own' and 'general affairs' 67

Table 5.2: Results from the 1846 municipal census) 93

Table 5.3: Port Elizabeth's municipal census results (000s)from 1855 to 1985 (excluding that of 1980 due to suspected under-numeration) 101

Table 5.4: Segregation Indices for Port Elizabeth's Population, 1951 -2001 111

Table 6.1: South African income tax brackets for 1996 122

Table 6.2: South African income tax brackets for 2011) 123

Table 6.3: 1996 Income Classifications utilized in this study 123

Table 6.4: 2011 Income Classifications utilized in this study 123

Table 6.8: Effect sizes for Cramer's V 127

Table 7.1: Entropy (H) scores at tract level for Cape Town and Johannesburg (1996-2011) ... 146

Table 7.2: Values for H across all geographic scales for Port Elizabeth (1996-2011) 162

Table 7.3: Values for H across all geographic scales for Cape Town and Johannesburg) 165
Table 7.4: Values for D obtained at tract level 173
Table 7.5: Values for D obtained at a 1km^2 grid resolution 174
Table 7.6: Values for D obtained at a 2km^2 grid resolution 174
Table 7.7: Values for D obtained at a 3km2 grid resolution..... 174
Table 7.8: Values for D obtained at a 4km^2 grid resolution 175
Table 7.9: Values for D obtained at a 5km^2 grid resolution 175
Table 7.10: Values for D obtained at a 6km^2 grid resolution 175
Table 7.11: Values for D obtained at a 7km^2 grid resolution 176
Table 7.12: Values for D obtained at a 8km^2 grid resolution 176
Table 7.13: Values for SI calculated at tract level for 1996, 2001 and 2011..... 177
Table 7.14: Chi-Square and Cramer's V values obtained for Race vs. Income 179
Table 7.15: Chi-Square and Cramer's V values for Race vs. Employment Status..... 179
Table 7.16: Chi-Square and Cramer's V values for Race vs. Level of Educational Attainment 179

LIST OF FIGURES

Figure 2.1: The dimensions of residential segregation 17
Figure 2.2: Stylized segregation profiles for four hypothetical regions, A to D 36
Figure 2.3: Stylized racial distribution patterns for four hypothetical regions, A to D 36
Figure 3.1: Segregation levels (expressed as percentages) for South Africa (1911-1996)..... 59
Figure 4.1: Timeline of major events in South Africa's governance history..... 64
Figure 4.2: Structure of the South African tricameral parliament established in 1984 66
Figure 4.3: The location of the Glen Grey District within South Arica 70
Figure 4.4: The Segregation City model..... 73
Figure 4.5: The apartheid city model..... 77
Figure 4.6: The modified apartheid city model 78
Figure 4.7: Original street layout of a section of Johannesburg 81

Figure 4.8: Altered urban form of a section of Johannesburg after the establishment of numerous road closures 81
Figure 4.9: Model of the 'new apartheid city', wherein segregation is enforced through the establishment of gated communities 83
Figure 4.10: The nature and products of integration and segregation-oriented urban planning mechanisms 84
Figure 5.1:Port Elizabeth area within the Nelson Mandela Bay Municipality, Eastern Cape Province, South Africa 87
Figure 5.2: Port Elizabeth's sub places 88
Figure 5.3: Structural layout of the Port Elizabeth Circa in 1860 91
Figure 5.4: Fingo Village) 93
Figure 5.5: The Esenhigh Survey map of Port Elizabeth, drawn in 1849 94
Figure 5.6: Racial segregation resulting from the Strangers Location Act of 1855 98
Figure 5.7: The locality of colonial Port Elizabeth's locations 98
Figure 5.8: Distribution and racial make-up of Port Elizabeth's population, 1911 104
Figure 5.9: Distribution and racial make-up of Port Elizabeth's population, 1951 106
Figure 5.10: Port Elizabeth's racial zones in accordance with the Group Areas Act of 1950 108
Figure 5.11: Distribution and racial make-up of Port Elizabeth's population, 1985 110
Figure 6.1: The geographical standards for the collection and dissemination of statistical data in South Africa 115
Figure 6.2: Location of Summerstrand, Fairview, New Brighton , and Motherwell in Port Elizabeth 119
Figure 6.3: Summerstrand 120
Figure 6.4: Fairview 120
Figure 6.5:New Brighton 120
Figure 6.6: Motherwell 120
Figure 7.1: Port Elizabeth study area boundary based on enumeration area boundaries from Census 1996 133
Figure 7.2: Port Elizabeth study area boundary based on small area layer boundaries from Census 2001 134

Figure 7.3: Port Elizabeth study area boundary based on small area layer boundaries from Census 2011 135
Figure 7.4: Port Elizabeth's Group Areas (drawn from Census 2011 sub-place data) 136
Figure 7.5: Racial population distribution based on racial self-identification in Census 1996 .. 137
Figure 7.6: Racial population distribution based on racial self-identification in Census 2000 . 138
Figure 7.7: Racial population distribution based on racial self-identification in Census 2011 .. 139
Figure 7.8: Racial diversity at tract (enumeration area) level, Census 1996 142
Figure 7.9: Racial diversity at tract (small areas layer) level, Census 2001 143
Figure 7.10: Racial diversity at tract (small area layer) level, Census 2011 144
Figure 7.11: Entropy (H) scores for Port Elizabeth at tract level for 1996, 2001 and 2011 146
Figure 7.12: Segregation levels (H) measured at tract level for Port Elizabeth, Cape Town and Johannesburg 146
Figure 7.13: Racial diversity at $1km^2$ grid resolution, Census 1996 149
Figure 7.14: Racial diversity at $2km^2$ grid resolution, Census 1996 149
Figure 7.15: Racial diversity at $3km^2$ grid resolution, Census 1996 150
Figure 7.16: Racial diversity at $4km^2$ grid resolution, Census 1996 150
Figure 7.17: Racial diversity at $5km^2$ grid resolution, Census 1996 151
Figure 7.18: Racial diversity at $6km^2$ grid resolution, Census 1996 151
Figure 7.19: Racial diversity at $7km^2$ grid resolution, Census 1996 152
Figure 7.20: Racial diversity at $8km^2$ grid resolution, Census 1996 152
Figure 7.21: Racial diversity at $1km^2$ grid resolution, Census 2001 153
Figure 7.22: Racial diversity at $2km^2$ grid resolution, Census 2001 153
Figure 7.23: Racial diversity at $3km^2$ grid resolution, Census 2001 154
Figure 7.24: Racial diversity at $4km^2$ grid resolution, Census 2001 154
Figure 7.25: Racial diversity at $5km^2$ grid resolution, Census 2001 155
Figure 7.26: Racial diversity at $6km^2$ grid resolution, Census 2001 155
Figure 7.27: Racial diversity at $7km^2$ grid resolution, Census 2001 156
Figure 7.28: Racial diversity at $8km^2$ grid resolution, Census 2001 156
Figure 7.29: Racial diversity at $1km^2$ grid resolution, Census 2011 157
Figure 7.30: Racial diversity at $2km^2$ grid resolution, Census 2011 157
Figure 7.31: Racial diversity at $3km^2$ grid resolution, Census 2011 158

Figure 7.32: Racial diversity at 4km^2 grid resolution, Census 2011 158
Figure 7.33: Racial diversity at 5km^2 grid resolution, Census 2011 159
Figure 7.34: Racial diversity at 6km^2 grid resolution, Census 2011 159
Figure 7.35: Racial diversity at 7km^2 grid resolution, Census 2011 160
Figure 7.36: Racial diversity at 8km^2 grid resolution, Census 2011 160
Figure 7.37: Segregation profile for Port Elizabeth (1996-2011)..... 163
Figure 7.38: Segregation profile for Cape Town 165
Figure 7.39: Segregation profile for Johannesburg 165
Figure 7.40: Diversity Profile for Fairview in 1996 168
Figure 7.41: Diversity Profile for Fairview in 2001 168
Figure 7.42: Diversity Profile for Fairview in 2011 168
Figure 7.43: Diversity Profile for Summerstrand in 1996 169
Figure 7.44: Diversity Profile for Summerstrand in 2001 169
Figure 7.45: Diversity Profile for Summerstrand in 2011 169
Figure 7.46: Diversity Profile for New Brighton in 1996..... 170
Figure 7.47: Diversity Profile for New Brighton in 2001..... 170
Figure 7.48: Diversity Profile for New Brighton in 2011..... 170
Figure 7.49: Diversity Profile for Motherwell in 1996..... 171
Figure 7.50: Diversity Profile for Motherwell in 2001..... 171
Figure 7.51: Diversity Profile for Motherwell in 2011..... 171

ACKNOWLEDGEMENTS

I would like to extend special thanks to my supervisor, Professor Roddy Fox, for his expertise and continual guidance and support, without which this thesis would not have been completed. Thanks are also owed to Ms. Dawn McCarthy for her participation in this study, as well as to Mr. Kevin Parry for his expertise and the provision of Census data.

I would also like to acknowledge my funders, the Canon Collins Trust and the National Research Foundation, for their financial support.

Disclaimer: Opinions expressed and conclusions drawn are those of the author (unless otherwise stated), and do not necessarily represent the views of Rhodes University, the participants in this study, and the funders.

GLOSSARY

ANC	African National Congress
BEE	Black Economic Empowerment
CBD	Central Business District
D	Dissimilarity Index
DEDEA	Department of Economic Development and Environmental Affairs
EA	Enumerator Areas
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GVA	Gross Value Added
H	Entropy Index/Segregation
h	Diversity
MAUP	Modifiable Area Unit Problem
NMBM	Nelson Mandela Bay Municipality
RDP	Reconstruction and Development Programme
SAL	Small Area Layer
SI	Segregation Index
SMSA	Standard Metropolitan Statistical Areas
USA	United States of America

CHAPTER 1: INTRODUCTION

1.1. Background, Context and Motivation

"It is still too early to talk about the 'post-apartheid' era in other than political terms as the spatial systems and physical structures inherited from the past were solidly constructed and are proving to be remarkably resilient."

Christopher (2001a: 1)

As described by Christopher (2001a:1), the spatial development of South African cities has, from the outset, been governed by a number of "momentous social engineering projects", including colonialism, the apartheid regime, and most recently, democratization. Racial segregation[1] was the prime objective of the colonial and apartheid regimes. This study aims to investigate the extent to which this segregationist legacy prevails in the urban spatial layout of Port Elizabeth.

According to Lefebrve (1968), spatial organization is a crucial component of human societies, influencing social relations and revealing social truths and injustices. Therefore, when attempting to understand any form of social injustice, it is important to examine the relationship that exists between society and space. Soja (2009) describes the notion of the socio-spatial dialectic, in which it is stated that space shapes society and society, in turn, shapes space. This theory holds true within the South African urban context, in which the segregationist ideals of the White minority rule governed the spatial development of cities in the colonial and apartheid eras, while in the post-apartheid era, it is this spatial legacy which largely contributes to racial inequalities.

Before its colonization, South Africa had no established urban tradition; South African cities, therefore, were established by White settlers as their own cultural dominions (Lemon, 1991). While the White settler population required Black labourers, they were not willing to accept

[1] The terms 'segregation' and 'integration' will refer specifically to racial segregation/integration.

Blacks as equal citizens in their newly annexed domains (Lemon, 1991). Racial exclusion and segregation, therefore, represent the inherent 'congenital defects' present with the birth of urban spatial planning in South Africa. As Maylam (1990) states, efforts to extort labour from Blacks, while controlling their access and rights to urban space, have been a major influencing factor in the development of urban policy in the country, resulting in controls being put in place to govern the rural-urban migration and settlement of those who were classified as 'non-White'.

While segregationist ideals have, from the outset, influenced the nature of urban spatial planning in South Africa, its entrenchment into the legislation governing spatial planning began in 1948, with the start of the apartheid era. Apartheid (Afrikaans for 'apartness') refers to the legally-enforced segregationist policy enforced by the National Party government, which promoted the political, social and cultural segregation of racially-defined communities for the sole benefit of the White minority (Christopher, 2001). While a loose zonal framework of segregation was already present in most South African cities, the Group Area Act of 1950 cemented this. The Act stated that individuals classified under differed race groups, as defined by the Population Registration Act of 1950 (Whites, Blacks, Indians and Coloureds)[2] were to live in separate demarcated residential areas. According to Davies (1976, cited in Smit, 1989: 100) what resulted was a "city more structured and quartered than anything which preceded it".

The year 1991 saw the repeal of the Population Registration Act and other major legislation enforcing racial segregationist agendas in South Africa, marking the beginning of the country's transition towards racial integration. Since the attainment of democracy in South Africa in 1994, numerous efforts have been made to facilitate the integration and transformation of the apartheid urban fabric. In 1996, the state adopted a new constitution, aimed at righting the wrongs of the past and laying the foundation for a free and open society, governed by democratic ideals of equal human rights and social justice. The year 2014 was a significant milestone as it marked the twentieth year of democracy in South Africa. Now that more than 20 years have passed since the repeal of apartheid legislation, it seems a suitable time to investigate the extent to which post-apartheid cities reflect the fundamental values on which our constitution is based.

[2] It is standard practice, when referring to race groups in South Africa, to refer to Africans, Indians, coloureds, and whites. The South African Census classifies South Africa's population into four dominant racial groupings, these being: Black African, Coloured, Indian or Asian, and White. In this report, these groups will simply be referred to as African, Coloured, Indian, and White.

Dijkstra *et al*. (2001), in their paper which critiques efforts made towards the reconfiguration of urban spaces in post-apartheid Durban, stated that integration recognizes the existence of racial diversity and guarantees the rights of individuals to preserve and practice their cultures, while being privileged to full participation in (and adherence to) the constitutionally-defined principles governing a society. In the context of the 1996 South African constitution, integration is aimed at levelling the constitutional rights of four race groupings (Africans, Coloured, Indians and Whites), as defined by the 1996 census. The transformation of the post-apartheid city embraces the ideal of a non-racial spatial order, wherein various types of geographic space (including residential, recreational and heritage sites) are legally accessible to all citizens, irrespective of race (Williams, 2000).

In order to achieve this, numerous pieces of legislations were passed by the democratic government; this included the Development Facilitation Act (1995) and the Local Government Transition Act Second Amendment (1996), which directed all local councils to develop plans that facilitated the development of more integrated settlements. The Department of Human Settlement's Breaking New Ground initiative, introduced in 2004, was aimed at promoting the "achievement of a non-racial integrated society through the development of sustainable human settlements and quality housing" (Department of Human Settlements, 2009: 18).

Since the passing of the Abolition of Racially Based Land Measures Act in 1991, it has been legally possible for individuals from all race groups to reside in residential areas from which they were formerly excluded without any legal restrictions. However, the inherited city fabric and the lack of economic opportunities prevalent in those areas that were formerly marginalized, significantly inhibit the majority of the South African population from employing this newly acquired right of spatial mobility (Cristopher, 2001b). Seekings (2012: 9) corroborates this statement, describing post-apartheid South Africa as being characterized by the "dual legacies of apartheid", that being cultural diversity and economic inequity, both of which are race-related. Numerous studies have been carried out that have linked racial segregation to economic factors and persistent income inequalities. A study by Bwalya and Seethal (2015) investigated socio-spatial integration in post-apartheid South Africa by analyzing residential property transfer data from 1993-2008 in the former White residential areas of the Eastern Cape's second metropole (Buffalo City). The study found that the post-apartheid racial integration that took place was

class-based, with the majority of Black[3] property transfers occurring in relatively cheaper suburbs, while the majority of White buyers purchased property in more expensive suburbs.

Therefore, residential segregation remains a prominent feature of the post-apartheid urban landscape (Christopher, 1999, 2001a,, 2001b, 2005; Bwalya and Seethal, 2015). Furthermore, old patterns of segregation are being reinforced by the emergence of new segregation patterns, such as gated communities (Bremner, 1999; Harrison, 2003). The consideration of racial segregation in the post-apartheid context is of immense importance. Determining the extent to which society remains racially segregated is essential in monitoring the successes and shortcomings of policy interventions aimed at endorsing integration. Furthermore, numerous studies have demonstrated the adverse impacts stemming from a segregated society, showing that segregation can be correlated to a number of prevalent socio-economic issues that need to be addressed. According to Horn (2005), racial segregation is a primary cause of economic, social, political and institutional exclusion, and is therefore the root of social injustice. A study by Lee *et al.* (2008) examining the social impacts of ethnic segregation found that segregation was directly linked to discrepancies in education, employment, safety and health.

This study draws its motivation from the context of spatial justice in that it seeks to investigate post-apartheid segregation from a spatial, as well as temporal, perspective. To do this, census data from 1996, 2001 and 2011 are used to map the racial makeup of Port Elizabeth's residential areas to determine to what extent racial integration has been achieved thus far in the post-apartheid era. Furthermore, it seeks to contextualize the observed trends in racial mobility within legislative and policy frameworks that have been implemented to this regard, as well as the changing socio-economic environment. A study of this nature is crucial to assess the relative success of governmental actions enacted thus far to promote racial integration, and can also aid in advising future spatial planning and policy formation.

In doing so, this study aims to contribute to the existing literature on the subject of post-apartheid racial residential segregation in South Africa. Data from the 2011 National Census have only recently been incorporated into such studies. Furthermore, it aims to add a different dimension to the extensive research conducted by Christopher (1999, 2001a, 2001b and 2005) in the city of

[3] Black collectively refers to members of the African, Indian/Asian and Coloured populations, while Black refers to members of the African population alone.

Port Elizabeth by, firstly, analyzing data across geographical scales using racial information at the smallest available levels. Furthermore, in conjunction with the traditionally used dichotomous measures used to measure segregation (namely the dissimilarity and segregation indices), this study aims to incorporate a different measure, this being Theil's entropy index, to investigate segregation from a multi-ethnic perspective.

1.2. Research Aim and Objectives

This study aims to determine the trends in post-apartheid racial segregation that have occurred in Port Elizabeth from 1996 to 2011 at different geographic scales based on the data collected in the National Censuses and to investigate the linkages to the socio- economic position of households. Eight individual objectives were formulated to achieve this aim:

i. Define appropriate study area boundaries for each of the census periods being investigated.

ii. Map the racial distribution of Port Elizabeth's population from 1996 to 2011.

iii. Measure the changes in racial segregation in Port Elizabeth from 1996 to 2011 using a multi-group index.

iv. Measure the changes in racial segregation from 1996 to 2011, using a multi-group index, across different geographic scales to develop a segregation profile for Port Elizabeth.

v. Investigate the changes in racial diversity across geographical scales for selected areas in Port Elizabeth.

vi. Measure the changes in racial segregation between the specific race groups in Port Elizabeth from 1996 to 2011 using dichotomous indices.

vii. Investigate the relationship between race and various socio-economic variables to determine possible constraints to achieving racial integration.

viii. Conduct interviews with relevant government persons involved in spatial planning to contribute further understanding of the processes governing the spatial dynamics of Port Elizabeth.

1.3. Structure of the Thesis

The Literature Review will be presented in two chapters: Chapter 2 will explore the theoretical foundations underpinning this field of study, and will then examine the methodological approaches implemented when conducting research. Case study examples of such research, both in the South African and international context, will be critically examined in Chapter 3. Chapter 4 endeavours to explore the nature of racial segregation in the South African context. The Study Area chapter (Chapter 5), which follows, will present an overview of Port Elizabeth's unique history of segregation, and will review the relevant literature pertaining to segregation research on this city. Relevant information on the geography and demographics of the city are also presented here. Overall, this chapter will identify three significant gaps apparent in the literature when considering racial segregation in the South African context: (i) the majority of the research investigating racial segregation in South African cities (and none of the research investigating this topic in Port Elizabeth) have relied solely on dichotomous indices that are not suitable when examining a multi-ethnic society; (ii) geographic scale does not factor into the research that has been conducted in Port Elizabeth thus far, and (iii) the data from the most recent 2011 National Census has not yet been incorporated into studies investing post-apartheid segregation in Port Elizabeth. In response, this chapter will explore the use of multi-group indices in investigating racial segregation, as well as the methodological approaches to incorporating geographic scale into research of this nature. Chapter 6 is the 'Methodology' chapter. It will present information

on how the Census data was manipulated and analyzed, and will discuss the methods employed to carry out each of the research objectives. It will also provide information on how the generated results were analyzed. The empirical and qualitative findings are presented in the Chapter 7.

The interpretation of the results, as well as the overall deductions drawn, are presented and contextualized within the broader spectrum of the existing body of literature in the 'Discussion and Conclusion' chapter. Furthermore, this section will present the shortcomings of the study and propose suggestions for future potential studies on this topic.

CHAPTER 2: THEORETICAL UNDERPINNINGS AND METHODOLOGICAL APPROACHES OF SEGREGATION STUDIES

2.1 Introduction

Racial segregation has been the focus of extensive research within the field of urban geography, particularly in the United States of America (USA). Comparatively little research has been conducted within the South African context relative to the United States, although this remains a highly relevant topic. This section aims to review the existing literature pertaining to racial segregation studies. The chapter is comprised of six sections that aim to evaluate the existing literature on segregation studies from the theoretical perspective.

In brief, this chapter will explore with the theoretical foundations of segregation research and the methodological approaches to investigating racial segregation. Sections 2.1 and 2.2 will explore its definitions and theoretical models respectively. Section 2.3 examines the ways in which segregation is measured, both quantitatively and qualitatively, across its various dimensions (highlighted in Section 2.4), while briefly touching on the importance of this topic from a geographical perspective. The use of segregation indices is then discussed in Section 2.5. Specific emphasis is placed on discussing the application of the Dissimilarity Index (the most historically utilized index in segregation research) and the Entropy Index (an index which has gained recent prominence in segregation research). The potential benefits of integrating Geographical Information Systems (GIS) to enhance segregation studies is noted in Section 2.6, highlighting the capacity for new and innovative approaches to be incorporated in this field of research. Lastly, the theoretical importance of incorporating scale into segregation research is discussed in Section 2.7, as well as methods of achieving this.

2.2. Defining Residential Segregation

Residential segregation generally refers to the differentiation of two or more population groups into distinct units of physical space. Population groups have been defined along racial, religious and socio-economic lines.

White (1983) differentiates between sociological segregation and geographical segregation, the former describing the lack of interaction between different social groups and the latter referring to lack of evenness in the distribution of different social groups in space. While these two types of segregation are not strictly mutually exclusive, they are correlated. As White (1983) states, policy interventions aimed at desegregating communities are usually based on the presumed correlation of the two segregation types. Similarly, the use of empirical segregation indices to make inferences about the structures of communities is reflective of this same presumed relationship.

Furthermore, as White (1983) argues, spatial proximity between different social groupings is vitally important when investigating segregation; how far one lives from people who are considered different defines, to a large extent, the nature of one's urban social life by limiting opportunities for exposure and interaction with a diverse range of people. Mortensen (2013) describes how similarity theory (which states that familiar objects are preferred over unfamiliar ones) applies to people; people tend to gravitate to people who are perceived as similar to themselves, sharing common backgrounds, financial means and perspectives.

Masset and Denton (1988) define segregation as the extent to which two or more population groups live separately from one another in an urban setting. Traditionally, segregation is considered to function as a self-sustaining cycle, in which it is argued that social division itself contributes to processes, situations and further trends in segregation (Wilson, 1987; Massey and Denton, 1989).

Horn (2005) expand on this definition, in which he defines two components of which segregation is comprised, that being behavioural segregation and distributive segregation (Horn, 2005). The behavioural component is concerned with institutional and normative aspects, including national and institutional policies and the values and attitudes accepted collectively by society; this

component of segregation is qualitatively analyzed (Horn, 2005). The distributive component of segregation, which forms the focus of this study, is concerned with patterns and the processes driving segregation; this aspect of segregation is investigated quantitatively through the use of segregation indices (Horn, 2005). Although the two are often analyzed separately, they are, in reality, inextricably linked - the distributive component can establish *what* patterns exists, the behavioural component explains *why.*

2.3. Theoretical Models of Segregation

"Residential segregation tends to become problematic if it is associated with overlapping inequalities that persist across generations." (Iceland, 2014:3).

Four theoretical models have been formulated to describe the connection between spatial location and social status (Alba and Logan, 1991, 1993; Zelinsky and Lee, 1998; Peach, 1996, 2005). These are: (i) place stratification, (ii) spatial assimilation, (iii) heterolocalism, and (iv) the dichotomy of ethnic enclaves versus ethnic ghettos. The first two of these theoretical models, proposed by Alba and Logan (1991; 1993) consider changes in residential localities of certain ethnic groups as an indicator of changing social status. The latter two models, proposed by Zelinsky and Lee (1998) and Peach (1996; 2005) respectively, were introduced later to address the shortcomings of those proposed by Alba and Logan.

2.3.1. Place Stratification

In this model, social barriers limit the spatial integration of ethnic groups, thereby resulting in a racially segregated city. As Alba and Logan (1991) explain, place stratification results when members belonging to an ethnic or racial group are unable to use socio-economic gains to bring about a change in residential location that is conducive to assimilation into the greater population. For example, housing discrimination by landlords and property agents may serve as a barrier preventing members belonging to a specific ethnic group from purchasing property in

affluent areas, regardless if they have the financial means to afford it. Place stratification has resulted in the formation of ethnic ghettos that continue in existence for generations.

2.3.2. Spatial Assimilation

In this model, fewer social barriers inhibit the movement of members of ethnic groups. Therefore, some members of ethnic groups are able to relocate and assimilate into broader society. According to Alba and Logan (1991), residential mobility is a step towards achieving ethnic or racial assimilation. From this perspective, the spatial distribution of ethnic residential locations can be considered as a gauge of social inequality.

2.3.3. Heterolocalism

A shortcoming of the above two theoretical models is that they do not account for the possibility that members of an ethnic group may reside within an ethnically diverse area, but still not be assimilated within broader society.

Addressing this, Zelinsky and Lee (1998) developed the model of heterolocalism, referring to individuals with a shared ethnic identity that take on a dispersed pattern of residential location, yet who maintain their social cohesion by various other means despite the lack of spatial proximity. Examples of such means could entail ethnic congregation at cultural establishments such as restaurants or religious institutions. Heterolocalism, therefore, entails a lack of ethnic segregation coupled with a lack of the spatial assimilation of ethnic group members into broader society. This model, therefore, opposes the spatial assimilation model which equates the mobility of ethnic group members with their assumed assimilation into wider society.

2.3.4. Ethnic Enclaves and Ethnic Ghettos

Peach (1996) emphasizes that racial segregation can have both positive and negative impacts, a feature conceptualized in the dichotomy of the ethnic 'enclave-ghetto' paradigm. According to Peach (1996), there exists both 'good' and 'bad' segregation; the former entails the 'safety in numbers' analogy, whereby members receive cultural acceptance and support from one another and strive to preserve a common heritage, while the latter refers to segregation circumstances which impose limitations on the life chances of residents. The single element which differentiates the two types is that of choice. If ethnic groups choose to reside in segregated neighbourhoods, these neighbourhoods are classified as ethnic enclaves. In contrast, if members are forced, either by coercion or circumstance, to live in a segregated neighbourhood in which their social standing and spatial mobility become inhibited, such a neighbourhood would be classified as an ethnic ghetto.

What this paradigm does not take into account is that the choice to be segregated within an ethnic enclave may be influenced by factors such as discrimination and negative racial stereotypes. In such a scenario, whether such segregation can still be considered good becomes a much more complex question. Furthermore, as Peach (2005) emphasizes, the dichotomy of enclave versus ghetto is too simplistic, discounting the fact that a case of segregation can simultaneously have good and bad impacts. Peach (2005), therefore, proposes that segregation be considered as a spectrum, with enclave and ghetto representing the opposite extremities. The number of positive impacts relative to the number of negative impacts would then ultimately determine if a segregated neighbourhood should be considered as an ethnic enclave or ghetto.

In his classification of racial segregation as a continuum, Peach (2005) defined five main types of segregated neighbourhoods:

i. Transitional Assimilation-Diffusion: neighbourhoods where consecutive generations have relocated over time. This type of segregation complies with the spatial assimilation model.
ii. American Ghetto: neighborhoods where racial segregation is involuntary. This type of segregation complies with the place stratification model.

iii. Voluntary Plural-Persistent Enclave: neighbourhoods where residents with a shared ethnic identity wish to remain in an enclave that has thriven over time.
iv. Voluntary Plural-Relocated: neighbourhoods into which there was a mass movement by members of a common ethnic group.
v. Parachuted Suburb: racially-concentrated neighbourhoods comprised of affluent members of an ethnic group (often temporary immigrants).

The case of racial segregation enforced under the South African apartheid regime falls within the 'American ghetto' category. However, the other segregation types categorized by Peach (2005) may prove useful to describe the racial residential patterning emerging in the post-apartheid context.

2.4. Quantitative Measurement of Segregation

Jahn *et al*. (1947) presented the first article detailing methodological approaches to measuring 'ecological segregation'. The authors aimed to provide a mathematical definition for segregation, which up until then had primarily only been approached from a sociological, theoretical perspective. In doing so, the authors first defined the necessary properties of suitable segregation measures, after which they developed four indices which conform to these, in conjunction with being logically sound and computationally feasible. Finally, the authors conclude that no index could be considered superior to another, and that not all are equally applicable in all situations.

Williams (1948) scrutinized the study by Jahn *et al*. (1947) and similar works in her commentary on proposed segregation measures. The author explicates the mathematical properties of previously derived segregation indices. The author defines two additional properties for a desirable index, but does not take this forward in developing one.

Bell (1954) developed the 'P' family of indices, which was most applicable in measuring the segregation dimension of exposure, referring to the degree to which members belonging to separate population groups are exposed to or isolated from one another in a social setting. The dimensions of segregation will be subsequently addressed in detail in Section 2.5.

In their seminal work, Duncan and Duncan (1955) reviewed a variety of proposed segregation indices. The authors argued that all of these indices were variations of a common fundamental geometrical paradigm which they defined as the 'segregation curve'. After appraising the strengths and weaknesses of these indices, they then devised their own, known as the Dissimilarity Index. The authors argued that their Dissimilarity Index was superior to all other measures. It subsequently became the dominant segregation measure used in the field of segregation studies for over two decades, a period which Massy and Denton (1988) would later refer as the 'Pax Duncana'. The Dissimilarity Index will be explored in greater detail in Section 2.6.1.

Winship's (1977) paper presented the first critique of the Dissimilarity Index, contending that this index yielded an arbitrary value for interpretation. The focus of this paper was to determine the appropriate baseline against which segregation measures should be compared for analysis. The author concludes that random segregation should serve as a baseline in investigations into the causes of segregation, and that complete segregation should serve as the baseline in investigations into the consequences of segregation. This paper was subsequently followed by studies, described below, proposing alternate spatial and multigroup measures.

White (1983) derives four variations of a measure known as the Proximity Index. This measure quantified the degree to which groups were clustered together or widely dispersed within an urban unit. The author applied this measure to seventeen metropolitan areas in the USA. James and Tauber (1985) differentiate between segregation indices that calculate (i) the central tendency of distribution among groups in a population and (ii) those that measure the extent of dispersion of groups in a population. The authors define five methodological criteria on which segregation scores should be assessed. Based on the evaluation of five indices based on these criteria, the authors concluded that the Dissimilarity Index was the most suited.

After a decade of reintroduced debate, Massey and Denton (1988) conducted a comparative analysis of twenty segregation indices. The authors theorize that segregation can be decomposed into five distinct dimensions, discussed below. The authors conducted a factor-analysis and appraisal of each of the segregation indices for sixty metropolitan areas in the USA. The study recommends a different index for the investigation of each of the respective dimensions.

2.5. The Dimensions of Distributive Segregation

The study conducted by Massey and Denton (1988) recommended the use of a different index for each of their five defined dimensions of segregation. In order to then choose the appropriate index for the current study, it becomes imperative to consider these dimensions in greater detail.

Massey and Denton (1988) acknowledged that different population groups could be segregated in a number of ways, and, therefore, outlined five dimensions of distributive segregation: *evenness* (how uniformly population groups are distributed), *exposure* (chance of different groups being in contact), *concentration* (the relative amount of physical space occupied by specific population groups), *centralization* (the proximal location of different population groups relative to the urban center) and *clustering* (the extent to which zonal areas inhabited by the same population group are adjoined). Table 2.1 shows the segregation indices recommended by Massey and Denton (1988) for each of their five dimensions.

Table 2.1: Recommended segregation index for calculating each of the segregation dimensions (Massey and Denton, 1988)

Segregation Dimension	Suitable Segregation Measure
Evenness	Dissimilarity Index
Exposure	*P* Indices
Concentration	Absolute Concentration Index
Centralization	Absolute Centralization Index
Clustering	Spatial Proximity Index

In reviewing these five dimensions, Reardon and O'Sullivan (2004) remark that evenness and exposure are implicitly spatial (because their computation is subject to census tract boundaries) and that concentration, centralization and clustering are explicitly spatial (because computation requires additional information on the size and location of census tract boundaries). Reardon and O'Sullivan (2004) also argue against the need for a distinction between evenness and clustering, stating that the movement of an individual that resulted in decrease in evenness would also result in an increase in clustering. From this perspective, Reardon and O' Sullivan (2004) instead proposed two dimensions of spatial segregation: *spatial evenness (or clustering)* and *spatial exposure (or isolation). Spatial evenness* refers to the degree to which different social groups are similarly distributed in space (Reardon and O Sullivan, 2004). *Spatial exposure* refers to the extent that individuals belonging to different social groups come across each other within their local spatial settings (Reardon and O'Sullivan, 2004). Massey and Denton's dimensions of concentration and centralization are considered as sub-classes of spatial evenness. The authors state, however, that the context of a study necessitates whether they should be addressed as distinct sub-dimensions. Furthermore, Wong (2008) questions the relevance of centralization to segregation studies given that the majority of cities have now become polycentric in nature.

From their theoretical standpoint, Reardon and O'Sullivan (2004) follow the example of Massey and Denton (1988), conducting their own review of a variety of segregations indices with respect to their two defined dimensions. They evaluated measures of segregation against eight desirable methodological properties and concluded that Theil's Entropy Index and the Spatial Exposure Index should be used for measuring spatial evenness and spatial exposure respectively. This study, which investigates spatial evenness, utilizes Theil's Entropy Index.

Figure 2.1 demonstrates how Reardon and O'Sullivan's dimensions of spatial evenness and spatial exposure are discrete entities. Each of the quadrants represents a separate neighbourhood, comprised of numerous households (circles). Each household is, furthermore, classified into one of two different racial groupings (indicated by the circle colour). Both neighbourhoods A and B have an even distribution of African and White households (i.e. low levels of clustering). Neighbourhood B has more African households situated in the vicinity of each White household, indicating that while both neighbourhoods have high levels of evenness, they differ with respect to their levels of White-African exposure. Neighbourhoods C and D both have high levels of

clustering. White-African exposure levels in these two neighbourhoods correspond to those in the neighbourhoods in the above quadrants, with there being more African households located in close proximity to White households.

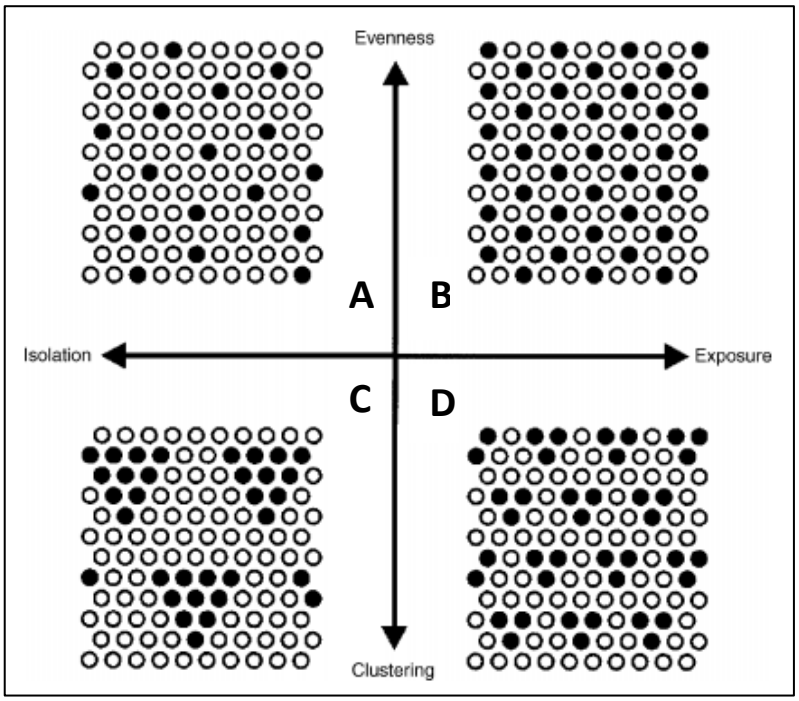

Figure 2.1: The dimensions of residential segregation (Reardon and O'Sullivan, 2004)

2.6. Segregation Indices

To reiterate, numerous indices have been developed to quantify each of the above dimensions of segregation, all of which are based on the relative proportion of social groups occupying designated geographic units (Massey and Denton, 1988). All of these indices quantify different facets of segregation and are all valid measurements (Jahn *et al*, 1947; Massey and Denton, 1988; Reardon *et al*., 2004); the nature of the study ultimately determines which is the most

suitable. In order to choose the appropriate measure(s) for the current study, it is imperative to first identify the segregation dimension being considered.

According to White (1983:1009), segregation, from a geographic perspective, refers to the "unevenness in the distribution of individuals across physical space". The focus of this study, therefore, will be primarily on (spatial) quantifying evenness, which considers how uniformly different social groups are distributed across defined spatial units within an urban area. Numerous academics have singled out evenness as the most important dimension of segregation (Massey and Denton, 1988; Wong, 1999; Horn, 2005).

Reardon and Firebaugh (2002) note that all the major literature reviewing the various segregation indices (e.g. Duncan and Duncan, 1955; Zoloth, 1976; James and Taeuber, 1985; Massey and Denton, 1988; White, 1986; Massey *et al.*, 1996) have all limited their analysis to dichotomous measures of segregation. When segregation is being investigated in communities characterized by multiple groups, it becomes imperative to select an index that can completely reflect multi-ethnic situations (White, 2004). This, therefore, presents a compelling argument for implementing Theil's Entropy Index when examining segregation in a multi-ethnic context.

As stated above, there are two segregation indices that are aimed at quantifying (spatial) evenness: the Dissimilarity Index (D) and Theil's Entropy Index (H) (Massey and Denton, 1988; Reardon and O'Sullivan, 2004). D has been extensively used to calculate racial segregation for Port Elizabeth and other South African cities, while H had only recently been used to investigate segregation in the cities of Johannesburg and Cape Town. Both of these will now be discussed in detail.

2.6.1. The Dissimilarity Index

The Dissimilarity Index (D) was proposed by Duncan and Duncan (1955). It measures the structural segregation of one ethnic group from another. D can also be applied as a measure of segregation between one ethnic group relative to the remaining population; in this case, it is referred to as the Segregation Index (SI). It yields a value ranging from 0 (complete integration) to 100 (complete segregation). Conceptually, the Dissimilarity Index indicates the percentage of

a group's population that would have to move to another neighbourhood so that each neighbourhood in a defined area (e.g. a city or metropolitan area) would contain the same proportion of that group as the entire area concerned. The generally accepted interpretation of this index amongst academics is that a D value ranging from 0 to 30 represents low levels of segregation, and a D value greater than 70 represents high levels of segregation (Kaplan *et al*. 2009). The index is computed with the following formula, obtained from Frey and Myers (2005).

$$D = \frac{1}{2}\sum_{i=1}^{n} \left| \frac{P_{1i}}{P_1} - \frac{P_{2i}}{P_2} \right| \quad (1)$$

Where n = number of census tracts or spatial units

P_1 = Population of race group 1 in the entire study area

P_2 = Population of race group 2 in the entire study area

P_{1i} = Population of race group 1 in the *i*th census tract

P_{2i} = total number of race group 2 in the city *i*th census tract

Table 2.2 represents a worked example based on hypothetical census data, for six tracts with three race groups, provided by Forest (2005). The calculated value for D represents the percentage of a population group that would have to relocate in order to achieve a uniform distribution. In the example below, 60 percent of the Black (or White) population would have to relocate in order to achieve complete integration between the two groups; 38 percent of the Asian (or White) population would have to relocate to achieve complete Asian-White integration; and 48 percent of the Black (or Asian) population would have to move to achieve complete Black-Asian integration.

Table 2.1: Worked example of the Dissimilarity Index (Forest, 2005)

Tract	White	Black	Asian	wi/WT	bi/BT	ai/AT	Absolute Value (wi/WT-bi/BT)	Absolute Value (wi/WT-ai/AT)	Absolute Value (bi/BT-ai/AT)
1	100	0	10	0.23	0.0	0.08	0.23	0.15	0.08
2	120	10	20	0.27	0.07	0.16	0.20	0.11	0.09
3	40	0	5	0.09	0.00	0.04	0.09	0.05	0.04
4	50	20	50	0.11	0.14	0.40	0.03	0.29	0.26
5	100	20	20	0.23	0.14	0.16	0.08	0.07	0.02
6	30	90	20	0.07	0.64	0.16	0.57	0.09	0.48
Sum	440	140	125				1.21	0.76	0.97
						D=	0.60	0.38	0.48

The Dissimilarity Index has been historically very popular and has become the international standard measure of segregation in studies investigating residential segregation (White, 1983; Massey and Denton, 1988). Also, as stated by Horn (2005), the index became the standard measure of urban racial segregation in South Africa during the apartheid and post-apartheid eras (Davies, 1971; Christopher 1990, 1994, 1988, 2001a, 2001b; Donaldson and van der Merve, 1999). Therefore, it provides a measure of segregation that is commonly understood and very comparable to previous studies. Additionally, the Dissimilarity Index is easily computed, with the only required data inputs being the proportions of the various social groups at tract level and for the city as a whole. Furthermore, it is easily interpreted and is independent of population composition (White, 1983).

There are also many disadvantages associated with the Dissimilarity Index. A major criticism of the Dissimilarity Index is the 'checkerboard problem', that being that the index considers each aerial unit as a discrete entity, discounting possible spatial relationships between tracts (Morrill, 1991). This means that if each aerial unit is dominated by one population group, the value for D will be 100, indicating complete segregation. This does not consider the possibility that adjacent aerial units may be dominated by different groups, or allow integration between units to lower segregation values. Scale dependency, or the grid problem, is another weakness of the Dissimilarity Index (Morrill, 1991; Wong, 1993). Openshaw (1984) showed that smaller units

(more areas) in a grid system yielded higher values for D than larger units (fewer areas); therefore altering the scale and the number of units in a grid results in a distortion of results. Furthermore, the Dissimilarity Index only yields a single value for an entire study area and can only calculate segregation between two population groups at a time (Reardon and Firebaugh, 2002; Reardon and O'Sullivan, 2004).

Reardon and O'Sullivan (2004) emphasized that the Dissimilarity Index, being a dichotomous measure, was unsuitable for quantifying segregation in cases characterized by the presence of multiple ethnic groups. The authors proposed Theil's entropy index, which apart from being a multi-group index, also generates racial diversity for sub-units within in a study area as well as an overarching segregation value. This index will now be considered in further detail.

2.6.2. The Entropy Index

The Entropy Index (H), also referred to as the information index, proposed by the Dutch economist Henry Theil in 1971, represents a measure of segregation based on entropy (Theil and Finizza, 1971). In other words, it is based on comparisons between the diversity measured at one smaller scale (e.g., census tracts) to the diversity measured at a higher scale (e.g. a city boundary) (Morse, 2012). While the Entropy Index has not historically been utilized as often as the Dissimilarity Index in segregation research, and in the past was more referred to by economists and sociologists (in studies relating to aspects of inequality) than geographers, it is now becoming increasingly popular (Iceland *et al*., 2002). The extensive use of the Entropy Index in the geographical sphere is detailed in section 2.6.4.

Parry (2012), who applied the Entropy Index in his investigation into segregation in the cities of Cape Town and Johannesburg, notes there are several ways of calculating Theil's entropy index, stating that they are all derived from the same basic equation and inevitably yield identical results. This study used the equations developed by White (1986), which he applied to measured segregation for twenty-one SMSA's (Standard Metropolitan Statistical Areas) in the USA. These equations are detailed below.

Theil's Entropy Index is comprised of two calculations. The first equation calculates the diversity score (*h*) for every sub-unit of the study area, as well the study area as a whole, and is as follows:

$$h_i = -\sum^{k} p_{ij} \ln(p_{ij}) \qquad (2)$$

Where *k* =number of race groups

pij =proportion of population of jth ethnicity in tract i (=nij/ni)

nij =number of population of jth ethnicity in tract i

ni =total number of population in tract i

In the Entropy Index, *h* is a measure of the diversity of each sub-unit, taking into account the relative size of the population within each sub-unit to that of the entire study area. This calculation needs to be applied to each sub-unit of the study area, as well as to the study area as a whole, using the totaled values.

The *h* scores calculated using the above equation are then used in the second calculation to compute the Entropy Index (*H*) for the entire study area. The following equation, used by White (1986), was selected for this study:

$$H = \left(\hat{H} - \overline{H}\right) / \hat{H} \qquad (3)$$

Where $\hat{H}$ = Entropy Index for the city as a whole (i.e. the sum of the *h* scores of all the sub-units

$\overline{H}$ = the average of the individual tracts' *h* scores, weighted by their populations as a proportion of the entire population.

H yields a value ranging from 0 (complete integration) to 1 (complete segregation). Unlike *h*, *H* can only be calculated for the entire study area as a whole. Like the Dissimilarity Index, the Entropy Index is a measure of evenness that compares the proportion of separate groups in individual tracts to the proportion of those groups within the city as a whole. However, there are several advantages it has over the more commonly used Dissimilarity Index:

i. It is a multi-group measure of segregation, meaning that it can measure segregation among more than two groups simultaneously. The Dissimilarity Index can only measure the segregation between two groups at a time (White, 1986; Wong, 1996; Reardon and Firebaugh, 2002; Iceland, 2004).
ii. It yields a diversity measure for every sub-unit within a study area, unlike the Dissimilarity Index, which produces a single segregation value for the entire study area (White, 1986; Wong, 1996; Reardon and Firebaugh, 2002; Iceland, 2004; Horn, 2005).
iii. It is a decompositional measure, meaning that it can be aggregated and disaggregated. It can, therefore, be used to measure segregation at different scales (Reardon and

Firebaugh, 2002; Fischer *et al.*, 2004; Morse, 2012). . Furthermore, this allows the researcher to use subgroups of racial categories (White, 2004).

Table 2.3 represents a worked example based on hypothetical census data, provided by Forest (2005). Firstly, diversity (*h)* is calculated for each of the individual tracts and for the city as a whole. The maximum value for *h* is ln(*k*), which for the example below, would be ln(3)=1.10. Tracts with an *h* value of 1.10 will contain equal proportions of all race groups, while those with *h*=0 will contain only one race group. From Table 2.3, it is evident that tracts 4 and 6 have the highest diversity values.

Table 2.2: Worked example of Theil's entropy index (Forest, 2005)

Tract	White (1)	Black (2)	Asian (3)	Total Population	Proportion White	Proportion Black	Proportion Asian	h=- p1*ln(p1)+ p2*ln(p2)+ p3*ln(p3)
1	100	0	10	110	0.91	0.00	0.09	0.30
2	120	10	20	150	0.80	0.07	0.13	0.63
3	40	0	5	45	0.89	0.00	0.11	0.35
4	50	20	50	120	0.42	0.17	0.42	1.03
5	100	20	20	140	0.71	0.14	0.14	0.80
6	30	90	20	140	0.21	0.64	0.14	0.89
Total	440	140	125	705	0.62	0.20	0.18	0.92

The *h* values obtained for each of the tracts in the above example are then weighted relative to the city's total population, as is shown below in Table 2.4.

Table 2.3: Weighted diversity (h) values (Forest, 2005)

Tract i=1,2,3…	h=-p1*ln(p1)+ p2*ln(p2)+ p3*ln(p3)	Proportion of Total Population	Weighted Average
1	0.30	0.16	0.05
2	0.63	0.21	0.13
3	0.35	0.06	0.02
4	1.03	0.17	0.18
5	0.80	0.20	0.16
6	0.89	0.20	0.18
Sum			0.71

The Entropy Index for the entire city ($\bar{H}$) is then calculated as per the example below in Table 2.5.

Table 2.4: Final segregation (H) calculation (Forest, 2005)

	White (1)	Black (2)	Asian (3)	Total Population	Proportion White	Proportion Black	Proportion Asian	h=-p1*ln(p1)+ p2*ln(p2)+ p3*ln(p3)
Total	440	140	125	705	0.62	0.20	0.18	0.92

The overall *H* value is then calculated as shown below.

H= (0.92-0.71)/0.92

= 0.226

*(rounded off to 3 decimals)

Now that these two measures of (spatial) evenness have been explained, the question remains as to which index will be selected for the purpose of the current study. The literature comparing these two indices will now be considered to inform this decision.

2.6.3. Comparing the Dissimilarity and Entropy Indices

Reardon and Firebaugh (2002), after undertaking a thorough evaluation of numerous dichotomous and multi-group indices, strongly endorsed the Entropy Index for segregation studies in multi-ethnic situations. In their study, the authors examined a plethora of indices against seven criteria established for the assessment of segregation indices (James and Taeuber, 1985; Reardon and Firebaugh, 2002).

James and Taeuber (1985) defined four criteria for evaluation measures of segregation in multi-group situations:

i. Organizational Equivalence: the measure should be unaffected if spatial units with the same minority composition are merged.
ii. Size Invariance: the measure should not be affected if the total number of people in each group is multiplied by a constant.
iii. The Principle of Transfers: the measure should be sensitive to the relocation of members of minority populations from tracts with higher proportions of that minority group to tracts with lower proportions of that minority group (as opposed to just redistribution in the opposite direction).
iv. Composition Invariance: the relative size of the minority group should not impact the measurement.

Reardon and Firebaugh (2002) added three additional criteria to those listed above in their evaluation of multi-group indices:

i. Exchanges: if two individuals belonging to separate groups, who are located in separate spatial units in which their respective groups constitute the majority, exchange places, then segregation is reduced.
ii. Additive Organizational Decomposability: If x spatial units are clustered into a number of clusters, then the segregation measure should be decomposable into the sum of that of the individual clusters.
iii. Additive Group Decomposability: If x groups are collectivized into a number of super-groups[4], then the final segregation measure should be decomposable into the sum of that of the separate sub-groups. For example, in South Africa, the African population is comprised of numerous distinct ethnic groups. Therefore, under this principle, the overall segregation measure derived for the African super-group should be equivalent to the sum of those derived for each of the component ethnic groups.

[4] The term 'super-group' refers to an overarching race group that is comprised of sub-groups of different races or ethnicities. For example, in apartheid South Africa, the White super-group was comprised of Caucasians and East Asians, while in post-apartheid South Africa, the term 'Black' often refers to a super-group comprised of Africans, Coloureds and Indians.

Table 2.6, adapted from Reardon and Firebaugh (2002), shows the extent to which the Dissimilarity Index and Entropy Index satisfy the above-listed criteria.

Table 2.6: Reardon and Firebaugh's (2002) evaluation and comparison of two segregation indices

	Dissimilarity Index (D)	Entropy Index (H)
Organizational Equivalence	✓	✓
Size Invariance	✓	✓
Transfers (2-G)	×[2]	✓
Transfers (M-G)	×[2]	✓
Exchanges (2-G)	×[2]	✓
Exchanges (M-G)	×[5]	✓
Compositional Invariance (2-G)	✓	×
Compositional Invariance (M-G)	×	×
Additive Organizational Decomposability (2-G)	×	✓
Additive Organizational Decomposability (M-G)	×	✓
Additive Group Decomposability	×	✓

**2-G refers to two population groups while M-G refers to multiple (>2) population groups.*

The results summarized in Table 2.6 show that the Entropy Index satisfies more of the criteria defined by James and Taeuber (1985) and Reardon and Firebaugh (2002) for an ideal segregation index. Of the six indices evaluated by Reardon and Firebaugh (2002), the Entropy Index was found to be the only index that satisfied the principle of transfers in the multi-group context. It was also found to be the only evenness-directed index that allows organizational decomposition where multiple groups are concerned. The only criterion not satisfied by the Entropy Index is the

[5] *D* does not satisfy the criteria of transfers and exchanges to a satisfactory extent; the relocation of individuals from a unit of higher proportion to one of lower proportion may have no impact on the final value for *D*, but will never cause an increase in *D*.

principle of compositional invariance since its value is based on the level of entropy, which is correlated to the proportion of the minority group in the area; the level of entropy changes as the proportion of the minority group changes. Therefore, the index changes constantly through time and space, even if the spatial distribution of the population remains the same, which as Flores (2008) states, makes it difficult to compare the index across cities or time periods. While this phenomenon is a potential flaw, it is, however, unavoidable. According to Reardon and Firebaugh (2002), none of the reviewed segregation indices satisfied this principle; the Gini Index was the only index found to meet this criterion. The fourth objective of this study, which aims to compute the Entropy Index using grid cells across a range of geographic scales (in which the proportion of the minority population group will inherently change) aims to address this shortcoming by generating a segregation profile of the study area (which will reflect the changes measured across time and space) to analyze trends, as opposed to relying on a sole value. The concept of the segregation profile is subsequently explored in greater detail Section 2.8.3.

Compositional invariance is not considered a suitable criterion for segregation measurement by all (Reardon and Firebaugh, 2002; Reardon and O' Sullivan, 2004). Reardon and O'Sullivan (2004: 133) state that the key to making this "seemingly intuitive concept" operative was to suitably define what it means for the relative distribution of different groups in space to remain unchanged. This argument was first proposed by Coleman *et al.* (1982), who argue that the definition of compositional invariance was somewhat arbitrary, implying that, provided an appropriate definition of segregation was used, any segregation index could potentially be classified as composition invariant. Reardon and O'Sullivan (2004) conclude that the criterion of compositional invariance is of secondary importance to ensuring that the segregation measure used has a strong conceptual foundation. Nonetheless, the overarching conclusion drawn by Reardon and Firebaugh (2002) in their analysis was that the Entropy Index be utilized in segregation research where evenness was the conceptual dimension being analyzed.

2.6.4. Application of the Entropy Index in Racial Segregation Studies

Theil's Entropy Index became more widely applied in investigating racial residential segregation. The following papers can be referred to as examples of segregation studies that have successfully applied the Entropy Index:

Iceland (2004) investigated the trends in racial and ethnic residential segregation in the USA from 1980 to 2000, as well as the relation between growing diversity levels and segregation trends. The Entropy Index was used, accounting for the presence of multiple ethnic groups, and also considering the segregation of each of these groups respectively. The study found that there was an overall decline in multi-group segregation, accompanied by declines in White and African segregation respectively. Hispanic segregation was found to remain unchanged, while that of the Asian and Pacific Islander groups marginally increased. Additionally, the study found that a rise in ethnic diversity was directly related to increases in segregation, particularly for the White, Hispanic and Asian groups. Increased diversity was correlated to a decline in African segregation.

Fischer *et al.* (2004) investigated the relationship between African-American shifts to suburban areas and metropolitan segregation in the USA using census data from 1960 to 2000. The study utilized the decomposability of the Entropy Index to compartmentalize metropolitan segregation into within-city, within-suburb and between-city-and-suburban components. Given that these partitions would add up to the total metropolitan segregation, the authors were also able to calculate the proportion of metropolitan segregation attributed to each sub-division. The study found that the levels of African segregation from other race groups declined across all geographical scales in most metropolitan areas, and the process was found to be much more rapid in the central city than in the suburbs. Overall African segregation was, therefore, attributed to residential distribution in suburban areas.

Morse (2012) applied the Entropy Index in his study which investigated the role of scale in segregation measurement for five North Carolina Counties. Radii of varying distances were used to define the spatial units for which segregation was computed; the distances of the radii chosen (500 m, 1000 m, 2000 m and 4000 m) were based on the recommendations made by Reardon *et al*. (2008). The study found that segregation occurred at a large scale within all five counties.

Furthermore, the study concluded that, for the study area being investigated, segregation was a non-increasing function of scale, where no change in segregation was measured when considered at increased scales.

Parry and van Eeden (2014) used to Entropy Index to measure residential segregation (within a multi-group context) across different scales in two South African cities, Cape Town and Johannesburg. The study also investigated how residential segregation changed from 1991 to 2011. The study showed that residential segregation decreased at all scales over time for both cities. The findings of this study are considered later in Section 3.4.

2.6.5. Limitations of Segregation Indices

There are four commonly cited limitations associated with the use of segregation indices. Firstly, segregation indices are aspatial in nature (Duncan and Duncan, 1955). However, the recent advancement of geospatial technologies, particularly Geographical Information Systems (GIS), has made this a non-issue. The role of GIS in advancing segregation studies is laid out in the subsequent section.

Secondly, Lee *et al*. (2008) state that the use of census tract boundaries as the spatial unit of measurement in segregation studies is based on three problematic assumptions: (i) it assumes that the census tracts are of a suitable size to reflect segregation, (ii) it assumes that all census tracts are the same geographic size, and (iii) there is no concept of proximity within a tract; for example, a house located on the periphery of a tract and one located in the centre will have the same location, whereas households situated in close proximity to each other, but in different tracts are considered further away from each other than they are in reality.

The last of these assumptions is known as the Modifiable Area Unit Problem (MAUP), which according to Reardon and O'Sullivan (2004) highlights how segregation indices are sensitive to the way in which aerial boundaries are defined. The only way to avoid the MAUP is to use georeferenced household-level data as opposed to census tract data (Weeks, 2004; Parry, 2012).

Parry (2012), however, states that because household-level census data have not yet become available in South Africa, all research conducted for the region will be subject to this problem.

2.7. Using GIS to Enhance Segregation Studies

Kaplan and Holloway (1998) state that the traditional measures of segregation are derived solely from population and other attribute (non-spatial) data, without considering any information of a cartographic or geographical nature. Geographical Information Systems (GIS), however, have the potential to add a spatial dimension when investigating racial segregation. One of the major strengths of GIS is its capacity for spatial analysis. As Goodchild (1987) states, GIS enables the analysis of spatial features and relationships by combining the geographical and attribute data.

The advantages of integrating GIS into segregation studies have been well documented by Wong (1996):

i. The ability to integrate the calculation of numerous segregation measures into a GIS allows for calculations to be programmed and simply repeated for different regions. For example, the GIS-based S-index, created by Wong (1999) is a spatial measure of segregation that generates a statistical summary of the segregation levels in an urban setting, while also enabling users to map the spatial distribution of different racial groups.
ii. The spatial selection tools included in GIS software packages provide a suitable platform for analyzing spatial trends based on attribute data.
iii. The ability to map various segregation measures and socio-economic variables enables correlations to be drawn between observed segregation trends and changing socio-economic environments. This is conducive to exploratory research approaches. A prime example of how this can be achieved is through choropleth mapping. A choropleth map is one that uses colour gradients to colour spatial units (like census tracts) to represent classed values of a particular variable (such as a segregation index). Parry and van Eeden (2014) utilize this method to display racial diversity at census tract level and grid-levels of varying scales in their investigation of racial segregation in Cape Town and

Johannesburg. In doing so, the authors were able to show which areas in the respective cities were the most racially diverse, and how this changed over time.

iv. Overall, GIS enables one to understand the spatial aspect of segregation.

This study, which builds on the work by Parry and van Eeden (2014), will utilize GIS in the same way to spatially represent and analyze racial segregation.

2.8. Segregation and Scale

2.8.1. Theoretical Importance of Considering Scale in Segregation Studies

Reardon *et al.* (2008) highlight three analytical aims as the key foci of segregation studies, these being the patterns, causes and consequences of segregation. However, as Reardon *et al.* (2008) further point out, geographic scale is often overlooked when attempting to understand each of the above issues.

Kaplan and Holloway (2001:61) emphasize the "inherently scalar nature" of segregation, in which segregation can simultaneously be considered at numerous levels, from individual households to national scale. Therefore, scale ultimately determines how segregation can be measured, analyzed and represented (Kaplan and Holloway, 2001). In order to implement the scale aspect into segregation studies, Reardon *et al.* (2008) state that is imperative to differentiate between areas where residential patterns can be dominated by large racially homogenous areas that are spatially discrete (macro-scale segregation) and areas dominated by smaller racially homogenous areas that are scattered throughout a region (micro-scale segregation). Segregation measures that are more suited to larger scales would describe the first of the above situations as more segregated than the latter, whereas segregation measures suited to smaller scales would describe both situations as highly segregated. Therefore, neither of these descriptions can sufficiently be considered in isolation. While in the above case, it is apparent that scale is imperative for describing segregation patterns, Reardon *et al*. (2008) also describe its importance

when considering the causes and consequences of segregation, stating that the causes and consequences of macro-scale segregation often differ from that of micro-scale segregation. Segregation in this study, therefore, will be investigated across a variety of scales. The methodological approaches to doing so will now be considered.

2.8.2. Approaches to investigating the geographic scale of segregation

The existing literature exhibits examples of approaches to investigating segregation in which its scalar nature is implicit. Reardon and O'Sullivan (2004) provide discussion on the relationship between Massey and Denton's (1988) clustering dimension and geographic scale. Furthermore, as Reardon *et al.* (2008) point out, several studies have analyzed segregation at different scales by using a number of census aggregation units (tracts, places, cities, metropolitans, countries, and so on) to determine if segregation observed at tract level can be explained by larger-scale segregation patterns (See Fischer *et al.*, 2004; Massey and Fischer, 2000; Reardon *et al.*, 2009). This method, however, is limited in that it can only consider geographic scales conforming to census boundaries and, furthermore, does not take into account segregation patterns that do not neatly correspond with these boundaries (Reardon *et al*., 2008).

With the development of tools specifically aimed at spatial analysis, such as GIS, a number of recent studies have developed methods for investigating segregation at multiple scales (Jargowsky and Kim, 2004; Wu and Sui, 2001; Reardon and O'Sullivan, 2004; Reardon *et al*., 2008; Parry and van Eeden, 2014).

2.8.3. The Segregation Profile

Reardon and O'Sullivan (2004) conceptualized the idea of the segregation profile, a curve plotting the level of segregation at each scalar unit. In order to investigate segregation at a range of geographic scales, Reardon and Sullivan (2004) propose demarcating a series of 'local environments' defined by a range of radii. This addresses the limitations of relying on

aggregated census boundaries that were previously highlighted. The Reardon and O'Sullivan (2004) method assumes that every individual inhabits a local environment, whose population is comprised of the spatially-weighted average of the populations at each of local environments in the region being investigated. Segregation is determined by calculating the weighted racial composition of each local environment in the region of interest and comparing them.

The computed segregation profile describes both the level of segregation at a particular scale (shown by the height of the curve) as well as the rate of change in relation to scale (shown by the slope of the curve). Figure 2.2 shows an idealized segregation profile based on the racial composition of four hypothetical regions shown in Figure 2.3 (Reardon *et al*., 2008). The racial distribution patterns of these regions are detailed below (Reardon *et al.*, 2008):

Region A: The proportion of the Black population varies substantially with location and racial composition changes considerably over small distances.

Region B: The spatial scope is similar to Region A, but displays a higher range in racial composition.

Region C: Exhibits two types of spatial segregation, with the proportion of Blacks varying at a macro-scale level (at an approximate 20 km scale) and at a micro-scale level (at an approximate 2 km scale). This reveals that the proportion of Blacks varies at a local scale within large regions that are primarily Black or White. This type of segregation profile is what can be expected to be observed in the typical post-apartheid city.

Region D: Has a similar macro-scale pattern as Region C, but does not display the same micro-scale pattern, meaning that the proportion of Blacks does not vary at the local scale within larger racially homogenous regions. This type of segregation profile would likely characterize the South African apartheid city.

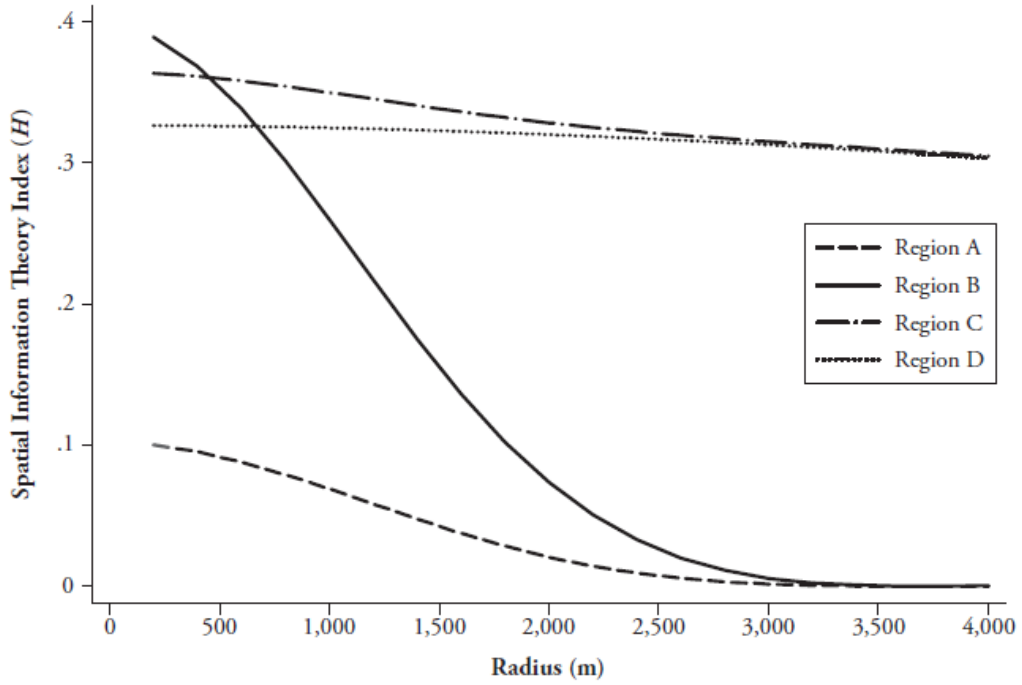

Figure 2.2: Stylized segregation profiles for four hypothetical regions, A to D (from Reardon et al., 2008)

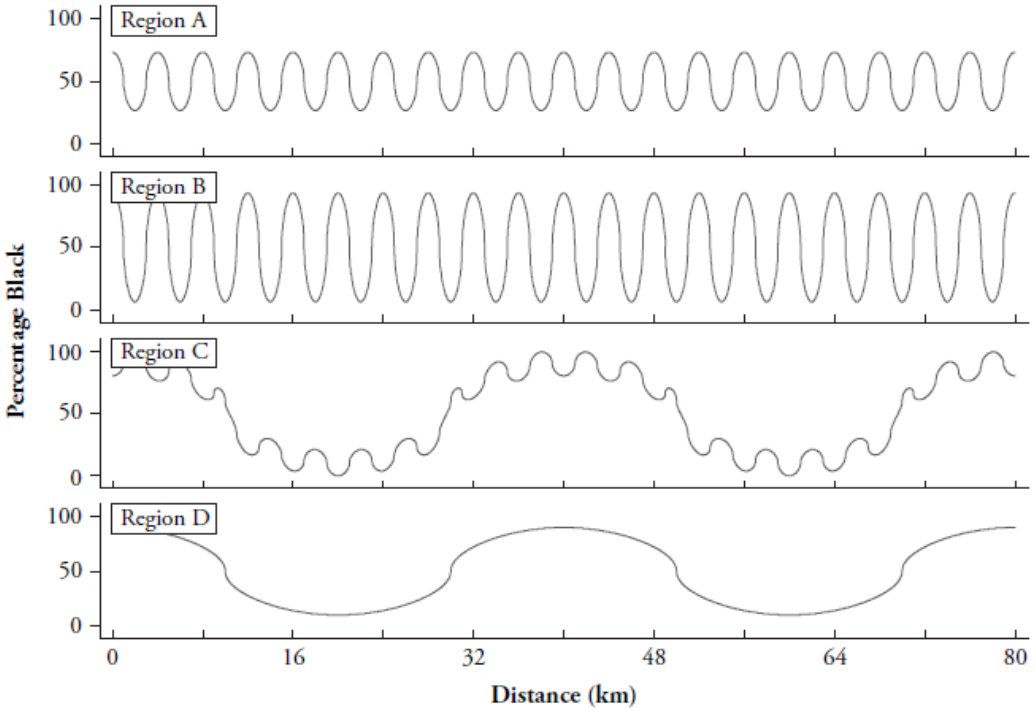

Figure 2.3: Stylized racial distribution patterns for four hypothetical regions, A to D (from Reardon et al., 2008)

The segregation profile shown in Figure 2.3 was computed using local environment scales defined by radii ranging from 100 m to 4000 m. Reardon *et al.,* (2008) note the following observations:

When comparing Regions A and B, it is apparent that at a scale smaller than 3000 m, A is less segregated than B. However, at a scale of 3000 m or more, segregation in both regions is no longer reflected. This is because in both regions, all of the segregation is explained by micro-scale racial distribution patterns. When comparing Regions C and D, D is less segregated than C at smaller scales due to the former lacking micro-scale segregation, but at larger scales there is no discernable difference. This is because at larger scales, the micro-scale segregation characteristic of Region C becomes indistinct. When comparing B and C, it is apparent that at a scale of 500 m, both regions are equally segregated, but at a larger scale, C displays greater segregation due to more of the racial variation occurring at a macro-scale. Region B, therefore, has a steeper segregation profile than Region C.

As Reardon *et al.,* (2008) demonstrate, the segregation profile is useful in that it does not merely represent the level of segregation at specified scales, but it also reflects the extent to which segregation at small scales is the result of racial distributions at larger scales (i.e. the extent to which micro-scale segregation patterns are due to macro-scale segregation patterns). In order to determine the relationship between macro- and micro-segregation, Reardon *et al*., (2008) introduced the macro/micro segregation ratio which indicates the proportion of micro segregation that is resultant from racial residential patterns occurring at a macro-scale. This ratio is calculated by dividing the segregation value obtained at the highest scale investigated by that obtained at the smallest scale investigated, yielding a value ranging from 0 (indicating that no proportion of the micro-scale segregation patterns can be attributed to macro-scale patterns) to 1 (indicating that 100 percent of the micro-scale segregation patterns are due to patterns occurring at the macro-scale level) (Reardon *et al*., 2008). A city with a steep segregation profile will have a higher macro/micro segregation index, while a city with a gentle slope will have a lower macro/micro segregation ratio (Reardon *et al*., 2008).

The study conducted by Reardon *et al.,* (2008) modified Reardon and O'Sullivan's (2004) methodology to account for the lack of census data collected at household level. The authors superimposed a 50 m^2 grid over the census tracts to approximate the location of individuals and

used a quartic kernel function to compute the racial diversity of each grid cell. The Spatial Information Theory Index, a variation of Theil's Entropy index, was then used to calculate overall segregation for the region. Another approach by Morse (2012) used the centroid of each census tract as the spatial point around which local environments were defined by creating overlapping buffers. Parry and van Eeden (2014) used non-overlapping grid cells of various spatial resolutions to represent local environments at a range of scales. According to Parry and van Eeden (2014), a 1 km^2 grid cell spans approximately the same area as a buffer with a 500 m radius.

2.9. Conclusion

Based on the literature reviewed above, it was decided that both the Entropy and Dissimilarity Indices would be utilized in this study to measure racial segregation (specifically referring to the dimension of racial evenness). The Entropy Index was selected due to the plethora of benefits advocating its superiority as an index for the measurement of racial evenness highlighted above in Section 2.6.3. Furthermore, the Entropy Index, which involves the calculation of racial diversity at tract-level, would enable trends in racial diversity (across space and time) to be easily displayed and mapped in a GIS. The inclusion of the Dissimilarity Index was also decided for two reasons: (i) to enable the findings of this study to be comparable to prior studies investigating segregation in Port Elizabeth, and South Africa as a whole, and (ii) because it's dichotomous nature would allow the investigation of the inter-race dynamics governing the observed trends in racial integration and persisting segregation. With regards to the incorporation of scale into this study, to correspond with the scale dimensions proposed by Reardon *et al*., (2008), as well as those used by Parry and van Eeden (2014) in their investigation of segregation in Cape Town and Johannesburg, scale resolutions of 1 km^2, 2 km^2, 3 km^2, 4 km^2, 5 km^2, 6 km^2, 7 km^2 and 8 km^2 were chosen for this study. The methodologies applied in this study will be elaborated in Chapter 6.

CHAPTER 3: OVERVIEW OF SEGREGATION RESEARCH

3.1. Introduction

This chapter is comprised of three sections. Section 3.2 presents an overview of the findings of segregation studies. The abundance of segregation literature from the USA is reviewed, detailing the evolution of the major themes and methodologies in this field of research. Some of the research conducted outside of the USA is then described in Section 3.3.

Lastly, Section 3.4 aims to contextualize the topic of racial segregation within the South African case, detailing the evolution of segregationist policy in the periods preceding and during the apartheid era, while also examining the trends observed in the post-apartheid period. More detail on the segregationist policies of the pre-apartheid era will follow in the subsequent Chapter, which will detail the evolution of segregation in South Africa. Lastly, a brief overview of the research investigating residential segregation in South Africa is presented.

3.2. The Nature of Residential Segregation Studies: The USA Context

3.2.1. Overview of Segregation Research

The literature on residential segregation showed that the research published can be classified into one of three categories: (i) spatial and temporal trends, (ii) historical and contemporary causes, and (iii) the consequences residential segregation imposed on the life chances of the population groups being considered. The majority of the scholarship on residential segregation focuses specifically on the degree of separation between groups defined by race, ethnicity and

nationality, although segregation along other lines, such as religion, criminality and socio-economic status, are also widespread.

As previously stated, the overwhelming body of racial segregation research that has been conducted has investigated the USA case. This literature will now be considered to provide a chronicle of how segregation research has evolved since its conception in academia.

3.2.2. Classical Segregation Research

The earliest scholarship investigating the phenomenon of residential segregation came from proponents of what was known as the Chicago school of human ecology. This included influential works by Park *et al*. (1925), Park (1926) and Burgess (1928). The general argument put forth by these scholars was that a number of natural mechanisms operate within a city to produce an "orderly and typical grouping of its population and institutions" (Park, 1925: 1).

Park (1926) proposed the existence of a positive relationship between social distance and spatial distance. That is, individuals who are socially similar tend to live in closer proximity to one another. This observation formed the foundation of the human-ecological approach towards investigating urban segregationist patterning, in which the statistical levels of racial segregation of minority groups were equated with their level of integration into broader society. This school of thought was influential in early segregation research throughout the United States of America of America.

Chicago became the central case on which much of the early scholarship of racial segregation was based. Duncan and Duncan (1957), in their seminal work, applied the school of thought described above to investigate racial neighbourhood change in Chicago. The study computed dissimilarity indices using data obtained from the USA Census. Their work was later expanded upon to other cities in the USA by Tauber and Tauber (1965), who computed dissimilarity indices to examine racial segregation patterns between the African-American and White populations. This study showed that the observations found in Chicago could not be extrapolated

to the rest of the USA, highlighting the need for similar studies to be carried out in the local context.

3.2.3. Contemporary Segregation Research

The research of the Chicago-school was predominantly focused on generating quantitative analyses of segregation. White (1987) continued this tradition with his research, which quantitatively analyzed racial patterning in the USA using data from the 1980 National Census. The 1980s, however, also saw the field of segregation research evolve from mere quantitative chronicling to its consideration within a wider social context. Massey (1985) drew theoretical connections between racial segregation and various neighbourhood-scale social conditions which resulted in the structural marginalization of the USA minority populations, particularly the African-American community. In their ground-breaking research, Massey and Denton (1993) used historical and contemporary census data to generate a holistic spatio-temporal perspective on the nature of racial segregation in the USA. The study revealed that the formation of underclass communities in the USA was largely underpinned by racial segregation. Following 1985, due to a rising influx of immigrants into the USA, segregation research started to focus on that of Asian and Latin American population groups (Charles, 2003; Iceland, 2009).

3.2.4. Spatial and Temporal Trends

The segregation research in the USA has, for the most part, utilized decadal census data. Periodic analyses across the censuses have, therefore, enabled the investigation of changes in segregation patterns across time as well as space.

Van Valey *et al.* (1977) investigated the changes in segregation at a national level between the African-American and White populations using census data from 1960 to 1970. The study found an overall decline in segregation and attributed this to the development of new metropolitan areas. Massey and Denton (1987) expanded on this research, examining the changes that

occurred from 1970 to 1980, while also incorporating the Asian and Latin American populations. The study concluded that while segregation levels between the African-American and White groups declined in smaller metropolitan regions in the South and West areas of the USA, they remained high in the Northeast and Midwest regions. Furthermore, Asian and Latin American segregation was increasing in metropolitan areas in conjunction with rising immigration levels. Farley and Frey (1994) then explored the changes in segregation between African-American and White groups from 1980 to 1990. The study yielded the same observations made by Massey and Denton (1987).

Numerous studies have also investigated spatio-temporal trends across longer time periods. Cutler *et al.* (1999) investigated changes in segregation between African-Americans and Whites over a 100-year period from 1890 to 1990. The study found a steady increase in segregation levels from the early 1900s to 1970, which thereafter declined. Segregation levels in the mid-1900s were attributed to the exclusion of the African-American population by Whites, while the more recent segregation referred to the economic position of African-American households preventing their integration into White neighbourhoods. Logan *et al.* (2004) investigated the changes in segregation levels amongst the African-American, Asian and Latin American populations from 1980 to 2000. The results were similar to those found by Massey and Denton (1987), with declines in the segregation between African-Americans and Whites occurring in smaller metropolitan regions in the South and West, as well as increasing segregation amongst the Asian and Latino groups. Fischer *et al.* (2004) investigated segregation levels from 1960 to 2000, but unlike prior studies which conducted analyses solely at census tract-level, they incorporated the element of scale. The authors found that African-American segregation had declined most rapidly when considered at tract level, but slowed when investigated at increasingly higher geographic scales. Furthermore, increased segregation was found between American-born citizens and immigrants due to clustering occurring in metropolitan areas.

While each of the above examples considers the spatial patterns of segregation, studies by Massey and Denton (1989), and Wilkes and Iceland (2004) specifically focus on the spatial variation of segregation. Both studies use census data (for the years 1980 and 2000 respectively) to identify metropolitan areas that are classified as ‘hypersegregated’. This term, introduced by Massey and Denton (1989), refers to the state where a population group is highly segregated

within each of the five segregation dimensions defined by Massey and Denton (1988). The study by Massey and Denton (1989), which considered segregation specifically amongst the African-American and Latin American groups, found that African-Americans were the most segregated across the five dimensions, considering them both singularly and cumulatively, and were found to be hypersegregated in a small number of metropolitan areas. Wilkes and Iceland (2004) found declines in the number of metropolitan areas in which African-Americans were hypersegregated, while Latin Americans were found to be hypersegregated in two metropolitan areas.

3.2.5. The Causes of Racial Segregation

The causes of racial segregation can be classified into two broad categories: endogenous and exogenous. The former describes those which result from the constraints and preferences of individuals while the latter refers to external drivers. Although the drivers found in each of these categories are distinct, they often do correlate.

3.2.5.1. Endogenous Causes

The literature on the endogenous causes of segregation can be subdivided into two groups, these being (i) differences in socio-economic status, and (ii) racial preference. The first of these reflects the ability of individuals to assimilate, while the latter two reflects the willingness of individuals to assimilate.

3.2.5.1 (a). Differences in socio-economic status

One of the key theories held by the Chicago school was that differences in the socio-economic status of different groups would result in the residential segregation of that group. According to Park (1926:18), *"It is because social relations are so frequently and so inevitably correlated with spatial relations; because physical distances, so frequently are, or seem to be, the indexes of*

social distances, that statistics have any meaning whatsoever for sociology." This principle gave rise to what was considered the theory of spatial assimilation, which correlates a higher socio-economic status of groups with declining segregation.

The bid-rent theory, developed by Alonso (1964) is a classic geographical economic theory which provides a theoretical context for understanding the occurrence of segregation due to socio-economic status. This model applies to monocentric cities, in which all economic activity is located in a central business district (CBD) surrounded by residential areas. Typically, individuals with a higher socio-economic status would locate in residential areas located further away from the CBD, due to their being able to afford the cost of commuting to work, while individuals with a lower socio-economic status would choose to reside closer to the CBD to avoid high commuting costs. Numerous studies have investigated the relationship between the relative socio-economic statuses and segregation levels of different race groups in the USA, showing that the two are directly related. Examples of such studies will be discussed below.

Massey (1981) investigated the relationship between ethnic segregation and social status by employing a method of indirect standardization. Cross-tabulation data of race versus socio-economic status, obtained from the USA 1970 census, were used to compute dissimilarity indices within socio-economic bands. The study supported what was known as the Assimilation Hypothesis, which predicted a negative relationship between socio-economic status and ethnic segregation. Massey and Denton (1985) then used individual level-data from the 1970 USA census to test the spatial assimilation hypothesis. This was done to validate the findings of prior studies which applied structural equation models to ecological data, generating results which supported the spatial assimilation hypothesis. The study reconfirmed the results found in earlier studies.

Alba *et al*. (2000) conducted a study which compared the segregation levels between middle-class and poor African-Americans. The study found the middle-class African-Americans tended to reside in neighbourhoods with a higher concentration of White inhabitants than poorer African-Americans. Furthermore, these neighbourhoods in which middle-class African-Americans lived were poorer than those in which Whites of a similar socio-economic status tended to reside. A study by Iceland and Wilkes (2006) analyzed gradients between socio-economic status and segregation for the African-American, Asian and Latin American

populations in the USA. Steeper gradients were found for the Asian and Latin American groups than for the African-American group. Additionally, socio-economic status became a stronger indicator of segregation for African-Americans from 1990 to 2000, with the reverse trend evident for the other two groups. In a more recent study, Spivak *et al*. (2011) computed dissimilarity and exposure indices for thirty-six USA metropolitan areas to investigate the relationship between socio-economic status and racial segregation. The study yielded similar results to the prior studies, supporting the spatial assimilation hypothesis, with the relationship being more strongly represented with the exposure index than the Dissimilarity Index.

Overall, the literature has revealed two primary observations. All of the above studies supported the spatial assimilation hypothesis. Additionally the studies by Massey (1981), Massey and Denton (1985), and Iceland and Wilkes (2006) showed that the levels of racial assimilation between the African-Americans and White population groups was lower than of the other minority populations.

3.2.5.1 (b). Racial Preference

While investigating the relationship between socio-economic status and segregation has been a fairly straightforward process, investigating the nature of the racial neighbourhood preferences of individuals belonging to different race groups has proven more complex to decipher. The theory of preference suggests that individuals belonging to various race groups make decisions on where to live based on factors such as the racial composition of neighbourhood, or the socio-economic status of potential neighbours. Preference, therefore, potentially leads to self-segregation.

Schelling (1971) authored the seminal work investigating the relationship between neighbourhood preference and racial segregation. The study employed simulation methods to demonstrate that minimal differences in the level of desire to live in close proximity to other races between two groups would likely lead to pronounced levels of racial segregation. Clark (1991) tested the application of the Schilling Model. The study used census data from five cities in the USA to generate estimates of preference for the African-American and White groups. The

study supported the theory of a direct link between preference and segregation, but concluded that Schilling (1971) devalued the degree of the race groups' preference for racially diverse neighbours, showing that segregation would be far less pronounced than indicated by Schilling (1971). Fosset (2006) investigated the relationship between racial segregation and three potential contributing factors: (i) racial preferences (ii) status preferences, and (iii) status differences. The study found that various combinations of all three factors could produce high levels of segregation, and, therefore, concluded that a reduction in neighbourhood segregation would not necessarily lead to lowered segregation levels.

Critics of the preference theory have argued that the desire of minority groups to live in greater proximity to Whites is greater than that of Whites to have racially diverse neighbours. The counter argument posited is that of White evasion rather than the self-segregation of minority groups.

Farley *et al.* (1994) investigated the hypothesis that the neighbourhood preference of Whites was directly related to negative stereotypes of prospective Black neighbours. The study found a strong correlation between the two, indicating that racial stereotypes were greater than socio-economic factors in influencing neighbourhood preference. Another study by Bobo and Zubrinsky (1996) tested and compared three contending theories about the source of Whites' neighbourhood racial preferences, these being: (i) economic status differences, (ii) within-group differences, and (iii) racial prejudices. The study found that the neighbourhood preference of Whites was most strongly linked to racial prejudice. Emerson *et al.* (2001) investigated the theory that neighbourhood desirability was influenced more by its racial composition or by socio-economic variables. The study found that neighbourhood desirability for Whites was driven by the proportion of African-Americans living in the neighbourhood, but was not affected by that of Asians and Latin Americans. A further study by Kryson *et al*. (2009), conducted in Chicago and Detroit, presented video fragments depicting neighbourhoods characterized by homogenous and mixed racial and class groups. The study found that the White participants displayed greater desire towards neighbourhoods with only White inhabitants, and that this desire was influenced by negative stereotypes of African-Americans.

3.2.5.2. Exogenous Causes

The literature on racial segregation focuses on two main types of exogenous drivers, that being housing markets, and policies which indirectly result in segregated neighbourhoods. The first of these will be elaborated within the USA context. The latter, which related more directly to the topic of the study at hand, will be elaborated in the subsequent section.

3.2.*5.2 (a). Discrimination in Housing Markets*

Another dominant theme in the literature investigating the causes of segregation is that of racial discrimination in housing markets. Like racial preference, this is somewhat complex to analyze empirically. The redlining policies implemented in the USA from roughly 1934-1968, combined with restrictive clauses on property deeds and acts of intimidation by members of the White population led to the formation of African-American *ghetto* areas, the equivalent of a South African *location* or *township* (Massey and Denton, 1993). However, little research has investigated persistent housing discrimination in the USA as a cause of segregation.

Research into this phenomenon has primarily been conducted by Housing Discrimination Studies, which are state-funded. These studies are based on reports of auditors sent to housing units where they record their treatment. Yinger (1995) found that higher costs were levied upon minority groups. Ross and Turner (2005) found that African-Americans were typically steered to specific residential locations by real-estate agents, while Latin Americans still face numerous challenges in obtaining rental housing. Zhao *et al*. (2006) concluded that ongoing housing discrimination was the result of both the prejudices of real-estate agents and their White clients. Turner *et al*. (2013) found that clients belonging to minority groups were typically shown fewer housing units relative to White clients.

A study by Massey and Lundy (2001) utilized telephone-based audits to discern discrimination in Philadelphia. Black and White participants were required to telephone landlords, upon which they were to adopt one of three stereotypical accents in the region. The study generated evidence

of linguistic profiling by landlords, with particular discrimination directed to African-American female callers speaking in a stereotypical African-American dialect.

3.2.5.2 (b). Social Engineering through Spatial Planning Policies

A prime case of spatial planning being utilized to enforce racial segregation is South African apartheid. This topic is dealt with in detail Chapter 4.

3.2.6. The Consequences of Racial Segregation

As previously mentioned, segregation studies can broadly be categorized into three thematic groups, examining the patterns, causes and consequences of segregation. This study investigates only the patterns and causes of segregation in post-apartheid Port Elizabeth. However, due to the inherently cyclical nature of the causal paths driving segregation, in which the consequences of segregation in turn act as drivers entrenching further segregation, it is argued that the literature relating specifically to the consequences of segregation is relevant for consideration in this study. The extensive body of literature relating to the consequences of segregation will, therefore, be touched on below. The body of research specifically investigating the consequences of segregation can be classified into two thematic groups, that being (i) how segregation results in poverty concentration and (ii) the impacts of segregation on the life chances of inhabitants in marginalized communities. Prominent studies falling within each of these categories will simply be itemized below, accompanied by a brief description of the studies' aims and findings.

Since the 1990s, the emphasis of segregation research has shifted to include investigations into racial segregation as a demographic driver of racial marginalization. There is a general consensus amongst scholars that racial segregation often results in the concentration of poverty. Furthermore, studies investigating the consequences of racial segregation have determined that this concentration of poverty in turn leads to a number of social problems, such as poor health and increased criminality.

Martin (2006) states that residential segregation becomes problematic when it stems from racial and ethnic prejudice and, furthermore, is coupled with inequality. According to Martin (2006), such segregation leads to the development of structural barriers that result in the clustering of poverty and the limiting of economic and social opportunities afforded to particular residential clusters. The adverse effects of segregation has been linked to poor schooling systems and a lack of educational opportunities, higher health risks, elevated criminality, social anarchy, racial and cultural stereotyping, and a lack of access to positive role models (Massey and Denton, 1993; Settles, 1996; Wilson, 1996; Donaldson and Kotze, 2006; Lee *et al.*, 2008; Herbst and Lucio, 2014). Residential segregation is, therefore, a major contributor to the formation of marginalized ethnic enclaves. Furthermore, Eckardt and Eade (2011) suggest that ethnic segregation becomes commonplace in multicultural societies for two reasons: the preservation of a common culture of origin and the instinctive kindness that often stems from kinship. Where segregation is forced, however, the negative impacts become a particular concern.

According to Parry (2012), racial residential segregation can have both positive and negative outcomes for society. One example of a positive consequence resulting from racial residential segregation is protection from bigotry. As Parry (2012) states, immigrants in a foreign country will often congregate with others of the same nationality or race with a 'safety in numbers' tactic in mind.

3.2.6.1. Poverty Concentration

The earliest research into the deleterious effects of segregation was that by Wilson (1987). The study, which focused on Chicago, made the observation that poorer households were becoming concentrated in the central neighbourhoods. Wilson (1987) stated that it was a combination of deindustrialization and the migration of middle-class African-Americans to ghetto areas that were formerly diverse in terms of class, which resulted in a remaining population comprised of disadvantaged African-Americans in declining, marginalized neighbourhoods.

A study by Massey *et al.* (1994) analyzed mobility data obtained from the Panel Study of Income Dynamics at a household level to test the hypothesis that segregation was related to the concentration of poverty in American neighbourhoods. The study concluded that high levels of

segregation was a necessary precondition for the deriving forces identified by Wilson (1987) to so quickly yield such pronounced poverty-concentrated neighbourhoods.

Jargowsky (1997) investigated patterns of change in high-poverty neighbourhoods in the USA. The study yielded a counter argument to that provided by Massey *et al*. (1994), concluding that economic segregation, which also featured changes in the distribution of income among the race groups, was the prime cause resulting in the configuration of high-poverty neighbourhoods.

Quillan (1999) tested the argument posed by Wilson (1987) that the migration of middle-class African-Americans out of central city neighbourhoods yielded poverty-concentrated neighbourhoods. The study found that Wilson's argument to hold, but also concluded that the neighbourhoods into which middle-class African-Americans migrated shifted to be completely African-American in racial composition. This supported the notion that the processes of racial segregation and economic segregation operated simultaneously, but independently.

Massey and Fischer (2000) reinvestigated the relationship between racial segregation and concentrated poverty. The study yielded empirical evidence that the process of racial segregation interlinks with other processes such as economic segregation, resulting in poverty-concentrated, racially-homogenous neighbourhoods. This observation meant that racial segregation could not be ruled out as a cause of poverty concentration, but emphasized its inclusion amongst a host of complex causal systematic processes.

Ananat (2011) investigated the causal impacts of racial segregation on poverty concentration by using railroad tracks as a statistical parameter to show that segregation produces higher poverty among African-Americans and raised the income inequality between Whites and African-Americans. The study also showed that racial segregation decreased poverty concentration among Whites, as well as lowered economic segregation levels within the White population.

Quillan (2012) classifies the driving factors resulting in concentrated poverty neighbourhoods into the impacts of 'three segregations'. The study found that Massey's model of the relationship between segregation and concentrated neighbourhood poverty was accurate, but overlooked a crucial element. The author states that poor African-Americans and Latin Americans have a tendency to live in neighbourhoods with racially diverse, poor neighbours, highlighting that in such cases the beneficial impacts associated with racial integration become somewhat weakened.

3.2.6.2 Impacts on Life Chances

Building on his hypothesis that segregation led to concentrated neighbourhood poverty, Wilson (1987) coined the term 'concentration effects', referring to the socio-economic, physical and psychological impacts resulting from living in high-poverty neighbourhoods. Much research into the impacts of segregation has been done from both theoretical and empirical perspectives. This research will be considered below in accordance with these two broad themes.

3.2.6.2 (a.) Qualitative Research

The study conducted by Clark (1965) represents one of the earliest works detailing the relationship between the deprivation present in selected poverty-concentrated African-American neighbourhoods in the USA and the consequent behavioural and psychological effects on inhabitants. Another early work was that done by Stack (1974), which explored the coping mechanisms of families in poverty stricken African-American neighborhoods. Wilson's (1987 seminal study catalyzed widespread research into the impacts of what he termed 'neighbourhood effects', referring broadly to consequences of being exposed to specific types of neighbourhood circumstances. This research was mainly focused on the consequences of neighbourhood impacts on the youth living in high-poverty neighbourhoods.

The article by Mayer and Jencks (1989) reviewed the current literature detailing the relationship between the racial and socio-economic makeup of children's neighbourhoods and their potential life chances. The authors warn that the evidence for such neighbourhood effects was, for the most part, weak.

In his book, Anderson (1999) contended that youth living in segregated, violent neighbourhoods subsequently develop a 'street code', which often opposes mainstream societal norms. Anderson explains this by the conceptualization of a causal chain connecting physical conditions to a resulting cultural response, and then to consequential social and economic conditions.

Small (2004) investigated the hypothesis that poor neighbourhoods have low levels of social capital which subsequently results in high levels of social estrangement and isolation. The study

was conducted within a homogenous Puerto Rican neighbourhood. The author found variable levels of social capital, and concluded that this could not simply be classified as a concentration effect.

Harding (2010) investigated the impact of neighbourhood culture and violence in the lives of poor and financially well-off boys in Boston neighbourhoods. The author concludes that what distinguishes the poor and well-off neighbourhoods was not the existence of a homogenous neighbourhood culture born out of neighbourhood conditions, but rather the result of multiple and varied factors, or what the author describes as 'cultural heterogeneity'.

3.2.6.2 (b). Empirical Research

An extensive number of studies have been aimed at empirically measuring the consequences of living in segregated neighbourhoods. The main focus of this research has centered on directly linking outcomes such as levels of education attainment, employment levels and family structures to socio-economic segregation.

Crane (1991) tested the hypothesis that school dropout rates and occurrences of teenage pregnancies are related to the proportion of affluent neighbours in urban neighbourhoods in the USA. The study concluded that the probability of incidents of school dropouts and teenage pregnancy occurring rose when the percentage of affluent neighbours was below ten percent. A similar study by Brooks-Gunn *et al.* (1993) investigated the impacts on school dropout and teenage pregnancy rates in relation to the presence of poor neighbours and the absence of affluent neighbours. The study attributed these impacts more to the absence of affluent neighbours, but, furthermore, concluded that this effect was more pronounced for White adolescents than for African-Americans.

Cutler and Edward (1997) tested the hypothesis that racial segregation may be beneficial in that it could encourage class-mixing in the racially homogenous communities in ghetto areas in the USA. This hypothesis was rejected, with the authors concluding that, with respect to the African-American population in particular, segregation impacts were largely negative. Racial segregation

was found to be linked with lower education levels and employment status, as well increased instances of single-parent family structures.

Ludwig *et al*. (2008) present the outcomes of the 'Moving to Opportunity' experiment. The study revealed that families who were subjected to the treatment of relocating from a high-poverty neighbourhood to a more affluent environment did not record improved self-sufficiency.

Wodtke *et al*. (2011) measured the effect that persistent exposure to conditions of neighbourhood poverty would have on the probability of high school matriculation in the USA. The study concluded that the probability of matriculation decreased by twenty-one and eight percent for African-Americans and Whites residing in marginalized neighbourhoods, respectively.

Sampson (2012) provides a comprehensive account of the findings of two decades of research conducted under the 'Project on Human Development in Chicago Neighbourhoods'. The study revealed that the city's neighbourhood traits have, for the most part, prevailed through time despite the racial makeup of those neighbourhoods. The author, therefore, concludes that 'neighbourhoods' themselves, rather than the inhabitants, be considered an independent factor impacting numerous socio-economic outcomes.

3.3. Segregation Research Outside of the USA

The literature described thus far in Section 3.2 has all pertained to the segregation research in the USA. While the majority of such research stems from the USA, studies of this nature have been conducted in various countries across the globe where segregation is marked.

Telles (1992) used data obtained from the 1980 population census to investigate segregation by skin-colour in thirty-five metropolitan areas of Brazil. Dissimilarity indices were calculated, showing that the level of White-Black segregation was much higher than that of White-brown and brown-Black segregation. Multivariate analysis also identified housing markets and socio-economic status as drivers of racial segregation.

Fong and Wilkes (2003) investigated racial segregation patterns among seventeen ethno-racial groups in twelve Canadian cities to explain modern segregation patterns in multiethnic cities. The main finding of the study related the ethno-racial segregation among the different groups to different urban drivers. The authors concluded that the segregation of European-descendent ethnic groups was driven primarily by demographic factors (such as population numbers,) while segregation among minority groups was credited to structural factors such as employment and housing construction.

Musterd and Sako (2005) implemented the index of segregation to investigate the nature of ethno-racial segregation in various European countries. The study concluded that segregation levels across Europe were moderate compared to that found in the USA. Furthermore, the segregation levels and patterns observed varied across the countries considered, as well as for the different ethnoracial groups considered. The authors attributed this variation to a number of factors, including the different social welfare programmes implemented within the different countries, and income inequality.

Johnstone *et al*. (2007) conducted a comparative analysis of segregation patterns across five Anglophone regions: Australia, New Zealand, Canada, the United Kingdom and the United States of America. The study used population data sourced from the latest available census for each region (ranging from 2000-2001). Overall, the authors found that segregation levels were lower for Australia and New Zealand compared to the other regions. The authors also concluded that common attributes between the different regions, such as the relative proportions of the minority populations, was correlated to the observed segregation levels across the five regions.

Owusu *et al*. (2011) measured the levels of ethnoracial segregation in Accra and Kumasi, the two largest cities in Ghana. Data sourced from the Population and Housing Census (2000) was used to compute a location quotient index for the respective cities, calculating ethnoracial diversity and concentration. The authors found that segregation levels were more balanced in Accra than in Kumasi, and that socio-economic segregation was more pronounced than ethnoracial segregation.

Préteceille (2011) investigated changes in the segregation levels between national citizens and immigrant groups in Paris, France. The Dissimilarity Index was calculated using population data

from the 1982, 1990 and 1999 censuses. The author found that the North African, sub-Saharan African and Turkish groups were the most segregated, and that segregation levels among these groups have been increasing over time.

Wang *et al*. (2012) investigated the impact of gated communities as drivers of social segregation in Beijing, China. To do this, the authors specifically examined the activity space of residents who inhabited different types of neighbourhoods. The authors found that the use of public space was strongly correlated to occupancy within and outside of 'privileged enclaves'. The authors found significant differences in the use of time and space between residents inside and outside of privileged enclaves, with most of the variation in time and space utilization relating to exclusivity, extensity, and intensity. The authors deduce that the fragmentation of the urban space in Beijing results not only from residential segregation, but also in the different time and space usage of different social groups. Therefore, the authors concluded that there was a direct link between residential segregation and social segregation.

Research into segregation has also been conducted within South Africa. Before reviewing this, the context of South Africa's segregationist history, and resultant urban fabric, will first be elaborated on in the subsequent section.

3.4. Segregation Research in Post-Apartheid South Africa

According to Donaldson and Kotze (2006), comparatively little research has been conducted on residential desegregation in post-apartheid South Africa. The studies that have been conducted have utilized census and property transfer data to measure desegregation, and, for the most part, point towards urban settings characterized by persistent patterns of segregation.

Turok (2001) investigated the extent to which Cape Town had managed to reduce social and spatial divisions inherited from apartheid. This study was contextualized within the development trends taking place in the city. Findings showed that private investment and job opportunities remained concentrated in the affluent northern and western areas, while subsidized low-income

housing was concentrated in the poorer south-east region. In this way, institutional practices and market forces were found to be reinforcing spatial segregation.

Christopher (2001b) measured segregation levels for South Africa using population data from the 1996 National Census. The study revealed that for the first time in an inter-census period, racial segregation had declined in South Africa, albeit marginally from 96 to 95 percent. Additionally, Christopher (2001b) stated that in comparison to trends in the USA in the second half of the Twentieth Century, the effect of the removal of segregationist legislation was more immediate and extensive in South Africa. Some key features were identified by Christopher (2001b) characterizing the process of desegregation in South Africa:

i. The White population remains the most segregated, and is integrating at the slowest rate, despite the fact that most of the racial integration was occurring in the domain of the former White Group Areas. The emergence of new, segregated, ghetto areas in the central city areas is offered as a partial explanation for this.
ii. The South African population is integrating at very slow pace, with only a small proportion of the Black population reaping the benefits of political empowerment. The lack of economic empowerment afforded to the overwhelming majority of the African population (which also represents the vast majority of the country's total population) was identified as a major factor hindering the integration process.
iii. The majority of integration that has occurred predominantly involved the Indian and Coloured populations, attributed to their intermediate social and economic status between the Whites and Africans in the apartheid racial and social hierarchy.
iv. Desegregation has reintroduced features of the pre-apartheid city, with suburbs ranging from racially integrated to segregated.

A nation-wide study by Christopher (2005) used population census data from 1996 and 2001 to compute and analyze segregation indices to determine the extent to which desegregation had occurred in the towns and cities of South Africa. The study found that while the levels of racial segregation decreased between 1996 and 2001, the rate of desegregation was slower than that observed in the five years prior, as investigated by Christopher (2001b). The study concluded that the post-apartheid city continued to resemble its precursor.

Lemon and Clifford (2005) investigated property transfers amongst members of the African population in Margate to gauge the trends in post-apartheid transition. Margate, a small town located on the south coast of KwaZulu-Natal, roughly 130 km south-west of Durban, presented an interesting case study for the investigating of post-apartheid transitions due to the fact that the whole of the town was proclaimed a White area under the apartheid regime. A small amount of desegregation was found to have taken place in the residential areas. While the size of the African middle class grew substantially since democratization, the low-cost housing provided by the state, which was aimed at increasing the levels of African home-ownership, was clustered in the peripheral regions of the town, and, therefore, not conducive to promoting racial integration.

Schensul (2010) investigated post-apartheid segregation in Durban, focusing primarily on the interactions of race, class and space in determining the urban spatial organization of the city. The study conducted a spatial analysis of residential areas and produced a 'sociological cartography' of the city, demonstrating how race, class and space acted together to yield three distinct, although interconnected, urban transformation types: the racialized city, the class-stratified city and the transformed city.

The racialized city represents the foremost legacy of urban spatiality; comprising separate residential areas inhabited exclusively by members of a single racial classification. Linking back to Peach's (2005) theoretical categories of segregation (refer to Section 2.3), the racialized city can be representative of either (or both) the American ghetto scenario, wherein segregation is involuntary and social barriers prevent spatial integration, or the voluntary plural-persistent enclave, in which residents of a shared ethnic background actively choose to remain in their segregated neighbourhoods.

In the class-stratified city, residential areas are inhabited by mixed racial groups of similar class levels. This scenario can be related to Peach's (2005) transition assimilation-diffusion model, wherein successive generations relocate into specific neighbourhoods over time. The class-stratified suburb also displays an element of Peach's (2005) parachuted suburb model, referring to neighbourhoods into which affluent members of an ethnic group have relocated in concentrated numbers.

The transformed city, which is characterized by a spatial configuration that transcends both race and class, epitomizes the notion of integration. The study demonstrated that both race and class form important factors governing how transformation takes place within an urban context. The transformed city clearly reflects Peach's (2005) transitional assimilation-diffusion model.

Numerous studies have focused on examining desegregation in specific cities. A study by Irvine (2012) investigated the nature of post-apartheid segregation in Grahamstown from a time-geographical perspective. The study concluded that Grahamstown, 20 years after South Africa's transition into democracy, was still segregated along racial and class lines. The racial makeup of both schools and residential areas was found to still adhere to the apartheid city design. Furthermore, the integration that did take place was found to be one-way, characterized by the movement of the African population into former-White domains, with Whites remaining within the confines of their formerly designated boundaries.

Figure 2.4 shows the results obtained by Christopher (2001b), reflecting the changes in national segregation levels in South Africa from 1911-2001. These results show that racial segregation has always been prevalent within the urban context of South Africa. The Group Areas Act of 1950 exacerbated the already present trends. Following the repeal of the Group Areas Act in 1991, as well as other major pieces of apartheid legislation, a decrease in the level of racial segregation has taken place; this, however, is minor, and racial segregation remains a major theme within the post-apartheid urban fabric. Relating this back to the stylized segregation profiles developed by Reardon *et al.* (2008), this segregation profile corresponds to Region C, as shown by the outlined area in Figure 2.5.

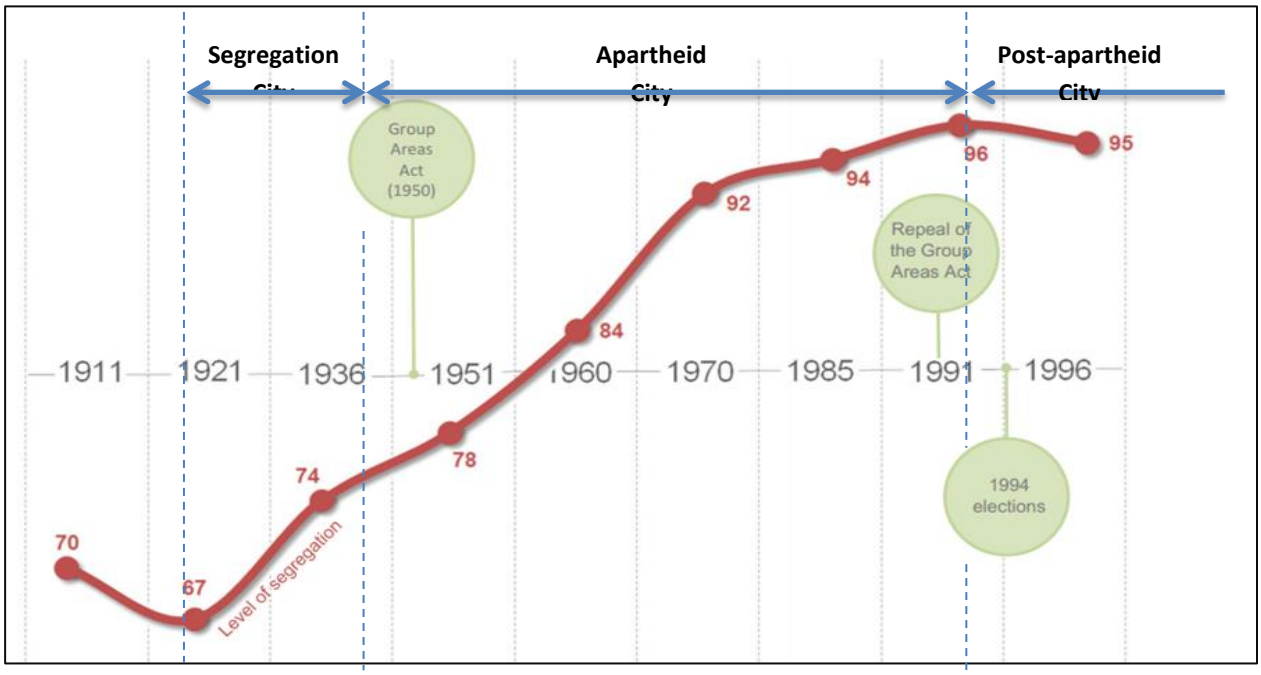

Figure 3.1: Segregation levels (expressed as percentages) for South Africa (1911-1996) (Adapted from Parry (2013) with data originally obtained from Christopher (2001b))

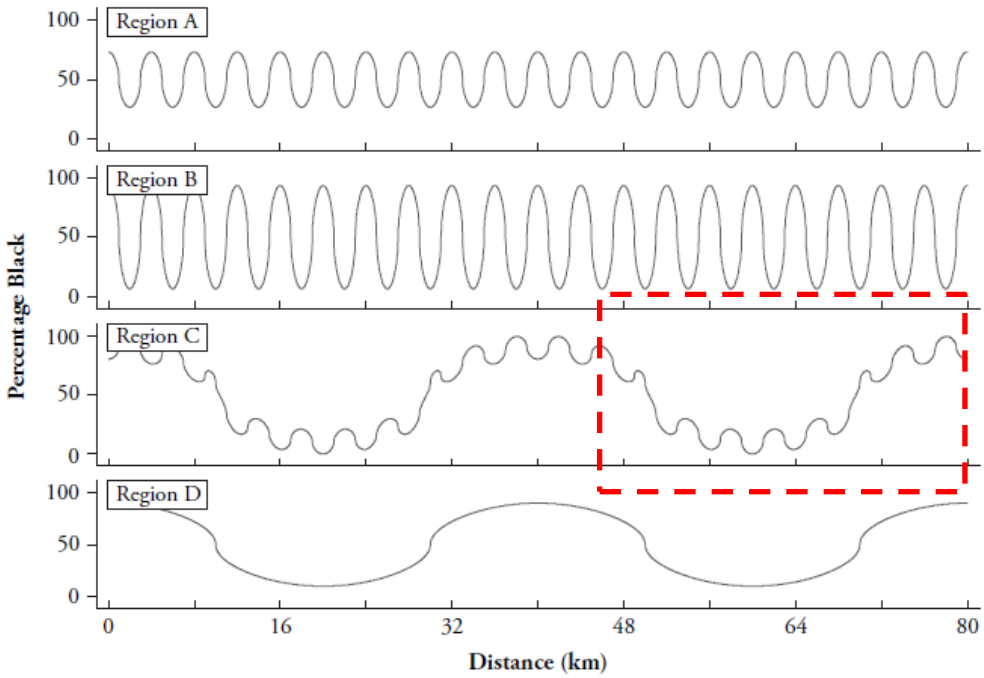

Figure 3.2: The stylized segregation profiles developed by Reardon *et al*. (2008), with the outlined section highlighting the pattern observed in Port Elizabeth

Christopher (2005) summarizes how the apartheid city has changed following the dismantling of the apartheid regime: following the repeal of the Group Areas Act in 1991, rapid integration (subsequently followed by re-segregation) took place in the CBDs as Whites relocated to suburban areas in the outer lying regions and middle-income Africans then entered the CBD. Integration, overall, has been characterized as a slow process, with a limited movement of Africans into formerly-White areas. The majority of the country's African population is still clustered in highly segregated and rapidly expanding townships located on the periphery of cities. Whites remain the country's most highly segregated racial group.

Donaldson and Kotze (2006) summarize five major observations that can be drawn from the body of literature on post-apartheid residential segregation:

i. Only limited desegregation has occurred, with the desegregation that has occurred being place and group specific.
ii. The racial integration that has taken place consists primarily of Africans relocating into formally-White residential areas.
iii. Racial segregation is slowly being eclipsed by income-based segregation.
iv. Interracial mixing does not necessarily guarantee racial desegregation and interaction.
v. African home-owners, who have not been active in the secondary housing market for long, are more highly impacted by tough economic conditions.

Bwalya and Seethal (2015) investigated racial integration in selected residential areas in East London by analyzing property transfer data from 1993 to 2008. The study found that 74 % of Black residential property purchases occurred in relatively cheaper residential areas, while 65.2 % of White purchases occurred in more affluent areas. Chi-square tests were computed to show that there was indeed a significant relationship between race and patterns of residential property transfers. The authors concluded that the patterns of residential property transfers in East London were representative of the link between class status and spatial segregation in residential areas that were formerly White.

Parry and van Eeden (2014) used population data from the National Censuses (1991-2011) to (i) measure racial segregation at different geographical scales for Cape Town and Johannesburg, and (ii) measure how segregation has changed during the time period for both cities. Theil's

Entropy Index was calculated for grid cells of varying size to determine both the racial diversity and segregation levels of each city. The study found that segregation levels decreased from 1991 to 2011 for both cities, but concluded that both cities remained highly segregated. Furthermore, the authors concluded that, when considered at census tract-level, Cape Town was the more segregated of the two cities, but that at higher geographical scales, Johannesburg was more segregated. The results of this study will be discussed later in Chapters 5 and 6 in relation to the findings of this study.

3.5. Conclusion

The consideration of the extensive segregation research conducted locally and globally has highlighted two aspects that need to be addressed in South African segregation research: (i) universal values of segregation need to be calculated through the use of a multi-group index to more accurately represent the country's multi-ethnic racial composition; (ii) segregation needs to be measured across varying geographical scales to properly understand the macro- and micro-scale processes driving the observed segregation patterns.

This study aims to build on the work by Parry and van Eeden (2014) by investigating the temporal changes in segregation levels, across various geographic scales, for Port Elizabeth from 1996 to 2011. The methods employed by Parry and van Eeden (2014) will be implemented. A universal segregation value will, for the first time, be calculated for Port Elizabeth for each of the post-apartheid census periods. Racial diversity will be mapped within a GIS to graphically represent changing patterns of racial segregation. Furthermore, the Dissimilarity Index and the segregation index will be used to explain the inter-race and individual race dynamics which result in the segregation levels measured, as well to build on the extensive work by Christopher (1987a, 1987b, 1988, 2001b, 2005) in the city.

In addition to building on the existing body of literature, this study also aims to take the segregation research a step further by not only empirically determining *what* the trends in post-apartheid segregation are, but also attempting to ascertain *why* these trends exist. After

establishing the trends in Port Elizabeth's post-apartheid racial segregation, this study will seek to identify possible drivers behind these observed patterns by (i) ascertaining whether a statistically significant relationship exists between race and various socio-economic variables, and (ii) conducting interviews with relevant government persons to supplement the study findings with possible explanations of the dynamics and processes influencing patterns of desegregation and persistent segregation.

CHAPTER 4: RACIAL SEGREGATION IN SOUTH AFRICA

4.1. Introduction

Racial segregation has long been a dominant theme in South Africa's history. This chapter aims to provide a brief overview of the emergence and evolution of the segregationist tradition in South Africa. Comprised of four sections, it begins by presenting a brief overview of the country's governance structures (Section 4.2), thereby providing the necessary context for understanding the segregationist policy and legislation borne of these structures. Section 4.3 accounts for South Africa's pre-apartheid segregation history, beginning with its founding during the Colonial period (1652-1910), and extending into the Union period (1910-1948). Following this, Section 4.4 discusses the nature of racial segregation as implemented under the apartheid regime, after which Section 4.5 examines current trends, observations and projections relating to the emergent post-apartheid cities in South Africa.

4.2. Historical Overview of South African Governance

Before detailing the nature of racial segregation throughout South Africa's turbulent past, it is beneficial to chronicle the evolution of the country's governance structures. Figure 4.1 presents a timeline of some key events that defined South Africa's various political transitions.

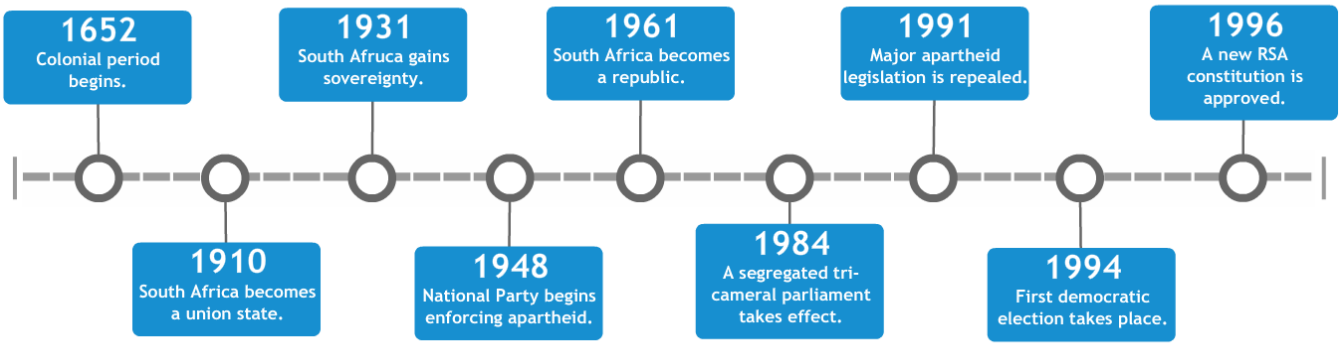

Figure 4.1: Timeline of major events in South Africa's governance history

South Africa was first settled by colonists under the Dutch East India Company in 1652, marking the beginning of the country's colonial period. By 1806, the Dutch period had ended and the colony was solely under British rule. There remained, however, a distinct community of Dutch-descent that would later become the Afrikaner nation. South Africa, during the Colonial period, was comprised of four separate British colonies, these being the Cape Colony, Natal, the Orange Free State and the Transvaal. The latter two were predominantly occupied by Afrikaners. Conflict between the British imperial authorities and factions of the Afrikaans community who sought political independence from the Crown remained a constant theme throughout the 19th century.

In 1910, the four colonies united to form the Union of South Africa, marking the end of the colonial period. The Union of South Africa was classified as a dominion of the British Crown. The term 'dominion' describes a semi-autonomous polity that was a constituent of the British Imperial Empire and British Commonwealth. According to Christopher (2001a:9), the establishment of this Union represented a "compromise between the two White 'races', which consequently had nothing to offer the indigenous population in the form of political and economic prospects". In 1931, South Africa was granted full autonomy from Britain with the passage of the Statute of Westminster, but remained a member of the British Commonwealth.

In 1948, the Afrikaner-led National Party was elected into power on a segregationist platform. The National Party immediately began implementing its policy of separate racial development, commonly known as apartheid. Apartheid will be discussed in further detail in the subsequent

section in relation to its impact on the spatial and social engineering that resulted in a segregated society. The Afrikaner-led party also saw the end of the Union of South Africa in 1961. Hendrik Verwoerd, the leader of the National Party and the then current president of South Africa, maintained that unity between the English and Afrikaners could only be realized with the formation of a new Republic. Following a national referendum held in 1960 (in which only the White population participated), it was decided that South Africa would become a Republic. The Republic of South Africa was formed in 1961, followed by its subsequent withdrawal from the British Commonwealth. The decision to opt out of the Commonwealth was taken in response to the disapproval expressed by numerous Commonwealth member states regarding the National Party's apartheid policies, which would have likely led to South Africa's imminent expulsion.

By the 1980s, increasingly violent uprisings by the African population, and the corresponding counter-violence by Whites, made maintaining order in South Africa problematic. As a preventative measure aimed at neutralizing the power of militant civic groups that were forming in the townships, the then Prime Minister of the country, P.W. Botha, proposed a constitutional amendment that sought to extend to Indians and Coloureds the right to participate in national government. This took effect in 1984, when the members of the South African parliament convened to generate a new South African Constitution with a three-tier parliament, aimed at enfranchising and re-enfranchising the Indian and Coloured populations, respectively. The tricameral parliament, as it became known, was comprised of three houses, these being the House of Assembly for the White population, the House of Delegates for the Indian population, and the House of Representatives for the Coloured population (See Figure 4.2). The House of Assembly constituted the majority, with the number of White representatives outnumbering that of the Indian and Coloured parliamentarians combined (Figure 4.2). The African population, who then comprised seventy-five percent of the South African population, remained disenfranchised. Africans could only get elected into municipal councils known as Black Local Authorities.

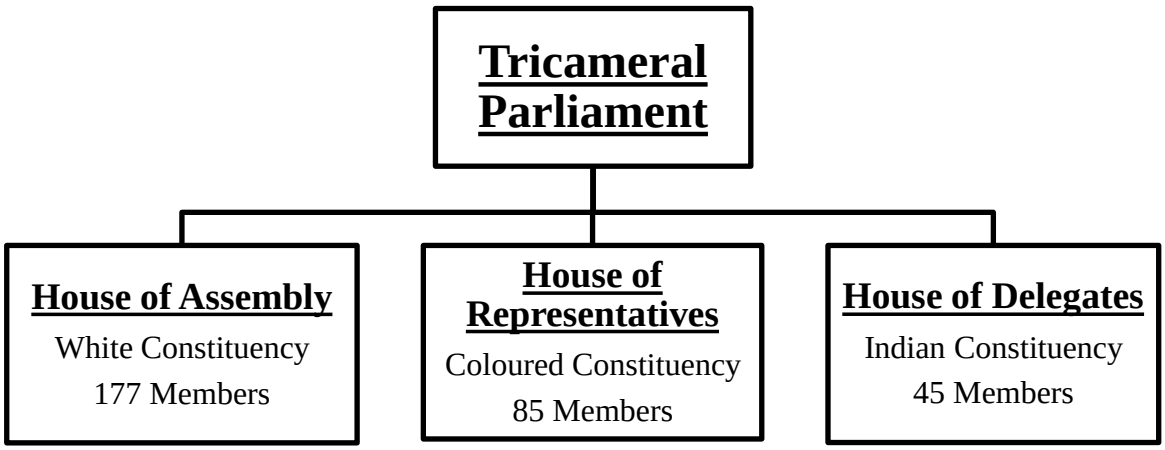

Figure 4.2: Structure of the South African tricameral parliament established in 1984

The formation of the tricameral parliament was based upon one of the fundamental principle of the 1983 Constitution, that, in conjunction with the spatial separation of the different race groups, there should additionally be a distinction between a racial population's 'own affairs' and the 'general affairs' of the country. Table 4.1 provides examples of sectors relating to legislation and municipal service provision that are classified as either 'own' or 'general' affairs. Legislation pertaining to the 'own affairs' of one race group was handled by the appropriate parliamentary house, while legislation relating to the 'general affairs', which were significant to all the race groups, was handled by all three parliamentary houses.

Table 4.1: Examples of government sectors categorized as 'own' and 'general affairs'

Own Affairs	General Affairs
Education	Foreign Policy
Health	Defence
Housing	Law and Order/Justice
Social Welfare	Finance
Local Government	Commerce and Industry
	Internal Affairs
	Transport
	Agricultural Policy

The structure of the tricameral parliament gave the illusion of shared power. Although the formation of the tricameral parliament facilitated the participation of Indians and Coloureds in government, in reality it afforded them very limited power as any legislation considered contentious was decided by a board known as the President's Council, which was White-dominated. The tricameral parliament was, therefore, a facade of political reform. In fact, having separate electoral registers for Whites, Indians and Coloureds held true to the separatist ideals of apartheid ideology. Furthermore, there were discrepancies in the resources available to each house for the management of their 'own affairs', with the majority of these being allocated to the House of Assembly. This, therefore, resulted in large inequalities in areas such as housing delivery and municipal services between the respective race groups. The tricameral parliament, therefore, not only reinforced the racial separateness, but also entrenched racial inequality.

The retirement of P.W. Botha in 1989, and the election of his successor, F.W. de Klerk, was momentous in South Africa's history. The apartheid policies implemented by the National Party

had been increasingly met with economic sanctions from the USA and other countries, posing financial difficulties for South Africa as a whole. Furthermore, De Klerk recognized that civil war was imminent under the apartheid regime. Recognizing these threats, de Klerk set about dismantling the apartheid regime. In 1991, the selected apartheid laws were repealed.

In 1994, the first democratic elections were held in South Africa. The African National Congress (ANC) won the election, resulting in Nelson Mandela becoming the country's first African president. While the social engineering policies of apartheid came to an end, its legacy still persists. Reversing the apartheid legacy, which includes racial segregation and inequality, presents a formidable challenge in the democratic era.

4.3. Racial Segregation before Apartheid

South Africa has a long history of racial segregation and presents a unique case study for investigating racial segregation. Firstly, the South African apartheid policy, from 1948 to 1994, is an example of forced segregation that was carried out through its formal entrenchment in the country's legislation and urban planning policies. Secondly, while the majority of segregation studies that have been conducted globally are concerned with that of minority population groups, the African population of South Africa, who were the most severely impacted by the South Africa's segregationist policies, represents the overwhelming majority of the South African population (Saff, 2002; Parry, 2012).

Apartheid, referring to the set of segregationist policies that were legislated in South Africa from 1948 to 1994, is one of the most recognized examples of racial segregation and spatial injustice worldwide. According to Christopher (2001a), the term 'apartheid' was considered one of the most emotionally-charged terms of the second half of the Twentieth Century. While it represents the pinnacle to which racial segregation was formally implemented, it by no means represents its beginning. Racial segregation was apparent in the spatial organization of South Africa as early as the colonial period (Christopher, 1988). According to Beall *et al.* (2002), the colonial practice was simply to allocate spaces for the settlement of indigenous populations so as to ensure homogenous settlement patterns.

The passing of the Glen Grey Act in 1894 by the then Prime Minister, Cecil John Rhodes, represents such an attempt at securing racial segregation. According to Bouch (1993), the Act was passed to serve several purposes, which are summarized as follows:

1. The establishment of a land tenure system based on small land plots for occupation, which could be bequeathed down successive generations. This was aimed at promoting male members of the population to take up employment within the district.
2. The introduction of limited self-governance through the establishment of local councils.
3. The limitation of the franchise rights of Africans by denying their right to possess land.

Edgecombe (1976: 89) described the Glen Grey Act as a prime example of "implicit and explicit segregationist legislation". According to Edgecombe, the passing of this legislation was spurred by numerous factors, including (i) the rise of the radically anti-African Afrikaner Bond group, who were extremely active in the politics of the Cape Colony at the time and who played an influential role in Rhodes' election to power, (ii) the facilitation of the Cape Colony's continuing annexation of what were autonomous African lands, and (iii) as a political response to the political awareness that was developing amongst the African population. According Rotberg (1988), the Act was consciously contrived by Rhodes as an African policy that would both secure labour for industrial and agricultural development, and provide a socio-political framework that would facilitate the suppression and management of Africans as subsidiary inhabitants. According to Rotberg (1988: 477), the passing of the Glen Grey Act "gave the nineteenth-century reserve a secure and expanded footing" towards the formal implementation of its segregationist ideals; the Act, therefore, can be considered a stepping stone towards the development of the overtly segregationist policy in later years.

Kahn (2013) states that although the Glen Grey Act only applied to the Glen Grey district of the Eastern Cape, as represented in Figure 4.3 (the shaded area within the red square), it epitomizes the prejudice surrounding African land procurement and ownership throughout South Africa. The Act not only controlled the number of Africans who could inhabit and own land in the area, but compelled those who were classified as unworthy to vacate the area to find work elsewhere (Kahn, 2013). Furthermore, as Kahn (2013) states, it was intended by Rhodes that the Glen Grey Act would eventually be applied throughout all Britain's African colonies.

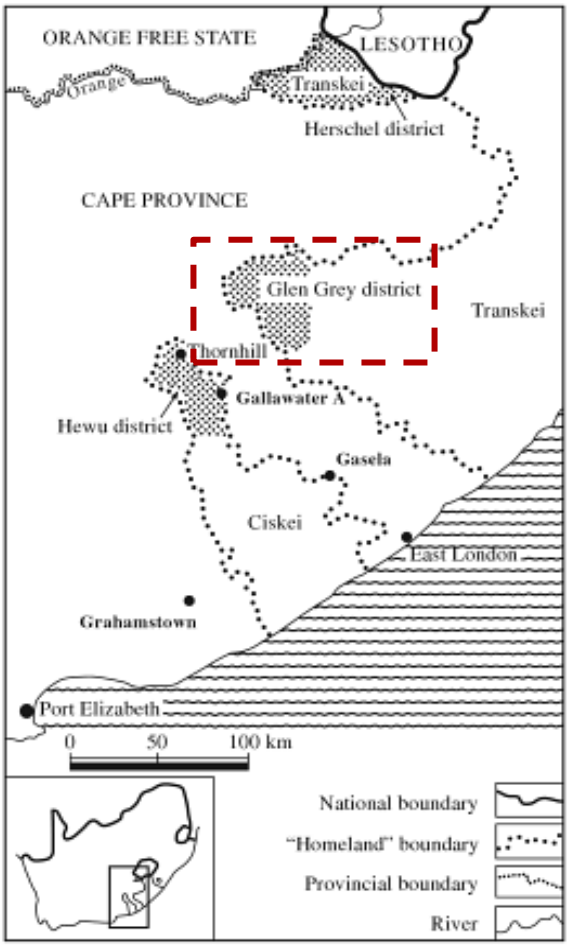

Figure 4.3: The location of the Glen Grey District within South Arica (from Blundo and Le Meur, 2009)

Racial segregation, during the colonial period, and the underlying imperatives, are discussed in greater detail in the next chapter with regards to Port Elizabeth specifically. Christopher (1988), after analyzing demographic data from the 1911 Census, found that by the time South Africa became a Union in 1910, the populations of its cities were already significantly segregated along racial lines.

The Union period in South Africa saw the legislation of limited institutionalized segregation. The first major piece of segregationist legislation passed by the Union parliament was the Natives Land Act of 1913. This Act prohibited the purchase or lease of land belonging to Whites by

Africans, who were then referred to as 'natives' (Gitta, 2011). In his book, *Native Life in South Africa*, Sol Plaatje documents the impact that this Act had on the African population of South Africa. The book's famous opening line reads as follows: "Awakening on Friday morning, June 20, 1913, the South African Native found himself not only a slave, but a pariah in the land of his birth" (Plaatje, 2007:1).

In this powerful statement, Plaatje draws parallels between what it was to be a slave in the western world and a new variant of 'slavery' in South Africa. Slaves were expected to work the land, yet had no right to the land they worked, as well as the bounty it yielded. The Natives' Land Act, passed in 1913, similarly, stripped the indigenous African peoples of their rights to the land they worked and the crops it produced, as well as the grazing land on which they were dependent. In doing so, it stripped them also of their livelihoods, leaving them no choice but to labour as 'slaves' for their White 'masters'.

While the passing of Natives Land Act of 1913 successfully divested the African population of their right to land-ownership, subsequent legislation would later be aimed at the total exclusion of Africans from the urban domain. In 1922 the Stallard Commission recommended that the Union's urban areas be proclaimed exclusive White territories. Subsequently, the Natives (Urban Areas) Act of 1923 was passed, which required that local authorities establish separate locations for the residence of Africans (Davenport, 1987). This Act, therefore, not only resulted in the segregation of urban space, but also imposed controls on the access and influx of Africans to cities. In Figure 3.1 (Section 3.4) which shows the change in segregation levels for South Africa, the sharp increase in the level of racial segregation from 1911 to 1991 is clearly reflected.

These Acts reflect the *status quo* idea of the time that Africans were aliens of the urban domain, an idea that would remain ingrained in the segregationist philosophy underpinning South Africa's path of on-going racial segregation. Davies (1981) delimited the Segregation City model that emerged in South Africa between 1923 and 1948, following the passing of the 1923 legislation, characterized by limited levels of racial integration in the country's primary city areas. The Segregation City would be followed by the Apartheid City model (also conceptualized by Davies, 1981), which would later represent the pinnacle of racial segregation in South Africa.

Davies (1981), who traced the spatial evolution in the layouts of South African cities, provides a conceptual model of the Segregation City, illustrated in Figure 4.4. In this model, Davies identifies nine structural elements characterizing the spatial layout of the typical South African city at the time:

i. A central business district (CBD) that was dominated by the White population.
ii. Subsidiary Indian and Chinese central business districts peripherally located to the primary CBD.
iii. Industrial areas that were characterized by White-ownership, but where mixed-race employment was permitted.
iv. A White residential core area, with sub-urban extensions, located in areas considered desirable.
v. Distinct Indian, Chinese and Coloured residential areas which were centrally located in the older residential sectors of the city.
vi. Residential areas for African workers usually comprised of compounds and barracks.
vii. African, Indian and Coloured settlements located in the periphery of the city
viii. Residential quarters for African domestic workers that could be located throughout the city.
ix. 'Mixing zones', describing regions in White residential areas where other race groups were integrating.

The increase in the levels of segregation between 1923 and 1950, measured by segregation indices, is clearly reflected in Figure 3.1 (Section 3.4).

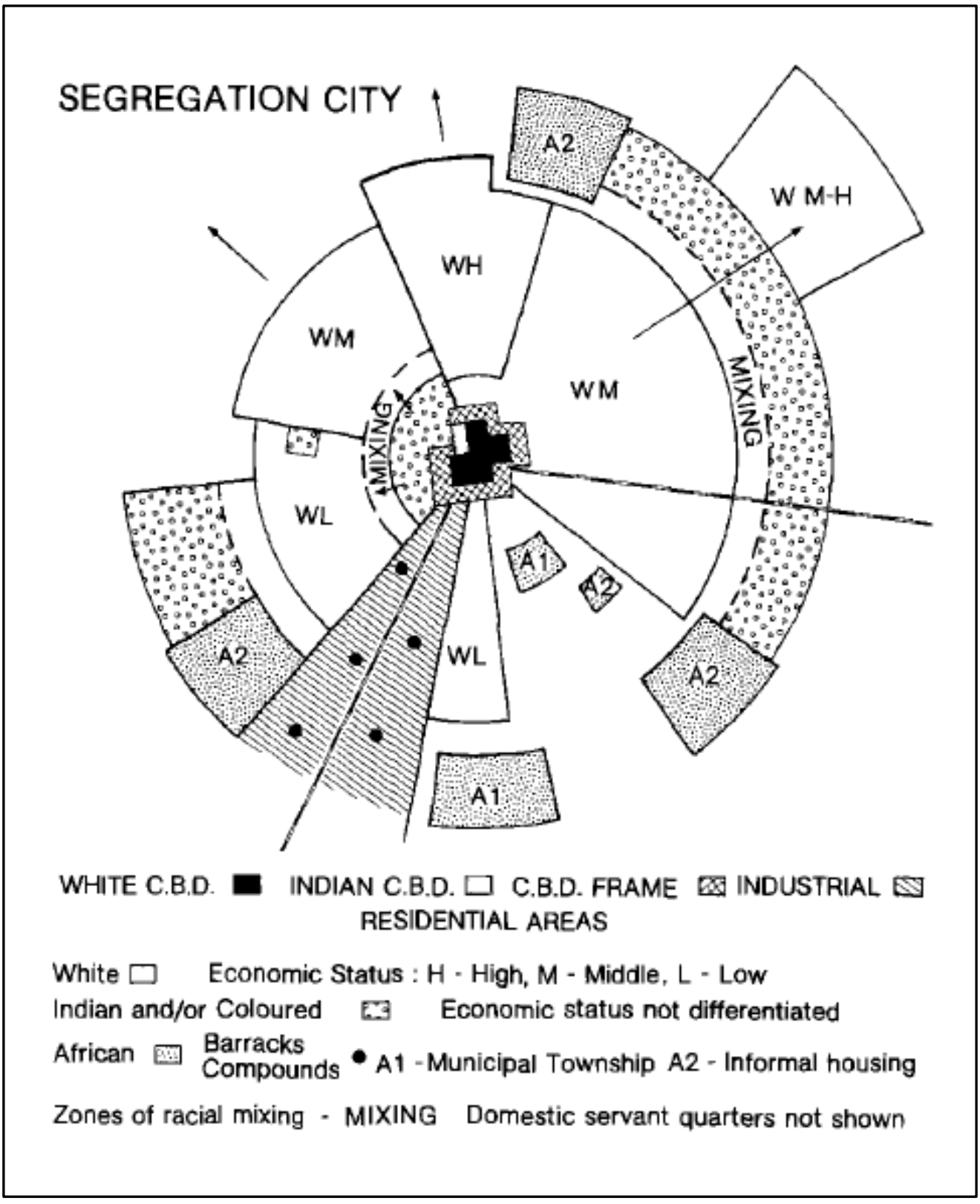

Figure 4.4: The Segregation City model (Davies, 1981)

4.4. Segregation during Apartheid

In 1948, the National Party, whose political platform was based on ideals of racial segregation, was elected to power. The National Party put in place a programme which aimed to enhance the segregationist policies that were already in place while introducing and implementing new legislative policies to achieve two aims: (1) the complete segregation of the African population, which had already begun prior to the National Party's election to power, with the ultimate goal of total urban exclusion and (2) the segregation of the remainder of the population into separate residential areas (Christopher, 1987b). Thus, the apartheid era, which would last for over four decades, began.

The first of these aims, as Christopher (1987b) explains, was achieved through tightening the existing controls on the African population. This included the expropriation of property owned by Africans in areas that were considered White. A building campaign was launched to develop new African locations on a scale that was unprecedented. Pass laws, which controlled the residence and movements of the African population, were implemented.

In order to achieve the second aim, two pieces of legislation were passed in 1950. The Population Registration Act required that the entire population be classified into defined racial groups (Africans, Whites, Asians and Coloureds); the Group Areas Act required that cities be divided into separate urban zones, each of which would be designated for the exclusive occupation of a specific racial group, as defined by the Population Registration Act (Christopher, 1987b). Also worth mentioning are the Mixed Marriages Act, passed in 1949, and the Immorality Amendment Act No.21, passed in 1950. The first of these Acts prohibited interracial marriages, while the latter prohibited interracial sexual relations (Christopher, 1987b).

The spatial organization of the apartheid regime remains one of the most well-known examples of a segregated state. According to Lemon (1991), no other country has so thoroughly reorganized its space to facilitate segregation.

Davies (1981) provides a model of the ideal urban layout of the apartheid city in South Africa (Figure 4.5), which was developed from the guidelines adopted by the Land Tenure Advisory Board. This required that Group Areas be designated on a sectoral pattern extending out from

the central business district. This would enable outward expansion as the city grew. Buffer strips of land, at least 30 m wide, were to serve as barriers restricting movement between areas designated to different race groups. To this aim, landscape and urban features, including rivers, geomorphological features, railways, bridges and industrial and central business districts, were integrated into spatial planning. Furthermore, while roads linked the Group Areas to common-use areas, like the central business district, no roads directly linked segregated areas to each other. The place stratification model, wherein social barriers inhibit the spatial integration of ethnic groups, takes on a new and unique characteristic in the South African context – both physical and socio-economic blockades enforce racial segregation.

Christopher (2001a) identifies three characteristics of the apartheid city model layout that were conducive to reinforcing White dominance in South Africa:

i. Central business districts were classified as part of the White Group Area.
ii. 'Non-White' Group Areas were located towards the peripheral regions of the city and were highly restricted.
iii. Sectoral zoning also impacted not only residential areas that were racially-mixed, but also those which were segregated prior to the passing of the Group Areas Act (if their borders encroached upon the domain of another Group Area).

It is also important to note that the apartheid system was not only aimed at facilitating legislated racial segregation, but also involved the establishment of a racial hierarchy in which the poor White population would be elevated socially and economically above the vast majority of all other race groups (Seekings, 2010). Urban segregation, therefore, entailed "ghettoization" - Whites lived in more affluent areas, with a good municipal infrastructure and economic prospects, Indians and Coloureds lived in less-serviced areas, and Africans, who were ostracized from the urban domain, lived in townships with negligible infrastructure (Seekings, 2010). Linking back to the theoretical models of segregation, the case of the African location in South Africa parallels the involuntary segregation typifying the African-American Ghetto.

Simon (1989) modified Davies' Apartheid City model, incorporating the changes that were occurring in South African cities at the time in response shifting political conditions (Figure 4.6). These changes, according to Simon (1989), were brought about by the international pressure

imposed on the country in the form of economic sanctions. The major changes to the spatial structuring of the South African city highlighted by Simon (1989) are:

i. The central business districts became open to all races.
ii. Free trade areas were established outside of the CBD area. Consequently, as Simon (1989) points out, this led to the decentralization of business and commercial activity, with these shifting towards White residential area.
iii. Squatting settlements formed at the periphery of South African cities due to shortages of township housing, poor living condition in township areas and the desire of migrant workers to maintain family-life, which was denied to them under the policies of the migrant labour system.

The Group Areas Act entrenched racial segregation and inequality in the spatial organization of the urban environment. As Beavon (1991; cited in Smith, 2003) postulated, the physical structures of apartheid would place significant constraints on the future development of a post-apartheid city. Whether Beavon's concerns came to fruition will be determined in this study for the case of Port Elizabeth

The increase in the levels of segregation between 1950 and 1994, illustrated by the use of segregation indices, was discussed in Section 3.4 in the previous chapter. Refer to Figure 3.1 in Section 3.4 to infer the expected levels of segregation during this period.

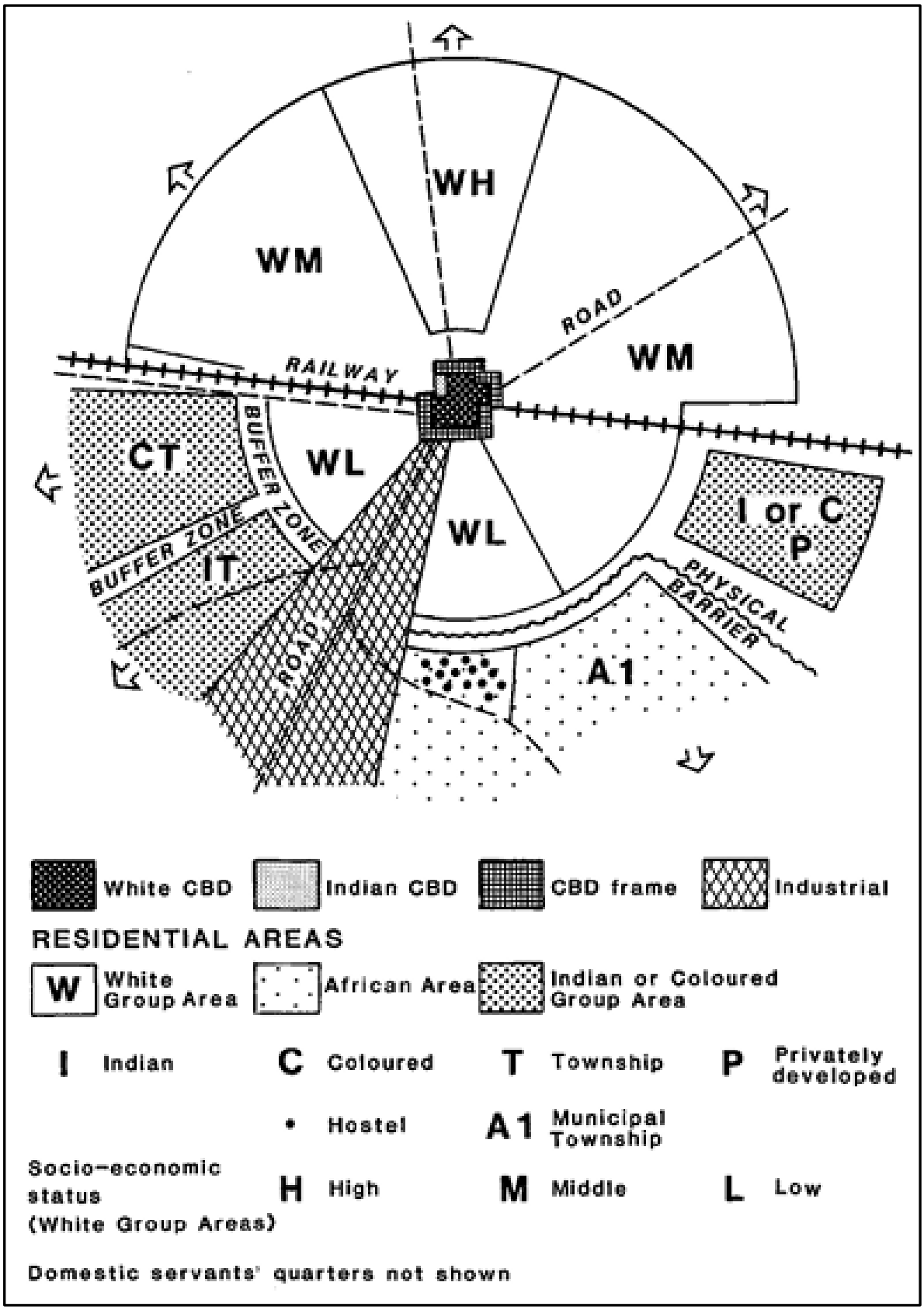

Figure 4.5: The apartheid city model (cited in Simon, 1989, after Davies, 1981)

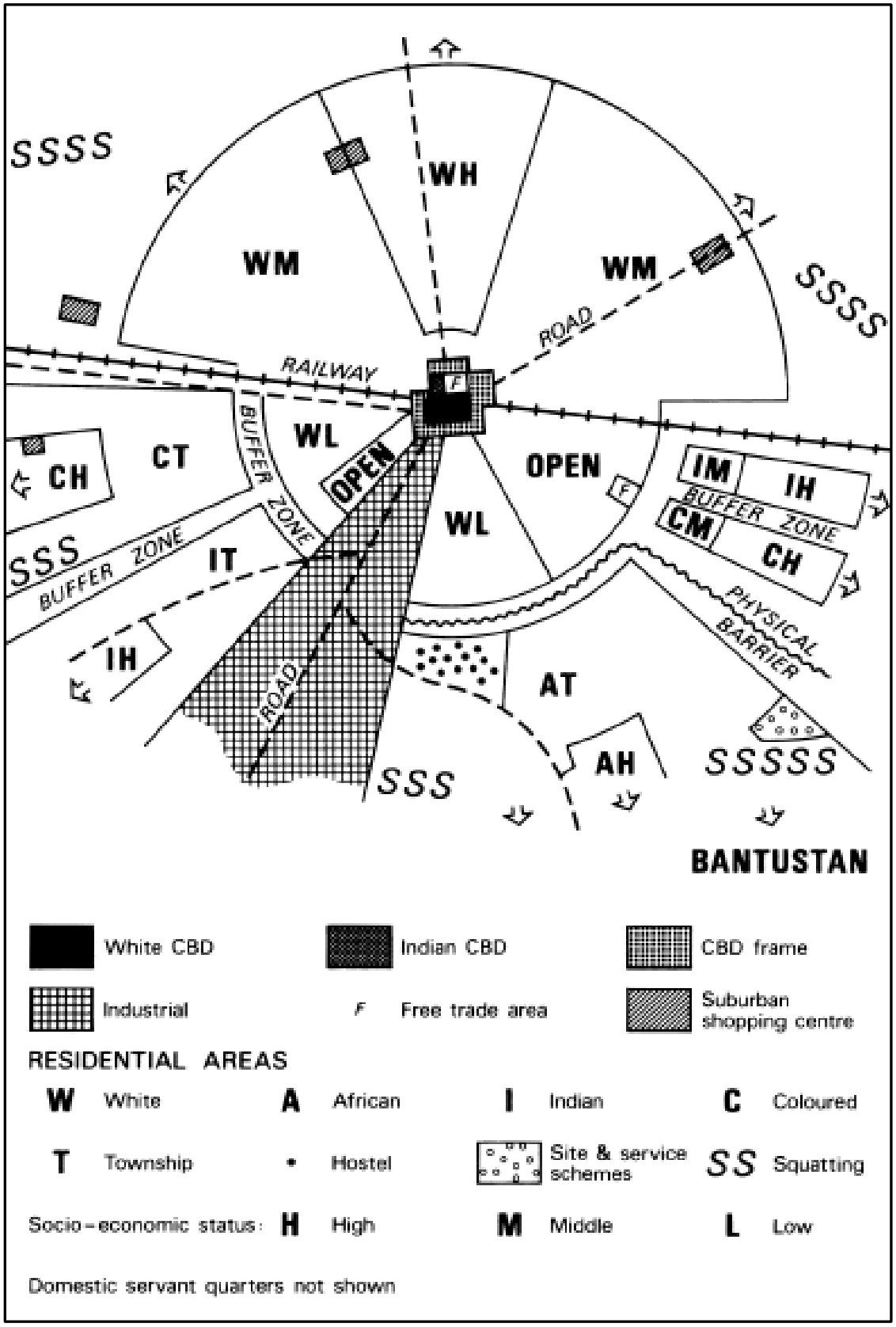

Figure 4.6: The modified apartheid city model (Simon, 1981)

4.5. The Emerging Post-Apartheid City in South Africa

Christopher (1999) presented an overview of demographic trends and development in the years following South Africa's democratization. With respect to the formation of a new post-apartheid city, Christopher (1999: 307) commented that the South African government "lacks the financial resources to undertake any massive social engineering programme to 'undo' the apartheid city on a scale to that required to create it". Based on the decline of the country's White population since democratization and the predicted growth of the African population, Christopher (1999) predicted that South African post-apartheid cities would develop along the same trajectory as happened in the case of Zimbabwe after gaining independence. The post-apartheid city, in this scenario, would be comprised of pockets of low-density, high-income neighbourhoods characterized by moderate levels of racial integration (the transitional assimilation-diffusion model described by Peach (2005) is evident here), surrounded by high-density, low-income neighbourhoods that were homogenously African in composition (again, these reflect the American ghetto model).

According to Christopher (1999), the informal settlements and the state-subsided housing schemes aimed at housing the poorest citizens are where the main growth in South Africa has occurred post-apartheid. Based on this observation, Christopher (1999) infers that the most recent developments in urban areas have served mainly to entrench the already present patterns of segregation inherited from apartheid. Christopher (1999) concludes that the integration process in South Africa would likely be very slow without state-intervention. Additionally, the author points out that the increased rate of African migration into urban regions would likely place strains on the major metropolitan areas. Christopher's overall prediction is that South African cities, in the post-apartheid context, would tend to resemble those of other African cities, as opposed to the desirable paragon of those found in North America and Europe.

Lemanski (2004) investigated the impact that a fear of crime in post-apartheid South Africa had on the spatial evolution of urban form, focusing specifically on the City of Cape Town as a case study. Lemanski pointed out, attempts to mitigate this fear have resulted in a general withdrawal from public space and the creation of fortified enclaves, or gated communities, which consequently led to the polarization of social groups in society. Lemanski (2004: 101) states that

in the post-apartheid context, fear is used as a "justification for a predominantly racist feat of difference". The study argues that this trend in South Africa carries forward the tradition of social separateness from the apartheid state into the post-apartheid era. Lemanski (2004) identified three key similarities between the apartheid and the post-apartheid cities:

i. Fear is used as a justification for racial exclusion

The use of 'Black fear' was a key practice of the apartheid government in arguing for the exclusion of the African population from the urban environment. The author points out that in the post-apartheid context; it is the citizens, as opposed to the government, who are using fear to warrant sociospatial exclusion. The author concludes that this 'fear of crime' is in fact cloaking a truer 'fear of difference'.

ii. Spatial mechanisms are used to displace social problems

Pre-apartheid and apartheid spatial planning involved the removal of African residents to the peripheral areas of the cities as a way of physically displacing what were perceived as social problems. The author relates this to the 'nimbyist' attitudes of urban residents in the post-apartheid era. This observation, according to Lemanski (2004) is corroborated in the responses obtained from urban residents in Cape Town's 1998 Crime Victims Survey, which show that poor Africans are prevented from accessing wealthier areas whose entrance was controlled by access points. The author draws a concerning parallel between this occurrence and the pass system applied in the apartheid era, which likewise, controlled the routes travelled and areas accessed by members of the African population.

iii. Social and Symbolic Exclusion are Prevalent

As Lemanski (2004: 110) points out, the apartheid government's policies of social separation and exclusion generated "minimal mixing and maximum ignorance". The different race groups were considered as entirely separate entities, divided by distinct physical boundaries and separate symbolic identities. In the post-apartheid city, residents now employ such fear-driven strategies as were previously implemented by the apartheid government, with the aim of excluding particular social groups from specific residential

areas. Lemanski (2004: 110) states that the persistent "dominance of symbolic exclusionary mentalities threaten to undermine South Africa's future", recognizing symbolic exclusionism as an inherited, detrimental legacy of apartheid.

A subsequent study by Landman (2006) examined the manifestation of gated communities both at a national scale in South Africa, and for the cities of Johannesburg and Tshwane. According to Landman (2006), in many South African cities, residents' responses to increased crime have been the introduction of road closures and access control, and that such residents perceive life within an enclosed neighbourhood as a step towards a better quality of life and safer living environment. The study investigated whether the development of gated communities in the South African urban landscape was indicative of a new form of structural spatial segregation, and whether this, in turn, could be considered reflective of a 'new apartheid city'. Figures (4.7 and 4.8) show how the urban form of a section of Johannesburg is altered by the establishment of a number of enclosed neighbourhoods. As Landman (2006: 140) explains, the closing off of a number of neighbourhoods severely transforms the road network and urban fabric of the city, transforming large urban areas into "isolated and inaccessible 'super-blocks' with little resemblance to the original fine-grained urban form". The formation of gated communities, therefore, represents a form of micro-segregation, which according to Reardon *et al.* (2008), is characterized by pockets of racially homogenous neighbourhoods that are dispersed throughout a region.

Figure 4.7: Original street layout of a section of Johannesburg (Landman, 2006)

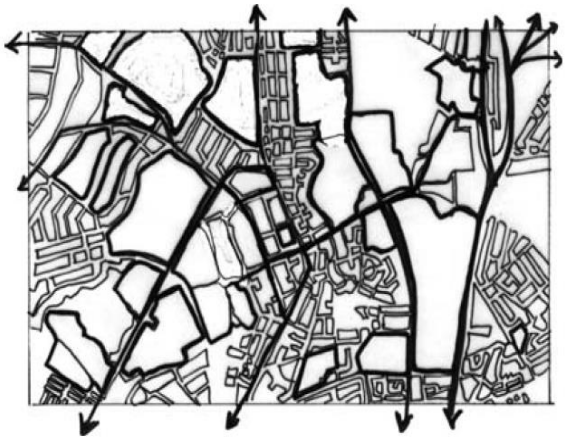

Figure 4.8: Altered urban form of a section of Johannesburg after the establishment of numerous road closures (Landman, 2006)

This is apparent in Landman's (2006) representation of the post-apartheid South African city, illustrated in Figure 4.9. In this model, social polarization is evident, with the city's population separated along financial lines. Given South Africa's history of racial segregation coupled with racial inequality, it can be presumed that the economic segregation shown in Landman's post-apartheid city eclipses, to a significant extent, racial segregation. Furthermore, it is evident that a central business district ceases to exist, with business activity relocating and dispersing towards the residential areas of the city. The decentralization of the business district, viewed within the framework of Landman's urban 'super-blocks', contributes to the segregation of the city's population in that it limits the need for travel across undefined 'economic boundaries', thereby limiting interaction between social groups of different economic and racial backgrounds. From the perspective that gates and fences signify the control of space by a specific group of the city's population, to the disadvantage of other groups, Landman (2006) redefines 'neighbourhood enclosures' as 'neighbourhood exclosures', stating that their formation promotes the privatization of public space. Gated communities, however, are not a dominant feature of Port Elizabeth's urban fabric, so it is unlikely that this will impact on the indices derived in this study.

Landman (2006), following Lemanski (2004), also likens the formation of gated communities to the segregationist divides of the apartheid regime, stating that the physical boundaries imposed by their manifestation restrict the degree of access to public space by all urban residents. More so, Landman (2006) emphasizes that the symbolic implications of this, wherein certain social groups are excluded from accessing certain areas of the urban realm, parallels that of the country's segregationist past. In response to the counterargument that under the apartheid regime, segregation was enforced, while residing within a gated community entails choice, Landman (2006) highlights the fact that choice, in most cases, is strongly dependent on affordability; financial limitations, therefore, limit the majority of the South African population from relocating to, or even temporarily accessing, such neighbourhoods.

Landman (2006) concludes that the development of gated communities threatens the continued existence of the public realm in South African cities, limiting interaction between social groups across financial and racial lines. According to Landman (2006: 145), the manifestation of gated communities are creating "barricaded shadowlands", opposing the aims of post-apartheid policies aimed at achieving integration.

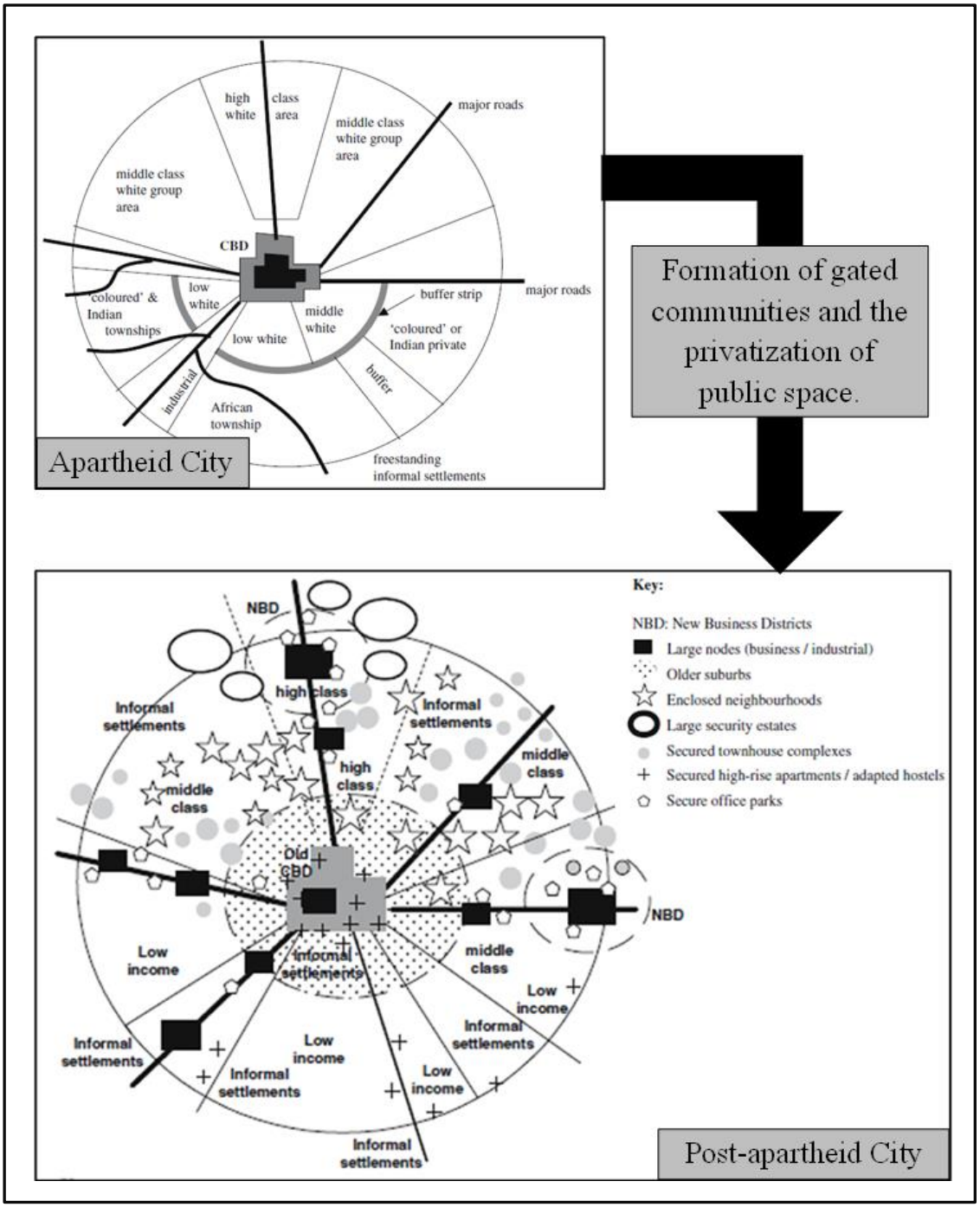

Figure 4.9: Model of the 'new apartheid city', wherein segregation is enforced through the establishment of gated communities (Landman, 2006)

According to Landman (2006), four components contribute to the spatial patterns and trends present in the post-apartheid city (Figure 4.10):

1. A spatial system which clusters urban population groups into separate residential segments according to income levels, yielding affluent enclaves and gated communities on one, as well as under-developed areas for poorer communities. A consequence of such a system is significant disparities in service delivery, housing, mobility, public transport and efficient land use.
2. A system of urban governance that is characterized by pooled sovereignty. Local governance is comprised of several micro-governments, each with separate administrative and financial structures. Landman (2006) lists Home Owner's Associations (HOAs), as an example of a private micro-government with independent executive and financial schemes. This is representative of a new level of local governance.

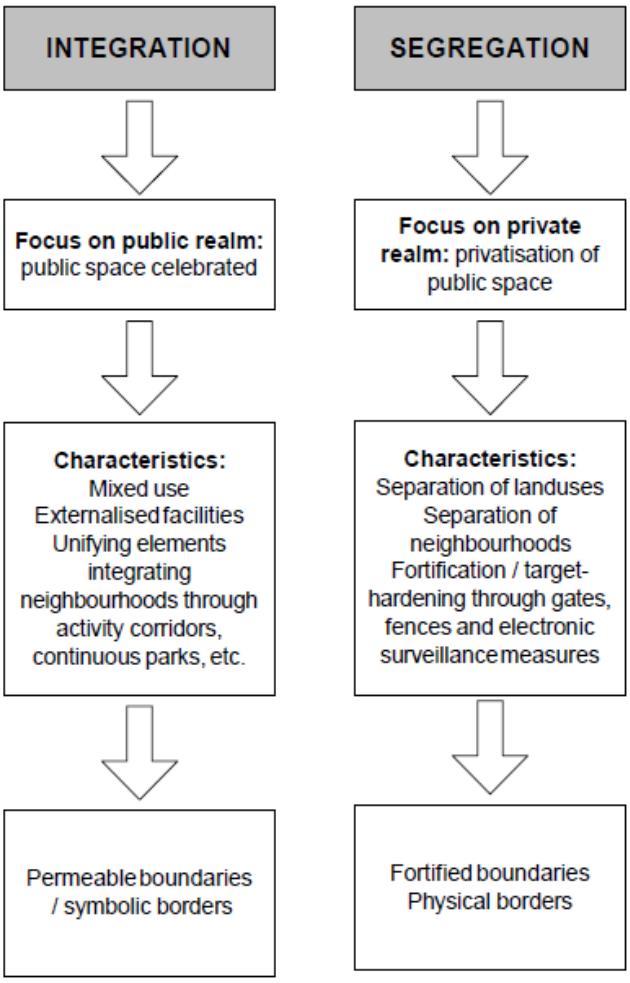

Figure 4.10: The nature and products of integration and segregation-oriented urban planning mechanisms (Landman, 2006)

3. A system of urban service provision that delivers land, service, transport and public amenities in a manner that favours those who have access to 'privatized' urban space, services and amenities, while denying such provisions to marginalized communities.
4. A distorted housing delivery system skewed between middle and high-income housing (which is predominantly developer-driven) and low-income housing (for which the secondary market value is little-to-none).

According to Landman and Ntombela (2006), these four components, which direct focus primarily on the private realm by privatizing public space, contribute to urban planning that is more segregated in nature. Such a system is characterized by segregated land uses, segregated residential areas, the privatization of public amenities and facilities, and the increased use of fences and gates to define and demarcate spatial zones (Landman and Ntombela, 2006). In contrast to this, an integrated approach to urban planning directs the main focus on the public realm (Figure C). This system is characterized by mixed land-use, externalizing pubic facilities and amenities through the development of accessible roads and development corridors (as opposed to centralizing such provisions within residential boundaries), and the integration of urban areas and residential areas through the development of integrated routes, operative public transport and communal open space (Landman and Ntombela, 2006).

4.6. Conclusion

This chapter highlighted the way in which the spatial evolution of the South African city has, throughout its history, been governed by the objective of establishing and maintaining racial segregation. The research investigating racial segregation in South Africa has reflected (i) the consistent increase in the degree of racial segregation brought about by the evolving spatial and social engineering strategies implemented under the country's segregationist regimes; and (ii) the gradual (albeit slow) decline in racial segregation during the post-apartheid period.

The following chapter will examine the case of racial segregation for Port Elizabeth specifically, in which it will explore how the objective of implementing and maintaining racial segregation influenced and, ultimately defined, the urban fabric of Port Elizabeth. Furthermore, it will present an overview of the trends observed based on the segregation research focusing specifically on Port Elizabeth.

CHAPTER 5: STUDY AREA

This chapter is comprised of seven sections. It begins by providing a brief description of Port Elizabeth's geography and demographic breakdown. Emphasis is then directed towards the city's founding and spatial evolution, providing the necessary context for understanding the development and progression of racial segregation in Port Elizabeth. Lastly, the nature of racial segregation is explored for the colonial, union, and apartheid periods, as well as that of the post-apartheid context up until 2001.

5.1. Locality and Demographics

Port Elizabeth, which occupies an area of 251.03 km^2, is located in the Eastern Cape Province of South Africa, and forms part of the Nelson Mandela Bay Municipality (NMBM) (Figure 5.1). Established in 1820 by British settlers, the city is one of the oldest in South Africa. Port Elizabeth is the largest economic centre in the Eastern Cape, and is the fourth largest contributor to the national gross domestic product (GDP), generating 8.1 % of the South African GDP (Department of Economic and Environmental Affairs (DEDEA), 2014). The automotive industry, agriculture, agro-processing and tourism form the major industries of the city (DEDEA, 2014). Figure 5.2 shows the relative location and extent of Port Elizabeth's sub-places[6].

Table 5.1 provides the racial breakdown of Port Elizabeth's population for 1996, 2001 and 2011. Port Elizabeth's overall population increased consistently from 1996 to 2011. The proportion of the Indian and Coloured populations remained fairly stagnant throughout this period. The proportion of Africans inhabitants increased by 4.62 percent while that of the White population decreased by 4.12 percent

[6] The term 'sub place' here refers to suburbs and locations.

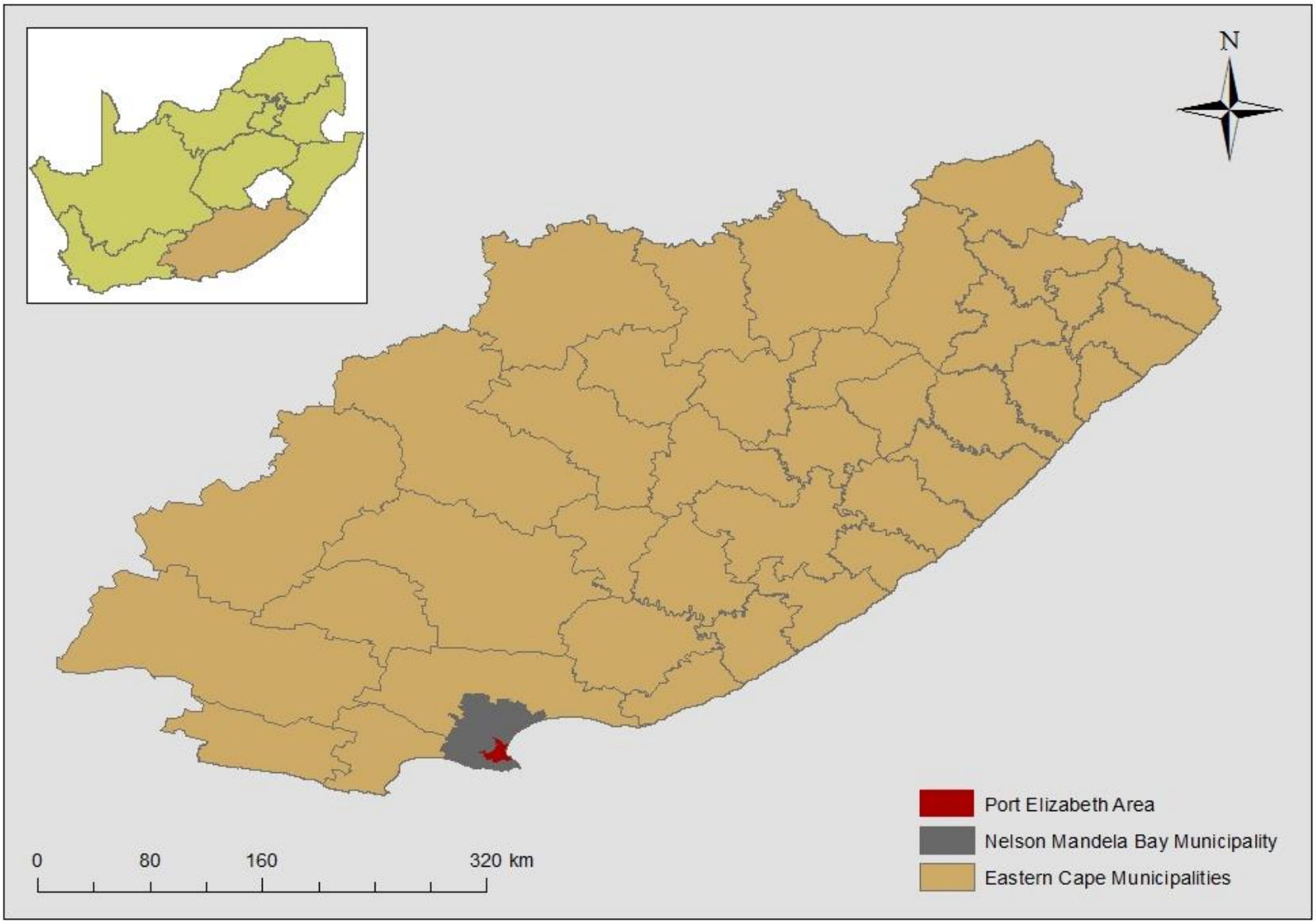

Figure 5.1:Port Elizabeth area within the Nelson Mandela Bay Municipality, Eastern Cape Province, South Africa

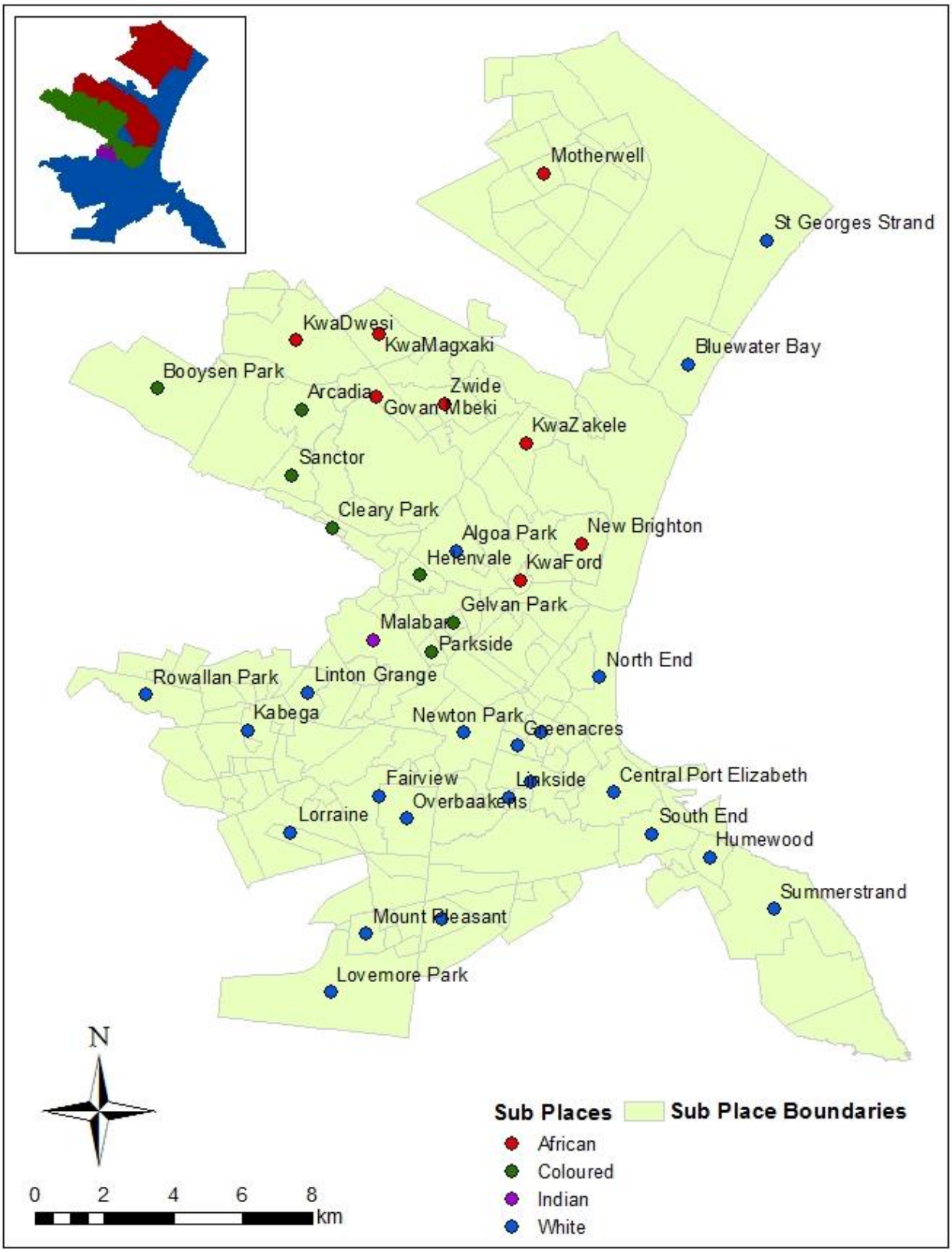

Figure 5.2: Port Elizabeth's sub places

Table 5.1: Racial composition of Port Elizabeth's population from 1996 to 2011

		1996	2001	2011
African	**Number**	426097	472207	523248
	%	56.88	60.09	61.50
Coloured	**Number**	179656	177391	200157
	%	23.98	22.57	23.53
Indian	**Number**	10064	10189	11121
	%	1.34	1.30	1.31
White	**Number**	133236	126031	116292
	%	17.79	16.04	13.67
Total		749053	785818	850818

What makes Port Elizabeth a particularly interesting place to carry out a study of this nature is its extensive history of segregation, essentially dating back to the founding of the city. According to Maylam (1995), Port Elizabeth can lay claim to being the founder of urban racially segregated societies in South Africa. Port Elizabeth has been described by Christopher as "one of the principal cities where the foundations of apartheid were laid" (cited in Lemon, 1999: p 43). Port Elizabeth has also been the site of studies into segregation such as Christopher (1987a, 1988, 2001a, 2001b, 2005) which found persistent patterns of racial residential separation up to the 2001 census period.

Given its long history of enforced urban racial segregation and of the city's status as the economic hub of the Eastern Cape, Port Elizabeth serves as a perfect case study in which to conduct research of this nature. The subsequent sections will detail the historical context of segregation in Port Elizabeth specifically.

5.2. The Introduction of Informal Segregation in Colonial Port Elizabeth

From the beginning, settlement in Port Elizabeth (referring to spatial layout) was driven by two factors: the topography of the land and the availability of water. The first settlement was developed on a narrow strip of land located between a high escarpment and the coastline (refer to Figure 5.3) (Baines, 1990; Lemon, 1991). This meant that the initial expansion of the settlement took place linearly along a north-south axis. When piped water became available, White residential expansion occurred in a westward direction on what was known as the 'Hill' (Beavon, 1970, cited in Baines, 1990). Baines (1990) details the structure of the city plan in detail (Figure 3.4): the economic centre of the town was located close to the landing beach within the low-lying areas adjacent to what is now Market Square, extending along Main Street. North of this were mixed-race[7] residential areas, including North End and the infamous Irish Town. Apart from residential land use, North End also served as the site for the expanding industrial sector in Port Elizabeth; this included tanneries, distilleries, as well as manufacturers of soap, candles, bricks and tiles. Before 1860, the middle and upper-class White population resided on the steep slope areas of the escarpment adjacent to the Donkin Reserve. South of Market Square, beyond the Baakens River, was located South End (refer to Figure 5.3), a mixed-race residential area occupied by working-class Whites and Malay fisherman. As Baines (1990) emphasizes, social status and income levels, in conjunction with the topography of the land, were all influential factors determining the pattern of residence of Port Elizabeth's White residents.

[7] 'Mixed-race' refers to the racial mixing of all race groups excluding the African population, who from the outset, resided apart from Whites.

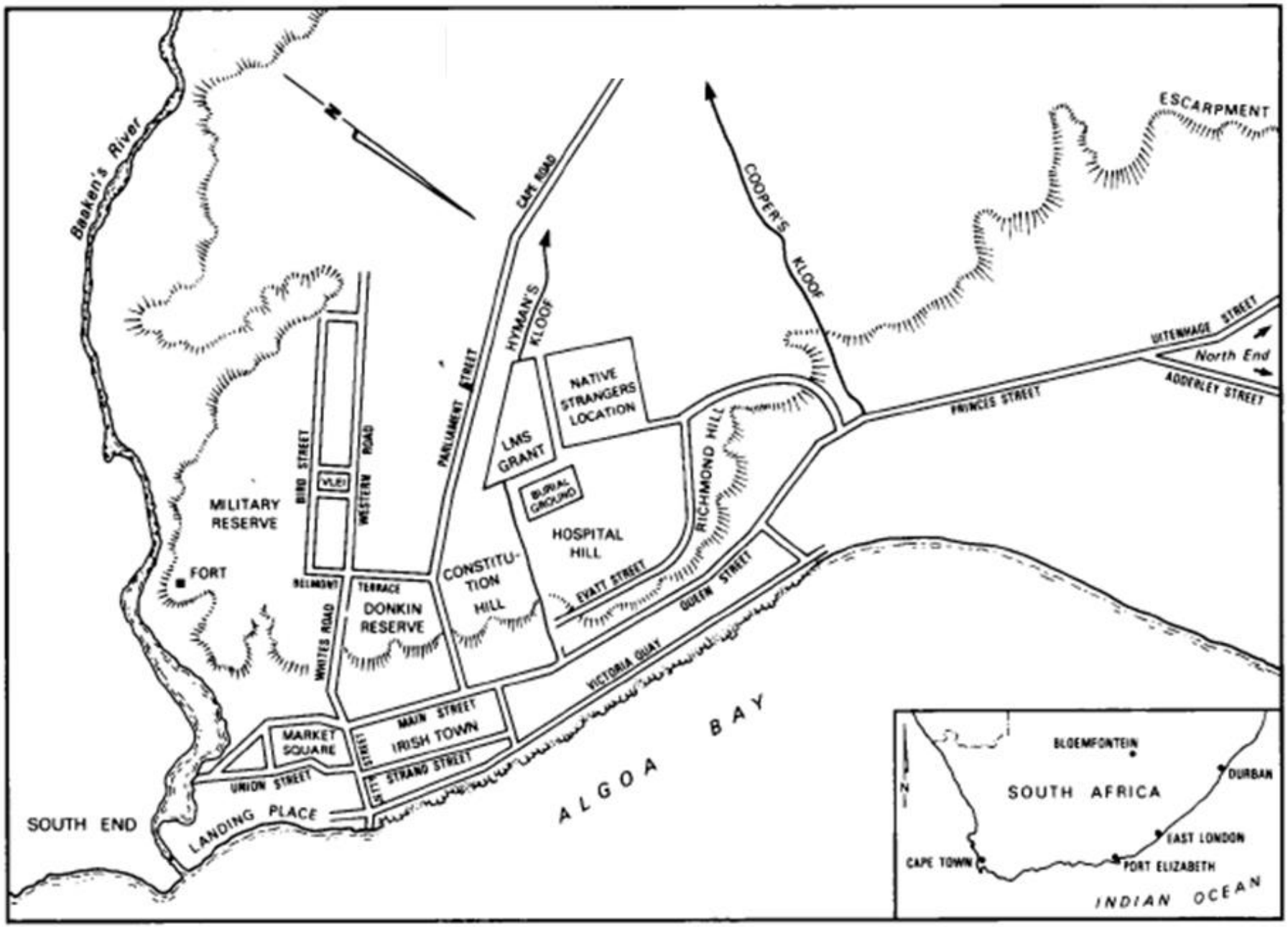

Figure 5.3: Structural layout of the Port Elizabeth circa in 1860 (Baines, 1990)

From the beginning, the indigenous African population of Port Elizabeth resided apart from the Whites. Beyond the boundary of the city's residential area, a separate settlement was established for Khoikhoi dwellers, known as a 'Hottentot Location', which was located on the western periphery of the town (Baines, 1989). This plot of land was issued to the London Missionary Church (LMS) in 1834 to provide a place of residence and burial for "Hottentots and other Coloured people who were members of the [London Missionary] Church" (excerpt from the LMS Directors Report (1835), cited in Baines (1989: 67). The Mfengu people, upon arrival in Port Elizabeth following the sixth Frontier War (1834-1836) , settled further up the escarpment where commonage land was available, and where water was easily accessible from the springs at Hymanskloof (modern day Russell Road area; refer to Figure 5.3) (Baines, 1989). According to Moyer (1976), there were four areas where the Mfengu established settlements: this was on the beach area in close proximity to the harbour; on the hillside area known as Hymanskloof (i.e. Russell Road), located above the town centre; and in two distinct villages located at a distance of fifteen minutes (on foot) from the town centre in opposite directions. The largest of these settlements was located on the Hill (today's Richmond Hill, refer to Figure 5.3), and was known as Fingo Village. Figure 5.4 shows a photograph of this settlement, with the Missionary church present in the background.

The Esenhigh Survey Map drawn in 1849 (found in Redgrave, 1947) (refer to Figure 3.16) shows two distinctly separate clusters of huts located on either side of the upper section of Hymanskloof (Russell Road), which according Baines (1989) corresponds to the 'Hottentot Location' and 'Fingo Village', which were distinct entities located in close proximity to one another.

The results of the municipal census conducted in 1846 are provided in Table 5.2. Within the Burial Ground designated for African populations, separate figures are provided for different ethnic groupings, which according to Baines (1990), serves as further indication that the Hottentot Location and Fingo Village were separate, although proximate, units.

Figure 5.4: Fingo Village (Published in Redgrave, 1947)

Table 5.2: Results from the 1846 municipal census (cited in Baines, 1989)

Wards	Male	Female	Children	Servants	Total
1. Baaken's River	13	24	34	10	81
2. Market	81	74	88	-	245
3. Church	78	72	102	-	252
4. Kemp's Division	116	77	139	-	332
5. J.O. Smith's	95	86	142	-	323
6. Hartman	83	98	141	-	376
7. The Hill	45	39	83	-	167
8. Burial Ground					
Mfengu	71	40	45	-	156
Khoikhoi	29	32	72	-	133
Tswana	18	-	-	-	18
Total	727	662	1, 006	10	2, 083

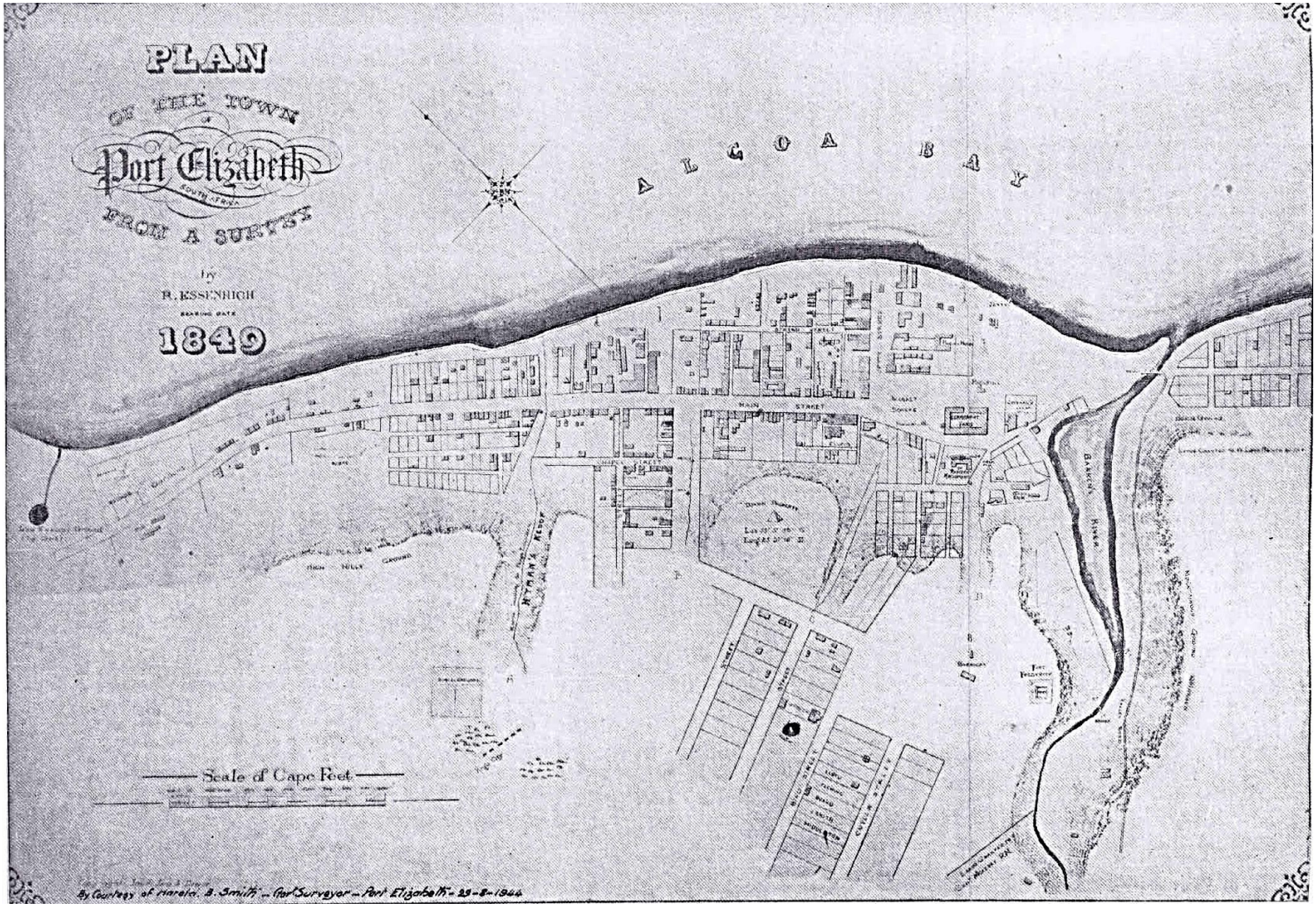

Figure 5.5: The Esenhigh Survey map of Port Elizabeth, drawn in 1849 (found in Redgrave, 1947)

5.3. Municipal Steps towards Implementing the Formal Spatial Segregation of the African Population

The establishment of the Hottentot Location and Fingo Village are indicative of a pattern of informal segregation in the Cape Colony. According to Baines (1990), settlement patterns would have arisen from other factors than just the sense of community prevalent amongst the Mfengu peoples. Such factors included the type of employment of the labourer, for example, beach labourers would take up residence in closer proximity to the harbour facilities, but those who worked within the town would preferably settle further inland. Settlement patterns which may have resulted out of pragmatism were instead to be controlled and institutionalized by the local government, who sought to govern the settlement of the increasing numbers of Africans moving into Port Elizabeth. The municipal endeavours implemented towards this aim will now be expanded upon.

5.3.1. Efforts to Establish a Formal Fingo location

In 1847, Sir Henry Young, the Lieutenant-Governor of the Cape, issued a government mandate which provided authorization for the development of 'Native Locations' in the eastern regions of the Cape Colony; these were to be situated on surveyed plots of land within one or two miles from the town centres (Baines, 1990). Numerous rules and regulations were also laid out in the mandate, regulating settlement in the proposed Location: residents would have to undergo a two-year trial period before qualifying for a deed to the land; it was made illegal for property in the Location to be sold to Europeans citizens; administrators of the Locations were bequeathed the power to evict 'unregistered' Africans (although this would result in generating illegal squatters) (Baines, 1990). Furthermore, the Municipality of Port Elizabeth issued a warrant for the removal and demolition of huts erected in sites not designated as location areas (Baines, 1990). The

Board of Commissioners[8] selected a site on Richmond Hill, to the north of Hyman's Kloof, for the development of the Location due to the fact that the area was already inhabited by some Mfengu residents, because it allowed for water to be easily sourced from the Cooper's Kloof springs and was out of the way of White residential development (Baines, 1990). This was comprised of 144 plots of land on which Fingo-style huts were to be erected. Regulations regarding the administration of the proposed Location were drafted by the Port Elizabeth Municipality and presented to the Cape government for authorization; it would, however, take seven years for the Board of Commissioners to institute its plans due to numerous hindering factors.

As previously mentioned, the Mfengu resided on commonage land in the Hymanskloof (Russell Road) area, which was granted to them before the establishment of the Port Elizabeth Municipality in 1847. Therefore, the Board of Commissioners was not legally permitted to evict the Mfengu people from the land they had formerly been granted legal access to, or to relocate them to the desired area in Richmond Hill. It was an incorrect assumption on the part of the Port Elizabeth Municipality that because the Mfengu were living within the Hymanskloof area which was considered part of the town's commonage, that they had a legal foundation on which to enforce their relocation (Baines, 1990). In addition, it was contested whether the Richmond Hill site allotted for the development of the 'Fingo Location' was part of the town commonage or actually government-owned, the latter of which meant that the Port Elizabeth Municipality had no jurisdiction over that area (Baines, 1990). Another impediment preventing government authorization for the establishment of the location was the question of whether the government was legally entitled to collect taxes from Mfengu residents. As Baines (1990) states, this concern had been brought forth by the Commission for Revision and Retrenchment in 1850; the consensus was that all residents of locations, located within municipal boundaries, were subject to being taxed by the municipality in compensation for enjoying the provision of municipal services.

Port Elizabeth's bid to establish a Fingo Location was not a unique endeavour in the Cape Colony, as Baines (1990) iterates. Since 1843, White residents in Grahamstown had advocated

[8] The Board of Commissioners represents the first form of local government established in Port Elizabeth in 1847 (also referred to as the Port Elizabeth Municipality in the text). It was comprised of eight members, the majority of whom had commercial interests (Baines, 1989).

for the development of separate wards in which Fingoes and other African populations were to reside. African locations were also established in the towns of Graaff-Reinet and Cradock. Seven years later, the establishment of separate formal 'Fingo' and 'Hottentot' Locations would be realized with the passing of the Strangers Location Act in 1855.

5.3.2. The Development of the Native Strangers' Location

Before 1855, whilst racial segregation was not yet formalized, it was, however, very apparent in the spatial organization of Port Elizabeth. The development of a formal location was finally authorized in 1855, after the position of Colonial Governor was granted to Sir George Grey in 1854. Grey adopted a 'civilization policy' which promoted the establishment of African locations around towns, both for the purpose of securing a source of labour and for cultivating the loyalty of Africans to the colonial powers by fostering their inclusion in colonial society, however minimally (Baines, 1990).

In 1855, following a visit to Port Elizabeth, Grey issued a grant to the Port Elizabeth Municipality for the development of a location in the town. The Board of Commissioners proceeded to authorize the survey of the site originally designated for the intended Mfengu location in 1847. The grant for the Strangers' Location, in which "Hottentots, Fingoes, Kaffirs and others Strangers" may settle, was passed on June 27th, 1855 (Baines, 1990: 74). The site allocated for the development of the Strangers' Location was described in the grant as "a piece of land situated within the limits of the Municipality … bounded on the south-east by an open space between this land and the Hottentots Location, and on all other sides by the Town grazing lands" (Baines, 1990: 74). It was proposed that this site be sub-divided into 128 separate plots, each meant to house a maximum of six residents, thus providing for a projected population of 768 (Baines, 1990). Furthermore, within the Location, separate units of land were to be designated to Khoikhoi residents who chose not to reside in the Hottentots Location, as well as for the 'Kaffirs' (i.e., Xhosa). Separate areas for the Mfengu, Khoikhoi and Xhosa residents were thereby delineated by White-washed beacon (Baines, 1990). This shows the extent to which segregation prevailed in colonial Port Elizabeth, going beyond the mere separation of Africans from Whites, as desired by the colonial government, but also promoting ethnic segregation

within the African population. As Baines (1990) points out, however, ethnic separation was proposed by the different African factions themselves, each hoping to maintain a separate cultural identity. Figure 5.6 shows the layout of the Strangers Location within the contemporary spatial layout of Port Elizabeth, while Figure 5.7 shows the position within Port Elizabeth where this specific area lies.

The Port Elizabeth Municipality, having obtained permission to proceed with the establishment of the Strangers' Location, began carrying out the intended removal of Africans from the city. In 1855, the Port Elizabeth Municipality tried to enforce racial segregation by passing regulations that made it compulsory for Africans to live in the Native Strangers Location, unless otherwise housed by their employers. On May 21st, 1855, Africans were granted a period of six weeks to relocate to the allotted sites in the new location. Failure to meet this mandate, particularly by the Mfengu peoples, was met with threats of the destruction of all huts not removed by the required deadline. It was later brought to the attention of the Board of Commissioners that the area laid out for the Location was too small to accommodate all of the incoming residents, and forced removals, therefore, had to be put on hold. The subsequent relocation of Port Elizabeth's African population to the Native Strangers

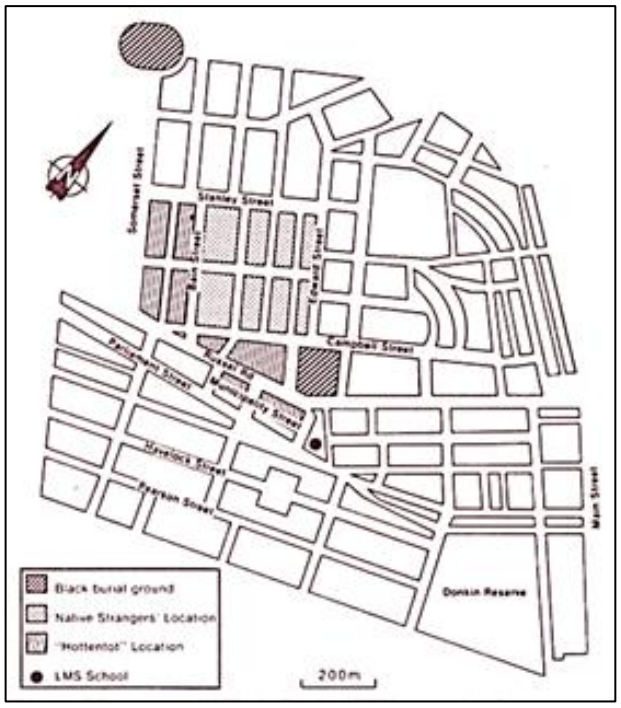

Figure 5.6: Racial segregation resulting from the Strangers Location Act of 1855 (Adapted from Nel, 1986, cited in Baines, 1989)

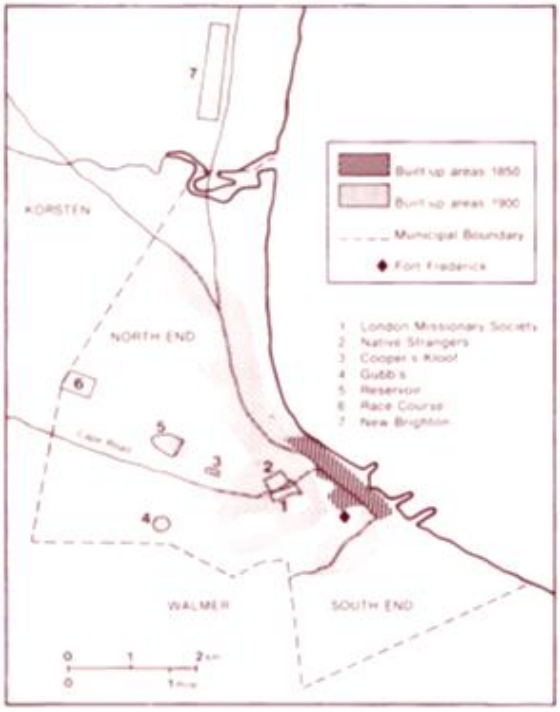

Figure 5.7: The locality of colonial Port Elizabeth's locations (Adapted from Christopher, 1987a)

Location was ultimately achieved with a measure of coercion on the part of the Port Elizabeth Municipality.

Therefore, nearly a hundred years before the passing of the Group Areas Act of 1950 in South Africa, urban segregation along racial (and ethnic) lines was already taking place in Port Elizabeth. The establishment of a formal location in which 'Strangers' were to reside, as Maylam (1995) explains, reflects the status quo idea of the time that Africans were aliens in the urban domain, an idea which would persist and be further entrenched in the dominant portion of the city's impending future.

5.3.3. The Expansion of Port Elizabeth's Locations

The increase in African population numbers in the city was met with the development of more formal locations from 1862 to 1896 (Christopher, 1987a). The returns of Port Elizabeth's Municipal Census of 1855 recorded White and African populations of 3,509 and 1,284 respectively (Baines, 1989; Christopher, 1987a). Following the cattle killing of 1857, Port Elizabeth experienced an influx of approximately 30,000 Xhosa refugees (van der Horst, 1942, cited in Baines, 1989). This resulted in the rapid growth of Port Elizabeth's African population, and consequently, the overcrowding of the Native Strangers' Location.

In 1858, Port Elizabeth experienced a smallpox epidemic. Unsanitary conditions in the Native Strangers' Location, exacerbated by overcrowding, made the Location particularly vulnerable. Furthermore, as Baines (1990) explains, the Port Elizabeth Municipality was prevented from evicting residents due to its inability to provide alternate places of residence. The high prevalence of smallpox incidence in the Native Strangers' Location ignited a stigma in which Africans were considered disease carriers, and fears of Africans transferring the disease to their White employers proliferated. As Baines (1990) suggests, the 'social metaphor' associated with disease was used as a foundational argument for the separate residence of White and African peoples in the Cape Colony, showing that the 'sanitation syndrome' (first described by Swanson, 1977) was, in fact, used to rationalize racial segregationist policy in the colonial context far earlier than Swanson's study suggests.

As a result of the overcrowding taking place in the Native Strangers' Location, several additional locations were established on privately-owned land, towards the western regions of the city (Christopher, 1987a). Figure 5.6 shows the location of Port Elizabeth's locations established during the colonial period. Baines (1990: 78) refers to these locations as the enterprises of "slumlord profiteers". The largest of these was Gubb's Location, located on a farm known as The Mill (present-day Mill Park) (Baines, 1990). Its owner, a merchant and town councilor called Thomas Gubb, from 1863 permitted Africans who could not find residence in the Native Strangers' Location to erect huts on his property (Baines, 1990). Being a private location, it fell beyond the confines of the city's jurisdiction, meaning that the Municipality had no authority over the poor conditions that became synonymous with Gubb's Location. Other smaller locations were located in the Baakens River Valley, South End and Walmer. Major industries, including the Port Elizabeth Harbour Board and brickworks companies, also developed their own independent housing facilities for African employees (Christopher, 1987b).

Table 5.3, which shows the results of the municipal census from 1855 to 1985, reflects the continued rapid growth of the African population. This, in conjunction with the fact that the Native Strangers' Location was already considered both a health risk and aesthetically unpleasing, raised the desire amongst the White community for the repositioning of the Location to a new site at Cooper's Kloof (off modern-day Albany Road; see Figures 3.4 and 3.7; Baines, 1989). Cooper's Kloof Location was established in 1877 to provide additional accommodation for 'strangers' and to relieve the overcrowding situation occurring within the Native Strangers' Location. Cooper's Kloof Location, according to Baines (1989), was soon viewed as the 'model location'; it was more orderly and lacked the squalor present in other locations, and instead of the traditional beehive huts present in other locations, its residents resided in wood and iron housing.

Table 5.3: Port Elizabeth's municipal census results (000s) from 1855 to 1985 (excluding that of 1980 due to suspected under-numeration) (Christopher, 1987b)

Year	White	Coloured	Asian	African	Total
1855	4	1	-	1	5
1875	9	2	-	2	13
1891	14	6	-	4	24
1911	20	12	1	8	41
1921	27	14	1	12	54
1936	54	28	2	30	114
1951	80	46	4	1	200
1960	95	68	4	121	288
1970	120	95	5	167	387
1985	131	131	7	233	502

Along with the establishment of Cooper's Kloof Location, the Port Elizabeth Municipality also issued a new set of regulations governing the management of locations. Residents of the locations were presented with site certificates which had to be renewed on an annual basis; the leasing of sites was permitted only for a maximum period of three years; no subletting of property was permitted; structures that were erected had to be permitted and approved by members of the town council; dwellings could accommodate a maximum of six individuals (unless the immediate family was larger than this); removal of refuse and night soil was made mandatory on a fortnightly basis and all location boundaries had to be clearly delineated (Baines, 1989). Furthermore, the Port Elizabeth Municipality also claimed supervisory jurisdiction over Gubb's Location, although it was located on private property, the fact that it was situated within the municipal boundaries meant that it was in the city's control.

In 1881, rising conflicts between ethnic factions within the Native Strangers' Location, expedited further efforts to relocate its inhabitants to a separate site located further away from the town (Baines, 1989). Plans to develop the Reservoir Location (in the present-day Mount Road area; refer to Figure 5.6) were proposed to achieve this end. In 1883, the Port Elizabeth Native Strangers' Location Act was passed, which made it compulsory for all residents of the Native Strangers' Location to move to the Reservoir Location. According to Kirk (1991), however, a coalition between members of the developing African middle class and liberal Whites ultimately

prevented its execution. Only a small proportion of the residents of the Native Strangers' and Cooper's Kloof Locations moved to the Reservoir Location, which now provided accommodation for the steady influx of Africans into Port Elizabeth (Kirk, 1991). The rapid growth of Port Elizabeth's African population was accompanied by the development of illegal squatter dwellings in proximal distance to the town; according to Baines (1989), by the 1890s an estimated one-third of the city's African population resided beyond the municipal and private location boundaries.

At this time, renewed pressure was exerted by property developers on the Port Elizabeth Municipality to remove the current municipal locations in order to free up land for the expansion of White residential areas. It was proposed to establish a new Race Course Location for the residents of both the Native Strangers' and Cooper's Kloof Locations to reside, located near current-day Fairview (see Figures 3.4 and 3.7) (Baines, 1989). The site was chosen due to the fact that the Government of the Cape Colony seized a portion of this land subsequent to the start of the second Anglo-Boer War in October, 1899 (Baines, 1989). Following the War, this site was later rejected due to number of concerns, namely that traffic stemming from the location would pass through White residential areas and that, although it was to be located on the periphery of the city, it was projected that the future expansion of White residential areas would in time occupy this area (Baines, 1989). This was in line with the thinking underpinning the formation of the segregation city (and the subsequent apartheid city) model. The sectoral nature of these models entailed that separate residential zones be demarcated for the different race groups, with no direct linkages existing between them; in order to inhibit inter-racial exposure and interaction.

In April 1901, an outbreak of the bubonic plague occurred in Gubb's Location (Baines, 1989; Christopher, 1987b). This further ignited pre-existing fears among the White populace that the locations were breeding zones for disease. Conditions of squalor, over-crowding and poor housing meant that locations were more vulnerable to such outbreaks than the comparatively low-density, White urban settlements. This led to the 'sanitation syndrome', identified by Swanson (1977), which refers to the racialization of disease at the time. The sanitation syndrome fueled demands by the White population for Africans to be segregated from areas of White residence. According to Swanson (1977) and Christopher (1987b), this argument provided such political pressure as to force the municipal planners to reconceptualize the whole strategy of

African urban housing. Outbreaks of the bubonic plague in other areas of the country were, therefore, a major influencing factor determining the locality of Black locations (Beavon, 1982; Swanson, 1977). Consequently, current locations were torn down and a newer, larger location, New Brighton, was developed approximately 8km northwards of the CBD (Figure 5.7). Although this site was located within the general direction that Port Elizabeth's industrial growth was occurring, the chosen plot was considered unsuitable for industrial development (Baines, 1989). Furthermore, as the expansion of White residential areas was occurring in a westerly direction, it was unlikely that the location would need to be relocated in the foreseen future.

Evictions of Africans from the inner city townships began in 1903, a month prior to the implementation of the Native Reserve Location Act. Baines (1989) describes that this was not a seamless process, however, due to a number of factors contributing to the unwillingness of residents to evacuate their current place of residence: members of the African middle-class were in opposition to the lack of tenure provided; additionally, inadequate accommodation provisions and compensation payments catalyzed resistance to such removals. Rent charged in New Brighton was also in excess of the average wage earnings of approximately a third of the African population group. Objections also arose from members of the White merchant class, who opposed the increase in wages that would be necessitated by the cost of labourers having to commute greater distances to work. Due to the above-mentioned reasons, many Africans chose rather to relocate to the village of Korsten (see Figures 5.7 and 5.8), which was situated just beyond the municipal boundary, and therefore, beyond the realm of the Native Reserve Location Act. Christopher (1987b) states that Korsten was located in closer proximity to the city than the New Brighton location and also enabled residents to obtain freehold deeds to their land.

The colonial period saw the occurrence of partial racial segregation in Port Elizabeth, attained mainly through the removal of Africans from the city through the implementation of the location strategy (Christopher, 1987b). By 1910, all Africans, with the exception of those who were not boarded by their employers and those who were able to procure land, were relocated out of the inner city area (Christopher, 1988). Fifty percent of Africans were housed in locations comprised of barrack-style houses, and a further thirty percent resided in Korsten (Baines, 1989). As Christopher (1987a) points out, these locations were structurally separated from the main town in spatial planning, and were to be exclusively inhabited by Africans. The rest of the town remained

racially mixed, with middle class areas being typically mixed, and upper class areas being predominantly White.

Port Elizabeth's African population was, therefore, highly segregated from the rest of the population towards the end of the colonial era, with a number of policy restrictions governing where they could reside. This is reflected in Figure 5.8, which shows the distribution and racial make-up of Port Elizabeth's population as determined in the 1911 Municipal Census.

5.4. Segregation during the Union Period (1910 -1948)

Port Elizabeth's population continued to grow (Table 5.4 reflects this population growth), expanding by approximately five times during the Union period (from 42,000 in 1911 to 200, 000 residents). New Brighton, which contained 3,650 residents in 1911, contained approximately 35,000 people in 1950 (Christopher, 2001b). This, according to Christopher (1988), was the result of Port Elizabeth's expanding industrial base which, by generating employment opportunities, attracted people to the city. The city's rapid population growth was accompanied both by the development of new residential suburbs, as well as the erection of informal shanty towns to house the growing number of African inhabitants. As Christopher (1988) describes, the city's growth took place within its established colonial framework; the municipal government, however, took on increased responsibility in managing urban development, introducing three policies which posed constraints on the options of residence for Port Elizabeth's growing population.

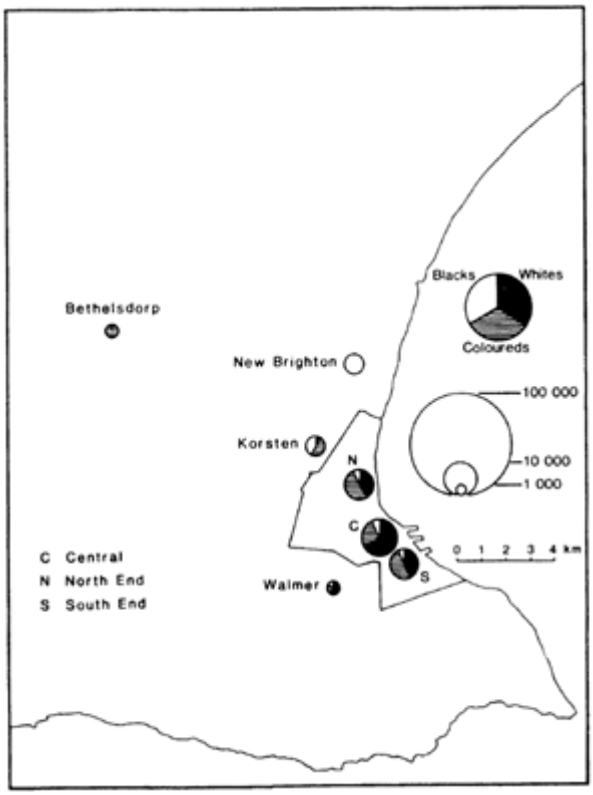

Figure 5.8: Distribution and racial make-up of Port Elizabeth's population, 1911 (Christopher, 1987b)

The first of these were the laws governing the residence and occupation of the African population (Davenport, 1971), which were made more stringent. One of the foremost pieces of legislation achieving this was the Natives (Urban Areas) Act of 1923, which stipulated that all municipalities had to develop separate locations for African residence (Tatz, 1962). Additionally, the passing of Native Trust and Land Act in 1936 meant that Africans were not permitted to purchase land outside of designated African areas, and facilitated the removal of African voters from the electoral roll, thereby eradicating the political platform for Africans to challenge the land question (Tatz, 1962). Furthermore, the passing of this Act removed the possibility for the establishment of independent African residential areas, as had transpired earlier when Africans who had been displaced from the inner city had implemented their former political right to purchase land in Korsten (Christopher, 1988). The municipality, therefore, assumed the duty of establishing and upholding African locations. A number of controls were put in place, limiting the number of incoming African migrants from rural areas. For Example, in accordance with the Natives Trust and Land Act of 1936, Africans were restricted from purchasing property outside of the locations demarcated for African habitation. This also prevented the development of new independent African residential settlements. All new African housing schemes were to take place within official demarcated areas, located adjacent to the New Brighton and Walmer Locations (Christopher, 1988).

Secondly, the period between 1910 and 1923 also saw measures introduced to increase segregation amongst the remaining population groups. The passing of the Housing Act in 1920 assigned the responsibility of housing the poor to the municipalities. As mandated by this Act, municipalities were required to build separate residential areas for the different racial groups in order to qualify for central government funding for housing schemes (Christopher, 1988). In Port Elizabeth, with no definition of what constituted 'separate areas' to direct town planning, the Coloured and White housing schemes were frequently developed next to one another. The construction of new, separate, residential areas was, however, characterized by separate zones with buffers of open land serving to separate them (Davies, 1971). Therefore, some Coloured property was located adjacent to White property, but without roads linking access between the two (Davies, 1971). Therefore, the occurrence of single-race suburbs began as early as the 1920s.

Thirdly, clauses with racial restrictions were contained in the title deeds of new White housing projects, preventing purchase by anyone classified as 'non-White' (Christopher, 1987b). National regulations also required that local municipalities designate sub-economic areas for Whites or Coloureds (Christopher, 1987b). Open townships that were not accompanied by racial contracts, therefore, drew in Coloured and Indian residents. The consequent increase in racial segregation resulted in the occurrence of all-White suburbs (disregarding the African and Coloured servants accommodated by their White employers[9]).

From 1910 to 1948, whilst no all-embracing segregationist policy had been officially adopted at a national or local level, the period had, however, witnessed the increased spatial separation of the different population groups. While all-African residential locations originated during the colonial period, the 1920s mark the appearance of all-White and all-Coloured residential areas. As Christopher (1988) states, mixed-race residential areas did continue to exist during the Union era; these were inhabited by a small fraction of the population, however, as the majority of new suburbs laid out with the city's expansion were single-race. Figure 5.9 shows the distribution and racial make-up of Port Elizabeth's population as determined in the 1951 Municipal Census. Compared to the results recorded in the previous census (Figure 5.8), a greater level of segregation is apparent between the White and Coloured groups, although racial residential mixing is still apparent.

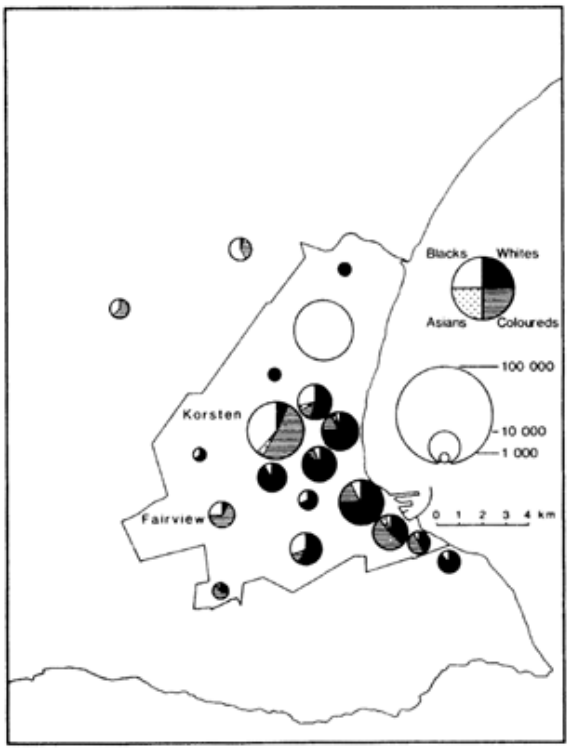

Figure 5.9: Distribution and racial make-up of Port Elizabeth's population, 1951 (Christopher, 1987b)

[9] It was common practice for White/affluent households to have servant quarters in which domestic employees, belonging to other race groups, were housed.

5.5. Segregation during the Apartheid Era (1948-1994)

In 1948, the National Party was elected into power with a mandate of achieving complete racial segregation in South Africa. This mandate had two main objectives, that being the total segregation, and eventual expulsion, of the African populations from the urban environment, and secondly, the segregation of the remainder of the population into separate Group Areas. According to Christopher (1987b), the conversion of Port Elizabeth to an apartheid city spanned the entire period from 1950 to 1985**.**

To achieve the first of these aims, controls on the African population were made more stringent; the movement and residence of Africans were controlled and monitored with the adoption of the pass laws, and African-owned property located in areas proclaimed as White were expropriated (Christopher, 1987b). Africans who had previously chosen to reside in Korsten became the priority target of forced removals. As a result, New Brighton's population tripled from 1951 to 1960 (Christopher, 1987b). Furthermore, harsher controls were placed on Africans who were housed by their employers. While the ultimate goal of totally expelling Africans from the city was never realized in full, by 1985 only 3.4 % of the Port Elizabeth's African population (approximately 17,000 out of a population of 502,000) were outside the designated locations (Christopher, 1987b). As determined by Christopher (2001b), South Africa had a segregation index of 94 at this time.

Achieving the second aim was a much lengthier process. The Population Registration and Group Areas Acts of 1950, and the resultant apartheid city model, have already been addressed. According to Davies (1971), the implementation of this policy had major spatial implications on Port Elizabeth, which up until now had enforced relatively little formal segregation (referring to segregationist ideals being formally entrenched in legislation) between the White, Indian and Coloured groups. As is evident from the results of the 1951 Municipal Census (Refer to Table 5.4), while the peripheral regions of the city were already segregated to a degree, the inner city remained racially mixed; this made the implementation of the Group Areas Act a complex and emotionally-charged process. According to Davies (1971), in 1950, no areas of predominantly Indian or Asiatic residence existed to serve as a base for the delineation of a Group Area in Port

Elizabeth. The municipality's Coloured housing schemes, and a portion of the poor residential area in Korsten served as a basis for the delineation of a Coloured Group Area (Davies, 1971).

According to Christopher (1987b), the sectoring of the White Group Area provides the key to understanding the nature of racial zoning in the apartheid context. The White Group Area boundaries were drawn to incorporate all members of the White population; all non-White residents located within these boundaries were removed from their homes and relocated accordingly. Approximately 36,000 non-White residents were expelled from their homes to carry out this measure (Christopher, 1987b). In the formerly mixed areas of Fairview and South End, approximately 87.5 % and 66.7 % of the population, respectively, were forcefully removed (Christopher, 1987b).

Figure 5.10 shows the Group Areas in Port Elizabeth in keeping with the requirements of the 1950 Group Areas Act. The CBD and central zones were classified as White, while non-White zones were located closer to the periphery of the city in accordance with the apartheid city model. The separate Group Areas were separated by buffers comprised of tracts of land at least 100 m in width, as well railways, roads and natural geomorphological formations.

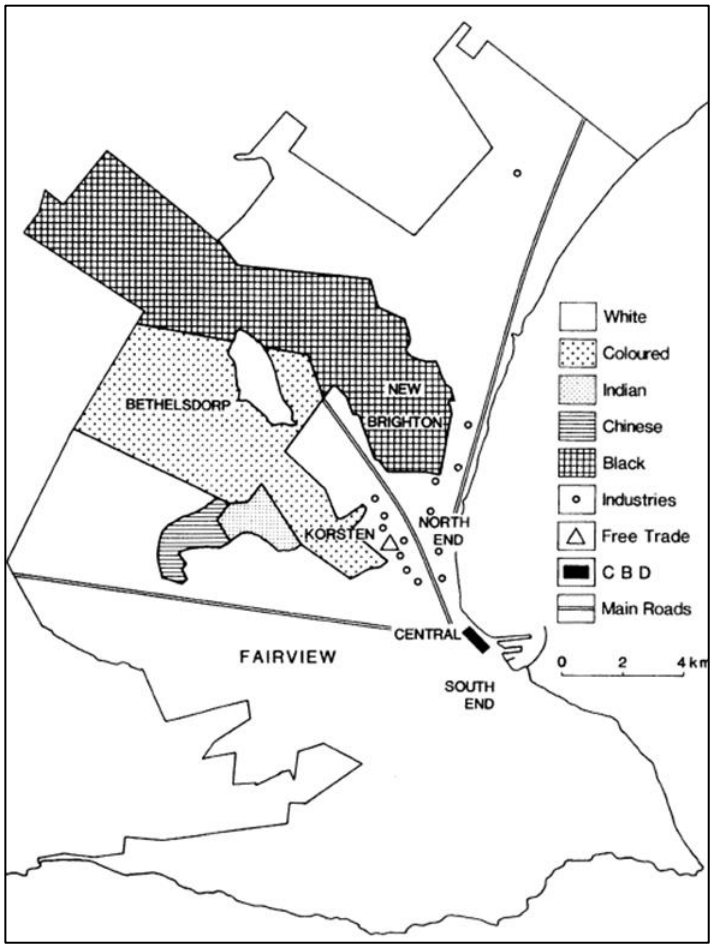

Figure 5.10: Port Elizabeth's racial zones in accordance with the Group Areas Act of 1950 (Christopher, 2001b)

The dual process of removals and resettlement was not a seamless one, with numerous moves being initiated to accommodate sequential priorities; for example, transitional relocations occurred in some instances to cater to the immediate problem of providing housing for a rapidly expanding population, meaning that those being relocated would have been moved

more than once. For example, during the 1950s, the removal of the African population from the city areas to the locations was the main priority; authorities acquired a reserve of properties in which members of the other groups could be temporarily housed to allow for a twin-process of removal and resettlement. In Korsten (an area designated for Coloureds), for example, the African population declined from 17, 200 to 2, 200 from 1951 to 1960; this was coupled by an increase in the Coloured population from 19, 300 to 31, 800 during the same period (Christopher, 1987b)

In the 1950s, the main focus was primarily the removal of the entire urban African population to New Brighton, as described above. By 1960, approximately 83.6 % of the city's African population lived in the demarcated location areas (Christopher, 1988). It was only in the 1960s, when the removal was finally achieved, that the Group Areas Act was then stringently applied to the inner city. The configuration of racial zones shown in Figure 5.11 was only approved in 1960, after which the reorganization of the city's population began with the relocation and removal of the remaining population groups.

As Christopher (1988) describes, the areas from which people were removed fall into two categories. In the first category, houses seized from removed groups were sold to the authorities or people whose race qualified them to reside there. These areas were not greatly altered. In the second category, all the houses were purchased by the authorities and torn down so that the areas could be redeveloped accordingly. Both Fairview and South End, described above, fall into the latter category; both areas, which were declared as White neighbourhoods, had mixed-race residents. In South End, following the removal of the Black residents and the demolition of their homes, new housing units were erected to redevelop the area into a suitable area for White residence. Fairview, however, remained undeveloped following the forced removals and demolitions, although it too was intended for White residents.

The Coloured population were displaced and relocated on a huge scale. As mentioned above, Korsten (and the adjacent area of Gelvandale, a site of Coloured municipal housing) formed the basis of the Coloured Group Area; growing population numbers also resulted in the establishment of new Coloured suburbs beyond the Korsten area. The Indian and Chinese populations (comprising Port Elizabeth's Asian population) were each contained in a single Group Area respectively, these being Malabar and Kabega Park. Both areas were located west of

North End, between the White and Coloured areas. In 1984, the Chinese population was reclassified as White, along with their Group Area. The city's Indian population, to a large extent, were business-oriented, strongly opposed the proposal that their business activity be constrained to Malabar, which was located at a distance of approximately 10 km from the CBD. To address this resistance, authorities established a zone of 'free trade' at Korsten, where residence, irrespective of race, was strictly prohibited (Christopher, 1987a).

The pattern of racial population distribution revealed by the 1985 National Census was in agreement with policies of the apartheid government (Figure5.11). Only 3.4 % of the population resided outside of their designated Group Area; this proportion mainly comprises African servants residing with their employers and Asians living in Coloured areas due to uncertain classification (Christopher, 2001b). Port Elizabeth had now completed the transition from a colonial segregation city to an apartheid city. As Christopher (1987a) explains, the different Group Areas were characterized by different growth schemes: growth in the White areas was typified by a free market system, enabling growth to be commercially driven and unrestrained by state intervention; in the Coloured and Indian areas, which were located on state-owned land, growth was state-controlled, with the municipal authorities determining the rate of development; the African areas were characterized by housing shortages and poverty, the latter of which prevented the acquisition of available housing, resulted in the formation of squatter camps, a characteristic feature of African locations during the apartheid (and post-apartheid) era. Christopher (1987b: 203) states that Port Elizabeth

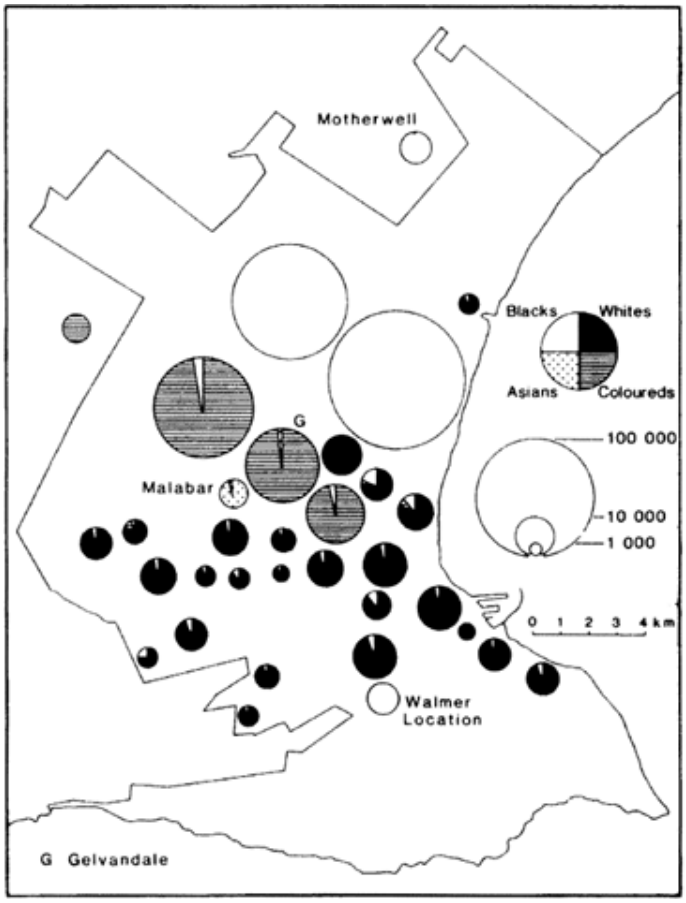

Figure 5.11: Distribution and racial make-up of Port Elizabeth's population, 1985 (Christopher, 1987b)

"exhibits traits of First, Second and Third World cities dependent upon the racially defined sectoral nature of the city", addressing the overlapping racial and economic segregation reinforced by the apartheid regime.

5.6. Segregation during the Post-Apartheid Era

A study by Christopher (2005) investigated the extent to which racial desegregation had occurred in the towns and cities of South Africa. Segregation indices (which reflect the degree to which each race group is segregated from the other race groups) were calculated using data from the National Census. The segregation values obtained in the study for each of the respective race groups are shown in Table 5.4.

Table 5.4: Segregation Indices for Port Elizabeth's Population, 1951 -2001 (Christopher, 2005)

	Apartheid Period						**Post-apartheid Period**	
	1951	**1960**	**1970**	**1980**	**1985**	**1991**	**1996**	**2001**
African	75	88	92	96	96	96	94	93
Coloured	68	84	92	96	96	94	91	89
Indian/Asian	61	75	83	88	87	86	81	79
White	79	89	94	97	97	98	96	94

The findings from Christopher's study indicate that after South Africa's democratization, segregation decreased consistently for all the race groups across the census periods, albeit by a small amount. Furthermore, the rate of decline was slighter greater for the 1991-1996 inter-

census period than that for 1996-2001. The White population was found to be the most segregated race group across the census periods, followed by the African group.

Christopher (2005) also states that by 2001, 97 % of the Port Elizabeth's population resided within their designated racial zones. Furthermore, by 2001, 25 percent of the residents in areas that were formerly White-designated areas were Black (Christopher, 2005). According to Christopher (2005), the influx of Black residents into former-White areas is barely reflected in the marginal decline of the Whites population's segregation indices, but attributes this largely to there being no out-migration of Whites into other areas of the city.

5.7. Conclusion

This chapter explored Port Elizabeth's history of racial segregation, with specific emphasis on how its mandate of racial segregation governed its spatial formation. The segregation research conducted on Port Elizabeth yielded similar results to those obtained in the national-scale studies, namely a steady increase in racial segregation in response to the imposition of increasingly stringent segregationist legislation and spatial planning policies, followed by a slow decline following South Africa's transition into democracy.

Based on the literature reviewed in this chapter, two areas were identified in which segregation research, specifically pertaining to Port Elizabeth, can be expanded. In 2012, Statistics South Africa released the population data collected in the 2011 Census. This data has not yet been included in the research investigating segregation in Port Elizabeth. Furthermore, all of the segregation research conducted on Port Elizabeth has relied solely on dichotomous indices. This study, therefore, aims to (i) incorporate this data into its analysis of segregation in Port Elizabeth, and thus to present an up-to-date picture of racial integration and persisting segregation trends; and (ii) to implement the multi-group Entropy Index to evaluate segregation for all the post-apartheid population censuses

CHAPTER 6: METHODOLOGY

6.1. Introduction

This section is divided into nine sections. The first of these sections provides a brief description of the Census data that was used to carry out the aims of this study. In the subsequent sections, the methods employed to address each of the study objectives (refer to Section 1.2) will be presented.

6.2. The South African Census Data

This study utilized spatial and demographic data sourced from the South African National Censuses of 1996, 2001 and 2011. Parry (2012) describes two main advantages of using census data to investigate residential segregation: (a) census data is usually the only source of population racial data at a census tract-level scale, and (b) due to the census being periodically conducted, it allows for temporal comparisons.

The study conducted by Parry and van Eeden (2014), investigating post-apartheid residential segregation trends in the cities of Cape Town and Johannesburg, included data from the 1991 National Census. This decision was taken due to the fact that 1991 marked the repeal of the Group Areas Act. According to Christopher (2001b), 1991 was when racial residential segregation was at its peak in South Africa, making it a suitable reference point to which post-apartheid residential integration could be compared.

This study, however, does not include the 1991 National Census owing to the fact that during the apartheid era, there was no uniform data collection method employed across the different racial populations. Hence, the data collected prior to the National Census of 1996 was uneven and inaccurate. This was particularly the case with regards to the African population, where, as

Schwabe and O'Donovan (1999) state, in the National Census of 1991, many African townships were represented by single polygons that were sample surveyed instead of being properly enumerated. The National Census of 1996 represents the first time that all the population groups were enumerated using a uniform methodology (Statistics South Africa, 1998) and was thus chosen as the suitable starting point for analyzing post-apartheid racial trends with the least possible distortion.

Geographical standards are used for the collection and analysis of statistical information. Figure 6.1 shows the various spatial levels at which information is collected and presented. For the data collected by Statistics South Africa during the Censuses, reference is made to the lower five tiers of this geographical hierarchy (Statistics South Africa, 2011).

The data used in this study were disseminated at the enumerator area (EA) and small area layer (SAL) levels. EAs refer to small-scale, geographical working units used by the census enumerators to collect and disseminate data. An EA represents the smallest geographical area into which the country is divided for the Census. The SAL was developed by Statistics South Africa in 2001 for dissemination purposes; each small area is comprised of one or more EAs, depending on the size of the EA, to guarantee an acceptable level of confidentially when distributing the collected information.

The relevant spatial data for the three census periods were obtained from Statistics South Africa in shapefile format, along with the corresponding population race data. For the 1996 Census, this data was available at the enumerator area (EA) level. For the 2001 Census, however, data at the enumeration area level was not made available publicly due to the possible compromise of respondents' confidentiality (Phirwa, 2004; Grobbelaar, 2005). To meet the needs of data users who required disaggregated data at a small geographic scale, while complying with the confidentiality clause in the Statistics Act of 1999, Statistics South Africa generated a new small area (SAL) layer, in which adjacent enumeration areas were combined to form new small areas polygons containing a minimum of 500 households (Phirwa, 2004; Grobbelaar, 2005). Population data was released at the small area level in 2005 (Parry, 2012). The population data collected in Census 2011 was sourced at the small area level.

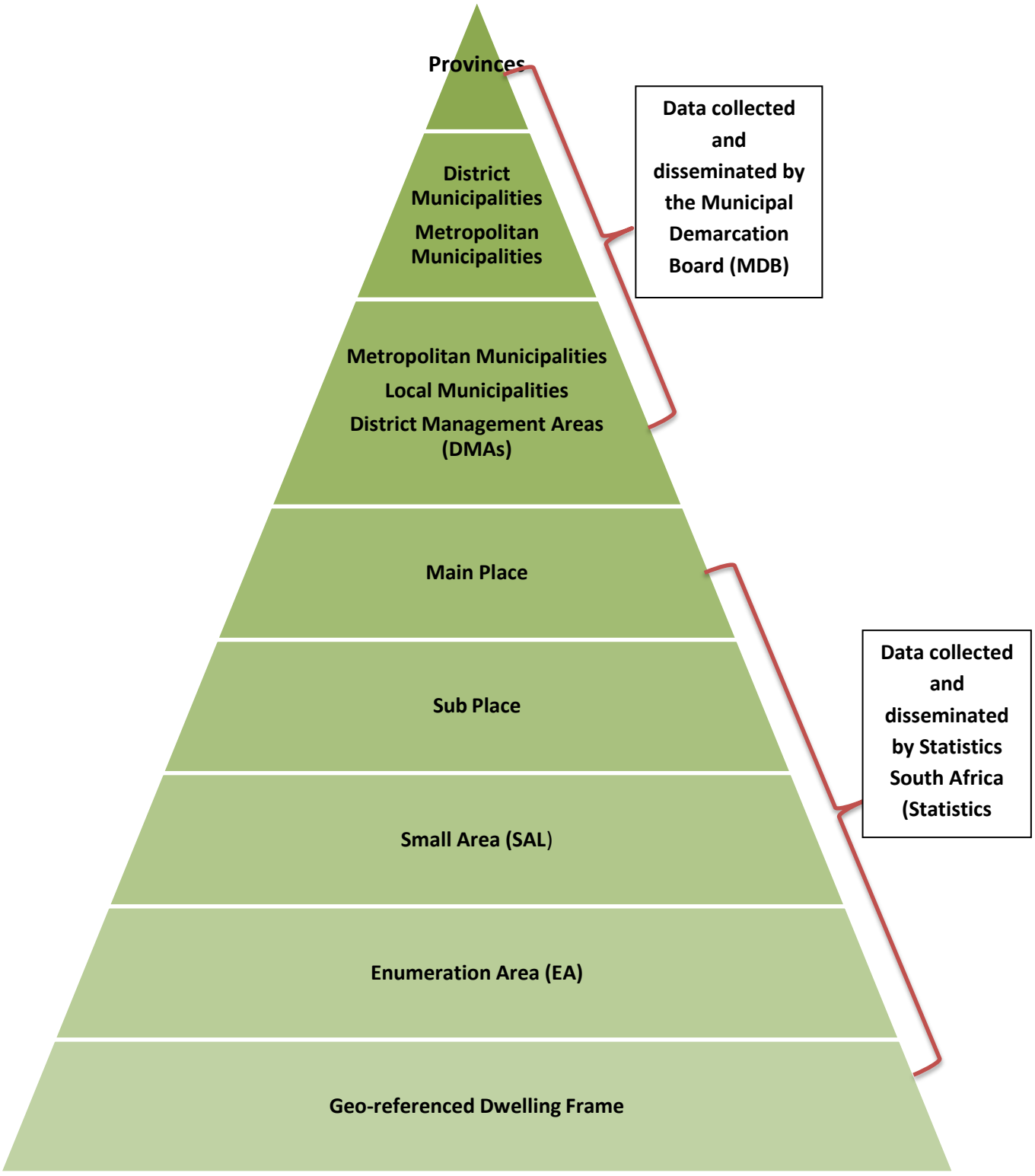

Figure 6.1: The geographical standards for the collection and dissemination of statistical data in South Africa (Adapted from Statistics South Africa, 2011)

All three censuses categorize respondents into one of five race categories: 'African/Black', 'Coloured', 'Indian/Asian',' White' and 'Unspecified'[10]. The 'unspecified' category was introduced in Census 1996 to account for individuals whose race was not recorded (Parry, 2012). This category was excluded from all analyses in this study on account of the fact that the racial classification of these individuals is unknown and to allow for the generated results to be more directly comparable to earlier studies in which the 'unspecified' category did not feature.

Prior to analysis, all spatial data was set to the WGS84 coordinate system and projected to the Transverse Mercator projection. The 25°E meridian was set as the Latitude of Origin.

Individual methodologies were developed and implemented to achieve each of the outlined research objectives; these are elaborated in the subsequent sub-sections.

6.3. Objective 1: Define appropriate study area boundaries for each of the census periods being investigated

Sub-place[11] spatial data sourced from the South African National Censuses were used in conjunction with SPOT imagery[12]of Port Elizabeth, obtained from the Fundisa hard disk drive (South African National Space Agency (SANSA)), to define the spatial extent of the study area for 1996, 2001 and 2011, respectively. The relevant spatial data were then extracted from the national database at enumerator area (EA) level for the 1996 National Census and at small area level (SAL) for the 2001 and 2011 National Censuses, respectively. Due to the implementation of different tract boundaries during each of the National Censuses, each of the respective study area extents does differ slightly. The study areas were mapped within ESRI's ArcMap10.2® platform.

[10] As mentioned in Chapter 1, the population be referred to as African, Coloured, Indian and White.
[11] Refers to suburbs in this context, but can also describe sections of a township, smallholdings, villages, wards, and informal settlements.
[12] Images 5131417120412080832 4JT and 5133418120629080623 2JT were obtained from the Fundisa disk, developed and issued by the South African National Space Agency (2014).

6.4. Objective 2: Map the racial distribution of Port Elizabeth's population from 1996 to 2011

Racial population data sourced from the South African National Census 1996, 2001 and 2011 were extracted for each of the study areas described above. This was used to generate racial dot density maps in ArcMap10.2®.

6.5. Objective 3: Measure the changes in racial segregation in Port Elizabeth from 1996 to 2011 using a multi-group index

The racial data extracted in the above step was imported into Microsoft Excel 2010®. The segregation indices used in this study were discussed in detail in sections 2.6.

First, Theil's Entropy Index (*H*) was computed for each of the study areas. This involved two calculations.[13] Firstly, racial diversity *h* scores were calculated for the individual census tracts and for the entire study area (i.e., the city) for each of the respective periods using equation (2), described in Section 2.6.2. The *h* scores were then used to generate choropleth maps for each of the census periods, displaying the diversity of each tract in the respective study areas. The *h* scores obtained were then used to calculate the overall Entropy Index *H* using equation (3), describe in Section 2.6.2.for each of the respective periods. These values were then tabulated and graphed, showing the overall trend in racial segregation.

[13] See White (1986) for details on how this calculation can be computed in software platforms such as Microsoft Excel®.

6.6. Objective 4: Measure the changes in racial segregation from 1996 to 2011, using a multi-group index, across different geographic scales to develop a segregation profile for Port Elizabeth

Sub-units of different sizes were used to calculate racial segregation across different geographic scales. This study utilized the same geographic units used by Parry and van Eeden (2014) in their analysis of Cape Town and Johannesburg in order to ensure comparability. The sizes of the geographic units used by Parry and van Eeden (2014) were based on the suggestion by Reardon *et al*. (2008) of measuring segregation at different geographic scales by using local environments of the following radii: 500 m, 1000 m, 1500 m, 2000 m, 2500m, 3000 m, 3500 m and 4000 m. According to Parry and van Eeden (2014), a grid cell of 1 km^2 covers approximately the same spatial extent as a buffer with a 500 m radius. Therefore, to correlate with the scales proposed by Reardon *et al*. (2008), Parry and van Eeden (2014) propose using fishnet grid layers with the following grid cell sized: 1 km^2, 2 km^2, 3 km^2, 4 km^2, 5 km^2, 6 km^2, 7 km^2 and 8 km^2.

Eight fishnet grid layers, of the cell sizes listed above, were then generated in ArcMap10.2® for each of the census period study areas. Within ArcMap10.2®, each of the study area layers was superimposed by one fishnet grid layer at a time. The population values (by race) for each cell were then derived from the census enumeration area and small area polygons for each respective period, This was achieved by using the *Intersect* tool in ArcMap10.2®, which allocated to each cell the proportion of the population of each enumeration area or small area that was contained within the extent of the cell. These values were imported into Microsoft Access 2010®, where a query was designed to aggregate the population counts for each grid cell. These data were then exported to Microsoft Excel 2010®, and the processes described in Section 2.6 were repeated to calculate the *h*, *H* and *D* values across the different geographic sub-units.

The *h* scores were then used to generate choropleth maps of the respective study areas at the varying geographic scales, with *h* displaying the diversity of each individual grid cell. The *H* values derived from the fishnet grids for each of the respective periods were tabulated and graphed in Microsoft Excel 2010® to generate an overall segregation profile for the city.

As pointed out by Parry (2012), the major advantage of using this fishnet grid approach is that in enables results to be compared across censuses and study areas due to the fact that all the cells

within the grid are identical in size. The major disadvantage of using fishnet grids lies in the fact that the boundaries imposed are non-egocentric, assuming that household interactions are confined only to other households within that grid cell (Parry, 2012).

6.7. Objective 5: Investigate the changes in racial diversity across geographical scales for selected areas in Port Elizabeth

Four sub-places in Port Elizabeth were selected, these being Fairview and Summerstrand (both of which were former White areas), and New Brighton and Motherwell (both of which are African locations). Figure 6.2 shows the location of these respective areas. Figures 6.3 to 6.6 show what each of these areas looks like. These four sub-places were chosen for specific reasons. Fairview and Summerstrand, which are not proximally located, have dissimilar spatial configurations and economic statuses, with the former being a more middle-income area and the latter being quite affluent. New Brighton and Motherwell, both peripheral African locations, have distinct spatial configurations. Motherwell, which is much younger than New Brighton, is located much farther towards the outskirts of the city.

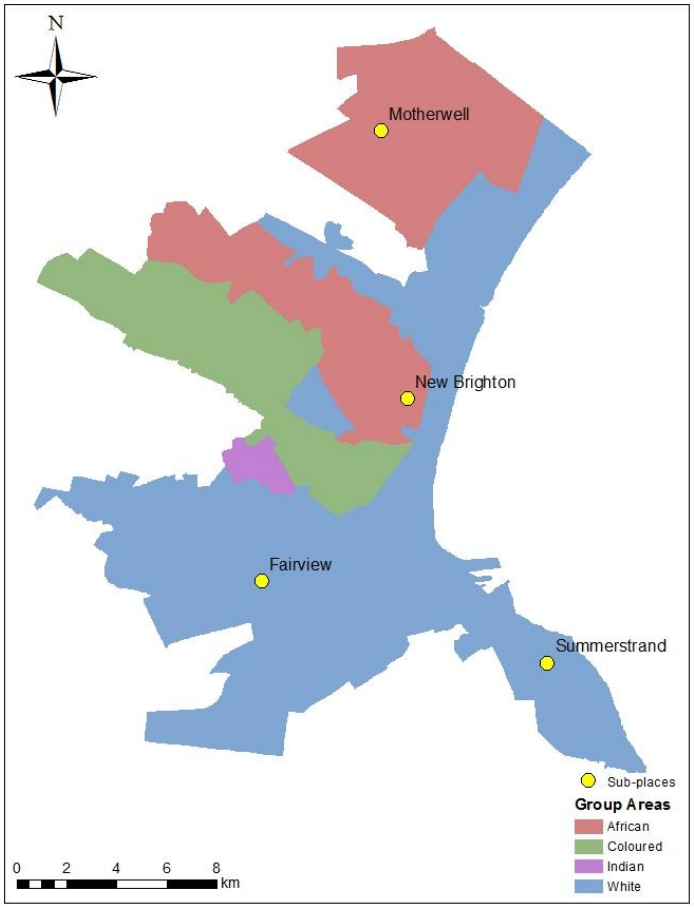

Figure 6.2: Location of Summerstrand, Fairview, New Brighton, and Motherwell in Port Elizabeth

The centroid (i.e. the central point of each of an area) of each of the sub-place areas were used as point references of the respective areas. The cells within which each of these points was contained were then selected, across the range of geographical scales, and the corresponding *h* scores (which were calculated in the previous objective's methods) were recorded. The calculated *h* scores were graphed Diversity profiles were then created for each of these respective sub-places by plotting the changes in the *h* scores obtained when considering them at different scales.

Figure 6.3: Summerstrand (Bally, 2010)

Figure 6.4: Fairview (Rizel Engineering, n.d.)

Figure 6.5: New Brighton (Kessel, 2010)

Figure 6.6: Motherwell (Portugalia, 2014)

6.8. Objective 6: Measure the changes in racial segregation between the specific race groups in Port Elizabeth from 1996 to 2011 using dichotomous indices

First, the Dissimilarity Index (*D*) was calculated using equation (1) to measure the degree to which the individual race groups were segregated from one another[14]. These results were tabulated, along with the calculated rate of change in the degree of segregation between the individual race groups across the census periods.

Secondly, the segregation index (SI) was computed to determine the respective rates of desegregation for each of the individual race groups. This involved computing the same equation as that used for the Dissimilarity Index (i.e., equation (1)), but in this case, the calculation was performed between each race group and the remaining three groups in conjunction (i.e., to calculate the extent to which the White population remained segregated from the rest of the population, the calculation was performed between the White population group and the combined total of the African, Indian, and Coloured groups).

6.9. Objective 7: Investigate the relationship between race and various socio-economic variables to determine possible constraints to achieving racial integration

Cross-tabulation data of income level, employment status and education according to race were sourced from Statistics South Africa. These data were only available for the 1996 and 2011 censuses. The employment and education level categories were consistent for both censuses, and were, therefore, used as is for statistical analysis. Different income bands were used in the 1996 and 2011 censuses. To enable comparison between the two census periods, the income bands used in the respective censuses were reclassified into one of four categories: *no income*, *low*

[14] See White (1983) for details on how this calculation can be computed in software platforms such as Microsoft Excel®.

income, *middle income* and *high income.* This was a largely intuitive process, in which the income tax brackets obtained from the South African Revenue Service from 1994-2012 (published by the South African Reserve Bank, 2012) were used as a guideline. The rates of taxation were used to segment the income groups defined by the South African Revenue Service into low, middle and high-income groups. This was done by identifying where there were large disparities in the rates of taxation in relation to income levels. Tables 6.1 and 6.2 show how the income tax brackets for 1996 and 2011 were sub-divided, respectively. Tables 6.3 and 6.4 show how the income bands used in the 1996 and 2011 censuses were reclassified.

Table 6.1: South African income tax brackets for 1996 (adapted from the South African Reserve Bank, 2012)

1996/97		
Taxable income (R per annum)	Rates of tax	
0–15 000	17% of each R1	
15 000–20 000	R2 550 + 19% of the amount above R15 000	Low
20 000–30 000	R3 500 + 21% of the amount above R20 000	
30 000–40 000	R5 600 + 30% of the amount above R30 000	
40 000–60 000	R8 600 + 41% of the amount above R40 000	Middle
60 000–80 000	R16 800 + 43% of the amount above R60 000	
80 000–100 000	R25 400 + 44% of the amount above R80 000	
100 000–and above	R34 200 + 45% of the amount above R100 000	High

Table 6.2: South African income tax brackets for 2011 (adapted from the South African Reserve Bank, 2012)

2010/11		2011/12		
Taxable income (R per annum)	Rates of tax	Taxable income (R per annum)	Rates of tax	
0–140 000	18% of each R1	0–150 000	18% of each R1	
140 001–221 000	R25 200 + 25% of the amount above R140 000	150 001–235 000	R27 000 + 25% of the amount above R150 000	Low
221 001–305 000	R45 450 + 30% of the amount above R221 000	235 001–325 000	R48 250 + 30% of the amount above R235 000	Middle
305 001–431 000	R70 650 + 35% of the amount above R305 000	325 001–455 000	R75 250 + 35% of the amount above R325 000	
431 001–552 000	R114 750 + 38% of the amount above R431 000	455 001–580 000	R120 750 + 38% of the amount above R455 000	High
552 001 and above	R160 730 + 40% of the amount above R552 000	580 001 and above	R168 250 + 40% of the amount above R580 000	

Table 6.3: 1996 Income Classifications utilized in this study

Income Category	Income Ranges (ZAR)	Census Income Bands
No Income	0	1
Low Income	1-2500	2-7
Middle Income	2501 -11000	8-12
High Income	>11000	13-15

Table 6.4: 2011 Income Classifications utilized in this study

Income Category	Income Ranges (ZAR)	Census Income Bands
No Income	0	1
Low Income	1-12800	2-7
Middle Income	12801-102400	8-9
High Income	>102400	10-12

Chi-square tests were calculated to determine the relationship between (i) race and income levels, (ii) race and employment status and (iii) race and level of education attainment. The Chi-square test, also known as the χ^2 test, is a non-parametric statistical test that determines whether two variables are significantly related, and is calculated using equation (4), shown below:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad (4)$$

Where r = number of rows

c = number of columns

O_{ij} = Observed frequency in $cell_i$

E_{ij}= Expected frequency in $cell_i$

(r-1)*(c-1) = Degrees of Freedom (df)

To compute the Chi-square test, the sets of data being compared (i.e. race and the chosen socio-economic variables) had to be classed into discrete categories, and arranged in contingency tables. The socio-economic variables chosen were: income, employment status, and levels of education attainment. Tables 6.5 , 6.6, and 6.7 show the contingency tables used to the Chi-square test for income, employment status, and levels of education attainment in relation to race.

Table 6.5: Contingency table used to compute the Chi-square test to investigate the relationship between race and income for Port Elizabeth's population in 1996 and 2011

	African	Coloured	Indian	White
No Income				
Low Income				
Middle Income				
High Income				

Table 6.6: Contingency table used to compute the Chi-square test to investigate the relationship between race and employment for Port Elizabeth's population in 1996 and 2011

	African	Coloured	Indian	White
Employed				
Unemployed				
Not Working (i.e. Not Economically Active)				

Table 6.7: Contingency table used to compute the Chi-square test to investigate the relationship between race and levels of education attainment for Port Elizabeth's population in 1996 and 2011

	African	Coloured	Indian	White
No Schooling				
Some Primary				
Completed Primary				
Some Secondary				
Grade 12				
Higher				

The Chi-square test calculates whether the observed frequency counts differ from the expected frequency counts[15]. If the observed and theoretical distributions are identical, then the calculation

[15] See Kitchin and Tate (2013) for a step-by-step explanation of how to calculate the χ^2 test.

will yield a χ^2 value of zero. A standard statistical table (for a specific confidence interval) with probabilities assigned to values of χ^2 at different degrees of freedom is used to determine whether the calculated value of χ^2 is significant: if the calculated χ^2 value is equal to or exceeds the tabulated χ^2 value, then the difference between the observed and expected frequencies is considered significant.

It is important to note that while the Chi-square test determines whether or not the relationship between two variables is statistically significant, it does not indicate the strength of that relationship. Cramer's V (Φc), a measure of association based on the Chi-square test was, therefore, also calculated to test the strength of these relationships. Cramer's V was calculated using equation (5), shown below:

$$\phi_c = \sqrt{\frac{\chi^2}{N(k-1)}} \tag{5}$$

Where χ^2 = Chi-square value

N = total population

(k-1) = df* = minimum (rows-1; columns-1)

This calculation yields a value from 0 (no association between variables) to 1 (perfect relationship between variables). Table 6.8 shows the standard developed by Cohen (1988) for interpreting Cramer's V, wherein the effect size varies depending on the df* used in the calculation.

Table 6.8: Effect sizes for Cramer's V adapted from Cohen (1988)

df*	Small Effect	Medium Effect	Strong Effect
1	0.10	0.30	0.50
2	0.07	0.21	0.35
3	0.06	0.17	0.29

6.10. Objective 8: Conduct interviews with relevant government persons involved in spatial planning to contribute further understanding of the processes governing the spatial dynamics of Port Elizabeth

Two government persons were approached to participate in an interview relating directly to the study findings. The first was Ms. Dawn McCarthy, the Senior Director of Strategic Planning and Coordination in the Nelson Mandela Bay Municipality, and the second was Mr. Gugile Nkwinti, the national Minister of Rural Development and Land Reform.

Although consent to participate in this study was received from both offices, only Ms. Dawn McCarthy complied. Communication was made with representatives from the Department of Rural Development and Land Reform over the course of two months (August to September, 2015), and interview questions were submitted for email response. Although receipt of the questions was acknowledged, as well as notification that their deliberation was underway, the required responses were never received.

A semi-structured interview was conducted with Mrs. Dawn McCarthy to ascertain the reasons behind the observed segregation patterns in Port Elizabeth. An interview schedule[16] was designed comprising nine key questions. Mrs. McCarthy was provided with a copy of the schedule in advance in order to prepare for the discussion. The interview was conducted on 20

[16] The interview schedule is provided in Appendix A at the end of the report.

August, 2015, at 11am and lasted approximately 45 minutes. Findings from the above described objectives were presented to Mrs. McCarthy and her responses to the interview questions were transcribed. All of the questions in the interview schedule were satisfactorily addressed.

6.10. Conclusion

There were various limitations associated with the methodologies outlined above; these will be expounded upon in Chapter 8. The results obtained from each of the above-described methodologies will be presented in the subsequent chapter.

CHAPTER 7: RESULTS

7.1. Introduction

This chapter is divided into seven sections, aligning with objectives 1 to 7, set out in Section 1.2. In brief, the objectives of this study set out to first define appropriate study areas for each of the respective Census periods, to investigate changes in the racial distribution of the city's population during the period 1996 – 2011, to investigate the changes in racial diversity and segregation for the city from 1996 to 2011 by computing multi-group and dichotomous segregation indices, and lastly, to investigate the reasons driving processes of racial integration and persistent segregation by computing statistical tests and interviewing relevant government persons. The interview results obtained in compliance with the eighth objective, and which relate to the preceding objectives, will be presented in the relevant sub-sections.

7.2. Objective 1 Results: Defining the study areas

The first objective of the study was to define suitable study area boundaries for each of the respective Census periods. Figures 7.1 to 7.3 show the study areas defined for the 1996, 2001 and 2011 Census periods, respectively. The tract boundaries represent the smallest unit of data collection for each of the respective Census periods, this being EA level for 1996 and SAL for 2001 and 2001. Due to the use of different tract boundaries across the Censuses, which could not be harmonized, each of the resulting study areas are slightly different. Within the defined study area boundaries for each Census period, there were 1351 EAs in 1996, 941 SALs in 2001 and 1380 SALs in 2011.

7.3. Objective 2 Results: The racial distribution of Port Elizabeth's population from 1996 to 2011

The second objective of the study was to map the racial distribution of Port Elizabeth's population for each of the Census periods from 1996 to 2011.

7.3.1. Analytical Observations

Figure 7.4 shows the location and extent of Port Elizabeth's former racial zones. Figures 7.5 to 7.7 represent dot density maps, showing the racial distribution of Port Elizabeth's population for 1996, 2001 and 2011, respectively. In these figures, each dot represents fifty individuals. When considering these figures all together, it is apparent that throughout the Census periods, while minor changes have occurred from 1996 to 2011, the spatial distribution of Port Elizabeth's different racial groups still largely corresponds to the former designated racial zones. The population redistribution that has occurred has predominantly involved the movement of Black population groups into areas that were formerly White-designated, while movement in the reverse direction has been limited.

7.3.2. Related Interview Responses

Ms. McCarthy (pers. comm, 2015) suggested numerous explanations of the above-mentioned observations. Firstly, persistent unemployment, as well as a continued demoted socio-economic status, among the vast majority of the African population has inhibited the mobility of the vast majority of the population due to affordability, restricting the possibility of relocation. Secondly, self-segregation is a dominant theme amongst all the Black population groups. The Group Areas, which concentrated people of like ethnic/race/culture together, produced what Ms. McCarthy (pers. comm, 2015) describes as 'entrenched traditional areas'. According to Ms. McCarthy (pers. comm, 2015), inhabitants of the Black population groups who have the economic means to

move out of their former Group Areas often choose to remain in their former Group Areas due to the following reasons:

i. Cultural ties: The creation of Group Areas, with specific residential zones for each of the race groups, not only resulted in racial concentration, but also cultural concentration. Many residents choose to remain in their Group Areas, even if able to relocate, out of a desire for cultural preservation and to remain close to cultural institutions (for example, religious institutions) and hubs (referring to general sites of cultural congregation).

ii. Family ties: The maintenance of the 'family unit' is a core value of numerous cultures, which resulted in individuals living in close proximity to family members.

iii. Safety in numbers: Members of the Black population groups often choose to remain in their former Group Areas due to a sense of comfort and comradery resulting from being surrounding by like individuals. Furthermore, remaining segregated in this context is also viewed as a means of remaining protected against the potential discrimination that could be faced if members were to relocate out of their former Group Areas.

iv. Transport: Transport routes and costs are a major determinant influencing Black individuals' choice not to relocate from their former Group Areas, and directly links with points 1 and 2 mentioned above. As mentioned in Chapter 4, the apartheid city model entailed that the distinct racial residential zones be separated by structural barriers (such as natural landscape features like rivers and geomorphic formations), or open tracts of land (called buffers), and furthermore, that no direct road-linkages should connect the different residential zones. The inconvenience of travelling longer distances, and the cost associated with it, in order to maintain cultural and family ties are perceived as impractical, and in some cases, financially unaffordable. This is particularly the case for the African population, the majority of whom remain at the lower end of the socio-economic spectrum, and who would have to travel the longest distances.

Ms. McCarthy (pers. comm, 2015) also highlighted the effect that the national government's Reconstruction and Development Plan (RDP) had in entrenching racial segregation, particularly

with regards to the African population. The main priority governing the RDP was the creation of housing. RDP homes were reserved for households which earned a monthly income of less than R3,500. As Ms. McCarthy (pers. comm, 2015) explains, the RDP housing strategy essentially generated African suburbs characterized by high levels of unemployment and low income. Furthermore, these housing schemes were developed on the cheapest land that local government could afford, which was located on the periphery of the city, and were essentially extensions of the already established African locations. The creation of what were monoracial African residential areas at the outskirts of the city, therefore, unintentionally prolonged the apartheid tradition of enforcing racial segregation,

According to Ms. McCarthy (pers. comm, 2015), the one-way pattern of movement, characterized by members of the Black populations relocating to areas that were formerly White-designated (refer to Figures 7.4 to 7.7) can typically be explained by Black Economic Empowerment (BEE)[17], which afforded members of the Black population the opportunity to infiltrate the South African economy. A rise in socio-economic status provided Blacks benefitting from BEE the economic freedom to relocate from their former Group Areas. Additionally, the higher socio-economic status of the Indian and Coloured populations during apartheid afforded members of these groups greater spatial mobility following democratization. Furthermore, as Ms. McCarthy (pers. comm, 2015) pointed out, the inequitable distribution of amenities inherited from the apartheid city has not yet been rectified; the racial integration that has taken place, therefore, has been confined to areas that were formerly classified as White.

[17] Black Economic Empowerment refers to the economic restrictions implemented nationally after South Africa's democratization; this was aimed at promoting and facilitating the participation of the Black population in the South African economy.

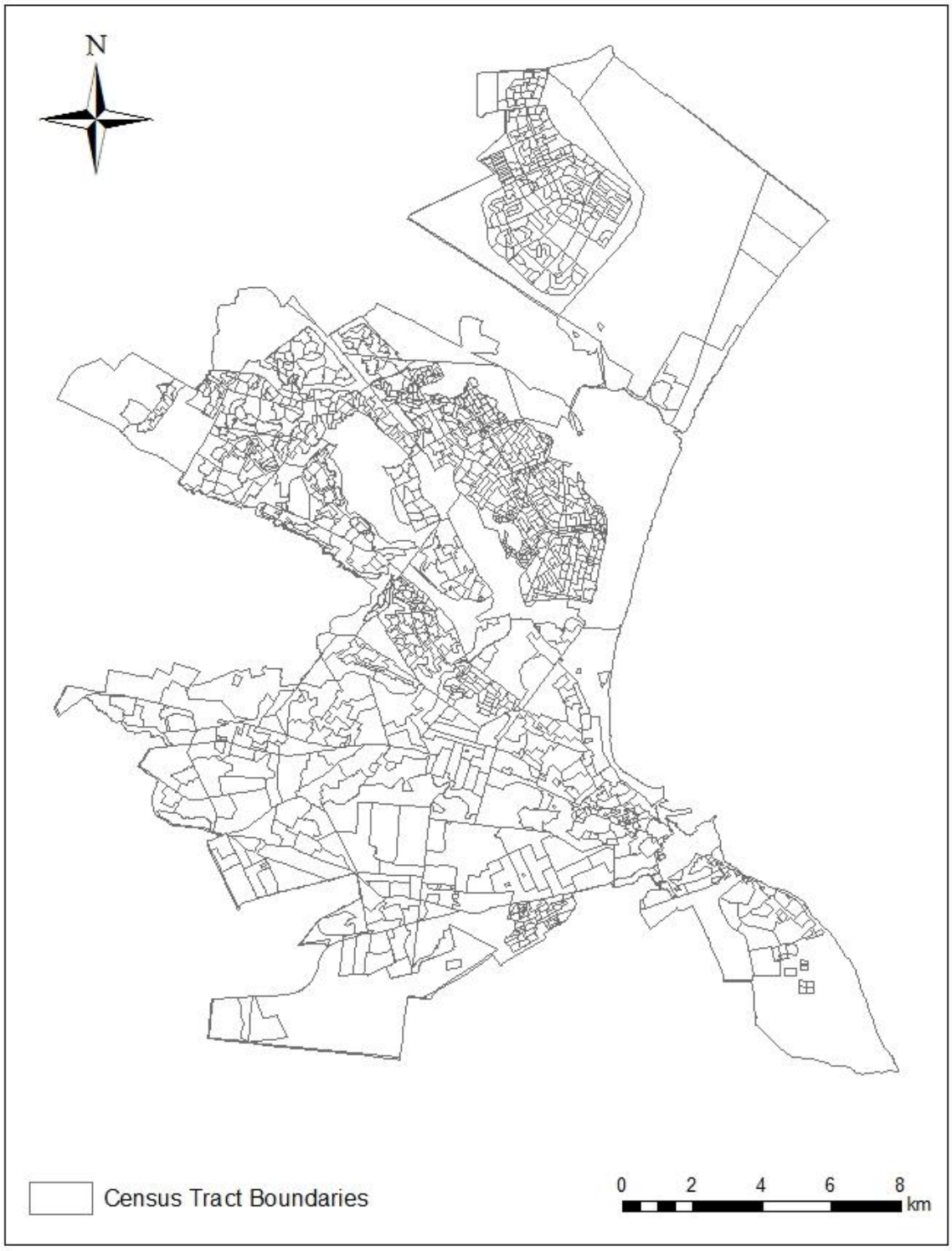

Figure 7.1: Port Elizabeth study area boundary based on enumeration area boundaries from Census 1996

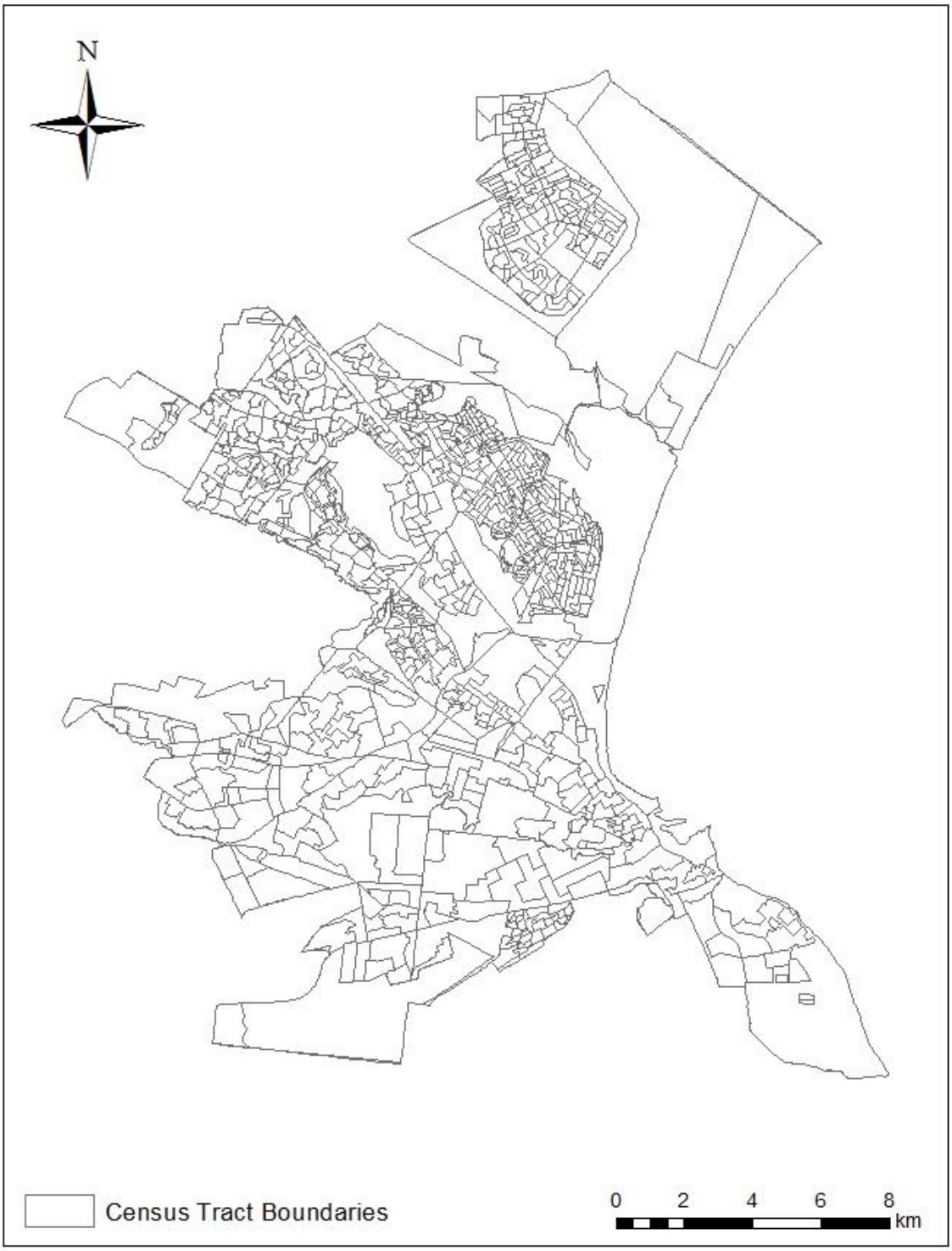

Figure 7.2: Port Elizabeth study area boundary based on small area layer boundaries from Census 2001

Figure 7.3: Port Elizabeth study area boundary based on small area layer boundaries from Census 2011

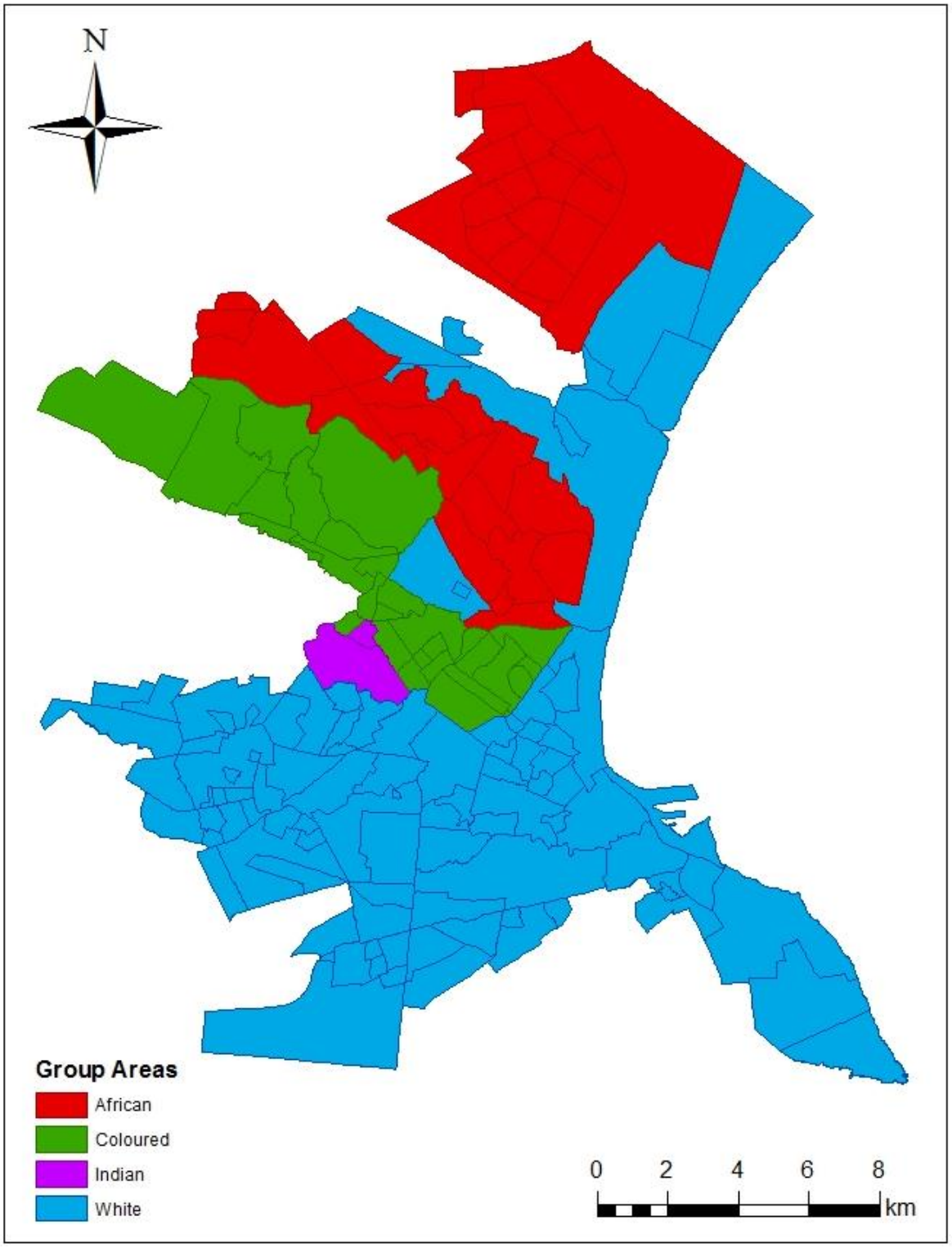

Figure 7.4: Port Elizabeth's Group Areas (brawn from Census 2011 sub-place data)

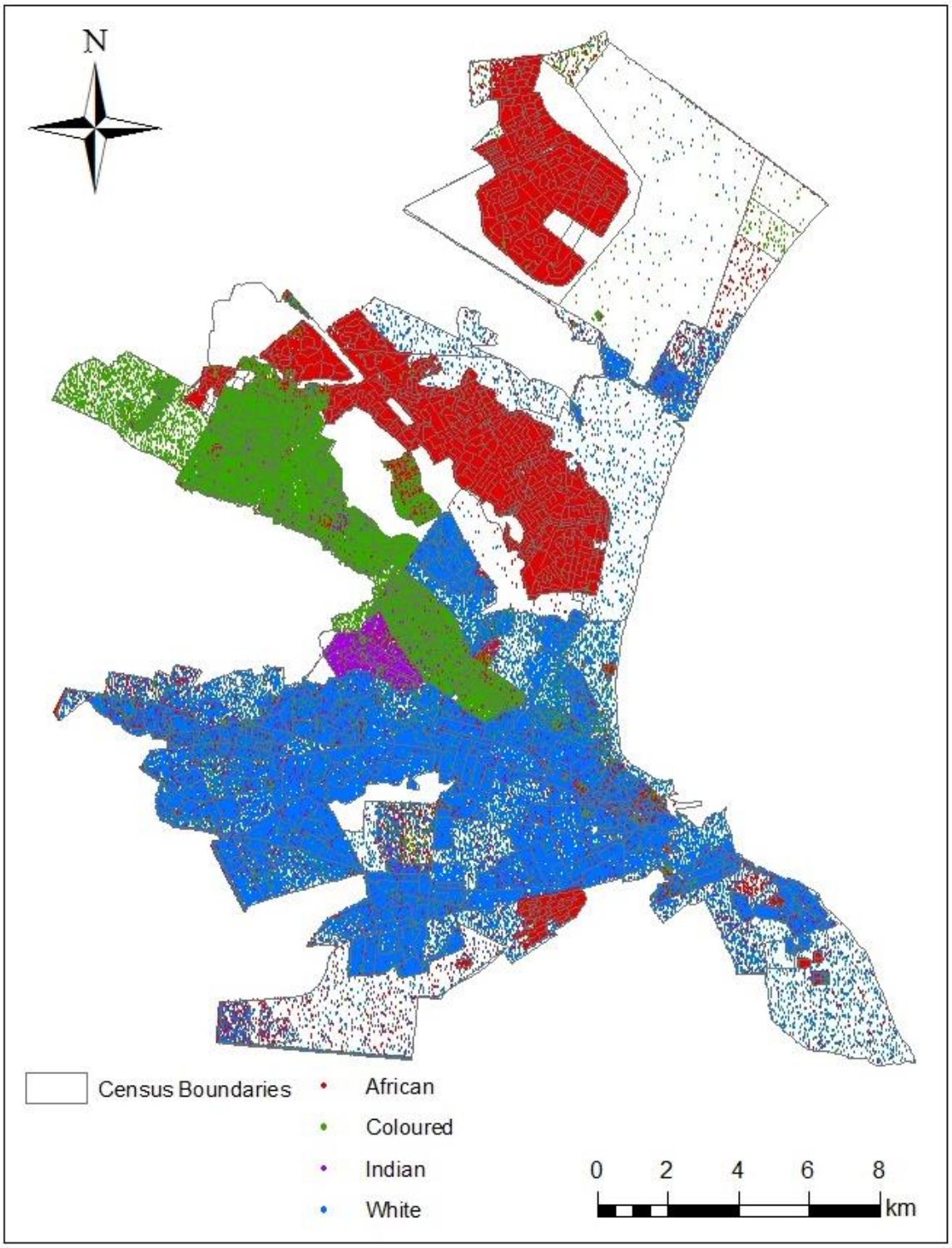

Figure 7.5: Racial population distribution based on racial self-identification in Census 1996

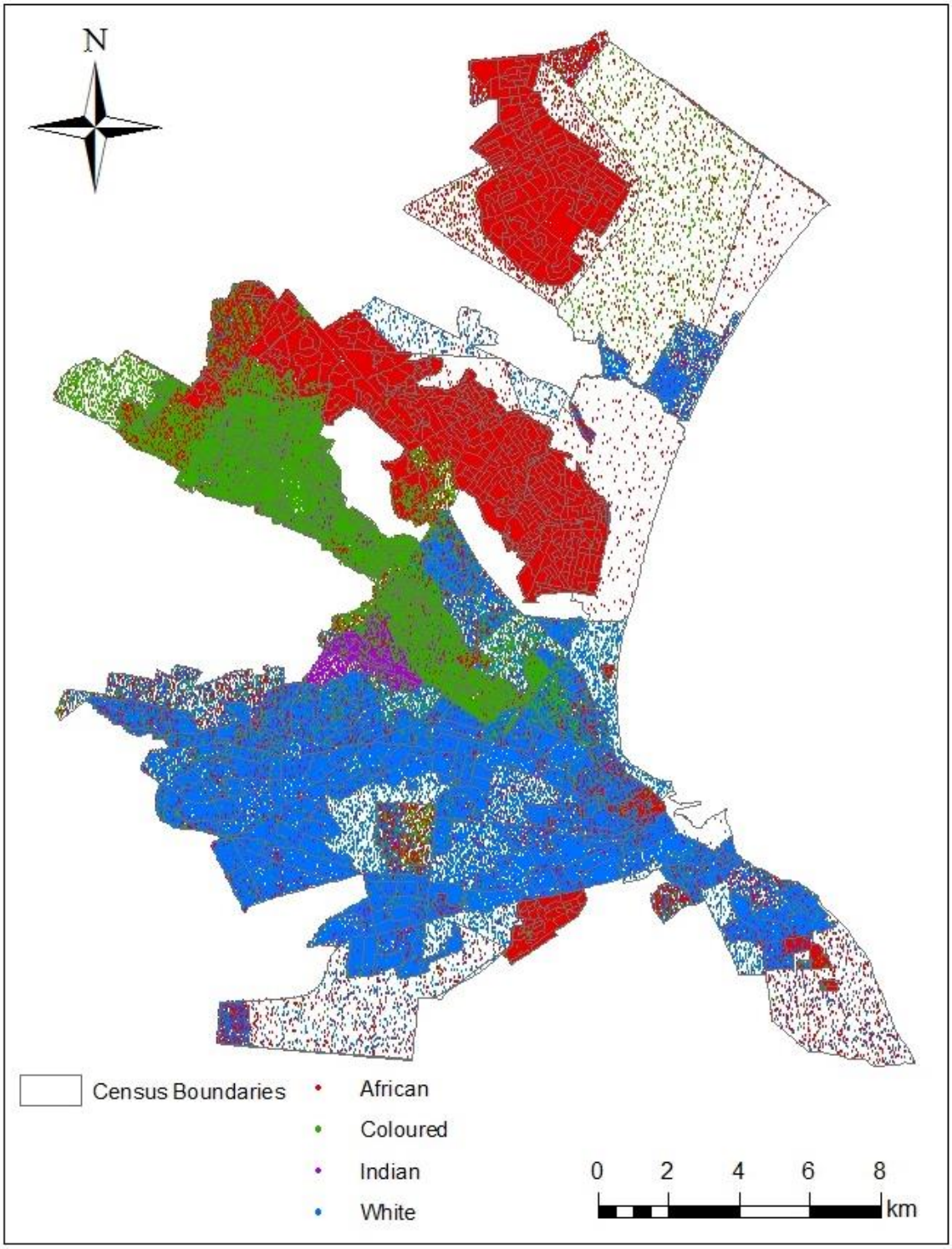

Figure 7.6: Racial population distribution based on racial self-identification in Census 2000

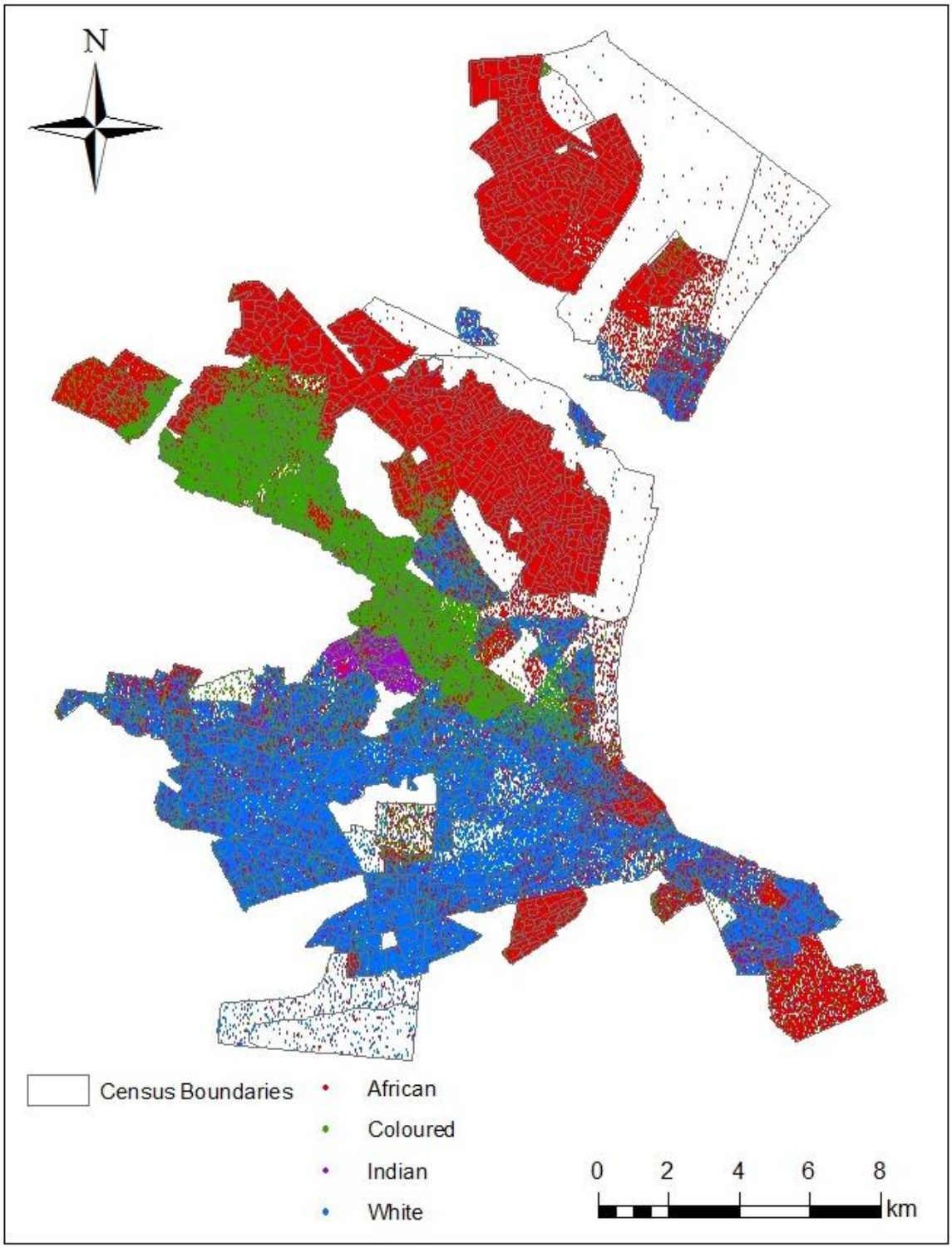

Figure 7.7: Racial population distribution based on racial self-identification in Census 2011

7.4. Measurement of Segregation for Port Elizabeth from 1996 to 2011

The third objective of the study was to quantitatively measure the changes in racial segregation from 1996 to 2011. This was achieved by computing a two-part multi-group index which measured (i) racial diversity at tract level and (ii) overall segregation.

7.4.1 Racial Diversity at Tract Level

7.4.1. (a). Analytical Observations

Theil's Entropy Index is a two-part calculation which yields two different results. The first calculation of Theil's entropy score involves the computation of a diversity score *h* for every subunit of a study area. If a particular subunit is inhabited by only one race group, then the *h* score of that subunit will be 0, indicating no diversity. The maximum value of *h* will be the natural logarithm of the number of race groups considered. This study considers four race groups (i.e., African, Coloured, Indian and White); therefore, sub-units with perfect diversity (i.e. inhabited by equal proportions of all four race groups) will have a diversity score of 1.386 (i.e. the natural logarithm of four).

Figures 7.8, 7.9 and 7.10 shows the racial diversity computed for Port Elizabeth at the smallest available tract level for 1996, 2001 and 2011, respectively (i.e. the enumeration area level for 1996 and the small area level for 2001 and 2011). In these figures, the darker the colour of the Census tracts, the more racially diverse they are as *h* approaches 1.386. From these figures, it is apparent that from 1996 to 2011, racial diversity increased predominantly in areas that were formerly designated for Whites (i.e. reflecting that most of the movement involved members of the Black race groups relocating to former-White areas). Patterns of low racial diversity are evident in Govan Mbeki, Kwadesi, Kwazekele, Motherwell, New Brighton and Zwide, all of which are former African location areas. Racial diversity increased in areas closer to the CBD area of Port Elizabeth, as well as along the eastern coastal areas of St Georges Strand, Bluewater Bay and North End.

7.4.1. (b). Related Interview Responses

Ms. McCarthy (pers. comm, 2015) attributed the increases in racial diversity in these areas due to the housing in these areas being more affordable. Bluewater Bay, in particular, represents a younger residential area characterized by high-density, lower cost housing. This area, which is located close to the African township areas, has become a popular residential area for members of the African economic elite.

Patterns of increased racial diversity are also found in the Summerstrand and Humewood areas. Although these areas are affluent, Ms. McCarthy (pers. comm, 2015) noted that their proximity to the Nelson Mandela Metropolitan University (NMMU) has resulted in these areas becoming popular sites of student accommodation. Students, who are counted as temporary residents in the National Censuses, contribute substantially to the increased racial diversity observed in these areas. Racial diversity has also increased in the areas of Fairview and Overbaakens. Ms. McCarthy (pers. comm, 2015) attributes this to these being the sites of social housing schemes which were high-density and low-cost. High levels of racial diversity are also observed in the Algoa Park area. These areas was classified as White residential areas under the Group Areas Act (see Figure 7.4), although located peculiarly in between the Coloured and African regions. Prior to the passing of the Group Areas Act, this area was inhabited primarily by lower class White and remained a White area during the apartheid period. Both its positioning in between the designated Coloured and African areas, and the relatively lower cost of property in the area made it particularly conducive to integration. In all of the above-listed cases, the proximity to former designated Group Areas can be implicit in the patterns of the migration of Blacks into former-White areas.

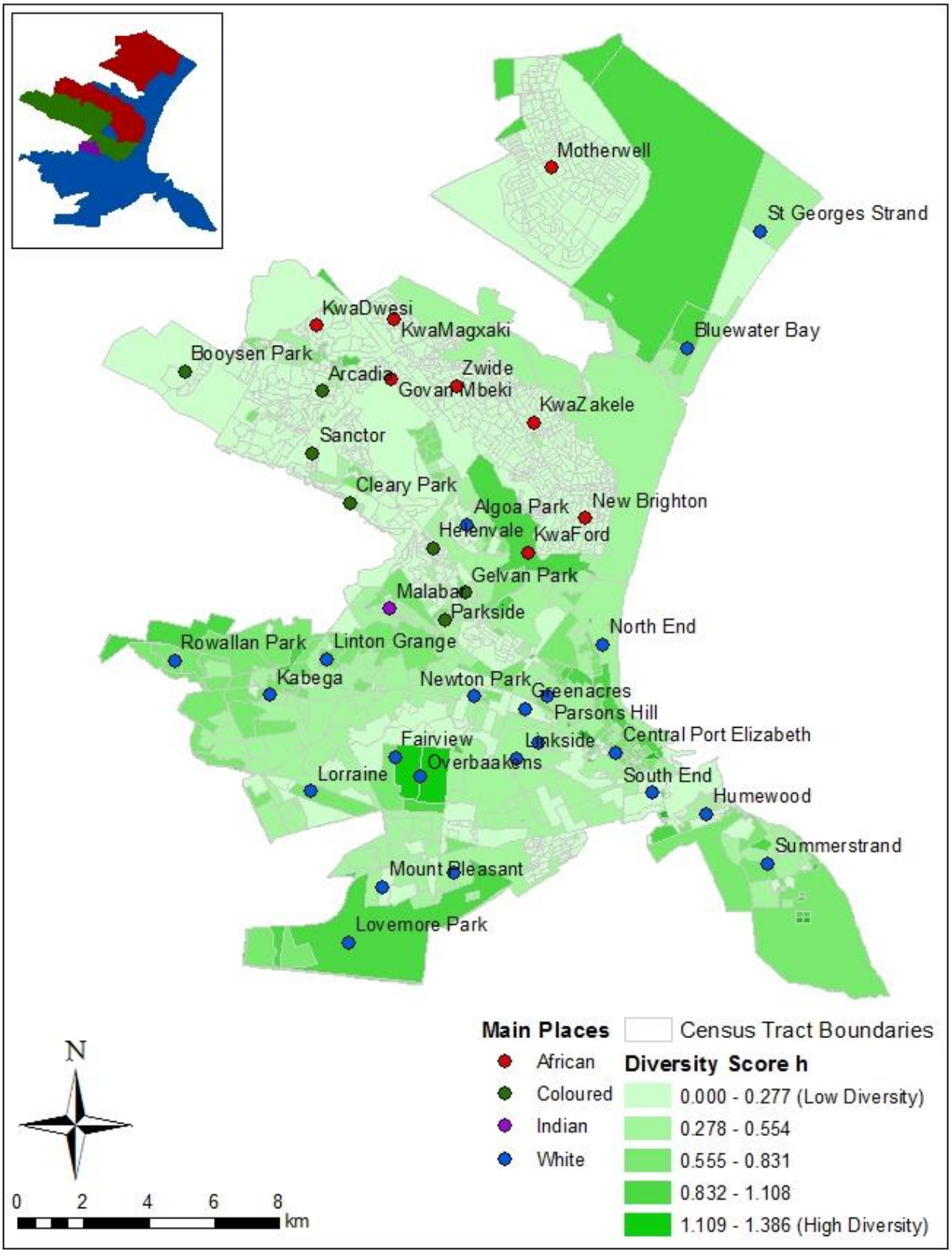

Figure 7.8: Racial diversity at tract (enumeration area) level, Census 1996

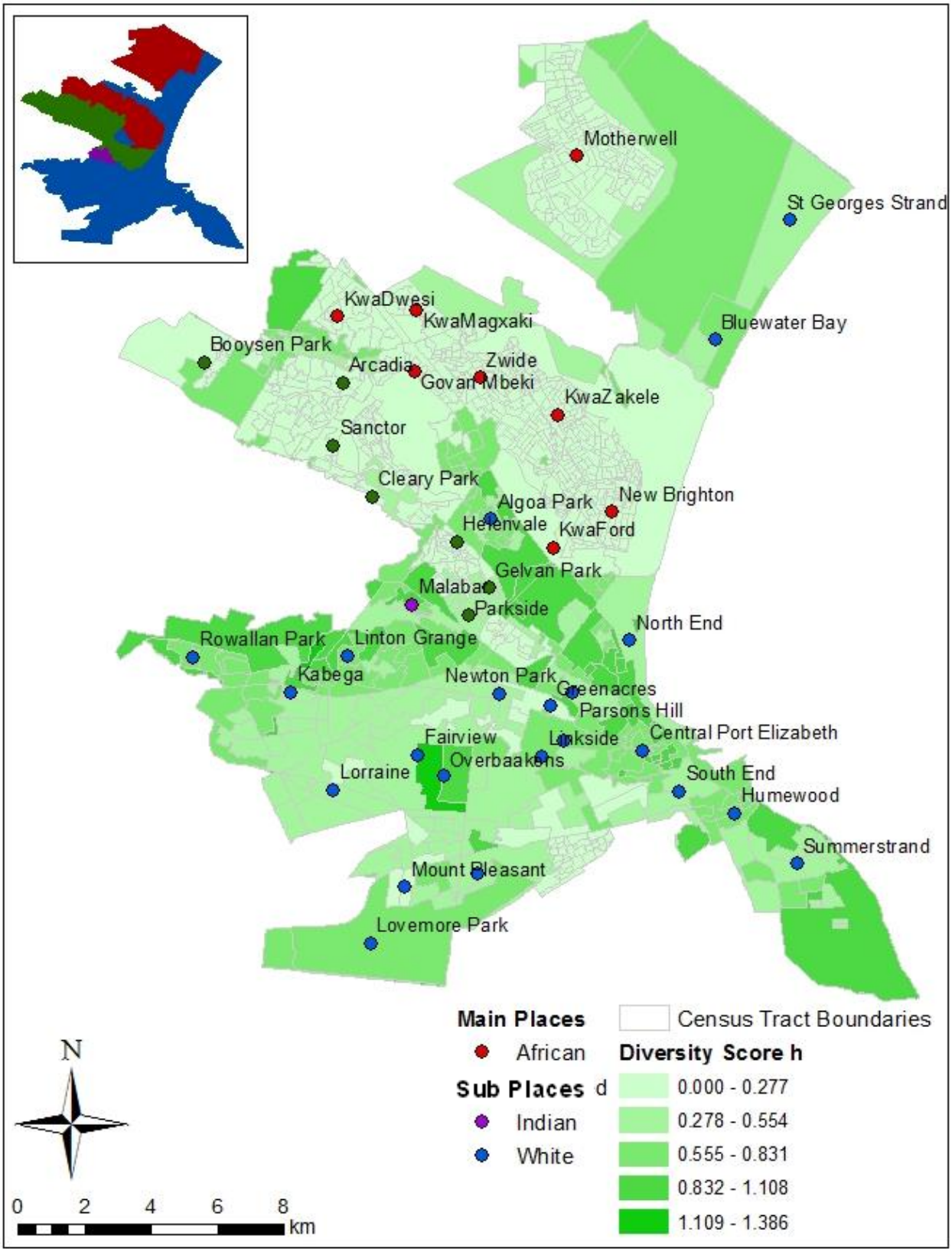

Figure 7.9: Racial diversity at tract (small areas layer) level, Census 2001

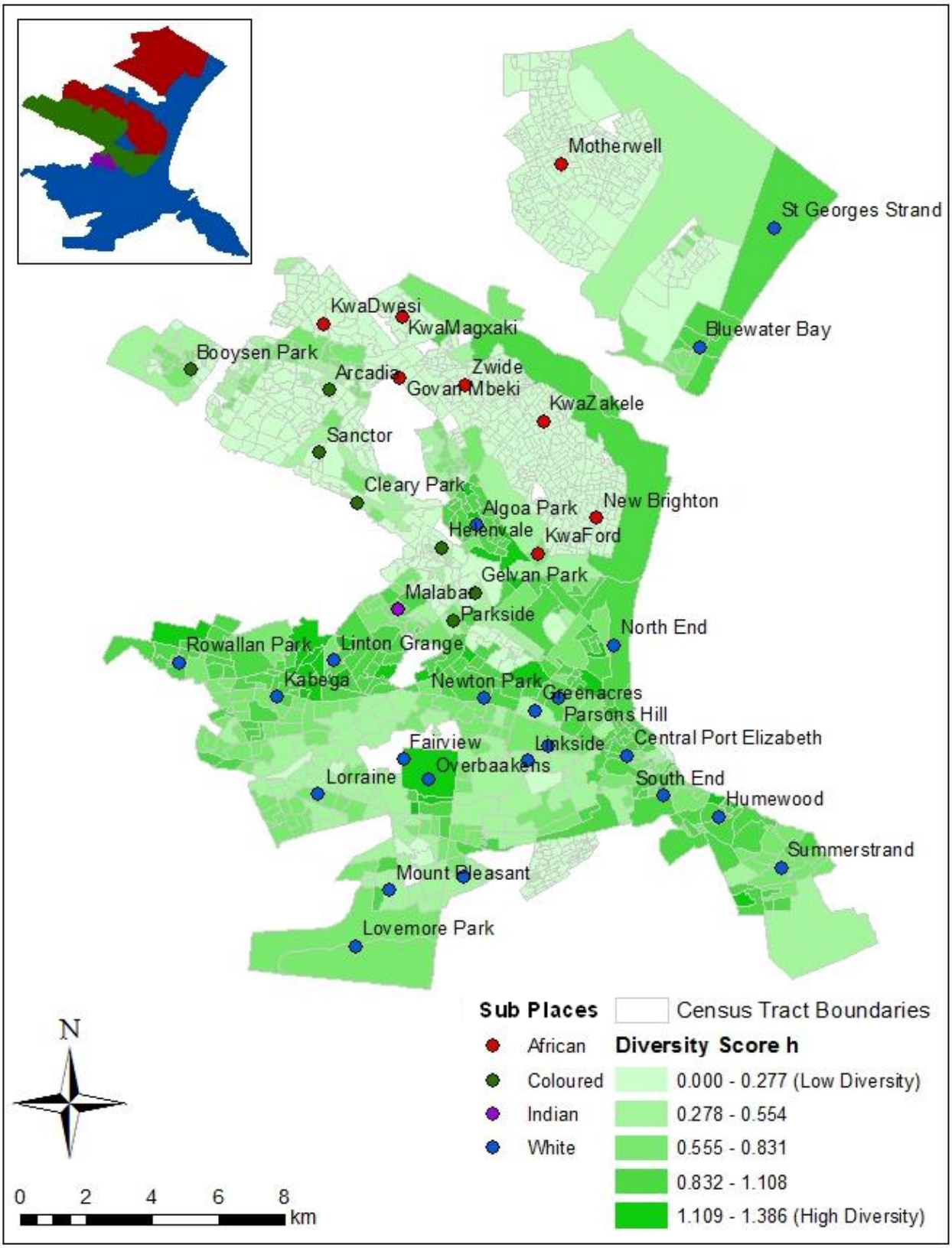

Figure 7.10: Racial diversity at tract (small area layer) level, Census 2011

7.4.2. Racial Segregation at Tract Level

7.4.2. (a). Analytical Observations

The second component of Theil's Entropy Index involves the computation of a segregation score *H* for an entire study area. Values for *H* range between 0 when all the subunits have the same racial composition as that of the study area as a whole (indicating no segregation/perfect integration) and 1, when all the subunits contain only one race group (indicating perfect segregation/zero integration).

Figure 7.11 shows the *H* values, which represent the segregation levels for the city as a whole, calculated for Port Elizabeth at tract level for each of the Census periods. Overall racial segregation decreased by 5.4 % from 1996 to 2001, and by a further 7.7 %from 2001 to 2011, resulting in an overall decrease of 13.1 %. Table 5.1 provides the *H* values calculated by Parry and van Eeden (2014) for the cities of Cape Town and Johannesburg for the same Census periods. These values were also calculated at tract level. The values from both studies are plotted as segregation curves for all three cities in Figure 7.12 for comparison.

Port Elizabeth displays the same segregation trends found in Cape Town and Johannesburg, these being (i) a continuous decrease in segregation from 1996 to 2011, and (ii) an increase in the rate of decline between consecutive inter-Census periods. According to Parry and van Eeden (2014), segregation in Cape Town declined by 5 % from 1996 to 2001 and by 10 % from 2001 to 2011 (producing an overall 15 % decline), while segregation in Johannesburg declined by 5 % from 1996 to 2001 and by 6 % from 2001 to 2011 (producing an overall 11 % decline). As is evident in Figure 7.12, segregation levels in Port Elizabeth were consistently higher than those of Cape Town and Johannesburg, suggesting that while Port Elizabeth exhibits similar trends in the declining levels of segregation, due to higher base levels of segregation, the city requires a greater rate of racial integration to be on par with Cape Town and Johannesburg with regards to racial integration.

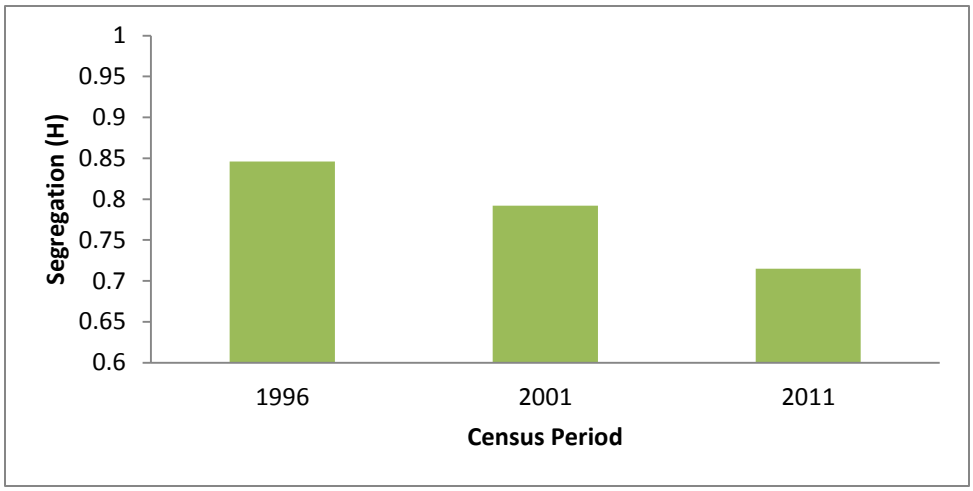

Figure 7.11: Entropy (H) scores for Port Elizabeth at tract level for 1996, 2001 and 2011

Table 7.1: Entropy (H) scores at tract level for Cape Town and Johannesburg (1996-2011) (Parry and van Eeden, 2014)

	Cape Town	Johannesburg
1996	0.80	0.70
2001	0.75	0.65
2011	0.66	0.59

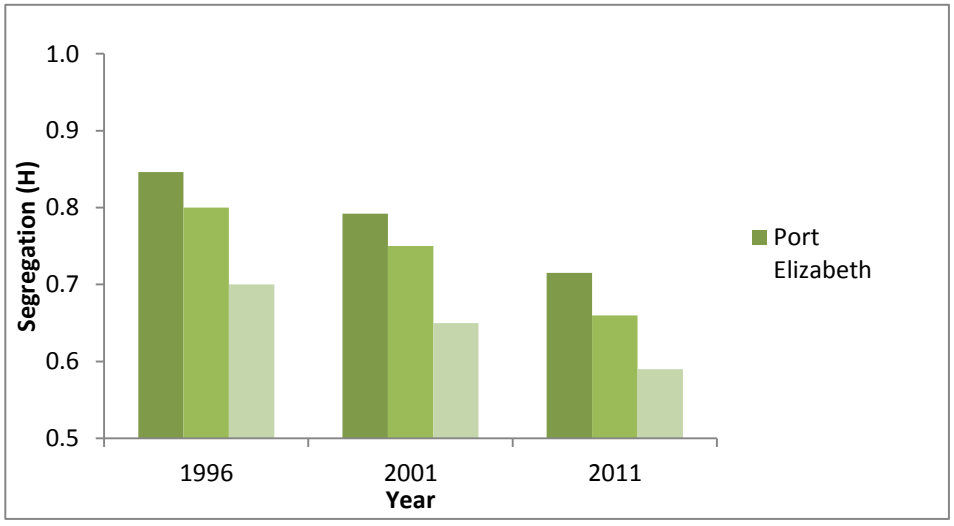

Figure 7.12: Segregation levels (H) measured at tract level for Port Elizabeth, Cape Town and Johannesburg. The values for Cape Town and Johannesburg were sourced from Parry and van Eeden (2014).

5.3.2. (b). Related Interview Responses

Ms. McCarthy (pers. comm, 2015) states that Port Elizabeth's overall 13.1 % decline in racial segregation can be considered as favourable for three reasons. Firstly, the low economic growth in the city (and the Nelson Mandela Bay Municipality on the whole) has substantially limited the ability of local government to facilitate racial integration[18]. The absence of a fluid economy, in conjunction with high levels of poverty, does not allow both local government and residents to make the desired decisions that are conducive to achieving racial and social integration. Secondly, both a lack of skills at a local government level and the absence of a coherent national policy and mandate aimed at inclusionary housing have restricted the extent to which government had been able to facilitate racial residential integration. As previously mentioned, housing strategies such as RDP, which were primarily aimed at creating shelter for the poorest households, could be considered, to some degree, as exclusionary in nature in that they consequentially generated monoracial, poverty-concentrated neighbourhoods which were located on the outskirts of the city. Thirdly, the region experiences low levels of in-migration compared to both Cape Town and Johannesburg which, being large economic hubs, experience greater levels of in-migration which contributes to increasing levels of racial diversity.

7.5. Measurement of Segregation at Different Geographic Scales for the City

The fourth objective was to compute the same multi-group index used above to investigate the changes in racial diversity and segregation across multiple geographic scales for the city, and across the census periods, and hence develop a segregation profile for Port Elizabeth. The city extents for the respective Census periods were partitioned into grid cells of varying sizes, from which diversity and segregation were computed.

[18] Referring to spatial planning strategies such housing projects that would promote racial integration, the creation of suitable transport routes to enable greater levels of spatial mobility across all areas of Port Elizabeth, and developing formerly-marginalized areas to promote relocation into all areas of the city (as opposed to the observed unidirectional pattern of movement into areas that were formerly White-designated).

Due to the fact that the Census tract boundaries do not correspond with the sub place boundaries of the city, and that the boundaries used for each of the respective Censuses are not coherent, investigating racial diversity and segregation at tract level only can yield a distorted view of real-life patterns of racial segregation. The measurement of racial segregation using grid cell boundaries, therefore, presents a more (practical/real-life representative) method of measuring racial segregation in that it allows for segregation to be measured across a range of geographical scales and to be comparable across the Census periods.

Figures 7.13 to 7.36 show the racial diversity measured at 1-8 km^2 scales. When considered across a range of geographical scales, the same pattern of migration from former African areas to areas that were formerly designated as White is evident. Racial diversity was found to be an increasing function of scale, meaning that greater levels of racial diversity were represented when considered at higher geographical scales. The trends described with regard to diversity measured at tract level (i.e., enumeration/small area) are still reflected when using grid cells of different scalar units. Racial diversity increases predominantly in areas that were formerly designated for Whites. As the scalar unit increases, racial diversity is also reflected as higher in areas located in closer proximity to the former-White Group Area. The peripheral African location areas exhibit lower levels of racial diversity relative to the other Group Areas at smaller and larger geographical scales.

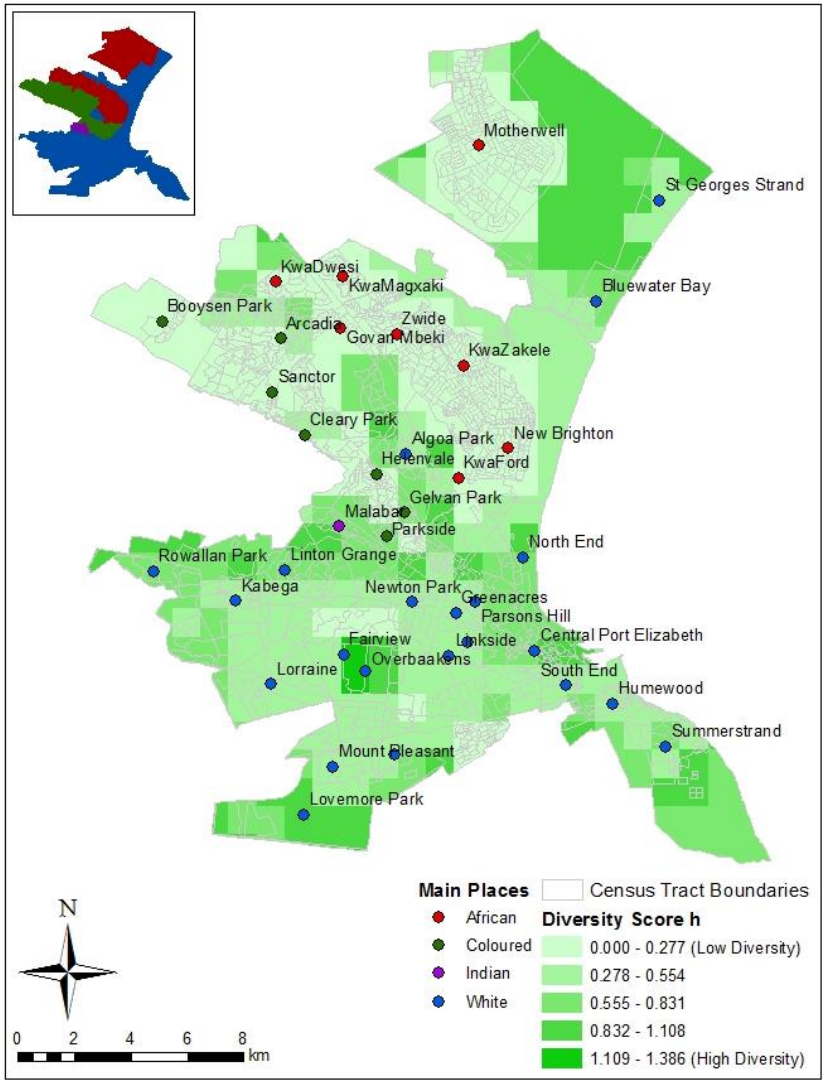

Figure 7.13: Racial diversity at 1km^2 grid resolution, Census 1996

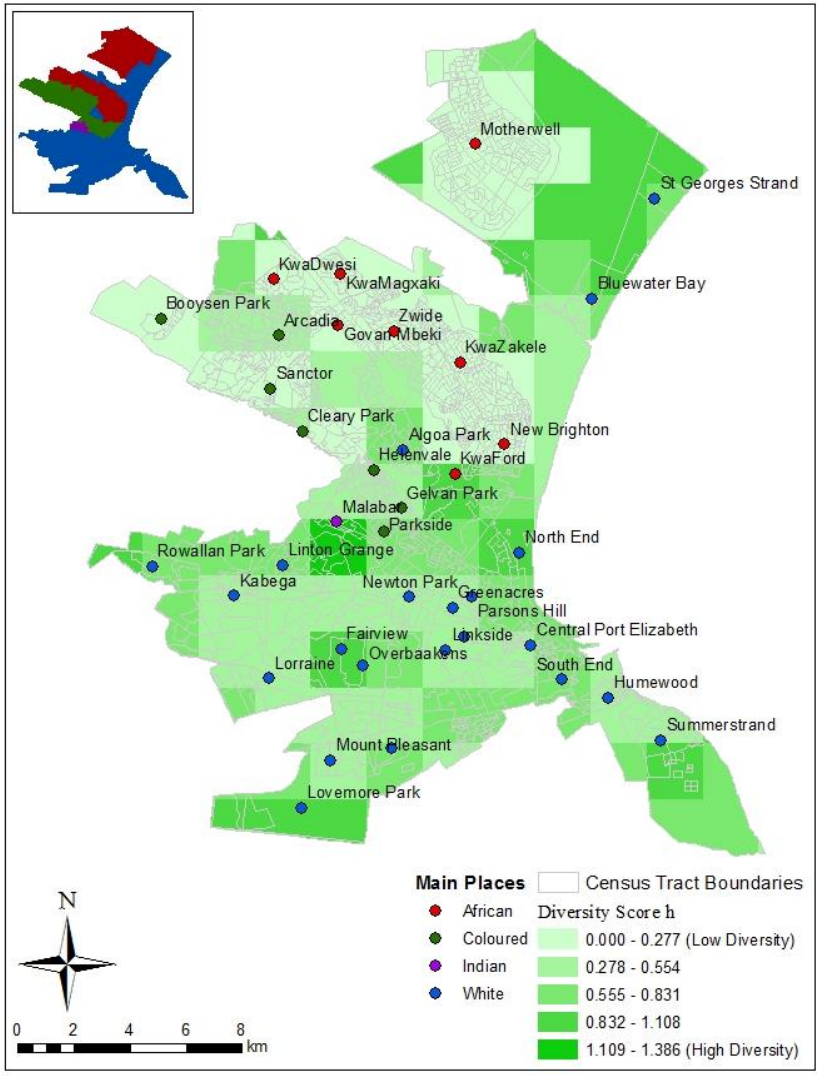

Figure 7.14: Racial diversity at 2km^2 grid resolution, Census 1996

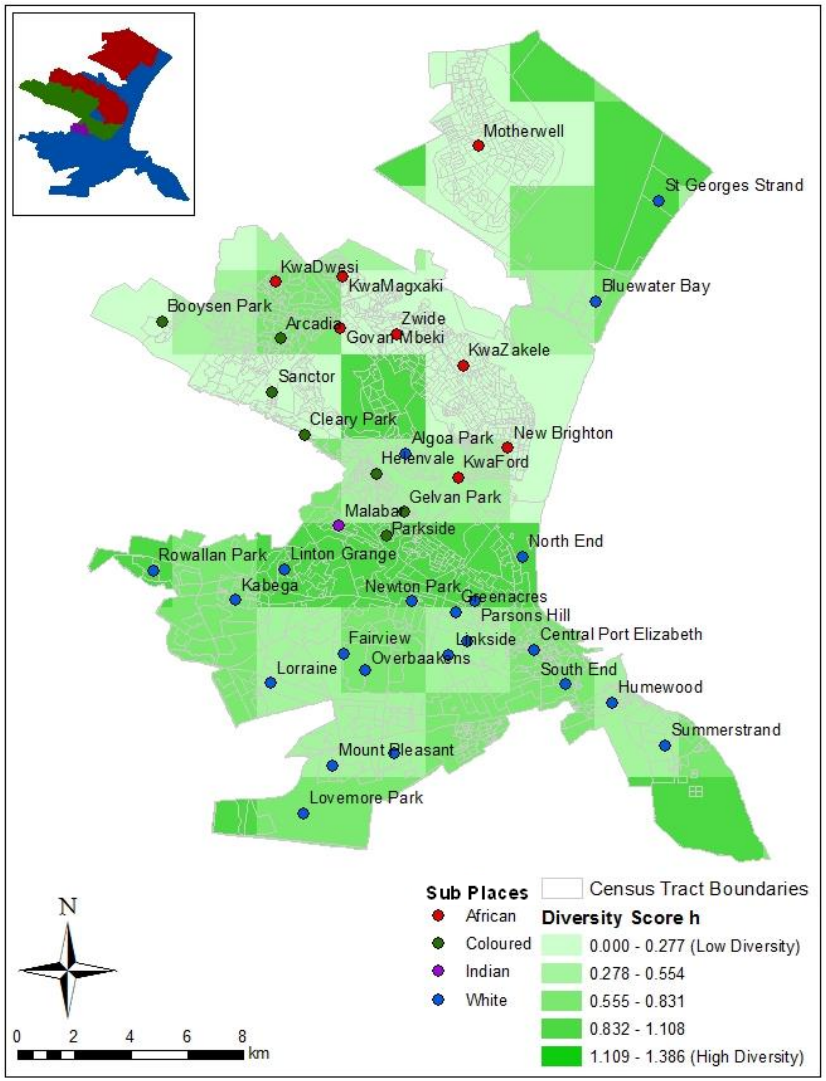

Figure 7.15: Racial diversity at 3km^2 grid resolution, Census 1996

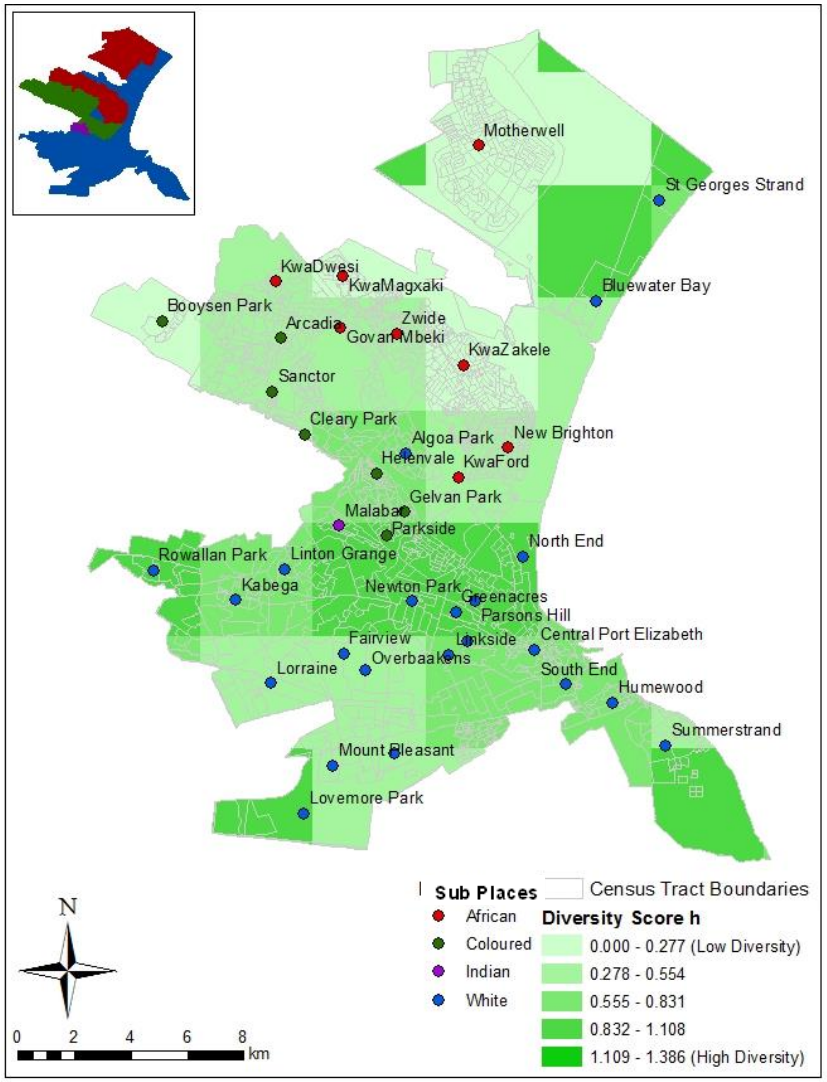

Figure 7.16: Racial diversity at 4km^2 grid resolution, Census 1996

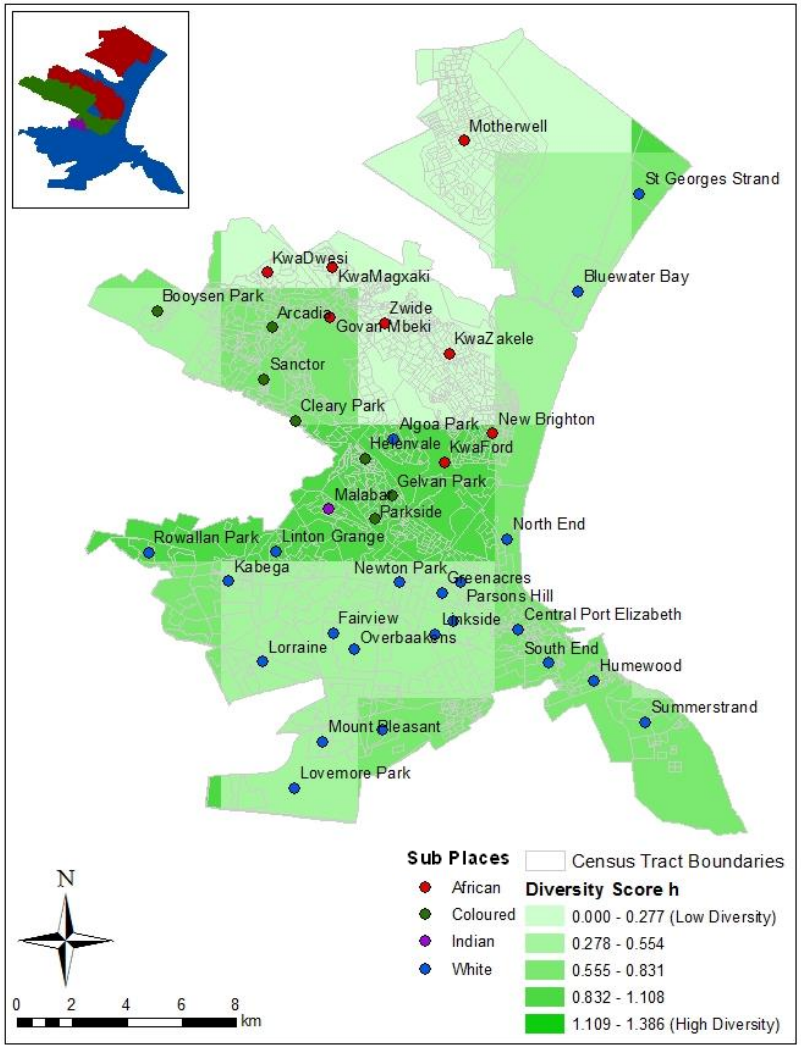

Figure 7.17: Racial diversity at 5km^2 grid resolution, Census 1996

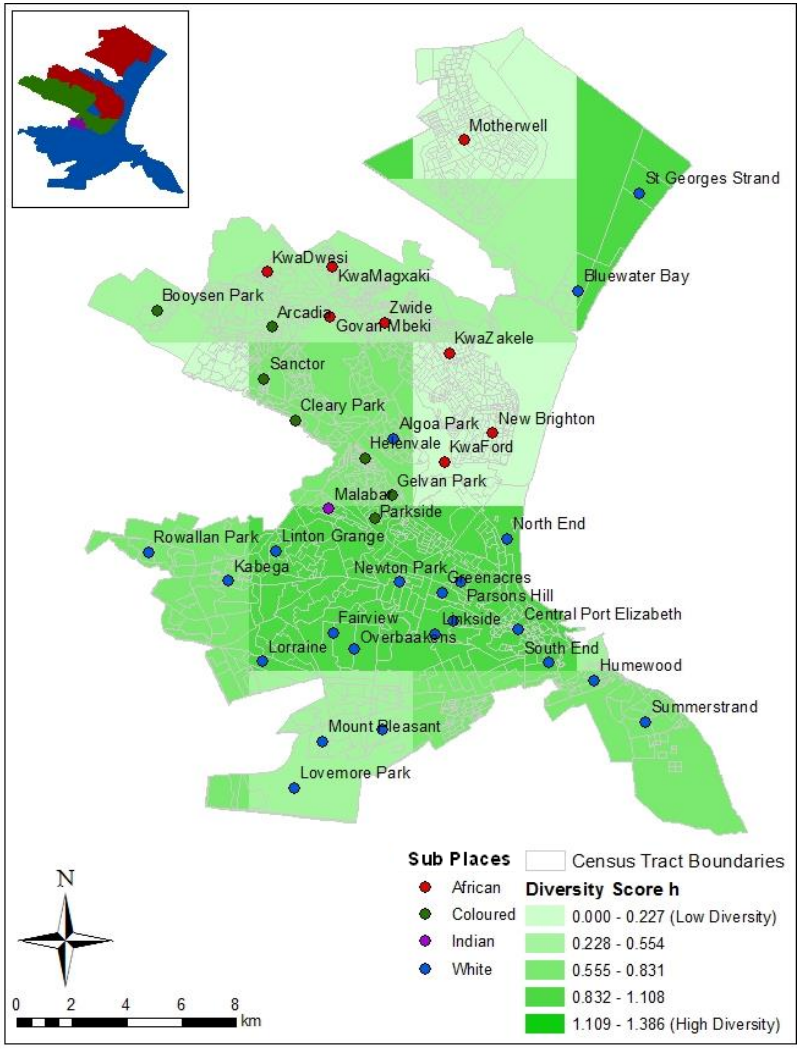

Figure 7.18: Racial diversity at 6km^2 grid resolution, Census 1996

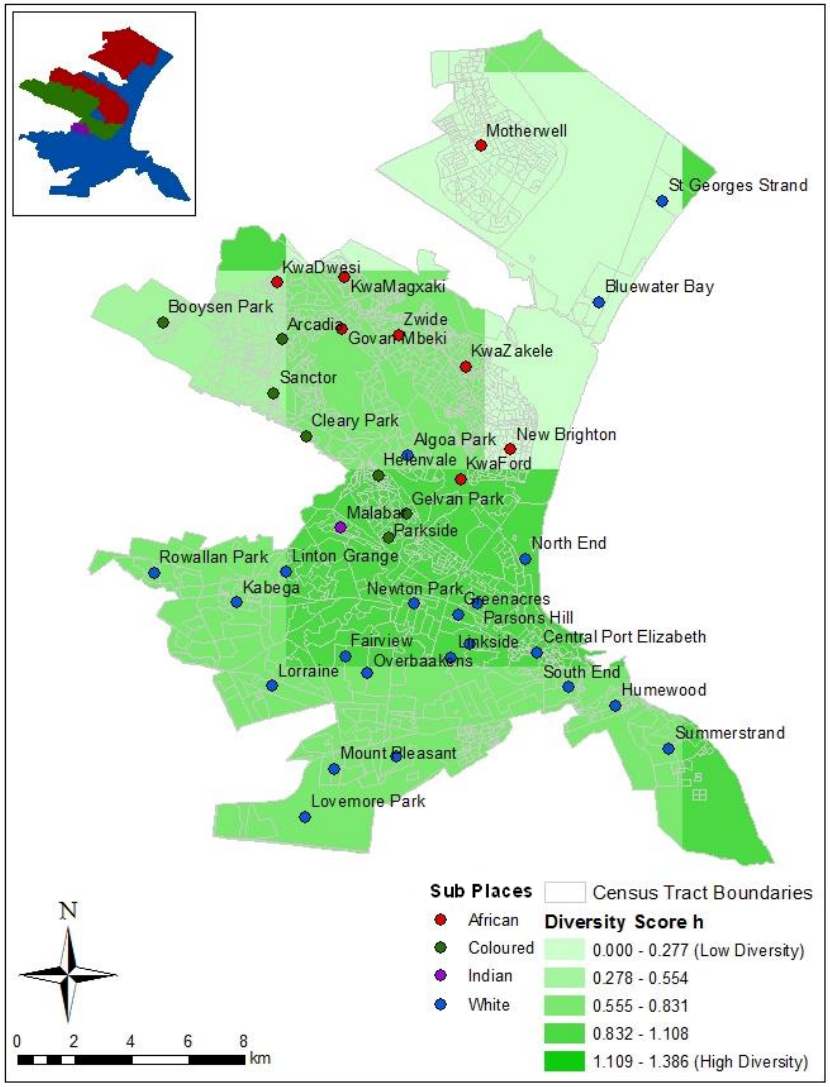

Figure 7.19: Racial diversity at 7km^2 grid resolution, Census 1996

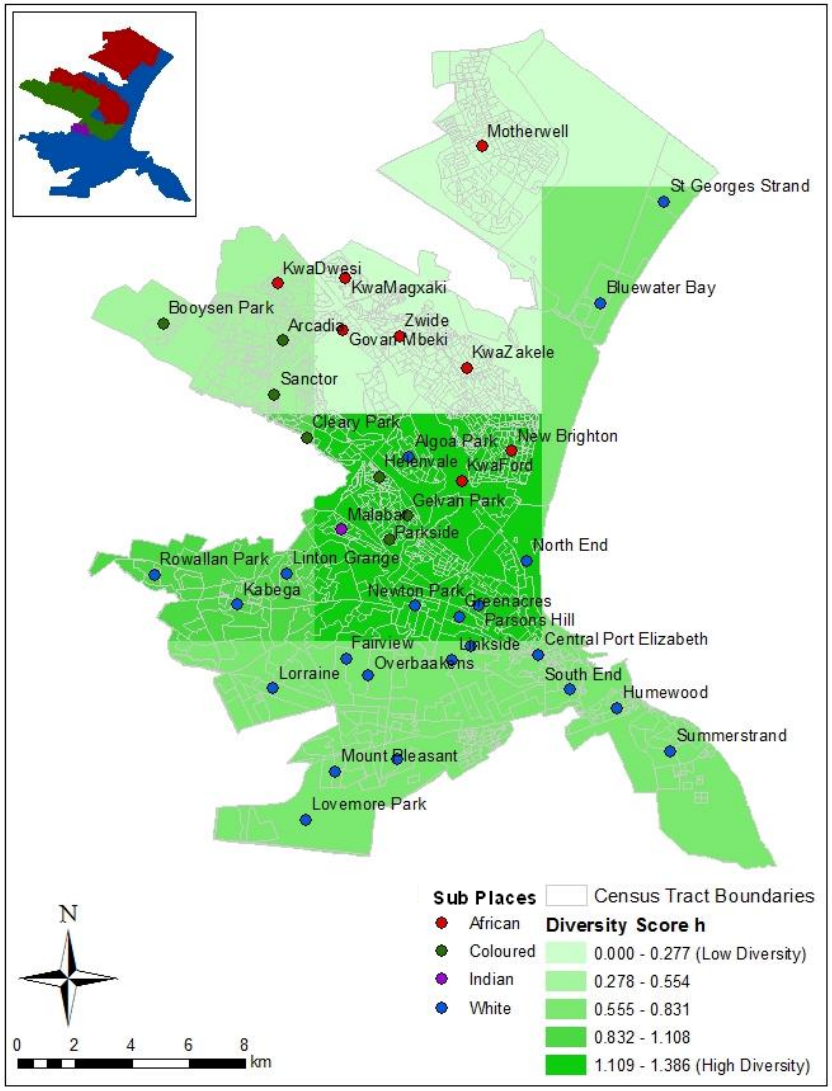

Figure 7.20: Racial diversity at 8km^2 grid resolution, Census 1996

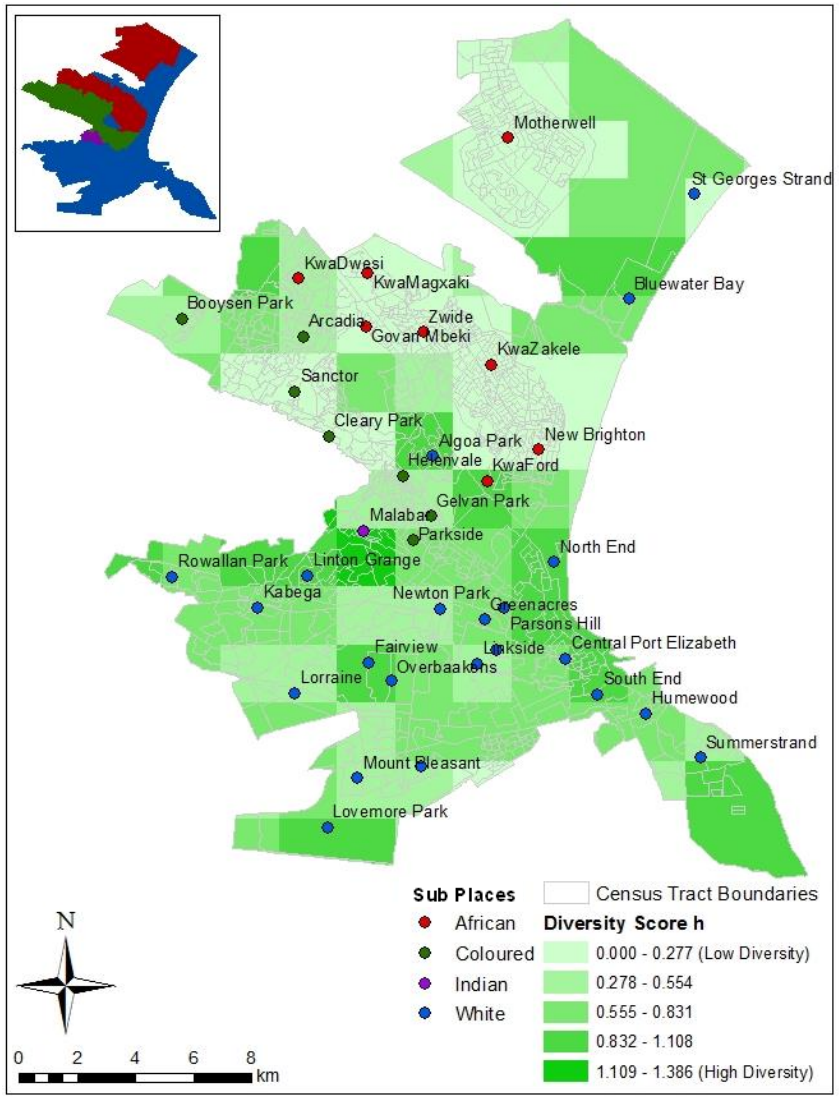

Figure 7.21: Racial diversity at 1km^2 grid resolution, Census 2001

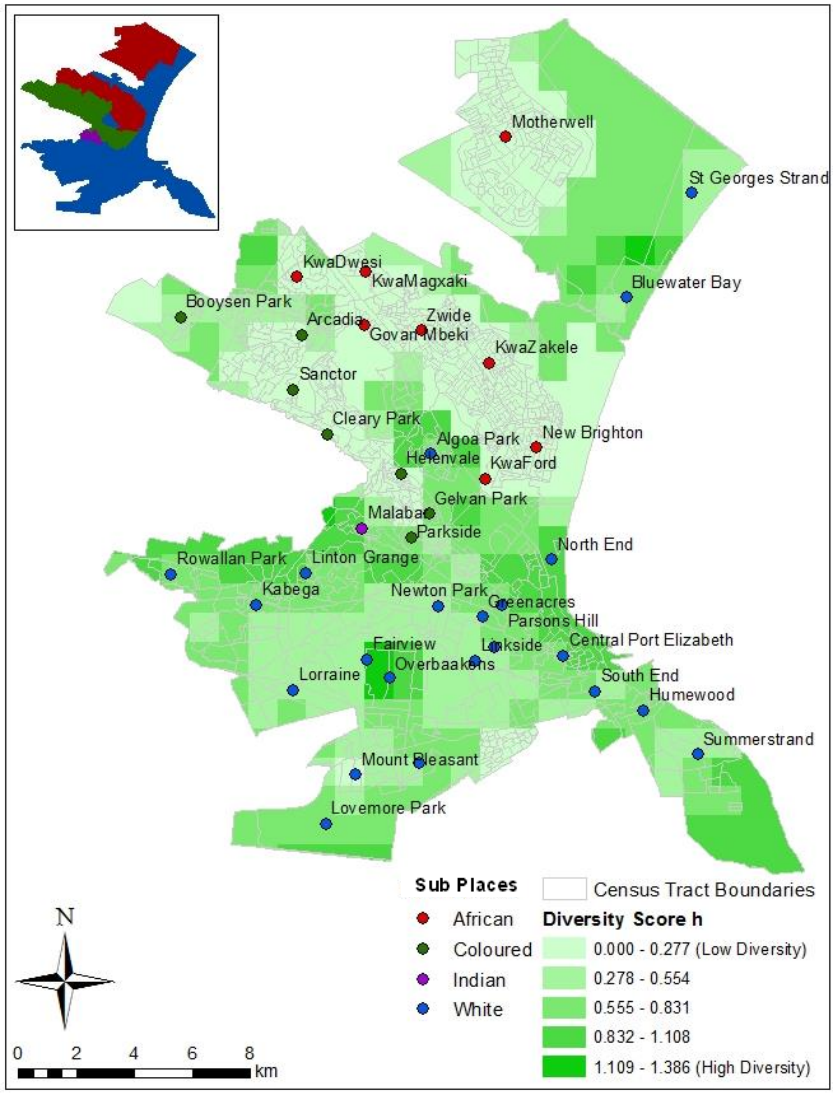

Figure 7.22: Racial diversity at 2km^2 grid resolution, Census 2001

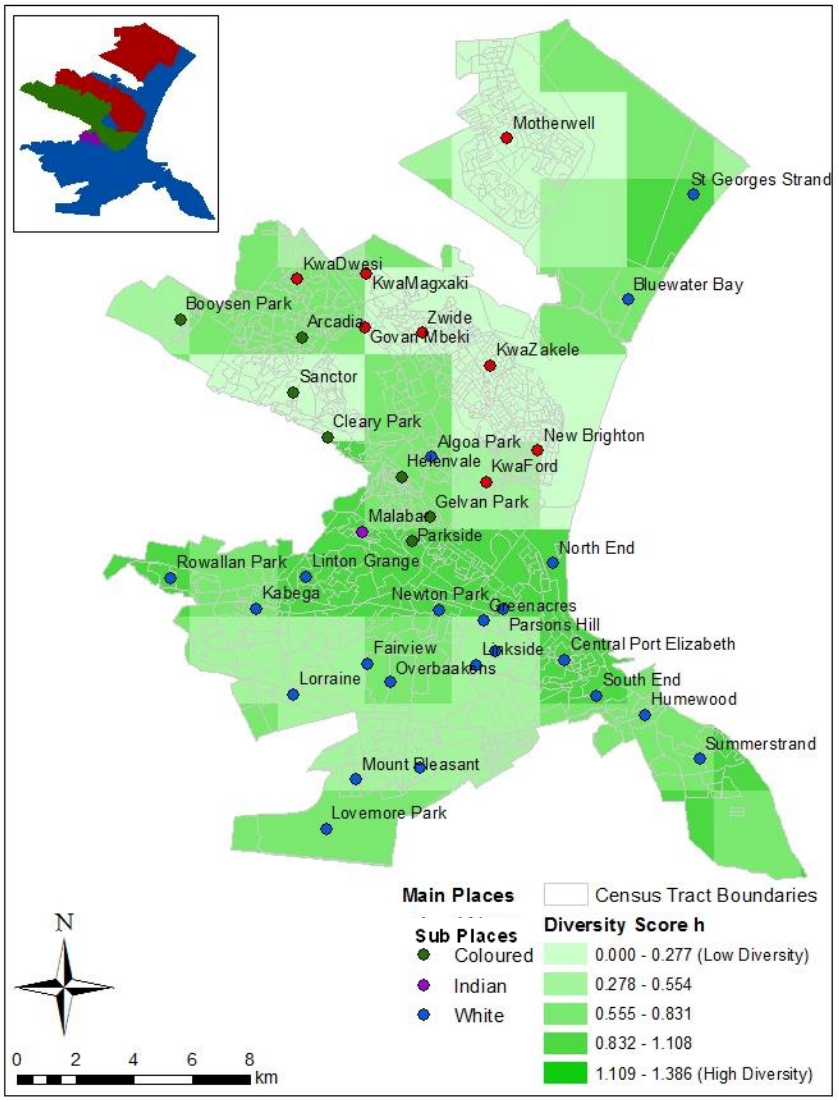

Figure 7.23: Racial diversity at 3km^2 grid resolution, Census 2001

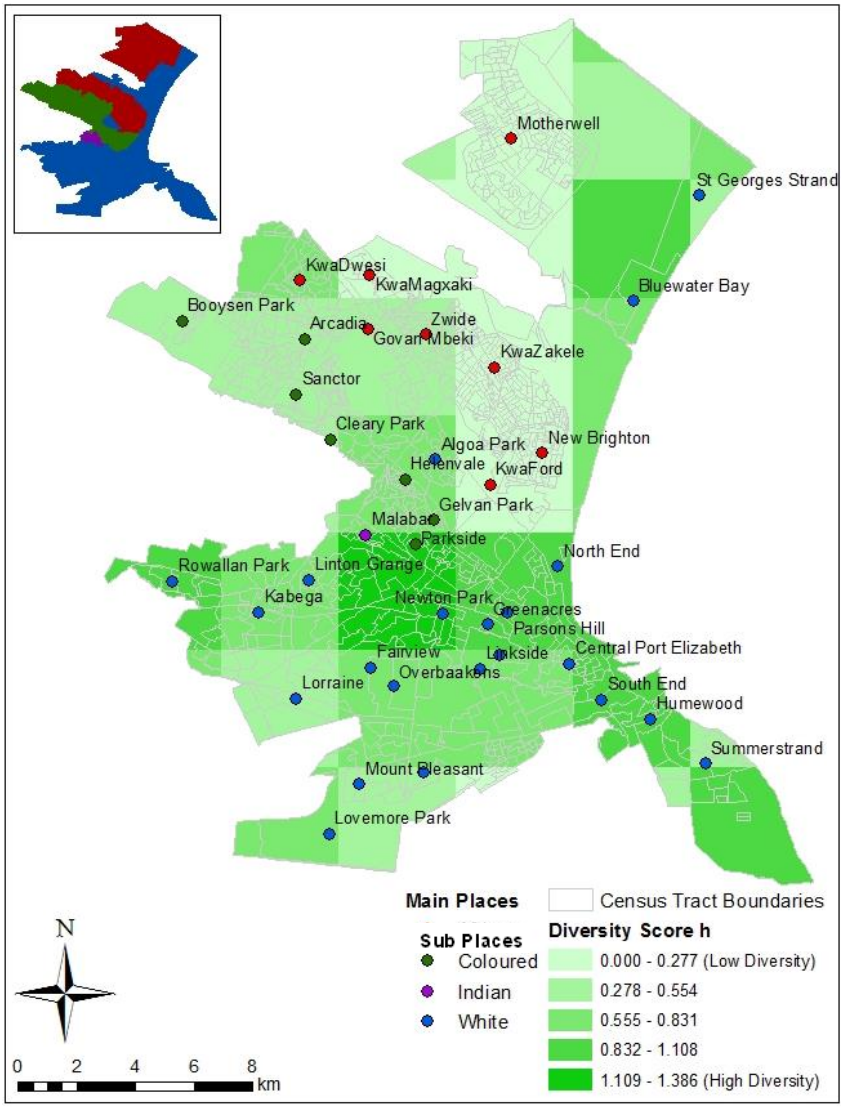

Figure 7.24: Racial diversity at 4km^2 grid resolution, Census 2001

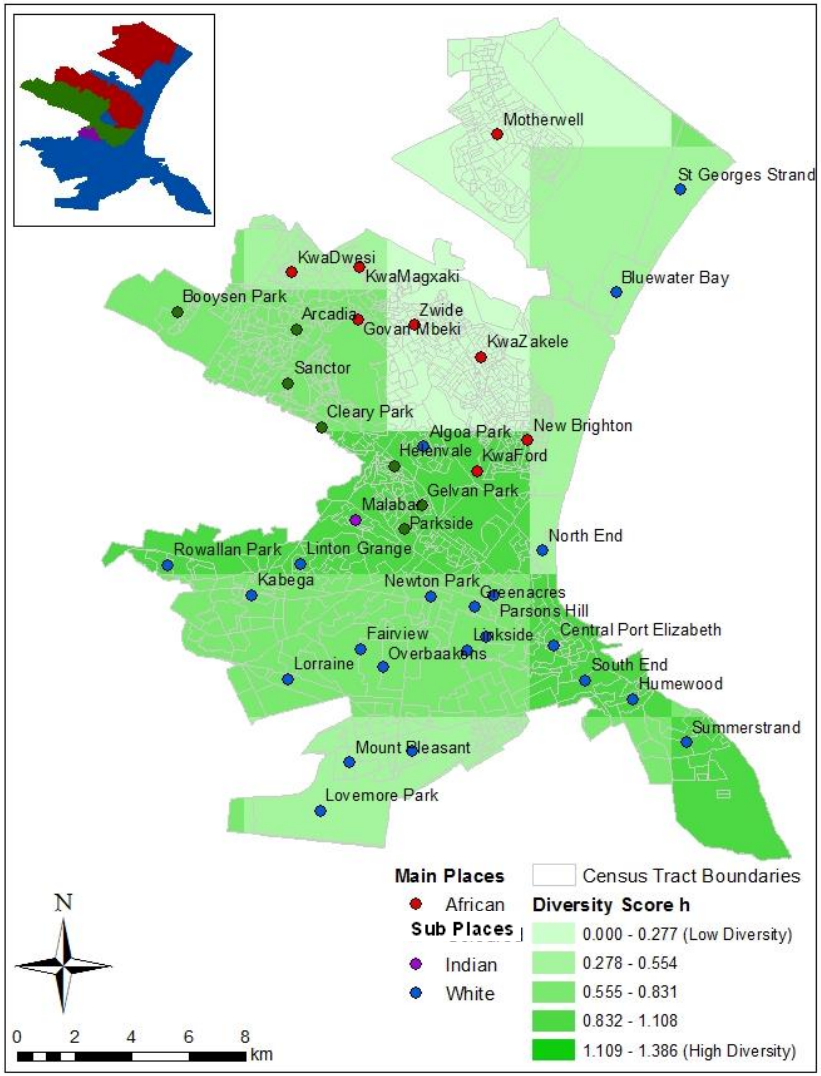

Figure 7.25: Racial diversity at 5km^2 grid resolution, Census 2001

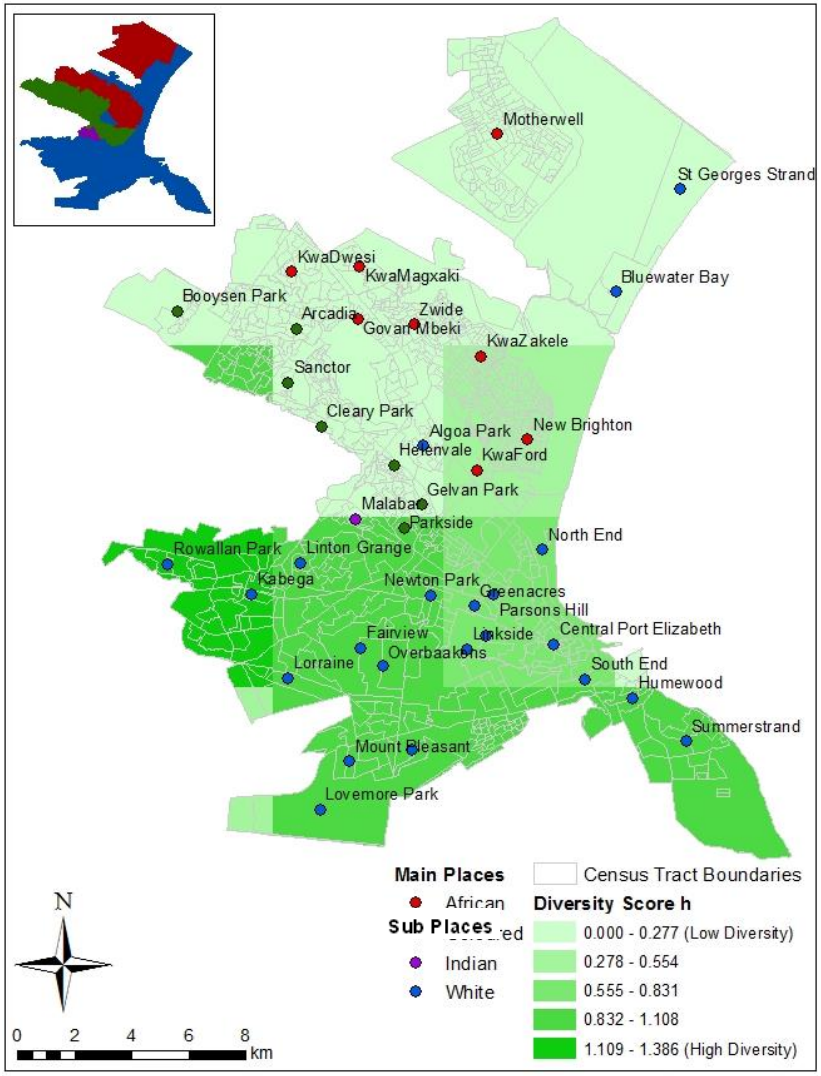

Figure 7.26: Racial diversity at 6km^2 grid resolution, Census 2001

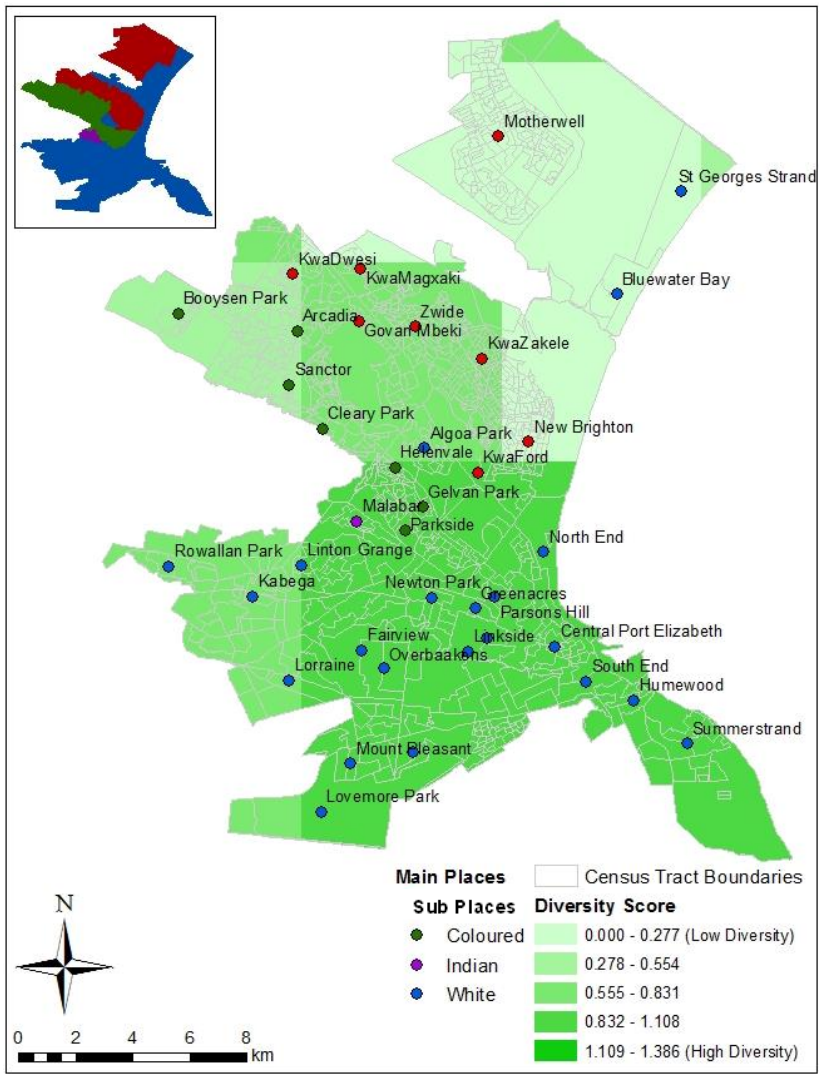

Figure 7.27: Racial diversity at 7km^2 grid resolution, Census 2001

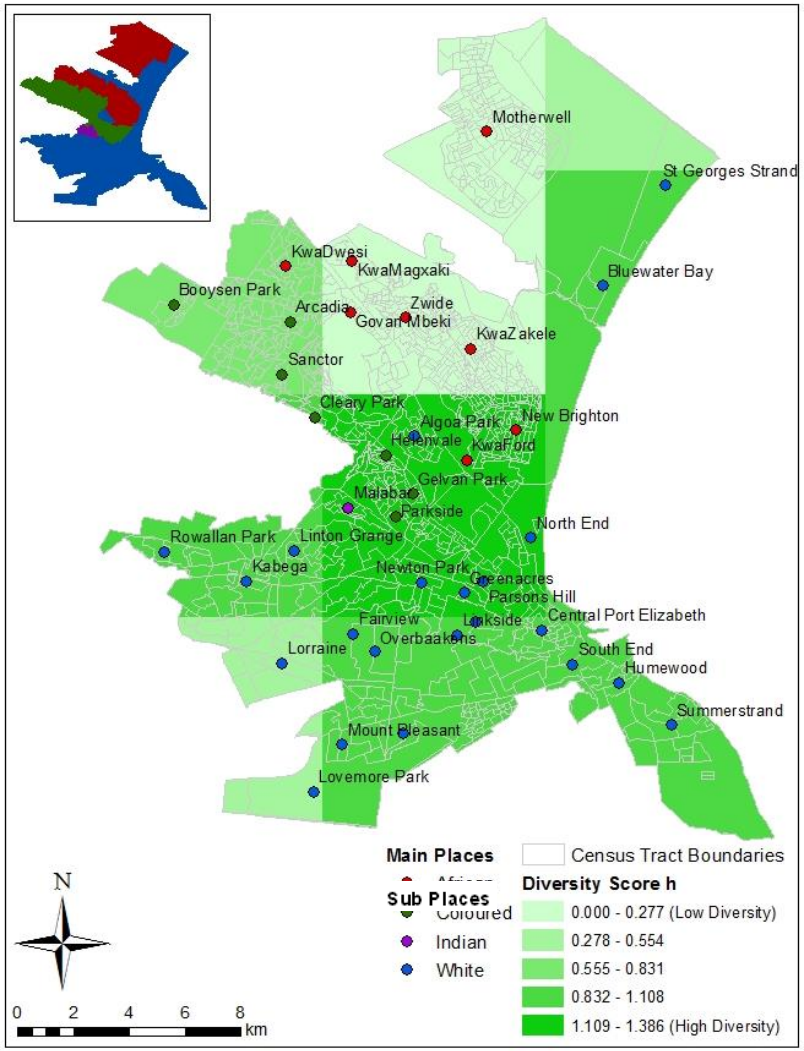

Figure 7.28: Racial diversity at 8km^2 grid resolution, Census 2001

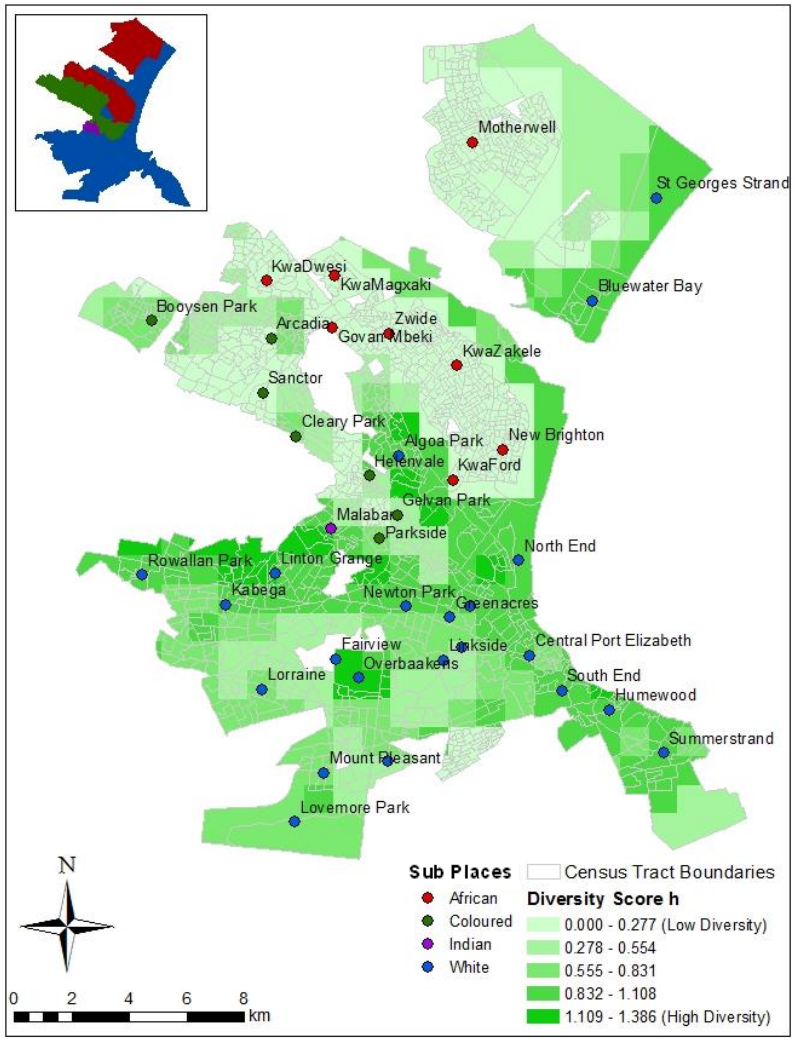

Figure 7.29: Racial diversity at 1km^2 grid resolution, Census 2011

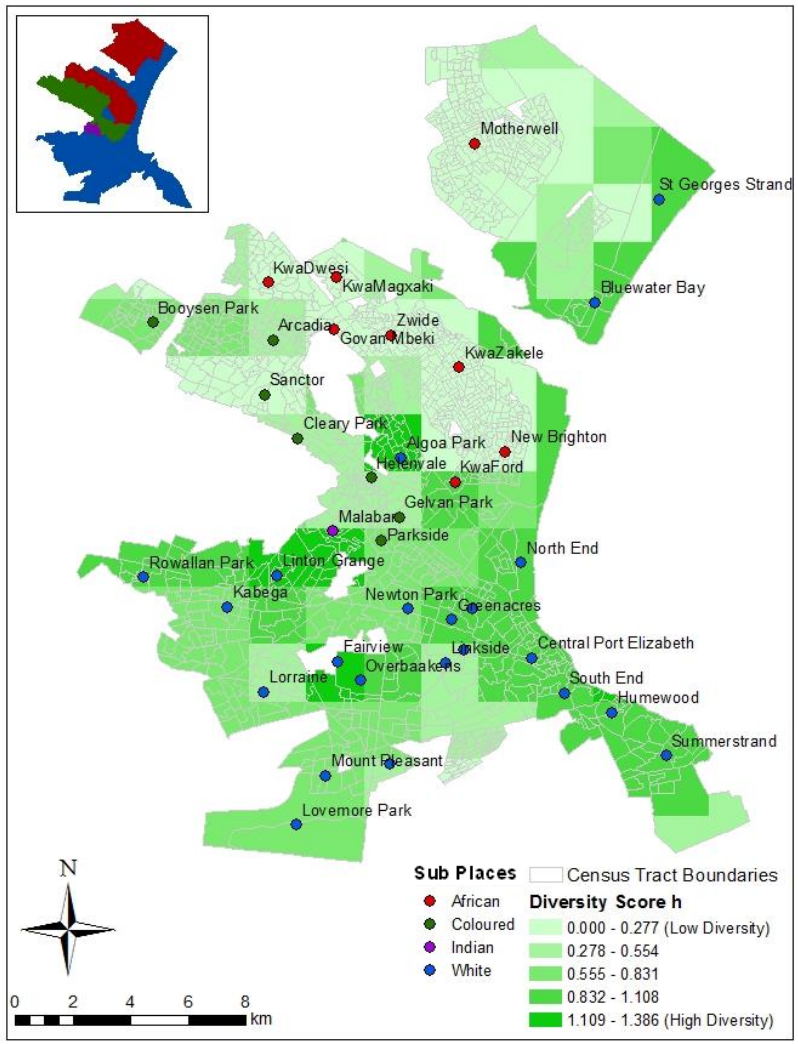

Figure 7.30: Racial diversity at 2km^2 grid resolution, Census 2011

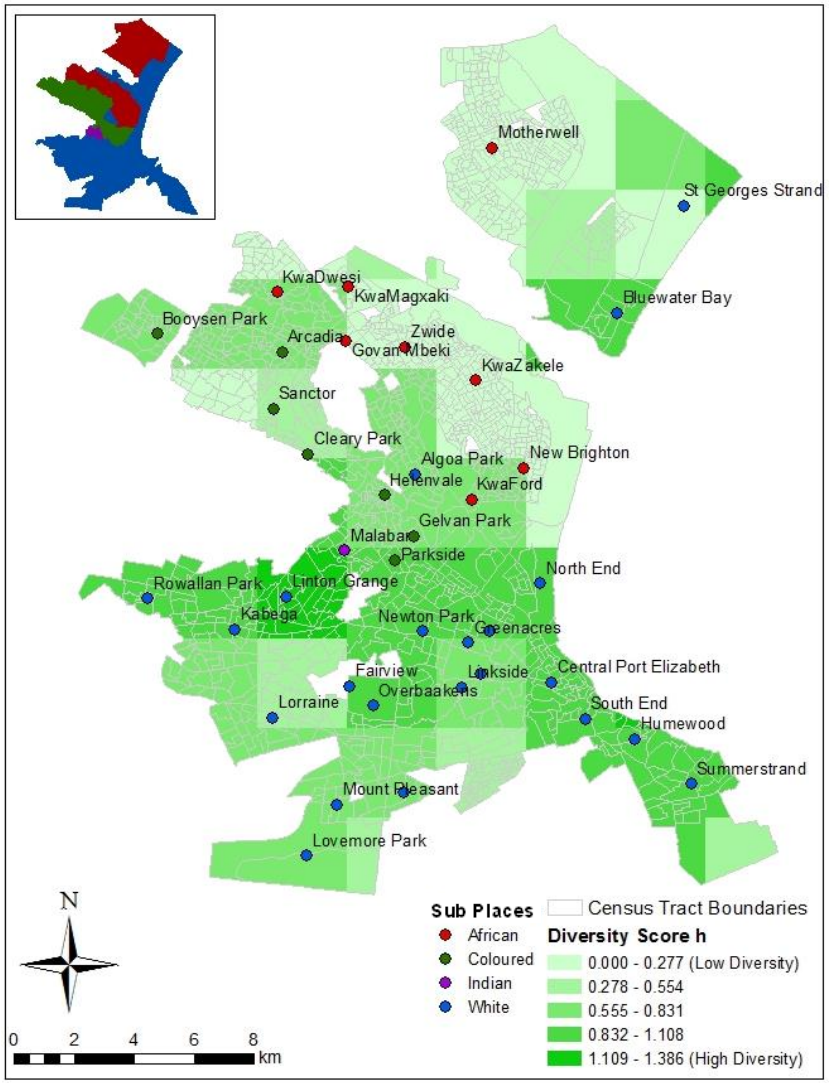

Figure 7.31: Racial diversity at 3km^2 grid resolution, Census 2011

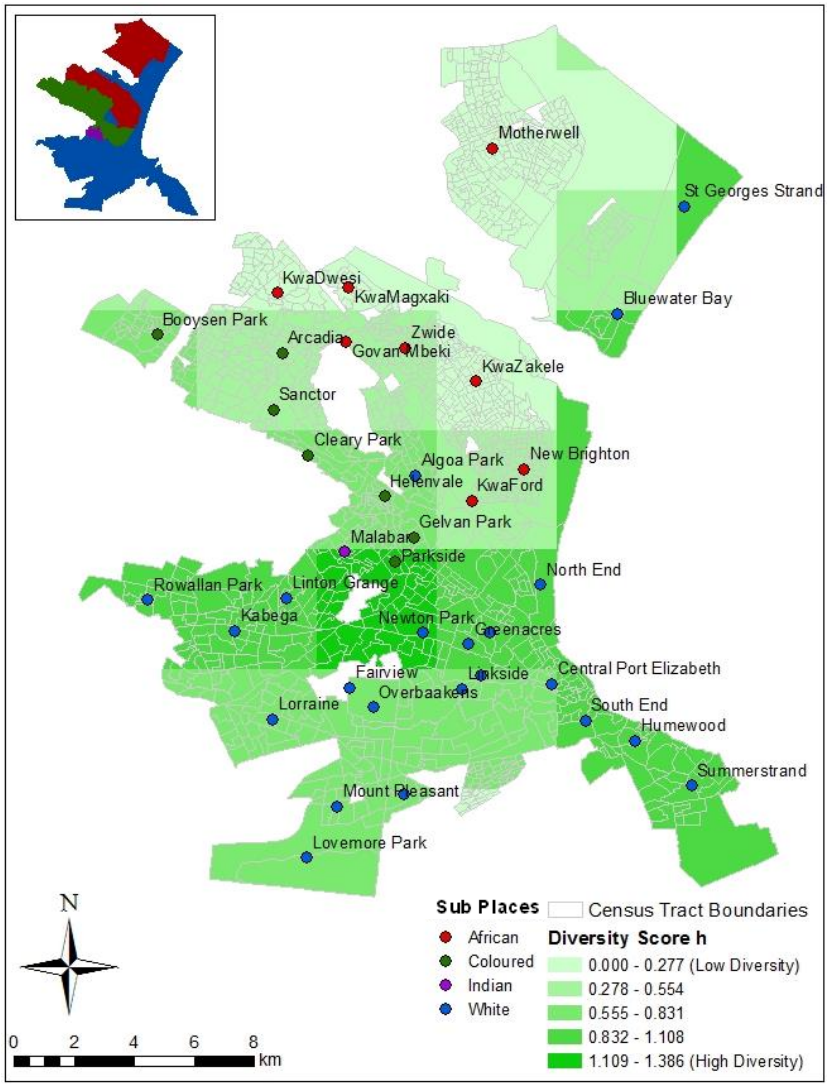

Figure 7.32: Racial diversity at 4km^2 grid resolution, Census 2011

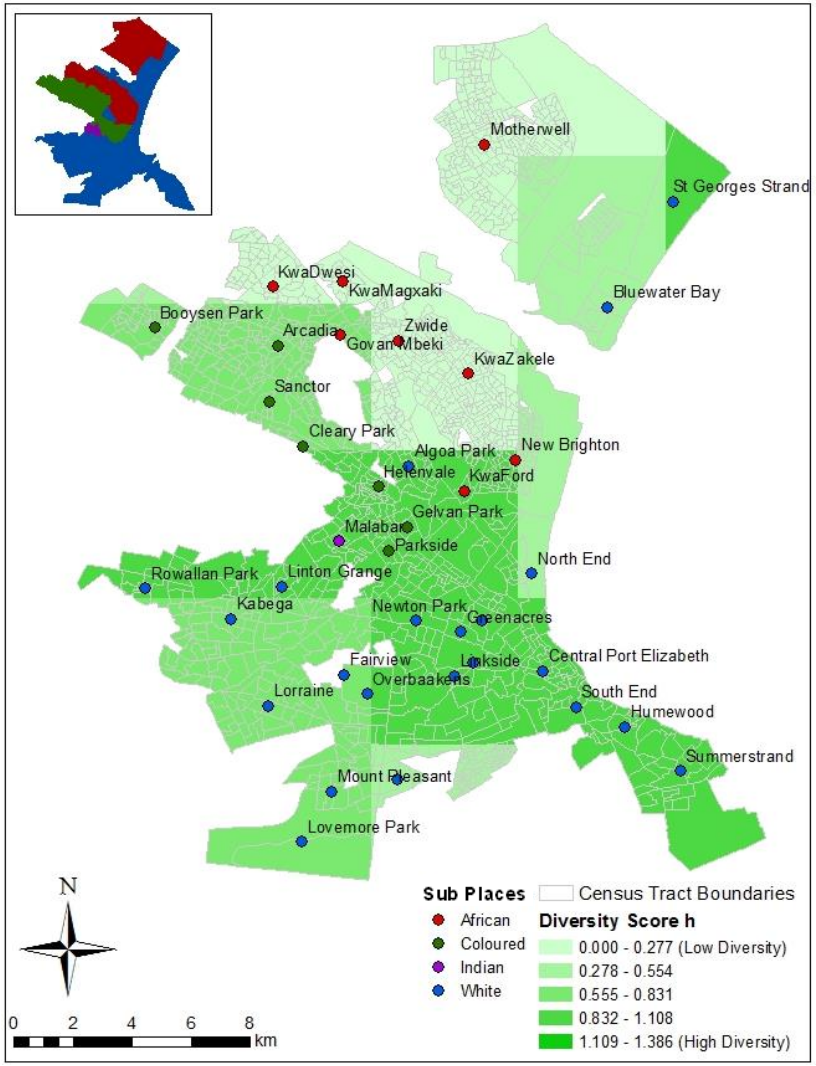

Figure 7.33: Racial diversity at 5km^2 grid resolution, Census 2011

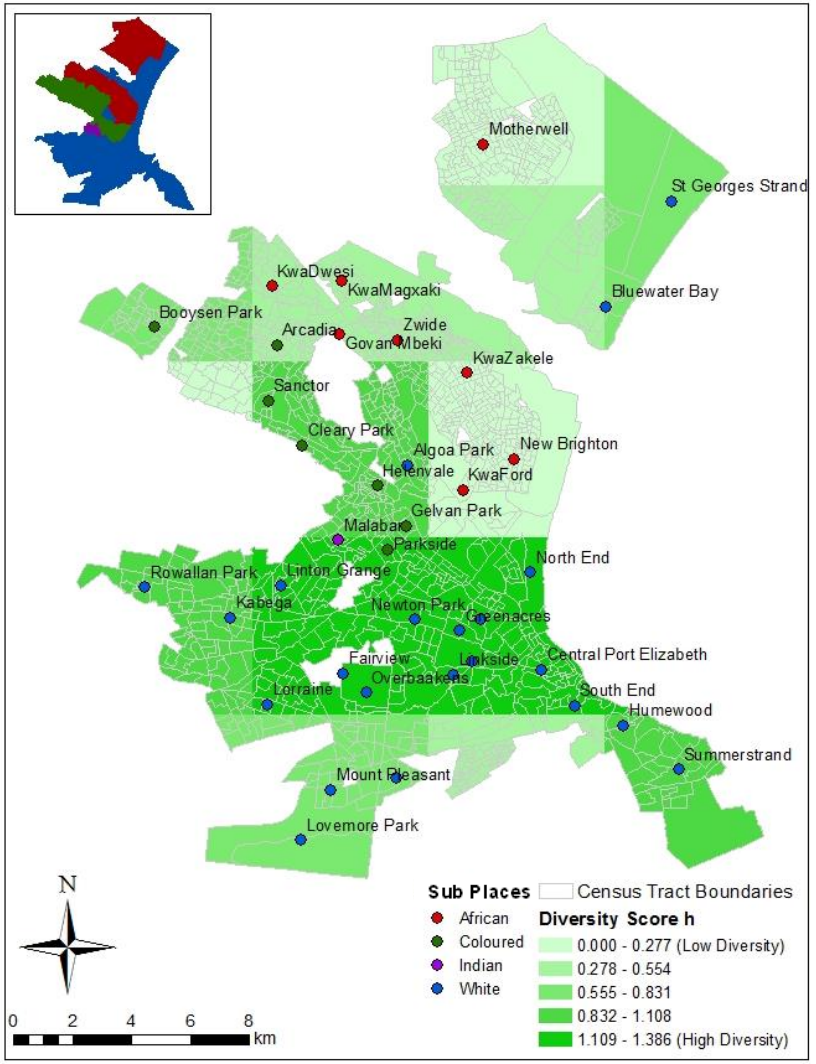

Figure 7.34: Racial diversity at 6km^2 grid resolution, Census 2011

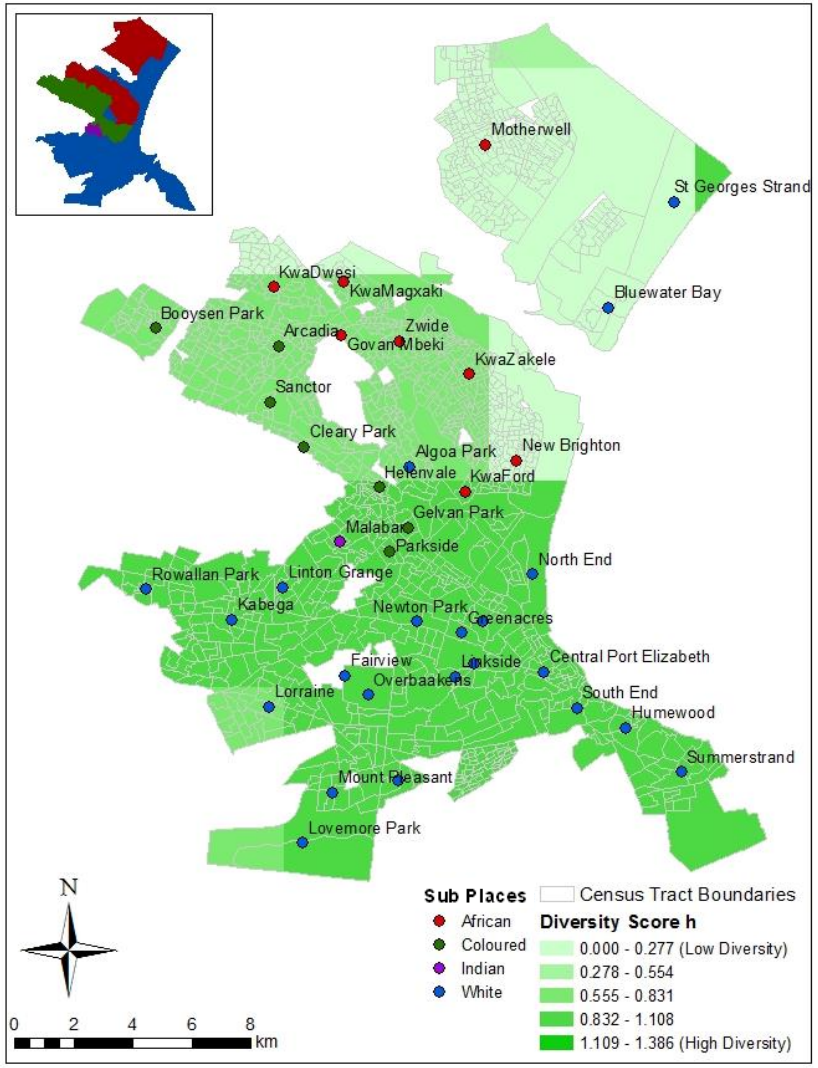

Figure 7.35: Racial diversity at 7km^2 grid resolution, Census 2011

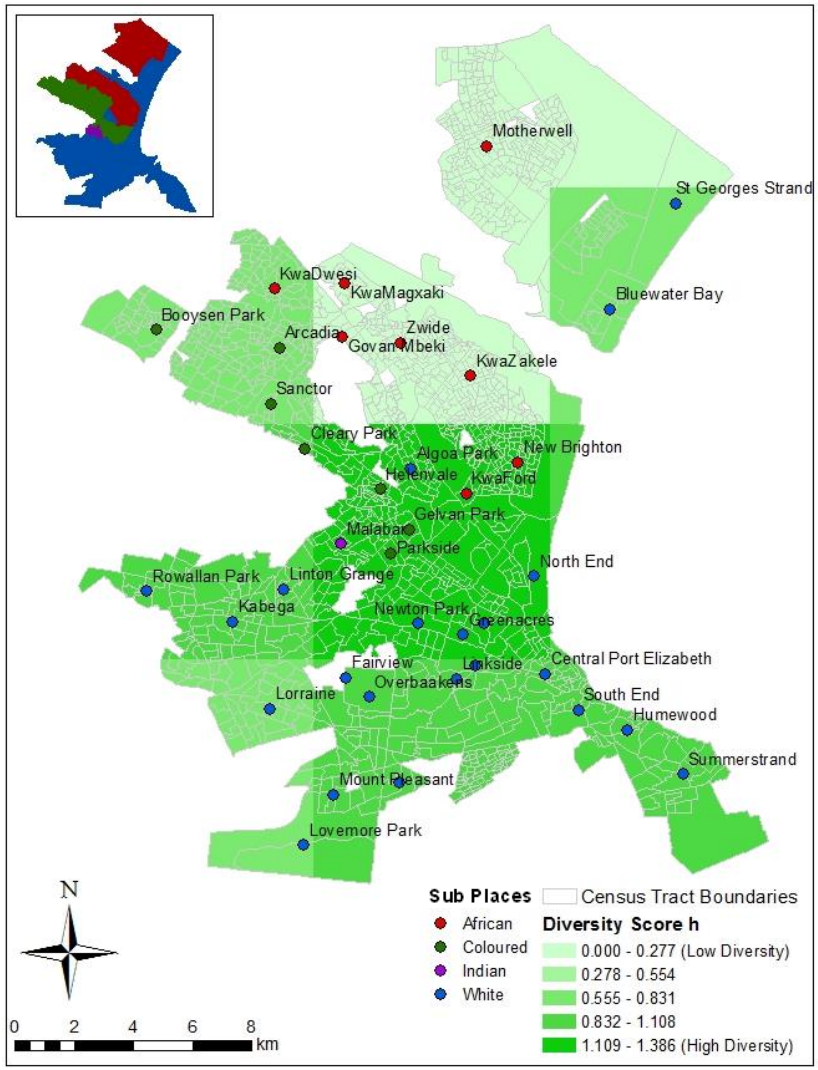

Figure 7.36: Racial diversity at 8km^2 grid resolution, Census 2011

The second component for Theil's Entropy Index calculates *H*, which is a global segregation estimate that measures racial evenness for the study area as a whole. The *H* score values between 0, when all of the sub-units (i.e. Census tracts or grid cells) have the same racial composition as the study area as a whole, and 1, when all sub-units contain a single race group only. Table 7.2 summarizes the *H* values obtained for Port Elizabeth at different geographic scales (i.e. at the Census tract level and for the different fishnet grid resolutions) for the three Census periods. From the results in Table 7.2, it is evident that at all geographical scales, segregation as measured by *H* decreased steadily from 1996 to 2011. Also evident from the results in Table 7.2 is that higher *H* values are yielded when measured at smaller geographical scales, highlighting the scale-sensitive nature of such segregation measures. This corresponds to the assumption made by Morse (2012) that segregation indices are always a non-increasing function of scale.

Furthermore, the pace at which desegregation declined increased between each consecutive inter-Census period. When measured at Census tract level, segregation decreased by 5.4 % from 1996 to 2001, and by 7.7 % from 2001 to 2011, yielding an overall 13.1 % decline from 1996 to 2011. This trend persists across all of the geographical scales considered The macro/micro segregation ratio is represented by $H8km^2/H1km^2$, was measured at 52.9 %, 50.9 % and 52.7 % for 1996, 2001 and 2011 respectively, indicating the percentage of micro-segregation occurring at a neighbourhood scale that could be attributed to the influence of macro-segregation patterns. This is due to the *H* values measured at $1km^2$ declining at a faster rate than those measured at $8km^2$ between 2001 and 2011, which can possibly by explained by the relative size, spatial configuration and former Group Area classification of the areas contained within the grid cells. Processes driving macro-segregation patterns had a greater influence on small-scale segregation patterns in 1996 and 2001, compared to 2011, although only marginally.

Table 7.2: Values for H across all geographic scales for Port Elizabeth (1996-2011)

	1996	2001	2011
***H*EA/*H*SAL**	0.846	0.792	0.715
***H*1km^2**	0.794	0.741	0.657
***H*2km^2**	0.727	0.682	0.603
***H*3km^2**	0.653	0.622	0.551
***H*4km^2**	0.626	0.590	0.525
***H*5km^2**	0.534	0.504	0.453
***H*6km^2**	0.531	0.497	0.437
***H*7km^2**	0.439	0.420	0.376
***H*8km^2**	0.420	0.377	0.346
***H*8km^2/*H*1km^2**	0.529	0.509	0.527

The segregation values in Table 7.2 are plotted as segregation curves, for each of the respective Census periods, in Figure 7.37. The curves show that segregation decreased consistently from 1996 to 2011, across all geographical scales, indicating that the residential space in Port Elizabeth was progressively becoming more racially integrated with time. An interesting observation, as indicated by the red dashed lines in Figure 7.37, was that segregation values changed in much the same way between certain scale intervals for each of the Census periods. The red dotted lines, therefore, represent 'segregation thresholds'. As is reflected in Figure 7.37, measured segregation values for Port Elizabeth decrease at similar rates between 1 to 3 km^2, 4 to 5 km^2, 6 to 7 km^2, and 7 to 8 km^2; as cell size at which segregation is measured increases, the racial composition of the population contained within them becomes more diverse. The segregation values measured at scales of 3 to 4km^2, and 5 to 6km^2, remain much the same, showing that as cell size increases within these ranges, the racial composition of the population contained within remains fairly constant. This not only highlights the importance of considering scale when investigating racial segregation, but also emphasizes the complexity of determining the appropriate scale at which segregation should be analyzed in the local context. The next sub-section, which presents the segregation profiles of four selected sub places in Port Elizabeth, will explore this notion further.

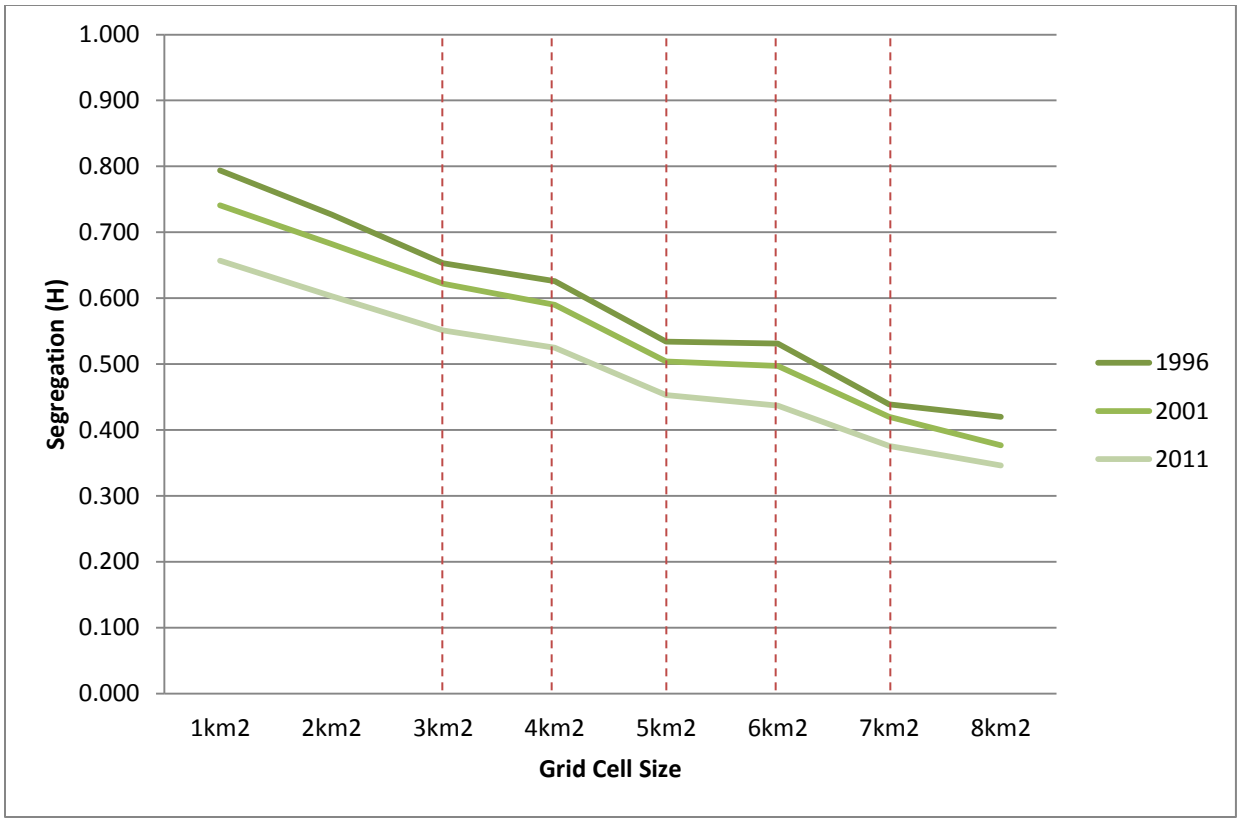

Figure 7.37: Segregation profile for Port Elizabeth (1996-2011)

When comparing the values in Table 7.2 to those calculated by Parry and van Eeden (2014) for Cape Town and Johannesburg, shown in Table 7.3, it is evident that Port Elizabeth follows the same trend displayed by Cape Town and Johannesburg. In all three cities, segregation as measured by *H*, declined consistently. However, calculated segregation levels in Port Elizabeth were consistently higher than those found in Cape Town and Johannesburg across all geographic scales.

The bottom row of Tables 7.2 and 7.3 shows the $H8km^2/H1km^2$ ratio, or the macro/micro segregation ratio, introduced by Reardon *et al*. (2008). This ratio indicates the relative extent to which overall segregation levels are due to macro- or micro-segregation patterns. In other words, the macro/micro segregation ratio describes the proportion of micro-segregation (i.e., that measured at a 1 km^2 scale) that can be explained by macro-segregation (i.e., that measured at an 8 km^2 scale). According to Reardon *et al*. (2008), it is important to acknowledge that correlations between the macro/micro segregation ratio and segregation levels are normally

much lower than correlations between the segregation levels (measured at various geographic scales) themselves. Reardon *et al.* (2008), therefore, state that the macro/micro ratio measures a distinct dimension of segregation (as described above) and cannot, therefore, be used as a sole indicator of a region's segregation level.

Higher macro/micro segregation ratios correspond with gentler segregation curves (and vice versa), representing less scalar variation when measuring segregation in a particular region. Therefore, the flatter the segregation curve (i.e., the higher the macro/micro segregation ratio), a large proportion of the segregation found at a micro-level can be attributed to macro-segregation patterns. In such cases, the scale at which one should measure segregation to accurately reflect the nature of racial patterning in the city overall, becomes less important. The macro/micro segregation ratios calculated for Port Elizabeth were 0.529, 0.509 and 0.527 for 1996, 2001 and 2011, respectively, decreasing marginally by 2 % from 1996 to 2001, and then increasing by 1.8 % from 2001 to 2011. Cape Town experienced no changes from 1996 to 2001 and decreased by 2 % from 2001 to 2011. Johannesburg exhibited constant declines in the macro/micro segregation ratio from 1996 to 2011, decreasing by 2 % between 1996 and 2001, and by a further 4 % between 2001 and 2011. Furthermore, across all three Census periods, Port Elizabeth's macro/micro segregation ratio was found to be higher than that of Cape Town and lower than that of Johannesburg. This is reflected in Figures 7.38 and 7.39, which show the segregation profiles created by Parry and van Eeden (2014) for Cape Town and Johannesburg, respectively. When comparing these segregation curves with those generated for Port Elizabeth (refer to Figure 7.37), it is evident that Port Elizabeth's segregation curves are steeper than those of Cape Town and flatter than those of Johannesburg. The scale at which segregation is measured is, therefore, of less significance for Port Elizabeth than it is for Cape Town, but more significant than it is for Johannesburg.

Table 7.3: Values for H across all geographic scales for Cape Town and Johannesburg (Parry and van Eeden, 2014)

	Cape Town			Johannesburg		
	1996	**2001**	**2011**	**1996**	**2001**	**2011**
***H*EA/*H*SAL**	0.80	0.75	0.66	0.70	0.65	0.59
***H*1km^2**	0.73	0.68	0.59	0.65	0.60	0.53
***H*2km^2**	0.66	0.62	0.53	0.61	0.56	0.49
***H*3km^2**	0.59	0.56	0.47	0.56	0.52	0.45
***H*4km^2**	0.50	0.46	0.39	0.54	0.49	0.43
***H*5km^2**	0.47	0.45	0.38	0.49	0.45	0.38
***H*6km^2**	0.46	0.43	0.35	0.44	0.41	0.35
***H*7km^2**	0.38	0.36	0.31	0.43	0.40	0.33
***H*8km^2**	0.33	0.31	0.26	0.40	0.36	0.30
***H*8km^2/*H*1km^2**	0.45	0.45	0.43	0.62	0.60	0.56

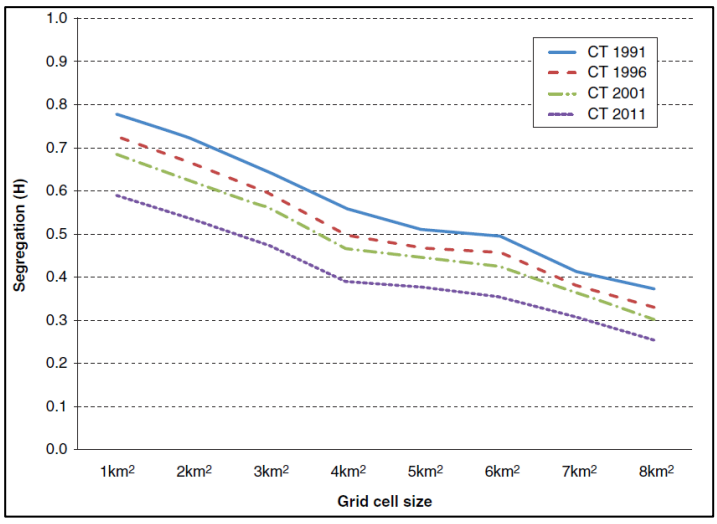

Figure 7.38: Segregation profile for Cape Town (from Parry and van Eeden, 2014)

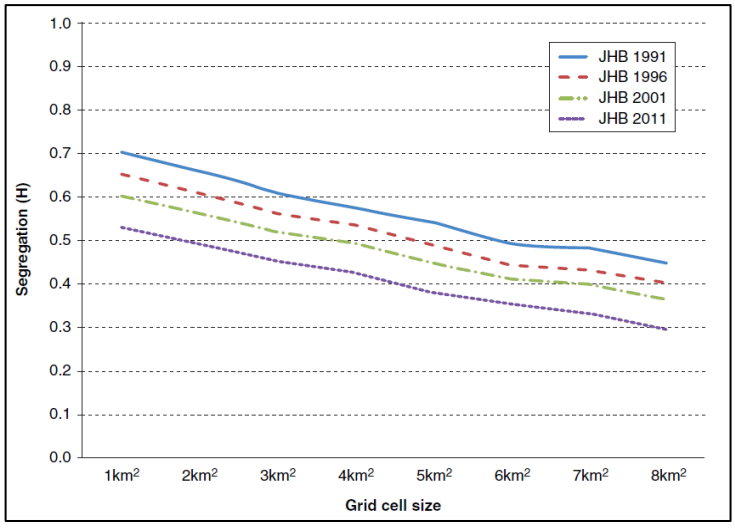

Figure 7.39: Segregation profile for Johannesburg (from Parry and van Eeden, 2014)

7.6. The Relationship between Racial Diversity and Geographic Scale for Selected Sub Places in Port Elizabeth

The fifth objective of the study was to investigate the changes in racial diversity for selected areas (Summerstrand, Fairview, New Brighton and Motherwell) in Port Elizabeth, which would enable further insight into the impacts of scale when investigating racial diversity and segregation.

Fairview (see Figures 7.40 to 7.42), when compared to Summerstrand (see Figures 7.43 to 7.45), displays greater fluctuations in racial diversity values when considered across a variety of geographic scales. This can be explained by its relative location within Port Elizabeth (refer to Figure 5.2 in Section 5.1 for the relative location of the selected sub places within Port Elizabeth); Fairview is surrounded by former-White residential areas, ranging from middle-income to affluent. At the smallest scale, racial diversity is high perhaps due to the area being the site of government social housing schemes aimed specifically towards integration. As the geographical scale at which diversity is considered rises, diversity values typically decrease as the surrounding areas being contained within increasingly larger grid cells are predominantly White. At scales higher than 5 km^2, racial diversity rises again.

The diversity curves for Summerstrand display minor fluctuations at scales lower than 4 km^2, with moderate racial diversity represented. The higher racial diversity observed in this area is mainly due to its location in close proximity to the Nelson Mandela Metropolitan University, which has resulted in it being a popular area for student housing. Also being quite an affluent area, it has also become a popular area into which members of the African economic elite have relocated. Racial diversity values tend to be higher, although remaining fairly constant, at scales higher than 4 km^2. Surrounding areas, which include the CBD, have all become racially diversified with members relocating here to be in closer proximity to sites of economic activity, as well as the local university.

New Brighton, an older African location area, (see Figures 7.46 to 7.48) shows no obvious pattern, typifying the relationship between racial diversity and the geographical scale at which it is measured, with its diversity curves fluctuating sporadically. Again, this can be explained by its relative location within the broader context of Port Elizabeth. At 5km^2, peripheral portions of the

former-White and Coloured areas become included within the grid cell, and again to a greater extent at a 7 km^2 scale.

In contrast, Motherwell, a fairly young African location area (see Figures 7.49 to 7.51), displays consistently low diversity values at all geographical scales. Motherwell, located on eastern periphery of the city, is characterized by racial homogeneity. Only at a scale of 7 $km^{2,}$ racial diversity rises marginally (a negligible amount) due to a peripheral portion of the adjacent Bluewater Bay (a fairly new residential area typified by affordable housing and, hence, higher racial diversity) being included within the grid cell parameters.

The diversity curves of Fairview and Summerstrand have changed from 1996 to 2011, characterized by a gradual flattening of the curves. In Fairview, this flattening is due to increases in racial diversity occurring at scales between 3 to 5 km^2, while in Summerstrand, this flattening is the result of increases in racial diversity at scales lower than 5 km^2. Significantly, both New Brighton and Motherwell have experienced no change.

Figure 7.40: Diversity Profile for Fairview in 1996

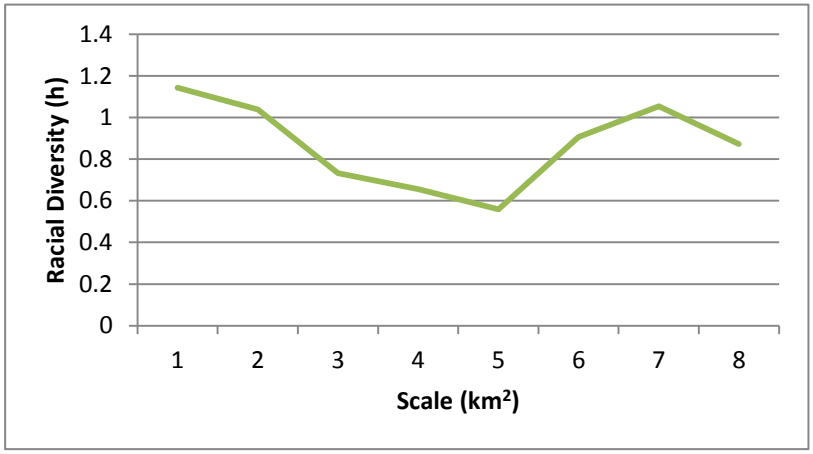

Figure 7.41: Diversity Profile for Fairview in 2001

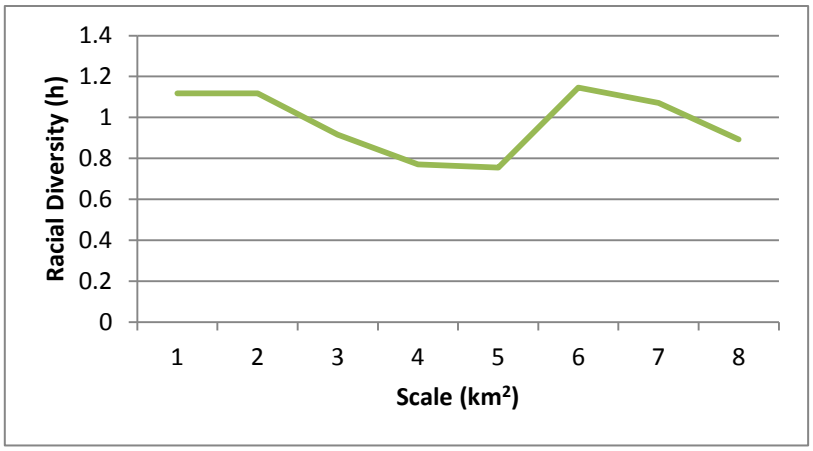

Figure 7.42: Diversity Profile for Fairview in 2011

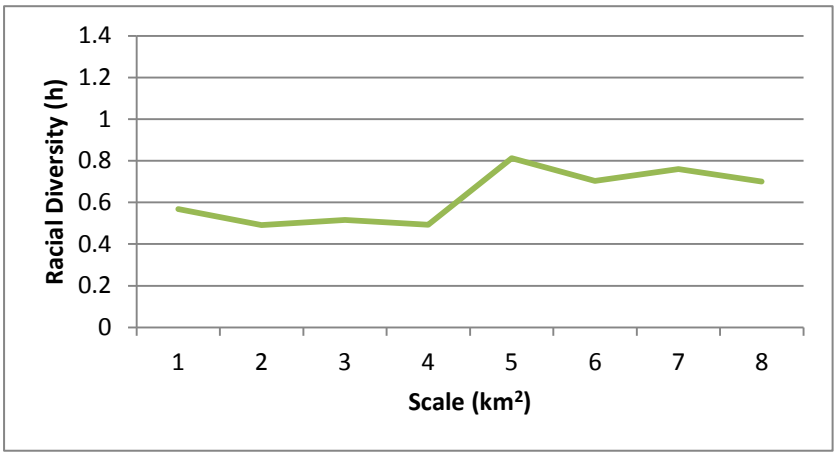

Figure 7.43: Diversity Profile for Summerstrand in 1996

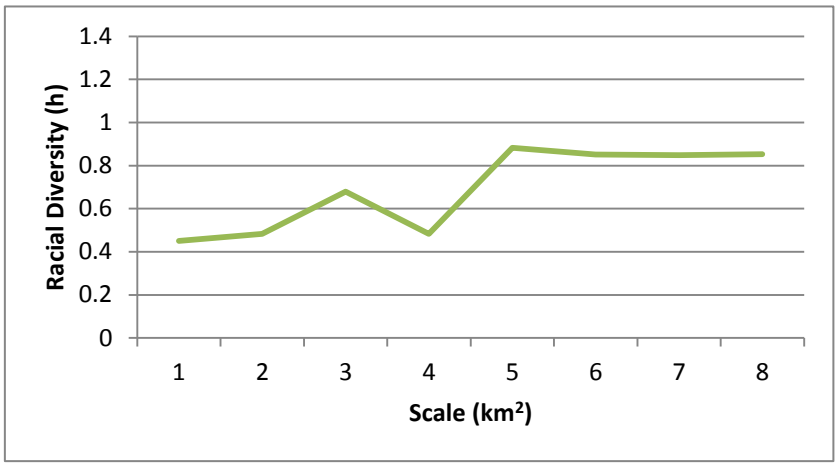

Figure 7.44: Diversity Profile for Summerstrand in 2001

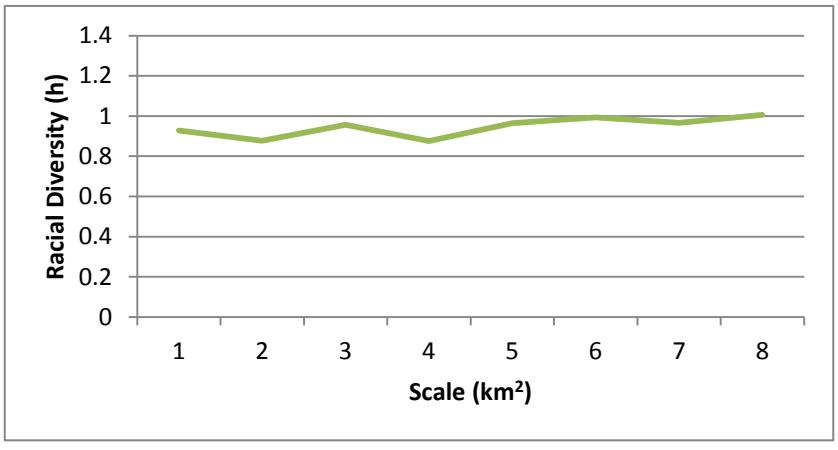

Figure 7.45: Diversity Profile for Summerstrand in 2011

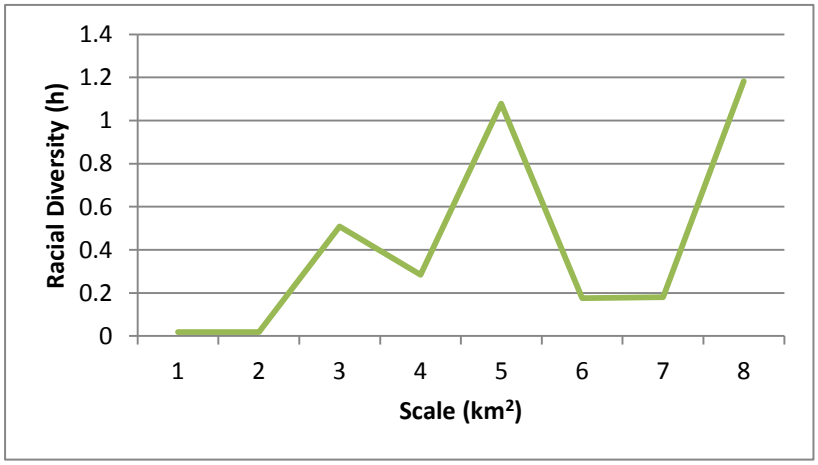

Figure 7.46: Diversity Profile for New Brighton in 1996

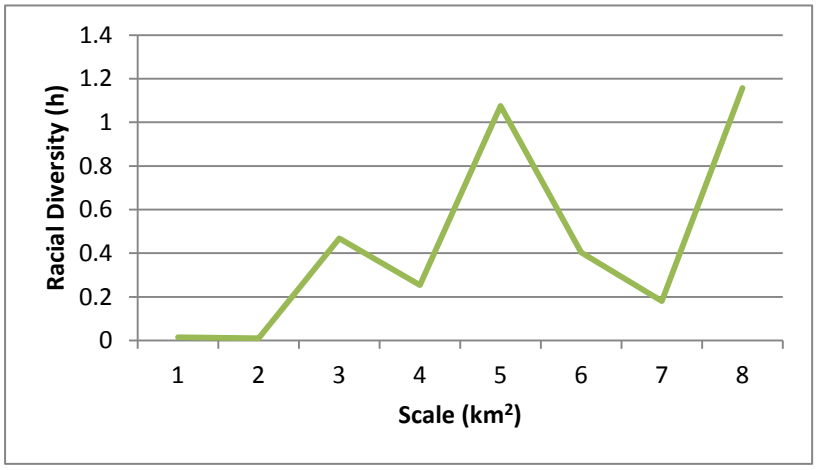

Figure 7.47: Diversity Profile for New Brighton in 2001

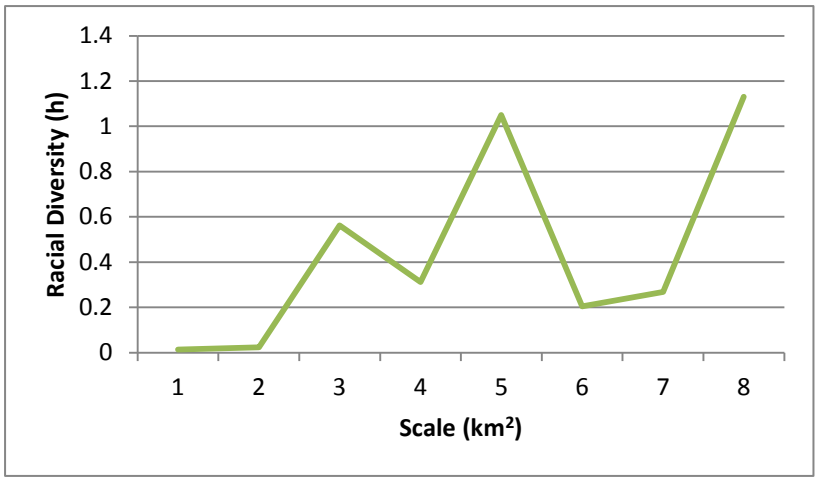

Figure 7.48: Diversity Profile for New Brighton in 2011

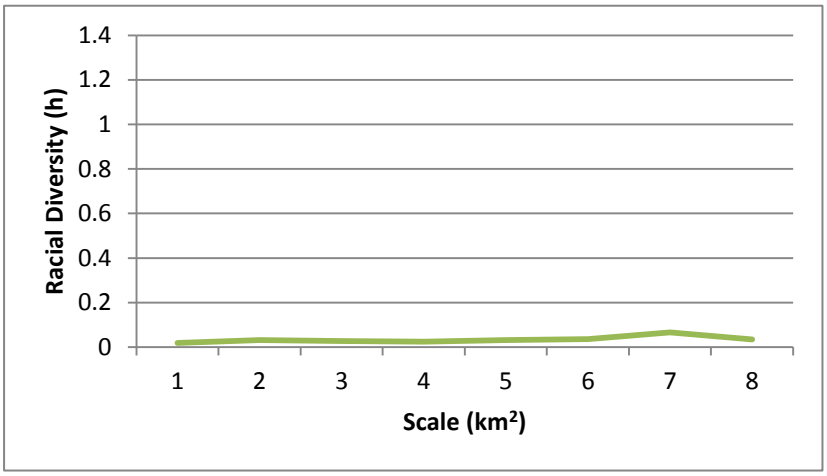

Figure 7.49: Diversity Profile for Motherwell in 1996

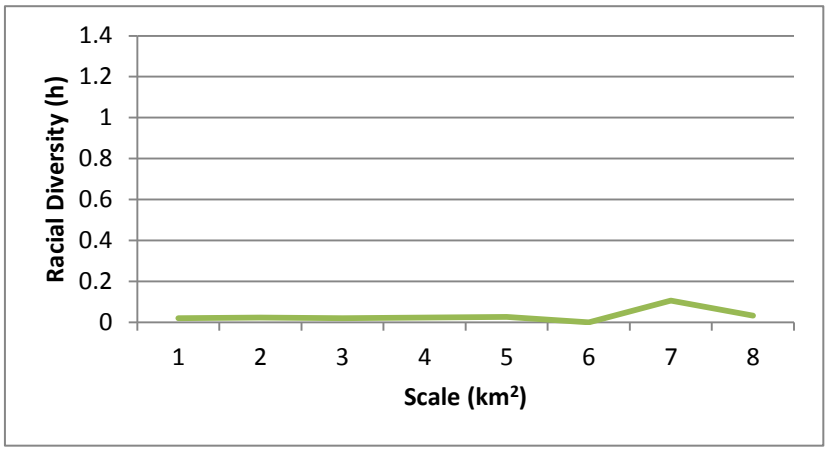

Figure 7.50: Diversity Profile for Motherwell in 2001

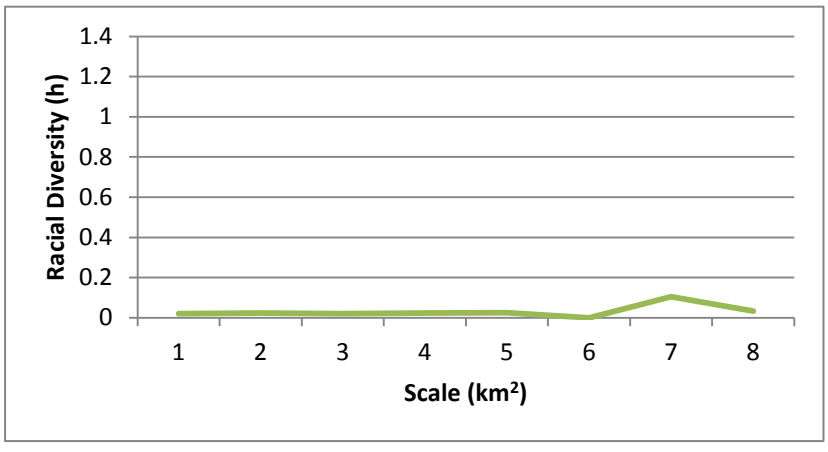

Figure 7.51: Diversity Profile for Motherwell in 2011

7.7. Measurement of Segregation with Dichotomous Measures

The sixth objective of the study was to compute the traditionally-used dissimilarity and segregation indices to investigate the inter-race dynamics that were reflecting the processes of racial integration and persistent segregation in Port Elizabeth in the post-apartheid period. Furthermore, the implementation of traditional dichotomous measures enabled this study to be more comparable to the wide array of historical research on the topic.

Table 7.4 shows segregation values for Port Elizabeth as measured using the Dissimilarity Index, calculated using the Census enumeration/small areas. The *D* values represented in the table below represent the extent to which each race group is segregated from another, with values ranging from 0, representing no segregation (or complete integration) to 1, representing complete segregation (or zero integration). Christopher (1999) pointed out that most of the racial integration taking place in post-apartheid South African cities involves the relocation of the African, Coloured and Indian race groups into spaces that were formerly designated to Whites. In Table 7.4, therefore, it is important to consider the changes in the segregation values measured between these race groups and the White population (i.e., the columns Table 7.4 encircled by the red dashed lines). Segregation levels declined between all groups from 1996 to 2011, decreasing by 4.1 % between Africans and Whites, 5.0 % between Coloureds and Whites and 17.8 % between Indians and Whites. Christopher (2005) and Parry and van Eeden (2014) cite the recommendation proposed by Kantrowitz (1979) that a change in *D* of 0.05 (i.e., 5 %) or more should be considered statistically significant when comparing values across Census periods. Therefore, significant integration occurred between both the Coloured and Indian groups and the White population from 1996 to 2011. The integration between Africans and Whites from 1996 to 2011 is insignificant.

Table 7.4: Values for D obtained at tract level

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.949	0.973	0.967	0.793	0.938	0.836
2001	0.917	0.959	0.949	0.778	0.912	0.770
2011	0.869	0.874	0.926	0.747	0.889	0.658
Change from 1996 - 2001	**0.031**	**0.014**	**0.018**	**0.016**	**0.026**	**0.066**
Change from 2001 - 2011	**0.048**	**0.085**	**0.023**	**0.031**	**0.023**	**0.112**
Overall Change	**0.079**	**0.098**	**0.041**	**0.046**	**0.050**	**0.178**

Tables 7.5 to 7.12 show the segregation values for Port Elizabeth as measured using the Dissimilarity Index, calculated across geographical scales using the fishnet grids ranging from 1- to 8 km^2. The values in red are those representing a significant change in desegregation. The values in Table 7.5, calculated for a grid resolution of 1 km^2, indicate that small-scale segregation declined between all race groups between 1996 and 2011, decreasing by 4.2 % between Africans and Whites, 3.7 % between Coloureds and Whites, and 18.2 % between Indians and Whites. Based on these values, the only significant integration occurred between the Indian and White populations. The values in Table 7.12, calculated at a grid resolution of 8 km^2, indicate that large-scale segregation declined by an insignificant 3.4 % between Africans and Whites, and by a significant 9.5 % between Indians and Whites. Segregation levels between Coloureds and Whites increased by 4.0 %. This change, however, is considered insignificant.

Table 7.5: Values for D obtained at a 1km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.933	0.959	0.952	0.692	0.899	0.800
2001	0.899	0.941	0.931	0.713	0.880	0.741
2011	0.842	0.840	0.910	0.687	0.862	0.618
Change from 1996 - 2001	**0.034**	**0.018**	**0.022**	**-0.021**	**0.019**	**0.059**
Change from 2001 - 2011	**0.058**	**0.101**	**0.021**	**0.026**	**0.018**	**0.123**
Overall Change	**0.091**	**0.119**	**0.042**	**0.006**	**0.037**	**0.182**

Table 7.6: Values for D obtained at a 2km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.912	0.941	0.900	0.620	0.873	0.755
2001	0.883	0.917	0.874	0.633	0.855	0.711
2011	0.822	0.818	0.865	0.622	0.840	0.598
Change from 1996 - 2001	**0.029**	**0.024**	**0.025**	**-0.012**	**0.019**	**0.044**
Change from 2001 - 2011	**0.061**	**0.099**	**0.009**	**0.011**	**0.015**	**0.113**
Overall Change	**0.090**	**0.123**	**0.034**	**-0.001**	**0.034**	**0.157**

Table 7.7: Values for D obtained at a 3km2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.862	0.940	0.874	0.584	0.764	0.651
2001	0.835	0.922	0.867	0.612	0.764	0.641
2011	0.765	0.815	0.847	0.627	0.785	0.546
Change from 1996 - 2001	**0.028**	**0.019**	**0.007**	**-0.028**	**0.000**	**0.011**
Change from 2001 - 2011	**0.069**	**0.106**	**0.020**	**-0.015**	**-0.021**	**0.095**
Overall Change	**0.097**	**0.125**	**0.027**	**-0.043**	**-0.021**	**0.105**

Table 7.8: Values for D obtained at a 4km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.886	0.910	0.880	0.459	0.739	0.619
2001	0.866	0.895	0.859	0.506	0.733	0.581
2011	0.809	0.797	0.830	0.501	0.748	0.474
Change from 1996 - 2001	**0.020**	**0.015**	**0.022**	**-0.047**	**0.007**	**0.038**
Change from 2001 - 2011	**0.057**	**0.099**	**0.028**	**0.005**	**-0.015**	**0.107**
Overall Change	**0.077**	**0.113**	**0.050**	**-0.042**	**-0.009**	**0.145**

Table 7.9: Values for D obtained at a 5km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.795	0.835	0.817	0.567	0.747	0.676
2001	0.770	0.816	0.805	0.582	0.744	0.636
2011	0.729	0.739	0.785	0.568	0.754	0.533
Change from 1996 - 2001	**0.024**	**0.019**	**0.012**	**-0.015**	**0.004**	**0.040**
Change from 2001 – 2011	**0.041**	**0.077**	**0.020**	**0.013**	**-0.010**	**0.103**
Overall Change	**0.065**	**0.096**	**0.032**	**-0.001**	**-0.007**	**0.143**

Table 7.10: Values for D obtained at a 6km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.792	0.900	0.830	0.438	0.735	0.550
2001	0.774	0.876	0.800	0.482	0.731	0.528
2011	0.693	0.783	0.783	0.476	0.743	0.436
Change from 1996 - 2001	**0.017**	**0.024**	**0.030**	**-0.044**	**0.004**	**0.022**
Change from 2001 - 2011	**0.082**	**0.093**	**0.018**	**0.006**	**-0.012**	**0.092**
Overall Change	**0.099**	**0.117**	**0.048**	**-0.039**	**-0.008**	**0.114**

Table 7.11: Values for D obtained at a 7km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.640	0.800	0.829	0.492	0.643	0.549
2001	0.644	0.812	0.811	0.520	0.644	0.519
2011	0.603	0.715	0.784	0.505	0.669	0.436
Change from 1996 - 2001	**-0.004**	**-0.011**	**0.018**	**-0.028**	**-0.001**	**0.030**
Change from 2001 - 2011	**0.041**	**0.096**	**0.026**	**0.015**	**-0.025**	**0.083**
Overall Change	**0.037**	**0.085**	**0.044**	**-0.014**	**-0.026**	**0.113**

Table 7.12: Values for D obtained at a 8km^2 grid resolution

	African-Coloured	African-Indian	African-White	Coloured-Indian	Coloured-White	Indian-White
1996	0.696	0.698	0.737	0.417	0.595	0.483
2001	0.667	0.679	0.710	0.429	0.599	0.429
2011	0.639	0.642	0.702	0.424	0.635	0.388
Change from 1996 - 2001	**0.029**	**0.020**	**0.027**	**-0.012**	**-0.004**	**0.054**
Change from 2001 - 2011	**0.028**	**0.037**	**0.007**	**0.005**	**-0.036**	**0.042**
Overall Change	**0.056**	**0.057**	**0.034**	**-0.007**	**-0.040**	**0.095**

Table 7.13 shows the segregation index values calculated for Port Elizabeth for 1996, 2001 and 2011 (i.e. the red values). Those values listed for 1951 to 1991 (i.e. the black values) were sourced from Christopher (2005), who investigated changing segregation in Port Elizabeth. The segregation index is similar to the Dissimilarity Index, only differing in the fact that it computes the segregation level for each distinct race group relative to the rest of the Port Elizabeth's population. The values range from 0, indicating zero segregation/perfect integration, to 100, indicating perfect segregation/zero integration.

As evident from the data in Table 7.13, the extent to which each race group remains segregated from the rest of the population has declined for all the race groups. An important observation

from this table is that, despite the fact that increased racial diversity has occurred predominantly in the former-White areas; the White race group still remains the most segregated from the other race groups, with an SI value of 91. From 1996 to 2011, the White population became more racially integrated by only 4 %, the slowest pace of the race groups. The African population is the second most segregated group, with an SI value of 87, corresponding with the low racial diversity observed in the African location areas. The Coloured population, although less segregated than the African population with an SI value of 83, experienced the same rate of decline in segregation as the African population, declining by 8 % from 1996 to 2011; the pace of desegregation for the African and Coloured groups is, therefore, twice that of the White group. The Indian population is the most racially integrated group, with an SI value of 69, representing a 12 % decline in segregation – three times that of the White population and 1.5 % greater than that of the Coloured and African populations.

Table 7.13: Values for SI calculated at tract level for 1996, 2001 and 2011. Values for 1951-1991 sourced from Christopher (2005)

	1951	1960	1970	1980	1985	1991	1996	2001	2011
African	75	88	92	96	96	96	**95**	**91**	**87**
Coloured	68	84	92	96	96	94	**91**	**88**	**83**
Indian	61	75	83	88	87	86	**81**	**78**	**69**
White	79	89	94	97	97	98	**95**	**93**	**91**

7.8. Relating Segregation to Contributing Socio-economic Factors

The seventh objective of the study was to investigate the relationship between race and various socio-economic variables to determine possible factors that impede the process of desegregation.

Tables 7.14, 7.15 and 7.16 show the results of Chi-square and Cramer's V tests performed to examine the relationship between race and three socio-economic variables: (i) income, (ii) employment status and (iii) level of education attainment. The Chi-square test calculated for each of the variables considered yielded a p-value (i.e. probability score) <0.01, indicating that race is significantly related to income, employment status and level of educational attainment at a 0.001 significance level. This was the case for both the 1996 and 2011 results.

Having determined that all three socio-economic variables were significantly related to race, Cramer's V scores were then calculated to determine the strength of these relationships (refer to Table 6.8 in Section 6.9 for the effect sizes of Cramer's V, provided by Cohen (1988), to see how these values were interpreted). The ϕc values indicate a medium-effect relationship between race and levels of education attainment for both 1996 and 2011. The relationship between race and employment status changed from medium-effect in 1996 to small-effect in 2011. The relationship between race and income changed from high-effect in 1996 to small-effect in 2011. The results from the Chi-square and Cramer's V tests show that the socio-economic status inherited from the apartheid regime can still be considered as contributing factors inhibiting the respective mobility (and, hence, ability to racially integrate) of the respective race groups.

Parry and van Eeden (2014) state that due to the intrinsic relationship between persistent post-apartheid residential segregation and economic well-being, any efforts to facilitate racial residential integration through the design of the city fabric may not come to fruition unless the socio-economic gap between the different race groups is bridged.

Table 7.14: Chi-Square and Cramer's V values obtained for Race vs. Income

Race x Income	Chi-Square (χ^2)	df	P	Cramer's V (ϕc)
1996	14909.61	9	<0.001	0.127
2011	44656.48	9	<0.001	0.287

Table 7.15: Chi-Square and Cramer's V values for Race vs. Employment Status

Race x Employment	Chi-Square (χ^2)	df	P	Cramer's V (ϕc)
1996	46646.12	6	<0.001	0.219
2011	39675.47	6	<0.001	0.184

Table 7.16: Chi-Square and Cramer's V values for Race vs. Level of Education Attainment

Race x Education	Chi-Square (χ^2)	df	P	Cramer's V (ϕc)
1996	87684.846	15	<0.001	0.256
2011	62860.684	15	<0.001	0.196

7.9 Conclusion

The results showed that segregation levels in Port Elizabeth have declined but still remain high. Port Elizabeth, therefore, mirrored the trends observed in Cape Town and Johannesburg. The integration that did occur was unidirectional, involving the movement of Blacks into areas that were former-White. This movement was predominantly limited to the Indian population, and to a lesser extent, the Coloured population, owing to their higher socio-economic status under the apartheid regime. It was also found that the overwhelming majority of the African population remains confined to their former designated location areas. The results also revealed that, despite most of the racial integration was found to occur in areas that were formerly classified as White, the White population remains the most segregated group. The interview results and

statistical tests revealed that persisting socio-economic inequalities (i.e., income, employment and education) between the race groups can be considered determining factors, influencing the observed trends in racial integration and persisting segregation. The main observations and overall deductions drawn from the study results will be presented and discussed in greater detail in the subsequent chapter.

CHAPTER 8: DISCUSSION AND CONCLUSION

8.1. Introduction

This study analyzed Census data from 1996 to 2011 to determine the trends in post-apartheid racial segregation in Port Elizabeth across various geographical scales. Furthermore, it aimed to link the observed trends to likely causative socio-economic factors.

This section will be structured into six sections. Firstly, it will discuss the observed post-apartheid trends in racial segregation observed in Port Elizabeth from 1996 to 2011; secondly, it will discuss the impact of scale when investigating racial segregation in Port Elizabeth; after which it will discuss the extent to which the processes driving racial integration in the post-apartheid context in Port Elizabeth are constrained by factors relating to persistent socio-economic inequalities and choice.

8.2. Post-Apartheid Racial Segregation in Port Elizabeth

Overall, the study found that while there has been a consistent decrease in racial segregation in Port Elizabeth from 1996 to 2011, the city still remains highly segregated with an *H* value of 0,715. Port Elizabeth, while, exhibiting the same segregation trends as those found by Parry and van Eeden (2014) for Cape Town and Johannesburg, was found to be more segregated than both these cities, whose 2011 *H* values were measured at 0.66 and 0.59 respectively. Port Elizabeth, however, was the most segregated of the three cities in 1996, so the fact that it remains the most segregated in 2011 is not reflective of the pace at which desegregation (or racial integration) is taking place in the city. The rate of decline in segregation for Port Elizabeth (i.e. an overall 13.1

% decrease in racial segregation from 1996 to 2011) was similar to that of both Cape Town and Johannesburg (which experienced a 14 % and 11 % decline respectively).

The spatial distribution of Port Elizabeth's population still largely corresponds to the designated racial zones of the apartheid regime; and the population redistribution that has taken place is characterized by a one-way pattern of migration, with members of the Black population groups relocating into areas that were formerly White-designated. This was unsurprising as both the inequitable distribution of amenities and the unequal infrastructural development inherited from the apartheid city (in which the scales were tipped to benefit the White population) have not yet been reversed. Furthermore, this one-way pattern of movement was found to be predominantly confined to the Indian population and to a less extent the Coloured population, whose intermediate socio-economic status in the apartheid racial hierarchy afforded them a higher level of spatial mobility following South Africa's democratization. Racial diversity has increased primarily in former-White residential areas that are middle and low income, and where affordable housing permits racial integration, and in areas close to the CBD and the Nelson Mandela Metropolitan University, which are popular sites for student accommodation. The African location areas consistently displayed low racial diversity. The main factor governing this one-way pattern of movement is that the spatial inequality, stemming from the inequitable distribution of amenities and infrastructural development, has not yet been reversed.

The lowered socio-economic status still characteristic of the majority of the African population has considerably limited their capacity to relocate out of the location areas. Socio-economic factors such as income, employment and education have been identified as some of the drivers affecting this trend. Relating back to the theoretical models of segregation (refer to Section 2.3); the place-stratification paradigm defined by Alba and Logan (1991) is evident, particularly with regards to the vast majority of the African population. In brief, place-stratification describes a situation where social barriers, such as socio-economic inequalities, impede the spatial integration of ethnic groups into broader society. Members of the Black population that were able to relocate include the African economic elite who benefitted from the BEE initiatives, and members of the Indian and Coloured groups who were granted a higher socio-economic status under the apartheid regime, and hence, greater spatial mobility. Relating back to the theoretical models of segregation, the spatial-assimilation model defined by Alba and Logan (1991) is

relevant here. In this model, fewer social barriers hinder the ability of ethnic groups to spatially integrate into broader society.

The computation of the dichotomous Dissimilarity Index provided insight into the inter-race dynamics between the respective race groups that drive persistent segregation/integration patterns. The significant racial integration that has occurred between the White population and both the Indian and Coloured populations can be attributed to the in-migration of these groups into former-White areas. The lack of significant integration was evident between the White and African populations further emphasizes that persisting inequality, both racial and spatial, are major factors limiting racial integration.

The computation of the dichotomous segregation index, which examined the extent to which each race group was segregated from the rest of the population on the whole, revealed that the White population remains the most segregated group, despite most of the integration taking place in areas that were formerly White-designated. The same observation was made by Christopher (2005). The changing racial composition of Port Elizabeth over time is of note. The growth in Port Elizabeth's population was accompanied by both a decline in the White population and growth in the African population. This decline in the proportion of the White population throughout the concerned period (i.e., 1996 to 2011) provides some explanation for this phenomenon. Christopher (1999, 2005) attributes the substantial decline in the number of Whites to emigration. Within the local context of Port Elizabeth, however, the decline in the White proportion of the population can also likely be attributed to the out-migration of people to bigger economic centres in the country, owing to the poor economic growth experienced in the city.

The findings of this study were found to be indicative of Christopher's vision of the post-apartheid city. Christopher (1999) argued that two demographic trends, these being a rapid increase in the proportion of urban Africans as well as a steady decline in the proportion of Whites, would be foremost drivers in the development of post-apartheid cities in South Africa. Furthermore, Christopher (1999) predicted that the typical post-apartheid South African city would be characterized by pockets of low density, relatively integrated residential areas with a high socio-economic status, surrounded by mono-racial African, high density residential areas that are characterized by low socio-economic status. This findings of this study conformed to Christopher's (2001b) observation that within the continuum of suburbs ranging from racially

integrated to highly segregated, the peripheral African location (which remains completely segregated) persists as a constant feature in the South African urban fabric. This is due both to the socio-economic barriers preventing Africans from relocating, resulting in the South African 'African location' paralleling Peach's (2005) definition of the USA African-American ghetto, as well as the creation of newer high-density African residential areas on the outskirts of the city (under the national government's RDP initiative), which entrenches rather than reverses the urban exclusion of the overwhelming majority of the African population.

Port Elizabeth was also found not to comply with Landman's (2006) model of the 'new apartheid city', in which he stated that the formation of gated communities would structurally enforce a new form of economic segregation (which to a large extent would eclipse, though not replace, racial segregation). The formation of gated communities, as have been observed in larger metropoles like Cape Town and Johannesburg, are unlikely to arise in Port Elizabeth due to the relatively small area of the city compared to that of larger cities, as well as the city's low economic productivity. Lastly, the limitations encountered in this research will be enumerated, and recommendations for potential future studies related to the topic at hand.

8.3. Scalar Nature of Racial Segregation

As is evident in Port Elizabeth's segregation profile (refer to Figure 5.37), racial segregation has steadily decreased from 1996 to 2011 across all geographical scales. Across the census periods, the segregation curve becomes less steep at geographic scales higher than 3 km^2, suggesting that racial integration has taken place at a neighbourhood level, but at a large scale racial diversity remained fairly constant. This supports the hypothesis put forth by Parry (2012) that small-scale racial integration in South African cities is attributed to the movement of members of the Black population groups into areas that were formerly White-designated, while the large-scale patterns of racial integration is mainly influenced by the persisting racial homogeneity in the African location areas.

When examining the diversity profiles of the four selected sub places (these being the former White areas of Fairview and Summerstrand, and the former-African areas of New Brighton and Motherwell), it was apparent that increases in racial diversity at lower geographical scales contributed to flattening diversity curves. In contrast, no apparent changes occurred in both New Brighton and Motherwell. This, again is reflects that increasing racial integration is typified by the one-way pattern of movement from former Black residential areas to former-White residential areas.

When looking at the individual curves, a lack of a distinct trend defining the relationship between segregation and scale for the sub places reflects the inherent complexity of establishing the 'ideal scale' at which segregation should be measured in the local context. Furthermore, this emphasizes that racial diversity is not only scale-sensitive, but is also dependent on factors such as the location, spatial extent, and the spatial configuration of specific (and surrounding) areas within a study site.

The segregation profile generated for Port Elizabeth as a whole revealed that regardless of the geographical scale at which segregation was considered, the overall level of racial segregation has steadily declined from 1996 to 2011. Furthermore, the increased rate of this decline between the two consecutive inter-census periods suggests that this trend is likely to continue. The diversity curves of the selected main places (which all varied in accordance with their relative location, extent and the surrounding spatial configuration) emphasized the inherent complexity of the scale-sensitive nature of segregation studies. In doing so, it revealed the importance of not only relying on the city-level segregation profile on the whole, but in conjunction, considering the dynamics occurring at an 'increasingly local' context. Theil's two-part entropy index, which computes both diversity at tract level and overall segregation for a study area as a whole, is a useful tool.

8.4. Factors Limiting Racial Integration

The significant relationship between race the socio-economic variables considered (these being income, employment status, and level of education attainment, indicates that all three still play a significant role in impacting the relative spatial mobility of the respective race groups and, therefore, influences racial migration dynamics. This complies with the findings of Christopher (2001b) that the lack of economic empowerment experienced by the vast majority of the African population significantly impedes their ability to racially integrate. This study also found that it has been the migration of the Indian and Coloured populations, whom Christopher (2001b) describes as the 'intermediate groups' owing to their intermediary socio-economic status between the White and African populations, into former-White areas that has primarily affected the greatest change in desegregation. Christopher (2001b) also relates this to the USA context, where it was found that such 'intermediate' groups were more able to escape the polarity of the 'Black-White divide'[19].

Additional issues were identified as factors limiting the attainment of racial integration. Port Elizabeth experiences higher volumes of out-migration compared to Cape Town and Johannesburg. Furthermore, the rate at which desegregation has occurred in Port Elizabeth is significant given the low economic growth, characteristic of the region, as well as the lack of resources and skills, limiting the capacity of local government to facilitate racial integration.

The aspect of choice is also an important, and often overlooked, factor driving persistent segregation. This particularly applies to members of the Indian and Coloured populations, as well as the elite proportion of the African population who have become economically empowered following the country's democratization. This complies with Peach's (2005) voluntary plural-persistent enclave model, wherein individuals of a common ethnic background choose to remain within their racially homogenous communities. Numerous reasons were identified as factors influencing the choice of spatially mobile residents not to relocate; typically this includes the desire to maintain strong cultural and family connections, both of which are amplified by the availability of transport routes and the associated cost of commuting, as well as the perception of 'safety in numbers', whereby individuals feel a sense of comradery being

[19] The term 'Black', in this one instance, refers specifically to the African-American population of the USA.

surrounded by like individuals, and furthermore, within the historical context of racial subjugation, feel protected against potential recurrent discrimination.

8.5. Research Limitations

There were numerous shortcomings associated with the use of census data in this study. Firstly, the fact that the EA/SAL boundaries were revised for each of the census periods negated the possibility of making a direct time comparison at tract-level. Secondly, the use of grid cells assumed that the interaction of households contained within a cell was confined only to other households within that same cell. Thirdly, only one of the two approached government persons (who both consented to participate in this study) complied. While the interview with the local government official, Ms. Dawn McCarthy, provided invaluable insight that contextualized the study findings in the local context of Port Elizabeth's spatial planning, the failure to respond by the national-level government official detracts the value that would have been gained by a similar contextualization of the study findings for Port Elizabeth in the national-level spatial planning scheme.

8.6. Recommendations for Potential Future Studies

Three potential areas in which this research can be expanded have been identified. Firstly, it is proposed that this study be extended to other small cities of a similar size to that of Port Elizabeth. This will be useful in determining if key trends and dynamics drive segregation in cities of a similar scale and economic status. Potential study areas in which this which the methods employed in this study can be implemented include Bloemfontein, East London, Pietermaritzburg and Stellenbosch.

Secondly, it is recommended that racial interaction, measurable by the interaction index (also referred to as the exposure index), be incorporated into future studies of this nature. This will add

a new dimension to the segregation research conducted in South Africa and, furthermore, address the assumption that households contained within common tract/cell boundaries only interact with each other.

Thirdly, the topic of 'self-segregation' is a very relevant and overlooked factor in the South African context that warrants more consideration when investigating the dynamics driving processes of ongoing racial segregation in the country. Qualitative research aimed at exploring this topic will address a major gap present in the body of literature relating to segregation studies in South Africa.

REFERENCES

Alba, R. D., and Logan, J. R. (1991). Variations on two themes: Racial and ethnic patterns in the attainment of suburban residence. *Demography*, *28*(3), 431-453.

Alba, R. D., and Logan, J. R. (1993). Minority proximity to Whites in suburbs: An individual-level analysis of segregation. *American Journal of Sociology, 98*(6), 1388-1427.

Alba, R. D., Logan, J. R., and Stults, B. J. (2000). How segregated are middle-class African-Americans? *Social Problems, 47*(4), 543-558.

Alonso, W. (1964). *Location and land use.* Cambridge, MA: Harvard University Press.

Ananat, E. O. (2011). The wrong side(s) of the tracks: the causal effects of racial segregation on urban poverty and inequality. *American Economic Journal: Applied Economics,* 3(2), 34-66.

Anderson, E. (1999). *Code of the street: decency, violence, and the moral life of the inner city.* New York: W. W. Norton.

Baines, G. (1989). The control and administration of Port Elizabeth's African population, c. 1834-1923. *Contree,* 26(1), 13-21.

Baines, G. (1990). The origins of urban segregation: local government and the residence of Africans in Port Elizabeth, c. 1835-1865. *South African Historical Journal*, 22(1), 61-81.

Bally, R. (2010). *View from pier, Summerstrand, Port Elizabeth,* photograph, viewed 19 March <2016. http://www.panoramio.com/photo/33852174>.

Beall, J., Crankshaw, O., and Parnell, S. (2002). *Uniting a divided city: governance and social exclusion in Johannesburg.* London: Earthscan.

Beavon, K. S. O. (1970). "Factors affecting the growth and form of Port Elizabeth, 1820-1968: a study of historical urban geography", in Watts, H. L. (1970). *Focus on cities.* Durban: Institute for Social Research, University of Natal.

Beavon, K. S. O. (1982). Black townships in South Africa. *South African Geographical Journal, 64*(1), 3-20.

Beavon, K. S. O. (1991). "The post-apartheid city: hopes, possibilities, and harsh realities", in Smith, D. M. (2003). *The apartheid city and beyond: urbanization and social change in South Africa.* London: Routledge.

Bell, W. (1954). A probability model for the measurement of ecological segregation. *Social Forces, 32*(4), 357-364.

Bobo, L., and Zubrinsky, C. L. (1996). Attitudes on residential integration: Perceived status differences, mere in-group preference, or racial prejudice? *Social Forces, 74*(3), 883-909.

Bouch, R. (1993). Glen grey before Cecil Rhodes: How a crisis of local colonial authority led to the glen grey act of 1894. *Canadian Journal of African Studies / Revue Canadienne Des Études Africaines, 27*(1), 1-24.

Brenner, L. (1999). "Crime and the emerging landscape of post-apartheid Johannesburg", in Judin, H., and Vladislavik, I. (eds.). *Blanc architecture, apartheid and after.* Rotterdam: Nai Publishers.

Brooks-Gunn, J., Duncan, G. J., Klebanov, P. K., and Sealand, N. (1993). Do neighborhoods influence child and adolescent development? *American Journal of Sociology, 99*(2), 353-395.

Brunn, S. D. (2011). *Engineering Earth: the impacts of mega-engineering projects (Vol. 1.).* New York: Springer.

Bundy, C. (1979a). "The abolition of the Masters and Servants Act", in Hare, P., and Wiendieck, G. (1979). *South African sociological analysis.* Cape Town: Oxford University Press.

Bundy, C. (1979b). *The rise and fall of the South African peasantry (2nd ed.).* London: Heinemann.

Bwalya, J., and Seethal, C. (2015). Spatial integration in residential suburbs of East London, South Africa (1993–2008). *Journal of Asian and African Studies, 50(6), 637-649.*

Charles, C. Z. (2003). The dynamics of racial residential segregation. *Annual Review of Sociology, 29,* 167-207.

Christopher, A. J. (1987a). Apartheid planning in South Africa: The case of Port Elizabeth. *The Geographical Journal, 153*(2), 195-204.

Christopher, A. J. (1987b). Race and residence in colonial Port Elizabeth. *South African Geographical Journal, 69*(1), 3-20.

Christopher, A. J. (1988). Formal segregation and population distribution in Port Elizabeth. *Contree Journal for South African Urban and Regional History,* No. 24.

Christopher, A. J. (1990). Apartheid and urban segregation levels in South Africa. *Urban Studies, 27*(3), 421-440.

Christopher, A. J. (1994). Segregation levels in the late-apartheid city 1985?1991. *Tijdschrift Voor Economische En Sociale Geografie, 85*(1), 15-24.

Christopher, A. J. (2001). Urban segregation in post-apartheid South Africa. *Urban Studies, 38*(3), 449-466.

Christopher, A. J. (2005). The slow pace of desegregation in South African cities, 1996-2001. *Urban Studies, 42*(12), 2305-2320.

Clark, K. B. (1965). *Dark ghetto: dilemmas of social power.* New York: Harper and Row.

Clark, W. A. V. (1991). Residential preferences and neighbourhood racial segregation: a test of the Schelling segregation model. *Demography,* 28(1): 1-19.

Cohen, J. (1988). *Statistical power analyses for the behavioural science (2nd ed.).* Hillsdale: Lawrence Earlbaum Associates.

Coleman, J., Hoffer, T., and Kilgore, S. (1982). *High school achievement: public, private, and Catholic schools compared.* New York: Basic Books.

Crane, J. (1999). The epidemic theory of ghettos and neighbourhood effects on dropping out and teenage childbearing. *American Journal of Sociology, 96(5), 1226-1259.*

Cutler, D. M., and Glaeser, E. L. (1997). Are ghettos good or bad? *The Quarterly Journal of Economics, 112*(3), 827-872.

Cutler, D. M., Glaeser, E. L., and Vigdor, J. L. (1999). The rise and decline of the American ghetto. *Journal of Political Economy, 107*(3), 455-506.

Davenport, T. R. H. (1971). *The beginnings of urban segregation in South Africa: the Natives (Urban Areas) Act of 1923 and its background.* Grahamstown: Institute for Social and Economic Research, Rhodes University.

Davenport, T. R. H. (1987). *South Africa: a modern history (3rd ed.).* Basingstoke: Macmillan.

Davies, W. J. (1971). *Patterns of non-White population distribution in Port Elizabeth with special reference to the application of the Group Areas Act.* Port Elizabeth: Institute for Planning Research, Nelson Mandela Metropolitan University. Davies, R. J. (1981). The spatial formation of the South African city. *Geojournal, Supplementary Issue,* 2(2), 59-72.

Department of Economic Development and Environmental Affairs. (2014). *The Eastern Cape socio-economic review and outlook.* King Williams Town: Department of Economic Development and Environmental Affairs (DEDEA).

Department of Human Settlements. (2009). *The policy context: part 2 of the national housing code.* Pretoria: Department of Human Settlements (DHS).

Dijkstra, S., Geuijen, K., and de Ruijter, A. (2001). Multiculturalism and social integration in europe. *International Political Science Review / Revue Internationale De Science Politique*, *22*(1), 55-83.

Donaldson, R., and Kotze, N. (2006). Residential desegregation dynamics in the South African city of Polokwane (Pietersburg). *Tijdschrift Voor Economische En Sociale Geografie, 97*(5), 567-582.

Donaldson, S. E., and van, d. Merwe, I. J. (1999). Urban transformation and social change in Pietersburg during transition. *Society in Transition, 30*(1), 69-83.

Duncan, O. D., and Duncan, B. (1955). A methodological analysis of segregation indexes. *American Sociological Review, 20*(2), 210-217.

Duncan, O. D., and Duncan, B. (1957). *The negro population of Chicago: a study of residential succession.* Chicago: University of Chicago Press.

Eastern Cape Socio Economic Council. (2014). *2014 socio-economic profile report.* East London: Eastern Cape Socio Economic Council (ECSECC).

Eckardt, F., and Eade, J. (2011). *The ethnically diverse city.* Berlin: Berliner Wissenschafts-Verlag.

Edgecomb, R. (1976). "The Glen Grey Act: local origins of an absolute 'bill for Africa'", in Benjon, J. (ed.). *Studies in local history*. Cape Town: Oxford University Press.

Emerson, M. O., Chai, K. J., and Yancey, G. (2001). Does race matter in residential segregation? exploring the preferences of White Americans. *American Sociological Review, 66*(6), 922-935.

Farley, R., and Frey, W. H. (1994). Changes in the segregation of Whites from Blacks during the 1980s: Small steps toward a more integrated society. *American Sociological Review, 59*(1), 23-45.

Farley, R., Steeh, C., Krysan, M., Jackson, T., and Reeves, K. (1994). Stereotypes and segregation: Neighborhoods in the detroit area. *American Journal of Sociology, 100*(3), 750-780.

Fischer, C. S., Stockmayer, G., Stiles, J., and Hout, M. (2004). Distinguishing the geographic levels and social dimensions of U.S. metropolitan segregation, 1960-2000. *Demography, 41*(1), 37-59.

Flores, C. A. (2008). *Residential segregation and the geography of opportunities: a spatial analysis of heterogeneity and spillovers in education* (Unpublished Doctoral Thesis). University of Texas at Austin, United States of America.

Fong, E., and Wilkes, R. (2003). Racial and ethnic residential patterns in Canada. *Sociological Forum, 18*(4), 577-602.

Fossett, M. (2006). Ethnic preferences, social distance dynamics, and residential segregation: Theoretical explorations using simulation analysis∗. *The Journal of Mathematical Sociology, 30*(3-4), 185-273.

Frey, W. H., and Myers, D. (2005). *Racial segregation in the USA metropolitan areas and cities, 1990-2000: patterns, trends, and explanations.* Michigan, Population Studies Centre (PSC), Institute for Social Research, University of Michigan.

Gitta, M. C. (2011). *Natives Land Act, 1913.* United States of America: Sent Publishing.

Goodchild, M. F. (1987). A spatial analytic perspective on Geographical Information Systems. *International Journal of Geographic Information Systems,* 1(4), 327-334.

Grobbelaar, N. (2005). *The creation of a dissemination layer for census 2001 information.* Pretoria: Statistics South Africa (Stats SA).

Harding, D. J. (2010). *Living the drama: community, conflict, and culture among inner-city boys.* Chicago: University of Chicago Press.

Harrison, P. (2003). "Fragmentation and globalization as the new meta-narrative", in Harrison, P., Huchzermeyer, M., and Mayekiso, M. (eds.). *Confronting urban fragmentation: housing and urban development in a democratic society.* Cape Town: University of Cape Town Press.

Herbst, C. M., and Lucia, J. (2014). *Happy in the hood? The impact of residential segregation on self-reported happiness.* Bonn: The Institute for the Study of Labour.

Horn, A. (2005). Measuring multi-ethnic spatial segregation in South African cities. *South African Geographical Journal, 87*(1), 58-72.

Iceland, J. (2009). *Where we live now: immigration and race in the United States of America.* Berkeley: University of California Press.

Iceland, J. (2014). *Residential segregation: a transatlantic analysis.* Washington, DC: Migration Policy Institute (MPI).

Iceland, J., Weinberg, D.H., and Steinmetz, E. (2002). *Racial and ethnic residential segregation in the United States of America: 1980-2000.* Suitland: USA Census Bureau Department.

Iceland, J., and Wilkes, R. (2006). Does socio-economic status matter? race, class, and residential segregation. *Social Problems, 53*(2), 248-273.

Inggs, E. J. (1986). *Liverpool of the Cape: Port Elizabeth harbour development* (Unpublished Master's Thesis). Rhodes University, South Africa.

Inggs, E. J. (1987). Mfengu beach labour and Port Elizabeth harbour development. *Contree,* 21(1), 11-12.

Irvine, P. M. (2012). *Post-apartheid racial integration in Grahamstown, a time-geographical perspective* (Unpublished Master's Thesis). Rhodes University, South Africa.

Jahn, J., Schmid, C. F., and Schrag, C. (1947). The measurement of ecological segregation. *American Sociological Review, 12*(3), 293-303.

James W. J. (2000). South Africa: Urban transformation. *Cities, 17*(3), 167-183.

James, D. R., and Tauber, K. E. (1985). Measures of segregation. *Sociological Methodology,* 14(1), 1-32.

Jargowsky, P. A. (1997). *Poverty and place: ghettos, barrios, and the American city.* New York: Russel Sage Foundation.

Jargowsky, P. A., and Kim, J. (2004). *A measure of spatial segregation: the generalized neighbourhood sorting index.* Richardson: University of Texas at Dallas Press.

Johnston, R., Poulsen, M., and Forrest, J. (2007). The geography of ethnic residential segregation: A comparative study of five countries. *Annals of the Association of American Geographers, 97*(4), 713-738.

Kahn, F. (2013). *The Native's Land Act, 1913 – the historical context and political implications.* Cape Town: Research Unit, Parliament of the Republic of South Africa.

Kaplan, D. H., and Holloway, S. R. (1998). *Segregation in cities.* Washington, DC: Associaition of American Geographers.

Kaplan, D. H., and Holloway, S. R. (2001). Scaling ethnic segregation: Causal processes and contingent outcomes in Chinese residential patterns. *Geojournal, 53*(1), 59-70.

Kaplan, D., Wheeler, J., and Holloway, S. (2009). *Urban geography.* Hoboken: John Wiley and Sons, Inc.

Keegan, T. (1996). "Introduction", in Phillips, H., Warner, B., and Westraends, P. E. (1996). *Voices of Black South Africans.* Cape Town: South African Library.

Kessel, S. (2010). *New Brighton township in Port Elizabeth*, photograph, viewed 19 march 2016. <http://www.theguardian.com/travel/2010/jun/23/port-elizabeth-township-south-africa>.

Kirk, J. F. (1991). Race, class, liberalism, and segregation: The 1883 native strangers' location bill in Port Elizabeth, South Africa. *The International Journal of African Historical Studies, 24*(2), 293-321.

Kitchin, R., and Tate, N. (2013). *Conducting Research in Human Geography: Theory, Methodology and Practice.* London: Routledge.

Kryson, M., Couper, M. P., Farley, R., and Forman, T. A. (2009). Does race matter in neighbourhood 'preferences' Results from a video experiment. *American Journal of Sociology,* 115(2), 527-559.

Landman, K. (2006). Privatising public space in post-apartheid South African cities through neighbourhood enclosures. *Geojournal, 66*(1), 133-146.

Landman, K., and Ntombela, N. (2006). *Opening up spaces for the poor in the urban form: trends, challenges and their implications for access to urban land.* Pretoria: Council for Scientific and Industrial Research (CSIR).

Lee, B. A., Reardon, S. F., Firebaugh, G., Farrell, C. R., Matthews, S. A., and O'Sullivan, D. (2008). Beyond the census tract: Patterns and determinants of racial segregation at multiple geographic scales. *American Sociological Review, 73*(5), 766-791.

Lefebvre, H. (1968). *Le droit à la ville [The right to the city] (2nd ed.).* Paris: Anthropos.

Lemanski, C. (2004). A new apartheid? the spatial implications of fear of crime in cape town, South Africa. *Environment and Urbanization, 16*(2), 101-112.

Lemon, A. (1991). *Homes apart: South Africa's segregated cities.* Indiana: Indiana University Press.

Lemon, A., and Clifford, D. (2005). Post-apartheid transition in a small South African town: Interracial property transfer in Margate, KwaZulu-Natal. *Urban Studies, 42*(1), 7-30.

Logan, J. R., Stults, B. J., and Farley, R. (2004). Segregation of minorities in the metropolis: two decades of change. *Demography,* 41(1), 1-22.

Ludwig, J., Liebman, J. B., Kling, J.R., Duncan, G.J., Katz, L.F., Kessler, R.C., and Sanbomatsu, L. (2008). What can we learn about neighbourhood effects from the Moving to Opportunity experiment? *American Journal of Sociology,* 114(1), 144-188.

Mabin, A. (1986). The rise and decline of Port Elizabeth, 1850-1900. *The International Journal of African Historical Studies, 19*(2), 275-303.

Martin, M. E. (2006). *Racial segregation patterns of Latinos in the United States of America, 1990-2000: testing the ethnic enclave and inequality theory.* London: Routledge.

Massey, D. S. (1981). Social class and ethnic segregation: A reconsideration of methods and conclusions. *American Sociological Review, 46*(5), 641-650.

Massey, D. S. (1985). Ethnic residential segregation: a theoretical synthesis and empirical review. *Sociology and Social Research,* 69(3), 315-350.

Massey, D. S., and Denton, N. A. (1985). Spatial assimilation as a socio-economic outcome. *American Sociological Review, 50*(1), 94-106.

Massey, D. S., and Denton, N. A. (1987). Trends in the residential segregation of Blacks, Hispanics, and Asians: 1970-1980. *American Sociological Review, 52*(6), 802-825.

Massey, D. S., and Denton, N. A. (1988). The dimensions of residential segregation. *Social Forces, 67*(2), 281-315.

Massey, D. S., and Denton, N. A. (1989). Hypersegregation in U.S. metropolitan areas: Black and hispanic segregation along five dimensions. *Demography, 26*(3), 373-391.

Massey, D. S., and Denton, N. A. (1993). *American apartheid: segregation and the making of the underclass.* Cambridge, MA: Harvard University Press.

Massey, D. S., and Fischer, M. J. (2000). How segregation concentrates poverty. *Ethnic and Racial Studies, 23*(4), 670-691.

Massey, D. S., Gross, A. B., and Shibuya, K. (1994). Migration, segregation, and the geographic concentration of poverty. *American Sociological Review, 59*(3), 425-445.

Massey, D. S., and Lundy, G. (2001). Use of Black English and racial discrimination in urban housing markets: New methods and findings. *Urban Affairs Review, 36*(4), 452-469.

Massey, D. S., White, M. J., and Phua, V. (1996). The dimensions of segregation revisited. *Sociological Methods and Research, 25*(2), 172-206.

Mayer, S. E., and Jencks, C. (1989). Growing up in poor neighbourhoods: how much does t matter? *Science*, 243(4897), 1441-1445.

Maylam, P. (1995). Explaining the apartheid city: 20 years of South African urban historiography. *Journal of Southern African Studies, 21*(1), 19-38.

Molteno, P. A. (1900). *The life and times of Sir Charles Molteno (Vol.2.)*. London: Smith, Elder and Co.

Morrill, R. L. (1991). On the measure of spatial segregation. *Geography Research Forum*, 11(1), 25-36.

Morse, D. D. (2012). *A geospatial analysis of racial segregation in North Carolina's major metropolitan areas* (Unpublished Master's Thesis). University of North Carolina at Greensboro, United States of America.

Mortensen, K.W. (2013). *Maximum influence: the 12 universal laws of power persuasion.* New York: American Management Association.

Moyer, R. A. (1976). *A history of the Mfengu of the Eastern Cape* (Unpublished Master's Thesis). London: University of London.

Musterd, S. (2005). Social and ethnic segregation in Europe: Levels, causes, and effects. *Journal of Urban Affairs, 27*(3), 331-348.

Openshaw, S. (1984). *The modifiable area unit problem.* Norwich: GeoBooks.

Owusu, G., and Agyei-Mensah, S. (2011). Acomparable study of ethnic residential segregation in Ghana's two largest cities, Accra and Kumasi. *Population and Environment*, 32(4), 332-352.

Park, R. E. (1925). The concept of position in sociology. *Publications of the American Sociological Society, 20(1), 1-14.*

Park, R. E. (1926). "The urban community as a spatial pattern and moral order", in Burgess, E. W. (ed.). *Urban Community.* Chicago: University of Chicago Press.

Parry, K. (2012). *Measuring racial segregation at different geographical scales in Cape Town and Johannesburg* (Unpublished Master's Thesis). University of Stellenbosch, South Africa.

Parry, K., and van Eeden, A. (2015). Measuring racial residential segregation at different geographic scales in Cape Town and Johannesburg. *South African Geographical Journal, 97*(1), 31-49.

Peach, C. (1996). Good segregation, bad segregation. *Planning Perspectives, 11*(4), 379-398.

Peach, C. (2005). "The ghetto and the ethnic enclave", in Varady, D. P. (ed.). *Desegregating the city: Ghettos, enclaves and inequalities.* Albany: State University of New York Press.

Peires, J. B. (1996). *The dead will arise: Nongqawuse and the Great Xhosa Cattle-Killing Movement of 1856-57.* Johannesburg: Ravan Press.

Phirwa, M. (2004). *Small area dissemination – housing and population census.* Pretoria: Statistics South Africa (Stats SA).

Plaatje, S. T. (2007). *Native life in South Africa.* Johannesburg: Picador Africa.

Phimister, I., and van Onselen, C. (1980). The political economy of tribunal animosity. *Journal of Southern African Studies,* 6(1): 1-41.

Potugalia (2014). *PORT ELIZABETH – Motherwell Township,* photograph, viewed 19 March 2016. <http://www.panoramio.com/photo/104179530>.

Préteceille, E. (2011). Has ethno-racial segregation increased in the greater Paris metropolitan area? *Revue Française de Sociologie,* 52(1), 31-62.

Quillian, L. (1999). Migration patterns and the growth of high-poverty neighborhoods, 1970--1990. *American Journal of Sociology, 105*(1), 1-37.

Quillian, L. (2012). Segregation and poverty concentration: The role of three segregations. *American Sociological Review, 77*(3), 354-379.

Reardon, S. F., and Firebaugh, G. (2002). Measures of multigroup segregation. *Sociological Methodology, 32*(1), 33-67.

Reardon, S. F., and O'Sullivan, D. (2004). Measures of spatial segregation. *Sociological Methodology, 34*(1), 121-162.

Reardon, S. F., Matthews, S. A., O'Sullivan, D., Lee, B. A., Firebaugh, G., Farrel, C. R., and Bischoff, K. (2008). The geographic scale of metropolitan racial segregation. *Demography,* 45(3): 489-514.

Reardon, S. F., Farrel, C. R., Matthews, S. A., O'Sullivan, D., Bischoff, K., and Firebaugh, G. (2009). Race and space in the 1990s: changes in the geographical scale of racial residential segregation, 1990-2000. *Social Science Research*, 38(1), 55-70.

Redgrave, J. J. (1947). *Port Elizabeth in bygone days.* Wynberg: Rustica Press.

Rizel Engineering. (n.d.) *Fairview Link Housing Project*, photograph, viewed 19 March 2016. <http://www.rizelengineering.co.za/fairview-link-housing-project>.

Ross, S. L., and Turner, M. A. (2005). Housing discrimination in metropolitan America: Explaining changes between 1989 and 2000. *Social Problems, 52*(2), 152-180.

Rotberg, R. (1988). *The founder: Cecil Rhodes and the pursuit of power.* Johannesburg: Southern.

Saff, G. (2002). Residential segregation in South Africa and the United States of America. *Safundi: The Journal of South African and American Studies,* 3(1), 1-29.

Sampson, R. J. (2012). *Ghetto American city: Chicago and the enduring neighbourhood effect.* Chicago: University of Chicago Press.

Schelling, T. C. (1971). Dynamic models of segregation. *The Journal of Mathematical Sociology, 1*(2), 143-186.

Schensul, D., and Heller, P. (2011). Legacies, change and transformation in the post-apartheid city: Towards an urban sociological cartography. *International Journal of Urban and Regional Research, 35*(1), 78-109.

Schwabe, C., and O'Donovan, M. (1999). The use of census data to develop a geodemographic or lifestyle segmentation system for South Africa. *South African Journal of Demography,* 7(1), 51-61.

Seekings, J. (2010). *Race, class and inequality in the South African city.* Cape Town: Centre for Social Science Research (CSSR), University of Cape Town.

Settles, I. H. (1996). Use of an intersectional framework to understand Black women's racial and gender identities. *Sex Roles,* 54(9), 589-601.

Shields, R. (2013). Lefebvre and the right to the open city? *Space and Culture, 16*(3), 345-348.

Simon, D. (1989). Crisis and change in South Africa: implications for the apartheid city. *Transitions of the Institute of British Geographers,* 14(2), 189-206.

Small, M. L. (2004). *Villa Victoria: the transformation of social capital in a Boston barrio.* Chicago: University of Chicago Press.

Smit, D. (1989). *The political economy of urban and regional planning in South Africa, 1900-1988: towards theory to guide progressive practice* (Unpublished doctoral thesis). Durban: University of Kwa-Zulu Natal.

Soja, E. W. (2009). *Seeking spatial justice*. Minesota: University of Minesota Press.

South African National Space Agency. (2012). *Fundisa Disk.* Hermanus: South African National Space Agency (SANSA).

South African Reserve Bank. (2012). *Annual Report, 2011/12.* Pretoria: South African Reserve Bank (SARB).

Stack, C. B. (1974). *All our kin: strategies for survival in a Black neighbourhood.* New York: Basic Books.

Statistics South Africa. (1998). *Annual Report, 1998.* Pretoria: Statistics South Africa (STATS SA)

Statistics South Africa. (2011). *Census 2011 Statistical Release.* Pretoria: Statistics South Africa (STATS SA).

Swanson, M. W. (1977). The sanitation syndrome: Bubonic plague and urban native policy in the cape colony, 1900-1909. *The Journal of African History, 18*(3), 387-410.

Swart, P. (1986). *Die Munisipale van Port Elizabeth* (Unpublished Master's Thesis). Nelson Mandela Metropolitan University, South Africa.

Tatz, C. M. (1962). *Shadow and substance in South Africa: a study in land and franchise policies affecting Africans, 1910-1960.* Pietermaritzburg: University of Natal Press.

Telles, E. E. (1992). Residential segregation by skin color in brazil. *American Sociological Review, 57*(2), 186-197.

Theil, H., and Finizza, A. J. (1971). A note on the measurement of racial integration of schools by means of informational concepts. *The Journal of Mathematical Sociology, 1*(2), 187-193.

Turner, M. A., Santos, R., Levy, D. K., Wissoker, D., Aranda, C., and Pitingolo, R. (2013). *Housing and discrimination against racial and ethnic minorities 2012.* Report prepared for the USA Department of Housing and Urban Development. Washington, DC: The Urban Institute.

Turok, I. (1994). Urban planning in the transition from apartheid: part 1: the legacy of control. *The Town Planning Review,* 65(1), 243-259.

Turok, I. (2001). Persistent polarization post-apartheid? progress towards urban integration in cape town. *Urban Studies, 38*(13), 2349-2377.

Van Valey, T. L., Roof, W. C., and Wilcox, J. E. (1977). Trends in residential segregation: 1960-1970. *American Journal of Sociology, 82*(4), 826-844.

Wang, D., Li, F., and Chai, Y. (2012). Activity spaces and sociospatial segregation in Beijing. *Urban Geography, 33*(2), 256-277.

Weeks, J. R. (2004). "The role of spatial analysis in demographic research", in Goodchild, M. F., and Janelle, D. G. (eds.). *Spatially integrated social science: examples in best practice.* New York: Oxford University Press.

White, M. J. (1983). The measurement of spatial segregation. *American Journal of Sociology, 88*(5), 1008-1018.

White, M. J. (1986). Segregation and diversity measures in population distribution. *Population Index, 52*(2), 198-221.

White, M. J. (1986). Segregation and diversity measures in population distribution. *Population Index, 52*(2), 198-221. White, M. J. (1987). *American neighbourhoods and residential differentiation.* New York: Russel Sage Foundation.

White, M. J. (2004). *Report on USBC segregation measures peer review.* Suitland: USA Census Bureau Department.

Williams, J. J. (1948). Another commentary on so-called segregation indices. *American Sociological Review, 13*(3), 298-303.

Wilson, W. J. (1987). *The truly disadvantaged: the inner city, the underclass, and public policy.* Chicago: University of Chicago Press.

Wilson, W. J. (1996). *When work disappears: the world of the new urban poor.* New York: Alfred A. Knopf.

Winship, C. (1977). A revaluation of indexes of residential segregation. *Social Forces, 55*(4), 1058-1066.

Wodtke, G. T., Harding, D. J., and Elwert, F. (2011). Neighborhood effects in temporal perspective: The impact of long-term exposure to concentrated disadvantage on high school graduation. *American Sociological Review, 76*(5), 713-736.

Wong, D. W. S. (1996). "Aggregation effects in geo-referenced data", in Griffith, D. (ed.). *Advanced Spatial Analysis.* Boca Raton: CRC Press.

Wong, D. W. S. (1999). Geostatistics as measures of spatial segregation. *Urban Geography, 20*(7), 635-647.

Wong, D. W. S. (2003). Implementing spatial segregation measures in GIS. *Computers, Environment and Urban Systems, 27*(1), 53-70.

Wong, D. W. S. (2008). A local multidimensional approach to evaluate changes in segregation. *Urban Geography, 29*(5), 455-472.

Wu, X. B., and Sui, D. Z. (2001). An initial exploration of a lucranity-based segregation measure. *Environmental and Planning B: Planning and Design,* 28(1), 433-446.

Yinger, J. (1995). *Closed doors opportunities lost: the continuing cost of housing discrimination.* New York: Russel Sage Foundation.

Zelinsky, W., and Lee, B. A. (1998). Heterolocalism: An alternative model of the sociospatial behaviour of immigrant ethnic communities. *International Journal of Population Geography, 4*(4), 281-298.

Zhao, B., Ondrich, J., and Yinger, J. (2006). Why do real estate brokers continue to discriminate? evidence from the 2000 housing discrimination study. *Journal of Urban Economics, 59*(3), 394-419.

Zoloth, B. S. (1976). Alternative measures of school segregation. *Land Economics, 52*(3), 278-298.

Appendices

APPENDIX A: INTERVIEW SCHEDULE

Department of Geography, Rhodes University

Post-apartheid apartheid? Integrating census data and GIS to investigate post-apartheid integration in Port Elizabeth, South Africa, from 1996-2011.

Semi-Structured Interview

Background

I am completing my Master's degree at Rhodes University. My research is investigating changed in racial residential segregation from 1996-2011 using data from the National Censuses. I would appreciate your response to the questions laid out and your comments on my research findings. This interview will be conducted in alignment with the Rhodes University Ethnical Standards. Interviewees will have the option to remain anonymous.

---

1. Have policies been formulated by national and local government to facilitate post-apartheid residential integration?

---

2. If yes, can you elaborate on the key strategies set out in these policies?

---

3. Have any quantifiable targets been set towards achieving post-apartheid integration?

4.

> Overall, my study showed that racial segregation decreased by 13.1 % from 1996 to 2011 (declining by 5.4 % from 1996 to 2001 and by 7.7 % from 2001 to 2011).

Would you describe this as an acceptable rate of decline and why?

---

5. Based on the racial self-identification of individuals in the National Censuses from 1996-2011, the racial distribution pattern of the city's population reveals that individuals are still largely confined to their previously designated group areas.

Can you suggest possible reasons for this?

---

6. The majority of population redistribution that has occurred has involved the movement of Black population groups into areas that were formerly White-designated, while movement in the reverse directions has been limited.

Can you suggest possible reasons for this pattern of migration?

---

7. Can you identify factors (operating at both a small and large scale) which have impacted on population redistribution /a lack thereof?

---

8. Can you comment on the capacity of government to facilitate racial residential integration?

---

9. What challenges and constraints have been encountered in facilitating post-apartheid racial residential integration?
