Developing a GIS Based Method for School Site Identification in the Rural Eastern Cape

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Abstract

Historically, South Africa has not had equal education in terms of funding, curriculum or physical resources and structures. These issues are still present in contemporary South Africa and none more so than the issues surrounding "mud schools". Recently the Department of Basic Education (DBE) implemented a plan to eradicate inappropriate school structures using the Accelerated Schools Infrastructure Delivery Initiative program (ASIDI). Questions around effective placement of schools are now being asked. Using interviews and analysis of literature, this research developed criteria needed to determine how rural school sites are selected. Geographical Information Systems (GIS) was used to determine if current sites are in the most appropriate areas. The results of the research included a unique set of Eastern Cape criteria as well as an analysis of the current site selection methods used by the DBE. It also revealed that most of the schools are being constructed in acceptable areas. The main result that emerged from the research was that schools will be placed in areas where they are needed. Developing site selection criteria is still needed as South Africa seeks to reduce the education gap between rich and poor schools.

Keywords: Mud schools, School Site Identification, Criteria, Eastern Cape, GIS

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List of Abbreviations

APA	American Planners Association
ASIDI	Accelerated School Infrastructure Delivery Initiative
CDE	Californian Department of Education
CSIR	Council for Scientific and Industrial Research
DBE	Department of Basic Education
DEM	Digital Elevation Model (DEM)
DoE	Department of Education
ECSECC	Eastern Cape Socio Economic Council
EPA	Environmental Protection Agency
ERP	Education Rights Project
ESRI	Environmental Systems Research Institute
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GPP	Global Poverty Project
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
KZN DoE	Kwa-Zulu Natal Department of Education
LRC	Legal Resources Centre
NatEMIS	National Education Management Information System
NDP	National Development Plan
N.D.	No Date
NGO	Non-Governmental Organisation
SERC	Science Education Resource Centre
SGB	School Governing Body
SIBG	Schools Infrastructure Backlog Grant
UN	United Nations
UNDP	United Nations Development Program
UNICEF	United Nations
USA	United States of America
WEF	World Economic Forum
ZAR	South African Rand

CHAPTER 1: Introduction

Education is one of the most important aspects of modern society, it provides a basis for transferring cultural and scientific norms (Meyer, 1977). Education, especially basic education, is vital for survival as remuneration in employment is often based on education level. Education is seen by the United Nations Development Program (UNDP) as important; and universal education is a Millennium Development Goal, with the aim of achieving universal primary education by 2015 (UNDP, 2012). According to the UNDP (2012), primary education is seen as a way of combating poverty. This goal has seen out-of-school children drop from 102 million to 57 million globally from 2000 to 2011 and primary education enrolment has for the first time, reached 90 per cent in 2010 in developing countries (UNDP, 2012). There are, however, 57 million children who are not in schools and the majority of them are girls. UNICEF (2013) notes that while great strides are being made, the pace at which this is occurring will mean that a few developing countries will not attain universal primary education by 2015.

Education does not occur in a void, and needs to be conducted under conditions of suitable quality in order to be effective. Many schools around the world face difficult conditions on a daily basis and have to conduct lessons in inappropriate structures or out in the open. The Global Poverty Project (GPP) believes that by creating pro-poor infrastructural projects there could be a revolutionary elimination of poverty (GPP, 2013). Building schools provides education that breaks the cycle of poverty (GPP, 2013). Inappropriate infrastructure is a reality in many developing nations and it is truly a reality in South Africa (GPP, 2013).

Education in South Africa has always been surrounded by controversy. Throughout much of South Africa's history blacks were denied the same education as white children. This was apparent during apartheid where black and white children were purposefully educated to fit different spheres of the economy. In post-apartheid South Africa new plans, promises and programmes were put in place by the Department of Education (now the Department of Basic Education and Department of Higher Education) and the National Government. It was proposed that any child regardless of race could be educated in the same system and could go to school to receive quality education. Problems surrounded this promise: many schools did not have qualified teachers or lacked equipment and in some areas there were no schools. Some classes were too full, while in other parts of the country, schools were near empty.

These issues are still evident around the country but none more so than in the Eastern Cape Province. The problems in the education sector have attracted attention from various civil society groups. "Equal Education" advocated for minimum norms and standards for school infrastructure as many schools in the Eastern Cape (and South Africa as a whole) did not have sanitation or ablution facilities, electricity, libraries or fences (Equal Education, 2013). "Section 27", a public interest law centre, began protest action against the National Government for improvements in basic education. Various other sections of civil society and political parties became interested in the lack of educational infrastructure in the Eastern Cape.

In 2010 "The Legal Resources Centre" (LRC) went to court to challenge the issues faced by seven schools in the Libode Education District. The LRC recognised that many schools in the Eastern Cape were not built appropriately and that many schools in South Africa and the Eastern Cape lacked the appropriate infrastructure. Following lengthy litigation battles between the LRC and the Department of Basic Education (DBE), Eastern Cape Government, O.R. Tambo District Municipality and the Government of the Republic of South Africa, ZAR 8.2 billion was set aside to replace "mud schools" in South Africa under an initiative known as The Accelerated Schools Infrastructure Delivery Initiative (ASIDI) (LRC, n.d.). ASIDI emerged as part of the Schools Infrastructure Backlog Grant (SIBG) and aims to replace 510 schools in South Africa that are seen as "inappropriate". These schools are deemed to be dangerous and not suitable for education. ASIDI initially released a list of schools that were to be replaced, but did not state in what order they would be replaced or where these schools were. This project will also provide sanitation and electricity to various schools which did not have access to these. Over ZAR 6 billion will be spent in Eastern Cape alone. This money would be used to eradicate "mud schools" throughout South Africa as well as replace the seven schools in the Libode district (LRC, n.d.). The issue with this, however is that the DBE and others involved in the building of these schools do not have any agenda besides "replacing the mud schools". The lack of planning is likely to lead to poor decisions as where to place schools, which can waste large amounts of money and time, and supply improved, but unusable facilities in the province. The initial goal of the LRC was to secure funding to replace the seven schools in the Libode Education District, but in the settlement of the case funding was provided to eliminate all "mud schools" in South Africa. Most of these schools are located in the Eastern Cape. Money was also set aside to improve sanitation, safety and security, and to improve laboratory infrastructure at schools (LRC, n.d.).

This case was seen as a victory for many schools in the Eastern Cape, but the reality of improving schools and infrastructure on the ground is not a simple task. The LRC recognised that there was a need to determine if schools were being sited correctly and the state of the schools. LRC also needed to monitor if schools were getting what they needed, and if some schools actually needed to be replaced at all. They felt that in some cases schools should be closed and not rebuilt based on low learner numbers or proximity to better schools. A situation they wished to avoid was where some schools may be built in villages that have dwindling populations and schools in high population areas were ignored. Funds were thus made available, for this research, by the LRC to determine where schools that needed to be replaced were, what condition they were in, where schools should be built, and if schools that are being replaced are in the correct areas. The issue that arises now is how to plan effectively for optimal use of the funds.

Aim

The aim of this research was to demonstrate the use of Geographical Information Systems (GIS) as a tool for planning the optimal sites for rural schools in the Eastern Cape, South Africa.

Objectives

1. Review online and print media as well as expert opinion on South African and Eastern Cape education and provide a background to the current issues;
2. Identify and characterise a suitable study area and study sites along with school districts;
3. Compile and assess existing spatial and non-spatial data for the Eastern Cape and selected sites including the physical environment and location of ASIDI schools;
4. Identify criteria for Suitability Analysis;
5. Conduct Suitability Analysis to identify best locations for school sites (as well as verification of desktop analysis);
6. Create a working conceptual "model" for school site selection

Research Area

The Eastern Cape Province is located on the south eastern seaboard of South Africa. It shares borders with the Western Cape to the west, Northern Cape to the north-west, Free State to the north and Kwa-Zulu Natal to the north-east. Lesotho, an autonomous country, is located to the north. The Eastern Cape covers 13.8% (168 966km^2) of South Africa and is home to 12.7% (6

562 053) of the population of 52 000 000 as illustrated in Table 1. It has predominantly undulating topography with mountainous areas around the Lesotho border and in the interior. The major population centres are located on or near the coast (Port Elizabeth, East London). Port Elizabeth is the largest city and Bhisho is the capital of the province. There are large numbers of people who still live in rural areas, most notably in the former homeland areas. The rural population amounts to approximately 57% situated in dense rural and peri-urban concentrations.

Table 1: Provincial statistics (Source: StatsSA, 2011).

Province	Population	% of total	Land Area (Sq. Km)	% of total	Education Enrolment (Ages 5-24)	% of total	Unemployment %
Eastern Cape	**6562053**	**12.70**	**168966**	**13.84**	**2040311**	**31.09**	**37.4**
Free State	2745590	5.30	129825	10.63	736002	26.81	32.6
Gauteng	12272263	23.70	18178	1.49	2616530	21.32	26.3
KwaZulu-Natal	10267300	19.80	94361	7.73	3020720	29.42	33
Limpopo	5404868	10.40	125754	10.30	1837198	33.99	38.9
Mpumalanga	4039939	7.80	76496	6.27	1195535	29.59	31.6
North West	3509953	6.80	104882	8.59	880621	25.09	31.6
Northern Cape	1145861	2.20	372889	30.54	289812	25.29	27.4
Western Cape	5822734	11.30	129462	10.60	1221232	20.97	21.6
TOTAL	51770560		1220813		13837961	26.73	31.16

Administratively, South Africa is divided into Provinces, which are divided into District Municipalities. District Municipalities are divided into Local Municipalities and then further divided into Wards, which are electoral subdivisions within the local municipalities. The Eastern Cape Department of Education (DoE) makes their own division for administration of schools in a given area. These divisions are called Education Districts which are overseen by a District Office which is responsible for overseeing the schools that lie within them. The Education Districts generally follow the Local Municipality divisions, but some exceptions do exist. For example, when a Local Municipality's borders are changed then it may not reflect in the borders of the Education District. For the purpose of this research, the focus area will be based on the education district demarcation. There are 23 Education Districts in the Eastern Cape with an average size of 7, 343 km^2. The largest district is Graaf-Reinet, which is 39, 870 km^2 and the smallest is Bizana with an area of 2, 411 km^2.

The focus of the research will be on the Butterworth and the Lusikisiki Education Districts (Figure 1). Located in the former Transkei, the Butterworth district is 3, 323 km^2 and is fairly densely populated at 109 people per km^2. It has 391 schools within its boundary and 42 are

marked for replacement. The Lusikisiki district is 3, 912 km^2 and is slightly more densely populated with 164 people per km^2. There are 360 schools in Lusikisiki district and 49 of those schools are slated for replacement. Figure 1 indicates the location of the study areas. Geographically, they are not neighbours, but they do display similar social and physical characteristics.

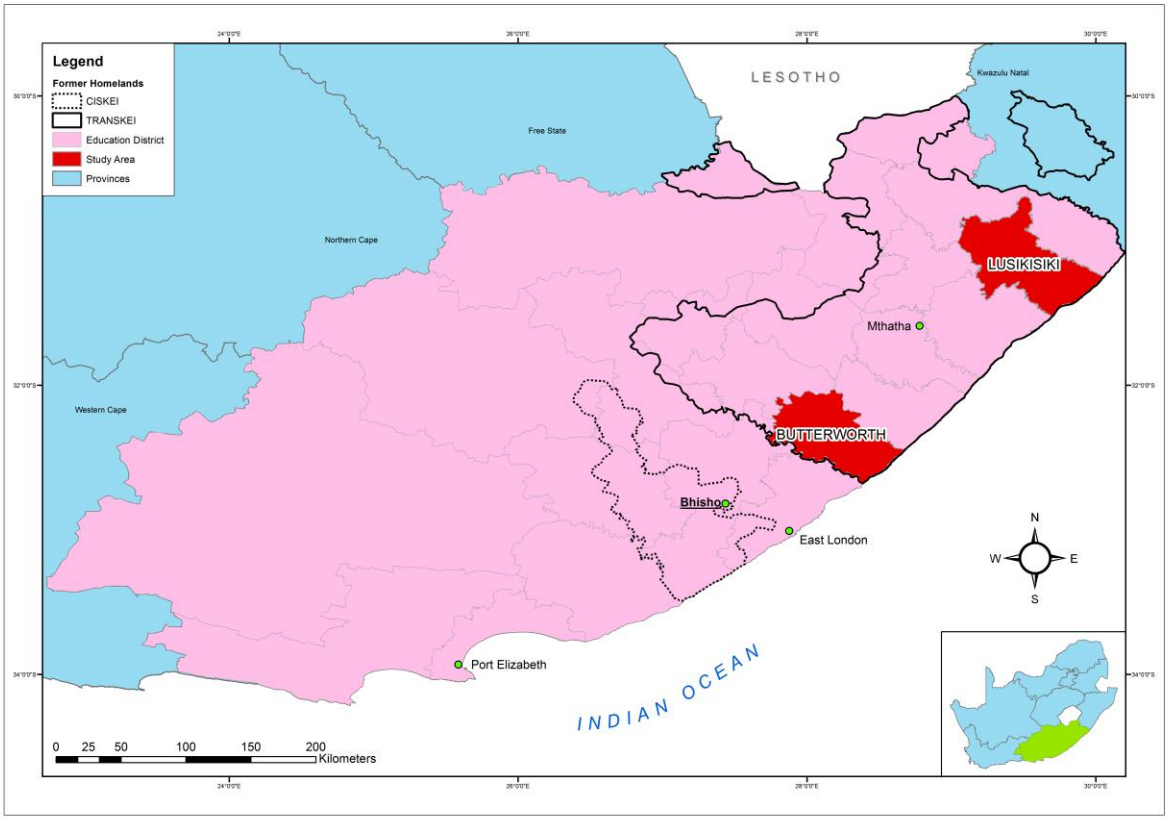

Figure 1: Location of the study areas in the Eastern Cape, South Africa.

After the collapse of apartheid, the boundaries of the Eastern Cape were delineated and its new land area included the former homelands of the Transkei (the largest of the homelands) and Ciskei. These homelands were underdeveloped during the apartheid period and lackedhealthcare, infrastructure, education and poverty reduction programmes that were unresolved. These problems have not been resolved effectively and still affect the Eastern Cape today. Over 37% of the Eastern Cape population is unemployed. Table 1 shows statistics for South Africa by province. The Eastern Cape, with 13% of the land area, (second largest province) is home to 13% of the population (third largest) has the second highest education enrolment (31%) and the second highest unemployment (37%). These statistics are important in this research as they indicate that a larger proportion of the Eastern Cape population is

enrolled in education than in the other provinces. (Further socio economic variables are given in Chapter 4 (Results) of this research as they form a justification for the site selection).

The former homelands appear to still have many issues that need to be addressed (Andrew, Shackleton & Ainslie, 2003) most notably poverty, employment, healthcare education and livelihood strategies. Apart from poor water distribution and high proportions of youth, certain areas, schools and other education facilities are very poor; many schools lack the fundamental necessities (water, electricity and proper structures) to operate (Harber, 2001).

It is proposed that the correct infrastructure in schools can create agreater learning potential, for example, schools with the facilities such as computer laboratories and science laboratories will produce students who recognise the importance of science and technology in society (Van Rooyen, 2010). In many schools it is also unsafe to conduct any classes as there are fears that walls and roofs will fall in on the students and injure them. Some schools do not have roofs and so in summer the students are exposed to the sun and in winter they are exposed to the cold (Van Rooyen, 2010). Some schools may have classrooms, but lack water and sanitation facilities (Van Rooyen, 2010). This often discourages female students who are menstruating from attending school as they have to deal with a lack of privacy, often they have to walk home to use the toilets and do not return to school because of the distance (Van Rooyen, 2010). It is thus extremely important to maintain and encourage an environment that is conducive to learning. Norms and standards which are set by the DBE that are monitored and understood by all stakeholders would be extremely helpful in reducing absenteeism and creating comfortable learning environments (Van Rooyen, 2010). This research aims to contribute to a better understanding of the criteria that should be considered when siting schools. A clear set of criteria is sorely needed to eliminate the ambiguity that may be faced by contractors, engineers, planners and educators when planning new school development.

Structure of the Thesis

Chapter 1 (this chapter) introduces the research topic and provides the educational context both locally and nationally. It also provides the aim and objectives while discussing the motivation of the research. Chapter 2 provides the theoretical framework of this research denoted from international and local literature. This chapter also discusses the theory and use of GIS while also explaining its use in this context. The methods used to complete the objectives are presented in Chapter 3.Chapter 4 presents the results of the research, while Chapter 5 provide

a discussion of the research in relation to the results (Chapter 4) and the theoretical context (Chapter 2).The thesis concludes with Chapter 6 which provides a remark on the current norms and standards and the necessity of further research into developing rural school placement guidelines.

CHAPTER 2: Literature Review and Background

Introduction

Globally, education is considered one of the cornerstones of society. Access to quality education is considered a basic human right: the United Nations (UN) made a series of goals that each country should achieve by 2015 (UNDP, 2012), one of which was "universal primary education". The Millennium Development Goals are a set of eight goals that a country should achieve by 2015 (UNDP, 2012). Many countries will not achieve these goals in the set as they face many challenges. South Africa is likely to achieve these goals by 2015, but many sub-Sahara African countries will not (UNDP, 2012). In this sense, it may appear that South Africa has very few educational issues, but this is not the case. Recently, a report by the World Economic Forum (WEF) stated that South Africa's primary education was ranked 132nd out of 144 countries (Schwab, 2012). On the criterion "Access to schools by children," South Africa was ranked 115th (Schwab, 2012). What makes this situation seem exceptionally bleak is that strength of Maths and Science in South Africa was ranked second last. This clearly indicates that although universal primary education might be achieved by 2015, the quality of the education is extremely poor (Schwab, 2012). Education is seen by the WEF as a pillar of competitiveness as basic education increases efficiency of workers (Schwab, 2012). Workers who do not have any formal education can only complete a limited set of tasks. Lack of basic education can thus be a constraint on business and innovation in a country (Schwab, 2012). There is therefore a need to examine educational systems in South Africa.

Other countries have experienced issues in education which are very similar to South Africa. India has had problems delivering schooling for its large population. Inadequate schools, curriculum ambiguity and lack of schools are severely hindering the country's development (Lall, 2005). Millions of children are not enrolled in a formal educational facility and some facilities are inadequate (Lall, 2005). Studies done on 188 government funded schools in India found that more than 89% of schools are without toilets, 59% had no drinking water and very few schools had toilets for different genders (Lall, 2005). Furthermore, most schools have high teacher absenteeism rates. An increased proportion of the national budget and initiatives to provide basic services have not had a noticeable effect, and in practice, no funds have reached poor rural schools (Lall, 2005). While India's tertiary institutes are considered acceptable, primary and secondary schools face many challenges (Lall, 2005). India is beginning a series

of programmes such as increases in funding and new policies in order to bring the education system in line with global expectations (Lall, 2005).

Zimbabwe once had one of the best education systems in Africa. It created many jobs and universal education was achieved (Chimhowu, 2009). Following the economic downturn and crisis in Zimbabwe this has changed, as pass rates in the national O-levels dropped from 70%, in the 1990 to 2000 period, to 12 % in the mid-2000s (Chimhowu, 2009). School was cancelled for the year in 2008 as teachers were striking and funds were no longer reaching schools. An astounding 94% of rural Zimbabwean schools were closed in 2009 and some remain closed today (Chimhowu, 2009). Very few schools can afford the teachers and those that still function pay all staff in foreign currency (This is mainly reserved for schools in the urban areas) (Chimhowu, 2009). School attendance rates were as low as 20% with some schools lacking basic necessities to stay functioning. Many teachers are fleeing to South Africa, Botswana and Mozambique (Chimhowu, 2009). The root cause identified by Pswaray and Reeler (2012) was the decline in investment in the education system. From 1980 to 1985 as much as 30% of the GDP was spent on education which reflected Zimbabwe's 'Education for All' ideology. From 1991 to 2001 only, however, 7% of the GDP was spent on education (Pswaray and Reeler, 2012). Coupled with a massive economic downturn and mega-inflation the education sector was severely impacted. Reinvestment in the education system has begun and pass rates have increased to 18% with expected pass rates of 42% by 2015 (Pswaray and Reeler, 2012). In reality, however, this is not expected to be achieved. In November 2012, the pass rate dropped from 19.5% in 2011 to 18.4% (The Herald, 2014); the 2013 results increased by 2.32% to 20.7% (The Herald, 2014). The June 2014, examination results of "O" levels were approximately 13% lower than the previous year's June results which stood at 37% (News Day, 2014).

History of South African Education

The history of education in South Africa has long been associated with racism and inequality. During the early colonial era, schools were organised in the Cape by the Dutch East India Company and were governed by the strict rules of the Church (le Roux, 2011a). These schools were set up in 1658 and catered for slaves (mainly from Malaysia and the South China Sea) and to Khoikhoi. The school served the purpose of converting slaves to Christianity and teaching slaves to speak Dutch (le Roux, 2011a). The first European school was established in 1663, but children of slaves could also attend (le Roux, 2011a). Many of the schools established

during the British occupation, around the 1800s, were mission schools or schools based on education systems in Britain (le Roux, 2011b). Education in the Afrikaner Republics (Orange Free State and Transvaal) during the 1800s was strongly centred on Christianity and the Afrikaans language, and formed the basis for the establishment of many schools. Many black students here were educated by mission schools who sought to "educate the native population" (le Roux, 2011b). The education often sought to eliminate "tribal" customs as the missionaries saw this as troublesome in the student's daily life (Ngubentombi, 1989).

From around 1854, the focus of the Cape Colonial system was to bring the "natives" into the industrial age in order to avoid any more costly border wars in contemporary Eastern Cape (Ngubentombi, 1989). This brought about the "Native Education" scheme which was championed by Lieutenant Governor Sir George Grey, who was responsible for the education and peaceful subjugation of the African people. He wished for the African population between Port Elizabeth and Natal to become more civil by opening education centres for the children (Ngubentombi, 1989). The system was similar to what the missionaries were currently doing, but the purpose differed as they wanted the native population trained in industrial occupations as interpreters, evangelists and schoolmasters (Ngubentombi, 1989). This system was based on inspections by the colonial authorities and subsidies to the mission schools to continue their work. As expenditure on black African education increased so did control over the mission schools which were pressured into providing industrial education (Ngubentombi, 1989). This curriculum was popularly supported in Transkei as schools were set up to teach courses such as carpentry, masonry, bricklaying and blacksmithing, andfield and Animal Husbandry was run as a course from the Teko Vocational School in Butterworth (Ngubentombi, 1989).

In 1921, detailed curricula and syllabuses were established in South Africa: primary education would consist of two sub-standards and six standards. The subjects included "religious and moral instruction, health education, home language, an official language, geography and history combined, agriculture, arithmetic, music, manual and industrial training and drill and games" (Ngubentombi, 1989:15). The language of instruction was the home language in the two sub-standards and English thereafter. The curriculum was relatively similar to that of white children. Several secondary schools were built throughout the Transkei at this time. Education, however, was never in the hands of the black students or teachers (Ngubentombi, 1989) although some teachers were elevated to the position of "district visiting teacher," they could

never become inspectors which was controlled by the National Government at the time (Ngubentombi, 1989).

From 1948 to the early 1990s, South Africa was ruled by a white minority who used education to perpetuate the system of racial separation and entrench ideas of differentiation amongst different race groups (Harber, 2001). The Bantu Education Policy of 1953 was the result of the Eiselen Commission which was set up to report on all aspects of native education. The report from the commission encouraged the National Government to resort to radical measures in order to "effectively reform the Bantu school system". It encouraged removing the black African population from the same education system as whites and govern them independently (Ngubentombi, 1989). The Bantu education system eliminated control from mission schools (which accounted for 90% of the black African schools) and introduced curricula based on racial separation that was controlled by the Bantu Education Department.

The Eiselen Commission encouraged local participation in education and the elimination of mission politics in education (Ngubentombi, 1989). Not only was this education system highly ineffective and costly, but moral issues abounded (Booyse, 2011). White schools were better funded than any other race group during this time. Black schools were funded by tax set up against the black population. Ultimately, this lead to numerous issues. Inadequate funds for the education of other races resulted in inadequate classroom structures, lack of teachers and decreased enrolment in schools in many areas (Booyse, 2011). Many civic organisations protested against these reforms and encouraged children to attend "cultural clubs" which bypassed the Bantu education system. This occurred until the National Government banned and closed the clubs. Problems soon began to emerge both in Transkei and Ciskei during the 1950's and 1960's: inadequate planning led to schools becoming over-burdened with students (Ngubentombi, 1989). The ratio of teachers to students rapidly increased, and while this occurred, many more learners began dropping out of the school system (Ngubentombi, 1989).

The proposed establishment of "independent republics" in South Africa led to the rise of the Bantustans. Each area was to govern its own affairs (Ngubentombi, 1989). This was the epitome of apartheid Separate Development Planning. In reality, however, all of the republics were only recognised by South Africa and were funded by the South African National Government. The South African government influenced all aspects of the "independent" republics including education (Ngubentombi, 1989). The Transkei became the largest of these republics. Education in Transkei was characterised by a lack of schools for children, a lack of

suitably qualified teachers, a lack of resources and a lack of funding. The establishment of the Department of Education in Transkei did little to solve this problem. Following the adoption of the recommendations made by the Cingo Commission (1962), the language of instruction in Transkeian primary schools was changed from mother-tongue (which in this case was predominantly isiXhosa) to either English or Afrikaans (Ngubentombi, 1989). This was cited as being detrimental to education in Transkei as many teachers taught regardless of the students understanding (Ngubentombi, 1989).

The Taylor Commission, which was submitted to the Government of Transkei in 1976, was of paramount importance to the improvement of schooling in Transkei and was earnestly taken into consideration by the Republic of Transkei Government (Ngubentombi, 1989). The Taylor Commission was formed in order to determine the quality of schooling in all sectors of the education in the Transkei. It outlined issues of the introduction of compulsory school attendance, provision of facilities, organisation of teacher placement and curriculum development (Ngubentombi, 1989). The Taylor Commission categorised the Transkei education system as "Stage 2," which meant that there was increased demand for education, limited education opportunities, limited adequately qualified teachers and numerous schools that are not appropriate (Ngubentombi, 1989). These characteristics of education remained in the Transkei for the duration of apartheid. Although some of the issues, such as poor infrastructure and lack of funding, were addressed with the advent of democracy in 1994, many problems still prevail today.

The recent history of the Eastern Cape DoE indicates that there are many issues inside the department which also need to be corrected in order to increase the quality of education in the province. In 2011, the Eastern Cape DOE was placed under National Government administration under section 100 (1)(b) of the Constitution of the Republic of South Africa, 1996 (Sello, 2013). Section 100 of the Constitution describes the intervention of the National Government in Provincial bodies: it is used "when a province cannot or does not fulfil an executive obligation in terms of the Constitution or legislation, the National Executive may intervene by taking any appropriate steps to ensure fulfilment of that obligation." (Constitution of the Republic of South Africa, 1996:51). This intervention was performed after the National Government recognised that the Eastern Cape DoE was performing poorly in its task of providing quality education for learners in Eastern Cape (Sello, 2013). Services such as replacement of "mud schools" and teacher appointments were not being delivered. After a year and a half of administration, it was announced that the Department of Basic Education would

gradually remove itself from the Eastern Cape DoE and that administration would only apply to finances and teacher appointments. The DBE claimed that the turnaround strategy was being implemented and that the Department was on a road to recovery (Sello, 2013). Under full control (section 100 (1)(b)), the Department was able to ensure that 2300 part time teachers were fully employed and ZAR 130 million was made available to teachers as a 'rural allowance' in order to encourage teachers to work in those areas. The ASIDI program was also successfully started in the rural Eastern Cape as well during this period. It appears, however, that full control of the Eastern Cape DoE would be reduced to partial control under section 100 (1)(a), which is where the specific Department is issued directives as to where improvements need to be made (Constitution of the Republic of South Africa, 1996). However issues still exist.

Many of the historical dilemmas related to the apartheid and the colonial era still prevail: former black schools have poor infrastructure and lack typical resources required by a school (Harber, 2001). What is remarkable is the fact that South Africa invests a higher percentage of the national budget in education than any other country of similar wealth (Anon, 1999), suggesting that money is not the issue, rather the distribution of money and planning. Even though the Constitution provides the right of adequate basic education to the citizens of South Africa, this is not always the case (Harber, 2001).

"Mud Schools"

"Mud schools" are still prevalent across the Eastern Cape and other provinces. "Mud-schools" are defined as schools that have inadequate structures or are in a bad state of disrepair (IBP, 2012). They often contain no resources for the teachers and students. There are close to 500 mud schools in South Africa, of which 400 are in the Eastern Cape (Legal Resources Centre, n.d.; IBP, 2012). Seven of these mud schools in the Libode District in the Eastern Cape along with Non-Governmental Organisations (NGOs) sued the Eastern Cape government, National government and the DBE (Legal Resources Centre, n.d.; IBP, 2012) for a failure to meet its constitutional right to provide adequate educational facilities at the seven schools. A landmark settlement was concluded by the Legal Resources Centre (LRC) on 4 February 2011, for ZAR 8.2 billion through the ASIDI program on behalf of seven mud schools in the Libode district (Legal Resources Centre, n.d.).

The Eastern Cape is serviced by over 5700 schools, the majority of which are located in the former Transkei and Ciskei homelands (DBE, 2014). There are estimated to be over two

million learners in the school system in the Eastern Cape (Hendricks, 2012), which equates to around 350 learners per school. The Eastern Cape appears to be well served against the backdrop of those statistics, however, this is not the case. Many schools in the Eastern Cape, especially in the former homeland areas, are either inappropriate and lack structural integrity or are under staffed and lack appropriate teaching equipment (Hendricks, 2012). Many of these schools are located in rural areas and do not receive the necessary support to continue operations (Hendricks, 2012). The Eastern Cape also suffers from high dropout rates; according to information provided by the South African Treasury Report, of 100 Grade Oness who start school, only 25 make it to matric (Hendricks, 2012). The matriculation rate in the Eastern Cape is also consistently under the national average (Hendricks, 2012).

Beginning with the practicalities of school attendance: many rural learners do not attend schools as they have to walk long distances to get to school (Hendricks, 2012). Some do not walk to school as they fear rape and robbery while they travel. In certain cases, where transport is provided, overloading in buses has occurred. In one such case, two busses designed to carry 60 learners each was found to have 326 learners squeezed into them (Hendricks, 2012). Results of a survey completed in 2005, suggested that 9.6% of schools in the Eastern Cape were 'disaster' schools, while schools with 'very weak' school buildings accounted for 53% of the survey (Hendricks, 2012). Schools are often left to their own devices by the Eastern Cape DoE, which leads to parents and learners having to do regular maintenance and repair work (Hendricks, 2012). These problems would be alleviated with proper planning.

GIS and Planning

GIS is a tool that is well suited and extensively used in many planning contexts. "Suitability Analysis" is one of the most useful planning applications of GIS. It can be broadly defined as "identifying the most appropriate spatial pattern for future land uses according to specific requirements, preferences or predictors of some activity" (Malczewski, 2004: 4). It is unique in the way it could be used in almost every sector including agricultural activities, ecological distribution, environmental impact assessments and selecting best sites for public and private sector facilities among others (Malczewski, 2004). It is a versatile tool that can be used to map, analyse and visualise almost any data. GIS has been used by many agencies, organisations and governments in many areas of application and has been widely used in "Suitability Analysis" around the world.

GIS has been used to locate land for housing developments. Sorrentino *et al.* (2008) describes how GIS was used in Pennypack Creek Watershed, Pennsylvania, USA, to locate suitable areas for suburban housing locations. The main focus of this study was to determine if suitable land for housing was available in the catchment area and what impact they would have on the environment. This was achieved through the use of GIS to analyse the 100-year flood plain as well as scenarios of housing development location in different areas of the catchment (Sorrentino *et al.,* 2008). Results of the study confirmed that much of the current housing developments would be located in unsuitable areas such as 100-year flood plains, important tributary areas, steep slopes and wetlands (Sorrentino *et al.,* 2008). This GIS analysis used data from various state wide datasets and used criteria from government defined housing criteria. A potentially dangerous site allocation was avoided in this case with the use of GIS and relevant data.

In a very different context, Oheim (2007) uses GIS and suitability analysis to predict fossil sites in order to eliminate unnecessary guesswork. Suitability analysis is the process of determining the best location for a site. This process can be performed for hospitals, schools, malls or old fossil beds (Briney, 2014). It is important in site selection as it includes the next best site if the best site is not available (Briney, 2014). Oheim (2007), states that old methods of locating fossils are time consuming, speculative and accidental. GIS and suitability analysis can improve the process of locating fossil beds and streamline the entire process by giving visual data and provide information about site locations. Oheim (2007) found that by using suitability analysis one could locate areas of fossils and can predict fossil existence. A simple map created in GIS could limit areas and provide useful information on where to locate fossils. The suitability analysis used an equation to give certain layers more importance than others e.g. Geology was considered more important than vegetation so it was given higher importance in the equation (Oheim, 2007). The GIS allowed for the raster layers to be merged or added together to create a final layer where suitable areas were one colour while less suitable areas were other colours (Oheim, 2007). However suitability analysis is not limited to fossils.

An interesting use of GIS was demonstrated by Charabi and Gastli (2011) who used GIS to search for suitable sites to locate photovoltaic power farms (solar farms) in Oman. They used a series of GIS techniques as well as multi-criteria analysis to determine sites in Oman. Multi-criteria analysis is used to condense large problems with multiple criteria into a ranking system of best scenarios (Charabi and Gastli, 2011: 2555). The study included criteria based on Digital

Elevation Models, distances to major roads and solar radiation levels. They found that use of multi-criteria analysis to locate potential solar farms was a successful approach (Charabi and Gastli, 2011). Although these examples are not directly related to school site location, they demonstrate the principles of suitability analysis for sites using multi-criteria analysis.

GIS has been successfully used as a component in planning using socio-economic data to locate information. Rosero-Bixby (2004) conducted a study to determine how far people were from health services in Costa Rica and determine which areas were not effectively serviced. Using population data from a national census, medical facility data points and household data points Rosero-Bixby discovered that geographic inequalities existed in the provision of medical care. The population in the centre of Costa Rica had to walk long distances to access medical care while other areas were better catered for (Rosero-Bixby, 2004). He went on further to discover that approximately 9% of the population is underserved. These people resided mainly in "pioneering" areas, which are areas that are rural and far away from the cities where people are often more at risk of disease and injury, and lack medical facilities (Rosero-Bixby, 2004). Rosero-Bixby (2004) concludes that by examining socio-economic data with a GIS he could determine where exactly more clinics need to be placed to solve inequality in access to medical centres.

Svatos (2001) produced a paper which deals specifically with locating potential school sites in Delaware, USA. The aim of the study was to see if GIS is a suitable approach for locating potential school sites. Svatos (2001) used GIS analysis of current school data, environmental data, school district data and land use data to locate school sites. By using fundamental GIS processes such as intersection, buffers and selecting by attributes, Svatos (2001) was able to locate various areas that were suitable. The author then selected the site followed by a network analysis function to determine how many children were located near the plot that was selected. Although much of the second part of the paper uses proxy or 'fake data', it shows that GIS is an effective tool in locating school sites. Svatos (2001) believed that GIS can be used effectively for school site suitability analysis and planning.

Education Planning

Planning itself can be defined as the "process of determining organizational objectives and selecting a future course of action for their accomplishments" (Oklahoma State University, 2014). Planning is the basis of any human endeavour. Successful planning can lead to the establishment of a project, while unsuccessful planning can lead to unforeseen circumstances

and often failure of a certain project (Oklahoma State University, 2014). Planning can refer to a range of areas from town planning, conservation planning, future planning, financial planning urban and spatial planning and many others. Planning for schools in South Africa encompasses managing the "types" of planning mentioned above to effectively deliver schools to the correct areas for the lowest prices for the government. The failure of planning in this situation would be the loss of billions of Rand in funds, and more importantly still not solving the issue of access to adequate schools.

McDonald (2010) describes how school siting has not been well discussed in academic literature. She argues that education, environmental concerns and health issues have now come to the forefront of academics and media as these topics receive more coverage. She has shown that there is need for literature focused on school siting. Currently in the USA, a phenomenon known as school sprawl is occurring, which is the process whereby school sites are becoming larger and are located further away on the urban periphery (McDonald, 2010). This was as a result of norms and standards introduced in the 1960s (McDonald, 2010). Thus, McDonald calls for a focus on school siting and discussion to avoid these issues. Placing schools in locations that are far away from students can increase transport and congestion, create health issues and decrease safety (McDonald, 2010). This article suggests that school siting issues are not a South Africa-specific problem. In South Africa, a similar trend with a different cause is occurring. Farm schools are schools located on private farms (ERP, n.d.) established to educate the families of the farm workers. Farm schools are usually small and located on private property so are seen as inconsequential by the national government and farm owners leading to the closure of these schools due to withdrawal of government support (between 1996 and 2000) (ERP, n.d.). This has led to more children having to walk long distances to school in unsafe environments while others no longer attend schools (ERP, n.d.). MacDonald (2010) and Svatos (2001) provide useful insights into school siting, but besides these two authors, there appear to be few have engaged with school siting in academic literature.

School Norms and Standards in South Africa

According to the South African-based activist group Equal Education (2013) there are no formal definitions of what makes a school, what it must contain or what it should be. There are only guidelines, but none of these were entered into law until recently. Even these norms and standards are inadequate in certain respects. In 2008, the then Department of Education established detailed norms and standards which they proposed would be entered into law by

2010 (Equal Education, 2013). This did not occur and the norms and standards that were provided were ignored once Minister Naledi Pandor, who had been involved in the process, was reassigned in 2009. Minister Angie Motshekga, appointed as the Minister of The Department of Basic Education in 2009, reiterated that norms and standards were important and would be in place by 2011 (Equal Education, 2013). This date passed with no further progress. In response, Equal Education then embarked on a campaign to improve school standards by introducing minimum norms and standards (Equal Education, 2013). At the outset of this research the norms and standards had still not been passed into law. When this research project was nearing completion, the norms and standards were entered into law on the 19th of November 2013.

In 2008, the then Department of Education released the call for comments on the draft national minimum, uniform standards for school infrastructure. The draft gives full details for classroom size, size of school sites for various schools and gives a more detailed range of plans to accommodate the perceived differences in each province (DoE, 2008). This indicates that cultural differences may have been taken into account while the draft was created. Its stance on safety was extremely rigid and did not allow any school to transgress the safety standards. Failure to adhere to the standards would mean immediate closure (DoE, 2008). The goal of the draft was to ensure that all schools would meet functionality norms 10 years after implementation of the norms, and that all schools would be functioning optimally 20 years after implementation of the norms (DoE, 2008). The draft was seen as comprehensive, but did not cover all aspects of education. The draft was never finalised and was seemingly forgotten by the DBE when it was established in 2009. The norms presented in 2008 are more comprehensive than norms presented in 2013.

In 2012, the DBE published the *Guidelines Relating to Planning for Public School Infrastructure*. This was specific, but non-binding and lacked enforceability and responsibility (DBE, 2012). It was broadly based on the 2008 draft norms, but was not followed up in the 2013 draft norms published by the DBE. These guidelines, however, form the basis of the final minimum norms and standards that were finally published in November 2013. They have similar recommendations concerning classroom size and school sizes. The 2008 guidelines, however, have more content concerning planning for the school site than the final norms and standards published in 2013. It specifically mentions "feeder zones", which are areas that provide the school with learners, and proposed distances learners shouldwalk to a school (DBE,

2012). Specifically, it states that walking distances to schools should not be more than ten kilometres and the feeder zone should have a radius of five kilometres. The DBE (2012) states that the minimum size for a school site should be 2.8ha for a primary school and 4.8ha for a secondary school (DBE, 2012). Any deviations from these would have to be given to the minister to make special considerations. The guidelines even state that consideration should be given to environmental factors when planning for school sites (DBE, 2012). These aspects mentioned in the 2012 guidelines are missing in the subsequent 2013 draft norms and final document of the norms and standards published in 2013.

The DBE introduced the draft for Minimum Norms and Standards for Infrastructure in 2013 (DBE 2013a; Equal Education, 2013). It essentially gave an outline on the minimum norms and standards for schools (DBE 2013a). It was considered extremely general in its standards and norms and was challenged by Equal Education which proposed more concrete norms and standards as well as holding government responsible for failures (Equal Education, 2013). This was positive step towards ensuring that minimum norms and standards were published by November 2013. The DBE (2013) wished that, by introducing norms and standards, children throughout South Africa would have a quality education and that all teachers would have access to the same resources. This draft and final version however, does not explain how and where school sites should be located, which is a gap that this research aims to partially fill. The 2013 draft norms were criticised by Equal Education and the legal rights group, Section 27. They saw the 10-page draft as being extremely vague and lacking in any detail. The details which were published for comment in 2008, were not included in the 2013 version and the draft was severely lacking in who would be responsible for failures and other issues (Section 27, 2013). The draft also proposed that 18 months after publication, there would be a framework regarding specific norms and standards to be released (Section 27, 2013). This was criticised by as a delaying tactic. The use of the word 'ordinary' in the draft would lead to the exclusion of special needs schools and may lead to discrimination of schools with special needs students (Section 27, 2013). The NGOs dismissed the 2013 draft as it was not binding and norms and standards for schools lacked specificity (Section 27, 2013).

In November 2013, it was finally announced that the *Regulations Relating to Minimum Norms and Standards for Public School Infrastructure (South African Schools Act, 1996, Act no. 84 of 1996)* would be released and signed into action. The objectives set out by the regulations are to provide minimum norms and standards, ensure compliance with the new standards when

new schools and their additions are built and provide frameworks for the completion of school infrastructure backlogs (DBE, 2013b). It makes the claim that replacement of schools built from mud, asbestos, metal and wood must be prioritised. Those that do not have access to water, electricity and sanitation must also be prioritised and where these cannot be supplied, reasonable alternatives must be provided (DBE, 2013b). Under section seven in the norms and standards document, planning has very few considerations: the document only mentions that topography and location should be taken into consideration when planning for school sites (DBE, 2013b). It also gives a list of what should not be near a school. These include cemeteries, business centres, railway stations, taxi ranks, sewage treatment plants, public hostels, busy roads, and bottle stores. The document states that the location of the school should be easily accessible by roads, to sewage lines and other services (DBE, 2013b). The rest of the document does not refer to any other meaningful regulations related to site selection for schools. Once again, it follows the same pattern as the draft before it as it lacks in the planning for site selection category.

The National Development Plan (NDP) (2012) of South Africa is another state document which deals with education. The National Development Plan was developed by the South African government in order to

> "eliminate poverty and reduce inequality by 2030 through uniting South Africans, unleashing the energies of its citizens, growing an inclusive economy, building capabilities, enhancing the capability of the state and leaders working together to solve complex problems" (NDP, 2012:303).

The NDP is a 'road map' of the future of South Africa, which includes suggestions and possible solutions to problems currently faced by the country. Although not discussed in detail, there is a section that discusses school infrastructure (NDP, 2012). This section simply states that all schools should meet minimum norms and standards, no-fee schools should be targeted when planning for new infrastructure, learner safety needs to be taken into account, high speed broadband needs to be available to all schools and the use of mobile devices should be explored (NDP, 2012). While it is mentioned in the document, there is a severe lack of detail on education in the NDP.

However, this is expanded on in greater detail in the DBEs document '*Action plan 2014. Towards the Realisation of Schooling 2025'.* A more detailed document published by the DBE:

Action plan 2014, provides details goals that it would like to achieve by 2014. This document outlines 27 goals which should be achieved. One of the 27 goals is to "ensure that the physical infrastructure and environment of every school inspire learners to want to come to school and learn, and teachers to teach" (DBE, 2011: 150). This goal aims to provide a learning environment that is suitable and safe for learners no matter where they live or attend school (DBE, 2011). The DBE acknowledges that there are prevailing issues with school infrastructure and that this occurs mainly in the Eastern Cape and KwaZulu-Natal. The DBE also recognise that the standard of infrastructure varies greatly within each district. It thus alludes to proclamation of basic norms and standards for school infrastructure which were released in 2013.

More money has been spent on building new schools and upgrading others. In 2010, annual spending on school infrastructure was six times the 2000 levels, increasing from 1.6% to 7% of the GDP (DBE, 2011). In terms of actual progress with school infrastructure, the DBE state that the number of schools without services dropped from 24 000 to 4 500 which is reflected in a decrease of complaints in the "General Housing Surveys". Since 2004, 9% of homeowners complained about poor school facilities, while in 2009, this decreased to 5% (DBE, 2011). Average class sizes have decreased as well with classrooms used by more than 45 learners decreasing from 55% to 25% for the same period. The ASIDI initiative has greatly increased the funding and the channelling of funds to alleviate the issue of poor infrastructure.

The ASIDI programme hopes to improve planning and the monitoring of rules and procedures. The ASIDI programme encourages greater responsibility by the national departments for their role in education (DBE, 2011). It encourages the National Treasury, Department of Public Works, Department of Human Settlements and the Department of Rural Development and Land Reform to work with the Department of Basic Education to target better methodologies and infrastructure improvement in order to create sustainable and cost effective buildings (DBE, 2011).

The ASIDI programme will promote more innovative schools. Instead of simply "building schools," the programme will aim to create schools that are effective for an area (DBE, 2011). There will also be a greater focus on technical schools and a promotion of subjects such as computer applications technology, electrical technology and mechanical technology (DBE, 2011). Having guidelines and norms is important, but the publication acknowledges that there is a large difference between, not only rural and urban schools, but between 'normal' and

technical schools. Different schools have different requirements and the ASIDI programme has acknowledged that there are differences that need to be accounted for (DBE, 2011).There is also a recognition of the fact that much of the current funding for infrastructural development is inadequate (DBE, 2011). ASIDI hopes to provide alternative funding streams for infrastructural investment by working with the National Treasury and by working with businesses, NGOs and faith-based organisations at the local level (DBE, 2011). These options provide alternative revenue streams and the possibility of permanent connections to the schools and the communities (DBE, 2011).

Existing Norms and Standards for School Planning in South Africa

Criteria for locating school sites in South Africa are deficient at this point. The Council for Scientific and Industrial Research (CSIR) created a set of guidelines known as the "Guidelines for Human Settlement Planning and Design," which provides certain recommendations on settlement. The guidelines have recommendations for school sizes, access distances and population sizes necessary for optimal schools. These are broadly based on the *Notice 1439 of 2008 South African Schools Act 84 of 1996, Calls for comments on National Minimum Uniform Standards for School Infrastructure* (Green and Argue, 2012). Table 2 and 3 indicates school site sizes for secondary and primary schools. Secondary schools require slightly more space than primary schools. The guidelines suggest that a minimum site size of 1.9ha be used for small primary schools while a minimum size of 3.5ha be used for large primary schools. Small secondary schools should be no smaller than 2.4ha while large secondary schools should meet the minimum of 4.0ha in size. As seen in Table 3 the guidelines state that a school's access distance should not be more than 10km for small settlements and no more than 5km for larger settlements (Green and Argue, 2012).

Table 2: National primary school prototype suggestions (Source: Green and Argue, 2012:100).

Proposed National Primary School Types

SCHOOL PROTOTYPES	MINIMUM CAPACITY (no. of learners)	MAXIMUM CAPACITY (no. of learners)	NO. CLASSES per grade	MINIMUM SITE SIZE (ha) – includes sports fields of 0.9 ha	OPTIMUM SITE SIZE (ha) – includes sports fields of 1.8 ha
Small primary school	135	310	1	1.9	3.2
Medium primary school	311	620	2	2.8	4.4
Large primary school	621	930	3	3.5	6.2

Table 3: National secondary school prototype suggestions (Source: Green and Argue, 2012:96).

Secondary School Prototypes

SCHOOL TYPE	MINIMUM CAPACITY (no. of learners)	MAXIMUM CAPACITY (no. of learners)	NO. CLASSES per grade	MINIMUM SITE SIZE (ha) – includes sports fields of 0.9 ha	OPTIMUM SITE SIZE (ha) – includes sports fields of 1.8 ha
Small secondary school	200	400	2	2.6	3.9
Medium secondary school	401	600	4	3.2	4.6
Large secondary school	601	1 000	5	4.0	5.5

The Kwa-Zulu Natal Department of Education (KZN DoE) produced a similar document to that of the CSIR entitled *Space Planning Norms and Standards for Public Schools* which deals with planning guidelines around the selection of sites for public schools. The document explains key design principles, which include paying attention to the curriculum and how they affect classroom and school design. Important aspects were considered important are: shared use with the community, low maintenance of buildings, and schools should be designed to be inclusive of all types of students no matter their ability (KZN DoE, 2011).

The document recommends sizes for each use of the school, which includes general teaching space, specialist teaching space, learning space and non-teaching space. Table 4 indicates an example of the school site recommendations regarding space in Kwa-Zulu Natal schools.

Table 4: Proportions of space assigned to each space category in a school and minimum space assigned for each activity in a school for KwaZulu Natal (Source: KZN DoE, 2011: 13).

B. Norms and standards			
Space category	**m^2/FTE band between**		**Design issues**
General teaching Space	**1.0**	**1.2**	The design of classroom space should be flexible and adaptable. Modular standard furniture should be used. Some storage for materials and equipment should be provided in or near classrooms.
Specialist teaching space	**0.1**	**0.3**	Space and equipment should be provided that can be used for specialist teaching. Access to outside spaces and facilities for practical learning should be provided, such as planting, painting, and experiments.
Learning space	**0.4**	**0.6**	Access should be provided to space, materials and equipment, such as books and computers, to enable learners to conduct learning at their own pace for an adequate amount of time each week. This can be provided, in order to allow large group learning/teaching events and theatre or music performances.
Non-teaching space	**0.3**	**0.5**	Ensure there is adequate space for educators to work together in groups in order to prepare joint lessons and co-coordinated learning events. Space should be provided for the healthy and safe preparation and serving of food where schools accommodate feeding schemes.
Balance	**0.4**	**0.6**	Ensure that all commonly used routes are easily accessible and safe for all learners, including those in wheelchairs.

School site	**m^2/FTE**	
Site area	**See Section 5**	A key consideration should be the proximity of the school to the learners that use it.
Informal social/play area	**min. 1.5**	Provide stimulating/educational play equipment/material, such as climbing frames, and sandpit where possible.
Sports area	**min. 7.4**	Ensure that a range of sporting events can be accommodated that will cater for the interests of all learners. This should include, as a minimum, football and netball, even if full-size pitches are not provided.
Parking	**min. 0.3**	Parking for staff vehicles and a small number of visitors should either be on site or adjacent to the school site.
Garden plots	**min. 0.3**	Provided a portion of agricultural land within the school site, which may be used by the school or local community to cultivate produce. This produce may be used by the school as part of a feeding scheme.

C. Proportions of space			
Space category	**% of total area between**		**Location issues**
General teaching space	45	38	Ensure that the noise between classrooms is not disruptive and views from windows are not distracting.
Specialist teaching space	5	9	Equipment, services and space for more specialist teaching, such as practical experiments, should be provided within or near classrooms.
Learning space	18	19	This should be located centrally or in classrooms, and learners encouraged to use this in their free time – i.e. during break or after school.
Non-teaching space	14	15	Locate admin/staff area to ensure good supervision of school entrance and grounds.
Balance	18	19	Toilets should be provided as per National Building Regulations (See Tables 5, 6 & 7) and located where they can be easily supervised by staff.

These standards are fairly specific and give details as to how many families should be in an area for a school to be placed there. Table 4 indicates the proportions of space needed for each

activity and learning area and has proportions that each of these categories should occupy in the school. The KZN DoE has given extremely specific norms and standards so as to reduce the differences between the rich and poor schools. Schools throughout Kwa-Zulu Natal should fulfil the needs of the students without the influence of class or socio economic background. Ultimately, a school needs an active population to feed into it. The guidelines given by the KZN DoE addresses this proposing the household size, size of the community and type of community that can act as a feeder school. The actual minimum size of new schools is also given. Primary schools should be no smaller than 2.8ha and secondary schools should be no smaller than 4.8ha (KZN DoE, 2011). This includes accommodating the sports grounds. If sports grounds are shared then the site needs to be 1.4ha for primary and 2.6ha for secondary (KZN DoE, 2011).

The KZN DoE (2011) also describes the general conditions for school sites which are similar to the 2013 Norms and Standards presented by the DBE. The main differences relate to: evenly distributing the schools across a residential area and not locating two schools of similar type near each other; including the community in the consultation process; taking the sites' soil characteristics into consideration as certain soil types are considered problematic such as clay or refuse filling; preserving of vegetation should be considered and removal of vegetation should not be too costly; finally, storm water drains and servitudes should not interfere with the school site and should be safe if they are in the immediate area (KZN DoE, 2011). The KZN DoE gives additional information with regard to the appearance of the school site. The site itself should allow for a north/south orientation of the buildings to have access to the most amount of sunlight possible. Additionally, schools should face the street and have at least 50% of the sites border on a street (KZN DoE, 2011). The slope of the site should not exceed 1 in 40 (2.5% or 1.4^{o}) and should not be 1 in 15 (6.6% or 3.82^{o}) in the area of construction. Finally, the site should not be located below the 1:50 year flood line and if the site is located below this limit, then the school buildings should not be built (KZN DoE, 2011). These standards are given as a way for the KZN DoE to maintain a standard throughout the province based on its socio-economic features. It is proposed here that these norms and standards would be extremely beneficial to implement within the national framework.

Norms and Standards around the World

In the USA, different government agencies appear to have school location criteria that are effective for the siting of school structures. The American Planners Association (APA) created

a guidebook as early as 1963 and is the basis for many planners today (APA, 2013). This guidebook gives specific criteria for locating schools including minimum site sizes, accessibility, as well as classroom capacity standards among others (APA, 2013). The guidelines cover physical hazards as well as social considerations when building schools. Figure 2, for example, indicates how costs may increase if proper criteria are not followed and used when considering locations for school sites.

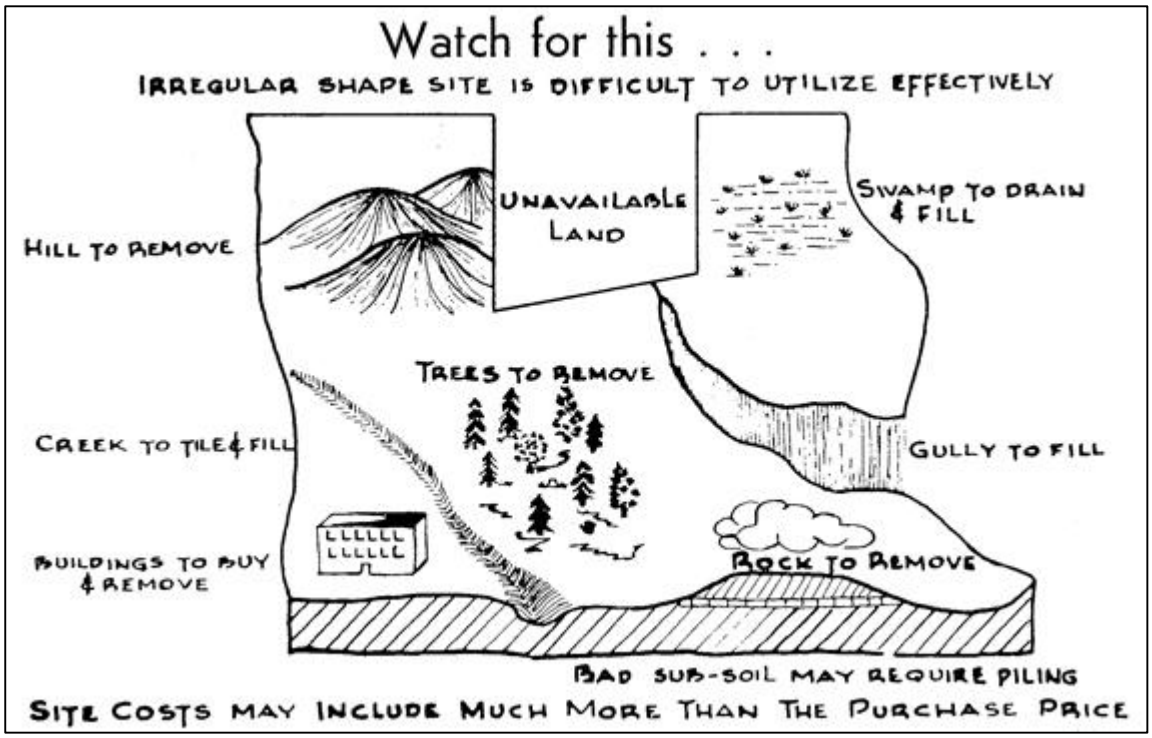

Figure 2: The cost of the land is not the only cost to consider. Removing or filling at the site may increase costs. All these need to be considered in determining school sites. Source: APA (2013).

The Californian Department of Education (CDE) also has a guidebook for the location of schools which provides the necessary criteria to consider when locating schools. They use a set of criteria that have been developed by experts in the field (CDE, 2013). Some of these criteria include safety, location, environment, soils, topography, size and shape, accessibility, public services, utilities, cost, availability, and finally, public acceptance (CDE, 2013). The United States Environmental Protection Agency (EPA) has environmental guidelines on school sites, and what should and should not be near a school. Planners and the EPA need to take the following into account:

> "The special vulnerabilities of children to hazardous substances or pollution exposures in any case in which the potential for contamination at a potential school site exists;
>
> The modes of transportation available to students and staff;
>
> The efficient use of energy; and
>
> The potential use of a school at the site as an emergency shelter" (EPA, 2011).

Most recommendations are based on health risks for children, e.g. avoid locating schools near heavy industry or avoid locating schools in areas of high air pollution (EPA. 2011).

For this research, many of the school sites will be located in rural areas. The African, and even the Eastern Cape, context is different so simply copying the criteria from an American context is insufficient. The above guidlines do, however, provide background for site selections for schools and aid in creating criteria specifically for the Eastern Cape.

The use of Litigation to Achieve Goals

Many authors have discussed the idea of using the legal system to pressure the national government to fulfil its obligation to provide basic education to all (Isaacs, 2010; McConnachie and McConnachie, 2010; Skelton, 2013). Isaacs (2010) attempts to find lessons from the USA to apply to South Africa. Isaacs (2010) describes how the case of *Brown vs. Board of Education* in the USA was thought to be a landmark case dealing with segregation, but ultimately the courts were powerless to enact their recommendations. States and counties would ultimately mention that school segregation was a result of living patterns and it was not their responsibility to desegregate schools (Isaacs, 2010).

All authors believe litigation combined with "mobilisation and organised based activism", operates best (Isaacs, 2010: 356). Simply using the justice system on its own would not be beneficial to the stakeholders at large. Using the justice system along with input from all stakeholders is considered by the authors to be extremely beneficial and the best use of the justice system. Results from the litigation described confirm that the legal system supports the basic right to education. The only issue the justice system faces is enforceability. While it is easy for a court to declare that basic education is not being provided it is often not stated how to enforce this right (Skelton, 2013). Skelton (2013) states that there needs to be a proper plan

and action at ground level for problems to be solved. Simply paying lip service to the Constitution does not solve problems by itself. In this sense, the establishment of ASIDI means the National and Provincial government are willing to solve the issue.

The result of recent litigation battles that were fought between the LRC and the DBE, Eastern Cape government, O.R. Tambo District Municipality and the government of the Republic of South Africa saw was a positive outcome for the plight of "mud schools" in South Africa. Seven schools in Lusikisiki initially hoped to gain basic services, but unwittingly drew attention to the degraded nature of the schools throughout the Eastern Cape (Skelton, 2013). The plight of some of these schools were not different from many other schools in the Eastern Cape and were as follows: school buildings were dilapidated with roofs missing and classes were often held in nearby homes (Skelton, 2013). The schools lacked sanitation and adequate water supply. The reaction that the DBE gave was swift and a memorandum of understanding was signed by all parties, which would confirm the rebuilding of the seven schools and then address the backlog of "mud schools" in South Africa (Skelton, 2013). This, then saw the establishment of the ASIDI programme, which aims to eliminate "mud schools" in South Africa. In essence, the litigation brought about pressure on the existing government structures by using the Constitution as leverage to deliver schooling to people who did not have the opportunity.

Summary

This chapter dealt with the background and literature that surrounds the topics of GIS and education in South Africa. Education in South Africa has evolved from a system of educating slaves to a system where issues from the past affect the education that is provided. GIS, which was also discussed in this chapter, has been used for a myriad of different functions including planning for solar photovoltaic stations, housing developments and educational instituions. The history of the development of norms and standards for schools is discussed as well.

CHAPTER 3: Materials and Methods

Introduction

This section explains the methodology and materials used to determine the site selection criteria for rural schools. This includes locating the ASIDI schools, identifying and interviewing experts and combining the data to create criteria. The methods of this research were based on the objectives that were stated in chapter 1.

Nature of the Research

The research was predominantly quantitative, but a few sections such as the interviews and the collection of resources were qualitative leading to the adoption of a pragmatic approach. Mixed methods from quantitative and qualitative were used to complete the research. Morgan (2007) describes the pragmatic research approach as an integration of quantitative and qualitative methods to form a 'mixed' research question. Using a strictly quantitative approach severely limits the human aspect of research and can dehumanise research (Morgan, 2007). Alternatively, a strictly qualitative approach negates a more rigorous scientific approach, which leads to the loss of valuable data (Morgan, 2007). Pragmatic research thus lends itself to holistic view of the topic that is being covered. Creswell (1994) states that pragmatism is the idea that knowledge arises out of actions and situations. The main approach of pragmatism is a search for solutions in order to solve problems (Creswell, 1994). Pragmatism allows researchers the freedom of choosing different methods to complete research and not be restricted to one path or ideal (Creswell, 1994). Evidence of the holistic approach in this research can be predominantly seen in the interviews. Approaching the research with background in Geography leaves the researcher well placed to perform inter-disciplinary research and apply methods from various disciplines. In essence, pragmatic research is the very nature of Geography.

Analysis of Media and Interviews

This followed objective one and was completed by the analysis of online and print media (from 1994 to 2014). This allowed the current perspectives in the media around the issue of "mud schools" to be gauged. A selection of 120 articles from three major online news vendors were viewed and organised into three categories; negative, neutral and positive. An analysis of the themes in these articles was conducted. The main themes chosen in the articles were if the articles conveyed a negative or positive 'mood'. Articles without a 'mood' were considered neutral. Articles would fall into the negative category if the overall mood and style painted the

DBE or any government organisation in a negative light. The positive category would indicate that the article was giving credit to the DBE or a government organisation. Articles were placed in the neutral category if no mood/style could be determined. The interviews were organised in the same manner.

This information was further confirmed by interviews with various experts in the field of study after questions regarding the current state of education in South Africa. Questions such as "*How would you score the current state of education in South Africa/Eastern Cape in general?*" and "*Why did you choose this rating?*" gave insight into the experts views about the state of the current education. The information was then collated to create a perception of the current state of education in South Africa. This includes perceptions on the site selection methods, national and provincial state of education, current issues in education and who should be responsible for solving these issues. Opinions that were considered similar were grouped together. These were placed on a scale from "Positive" to "Negative" with a neutral category present. These perceptions were tabulated and presented in the results section of this research. A similar method was used by Palau and Davesa (2013) who used a "barometer" to measured public and media opinion on corruption scandals in Spain. Many of the experts interviewed work with the DBE or on projects associated with the DBE so it was decided that they would remain anonymous for this research. Appendix B contains a list of respondents and their occupations who were interviewed for this research.

Selection of the Study Area

Objective two involved identifying and characterising a suitable study area. This involved various methods of examining the socio-economic background of the Eastern Cape. The main method used was an interview and consultation process with the LRC to establish their objectives for the research was. Ultimately, an informal interview was conducted to determine their needs. To complement the interview, socio-economic data was used to determine the demographics of each district.

A desktop study at both the provincial and district scale was conducted, which examined the existing socio-economic (census data) data, which was mapped using ESRIs ArcGIS 10.1 software package.. The non-spatial census data was attached to the ward level spatial data in order to display and visually analyse the spatial patterns in the socio-economic statistics. This was done to determine the context and to identify the most interesting case study districts. Variables, such as racial and age distribution indicates which groups are located in certain areas

allowing a certain degree of understanding of issues of the region and the possible solutions to the problems. This research also analysed the extent of piped water (improved drinking water) in the Eastern Cape. The UN describes access to "improved drinking water source" as a sub-goal of the Millennium Development Goals, which was achieved in 2010 (UN, 2014). Sub-Saharan Africa, however, is not expected to meet this goal. Over 40% of the population that lacks access to improved water sources are in sub-Saharan Africa (UN, 2014). Improved drinking water can be described as drinking water that by nature or construction is protected from contamination (UN, 2014). In this research, piped water is a form of improved drinking water. Water is extremely important in education as it provides learners and teachers with sanitation and drinking water. The variables discussed above were used to select the study sites of Lusikisiki and Butterworth. The areas with the worst indicators on list as well as areas with a large number of ASIDI schools would be chosen as the study sites. Thus the interview with LRC and the socio-economic indicators were used to choose study sites. It was decided that the poorest performing districts and the districts with the most ASIDI schools should be chosen as the LRC could then analyse a large number of schools in what they perceived to be the worst areas. These were seen as the most urgent. The other districts would be examined by the LRC at a later date (not covered by this research). The results of this socio-economic study produced a series of maps of the demographic data of the Eastern Cape and tables for the Eastern Cape.

Data Collation and Locating ASIDI Schools

Objective three involved compiling available data for the study area. This included collecting spatial data from various sources. Municipal and Education District boundaries were obtained from the Municipal Demarcation Board. The National Geospatial Information Directorate provided roads, rivers, inland water bodies, building points, 20m contour lines and 1: 10 000 orthorectified aerial photography. Non-spatial census data was collected from Statistics South Africa, which was used to establish population distribution in the selected study areas by ward. Schools masterlist data was collected from the DBE website for the Eastern Cape. This list contained all the normal schools currently open in the Eastern Cape. Normal schools are schools that do not educate special needs children and provide a general education (DBE, 2013).

Once data was collected and collated, it was entered into a GIS and checked for any inconsistencies. This was achieved by checking if the features would "fit" with the rest of the data: if overlaps or poorly digitised data were present then data would only be used at a small scale and not for local use. The data was of a reasonable quality, but there were a few issues

that emerged: the location of certain schools was questionable, borders of educational districts and local municipalities did not match correctly, not all roads were digitised and the rivers were not digitised correctly.

In order to complete objective three, the ASIDI schools had to be located within the Eastern Cape. The names and the locations of many ASIDI schools were not known and had to be verified (achieved by phoning various schools in June 2013). Schools that had been constructed had to be identified and removed from the list. This time consuming process led to the development of a list and a series of maps that located each school and the status of that school. The status of the schools had to be recorded, which was an indication of whether the school had been built or not and if not what level of contact there had been with the DBE. The categories that were chosen to represent the status of the schools can be seen in Table 5. These categories were chosen in consultation with the LRC. The categories in Table 5 represents the majority of categories that the schools fell into. The data was gathered by phoning the individual schools and asking the principals various questions regarding the status of their schools. If, for example, a school stated they already had a structure built in 2007, before the ASIDI programme, then it was placed in the 'Built Prior to ASIDI' category. If a school could not be contacted then it was placed in the 'Unknown' category.

Table 5: Categories that ASIDI schools fell into before the 2013 ASIDI list was published.

Status	Description
Built Prior to ASIDI	This indicates the school was built and completed prior to the commencement of the ASIDI programme.
Completed by ASIDI	Is indicative of a school that has been built and completed under the ASIDI programme.
DBSA Phase 2 List	This symbol indicates that the school is on the second phase rollout list produced by the DBSA. Some schools are unaware that they are on this list.
Special	This indicates that the school has special circumstances attached to its construction e.g. Construction has begun, but has not been completed, construction has only been completed on an admin block, or alternatively only on classrooms or new issues have emerged since the completion of the school.
Under Construction	Is indicative of a school that is currently being built by the ASIDI programme.
Unknown	Shows that no information can be found for the school. Contact cannot be made with the school to determine the status of the building.
Visited	Shows that a school has been visited by engineers, contractors, the Department of Basic Education etc.
Without Information	Indicates that the school was contacted, but they do not hold any information relating to how the ASIDI programme might affect their school.

Once the criteria was identified, the schools were located by cross-referencing the National Education Management Information System (NatEMIS) number (obtained from the DBE) with the information about ASIDI schools that was available to the LRC. The schools were then mapped using ESRIs ArcGIS 10.1 software. The roads, and rivers, police stations and healthcare centres were also added. These features were added on recommendation from the LRC as these were considered useful infrastructure to have a near a school site. Placing schools near established infrastructure would save on resources, as they could, in theory, be shared.

A new ASIDI list was published by the DBE in December 2013. This necessitated remapping and finding the schools based on the new ASIDI list. This remapping process was improved and individual schools could be located more easily than before. The list provided details on which schools had been allocated an implementing, agent which is an organisation that procures and appoints professional contractors to perform the work of constructing the school (Gumbo, 2013). Groups such as the Public Works Department and the Development Bank of South Africa, among others, are considered typical implementing agents. Contractors are groups that are tasked with constructing the schools (Gumbo, 2013). Schools on the ASIDI list have their co-ordinates listed, which aids in locating the schools. Using the same methods as before, the schools on the ASIDI list were imported into ArcGIS 10.1 and displayed according to their geographic coordinates. A map was produced of the location of all the ASIDI schools, but only the schools that had did not have an implementing agent were considered. Schools that had an implementing agent assigned were guaranteed to have the school constructed while schools that were not allocated an implementing agency had no clear indication of their future. The possibilities presented were that the unallocated schools could either be merged with nearby schools, closed by the DBE, given assistance, but no new buildings or rebuilding would take place. These unallocated schools were then mapped.

Determining Site Selection Criteria for Suitability Analysis

Objective four involved determining the criteria needed to select an effective school site. This was achieved by interviewing experts in the fields of education, planning, engineering, and construction. A total of 20 in-depth semi-structured interviews were administered to the various experts in the field, predominantly via email. In this research, a combination of convenience and purposive sampling was used. Convenience sampling is the process of selecting participants who are available (Durrheim, 2006). Purposive sampling is the technique of

sampling where cases are selected for theoretical reasons or where the population are good examples of the phenomenon (Durrheim, 2006). Thus, in this research, experts were chosen who made themselves available and who knew the issues that faced planning and engineering in the rural school site selection. Sampling redundancy is the point at which adding more participants would not add any value and further answers would only be redundant (Durrheim, 2006). In this research, sampling redundancy was achieved at approximately 12-15 interviews, beyond this similar themes and issues emerged.

The interview questions varied depending on the field, but most of the questions were similar. They varied from simple scoring '*How would you score the current state of education in the Eastern Cape?'* to open-ended questions such as '*What do you believe are the most important factors when selecting sites for schools?'* which allowed for the expert to express any feelings towards the subject at hand. The open-ended question mentioned above allowed for opinions to be gathered based on site selection of schools. These criteria form the basis of objective six. These interviews were then sent out to 25 experts and relevant people in the realm of planning education and engineering and a total of 20 responded by March of 2014. Two informal unstructured interviews were conducted with an engineer who was on site at a school in the Butterworth district and with the contractor who was in charge of building a school in the Butterworth district in October 2014. All but one interview was administered via email. This method was chosen as many of the respondents owned their own businesses and an email would allow them to respond in their own time. The disadvantage, however, is that the researcher was not able to view the interview process and reactions to the questions were not recorded.

The study by Svatos (2001) did not have a large focus on how sites of inclusion and exclusion were selected. One method used by Svatos (2001) was to simply exclude all the areas that a school would not be built in. These included floodplains, developed land and environmentally sensitive areas. A method used to determine the minimum size of a school was to digitise the existing schools in the area to determine how large the average size of the school site should be (Svatos, 2001). The current study used the guidelines published by the KZN DoE and the CSIR to determine how large a school site should be. The size of 4 ha recommeded by the CSIR for a large school is similar to the 10 acres (4.04 ha) prescribed by Svatos (2001).

Mapping Suitable Locations for School Sites: Suitability Analysis

Objective five involved combining the criteria identified in objective four and using them along with mapping to determine best locations for schools in Butterworth and Lusikisiki. The criteria

that were found in objective four were sorted according to their perceived importance. Physical representations of these criteria needed to be found in order to map them. Roads, rivers, 20m contours, inland water bodies and building points were used. Table 6 describes the processes that were run on each layer in order to create the desired result.

Table 6: Processes run on the various layers using ArcGIS 10.2.

Layer	Process	Factor
Roads	Buffered by 500m	Inclusionary
Main and National roads	Buffered by 50m	Exclusionary
Rivers	Buffered by 100m	Exclusionary
Electricity lines	Buffered by 200m	Inclusionary
Inland water bodies	Buffered by 100m	Exclusionary
National parks, Protected areas	Buffered by 100m	Exclusionary
Household points	Density map	Inclusionary
20m Contours	Created a DEM	Both

Roads were buffered by 500m as the contractor respondents (respondents N, O, P and T) believed that a site approximately 500m away could be adequately accessed by a temporary road. A road longer than 500 – 700m would begin to add significantly to the cost of the construction. The National and Main roads were buffered by 50m. This was seen as a necessity as schools could not be close to large roads as this poses a safety risk.

Rivers and inland water bodies were buffered by 100m for safety reasons as well (Table 6). The contours were used to create a Digital Elevation Model (DEM) of the two areas and a slope model was created in order to determine the slope for the districts. Areas that were greater or equal to 15 degrees were extracted from the DEM as these areas were considered too steep to build on and would lead to access issues to the site both for contractors and school users. Areas between 10 and 14 degrees were chosen as well, but were labelled as "Adequate" as the sites were adequate to build on, but less suitable.

Population distribution was created by making a density map of the dots of the 'houses' category in the building points layer. This allowed existing sites to be evaluated and new areas for school sites to be found. Svatos (2001) used a similar method where the author selected exclusion sites such as floodplains, steep slopes, water resource protected areas as well as man-made physical barriers. Svatos (2001) used land parcels of 10 acres or larger to find suitable

locations for schools. This was not done in this study as the nature of land ownership in the Transkei is very different to that of North America: the use of communal land in the Transkei is controlled by traditional leaders or in some cases by community leaders and elders unlike private ownership in North America (Du Plessis, 2011). Parcels of land often do not have set borders and can change depending on usage and time (Du Plessis, 2011). The approaches used by Svatos (2001) were similar to this research, but the Svatos research had more detailed resources such as a land use data set that covered the entire research area. Land use coverage is available for the Eastern Cape, but it is too coarse and does not give the required detail.

Once the sites had been chosen, Svatos (2001) used proxy data to determine if the sites were in appropriate areas regarding population. A similar method was used in this research, except the proxy data for population was household points provided by the National Geospatial Information. These points would give an understanding of how many households there were in certain areas. The small areas data category from Statistics South Africa was also used to determine areas of higher population, but was deemed to have too many missing data points to be considered valuable. Finally, the size of the school sites were examined. This was completed by digitising the school boundary on the 1:10 000 orthorectified images to determine the size of the school. These size of the schools were then compared to the CSIR recommended sizes as well as the site sizes recommended by the KZN DoE. Unsuitable and suitable school sites could then be deduced from this process. The design of the process allowed assessment of the results to be conducted easily. Schools that did not fall into the categories that were chosen in objective four would be considered not suitable as they did not meet the criteria provided.

The processes were run using ESRIs ArcGIS 10.1. A customised Albers Equal Area projection for South Africa was used with standard parallels set at -18° S and -32° S, central meridian 24° E, referenced to The World Geodetic System 1984 datum.

Data Verification

Data verification was conducted during a field trip to the Butterworth education district in October 2014. Upon arrival at the "unallocated school," information regarding slope, access, size, vegetation coverage and access to water and electricity were collected for each school site. The location with regard to community and closest towns and villages was also recorded. This was collected by observation and via LRC interviews with teachers at the school site. The data was later compared to the results from objective five. Two informal interviews were also conducted during this field trip, one was administered via personal communication and

administered to a junior engineer at a site of Nkonkwana Junior Secondary School. The basis of the questions revolved around whether the contractors had any regulations to follow regarding the selection of the site and what steps they followed to choose the site. The other interview was administered via email to the contractor's head office in order to determine if any regulations were given to the contractors from the implementing agent or the DBE. These interviews were used to determine if the opinions presented in objective one were correct or unfounded. They also provided insight into the practices followed by the contractors at the site of the schools during construction.

Conceptual Model/Framework

Objective six involved using the resulting data from the previous objectives and creating a single conceptual model that can be used to create a more detailed quantitative model for site selection in rural schools. Conceptual models or frameworks can aid research by giving theoretical aspects a visual nature (SERC, 2013). The development of the conceptual model in this research was created using the template provided by Goes (2002). Goes (2002) states that interesting phenomenon can be explained by humans' theoretical understandings of the world. Thus, if one was to ask 'What causes X?' the appropriate response is to use the theoretical understanding that underpins the subject to answer what the causes are as seen in Figure 3. Although not mentioned by Goes (2002) conceptual models do not simply convey cause and effect, but can be used to understand impacts of systems and view the system in a holistic manner. This in turn, relates to the pragmatic approach that this research used. This research thus utilises the conceptual model as way to visualise the factors that affect school site selection.

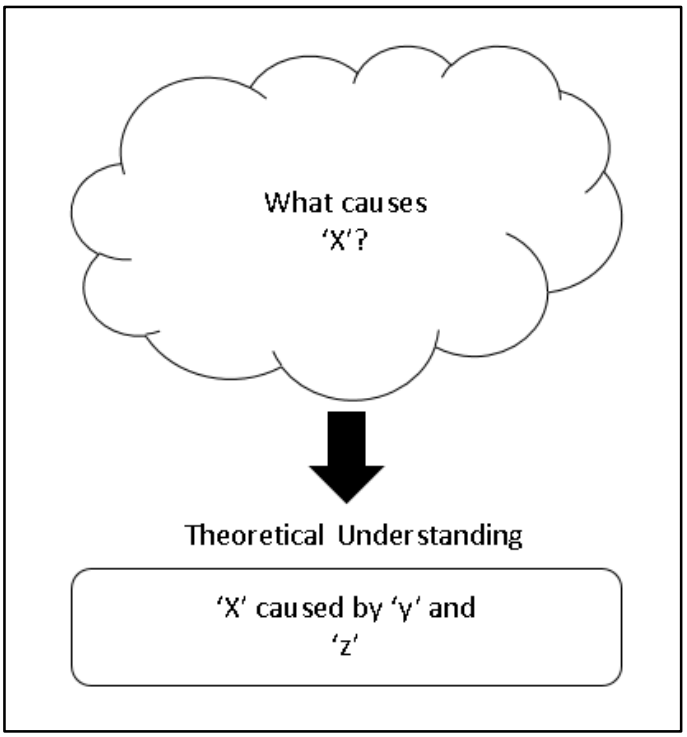

Figure 3: Theoretical understanding of a conceptual model. Theoretical understanding underpins causal relationships (Adapted from Source: Goes, 2002: 4).

Summary

This chapter outlines the methods and approach used to complete this research. It justified why certain processes and methods were selected and why the sites were chosen. It also provides an overview as to the data verification process and the methods chosen to display the results.

CHAPTER 4: Results

Introduction

This chapter presents the results and findings of the research as well as a description of these results. The results are presented in the order of the objectives.

Analysis of Media and Interviews

A search on major South African media groups websites for terms (from 1994 to 2014) such as "Education", "Eastern Cape", "Schools" and "mud-schools" revealed articles about South African and Eastern Cape education and schools. Within the articles, a search for negative and positive feeling words was conducted and Table 7 shows the results of this process. The Eastern Cape results were overwhelmingly negative: 88.3% of the results for the Eastern Cape indicate a negative response to education in the Eastern Cape. The predominantly negative news articles were based on the "mud-schools" and poor National Senior Certificate results for the Eastern Cape. The positive articles were based on the schools that ASIDI had completed and where the handover of the new school was complete.

The South African or more general article results were different compared to the Eastern Cape results: 51.6% of the articles from the websites were negative and 31.6% were neutral; 16.6% were positive, which is much higher than the Eastern Cape results, which only had 5% positive articles. The majority of positive news articles were based on improving National Senior Certificate pass rates and improvements to school infrastructure in the Western and Eastern Cape provinces. Most negative articles were based on South Africa's position globally in terms of maths and science.

Table 7: Media perception of Eastern Cape and South African education.

	Eastern Cape				South Africa			
	Articles Viewed	Negative	Neautral	Positive	Articles Viewed	Negative	Neautral	Positive
Mail & Guardian	20	18	1	1	20	10	8	2
News 24	20	19	1	0	20	9	5	6
Times Live	20	16	2	2	20	12	6	2
Total	60	53	4	3	60	31	19	10

The same tabular method was used to record the opinions of the experts from the interviews (Table 8). All 100% of the respondents to the interviews viewed Eastern Cape negatively with consistent use of negative words throughout the responses. The main themes that emerged were

the poor quality of the education and personnel, infrastructure, and the role of teacher unions role in education, possible solutions to the problems. Most respondents (n = 17) felt that education in the Eastern Cape was of poor quality and despite improving infrastructure in some areas, most teachers are not up to standard. A few respondents (n = 5) stated that despite the positives of having some of the best schools in the country, this only showed how large the gap between good and bad schools are. Respondents A, B, C and D believe that teacher unions were inhibiting progress nationally and in the Eastern Cape due to the amount of power they yielded. Policy could not effectively be implemented or used as teachers unions can simply use their power to stop it. The lack of proper facilities was also stated by a respondent as a reason education in the Eastern Cape education was so poor. One respondent stated "I have worked closely with young teachers and many refuse to teach in poor conditions. Without basics such as water, electricity and proper structures you will have a hard time attracting good teachers to a school" (respondent A). Lack of infrastructure in the former Transkei and Ciskei emerged from another respondent as a major hindrance. They stated that lack of roads, electricity and water to sites severely limits how well a school can operate.

Table 8: Perception of Eastern Cape and South African Education by the respondents.

Eastern Cape				South Africa			
Respondents Interviewed	Negative	Neautral	Positive	Respondents Interviewed	Negative	Neautral	Positive
20	20	0	0	20	9	7	4

The results at the South African scale were more varied, but still largely negative. There were nine respondents who viewed South African education in a negative light. The reasons varied: some believed that education in South Africa is affected by issues relating to teachers, the poor results globally in terms of maths and science subjects can be attributed to unqualified teachers and poor conditions. One respondent stated that "if you don't have good teachers then you can't expect good results no matter how 'state of the art' a classroom is".

There were seven respondents who viewed South African education in a neutral light stating that South Africa, like any developing country, would be facing issues. It was also proposed that based on the unique history and the recent emergence of democracy, South Africa would go through a tumultuous time until it finds a way to solve these dilemmas.

The positive aspects gathered from the respondents were based on the fact that the South African education is better than many other developing countries throughout the world. It was expressed that the backlog of problems with the education system cannot be expected to have

been fixed in the 20 years since democracy. Respondents also state that there may be issues regarding teacher qualifications and infrastructural problems to address, but overall 20% of the respondents believed that much of the media only covers negative stories and not does not report the successes of the education system.

When asked who should be responsible for addressing the issues, and how they should be fixed, the main theme that emerged was that national and provincial government are responsible for the provision of decent infrastructure. A theme that was common among education experts was that local communities and School Governing Bodies (SGB) need to demand more from provincial and national government. One respondent stated "Families rely on their children to be educated and skilled so they can earn larger incomes and support the family. Until they demand quality service from the education sector, nothing much will change and the cycle will carry on" (respondent D). Another respondent pointed towards a clear lack of leadership and accountability "from the top to the bottom" (respondent B). Another unanimous response was that it would take a complete change in mindset or personnel at all levels to fix problems facing education in South Africa and Eastern Cape. A theme that was found with the educational experts was that teacher unions had a part to play both as a cause of the problems and as a part of the solution. Some viewed the teacher unions as having too much power and they were able to control provincial and national spending and policy. This according to the respondents is a hindrance to completing even the most mundane tasks. One respondent stated that teacher unions "crippled progress" (respondent C). While they were viewed with a somewhat negative attitude by the respondents, a few stated that they have an important positive role to play in pressuring provincial and national government to provide better assistance to teachers and more accountable leaders. "They can be a problem and the solution at the same time" stated one respondent (respondent A).

Selection of Study Area

The Eastern Cape was selected as the study area as it is where the ASIDI programme is currently in action. Many "mud schools" in the Eastern Cape have been replaced and many more are yet to be replaced. On a local scale, the Education Districts of Butterworth and Lusikisiki were selected as they have unique characteristics that are worthwhile examining. During initial analysis, Butterworth had numerous anomalies such as missing schools, schools with little to no information about them and schools that were supposed to be in the district, but were in fact recorded as being in another. Although, not the only district with data

anomalies in its data, the Butterworth was chosen as it had so many. It was also selected as numerous ASIDI schools fall in this district.

Lusikisiki District was selected as it had many ASIDI schools in it. It has numerous schools that have been visited by the either a government department or a contractor and not many schools have been completed compared to neighbouring Libode district. Libode (91 schools) had many more schools completed (compared to Lusikisiki which had 49 schools on the ASIDI list) and Butterworth (42 schools) even though Libode had more schools on the ASIDI list (i.e. schools in need of attention). Libode's ASIDI schools were notable and could have been investigated, but it was decided by the LRC that Butterworth and Lusikisiki are similar both in number of ASIDI schools and unallocated ASIDI schools, thus research could be focused in these areas specifically and comparisons made. Table 9 indicates the number of ASIDI schools and unallocated ASIDI schools. Besides Dutywa and Ngcobo districts, Butterworth and Lusikisiki contain the highest number of unallocated schools. Unallocated schools are schools that were not yet allocated to an implementing agent who would appoint contractors. These schools face uncertain futures and have no knowledge of what will happen to them.

Table 9: Eastern Cape Education Districts with the number of ASIDI schools and Unallocated ASIDI schools. Butterworth and Lusikisiki District are highlighted.

DISTRICT	Area (Km^2)	ASIDI Schools	Unallocated ASIDI Schools
BIZANA	2411.97	5	0
BUTTERWORTH	3323.24	42	26
COFIMVABA	3615.06	24	0
CRADOCK	17752.06	1	0
DUTYWA	3029.89	45	28
EAST LONDON	3605.62	1	0
FORT BEAUFORT	6459.93	7	5
GRAAF-REINET	39870.02	2	0
GRAHAMSTOWN	6223.00	0	0
KING WILLIAMS TOWN	7159.29	13	0
LADY FRERE	3237.88	9	5
LIBODE	3898.26	91	15
LUSIKISIKI	3912.96	49	25
MALUTI	3648.23	16	9
MT FLETCHER	5359.25	26	9
MT FRERE	3201.60	31	21
MTHATHA	3020.33	23	2
NGCOBO	4515.01	33	25
PORT ELIZABETH	2647.96	0	0
QUEENSTOWN	7843.78	6	4

DISTRICT	Area (Km^2)	ASIDI Schools	Unallocated ASIDI Schools
QUMBU	2704.64	51	23
STERKSPRUIT	20042.75	0	0
UITENHAGE	11406.73	2	0
Total	**168889.47**	**477**	**197**

Racially, Butterworth and Lusikisiki districts are extremely similar. They are racially homogenous with 99% of the population belonging to the Black African race group. Coloured, Asian and White make up less than 1% of the population in these areas as seen in Table 10. Lusikisiki is 15% larger than Butterworth and has approximately 40% more population. This indicates that Lusikisiki district has a higher population density than Butterworth.

Table 10: Population demographics for the Butterworth and Lusikisiki District.

Characteristic	Education District	
	Butterworth	Lusikisiki
Population	±360 000	±600 000
Population Density (km^2)	±100	±150
Black pop (%)	99%	99%
Other race groups	>1%	>1%

Topographically these districts are more distinct. Generally, Butterworth has less variation in the highest and lowest altitude points while Lusikisiki is more undulating and experiences a greater range in altitude. A large section of Lusikisiki cannot be driven through as there is the large catchment area of the Mzimvubu River. There is also a lack of bridges to cross this river into this area. The area has steep hillslopes which inhibit movement across the district. Butterworth has a more extensive road coverage and allows for easier navigation through the district.

The following series of maps, based on Statistics South Africa Census 2011, show statistics for selected variables (racial distribution, household access to piped water, age distribution). A brief description of the patterns in the data is given which illustrate and contribute to developing an understanding of the socio-economic context of this research.

Figure 4 indicates the distribution of the “Black African” population in the Eastern Cape. The Black African population group, prevalent in many wards in the former Transkei and Ciskei, is located in the eastern half of the province, while the western half of the province has some wards which are less than 20% Black African group. This can be explained by the fact that

apartheid policies restricted the movement of race groups and confined Black Africans to townships and "homelands". These homelands were located predominantly in the eastern half of the province as can be seen in Figure 4. What is notable is that the result of racial segregation can be seen in the current racial spatial patterns.

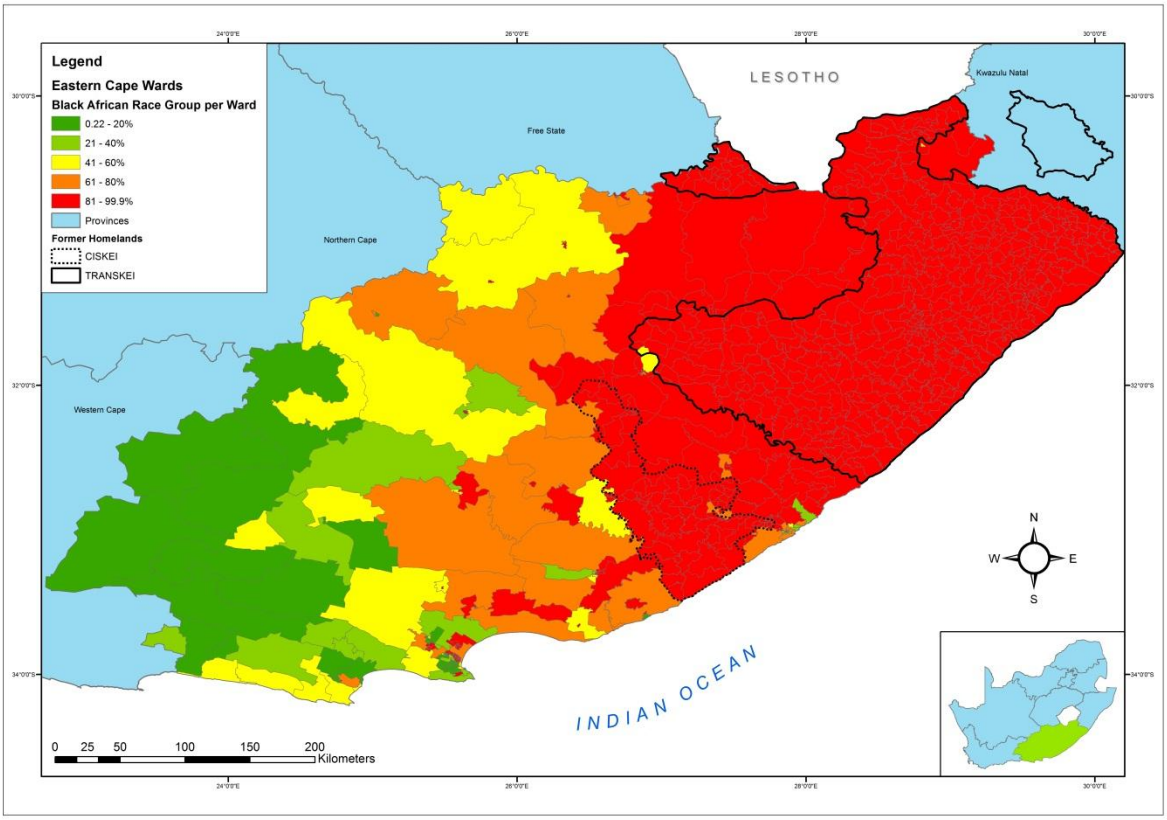

Figure 4: The proportion of the Black African race group per ward area in the Eastern Cape.

Figure 5 indicates households in the Eastern Cape that do not have any access to piped water. This includes community taps, municipal water schemes and backyard taps. Many of these households rely on water collection from rivers and dams. This, in itself, is a danger to a community as the water collected is often contaminated upriver by agriculture or by other human settlements. Most of these households are located in the former Transkei homeland. Areas outside of the former Transkei appear to have some form of piped water with only 0 – 5% of the area (green area) without piped water. This indicates a higher degree of development in these areas. Water is an essential part of infrastructure in a school without which it could not operate effectively.

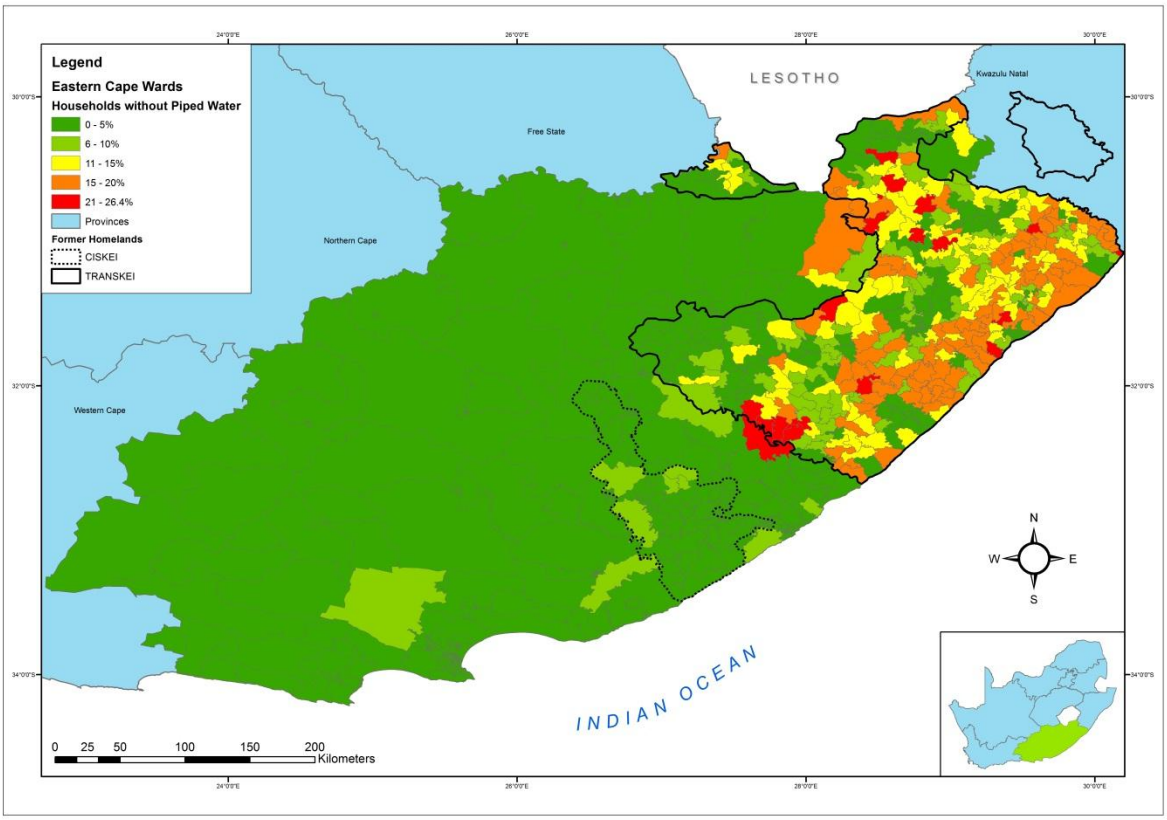

Figure 5: The proportion of households in the Eastern Cape without piped water.

Figure 6 illustrates the proportion of adults per ward between the ages of 19 and 64. This age group is usually representative of the workforce and is often located in major centres. The main centres of Port Elizabeth and East London are made up of 61 - 70% working adults with some areas in Port Elizabeth and East London containing 71 - 80% of this age group (Figure 6). In some outlying areas there is still a 51 - 60% presence of the workforce despite having relatively lower concentration of population. In the former Transkei, and to a limited extent, the former Ciskei areas there are wards with only 30 - 40% of the population made up of the workforce. There is a clear pattern that the workforce is located outside of the former homeland areas.

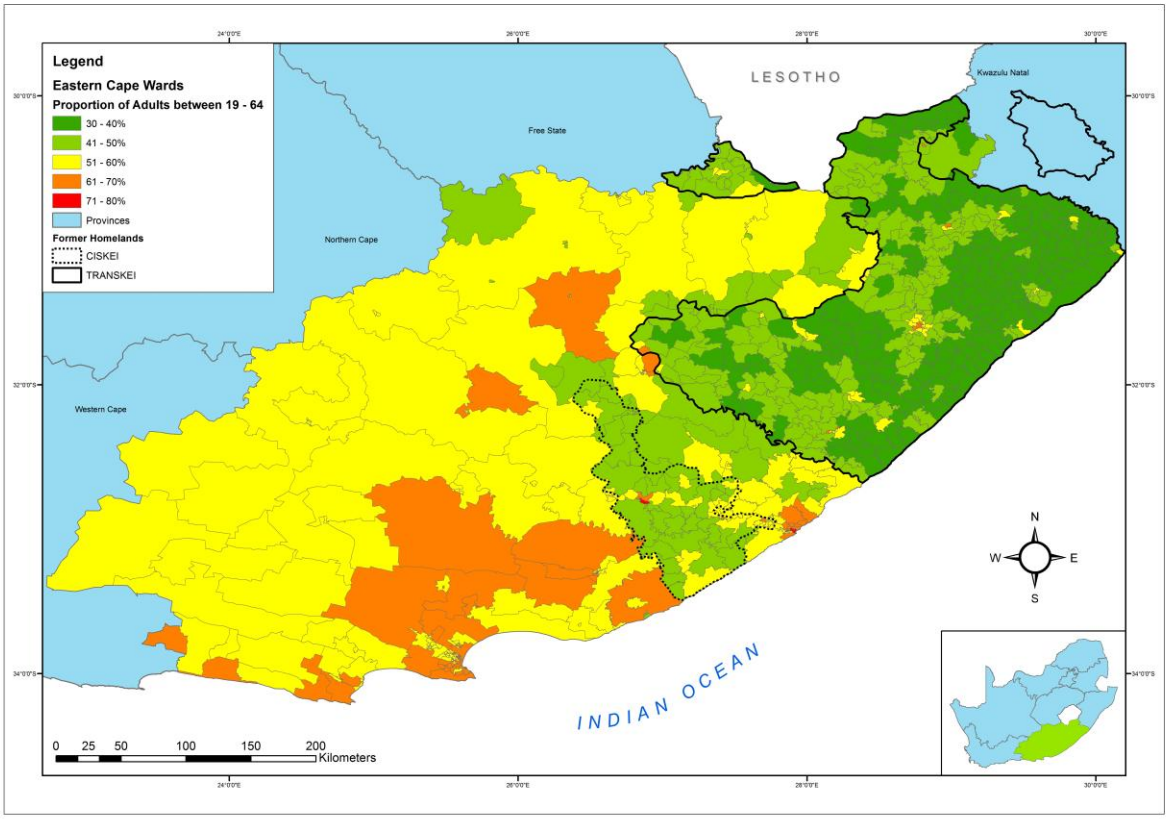

Figure 6: The proportion of adults between the ages of 19-64 (the workforce).

Figure 7 indicates the proportion of youth aged 0 -19 in each ward in the Eastern Cape. Many wards in the former Transkei have youth averages above 50% and some contain over 60% youth. Outside of the former homelands, wards consist of 24 – 45% youth. This is more indicative of the population of South Africa while the former homelands have high numbers of youth. Areas with high youth numbers need to contain specialised clinics that cater to early childhood development and young adult education centres. These areas do not have this focus and contain facilities that are often poor or simply understaffed.

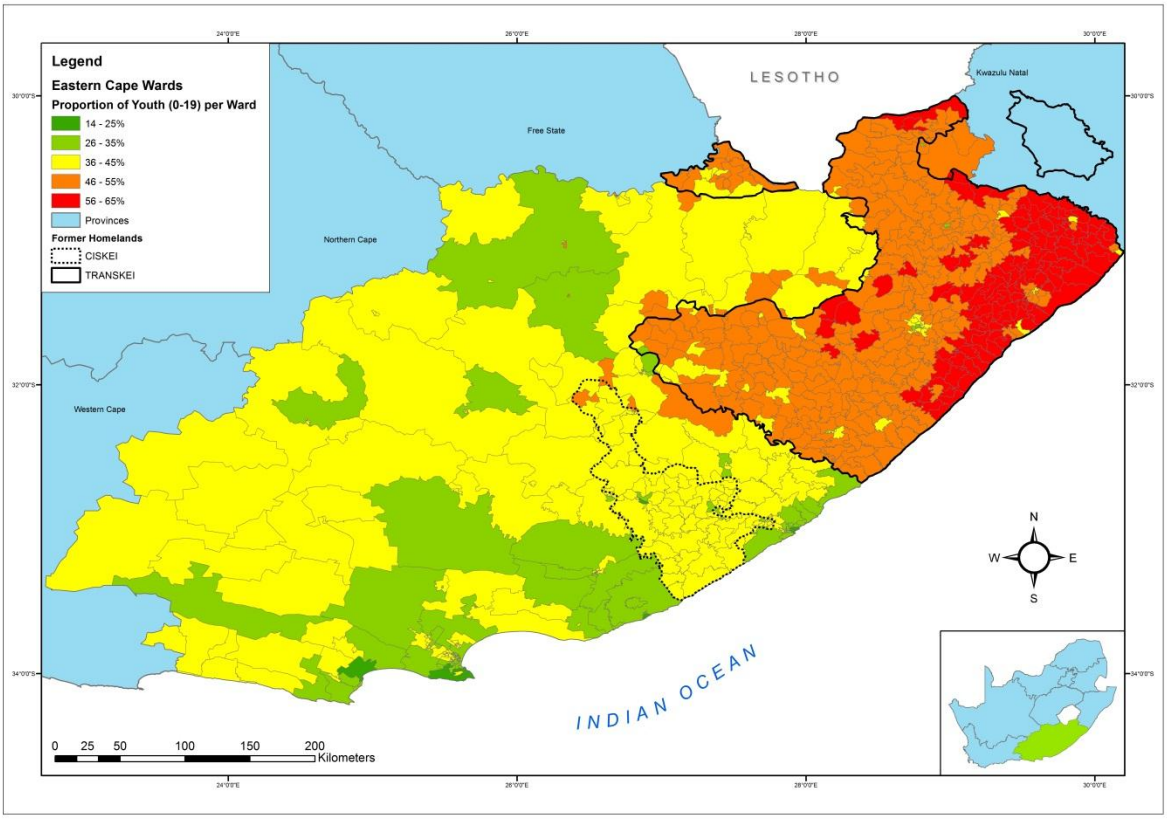

Figure 7: The proportion of youth (0-19) per ward.

There is then a clear need for schools to be placed in the areas where the population demographics reflect the need for education. Over 70% of the schools in the Eastern Cape are located in the former homeland areas but they need to function correctly as they are an important part of the socio-economic landscape of the areas.

Locating ASIDI Schools

Figures 8 and 9 indicate the results of the initial phase of locating and differentiating schools which were on the ASIDI list. Schools are mapped according to the categories in Table 5 (This was completed at the request of the LRC in July 2013). The initial phase of locating the schools proved difficult as many schools were able to be located, but approximately 33% of the schools in Lusikisiki District had no information about the status of their buildings or if they had been visited by any organisation. In Butterworth, approximately 48% of the schools lacked information regarding building status. This is illustrated in Table 11. According to the results, many more schools had been visited by contractors in Butterworth (34%) than in Lusikisiki (12.5%).

Table 11: The status of ASIDI schools in Butterworth and Lusikisiki Education Districts prior to the release of the January 2014 list.

Status	Butterworth	Lusikisiki
Built Prior to ASIDI	1	1
Completed by ASIDI	0	8
DBSA Phase 2	0	11
Special	0	1
Under Construction	0	1
Unknown	17	16
Visited	12	6
Without Information	5	4
Total	35	48

The lack of data for these schools caused concern as at an early stage of the research. Many schools could not be reached to establish the nature of the buildings on the site. Pressure from the LRC led to the release of the official ASIDI list.

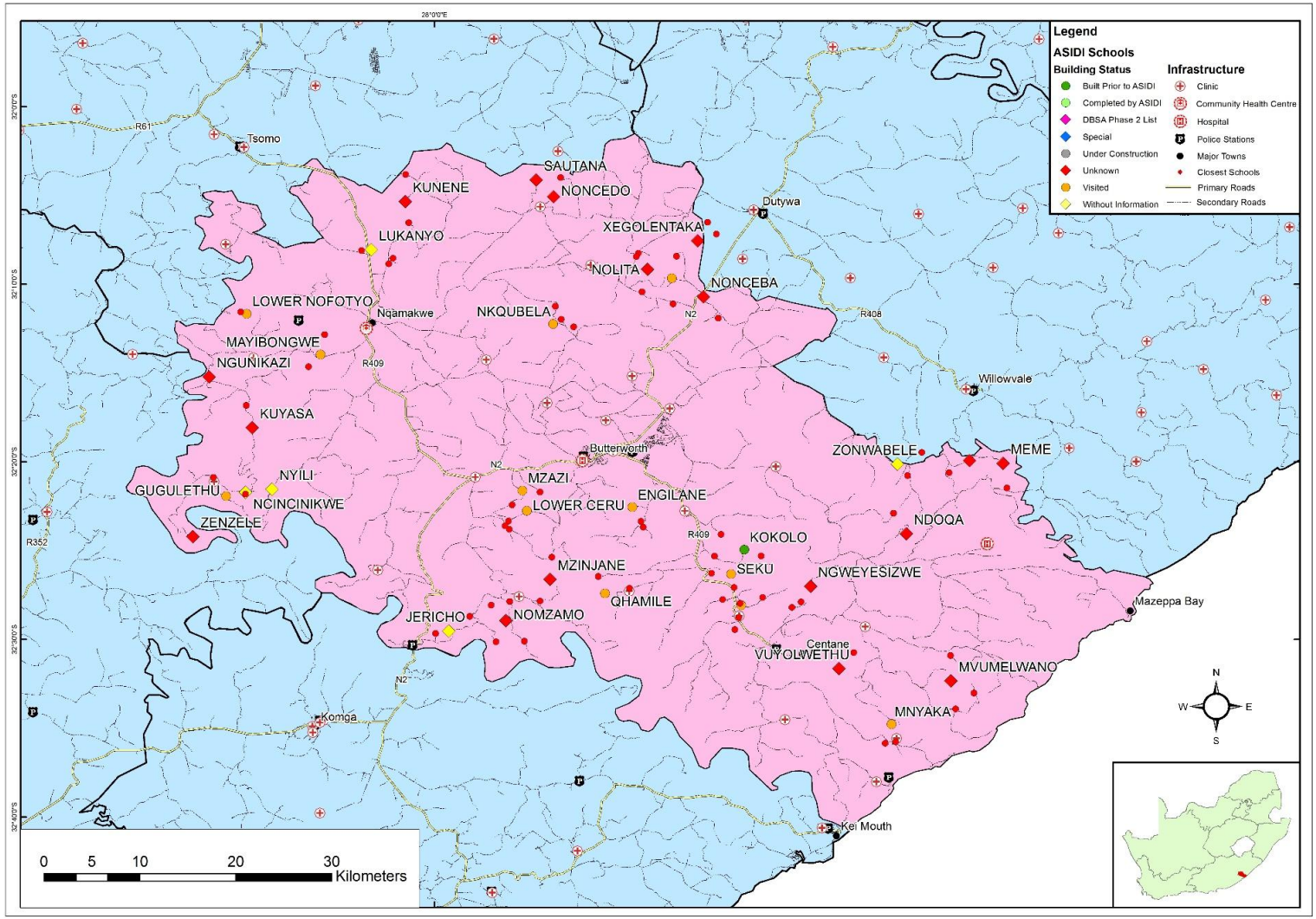

Figure 8: Location of the ASIDI schools in Butterworth Education District prior to the release of the January 2014 ASIDI list.

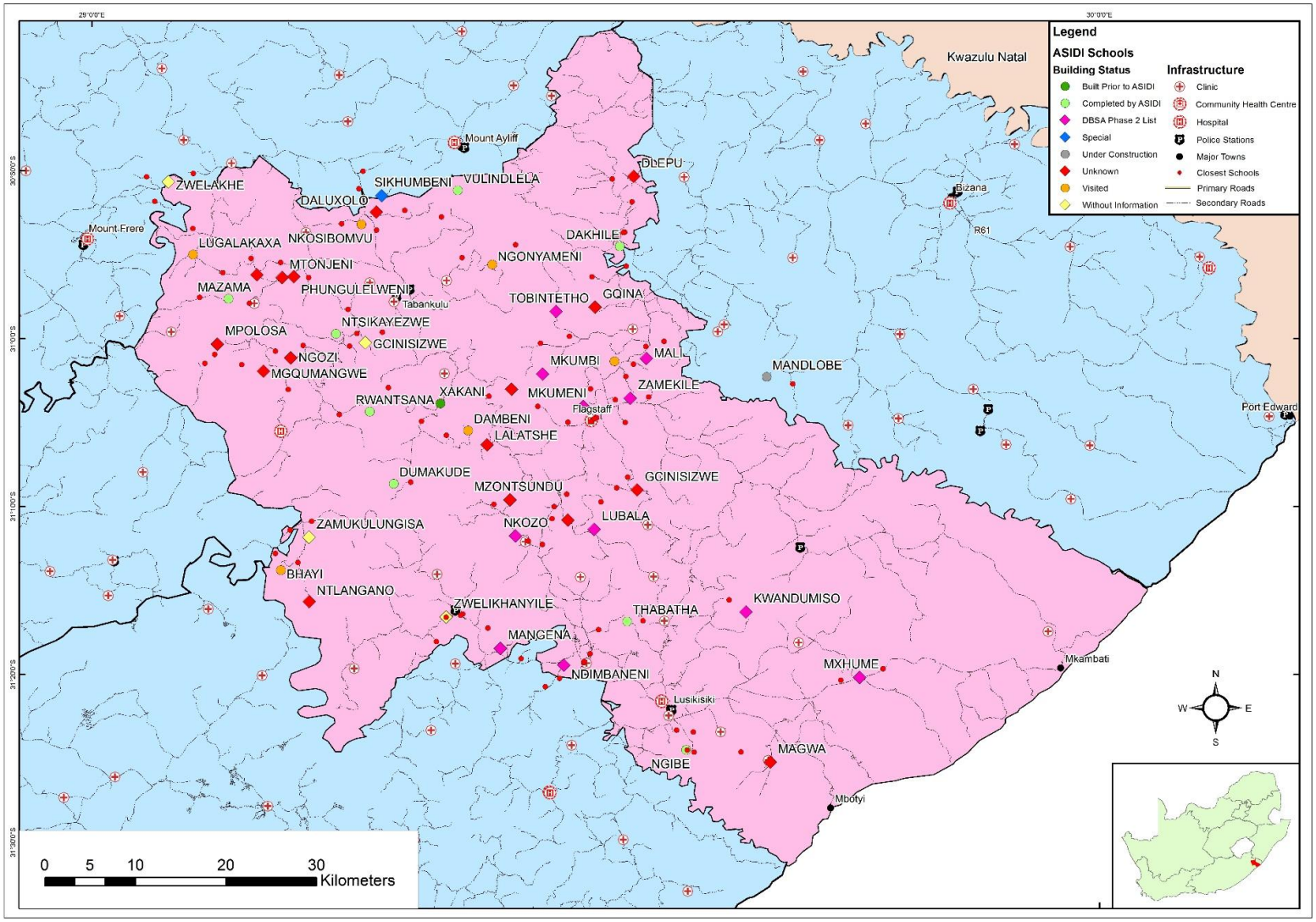

Figure 9: Location of the ASIDI schools in Lusikisiki Education District prior to the release of the January 2014 ASIDI list.

The release of the updated ASIDI list in January 2014 allowed for a more complete result regarding the schools that are currently awaiting replacement. The new list reduced the categories given by the LRC to only ‘Allocated’ and ‘Unallocated’. ‘Allocated’ schools were assured of replacement and were not mapped. This reduced the number of schools that had not been built in the areas from 48 in Lusikisiki to 25 andin Butterworth from 35 to 26. Figures 12 and 13 indicate the locations of the schools on the updated ASIDI list. The unallocated schools in Figures 12 and 13 show the unallocated schools and thus lack implementing agents. Upon investigation during a fieldtrip to the Butterworth District, it was discovered that three schools had been built, namely Kokolo, Kunene (Figure 10 and 11), and Nqubela. Nkonkwane was under construction while Endleleni had been closed since 2008. Unfortunately, a fieldtrip to Lusikisiki was planned, but was not completed. Information from the LRC fieldtrip, conducted in November 2014, was used instead.

Figure 10: Three newly constructed classroom blocks at Kunene Junior Secondary School.

Figure 11: The newly constructed Grade R area at Kunene Junior Secondary School.

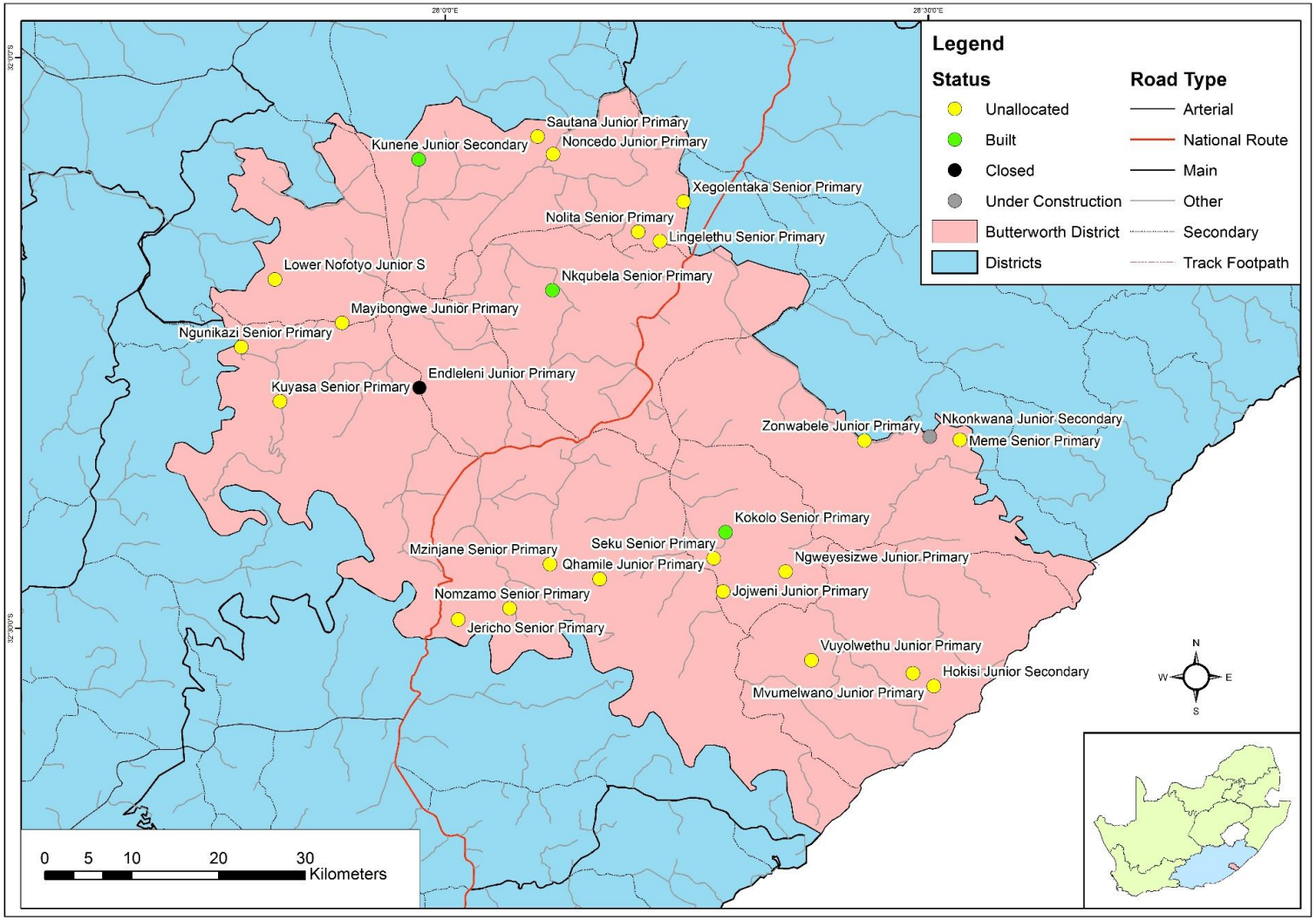

Figure 12: Location of the Unallocated ASIDI schools in Butterworth Education District (n = 26). Note the five schools that should not be on the list.

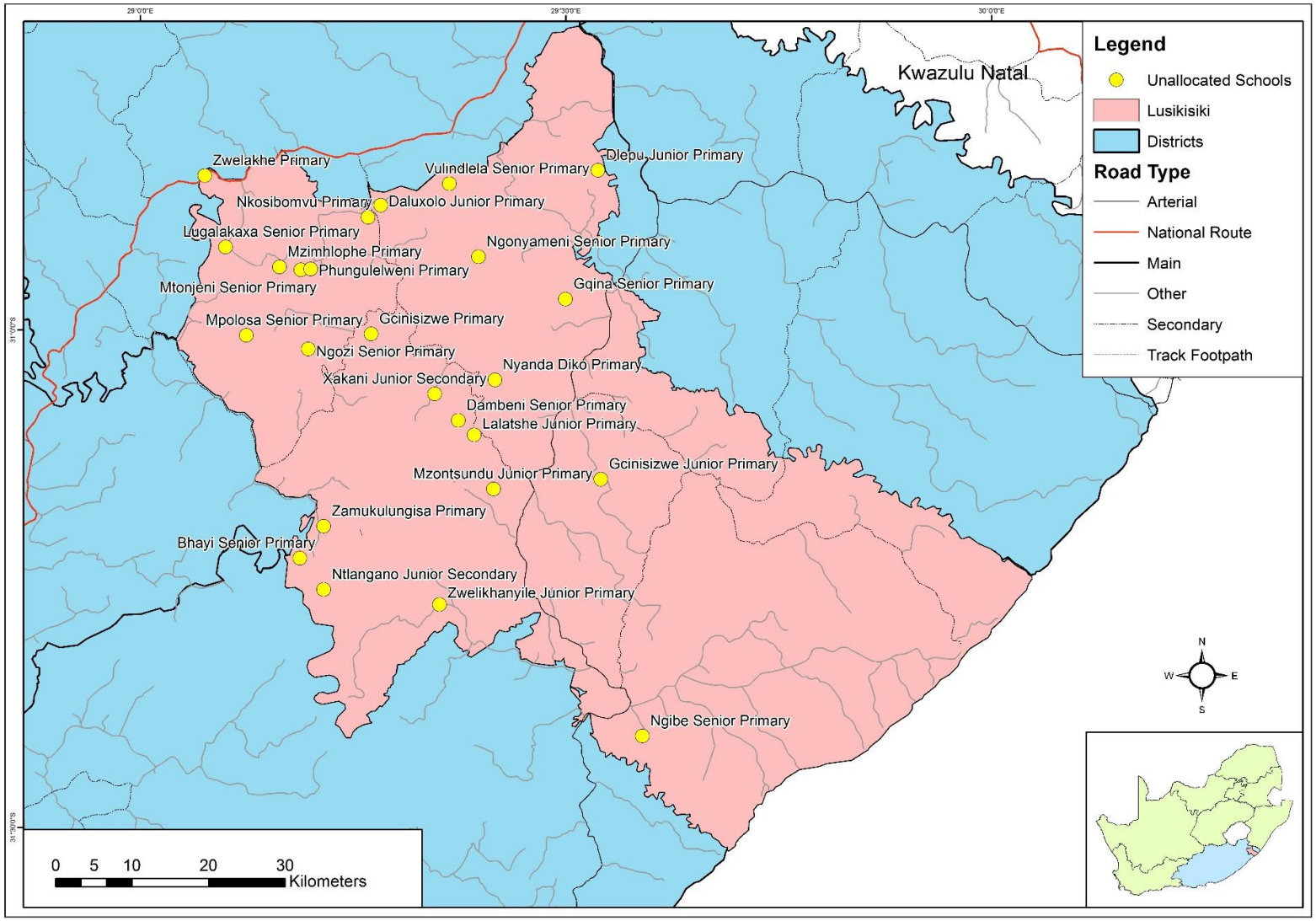

Figure 13: Location of the Unallocated ASIDI schools in Lusikisiki Education District (n = 25).

Determining Site Selection Criteria

The main purpose of the interview process was to determine the criteria for site selection. The process involved contacting various experts in the fields of education, planning, engineering, and construction. Respondents were asked which criteria were important in site selections for rural schools. The respondents ranked criteria from one to ten according to importance. This was then coded and similar responses from the interviews were grouped. The results of the process are shown in Table 12. A score close to one indicates that the criterion is considered more important than a criterion closer to 0. The questioning of 20 different respondents resulted in the emergence of many different criteria that were condensed and categorised into themes, then ranked according to importance as shown in Table 12.

Table 12: List of the site selection criteria, their description and the score they received after the interview process.

Criteria	Description	Score	Rank
Access	Access to the site during construction and during use	0.81	1
Population	Number of households in the area capable of supporting the school	0.65	2
Topography	Topographical features that may inhibit the development of a school	0.62	3
Safety	Distances from/to areas of perceived danger	0.58	4
Utilities	Electricity and water supply to the site. Includes sanitation.	0.42	5
Public Acceptance	Willingness of the community to accept having/not having a school in the area	0.4	6
Site Size	Size of the site	0.31	7

Table 12 indicates that the most important aspect as identified by the respondents was access to the site for construction workers and those involved at the school. This was almost unanimously chosen as the first criterion by with a score of 0.81. Access, in the context of this research, can be described as the ease with which access can be gained to the site during construction and use of the facilities. Respondents agreed that access was more important than resident population as children can be given transport to a school, but if a site is not accessible then it cannot be built or used. The access criterion also includes sites in national parks or protected areas as building schools in these areas may prove to be problematic from a legal perspective. Population was the second most important criterion with a score of 0.65. Respondents believed that a site cannot simply be where no one is close enough to use it, this also refers to access to facilities for teachers to use. The third highest scoring criterion is

topography which scored 0.62. Respondents believe that topography can influence the selection of school sites; building on slopes should be avoided as they require more funding to level the area and sites on steep slopes may affect young and old accessing the site. Safety was ranked fourth with a score of 0.58; respondents believed that schools should not be situated near main roads, rivers, and inland water sources. These pose threats to the safety of children and to the community at large; a river may flood or an accident could occur on a main road which could cause damage if the school is too close to the danger. Public acceptance was chosen by respondents as the fifth most important factor; it was not considered an overly important factor. Most respondents believe that it is important to work with the community to understand their desires, but it may not be in their best interests to build a school if the area does not have the population to support it. The respondents emphasised the importance of utilities at the site, but stated that this should not influence site location as a community may need a school and may simply not have the utilities. In this situation, water tanks and generators or solar power should be provided. The least important criterion rated by the respondents was that of site size, which had a rating of 0.31. Respondents agreed that in rural communities where community leaders and chiefs hold rights to the land, site size will not be a deciding factor. It was stated, however, that schools should be placed on adequate tracts of land that can accommodate the school, administration buildings and the sports fields if there are none in the community. Vegetation in this case was not considered a relevant factor at all as much of the former Transkei is undulating grasslands as seen in Figures 14 and 15. Vegetation is sparse and often is situated in steep ravines that would be too steep to build on (Figure 15). Slope was a more important factor to consider than vegetation. Overall, there were 17 criteria that were given by the respondents, which were condensed into seven themes as some were fairly similar to each other. These seven criteria formed the basis for the analysis of suitable locations for school sites.

Figure 14: Lack of woody vegetation and rolling hillslopes near Noncedo Junior Primary.

Figure 15: Woody vegetation located in steep ravines near Mayibongwe Junior Primary

Suitable Locations for School Sites

Figures 16 and 17 represent examples of the location of suitable areas for school sites in Butterworth and Lusikisiki district. This process is outlined in chapter three, and consists of a GIS analysis of buffering to exclude features (rivers, inland water sources, main roads) and inclusionary criteria (distances from roads, high population areas). The results ranged along the continuum from the "Best" areas to build schools to "Unsuitable" areas to build schools.

An area would be in the “Best” category if all inclusionary factors (access, electricity supply, suitable slope, higher population areas) were met and exclusionary factors (main roads, rivers, parks or protected areas, inland water bodies) were avoided. “Good” areas were covered by most of the above, but lack one of the inclusionary factors except for access. Access was identified by the experts as the most important factor when siting a school and needed to be present at all levels. If it was not present, then the area was deemed “Unsuitable”. “Suitable” areas were areas that had access, but lacked high population and electricity. These areas simply had access and an acceptable slope to build on. “Adequate” areas were inside of “Suitable” areas, but were in areas where slope was between 10 – 14 degrees steep. While not ideal, these areas were considered adequate to build schools on. Finally, “Unsuitable” areas were areas that contained exclusionary criteria and/or did not include inclusionary criteria. A school site may been situated in the “Best” category, but being too close to a main road or river would have meant it was excluded. These categories were devised in the study as they best represented the criteria identified by the experts.

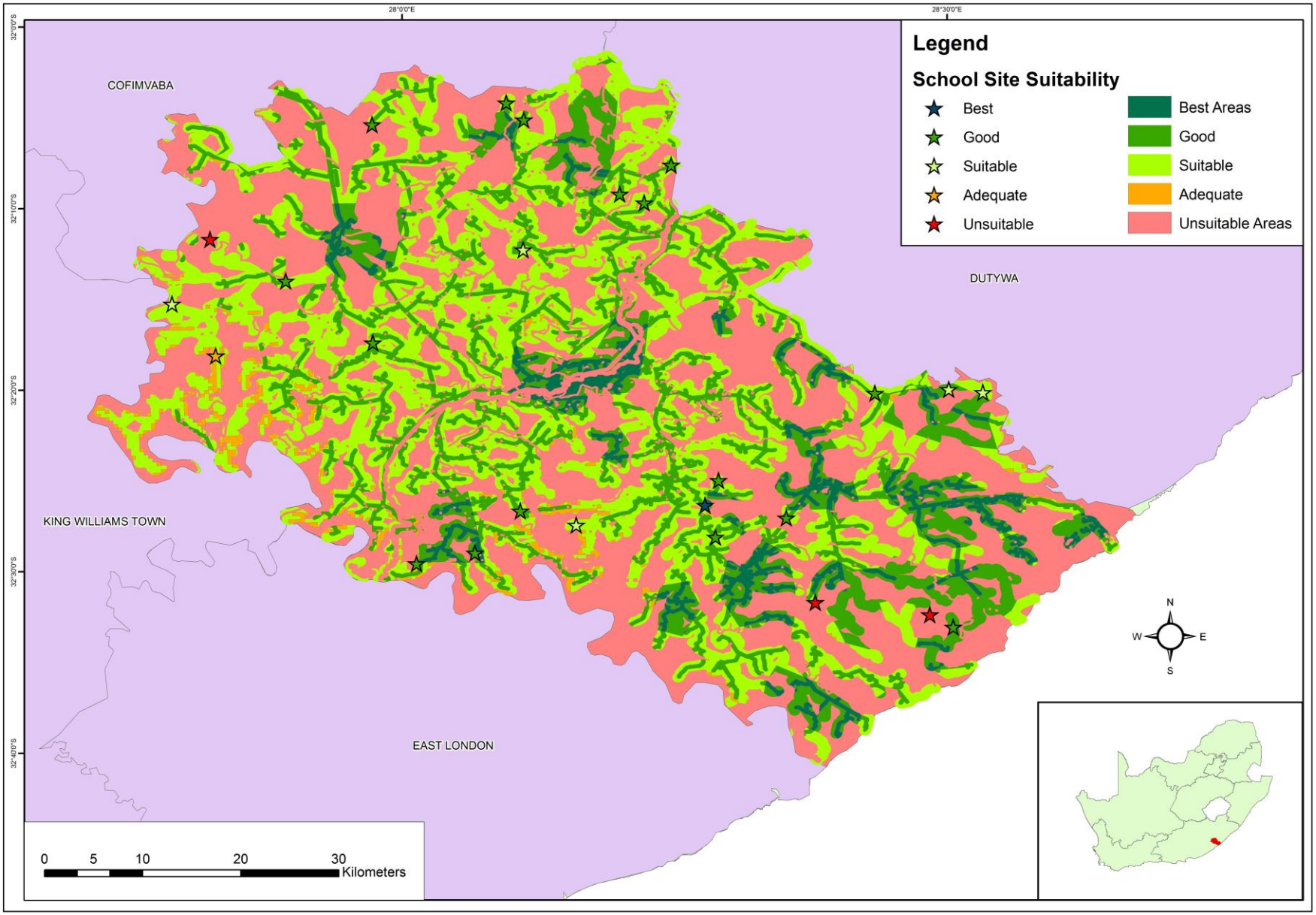

Figure 16: School Site suitability for Butterworth Education District.

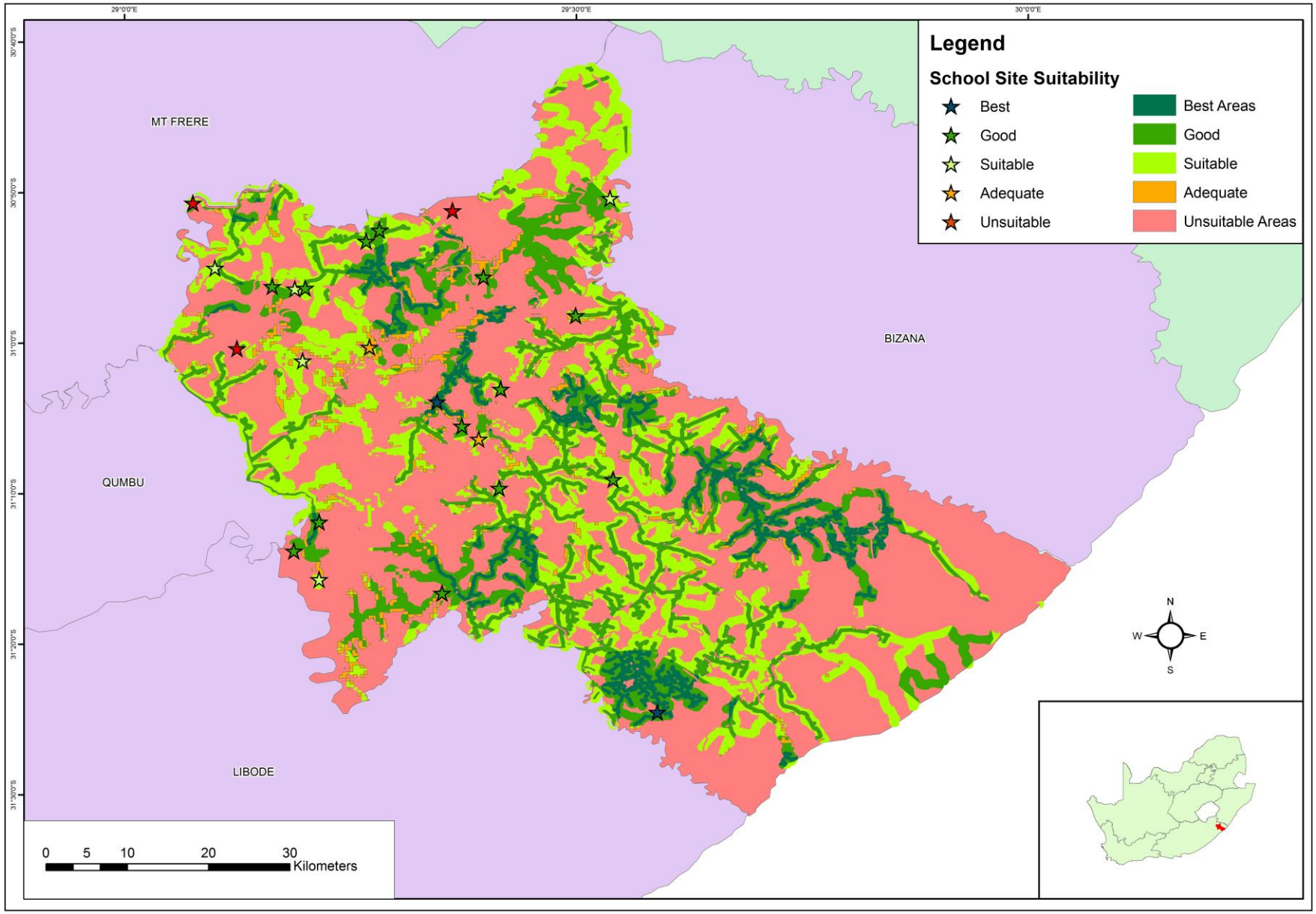

Figure 17: School Site suitability for Lusikisiki Education District.

The results of the analysis as portrayed in Figures 16 and 17 and Table 13 indicate that there are more schools in the "Good" category than any other category with 56 % of the schools. "Suitable" is the next most populated category of suitable areas with 20% and "Unsuitable" is the third highest with 12%. The two least populated categories are "Best" (6%) and "Adequate (6%)". Butterworth has 61.5% of its schools in "Good" areas whereas Lusikisiki has 52% in "Good" areas. The least populated categories in Butterworth and Lusikisiki are "Best" (3.85% and 8%), "Adequate" (3.85% and 8%) and "Unsuitable" (11.54% and 12%), respectively.

Table 13: Number of schools in each category in Butterworth and Lusikisiki Education District.

Category	Butterworth	%	Lusikisiki	%	Total	%
Best	1	3.85	2	8.00	3	5.88
Good	16	61.54	13	52.00	29	56.86
Suitable	5	19.23	5	20.00	10	19.61
Adequate	1	3.85	2	8.00	3	5.88
Unsuitable	3	11.54	3	12.00	6	11.76
Number of Schools	26		25		51	

Three schools in each District are in "Unsuitable" areas. All three of the Butterworth schools that are in "Unsuitable" areas lack suitable access. Lusikisiki had one school that was excluded as it was too close to the N2 National Route, one was excluded as it lacked access and was on a steep slope and another was excluded as it simply lacked adequate access. A total of 51 schools (26 from Butterworth and 25 from Lusikisiki) were examined in this analysis.

The size of sites was ranked low by the respondents who stated that only at a local level and mostly urban setting would it be ranked higher. Site size however is still important in a more urban context. An analysis of the current school sites was performed. The sites of the schools in Butterworth of Lusikisiki district were digitised and an average of all sites was taken. Table 14 indicates the results of the site analysis. The minimum site size suggested by KZN DoE and CSIR minimum standards were also included in the analysis.

Table 14: Sizes of the school sites in Butterworth and Lusikisiki Education Districts.

	Butterworth	Lusikisiki	Total
Average (ha)	0.69	0.87	0.78
Largest (ha)	1.46	2.12	2.12
Smallest (ha)	0.15	0.23	0.15
Meets CSIR Requirements (1.9ha)	1	0	0
Meets KZN DoE Requirements (1.4ha)	2	5	7
Number of Sites Digitised	23	23	46

Almost all the sites are smaller than the site sizes recommended by the CSIR and the KZN DoE. Approximately 15% of the sites fit the KZN DoE specification, while only one out of 46 sites fits the CSIR specification. The average size of the sites was 0.78ha, the largest was 2.12ha and the smallest was 0.15ha. The Lusikisiki school sites (0.69ha) are larger than Butterworth sites (0.87ha) and seven of the largest 10 school sites are in the Lusikisiki district.

It was also discovered during digitising that schools in the Lusikisiki district are irregularly shaped, while Butterworth school sites are more rectangular in size. Approximately 15 of the 23 schools in Lusikisiki are not rectangular and can be considered irregular.

Informal Interviews

The informal interview process was conducted during the field visit to the sites, with follow up interviews by e-mail. The first interview was with a junior engineer managing the site while the senior engineers were not on site. The engineer stated that no one was given any conditions on where to place the new school. The entire process of siting the school was decided by the contractors and partly by the community. He stated that "we asked where they [the community] would like the school, but in the end we put it here [in the original site of the old school] as this is where we thought the best place was". In this case the entire process was driven by contractor deadlines focused on trying to complete the school by a specified deadline. Site selection was not an important consideration in the construction process as the original site was adequate. The site itself would be approximately 1.2ha in size and incorporates a soccer field, Grade R block, classroom block with seven classrooms, and two ablution blocks. The community was not concerned about the placement as they were relieved that the school was eventually being replaced.

The email interview with contractors revealed that no specific instructions were given by the DoE or the Eastern Cape DoE regarding site selection. The entire process was focused on replacing the schools, not on selection of new sites. The old schools would be removed and temporary classrooms would be built while construction on the school is ongoing. The only specifications and conditions they follow are based on the architects suggestions and plans. The main issue was that the contractor believed that schools are being built without much consideration for utilities as seen in the statement below;

> "I think the schools are being built without much thought as to where electricity and water are located. When we build in these remote areas we often have to bring generators and our own water to run our equipment. It is frustrating, but in the end we get it done. It also takes a long time to get to the site because the roads are in a very bad shape."

The interview revealed that many of the schools this company has built are in areas that lack electricity and water supply. Representatives of the company believe that these utilities should be planned before any construction occurs. They do, however, concede that since many areas are without basic utilities, it would not be right to withhold education from them based purely on this. Figure 18 shows the early stages of construction at Nkonkwana Junior Secondary School andMeme Senior Primary (Figure 19) is an example of a school that was built in 2008 without access to electricity or piped water. It is located 2.5km away from Nkonkwana Junior Secondary School where the informal interview was conducted. These schools had to rely on generators and solar power units to provide power during construction.

Figure 18: Construction of the Nkonkwana Junior Secondary School underway without electricity or water services (October 2014).

Figure 19: Meme Senior Secondary Primary constructed without electricity or water access in 2008.

Conceptual Model/Framework

Based on the analysis of site selection according to the criteria a conceptual model has been devised and presented here. The conceptual model (Figure 20) depicts the process that should be followed in order to create an efficient system for determining school sites in a rural Eastern Cape context. It is divided into five stages or steps that should be followed. The first step is to determine the most important criteria by performing interviews with stakeholders. The creation

of criteria should be guided by national legislature provided by the DBE and Eastern Cape DoE. The second step is to gather the appropriate data for the given area. This can include census data and spatial data layers that will be required to support step three. The following step involves using the data to determine socio-economic profile of the given area and to use GIS to visualise the data. The criteria developed in step one will allow for site identification. Step four is the production of a GIS map accompanied by a report. Finally, step five is the critique of the criteria used to determine the sites. If criteria need to be added or revisited then the process will begin again at step one. This process is detailed in Figure 20.

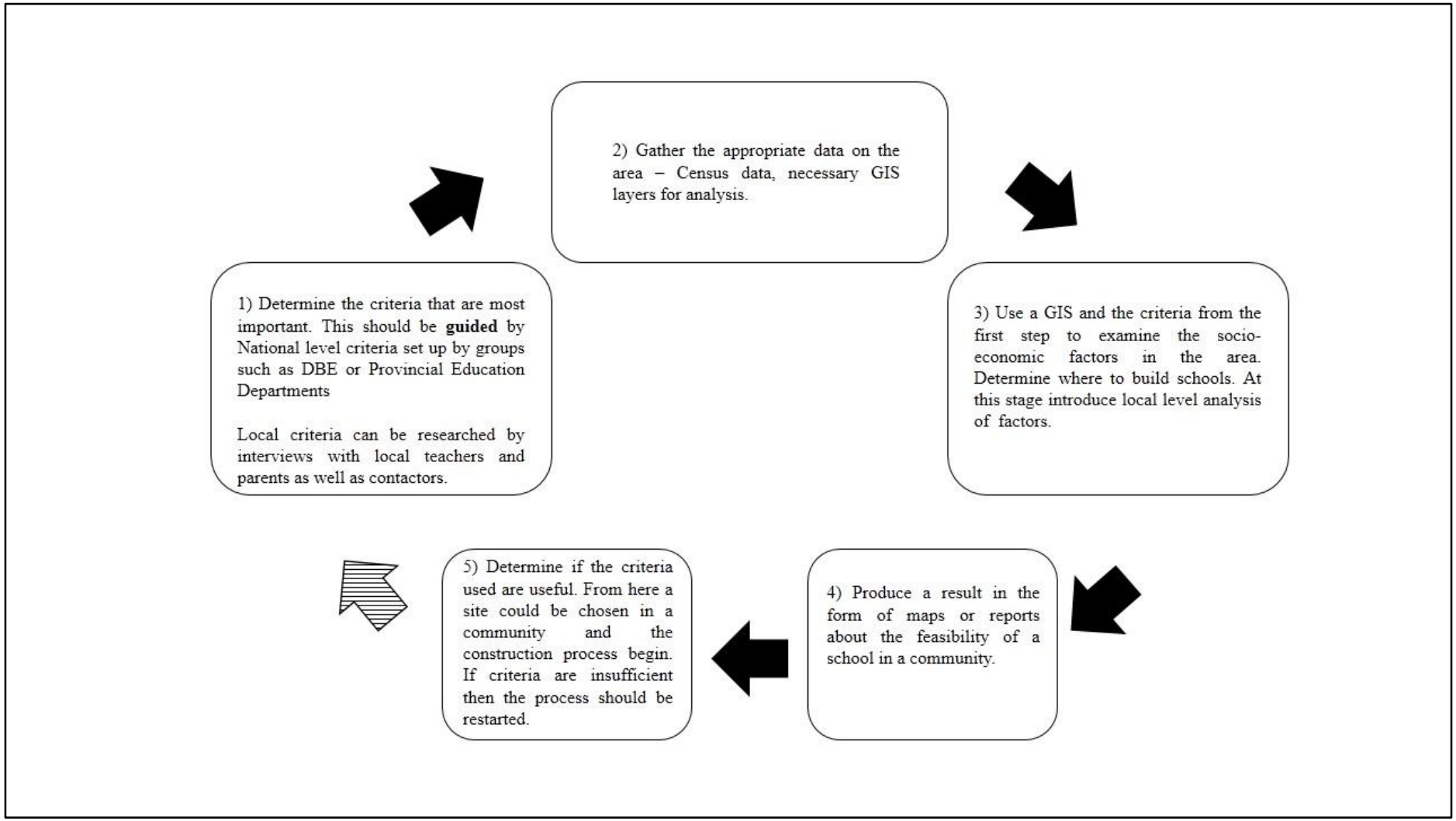

Figure 20: Conceptual model outlining the steps necessary to create school siting criteria and map suitable school sites

Summary

This chapter presents the results of this research. It depicts the results attained for each objective presented in Chapter 1. It shows how the study site was selected using the socio-economic data from Census 2011. This chapter indicates that experts view Eastern Cape education negatively while they view South African education more favourably. The media has a very similar view of education in South Africa. This chapter also contains the criteria used to perform analysis and how they were derived as well as the analysis of the siting of schools itself. Finally, it presents the informal interview results and the conceptual model of performing rural schools site selection. These results are further discussed in Chapter 5.

CHAPTER 5: Discussion of Findings

Introduction

This chapter discusses the results described in Chapter 4 focusing mainly on the establishing of criteria, the use of the criteria to find suitable areas to build schools and the interpretation of the interview results.

It is important to realise that simply copying norms from other countries or even norms for school site suitability and standards from other provinces could prove ineffective as they would not take the local character of the rural Eastern Cape into account. Eastern Cape is unique in numerous ways: it has a unique history that is not seen in many parts of the world. It was originally part of the Xhosa Kingdom (which itself creates certain issues) until it was colonised and became part of the British Empire as colony after a series of "Border" wars (from 1779 to 1879). Post colonially, it became part of South Africa as the Cape Province, however, during apartheid, the homelands became independent and were not recognised as separate states by the international community. These states, such as Transkei and Ciskei, had their own governments and policies and operated as independent countries with strict border control into the surrounding South Africa. In the post-apartheid South Africa, the new Eastern Cape Province emerged inheriting many different political systems namely racist nationalist state and traditional indigenous state with a strong colonial connection to the British Empire (Harber, 2001). Because of its history, it has a fairly unique socio-economic landscape. Some areas are high density rural areas, such as the former Transkei and Ciskei (this pattern is more commonly seen in south Asia). Former homeland areas are home to large number of villages in close in proximity to each other containing approximately 50% of the population of the Eastern Cape. On the other hand large areas of protected land and large tracts of farmland are present in non-homeland areas, which constitute low density rural areas. Outside of the two main centres of Port Elizabeth and East London, the province is not as densely populated (ECSECC, 2012a).

The Eastern Cape can be characterised as having large undulating savannah areas with little flat land in the former homelands. Soils and unreliable rainfall make commercial farming unreliable in the Eastern Cape and without active soil management nutrient levels are generally low (ECSECC, 2012a). Soils in the Eastern Cape are relatively shallow, poorly developed and unstable (susceptible to erosion). Soil erosion is a major concern in the Eastern Cape, but has

received little mainstream media attention (ECSECC, 2012a). There has also been a move away from farming towards game farms and hobby farms (ECSECC, 2012a).

There are high numbers of people migrating out of the province towards main centres such as Gauteng and Western Cape in order to seek employment. There are also high numbers of unemployed, sick (HIV/AIDS etc.) and poverty stricken people who call the Eastern Cape home. Many people who live in the former homeland areas lack services such as water and electricity. Many people in these areas are forced to rely on social welfare and remittances from family members to subsist (ECSECC, 2012a) Education in Eastern Cape is extremely polarised as well. Some of the poorest schools are located in the Eastern Cape. The LRC (n.d.) stated that the over 400 of the 510 ASIDI list schools were in the Eastern Cape.

These are the main factors that make the Eastern Cape context unique. Incorporating these differences into decision making will require an understanding of the physical, social and economic climate of the Province. These points need to be taken into consideration when examining a study that has taken place in the Eastern Cape.

Expert and Media Opinion on Education

The results from the analysis of the media compares well with the opinions of the experts. The main themes that emerged were the quality of the education and personnel, infrastructure, teacher unions' role in education and possible solutions to the problems. The Eastern Cape education system was viewed extremely negatively both by media and experts. One respondent stated that "At every step in the organisation there are people who inhibit the education process" which indicated a personnel issue. The bureaucracy of the Eastern Cape education system startled many experts and appeared to cause a sense of dismay for them while working with government projects.

A further personnel issue related to the infrastructure was that young teachers did not want to go to poor unequipped schools to teach. They felt as if this put them at a disadvantage in their careers and they would not progress very far. This, in itself, would create a continuing cycle of lack of young teachers, which leads to poor results, and in turn, leads to more dropouts and people without skills. Teachers stated they were not satisfied with the services around the villages either. They often had no homes that they would like to stay in and these areas sometimes lacked basic services. The same respondent viewed the teacher unions as responsible for stifling the progress of many changes in the DBE. Respondents viewed unions in a poor light as they felt the unions do not promote education and often hinder implementation

of policies due to internal fighting and jockeying for power. This inherently reduces the effectiveness of the DBE and the Eastern Cape DoE in solving problems in education.

Access was also an issue with a respondent stated that roads to the schools often would damage teachers cars that they had to pay for with their salary. This has made many teachers unwilling to teach in areas of poor access. There is a clear need for better rural services to attract teachers and to develop rural areas. This however, would be extremely difficult to achieve with the former Transkei areas owing to its high density rural characteristics. Respondents believed that South Africa in general had a poor education system, but there were positive points that were mentioned. These include the state of private education in the country and that the country may have a better education system than many other developing nations. This, however, should certainly not be considered a positive. South Africa has the worst education system among those countries which spend proportionally the same amount of the GDP on education (Anon, 1999). Comparing South Africa to developing countries not at the same level is not an effective comparison. There was a sentiment that the problems inherited from the previous regime could not be solved in only 20 years of democracy and more time was needed in order to complete these tasks. Other respondents viewed 20 years as sufficient time to at least construct an effective plan to combat the issues faced in the Eastern Cape. This, they felt, had not been achieved (Respondents F and I).

Many of these issues have been addressed in literature by Hendricks (2012) and Equal Education (2013). These issues are not new and have been raised for an extended period of time. Attitudes from the private sector towards education in South Africa and the Eastern Cape has been overwhelmingly negative. Many experts felt disdain towards the DBE and Eastern Cape DoE as they stated that there is "…no one willing to take responsibility. No one wants to get things done". This attitude permeates through the litigation cases that many schools have been forced to resort to in order for them to receive attention. Hendricks (2012) believes that poor schooling and thus negative attitudes emerge from the multitude of issues facing Eastern Cape and South African education. School and classroom resources are lacking while the provision of textbooks leads to delays in teaching and poor performance of learners (Hendricks, 2012). Underpinning these educational issues are those of underdevelopment, poverty and unemployment. Equal Education (2013) views the slow implementation of norms and standards as one of the main factors affecting government's poor image. The lack of communication along with ongoing problems surrounding sanitation, school infrastructure,

textbooks and personnel hampers the image of the DBE and Eastern Cape DoE (Equal Education, 2013).

Experts stated that national and provincial government should be responsible for provision of basic education in South Africa. This included infrastructure and support services in order to achieve the demands of basic education. This was brought to the forefront of media attention with the litigation battles fought by the LRC. They claimed that national and provincial government should be responsible for basic education. Skelton (2012) agrees with this point of view and states the Constitution gives the right to basic education and the government should deliver on the constitutional promise. Skelton (2012) also argued that parents, school governing bodies and teachers need to mobilise if they feel they are not receiving what is promised. This sentiment is also shared by experts who believe that infrastructure may have been delivered if the parents had demanded it from the government. The same respondent retorted that there is a lack of leadership amongst communities and a lack of accountability and communication in various departments involved with education in South Africa. There is a clear need for parents, students, councillors, local government, unions to stand up together to change schools and education.

An interesting point that was raised during the interviews was that not everyone believed that infrastructure would change Eastern Cape education. The theme that emerged was that better teacher training is more important. Teaching facilities matter, but are only useful if the teacher can perform the role effectively. They lay much of the blame on poor training and lack of knowledge of the syllabus. Radical reforms to the education system is needed according to one respondent. Once again, effective leadership and training emerged as a solution to this problem. Solutions such as more teacher training colleges and retraining older teachers to the new syllabus was the focus.

It is proposed here that objective one was met successfully and the results were beyond what was initially expected. The views of the experts interviewed corresponded with media views and established an opinion of the current situation on education. The best way to improve on the media results would be to increase the number of news websites and newspapers analysed and increase the number of articles viewed. Ultimately, this requires more time to completeand is not within the scope of this research project.

The Study Area Results

The study area results led to the selection of Lusikisiki and Butterworth Education Districts as being similar in number of unallocated ASIDI schools, size of the area and population demographics. They differed in their topography, different levels of road access and population density. What did however become immediately clear was that the "mud schools" problem was racialised not only in these districts, but in Eastern Cape as a whole. Most of the issues such as access to piped water, poor schooling and poor access to schooling affects areas that are predominantly of black African composition. This, in itself, is an issue as this stifles the development of black Africans in the Eastern Cape and continues a perpetual cycle of poverty and unemployment, specifically in the former Transkei. There is also evidence of large scale migration out of the province towards major centres such as Johannesburg and Cape Town (ECSECC, 2012b). This too contributes to a cycle of poverty in the Eastern Cape. Figure 6 indicates that employment and economic activity is not focused in the Transkei. Outside of the former homelands the majority of the wards have 51 - 60% workforce. A similar trend is seen throughout South Africa (with the exception of major centres with higher numbers of people aged 19 - 64). Many of the former homeland areas are in fact labour pools with much of the workforce seeking employment in the nearby centres of Durban, Port Elizabeth, East London and Queenstown (ECSECC, 2012b). ECSECC (2012b) believes that approximately 436 466 people left the province, while only 158 205 people migrated into the Eastern Cape in 2011. The main destination for migrants are Gauteng (which has 56% of the population born in the province) compared to Eastern Cape, which has 94% of the population born in the province (ECSECC, 2012b). When one compares the number of youth in the wards then it can be seen that many of these former homeland areas are home to predominantly the young and the old as seen in Figure 7.

Examining the evidence from the study areas revealed that almost all the ASIDI schools were located in the Eastern Cape and former Transkei. Close to three quarters of the ASIDI schools are located in the former Transkei and Ciskei. Education Districts such as Grahamstown, Port Elizabeth and Sterkspruit had no ASIDI schools while areas such as Libode had 91 ASIDI schools. The only anomaly from this set was the Bizana District which contained only five ASIDI schools. This may, however, be an oversight as the list has been proven to be unreliable with it not being updated to exclude certain schools while some schools which should not have been constructed in this phase were already under construction or complete, as is the case with Kokolo and Kunene (Figure 10 and 11). The fact that there are no schools that have inadequate

structures in areas such as Grahamstown and Port Elizabeth is flawed as the methodology that the DBE used to place schools on the list has not been published. This can be seen as a pressing problem as some schools that are not on the list may simply be left out of this process. Rhodes University Journalism students Munro, Kaminski and Allnut (2013) revealed that a school in the Libode District with only 137 students and no signs of growth was under construction while a school a few kilometres away was not even on the list. Thus, it can be stated that the list should not be seen as a conclusive document, but an ever-changing anomaly.

The ASIDI schools are generally being placed in the correct areas. Schools are costly to construct and cannot simply be seen as places to educate children, they should be available for use by the community and should add value to the community as a whole. This will give schools a double value and a shared connection to the community. Those who do not attend the schools can still have access to the services they provide. Schools should be placed where they are most effective. The DBE supports this statement as it states that it does not simply want to "build schools," and that the ASIDI programme will attempt to create schools that are effective for the community (DBE, 2011). Areas with high youth numbers should be a priority. Considerations need to be made as to the underlying social issues of the area. Issues such as low adult education rates, high numbers of youth and elderly and poor income could be proxy data for poorer areas and thus indicate low levels of schooling. The former Transkei appears to have the lowest proportion of working adults anywhere in the Eastern Cape. This trend indicates that much of the workforce leaves the area to find work leaving the young and old behind. Areas such as the former Transkei and Ciskei exhibit these social issues and should be a focus for development and investment. On a broad level, however, the analysis shows that the schools (Figures 16 and 17) are being placed in the correct areas.

Locating ASIDI Schools

At the outset of the research in January 2013, the list of ASIDI schools was not yet published. However, during the research period, lists emerged, but did not state where schools were or how far along in the process of construction they were. The updated ASIDI list only emerged in January 2014. Thus, in the study prior to this schools had to be found manually and the status of the building at the school had to be manually collected. Approximately 48% of schools in Butterworth and 33% of schools in Lusikisiki could not be contacted and thus there was a lack of information regarding the status of the buildings at the schools. Many schools existed on the initial lists that were not supposed to be there: either the schools were already built or were not "mud schools" at all. This oversight might be attributed to poor data collection and lack of

communication from schools to the DBE regarding their needs. Figures 8 and 9 and Table 11 indicated that prior to the release of the January 2014 ASIDI list very little was known about certain schools. In Lusikisiki and Butterworth, close to 40% of the schools could not be contacted as the information that was recorded by the DBE had changed or been recorded incorrectly (Table 11). A further 11% had been contacted by the LRC, but the lack of communication from the DBE and Eastern Cape DoE meant they did not even know they were on the first iteration of the ASIDI list. It must be noted that during this stage of uncertainty the building of schools by the DoE continued unabated. While it is important to build schools with urgency, if there are questions about the placement of schools then these need to be addressed before continuing.

Pressure from the civil society once again encouraged the DBE to release a list of schools that were allocated and unallocated. The release of this list meant that "mud schools" dropped from over 500 to under 300 as errors were corrected and schools that had been completed were moved to other categories. The new list reduced the number of schools that had not been built from 48 in Lusikisiki to 25 and in Butterworth from 35 to 26. During the field work, it was discovered that the new list not without its problems. In Butterworth alone there were three schools that had been built, with one under construction and another was closed since 2008. It was also discovered that officials had visited certain schools, but not others on the list. This, in itself, indicates that the list published by the DBE has a certain number of errors within it. Vague information was consistently given out to school principals and no plan was made for follow up visits. The results from the experts interviews showed a lack of communication with and accountability to the schools. This was found during the field work as many schools were not aware of the status of the school and many felt as if the department would make decisions on a whim and they were scared their schools might be merged with other schools without their knowledge or input into the process.

Determining Site Selection Criteria

Site selection criteria were developed by interviewing experts who selected criteria based on a rating system. The results from the interviews revealed that most experts thought access was extremely important. This finding ties in with the sentiments of the contractor during the informal interviews. The contractor stated that it was difficult to get to the site and inclement weather impacted access even more. It appears as if access is the most important factor as it is important during construction and once the school is open. Population was also considered important as the schools needed to be in communities that could act as feeders to the schools.

If no learners attend the school or if attendance drops due to low population numbers then that school would not be a success and may have resulted in the waste of funds that could have been spent sooner in another location. In order to determine population of an area, proxy data was used. The census data was used to determine the population as well, but it was difficult to determine where exactly the most populous areas were as the data set had 'holes' in it over the former Transkei area. This is most probably because of the high density rural nature of the former Transkei area. Thus, proxy data was used in the form of household building points. Similar methods were used by Svatos (2001) who used proxy population data to prove that schools could be planned using GIS. While it is not common for schools to be built in protected areas, there are communities who live in these areas. There is a need to service these communities, but there are a myriad of problems surrounding planning and construction in a protected area. No ASIDI schools are located in protected areas and national parks (this was a reason it was not included in the criteria). Topography was important to consider as a slope of 15 degrees or more could hamper construction and would not be acceptable for a school site. This angle was decided on as it was first presented in the draft norms and standards presented in 2008, which then was left out of subsequent publications. The contractors agreed that this was a suitable angle.

Public acceptance was not mapped as many of the communities in the former Transkei are willing to build new schools in their areas and are publically asking for their "mud schools" to be replaced. It is also difficult to map the idea of acceptance with regards to schools in the rural Eastern Cape. Instead, it was left out of the final mapping exercise. Public acceptance can be discussed at a local level when examining a single school. Site size had a surprisingly low rating. The main argument was that the size of the site could be as large as the community and local leaders wanted the site to be. This is not to say that size of the site is not important, but when determining a site from a district level then it may not be as important as other factors whereas in an urban context it may be more important. When placing a site at a local level, however, it is extremely important to consider size.

These criteria are similar to those presented in the California Department of Education (CDE, 2013). The CDEs criteria included safety, location, environment, soils, topography, size and shape, accessibility, public services, utilities, cost, availability and public acceptance (CDE, 2013). The main difference is that cost of the site was not included in this research as the community and traditional leaders allocate the land for use already. The main focus of criteria from the USA study is the access to utilities and the safety of schools (CDE, 2013; EPA, 2011).

There is also a large focus on feeder suburbs and population centres where schools are located in the USA (EPA, 2011). Fundamentally, this is different to placement in South Africa where it was found that access was the most important. This is mostly as a result of the space that these schools occupy. The majority of schools in the Eastern Cape appear to be located in the rural former homeland areas. In the USA they are located in population centres and are not as isolated as schools in the Eastern Cape (EPA, 2011). This, in itself, makes access to basic utilities for schools in the USA simpler as they are already part of a major population centre. Many schools in the Eastern Cape are not located in major population areas and thus lack utilities, which are then planned around the schools. Even comparing the "Proposed National Primary and Secondary School Types" (Table 2 and 3) presented by the CSIR (Green and Argue, 2012) to the rural criteria is inadequate as it appears to be focused around urban settings and is not necessarily useful for the Eastern Cape. This criterion may be more applicable to the towns and cities of the Eastern Cape. The KZN DoE (2011) appears to be the closest and most adequate set of criteria that suites the rural landscape that the Eastern Cape possesses. It gives specific details as to the size of community and teaching space. The site specifics include slope, flood line limitations, site size standards, and vegetation and soil type limitations (KZN DoE, 2011). It is proposed here that this is the best set of criteria that has been developed in South Africa so far as it provides details in each category. This type of document should be developed by each province to deal with the realities of their context.

The objective of determining site selection criteria was successfully met overall. Criteria were created based on expert opinion through questioning the current needs of rural Eastern Cape schools. The criteria created, however, need more input from teachers and government officials. These groups were not part of the consultation process criteria and may be able to add valuable input. Parents and students should be included as well as they may be able to provide more valuable input as they interact with the facilities regularly. The criteria tends to change depending on who is asked. For contractors and planners utilities and access seem more important, but for education specialists it is the population and safety aspects. Sampling saturation was achieved with the 20 respondents, so new groups should be focused on instead of asking planning and education experts in future research.

Suitable Locations for School Sites

The process of locating the schools used fundamental GIS analysis techniques and used these in relation to the criteria in order to create a map of suitable locations for schools (Figure 16 and 17). According to the analysis the Butterworth District had three schools which were in

unsuitable areas and all were excluded based on a lack of access to the site. Lower Nofotyo, a school which was in an unsuitable area, was visited during field work and it was established that access to the school was extremely difficult even during the dry season. Extremely steep slopes and poor road conditions made access difficult. There was also difficulty navigating to the site as the winding roads made the journey very long and tedious. The community in this area is also small and scattered. According to the analysis and the field visit, this school should not be built in this area. It should have been merged with the nearest school (Upper Nofotyo) and an extra classroom added on to the existing school. Mvumelwano and Vuyolwethu Junior Primary School (Butterworth District) are also in areas that are difficult to access. While not as difficult to access as Lower Nofotyo, these schools are in remote areas with low school enrolment numbers. The road quality once again is poor and difficult to access during inclement weather. This may not indicate that these schools should not be built in these areas, but under the criteria identified during the analysis they were selected as sites which fell out of the suitable areas. Seku Senior Primary was the only school located in the "Best" area in the Butterworth District. Upon visiting it, however, it was revealed that although it was technically in the best area, the school had very few students in attendance and rebuilding the school may not be an effective use of resources. This adds a further dimension to the process of creating the criteria. The vast majority of schools were located in areas that had high population and suitable access or in areas that had electricity supply and decent access. Kunene Junior Primary and Kokolo Senior Primary School, which had already been built by the ASIDI programme, were in "Good" areas while Nqubela Senior Primary was located in a suitable area with electricity access or high population concentration, but has acceptable access.

The analysis showed that the Lusikisiki District also had three schools which were not located in acceptable areas, and unlike the Butterworth District, these schools were not all excluded because of poor access. Zwelakhe Primary was excluded because it was within 50m of the N2 National Route. This was considered a safety risk as accidents could occur along this stretch of the road or children could wander onto the road accidentally. Mpolosa Senior Primary was excluded as it was on a slope of greater than 15 degrees and it lacked adequate access. This could pose a difficulty both during construction and during the use of the school. It would add to the cost of building the school and cause problems during construction and once in use. Vulindlela Senior Primary was excluded as it did not have adequate access and is in a fairly remote area which lacked a suitable population. The area itself is fairly mountainous and the closest school to it is approximately 10 km away. The problem, however, is that the school

itself has approximately 230 students. This clearly indicates the school needs to be rebuilt as there is a demand here and the nearest school is a fair distance away over steep terrain. The remainder of the schools were all located in areas that supported construction of the school.

The evidence shows that overall, 86% of the schools were in areas that were conducive to school activities. Only six schools were in "Unsuitable" areas while one school that was in an unsuitable area should be built as it has the population to support the school. The other anomaly was that a school in best area may be too small to rebuild. In effect, the school was too small to warrant rebuilding on that site. Other schools are already servicing this area. Up to a certain scale the analysis works effectively. It is recommended that for analysis of school site suitability a scale in between local and district level should be used. It is, however, not very effective at local scale. This is because the data that was used was collected at a regional scale. Using this data at a local scale will lead to inaccuracies. There is a need then to collect and create local level data. While work by Svatos (2001) gave good detail, the data that was used in the research was at a more local level than the data provided in this study. The results may show that common sense can also be an important factor in site locations. A contractor will not be willing to build in an area that cannot be accessed and a school will not be constructed in an area with no people or infrastructure. Schools will be built where they are requested or demanded. The main problem that may emerge is that as with Seku Senior Primary a school site may be in a very good area, but may lack the critical component, which is the learners. This problem needs to be solved. The main issues arising from the analysis for selecting suitable school sites can be summarised as such:

a) Siting schools is not simply a case of "Best" vs. "Unsuitable" areas;

b) Schools in "Best" areas may not have the local demand to necessitate building a school;

c) The data is only useful at a regional scale;

d) Contractors are not willing to build in areas that are difficult to access.

An examination of school site sizes did reveal that only seven of the 46 schools examined met the KZN DoE requirements of 1.4ha. Only one school met the CSIR requirements of 1.9ha. Upon investigation during the field work it, soon became apparent that many of the schools simply did not use the space that was given to them. Most schools only used a fraction of the space for classrooms, play areas, gardens and toilets. The rest often was covered in high grasses and did not appear to be used for anything. It became clear that these criteria, however, were

not created for the rural context. It may work for other schools, but in this situation the school sites were as large or small as necessary. No school sites visited appeared to be inadequate in size. The opposite might be true, however, that in most cases schools often had too much space. This clearly shows a need for developing criteria that is suited specifically one region or province. Examining the shape of the site revealed that in Lusikisiki there were many sites which were not rectangular. Butterworth had predominantly rectangular-shaped sites. This may indicate that little planning occurs in the Lusikisiki District while more planning with regards to site boundaries occurs in the Butterworth District.

Throughout this research, it became clear that desktop analysis could only be used to a certain point before it became necessary to visit the sites. Desktop analysis creates many opportunities to analyse data and to create maps, but without visiting the locations then the study is limited. It becomes a theoretical exercise with data that is often unreliable and too coarse. It is useful to visualise data, but ultimately site visits will immediately tell if a site can be useful or not. Even without the use of desktop analysis, one can observe the terrain, utilities and possibly safety factors which allows for site selection to be made. The best option is to use desktop analysis in conjunction with site visits.

The Informal Interview Results

The informal interviews revealed that no communication occurs between the private and public sector. The interview with the junior engineer revealed that most decisions related to site selection were made by the contractors with input from the community. While this method of selecting sites takes into consideration the community, it might not comply with the limited set of norms and standards released in 2013 by the DBE. The best aspect of this method is the consultation with the community. The community's choice is taken into consideration while the technical issues are handled by the contractors. This leaves the majority of the power of site placement in the hands on the contractors. This leads to contractors choosing the best technical option according to them which may not necessarily be the best option for the community. The engineers were not aware of the norms and standards required by the DBE and stated that they follow the architectural plans. This shows that there is a lack of communication between the DBE to the contractors.

The email interviews showed that the only instructions that the contractors take are from the architectural plans that are made. A concern, however, was that some schools were not being built near utilities, as this made construction difficult for the contractors. This, unfortunately,

increases construction costs, but it is unavoidable as generators and water have to be brought in to power equipment. These issues may be concerning during construction, but having no utilities should not disqualify a community from having adequate schools for the learners in the area. Another factor involved was access to the sites. The contractors felt that access to the sites was limited and hindered the construction. Poor roads often led to delays in construction of the site. Munro, Kaminski and Allnut (2013) back this statement and state that roads in many areas cause delays and problems in construction. This, in conjunction with inclement weather, leads to even more delays. Gumbo (2013) too states that many logistical challenges face construction companies. Transporting building materials is extremely difficult in some cases. Contractors have been known to offload building materials a few kilometres away from the site because of poor access (Gumbo, 2013). While the construction company did not have too much difficulty getting to various sites, it did state that getting materials to a site was time consuming and added to construction costs. Inclement weather also added to the costs of construction as they could not work during storms as it was dangerous and counterproductive.

Access clearly appears as the most commonly cited problem and most important criterion. It, however, cannot be simply used as an excuse in the construction process of these schools. Planning should have occurred with the Department of Public Works, private contractors or the communities to create better access to sites before construction began. This, in itself, could save time and money during the construction phase. Inclement weather is an understandable delay as weather patterns do vary throughout the Eastern Cape. Tornados, lightning and hail storms are known to have done extreme damage to the area (SABC, 2012; IOL, 2002). One meteorologist has dubbed the former Transkei "tornado valley" (de Milander, 2008). Precautions need to be taken during construction in order to avoid unnecessary injury and fatalities. Figure 21 indicates the loss of life and the cost that has been incurred as a result of weather in South Africa since 1980. In 445 loss events, 2500 people have lost their lives and $9 billion (ZAR 107 billion) has been lost (Schwarz, 2014). Effective planning and correct siting of buildings was seen as an important aspect of mitigating future losses in South Africa.

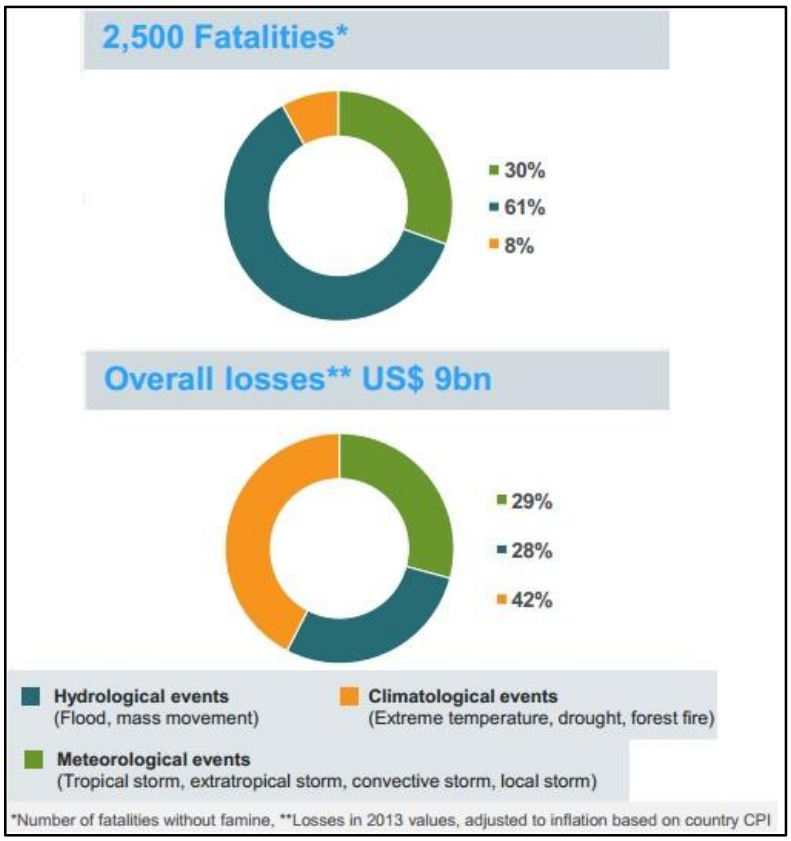

Figure 21: Weather related loss events in South Africa from 1980 - 2013 (Source: Schwarz, 2014: 12).

Conceptual Model/Framework

The conceptual framework (Figure 20) is derived from the method that was used in the research and was successful achieving results. The previous sections have shown that there is a need for individual criteria needed for certain regions. The first step involves determining the criteria for a region by using National legislature to guide the interview process.

The second step is to gather appropriate data for that region. The steps involves liaising with data custodians such as the National Geospatial Information, Eskom and the Department of Water and Sanitation among others. Getting data that is accurate and useful is extremely important in this process as any poor data that is imported into the system will decrease overall accuracy. During this stage, visits to sites can begin in order to collect local level data.

Step three involves combining the criteria and data gathered in steps one and two and performing suitability analysis in order to determine where schools should be built. Once again, local level data can be introduced here to add reliability to the data. Examining the socio-economic factors at this stage would also create a holistic view of the region and determine

where problem areas are. In the case of this research, it was determined that the problem of "mud schools" was racialised and disproportionately affected by the black youth and elderly sectors of the population.

Step four would involve producing a result in the form of a report or a map (Figure 16 and 17). This can be used to determine the feasibility of constructing a school in a community based on the criteria from step one, data from step two and local level data collection in step two and three. Step three consists of desktop analysis.

The fifth step involves determining if the criteria are useful or not. If they are useful then they may be used again in the future to determine where schools should be built, and if not, then returning to step one to determine if new criteria would be necessary. Once again, ground truthing is vitally important.

The framework itself is open to change. As mentioned before, the framework is based off the research itself. If there are other methods that change the way criteria can be formed then the model itself would change accordingly.

Comment on Current Specifications

The DBE has had several iterations of the Norms and Standards (2008, 2011, 2012 and 2013). Initially, these norms should have been in place by 2008, but complications and delays meant that it was not in place until 2013. While these Norms and Standards were welcomed by civil rights groups such as the LRC and Equal Education, they did not specifically state who was to blame for the failures that could occur. They were also seen as broad and did not give the necessary detail required for a set of standards. While it is understandable that various factors and criteria are specific to a certain region, it should be noted that the set of national standards given does not require each province to create norms and standards of their own. From speaking to educational experts, it was clear that general norms and standards should be set by the DBE with the help of organisations such as the CSIR, and specific standards should be created by each province with input from the CSIR regarding their own specific issues faced in the province, as can be seen in Figure 22. Local Municipalities could then implement these norms and standards at ground level and oversee the contractors accordingly. This basic framework places responsibility on Local Municipalities and contractors in abiding to the set of norms and standards.

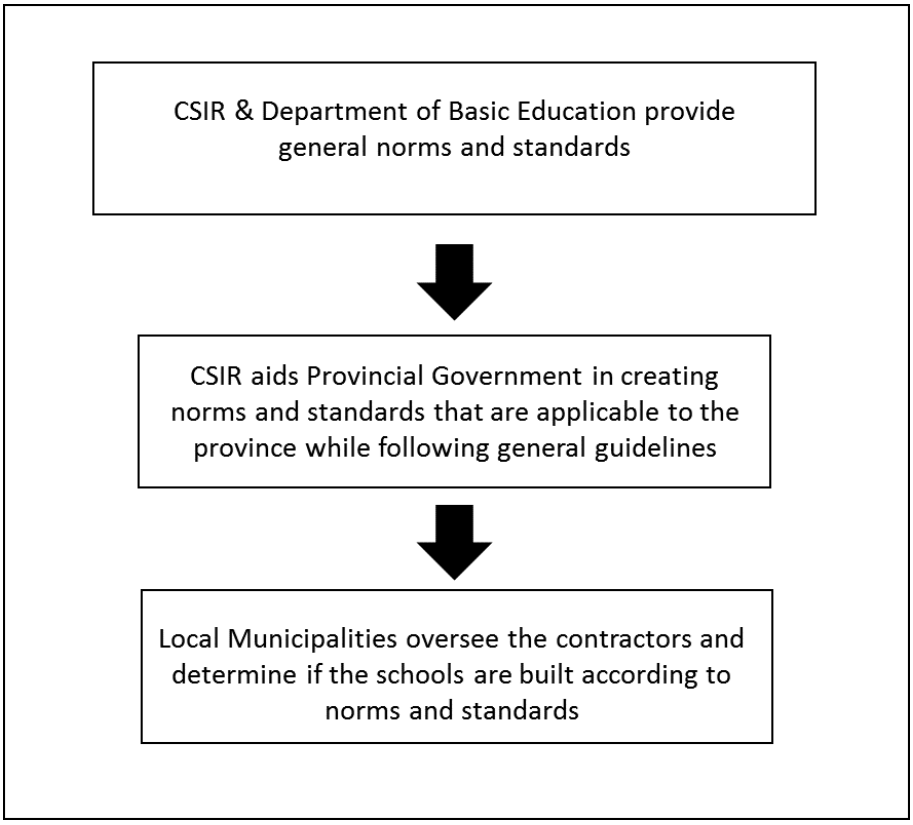

Figure 22: Recommended steps to follow in implementing norms, standards and criteria.

The CSIR's set of guidelines are applied purely to the urban context: the guidelines specifically state that villages with less than 500 people should be serviced with mobile solutions (Green & Argue, 2012). While this may be a suitable solution in a remote rural area, the former homeland areas have a denser concentration of villages of less than 500. A mobile solution might not work in this context. Instead, it may be more appropriate to develop an improved system of public transport. More research needs to be done with the provisioning of services to a rural "former homeland" context. Ultimately, the needs of these communities cannot be ignored.

An example of a province with specific norms and standards is the KZN DoE, which published "*Space Planning Norms for Public Schools*" (KZN DoE, 2011). The existence of this document indicates that the Education Department of KwaZulu-Natal was proactive. While not required by law, it was created and includes specific norms and standards for schools in the province. While these standards are extremely useful, they can still be improved with issues such as the environment and design aspects of the school still to be mentioned. Many other provinces could use these standards as a framework to develop their own. If specific norms are developed for each province then they need to be communicated to contractors, planners and educators.

Educating those who are involved in education will lead to an improvement in the standard of education in South Africa.

Documents such as the NDP simply outline the expected achievements of the sector. The wide scope of the NDP cannot be expected to be specific in the claims on education in South Africa as it has to deal with the various other social, environmental and financial issues of South Africa. Instead, the planning document "*Action plan 2014. Towards the realisation of schooling 2025"* should be seen as the "Education NDP" (DBE, 2011). It details where education in South Africa should be in 2025 by outlining detailed goals that need to be reached. This document should be seen as critical for all decision making about the future of education in South Africa. A local perspective should also be taken into account. Provincial education departments should have an education development goal which is in line with the "*Action plan 2014,*" but should be focused provincially. Local municipalities can then have the most specific development plans, which could be implemented with the help of the DBE and Provincial education departments.

Limitations

This research was not without limitations. One of the largest limiting factors was collecting spatial data for the sites selected. The NGI dataset included points called "schools" which were incomplete and often had schools in incorrect places. This dataset was the most easily accessible, but the least useful as the data was inaccurate. In the same dataset, points called "building points" were available, but did not cover all of the study site in this research. This lead to an extensive search for a complete building point dataset.

Importing the schools into ArcGIS 10 from an Excel spreadsheet proved challenging. Approximately 60 – 100 schools in the Eastern Cape did not have a spatial location. This data was missing from the Excel spreadsheet and thus were not present in ArcGIS and had to be manually collected. Many of these schools, however, were not in the exact locations, but, were rather placed in the district. Many schools were stated to be in certain districts, but when compared to the district boundaries these schools were in fact very far away from them. This influenced the numbers of schools per district as approximately 10 schools from each district were located in areas they should not have been in. Much of this is possibly a result of the inaccuracy during the data collection process.

Some datasets were older than others and were being used together to perform the analysis. The District boundaries had not changed since 2006 while the municipality boundaries had

changed as recently as 2011 (Municipal Demarcation Board, 2011). It was unclear from queries to the Eastern Cape Department of Education if the 2006 version of the District boundaries were current, but organisations such as ECSECC continued to use them to produce maps so it was decided to use them. Data scale and resolution is a common issue in desktop analysis. School sites only cover a few hectares, the best topographic data available is captured at 1: 50 000 which is not suitable at the survey and construction level. In terms of census statistics, ward data is generalised and does not necessarily represent the true nature of the population in an area. The only way to overcome these data resolution issues is to conduct detailed data capture and creation at selected sites.

Contacting representatives from the government bodies was extremely difficult and time consuming. Emails and phone calls were often not returned and when contact was made the employee was unable to transfer the communication to the correct channels. There appeared to be a severely negative attitude towards research into education in the Eastern Cape by government officials from national bodies such as the DBE to the ground level of municipal managers of local municipalities. The inclusion of information from the government would have added a great deal of value to this research. Private sector communication was not completely problem-free.

Organising dates to administer interviews proved extremely difficult. It was initially the intention to personally administer each interview, but it soon emerged that various experts would leave South Africa frequently so only email communication was available. The experts were also not in the immediate area that this research was conducted. Therefore email interviews allowed respondents to reply at their leisure in a timeframe that suited them.

The final limitation was that Lusikisiki District was not visited by the researcher individually due to time constraints. The LRC visited the District and notes taken from them aided in the final analysis and verification of the data.

CHAPTER 6: Conclusion

The LRC had an aim at the beginning of the project to determine where schools could and could not be built. This research employed methods and delivered results, which were able to identify where schools should be placed at a district level. Initially, interviews were conducted and an analysis of media was conducted in order to determine opinions on the current state of education in South Africa and Eastern Cape. This revealed a largely negative opinion towards the Eastern Cape and while perceptions of South African education overall were more positive, but still relatively negative. Research into the socio-economic factors around the Eastern Cape revealed that the issue of "mud schools" was racialised as one race group is disproportionately affected by it; the youth and the elderly are also mainly the affected groups. This also revealed that the former Transkei area lacks utilities in certain areas such as piped water and electricity. This led to two Education Districts in the former Transkei being identified as study areas. Initially, without a definitive ASIDI list, schools had to be located using a combination of GIS and fieldwork. When a list was eventually published in 2014, it was discovered that the initial number of approximately 500 ASIDI schools was reduced to approximately 300 schools that needed to be built due to errors on the list and schools being completed. Following this, it was decided to determine school siting criteria by using interviews with experts in the fields of planning, education, engineering and construction. The process produced a list of criteria of which access to the site was considered the most important while the least important factors were not used. These criteria were then used in conjunction with a GIS analysis to identify the best locations for schools. The locations were determined and the current ASIDI list was used to determine if schools were in correct locations. The majority of the schools on the list were in the correct locations with a few exceptions. The schools that were already completed and under construction appeared to be in good locations. Finally, the above methods and results were used in creating a conceptual model, which could be used in the future to create criteria for a region and identify suitable locations for schools in order to understand the process of creating norms and standards in a rural context. This model focused on five steps to create a set of criteria which included data collection, using GIS to produce maps and either revise the criteria or accept them.

This research established that quality education is a global concern. In South Africa and particularly in the Eastern Cape, it is also clearly a topical issue. Any research which can

contribute to addressing some of the issues faced in the education sector is valuable. This research has contributed to developing a method for use in planning for school development in the Eastern Cape. While the desk-top analysis must be supported by field verification, it may be a starting point for standardising the way in which resources and funds are allocated to school districts. It also shows that there are public domain datasets (high resolution aerial photos, Census stats, and topographic data) which can be used as the basis of a desk top study that can yield useful results. Part of the research was to update and generate a revised and better list of schools, which was achieved, such that to date (January 2015), this is probably the most accurate and up-to-date list.

The aim and objective of the research were met as the results determined locations to build schools in. These areas roughly corresponded with where current ASIDI schools were located. There were issues where a school was in the "Best" area, but had very few students to justify building a new school here. In such circumstances, the local factors would play a large role in eliminating these results. More time and man power will eliminate many of these issues. The main problems are not necessarily building or construction, as the research indicates that even without much direction, most of the schools end up being placed in the correct areas. It appears as if the easiest part of the education system is the construction of the schools. The main problems with education in the Eastern Cape were identified in one of the first steps of the research: respondents stated that among other issues communication, leadership, responsibility, planning, and management of resources was where the majority of the problems lie. The Eastern Cape DoE has had a troubled past where it was placed under Section 100 administration by the National Government and appears to be struggling to cope with management of normal operations and the ASIDI program. Ultimately, the main focus from respondents correspond with the sentiments of many in the media, which is that teachers are more important than buildings and classrooms. There needs to be good classrooms for teachers to educate learners, but the teachers need to be able to communicate and instruct in an effective manner before they enter a classroom.

The future direction of this research needs to be in determining the criteria needed for other areas, then comparing the techniques used to see if the criteria differ and what the reasons are for this difference. Ideally, a follow up study could be done to determine if the criteria created in this study would still be useful after the completion of the ASIDI programme. Ultimately, the goal would be for each province to find criteria for school siting norms and standards that

would be relevant for them. These could be used to place schools specific to their locations and conditions. The goal then becomes who applies the criteria in order to locate schools and who is responsible for overseeing the implementation of this system.

While school placement may not be as important as teacher training, there is still a need for school placement criteria to be developed. It goes beyond being financially beneficial and encompasses making use of the facilities easier for the relevant stakeholders. There is a need to carefully create and implement criteria that are usable and not ambiguous in order to create a system where all schools are sited and serviced in the same way and that the gap between rich and poor schools becomes narrower.

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Appendix A: Schedule of Questions Asked during the Interviews

NAME:

The aim of this interview is to establish perceptions of professionals, who are close to the education field, about the state of education in the Eastern Cape and current norms and standards of site selection in South Africa. The responses from this interview may be used in the Masters dissertation of Conrad Swart. The thesis revolves around searching for suitable sites in the Eastern Cape to build schools and the necessity to establish standards for site selection for new schools.

If you have any concerns please do not hesitate to call the Geography Department at Rhodes University on 046 603 8319

Thank you for taking time out of your busy schedule to answer these questions.

1. Could you give me a brief overview of who you are, what you do and how many years you have been in your field?

2. How would you score the current state of education in South Africa in general?

Extremely Unsatisfactory Excellent

Extremely Unsatisfactory				Excellent
1	2	3	4	5

2a. Why did you choose this rating?

3. How would you rate current state of education in the Eastern Cape?

Extremely Unsatisfactory Excellent

Extremely Unsatisfactory		Excellent

1	2	3	4	5

3a. Why did you choose this rating?

4. Could you please list in order of importance what you believe to be the major issues that need to be addressed in Eastern Cape education?

5. Who should be addressing these issues? (Mark with an X You may select more than one)

a) National Government		b) Provincial Governments	
c) Municipalities		d) National Departments	
e) Non-Governmental Organisations		f) Local Communities	
g) Private Investors/Organisations		h) Other	

6. Do you believe these groups (mentioned in 5) are currently doing enough to ensure the issues mentioned in 4 are addressed?

7. What do you understand by ‘site selection’?

8. What do you believe are the most important factors in selecting new sites for schools?

9. Do you think some of the issues mentioned in 4 may be related to ‘site selection’?

10. Can you give some ideas on how you think ‘site selection’ might influence success of education

11. Do you think that a(n) (improved) policy in regard to site selection norms and standards would be advantageous?

Yes	No

12. Who should be responsible for creating and policing the norms?

13. Do you know/understand what GIS is

13b. Do you believe GIS can be used as an effective tool for site selection for schools?

14. Can you comment on how much of an influence you believe a community has on the success of a school and therefore, should the community have the final say on the final location of the school?

15. What methods would you use to select a site in a rural area for a school?

16. Are there any other comments you wish to make regarding education, site selection, this study?

Thank you very much for your time.

Conrad Swart

Appendix B: List of Respondents Interviewed for the Research Project

List of Respondents	
Name	**Occupation and Description**
Cameron McConnachie	Lawyer at the Legal Resources Centre in Grahamstown who is currently monitoring the state of ASIDI schools in South Africa
A	Independent education consultant based in East London with 20 years' experience
B	Dean of Education at a university in South Africa taught for 10 years prior
C	Education consultant for a company in East London
D	Retired teacher/administrator who taught for 25 years and joined an education consultancy for 10 years
E	Junior policy development consultant for a firm in East London
F	Social development consultant who regularly works with government organisations
G	Owner of a consultancy that develops policy geared towards education and training
H	University professor and child law expert who deals with issues relating to school infrastructure
I	Head of an NGO who is monitoring the ASIDI programme
J	Development economist who works for a firm in East London
K	Owner of a major development and GIS consultancy in Eastern Cape
L	Owner of a small GIS consultancy firm in the Eastern Cape
M	GIS professional who works in a municipality in the Eastern Cape
N	Manager of a construction company responsible for constructing roads in the former Transkei
O	Owner of a construction company that used to public infrastructure
P	Owner of an engineering firm in Port Elizabeth with 25 years of experience
Q	Town and Regional planner working for a government organisation
R	Self-employed architect, structural engineer and planner with 30 years' experience.
S	Retired head surveyor/planner who used to work for a municipality
T	Owner of a large contracting firm in East London
U	Junior Engineer for the construction on site at Nkonkwane school
V	Managing director for a contractors building the Nkonwane school