Integrated Social Facility Location Planning For Decision Support

Accessibility Studies provide support to facility location and integration of social service provision

ACCESSIBILITY ANALYSIS FOR FACILITY LOCATION PLANNING

Developing sustainable, well provisioned settlements by:	Objective 1
Targeting the right people	Improvement of service accessibility and availability from the perspective of existing and potential customers
Spatially matching demand to supply	
Reducing overall travel distances and costs	Objective 2
Designing equitable distribution of service points	Attraction of the volume of customers needed (i.e. facility threshold) to cover overheads and make the service viable

Answers questions:	Uses GIS-based accessibility tools
Who (targeted demand) gets	To model the access to social facilities based on rational choices (e.g. assume that people will go to their nearest facility)
What (type, quantity & quality)	
Where	
How	

CSIR has developed/ uses:
- A facility access planning approach
- Guidelines for the provision of social facilities
- Customised accessibility analysis tools

Facility accessibility analysis:
- Support the achievement of a more equitable spatial distribution of facilities and the reduction of access distances
- Facilitate the clustering of facilities
- Assist departments to test and refine their distance access norms and threshold standards
- Test the relationship between service demand and the supply (service capacity) of the facility provision points within a defined catchment area
- Promote the 'right–sizing' of facilities relative to the demand
- Enables spatial visualisation of backlogs and proposed new facility locations which aids stakeholder communication

Outputs:
- Maps of current levels of access to public facilities relative to population distribution
- Spatially identified backlogs in facility provision
- Identification of suitable location(s) for selected new facilities and assisting in the development of a integrated facility provision location plans
- Evaluation of the impact of planned project or budget requests on facility backlog reduction

Accessibility Analysis Process

Determine Status Quo:

Step 1

Catchment area analysis

Run the catchment area analysis model to establish the status quo within an area.
Now using the results, undertake Steps 2 and 3 to establish the reach and the demand at each point relative to the capacity. This is based on an agreed standard in terms of travel distance and specified service capacity ratio, i.e. number of people per facility or an alternative capacity unit, such as class room size.

Step 2

Identify well served and poorly serviced areas
Calculate and map the current distances that populations have to travel to their nearest facility. Demarcate areas with sufficient capacity within the agreed distance to show well served areas and map density of poorly served areas.
Calculate facility backlog in the poorly served areas.

Step 3

Classification of facilities with respect to potential usage
Comparison of facility supply, demand and actual usage figures (Service Side Classification) to identify areas with over- or under-supply of a facility. The service side classification table is a typical output

Service Side Classification			
Facility Name	Capacity	Allocated Population	Usage
Facility 1	20 000	20 000	Well Utilised
Facility 2	10 000	20 000	Over Utilised
Facility 3	5 000	2 000	Under Utilised

Planning for new investment:

Step 4

Plan for new facilities
Identify unserved areas with sufficient demand to support new facilities and plan to expand or decrease capacity of facilities in served areas if supply and demand are not in balance. Optimisation analysis and/ or proximity counting may be used to find optimum locations for potential new facilities to assist planners and government prioritize investment and suggestions where services could operate from one point could be made

Step 5

Integration
Combine facility plan for two or more facilities to create an integrated plan for development

Step 6

Costing of development plan

Case Study

Local and national government authorities are required to provide services to all communities within their jurisdiction in a fair, equitable and sustainable way. The Government Programme of Action (Outcome 12) compels government departments to develop geographic access norms and to set targets for reducing the distances people have to travel to reach services, where this is appropriate. These goals can be supported by accessibility studies. The DPSA has commissioned the CSIR to do a study to assist departments to achieve these Goals.

Access to Thusong Service Centers And Clusters in eThekwini

Thusong Service Centres are one-stop centres where local, provincial and national government, as well as other sector service-providers, offer Services and developmental information to local communities. They provide information and services to communities from a hub within communities at which a multitude of government services and other community services can be accessed. The key anchor services include Department of Home Affairs, Labour and Social Development. Thusong . Each Centre is unique and may be located either in a single building or as part of a cluster of buildings. If facilities cannot be provided on one site they should be within a 1km radius of each other. The findings of this accessibility study will assist in the development of accessibility norms for Thusong Service Centres in metropolitan areas.

Basic Approach and Methodology

Project Tasks:
- Define / revise access norms and standards for Thusongs.
- Confirm 2011 population distribution, based on StatsSA population data
- Verify the location and capacity of facilities
- Evaluate current facility accessibility of Thusongs and Clusters in eThekwini by:
- Calculating distances that people currently travel to the Thusong or Cluster
- Comparing current supply versus total demand within the defined travel distance
- Identify areas not served or sub-optimally served by current Thusongs or Clusters in relation to the access norms and standards; and
- Identify theoptimal distribution of new facilities to meet the backlog in terms of access norms and standards / service levels.

Data Requirements

- **Population data - a detailed grid (in this case a hexagon grid)** is created and used to assign the population data . The population data include the total population as well as other socio-economic variables that are cardinal to establishing the people's access to transport
- **Road network – the road network is used to simulate the way in** which people traverse across spaces. Different types of roads also have different speeds at which traffic or a person can move on it or impedances. Using the road network is a major advantage to other GIS-based analysis which use the after inactive measure of straight line distance,
- **GIS Facility Inventory** –indicates precisely where a facility is located using its geographical coordinates. Attached to the facility must also be attribute data indicating its capacity and any other relevant information that has an impact on its usability

All three layers interact within the applicable set standards to determine
- Which Part of the **population**
- Have to travel **how far**
- to a facility with a set capacity to access a **service**
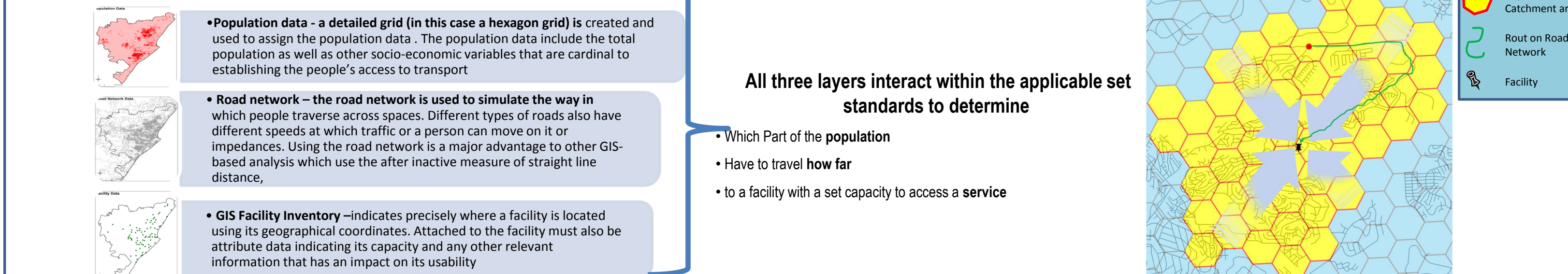
Evaluating Current Situation of access

Catchment area analysis outputs
A preliminary Analysis for the Thusong Service Centres was undertaken for eThekwini municipality. To establish the distance to the closest centre for the entire population a map was produced to indicate where the facilities where in relation to populations in five different distance bands (0 to >25 km in 5 km increments) to indicate the number of people that can reach a Thusong centre or cluster the white areas represent areas that fall beyond 15 km of a Thusong Facility. Figure 3 (The Unserved demand map) depicts the population densities in areas where people cannot reach a Thusong or Cluster within 15 km access distance. The areas coloured deep brown have severe access issues since they have high population densities. and limited access
These results indicate that currently, the majority (56.64%) of the total population in eThekwini live within 15 km of a Thusong Service Centre, and the average travel distance to a facility is 14.03km . I It was proposed and agreed that a 15 km access distance is the most appropriate distance to use for the provision and analysis of the Thusong facilities with respect to the actual distance and alignment of the access standard with other facilities at the same level, i.e. Labour and Home Affairs. It was proposed that the department of Government Communication and Information Systems set a target of Thusong Centres being within reach of 90% of urban dwellers within 15 km.
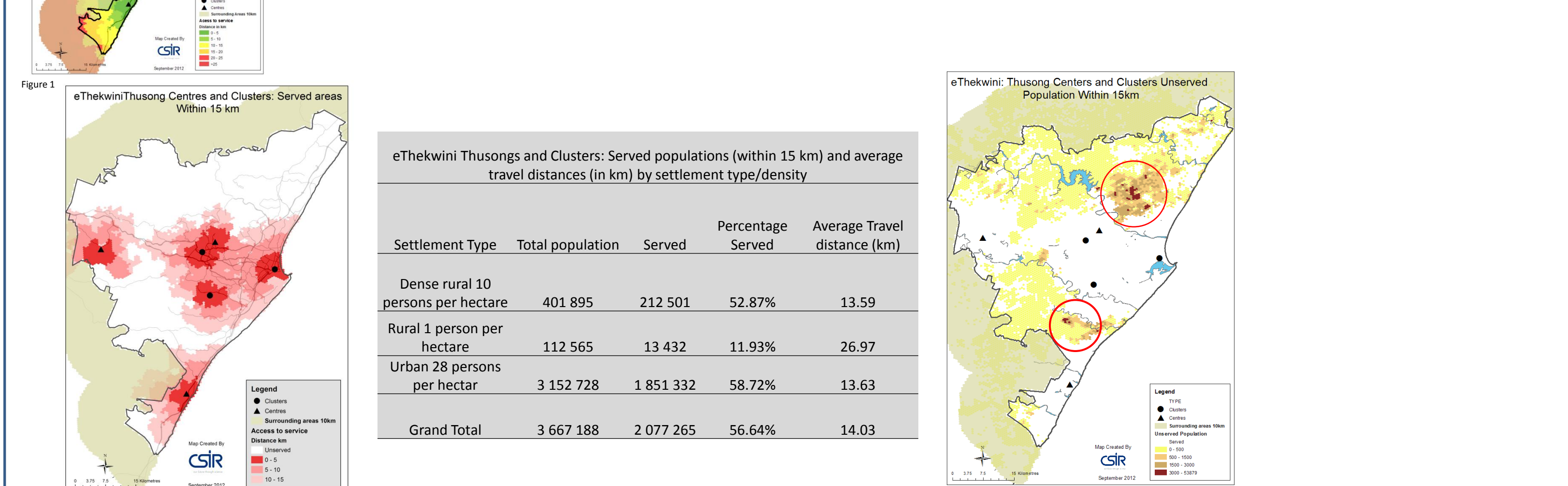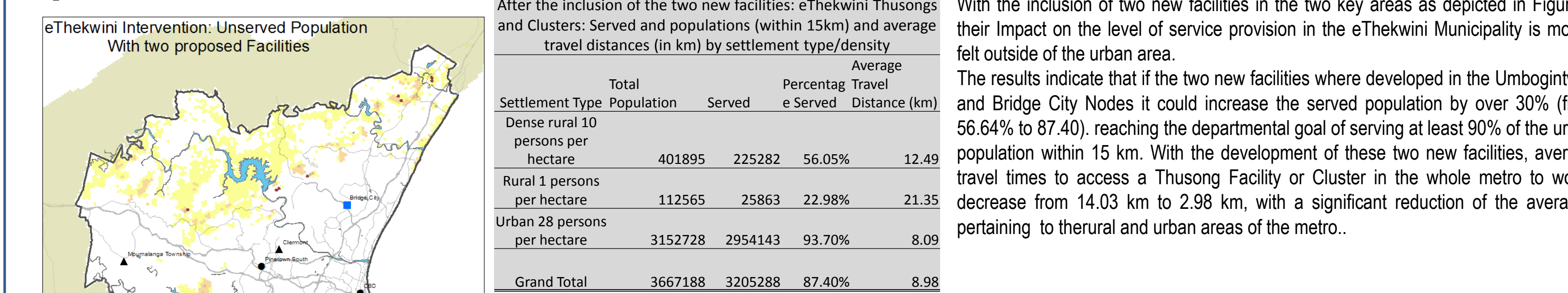
Figure 2 is a map showing areas that can reach a facility within the 15km standard, displaying the catchments of the facilities. table 1 indicates the statistical model outputs. They indicate that within the 15km standard 56.64% of the population could reach a Thusong centre or cluster the white areas represent areas that fall beyond 15 km of a Thusong Facility.

eThekwini Thusongs and Clusters: Served populations (within 15 km) and average travel distances (in km) by settlement type/density				
Settlement Type	Total population	Served	Percentage Served	Average Travel distance (km)
Dense rural 10 persons per hectare	401 895	212 501	52.87%	13.59
Rural 1 person per hectare	112 565	13 432	11.93%	26.97
Urban 28 persons per hectar	3 152 728	1 851 332	58.72%	13.63
Grand Total	3 667 188	2 077 265	56.64%	14.03

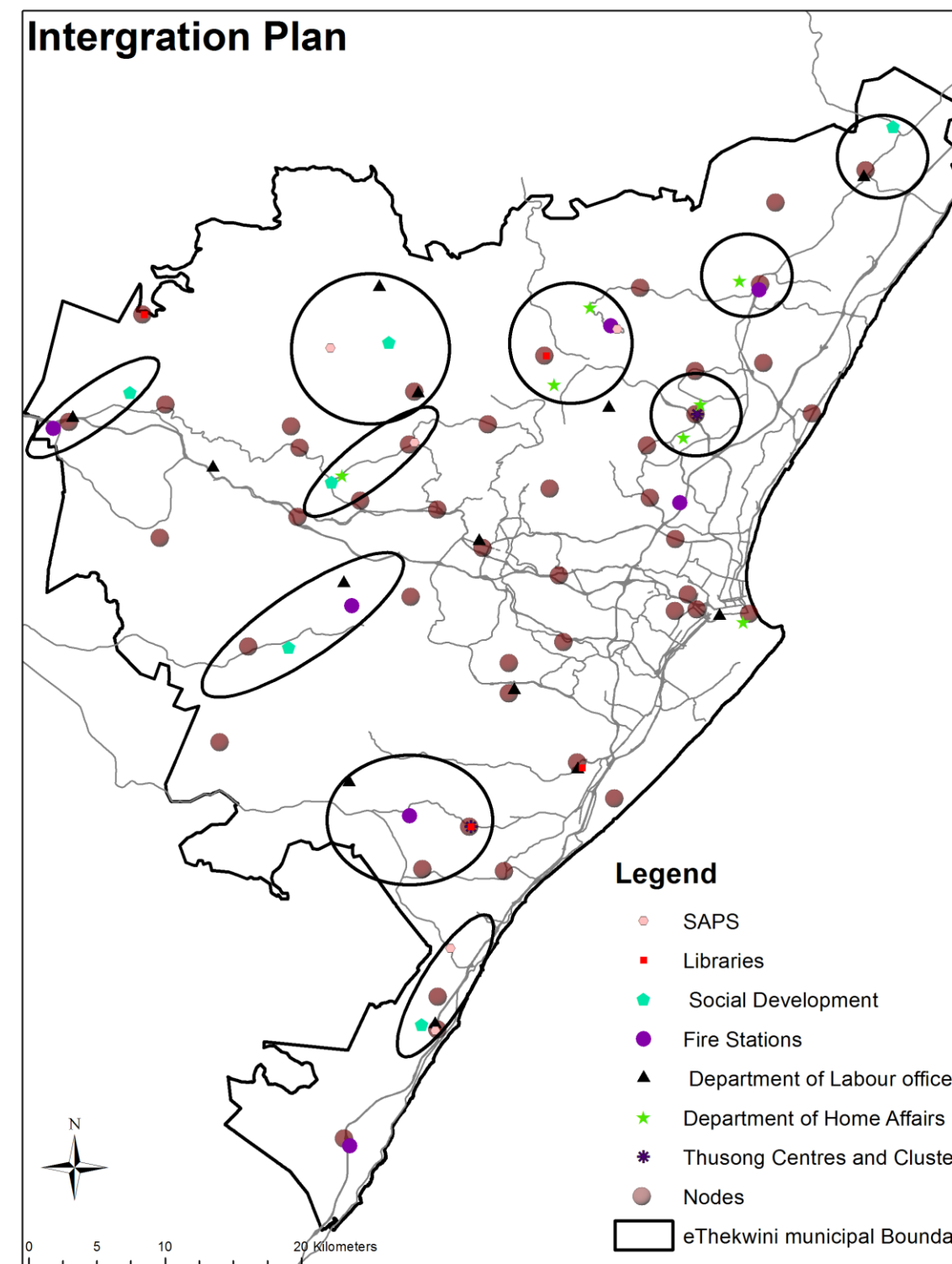### Seeking the best location for new facilities

The Inanda/Ntuzuma/Kwamashu (I.N.K) area and the Folweni/Adams Mission area (highlighted in red) require interventions as populations here are beyond 15 km and are the most dense. A 15 km standard access distance is the norm, currently only 59% are served in the urban area and this will need to be increased substantially to reach a 90% service level. This would be achievable with the proposed new facilities .Facilities in priority areas should be developed first, followed by smaller facilities in the dense rural areas. The low density in other areas which are beyond 15km means that mobile/periodic services may be more suitable. The impact of facilities at Bridge City and in the Umbogintwini areas are expected to shorten the travel distance for many in the rural areas. With these results the next stage of the accessibility analysis can be undertaken – the planning of interventions. A model called the optimisation model (from the FLOWMAP Software) could be used to produce points on the map which would be the optimum locations to build new facilities to meet the backlog and serve areas where service is poor. Since key areas of intervention have been identified new facilities were proposed for two of the key development Nodes, the Bridge City and Umbogintwini Nodes.

After the inclusion of the two new facilities: eThekwini Thusongs and Clusters: Served and populations (within 15km) and average travel distances (in km) by settlement type/density				
Settlement Type	Total population	Served	Percentage Served	Average Travel Distance (km)
Dense rural 10 persons per hectare	401895	225282	56.05%	12.49
Rural 1 persons per hectare	112565	25863	22.98%	21.35
Urban 28 persons per hectare	3152728	2954143	93.70%	8.09
Grand Total	3667188	3205288	87.40%	8.98

With the inclusion of two new facilities in the two key areas as depicted in Figure 4 their Impact on the level of service provision in the eThekwini Municipality is mostly felt outside of the urban area.
The results indicate that if the two new facilities where developed in the Umbogintwini and Bridge City Nodes it could increase the served population by over 30% (from 56.64% to 87.40). reaching the departmental goal of serving at least 90% of the urban population within 15 km. With the development of these two new facilities, average travel times to access a Thusong Facility or Cluster in the whole metro to would decrease from 14.03 km to 2.98 km, with a significant reduction of the averages pertaining to therural and urban areas of the metro..

Facility Integration

The analysis was conducted for a number of facilities including SAPS, Libraries, Social Development, Labour, Home Affairs and Fire Stations. Figure 5 depicts the locations for the proposed locations based on optimisation several facilities. The spheres on the map are represent the facilities that could be clustered together to promote integrated service delivery of the departments at key development nodes, to assist planning and priorities investment areas

Intergration Plan

Legend
- SAPS
- Libraries
- Social Development
- Fire Stations
- Department of Labour office
- Department of Home Affairs
- Thusong Centres and Clusters
- Nodes
- eThekwini municipal Boundary

Access norms and thresholds guidelines in accessibility analysis

Appropriate norms/provision guidelines facilitate both service provision and the determination of facility backlogs. They make provision levels and backlogs more easily quantifiable and transparent to decision makers. This ensures a more equitable provision of services and facilities to communities.

Incorporation of comparable and benchmarked standards in governance and delivery systems

Equitable, efficient, auditable allocation of facilities for well provisioned sustainable settlements

Access norms and GIS modelling

- Supports accessibility analysis as a key input
- Allows auditable progress of backlogs over time
- Informs capital budgets and sustainability
- Enables apolitical decision making

CSIR GUIDELINES FOR THE PROVISION OF SOCIAL FACILITIES IN SOUTH AFRICAN SETTLEMENTS
First Edition: August 2012

Input to standards required

Key elements of access and threshold norms provides visual representation of backlog based on specified parameters:
- Facility capacity -- range of facility sizes can be used
- Maximum travel access distance or time to reach facilities
- (Optional) extra information considered:
  - Restrictions on the use of facilities in other districts
  - Typical access mode (walk, cycle, taxi)
  - Typical site size for conventional design
  - Clustering and sharing options with other facilities

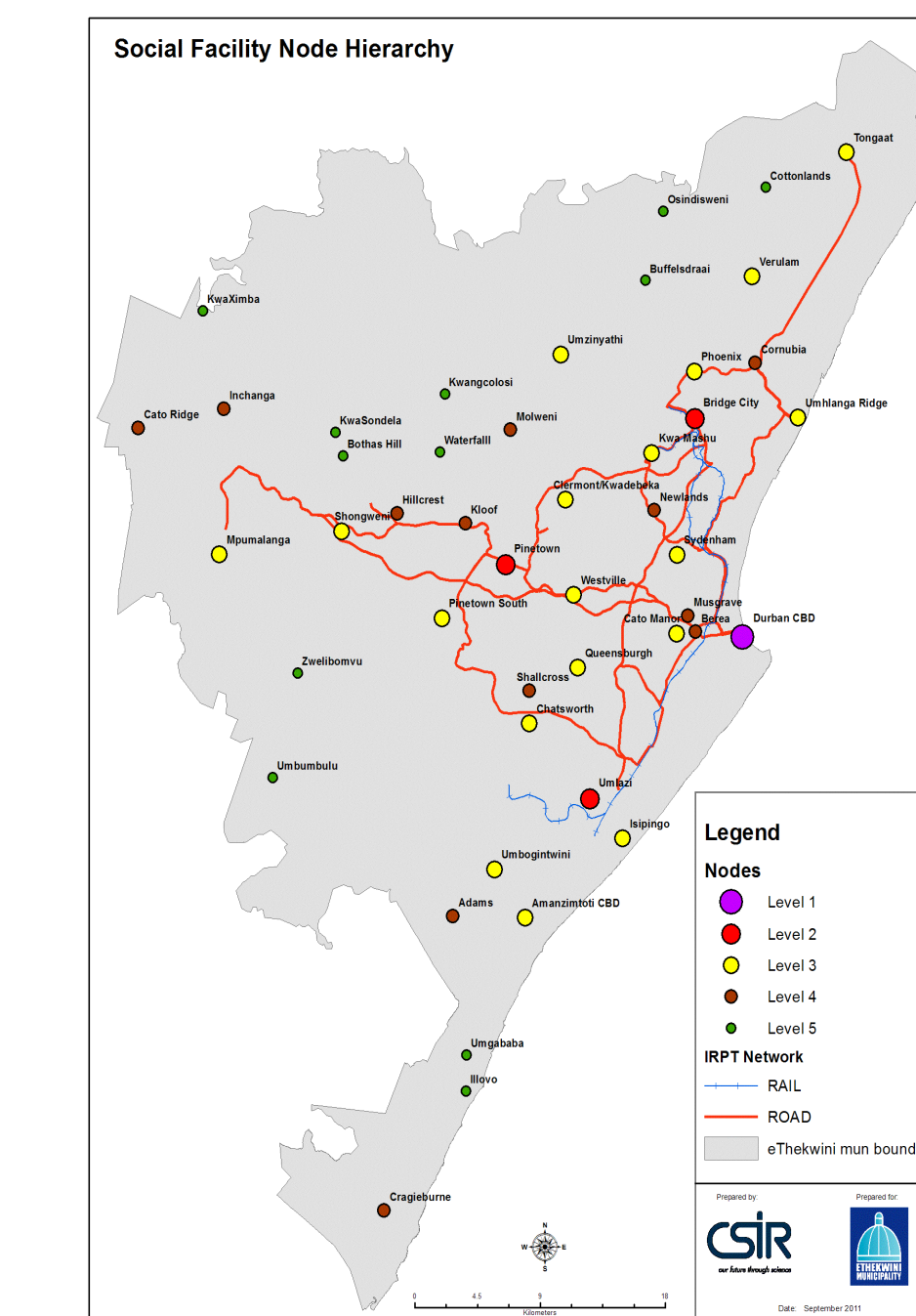| Example of summary information for guidelines			
Facility type	Access Distance	Threshold	Target population
Home Affairs office (medium size)	15 km	160 000 persons	Total population
Labour office	15 km Urban 25 km Peri-urban	Variable	Total population
SASSA (Social Service office)	15 km Urban 40 km ??National	Variable	Population meeting grant requirements
Secondary School (large – ??1 000 pupils)	5 km	12 500 persons	Population aged 13 - 18

Enhancing City Structure through the Provision of Social Facilities within a Hierarchy of Nodes

Clustered facility provision at nodes promotes integration. A hierarchy of nodes to serve as social facility delivery centres can be used together with accessibility analyses to facilitate this in practice.

A hierarchy of nodes

- Provides an effective distribution network for a range of social services by clustering facilities at central locations
- Assists in allocating facilities of various types to their most appropriate node level based on the provision threshold for that facility and the number of people required within the catchment of that facility. This is aligned to the catchment population of the specified node level. That is, facilities with high thresholds (such as stadia or hospital) require more people within their catchment than community halls which have a lower threshold. Stadia and hospitals can be located at level 3 nodes and above, while smaller facilities are located at most node levels.
- Creates opportunities for facility multi-use, sharing, etc. through the clustering of facilities and should result in land savings and trip reduction.

Example of Node Hierarchy for eThekwini				
Social Facility Focus Areas / Nodes	Typical catchment size	Typical access journey times (min)	Land use	General facility provision guidelines
Level 1: Primary nodal zone	800 000 – 3 000 000	60 – 80	mixed	Facilities should be fully provided but may require upgrade or maintenance
Level 2: Secondary nodal zone - mixed land use	400 000 – 800 000	20 – 30	mixed/ residential/ economic / industrial	All facilities except higher order facilities to match demand.
Level 3: Nodal zone - mixed / residential land use	90 000 – 390 000	15 – 20	residential/ mixed/ industrial	Mostly middle to lower order facilities.
Level 4 : Service Centre	30 000 – 90 000	10 – 20	residential/ mixed	Mainly local facilities
Level 5: Service Cluster	3 000 – 30 000	5 – 20	residential	Only local facilities with demand adjusted to local conditions
Level 6: Local node (not analysed or identified in this study)	0 – 12 500	5 – 15	residential	Local cluster of demand driven services; no specified minimum
Special nodes: Education, Health, Recreation & Sport, Tourist	1 000 000 – 4 000 000	30 – 90		

Social Facility Node Hierarchy

Legend
Nodes
- Level 1
- Level 2
- Level 3
- Level 4
- Level 5

IRPT Network
- Rail
- ROAD
- eThekwini mun boundary