TOOLKIT **EDITION 1** 2018

CITIES' **INFRASTRUCTURE DELIVERY** AND **MANAGEMENT** SYSTEM **CIDMS**

MODULE 4

Levels of service and customer profiling

national treasury

Department:
National Treasury
REPUBLIC OF SOUTH AFRICA

2030 NDP

MODULE PURPOSE

This module provides the means for identifying, locating and quantifying municipal customers, and for profiling such customers in terms of key built environment planning attributes such as land use type, density and income levels. This module also provides levels and standards of service options for infrastructure and community services as a basis for engaging with customers on appropriate service packages, for profiling the current state of service provision, for quantifying service access backlogs, and to estimate current and future demand.

Additionally, this module provides guidance on the type and location of social amenities to be provided in urban spaces to support spatial objectives such as densification and the strengthening of identified spatial structuring elements (e.g. nodes and corridors).

WHY

1. Cities have a mandate to deliver a wide range of infrastructure and community services to customers. This requires cities to know their customers, and to agree with these customers the scope and levels of services to be provided.
2. Cities also need to establish the state of service provision to its customers, both in terms of levels of service and spatially, to determine whether customers are receiving the services agreed upon, and to identify any service provision backlogs (e.g. lack of access to services, or services offered at levels of service considered too low) to be addressed through either asset or non-asset solutions.
3. Decisions on where infrastructure and community services are to be provided impact on the urban economy and the city's spatial structure.

OUTPUTS OF MODULE 4:

1. The adoption of a customer profiling system (which forms part of the city's asset management system, to be documented in the city's strategic asset management plan) and that meets the following criteria:
   - It will account for all major customer groups being planned for.
   - Key customer attributes, such as income levels and density must be included.
   - It will enable the optimal use of existing sources of data (municipal and other).
   - The level of data chosen must be sufficient to enable analysis, planning and reporting, but not excessively difficult or expensive to acquire, process or maintain.
   - It must be possible to spatially analyse and present customer profiles.
   - It must be possible to spatially depict and analyse population growth and infrastructure capacity to determine built environment impacts at that point in space.
   - The methodology used to profile and spatially segment customers must be repeatable.
2. The adoption of levels and standards of service options, including directives on when, to whom and where these options will apply, to be documented in the strategic asset management plan, and ideally also in a customer services charter that is available on the city's web site.
3. A spatially-based, segmented customer profile that supports built environment planning, inclusive of demand planning, as well as revenue planning.
4. Profiling of the current state of services provision for all customer types, by level of service per service type, and per spatial entity or regional segment reporting convention.

KEY RELEVANT NATIONAL REGULATIONS, POLICIES AND STRATEGIES:

1. Spatial Planning and Land Use Management Act, No. 16 of 2013
2. CSIR Guidelines for the provision of social facilities in South African settlements
3. Sectoral legislation, policies, norms and standards related to service provision.

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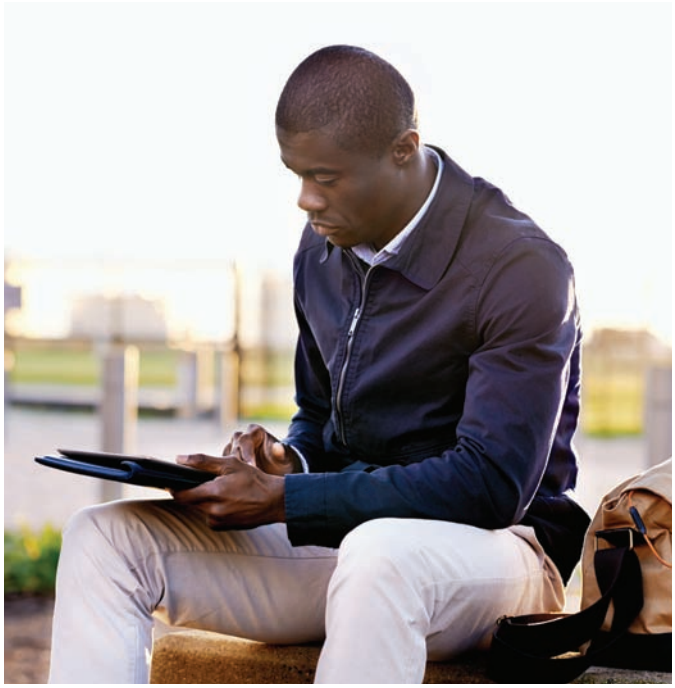
4.1 INTRODUCTION

4.1.1 Purpose and scope of this module

This module provides a customer classification system for profiling the different categories of customers in a municipality. Since infrastructure and community services are offered to customers, it naturally follows that the infrastructure planning process must start with knowledge of how many customers must be served and where, and understanding of their needs, preferences and abilities to pay.

The module then offers levels of service hierarchies for the main infrastructure and community services provided by cities to its customers. These levels of service hierarchies can be thought of as a shopping list of "service packages" or "products" offered to municipal customers. The type or level of service package will depend on several factors, such as: customer needs and preferences; ability to pay; the availability of bulk and distribution infrastructure; municipal affordability; and legal requirements. **A suite of levels of service hierarchies assists the infrastructure planner to:**

- Determine the type or level of services received by customers;
- Engage with customers on the levels of service they desire, and the costs associated with providing the services they want;
- Establish whether certain customers are underserved or not receiving services whatsoever, meaning they should receive higher levels of service – this would be considered a "service access" backlog; and
- Plan for future customers and the levels of services they should receive.



4.1.2 Scope of municipal infrastructure systems, social amenities and connected green-space systems

Cities are organisms. Like all organisms, a city depends on critical support systems to sustain life in it. These systems include, amongst others, the following engineering infrastructure systems, social amenities and connected green-space systems:

- Energy, whether from electricity or from some energy mix comprising electricity, renewable sources of energy and natural gas;
- Potable water and sanitation systems, sustaining life and providing indispensable health and sanitary services;
- Roads, bridges and footpaths, enabling physical movement;
- Public transportation systems, such as bus services, to move and connect people;
- Solid waste including the removal, recycling and disposal of solid wastes;
- Social amenities, supporting safe and healthy lifestyles, and offering opportunities for recreation, social interaction, a sense of belonging and social integration;
- Storm-water infrastructure, protecting the city from flooding; and
- Public open and connected green space to allow a city to breathe; fulfil key ecological functions such as carbon trapping and conversion to oxygen; mitigate the effects of flooding; support biodiversity; contribute to place-making; boosting land value capture; and allow opportunities for amusement, recreation and education.

All of the above functions are typically the responsibility of a metropolitan municipality, provided to its citizenry.

FIGURE 4.1: *Levels and standards of service: example potable water*

Following is an example of a level of service hierarchy for potable water services:

LOS OPTIONS	DESCRIPTION
0	Natural resources (no infrastructure)
1	Water point more than 200 m distance
2	Communal standpipe less than 200 m distance
3	Yard tap connection (single tap)
4	15–25 mm connection to building (multiple taps)
5	40–100 mm consumer connection
6	100 mm or larger consumer connection

TABLE 4.1: *Levels of service hierarchy for potable water services*

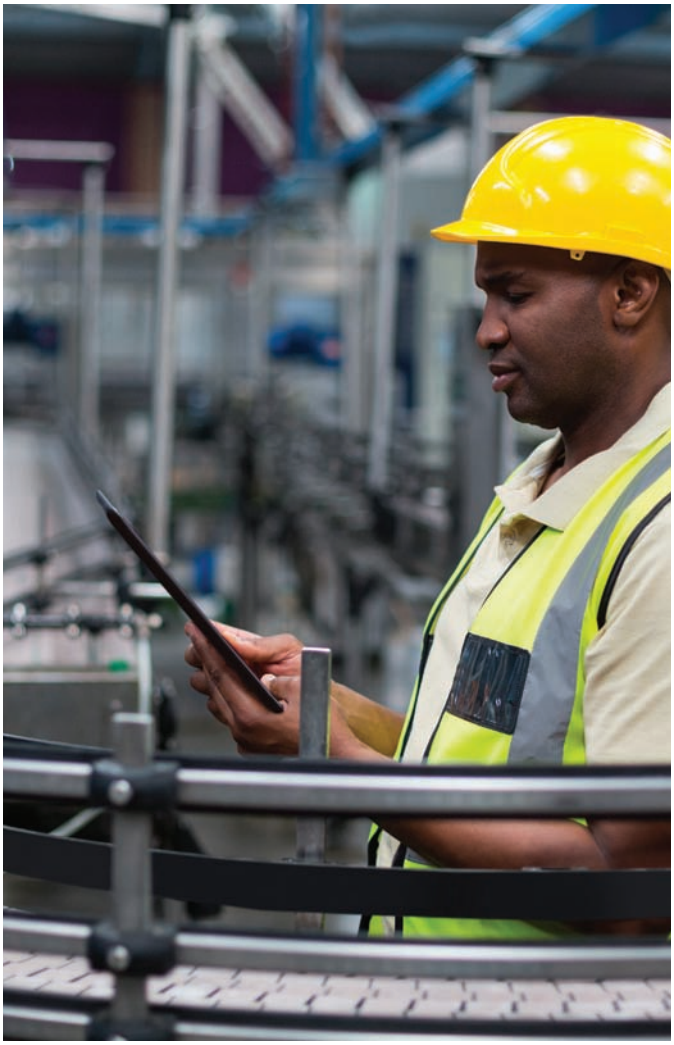
Typically, unit costs are attached to each level of service. This allows the infrastructure planner to both scope the size of the service access backlog and of future demand in terms of the number of customers to be served, but also to develop cost estimates.

This module also provides an approach to the segmentation of the city space to profile customers, services provided, and to plan and manage future service delivery. Lastly, this module provides guidance on the location and clustering of social amenities. First, though, a more in-depth insight into the need for these classification systems is provided.

4.1.3 Municipal customers vary: they have different needs, preferences and abilities to pay for municipal services

Citizens are people who organise themselves in many different ways, whether naturally or through legal means. The most common grouping is the residential customer, or household.

- Population. The number of people within a defined geographic area.
- Households. A household consists of a person, or a group of persons, who occupy a common dwelling (or part of it) for at least four days a week and who provide themselves jointly with food and other essentials for living. In other words, they live together as an unit. People who occupy the same dwelling, but who do not share food or other essentials, are enumerated as separate households. For example, people who shared a dwelling, but who bought food and ate separately, were counted as separate households (Statistics South Africa, 1998).



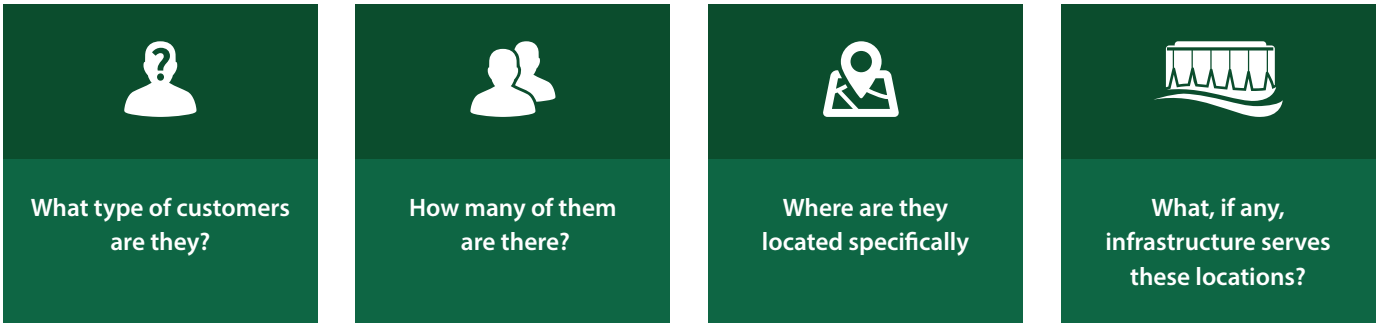
There are also many other ways for people to organise themselves. They create businesses to conduct trade or to provide specialised services (business customers), operate factories that provide the goods for businesses to sell (industrial customers), and form institutions that provide social support services (institutional customers). Each customer group has its own needs and preferences for infrastructure services, and varying levels of ability to pay for such services. Municipalities also have different tariff structures for different customer types.

A factory producing soft drinks, for example, requires large volumes of potable water delivered at high pressure. It also needs energy in the process of making soft drinks and access roads that are wide enough and with sufficient carrying capacity to support the fleet of large trucks that collect the soft drinks produced for distribution and sales. This factory requires larger diameter pipes delivering water (LOS 6 as per **Table 4.1**) than most other categories of customers, including residential, business and most institutional customers, but, unlike most residential customers, it mostly has no real need for a local neighbourhood park or cemetery. It may, though, like access to social amenities of the kind desired by residential customers to provide a more attractive work environment for its employees, such as crèches in close proximity to the workplace for those employees who are working mothers. So it is entirely possible for different types of customers to have high expectations for some services, and less so for others.

It is therefore necessary to construct a customer classification system to identify different groups of customers based on their typical needs and preferences for infrastructure and social amenities, and their ability to pay. Once a customer profile has been developed, municipal service planners must then determine what levels of services are offered to customers, both spatially and per customer category.

4.1.4 *Where are our customers and our infrastructure?*

From the point of view of the municipality a customer is located at some point in physical space. For a residential customer, that point in space will be the particular address or location where services are provided or to be provided, typically the dwelling where the customer lives. As we've seen, different customers need different levels of services for various infrastructure and social amenity services. Infrastructure too, is to be found located in physical space. To determine whether customers are serviced, and at the right levels, we need the following information:



So not only do we need to categorise customers and services, we also need information on the location of customers and infrastructure. But that level of detail (physical address, or GPS coordinates) is typically too much to deal with from a planning point of view, because cities are simply too large. Consider the following table: South African cities have areas of jurisdiction ranging between 164 536 to 629 830 hectares. Moreover, the land area of a municipality will be divided into multiple cadastre entities. A cadastre entity is a land parcel, such as a stand, erf, plot, farm portion or farm. Each cadastre entity will be owned by someone, whether a natural person (someone like Joe Modise or John Smith) or a legal person (a company, trust or other institution). But a quick glance at the table below will show that there are many more households than cadastre entities, and we've haven't even started counting non-residential customers yet. This anomaly largely results from the form of ownership and the intensity of use of the land parcel itself. A block of flats can be owned by one person, whether natural or legal, but occupied by dozens of households. However, each household within the block of flats is also a municipal customer, entitled to access to municipal services.

CITY	SIZE OF MUNICIPAL AREA (HECTARE)	NUMBER OF PEOPLE (2011)	NO OF HOUSEHOLDS (2011)	NO OF CADASTRE ENTITIES
Buffalo City	253 616	755 200	223 569	173 271
Nelson Mandela Bay	195 902	1 152 114	324 291	248 635
Mangaung	628 429	747 432	231 921	168 802
Ekurhuleni	197 554	3 178 470	1 015 464	528 549
City of Johannesburg	164 536	4 434 827	1 434 861	618 503
City of Tshwane	629 830	2 921 488	911 532	428 573
EThekwini	229 124	3 442 361	956 706	457 739
City of Cape Town	244 506	3 740 026	1 068 564	682 629
** Measurements as at February 2014*				

TABLE 4.2: *City size measured in hectares and number of cadastre entities**

The large number of different types of customers that require service provision at multiple points in physical space require the adoption of a system of spatial analysis, whereby customers are grouped and analysed spatially, to allow both profiling of customers (by type, income level and other relevant attributes) as well as of the municipal services they receive. This requirement also applies to infrastructure and social amenities. "Infrastructure" is normally defined as stationary components of a system, where the whole system provides services to a community. Due to the different functions of the components of an infrastructure system, proximity to some elements may not automatically mean access to infrastructure services. In fact, the proximity of some types of infrastructure will in all likelihood be contested by those members of the community that would have to live in close proximity to it. Think, for example, of sewage treatment works or landfill sites…no one wants to live close to them, and property values in the adjacent areas reflect this. This tendency of not wanting to be in close proximity to certain types of assets, areas, land use or other elements is referred to as Nimbyism: not in my backyard.

4.1.5 Spatial planning requirements

In analysing the existing spatial form of the city and deciding on the future spatial structure, planners use structuring and restructuring elements and tools, the outcomes of which are documented in the municipal spatial development framework (MSDF). The Spatial Planning and Land Use Management Act of 2013 (SPLUMA) establishes the following (among other) as requirements of a MSDF:

01 CLEARLY DEFINE WHO AND WHAT ARE BEING PLANNED FOR

Prior to SPLUMA, many MSDFs did not clearly specify the quantum of who and what are being planned for (e.g. the number of households, or square metres of a specific type of land use etc.). In addition, few MSDFs included specific time frames of when development is expected to occur. **SPLUMA includes specific requirements to address this:**

- Include a five-year population growth estimate and indicate how this growth will translate into a need for housing across different socioeconomic groups (and where in space this will occur); and
- Include five-year estimates of economic activity and employment trends and locations in the municipal area.

02 SPATIALLY IDENTIFY WHERE AND WHEN DEVELOPMENT WILL OCCUR

- Identify current and future significant structuring and restructuring elements of the spatial form of the municipality, including development corridors, activity spines and economic nodes (See **Figure 4.2** for more detail) where public and private investment will be prioritised and facilitated; and
- Include a written and spatial representation of five-, 10- and 20-year spatial development patterns (in other words where the quantum of residential and non-residential land uses identified above will spatially occur over time at specific locations within the municipality).

03 LINK FUTURE DEVELOPMENT NEEDS WITH INFRASTRUCTURE REQUIREMENTS

- Identify, quantify and provide location requirements of engineering infrastructure and services provision for existing and future development needs for the next five years.

04 DETERMINE WHO WILL BE RESPONSIBLE FOR IMPLEMENTING PROPOSALS

- Provide the spatial expression of the coordination, alignment and integration of sectoral policies of all municipal departments; and
- Include an implementation plan comprising sectoral requirements, including budgets, resources for implementation, institutional requirements, targets, dates and monitoring indicators.

05 SPATIALLY DETERMINE WHERE MONEY SHOULD BE SPENT

- Determine a capital expenditure framework for the municipality's development programmes, depicted spatially.

FIGURE 4.2: *Spatial structuring elements: examples and descriptions*

NODES

Economic and mixed-use development is concentrated in nodes in specific locations, and the nodes are usually separated by residential activity.

The spatial form of any city consists of a hierarchy of nodes connected by corridors (discussed below). This hierarchy is made up of one anchor (or primary node) in the form of a central business district where activities are concentrated.

This, in turn, is supported by secondary nodes and local nodes (such as local shopping centres). Nodes can also be classified by function (e.g. industrial node/tourism node/mixed-use node/transport-orientated development node etc.).

Like cities, nodes are also subject to a life cycle: new node, growing node, mature node, decaying node etc.

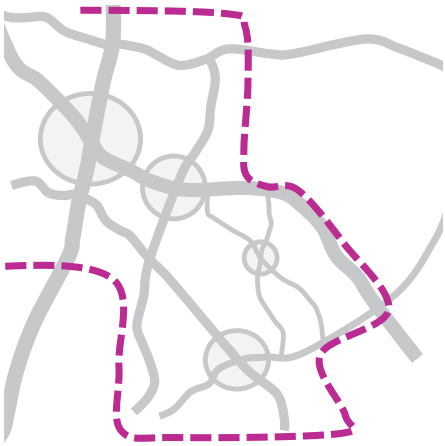
CORRIDORS

Corridors are areas of street-oriented uses that incorporate a mix of retail, employment and residential uses, developed at overall greater densities, located along arterial roads serving as major transit routes. Corridors link nodes and important areas of activity within a city and are intended to be key locations for intensification of land uses. In some instances a hierarchy is also introduced in corridor developments – an activity corridor and an activity spine:

Activity corridor
An area of generally higher intensity urban use or land suitable for intensification, parallel to and on both sides of an activity spine, and includes any associated higher-order transportation routes such as railway lines and through roads.

Activity spine
A public street, incorporating an existing or planned public transport route, and adjacent land used or intended for mixed-use development.

URBAN EDGE OR URBAN DEVELOPMENT BOUNDARY



An urban edge is a demarcated line to manage, direct and control the outer limits of development around an urban area. The intention of an urban edge is to establish limits beyond which urban development should as a rule not occur and to promote urban and environmental efficiency, effectiveness and economies in the interest of all (Department of Environmental Affairs and Development Planning, 2005).

Urban edges are not fixed or permanent, but rather flexible lines that can be extended over time in an effort to promote compact cities and efficient infrastructure.

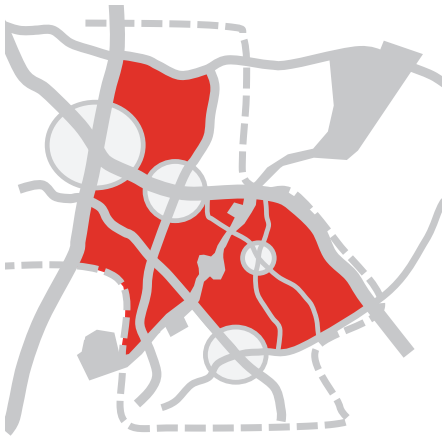
OPEN SPACE SYSTEM OR NETWORK

A well-designed, connected urban green-space system is considered essential for modern, progressive cities.

A properly designed green-space system will incorporate areas of high biodiversity value linked together in a viable network of open spaces, and will also support multiple, complementary land uses. Such green space in urban environments provides many advantages: formal and informal sport and recreation, preservation of natural environments, urban storm-water management and various ecological functions such as carbon trapping.

Not only does green space allow a city to breathe, it has also been found that well-designed and maintained green spaces improve land-value capture, and surrounding properties benefit from increases in property value.

INTERVENTION AREAS



The spaces in between nodes, corridors, and the metropolitan open-space system and inside the urban edge are sometimes referred to as intervention areas.

In most of these areas, some action or intervention is required to achieve a specific aim. The type of intervention can vary. Examples include interventions around infrastructure and facilities (e.g. provision of a minimum level of services to ensure the community is a sustainable human settlement) or interventions around densities (e.g. densification areas where a certain minimum density is required) etc.

One of the greatest trials facing modern cities is rapid growth. Our world is rapidly becoming more urban. Fast growing cities face additional challenges such as high percentages of people living in informal settlements, inadequate urban basic services, urban sprawl and poor public transport. If cities are to play their role as drivers of economic and social development, these challenges have to be addressed through effective planning and governance. Enormous amounts of infrastructure will need to be built in urban areas in the coming decades, creating an urgency and an opportunity to do things right, to use available resources efficiently and to address the infrastructure needed to create well-functioning cities.

Good urban planning can provide the framework for making decisions that are resource efficient and sustainable for all cities. Increasingly, there is evidence that well-managed and thoughtfully designed cities provide increased well-being for their citizens. The decisions on density, land-use and spatial patterns that urban planners make have a major impact on energy consumption, co^2 production and cost of construction. Integrating urban planning and infrastructure provision in the early stages of spatial planning is essential for getting the infrastructure "right". Infrastructure investments are long-term decisions and the choices we make today will lock us into patterns dictating the carbon, land, energy and water intensity of our future development.


GOLD
EXCHANGE
KWANTSHERE
AIR-SALON

4.2 CUSTOMER PROFILING

This subsection begins with a description of the basics of municipal customer profiling, proceeds to specify criteria for an effective, robust system of customer profiling and then proposes a customer classification system for adoption by cities. It also provides a methodology for developing a customer profile and closes with some examples of customer profiles.

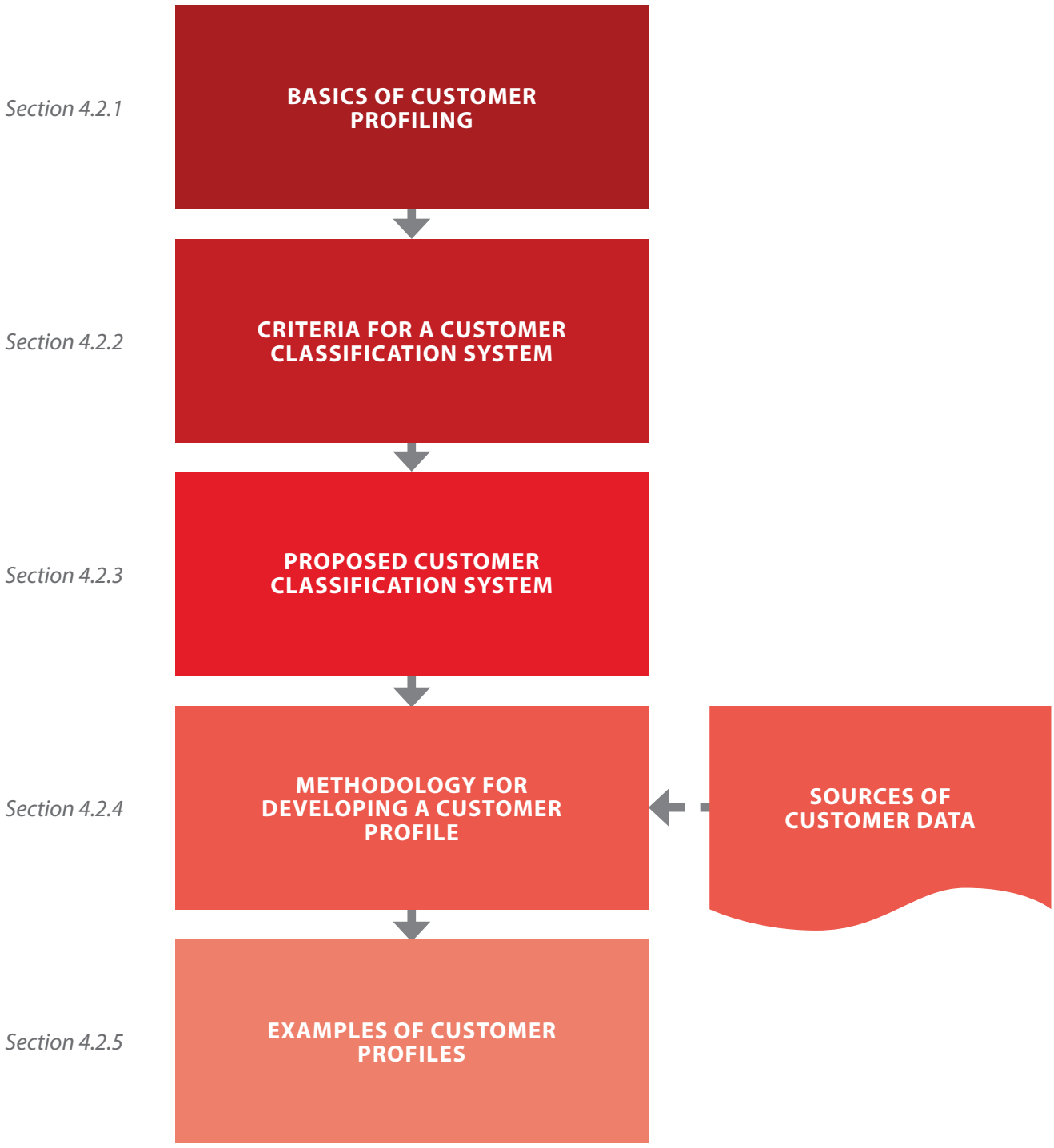


FIGURE 4.3: *Layout of subsections on customer profiling*

4.2.1 Basics of customer profiling

CUSTOMERS ARE PRIMARILY CATEGORISED ON THE BASIS OF LAND USE

Various functions in a municipality require customers to be categorised and profiled. The budget and treasury office in a municipality is interested in issuing customer bills (services rendered and, possibly, property rates as well). It generally obtains information on services rendered from reading water and electricity meters registered to account holders for specific properties, these being municipal customers. This data is stored in an electronic municipal billing system. How much to charge each customer for services rendered is specified in the municipality's tariff policy. This determines the amount to be charged for each unit (e.g. kℓ of water) consumed per category of customer. The tariff policy categorises different types of customers on the basis of land use classification (e.g. agricultural, residential or industrial).

Municipal valuers also have an interest in customers. They prepare, maintain and update municipal property valuation rolls that contain data on all properties in the municipality's area of jurisdiction. The data set for each property will include details of the owner, location of the property, its size, the value of the property, and the property-rates category that applies to that property. Rates categories are also determined on the basis of land use.

Permitted land use(s) for each property is(are) stipulated in the land use scheme of each municipality. Urban planners are greatly concerned with how land is used, and will indicate in spatial development frameworks (SDFs) how land should be used in future. Urban planners will also indicate in SDFs the target densities of development of various areas and the development controls to support those targets, such as building height restrictions. Engineers will interpret spatial development frameworks, and will plan for engineering services provision on the basis of land use, development density and other controls.

- Land cover refers to the physical surface of the earth, including various combinations of vegetation types, soils, exposed rocks and water bodies as well as anthropogenic elements, such as agriculture and built environments. Land cover can also describe "the vegetation and artificial constructions covering the land surface".
- Land use means the purpose to which the land cover is committed, or rather, man's activities on land, which are directly related to the land. Certain uses, e.g. agriculture, have a characteristic land-cover pattern, other land uses, such as business or commercial, are not readily discriminated by a characteristic land-cover pattern.
- Zoning is the process of planning for land use by allowing or restricting certain land uses in a certain geographic area. A "Zoning" is NOT necessarily restricted to a single land use and typically includes a number of related land uses. Zoning also includes restrictions in different zoning areas, such as height of buildings, density (number of structures in a certain area), coverage, parking requirements etc. Zonings are managed by means of a scheme.

The two important points from this discussion are that:

1. Land use is the basis for categorising municipal customers; and
2. Municipalities maintain vast electronic data systems with a wealth of data from which customers can be profiled.

SELECTION OF AN APPROPRIATE SPATIAL SYSTEM OF CUSTOMER SEGMENTATION, ANALYSIS AND PLANNING

Due to the large areas and number of customers in a city, planning for infrastructure is normally done on the basis of spatially defined areas. Each profession or function in a municipality would argue that they already use spatial systems of analysis, and they do. **Consider the following examples of systems in place:**

- The ward system, which is a spatially demarcated system for grouping voters, appointing ward councillors and ward committees.
- Spatial systems for engineering master planning, e.g. water distribution zones, traffic impact zones and drainage basins.
- Service-delivery zones, that may be decided on the basis of the location of depots (e.g. water services' depots, from where artisans are dispatched to attend to pipe leaks and bursts, or to connect new customers), or area-based customer care centres.
- A system of regions, the basis of which could be either for administrative management purposes, or as large spatial entities with particular identities and specified future visions that require differentiated management focus. A system of regions may be further segmented into service-delivery zones.
- A spatial system comprised of spatial structuring elements as found in a MSDF.

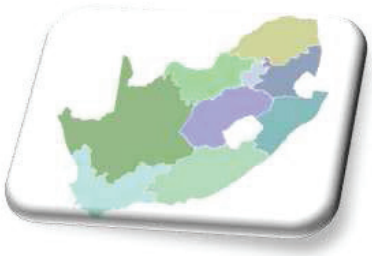
Each of the above spatial systems serve a purpose, but not all are equally suited for the purposes of strategic spatial planning or infrastructure asset management. To determine which spatial segment system to adopt for purposes of infrastructure asset management planning, **it is necessary to consider:**

- The availability of data at various spatial scales;
- The requirements of SPLUMA;
- The stability, benefits and challenges of spatial segmentation systems at various spatial scales and time.

AVAILABILITY OF DATA AT VARIOUS SPATIAL SCALES

Customer data is available at multiple spatial scales, ranging from the building level, which is generally the data set with the finest grain size, up to provincial- and country-level scales (see **Table 4.3** below). Ideally, municipal customer databases should be prepared at the building level, as this is where customers live or operate from, and where they normally would receive infrastructure services. However, data on key customer attributes is generally not available at the level of the building.

TABLE 4.3: *Geographic levels of analysis*

	**COUNTRY- AND PROVINCIAL-SCALE DATA** Examples of this includes population data (e.g. 51 770 560 people in South Africa). Typically this grain of data is too coarse for any detailed planning, although it can be useful to compare municipal data to provincial averages, for example the population growth rate of Ekurhuleni is 2.47 per cent per annum compared to the Gauteng growth rate (from 2001–2011) of 2.7 per cent.
	**MUNICIPAL-SCALE DATA** Many data sets provide answers at a municipal level (e.g. population totals, growth totals etc.). This is typically the lowest level of detail at which growth rates are calculated. It can therefore be useful to provide a "control total" for planning exercises, but often information is required at a more detailed level.
	**ADMINISTRATIVE OR MANAGEMENT-REGION LEVEL** Most cities are geographically divided into administrative or management regions. Very little primary information is available at this level – although it is often a requirement to report data at a regional level. These boundaries can also change (depending on political or administrative issues.)
	**WARD LEVEL** Wards are politically demarcated segments of municipalities that typically elect and are represented by a councillor. Statistical data generated by Stats SA is available at ward level. Usually community needs are also expressed at a ward level (as part of the integrated development plan). Often projects responding to these needs are also represented at a ward level. However, wards are not service-delivery units or configurations, and therefore infrastructure capacities and costs are not easily reflected at the level of the ward.

	**PROCLAIMED TOWNSHIP** Township-level data is available in billing systems, valuation rolls and land-use schemes. This is the first geographic level of data that is consistent across municipal data sets. Note, though, that proclaimed townships EXCLUDE most informal settlements or traditional villages. These settlement types mostly occur on farm portions in the rural parts of the municipality OR on farm portions in between proclaimed townships.
	**SUBPLACE AND SMALL AREA** Demographic information from Stats SA is available at subplace and small-area level. Subplace boundaries resemble community-level boundaries irrespective of its status as proclaimed or informal. The small-area boundaries are the lowest level of detail used by Stats SA. Any subplace will consist of a number of small areas. Small areas can be used to structure a customer database – from this level it is possible to aggregate data upwards to any other geographic level, or to assign customer attributes such as income levels and household size to lower spatial-scale data.
	**LAND-PARCEL LEVEL** This is the finest grain at which most municipal data sets are available. The land use scheme, valuation roll and billing system all provide data at an individual property level. While this level of data is sufficient for most purposes it is possible to have more than one customer on a land parcel (e.g. sectional title properties or properties with multiple storeys). In addition, informal settlements and traditional villages have mostly never been surveyed and will therefore not be included at this level of detail.
	**BUILDING LEVEL** This is the preferred level at which data should be available. From this detail level, data can be aggregated to any spatial level discussed above. Building-level data is also useful in informal settlements and traditional villages as well as in complex central business districts where multiple customer types can be found in the same building.

The most important national data set of use to cities is the National Census, compiled and released by Statistics South Africa. **Key data sets from the census include:**

Demographic indicators such as population, households and annual household income;

Number of households per dwelling type; and

For the infrastructure categories water, sanitation and electricity, the number of households for each level of service.

TABLE 4.4: *Example of the number of households per dwelling type – City of Johannesburg (2011)*

Census information is available at the following geographic levels:

- Country, provincial and municipal totals;
- Ward level;
- Main place and subplace; and
- Small area.

Table 4.4 below provides an example of dwelling type information for cities, as prepared by Stats SA. This type of data can be used to derive the formal and informal residential and backyard shack categories of the customer profile presented in **Section 4.2.3.** Note that census data is available in this format for 1996, 2001 and 2011. The next census will only be conducted in 2021.

TYPE OF DWELLING	NO OF HOUSEHOLDS
House or brick/concrete block structure on a separate stand or yard or on a farm	763 977
Traditional dwelling/hut/structure made of traditional materials	5 625
Flat or apartment in a block of flats	144 522
Cluster house in complex	46 224
Townhouse (semidetached house in a complex)	63 297
Semidetached house	33 930
House/flat/room in backyard	95 511
Informal dwelling (shack; in backyard)	124 074
Informal dwelling (shack; not in backyard; e.g. in an informal/squatter settlement or on a farm)	125 745
Room/flatlet on a property or larger dwelling/servants quarters/granny flat	20 436
Caravan/tent	789
Other	10 680
Unspecified	0
Not applicable	0
TOTAL	**1 434 810**

Table 4.5 below shows an example of the income profile for a suburb in Cape Town. The different income categories can be used to derive the income level of the formal residential customer category.

ANNUAL INCOME CATEGORY	NO OF HOUSEHOLDS
No income	2 853
R 1 – R 4800	948
R 4801 – R 9600	1 239
R 9601 – R 19 600	2 928
R 19 601 – R 38 200	3 921
R 38 201 – R 76 400	2 577
R 76 401 – R 153 800	1 035
R 153 801 – R 307 600	348
R 307 601 – R 614 400	120
R 614 001 – R 1 228 800	15
R 1 228 801 – R 2 457 600	9
R 2 457 601 or more	6
Unspecified	0
TOTAL	**15 999**

TABLE 4.5: *Example of a household income profile – Nyanga, City of Cape Town (2011)*

Other national spatial data sets include:

01 CADASTRE DATA, AERIAL AND SATELLITE IMAGERY

Available from the Department of Rural Development and Land Reform (DRDLR). The Surveyor General (part of DRDLR) is the official custodian of the National Cadastre, and cadastral data in GIS format can be obtained from the Surveyor General's office at a fee. Title deed information as well as sectional title information is also available for all surveyed cadastral entities from this department.

Note that in many instances, the cities themselves have GIS units maintaining cadastral data. In addition, the National Geo-Spatial Information (NGI) Branch of the DRDLR are the custodians of aerial and satellite imagery taken over a number of years that provide useful information in determining growth between census years.

FIGURE 4.4: *Example of time series imagery illustrating the pace of urban growth*

02 NATIONAL REFERENCE FRAMEWORK

Of the Department of Water and Sanitation (DWAS). This framework provides data on the number of households and levels of service for water and sanitation, especially helpful in cities with rural areas dotted with villages, as is the case in eThekwini and Buffalo City.

04 COMMERCIAL DATA VENDORS THAT SUPPLY DEMOGRAPHIC AND ECONOMIC INFORMATION

at various spatial scales. These data sets can generally be accessed by paying an annual subscription fee.

03 SPOT BUILDING COUNTS

Counts from Eskom. ESI-GIS, a section in the divisional technology department of the Eskom Corporate Services Division, uses SPOT satellite images to determine the geographical position of physical structures. For each point in the database, attribute information includes the date when it was captured (valuable in quantifying urban growth) as well as a rudimentary land-use classification (useful in deriving customer type). This data set is particularly useful in quantifying the number of customers living on land that is not formally surveyed (such as informal settlements or traditional villages).

FIGURE 4.5: *Use of SPOT building-count data to identify customers: Enkanyiswini Shozi Village, eThekwini*

Most, if not all, metropolitan municipalities have access to a centralised GIS Department. These departments maintain, among other, base GIS data such as cadastral data sets and road-centre lines. The following municipal spatial data sets can be used to derive and update customer profiles:

05 LAND USE AND ZONING DATA

A list and spatial database of properties together with their existing land uses and zoning (permissible land uses and development controls) can be obtained from the town planning department.

TOWNSHIP	STAND NUMBER	LAND USE
Kleinfontein 67-ir	382/67-IR	Agriculture
Northmead	4880	Church
Benoni x43	22/8481	Cluster complex
Northmead	3444	Dwelling
Northmead	3156	Dwelling
Benoni	2421	Educational
Kleinfontein 67-ir	190/67-IR	Filling station
Benoni x16	5681	Flats
Benoni	R/6493	Park
Benoni x71	8687	Private road
Kleinfontein 67-ir	190/67-IR	Shopping centre
Benoni	4/6493	Sports club
Benoni x17	5168	St complex

TABLE 4.6: *Example of land-use data (Ekurhuleni)*

06 VALUATION ROLL DATA

All municipalities compile a general valuation roll, generally every five years, and maintain this annually through a supplementary valuation roll. The roll consists of property data, the value of the property, the registered owner and an indication of land use (as specified in the Municipal Property Rates Act, No. 6 of 2004). The land use data can be used to derive a customer class for each individual property.

TOWNSHIP	STAND NUMBER	RATES CATEGORY	PROPERTY VALUE
Beacon Bay	1	Residential	R 1 504 000
Beacon Bay	2	Residential	R 2 170 000
Beacon Bay	3	Residential	R 1 240 000
Beacon Bay	4	Vacant land	R 700 000
Beacon Bay	5	Residential	R 2 380 000
Beacon Bay	6	Residential	R 1 200 000
Beacon Bay	7	Residential	R 2 170 000
Beacon Bay	9	Residential	R 1 128 000
Beacon Bay	10	Residential	R 1 058 000
Beacon Bay	11	Residential	R 1 167 000
Beacon Bay	12	Residential	R 1 254 000

TABLE 4.7: *Example of valuation roll data (Buffalo City)*

07 BILLING SYSTEM DATA

All cities use some form of billing system to issue municipal accounts to their consumers. Billing system data is useful in establishing a customer database and analyse customers, in the following ways:

- Billing systems use tariff codes in calculating monthly bills. These tariff codes can be used to derive customer categories. Consider the tariff code "EL0100" in the transaction file of Buffalo City's billing system – this tariff code describes a "Residential" consumer.
- Moreover, data from billing systems can be used to quantify the number of customers per property. In the example below there are six different consumers, all living on the same property, who each received an account for water in June 2014.
- Where revenue generation is a key consideration in infrastructure investment decision making, or the municipality needs to improve revenue performance, data from the billing system informs decisions on the revenue-generating potential of particular areas and customers, as well as the levels of outstanding debt.

TABLE 4.8: *Example – meter reading table June 2014, Buffalo City*

TOWNSHIP	STAND NO.	ACCOUNT NO.	DATE	SERVICE CODE	SERVICE BASE	TRANSACTION AMOUNT
East London	14554	10054745	**201406**	WA	MW08	**R 437**
East London	14554	10170007	**201406**	WA	MW08	**R 279**
East London	14554	10299947	**201406**	WA	MW08	**R 109**
East London	14554	10349178	**201406**	WA	MW08	**R 12**
East London	14554	10349177	**201406**	WA	MW08	**R 109**
East London	14554	10349180	**201406**	WA	MW08	**R 61**

THE STABILITY, BENEFITS AND CHALLENGES OF SPATIAL SEGMENTATION SYSTEMS AT VARIOUS SPATIAL SCALES

Many cities at present report spatially at the ward level, and the main benefit of doing so is to be accountable to voters in the areas where they live. But reporting at the ward level has several disadvantages as well. The ward system itself is not stable, every few years wards are redemarcated. As a result time-series data on, say capital investment per ward, presents a skewed picture. It is also natural for wards to demand capital investment and other resources over other wards and city-level objectives, and as a result, city-level optimal decisions may not be made, to the detriment of the citizenry at large. Conversely, while residents in a particular ward may demand investment, they may oppose much needed development, such as intensification in land use, corridor development or infrastructure such as sewerage plants.

All cities are actively planning to restructure their cities towards economic and social progress. Some of the planning interventions include: implementing strategic projects with city-wide benefits; the strengthening of specific corridors, nodes and intervention areas; and densification and mixed-use development. These objectives take time to achieve, and ideally the spatial segmentation system should focus attention on these strategic objectives and should remain fairly stable to measure progress towards achieving city strategic objectives over time. Whereas a city does not control the demarcation of wards, it is able to control the spatial segmentation of the city in terms of priority management areas.

4.2.2 Criteria for a customer-profiling system

An effective, robust municipal customer-profiling system will meet the following criteria:

1. It will account for all major customer groups being planned for.
2. Key customer attributes, such as income levels and density must be included.
3. It will enable the optimal use of existing sources of data (municipal and other).
4. The level of data chosen must be sufficient to enable analysis, planning and reporting, but not excessively difficult or expensive to acquire, process or maintain.
5. It must be possible to spatially analyse and present customer profiles.
6. It must be possible to spatially depict and analyse population growth and infrastructure capacity to determine built environment impacts at that point in space.
7. The methodology used to profile and spatially segment customers must be repeatable.

4.2.3 Customer classification

It is proposed that cities adopt as a minimum the customer classification system presented in **Table 4.9** that meets the criteria for such a system as defined in **Section 4.2.2.** Accordingly, customers are classified primarily as residential or non-residential.

Residential customers are further segmented based on settlement type and status, income levels and density. Non-residential customers are segmented into economic land uses such as agriculture, mining, manufacturing, business, public service infrastructure, major transport facilities and institutional land uses.

CLASSIFICATION	CUSTOMER CATEGORY		DESCRIPTION
Residential		Formal residential	All customers of a residential nature who are settled on proclaimed, surveyed stands (single or multiple residential), or residential customers living on farms. Formal domestic is further categorised on the basis of (a) income levels and (b) density.
		Informal residential	Areas where groups of housing units have been constructed on land that the occupants have no legal claim to, or occupy illegally; or unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorised housing).
		Traditional rural residential	This category of customer refers to villages or settlements under the administration of tribal or traditional authorities.
		Backyard residential (shacks)	Backyard residential (shacks) are additional informal units on a plot of land that are rented out by the land owner as a significant income to the main householder.

CLASSIFICATION	CUSTOMER CATEGORY		DESCRIPTION
Non-residential		Agriculture, forestry & fisheries	This customer category is dedicated to the practice of farming (including cultivation of the soil for the growing of crops and the rearing of animals or fish to provide food, wool, and other products) as well as forestry.
		Business	The term in this instance is used to describe both a retail as well as an office-related land use.
		Commercial and industrial	Factories, storage, manufacturing etc.
		Institutional	A customer category devoted to the promotion of a particular cause or programme of a public, educational, or charitable character (schools, clinics, community halls etc.). Note that institutional also includes sports facilities such as sport stadiums.
		Mining	Mining includes not only the extraction of valuable minerals or other geological materials from the earth, but also the beneficiation of extracted materials or substances (e.g. smelters and refineries).
		Ports and airports	Airports and ports are defined as tracts of land or water with facilities for the arrival, departure, shelter, supply, and repair of aircraft and marine vehicles used for receiving or discharging passengers and cargo. This category includes ports, airports and airfields that are municipally owned.
		Public service industries (PSI)	This category of customer consists of roads, storm-water, water, sewer, power or electricity and railway infrastructure under public or parastatal control.

TABLE 4.9: *City-customer classification system*

Customers in the "formal residential" category are further categorised based on income levels and density, as follows:

TABLE 4.10: *Customer classification system: formal residential income categories*

INCOME CATEGORY	ANNUAL HOUSEHOLD INCOME THRESHOLD
Poor	R 0 – R 76 400
Low income	R 76 401 – R 153 800
Medium income	R 153 801 – R 307 600
High income	R 307 601 +

TABLE 4.11: *Gross formal residential density categories*

DENSITY CATEGORY	NUMBER OF UNITS PER HECTARE
Very low	0-9 units/ha
Low	10-19 units/ha
Medium	20-49 units/ha
High	50-99 units/ha
Very high	100 units/ha or higher

4.2.4 *Methodology for the spatial profiling of customers*

Section 4.2.1 described available sources of data for the spatial profiling of customers, and **Section 4.2.3** provided the basic customer profiling classification system. In order to prepare customer profiles, cities require a methodology as well as the following:

1. Capable geographic information system (GIS) practitioners, preferably GISc professionals registered with the South African Geometrics Council (SAGC)
2. GIS software (e.g. Esri GIS, Quantum GIS, etc.)
3. Relational database management system software (e.g. Microsoft SQL Server, MySQL, Oracle etc.)
4. Note that software such as Microsoft Access does not have sufficient capacity to deal with the large volumes of data required to compile a customer database and profile
5. Computers and storage adequate to deal with large data sets (e.g. cadastral GIS data sets).

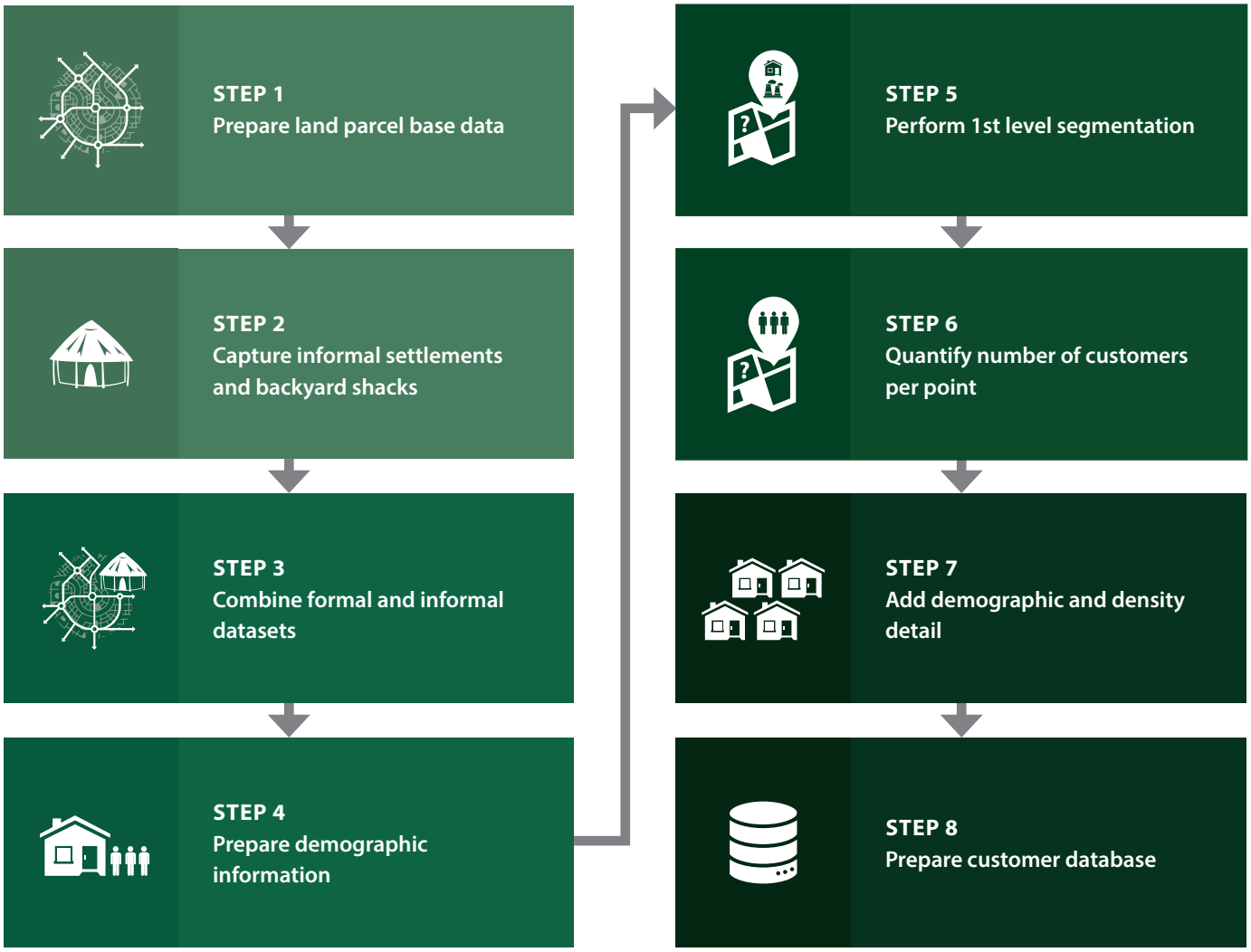


FIGURE 4.6: *Methodology for spatial profiling of customers*

STEP 1: PREPARE LAND PARCEL BASE DATA

The process commences with preparing all data necessary to describe a customer on a formally proclaimed land parcel (e.g. erf, holding or farm portion). **Data requirements for this stage include:**

- Updated cadastre
- Municipal zoning scheme (available as table or spatial file)
- Municipal land use data (available as table or spatial file)
- Municipal valuation roll
- Billing system data:
  - master file (indicating property description and land use);
  - meter file (water and electricity meters); and
  - transaction file for one financial year (all transactions per account)
- Recent aerial photography

Once the above data sets have been obtained, the process of matching attribute data to the cadastre begins. Attribute (tabular) data collected must now be related to the cadastral information through the use of GIS. Cities should conform to the Surveyor General convention of using a 21-digit code to describe each property in the municipality (some cities use an amended version of this code comprising more digits). The figure below serves as a rudimentary database diagram indicating how all the attribute files should relate to the cadastre.

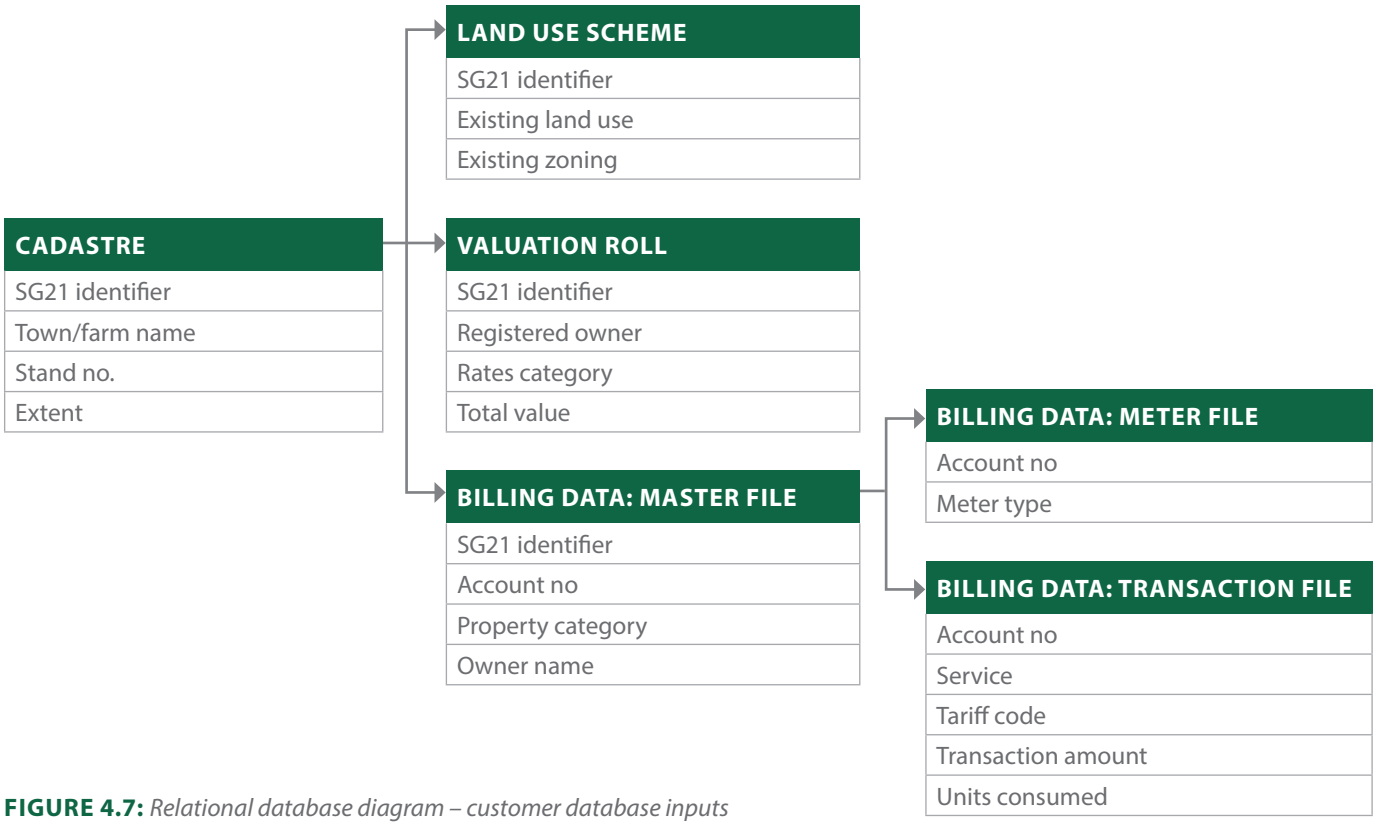


FIGURE 4.7: *Relational database diagram – customer database inputs*

After all the attribute data has been "related" or "joined" with the cadastre, some analysis is necessary to populate the following fields:

ATTRIBUTE	DESCRIPTION / SOURCE
SG21 identifier	A unique identifier (note that in some cases this can comprise more than 21 digits) used by the Surveyor General to uniquely identify cadastral entities.
Town/farm name	The name of the town (from a general plan) or the farm (in the case of a farm, including the farm number and registration division).
Stand number	The parcel number (including subdivision or remainder). In the case of farm portions, the farm number and subdivision or remainder.
Extent	The geographic extent of the property, measured in square metres (m^2).
Existing land use	The existing land use should ideally originate from the land use data that informed the municipal land use scheme. This can be updated by "rates category" from the valuation roll or the "property category" and "tariff code" from the billing-system data.
Owner name	Name of the registered owner.
Number of water meters	From the billing system – and specifically the meter table, the number of all "active" water meters on a property. This can be an important indicator of the number of customers.
Number of electricity meters	From the billing system – and specifically the meter table, the number of all "active" electricity meters on a property. This can be an important indicator of the number of customers.

TABLE 4.12: *Customer database – data field structure*

STEP 2: CAPTURE INFORMAL SETTLEMENTS AND BACKYARD SHACKS

Step 1 in the customer-profiling process accounts for customers located on formally surveyed land parcels. Step 2 incorporates customers residing in informal settlements, backyard shacks and traditional villages into the customer database. While a number of cities do have GIS data available on the location and extent of informal settlements, backyard shacks and traditional villages, **there are additional data sets that can assist cities:**

- Department of Human Settlements (housing demand database);
- Stats SA – South African Dwelling Frame;
- Eskom – SPOT building count; and
- Commercial data sets available from data vendors (e.g. GeoTerraImage).

The above data sets can be used as starting point and updated by means of capturing structures using the latest satellite imagery or aerial photography. In the example, the yellow dots represent data obtained from Eskom (the SPOT building count, 2011). Additional structures representing growth from 2011 to 2015 were captured using the latest aerial photos (in this case from Google Earth) as backdrop – these structures are shown as red points.

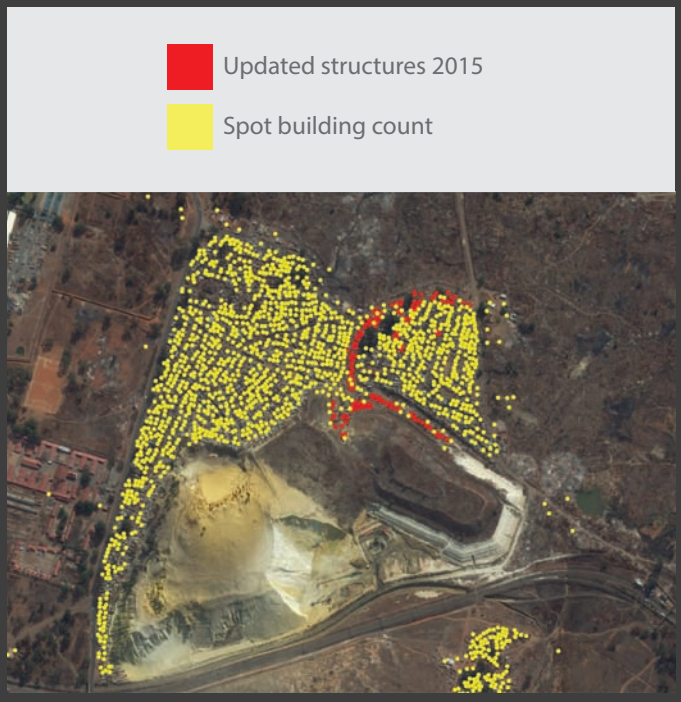


FIGURE 4.8: *Example – capturing structures in informal settlements (Kanana Driefontein – Ekurhuleni)*

Typically each point (housing structure) captured in an informal settlement or traditional village, or backyard shack represents one customer. The next step in the process is to add the necessary attribute fields in the database:

ATTRIBUTE	DESCRIPTION/SOURCE
SG21 identifier	Cities can compile their own identifier, depending on data available from their own GIS. The only requirement is that the identifier should be unique.
Town/farm name	In this case, the name of the settlement or village can be used (or formal town in the case of backyard shacks).
Stand number	The structure number (if available).
Existing land use	Use "traditional rural residential" or "informal residential" or "backyard shack".
Number of customers	In most instances, the number of customers per structure will be one. Possible exceptions are multi-household structures.
Data source	List as appropriate e.g. field verification

TABLE 4.13: *Attribute fields: informal/backyard shack or traditional rural residential*

STEP 3: COMBINE FORMAL AND INFORMAL DATA

This step combines the formal and informal spatial and attribute data from the previous two steps into one data set. To do this, it would first be necessary to convert the formal cadastre to centroids (or points) that are then combined (or merged) with the informal data set's points.

STEP 4: PREPARE DEMOGRAPHIC DATA

This step relies on the latest census information from Stats SA. **The following data is extracted at the lowest level of geographic detail (the small-area layer):**

- Number of households per small area; and
- Annual household income per small area.

Using the above data, calculate the gross density (number of households divided by the geographic extent of the subplace in hectares). In addition to the above, calculate the average annual household income for that subplace.

STEP 5: PERFORM FIRST LEVEL SEGMENTATION

This step involves reworking the existing land use data for each point into one of the customer categories defined in **Table 4.9.** The customer category is added as an additional data field to the customer database.

STEP 6: QUANTIFY THE NUMBER OF CUSTOMERS PER POINT

Now that a specific customer category has been assigned to each spatial point, the number of customers at that spatial location needs to be calculated. **In most instances the number of customers per land parcel (or structure) will equal one but for the following exceptions:**

- Sectional title schemes, where multiple households (or businesses) can be located on one property or in one building; or
- Multistorey buildings (for example the central business districts of cities) where more than one customer can be situated in a single building.

One of the best sources of data to use in this exercise is the number of water or electricity meters per point (calculated in Step 1). **Take note of the following common issues associated with this step:**

- In some instances, a single customer can be spatially located on a number of properties, care should be taken to quantify this as one customer, instead of counting the number of stands;
- In some cities, prepaid electricity meters are installed making it more difficult to use electricity meters as an indicator of the number of customers; and
- The cadastre may be outdated; customers should always be visually verified making use of aerial photography or satellite imagery.

STEP 7: ADD DEMOGRAPHIC AND DENSITY INDICATORS

Once customers have been classified and quantified, all that remains is to further segment all formal residential, informal residential, traditional rural residential and backyard shack customers by adding density and income indicators calculated earlier to the customer database. This is done by using the income and density categories defined in **Table 4.10** (income) and **Table 4.11** (density).

STEP 8: PREPARE MUNICIPAL CUSTOMER DATABASE

If all the previous steps were followed, the final customer database should contain the following data fields (not that additional fields cannot be accommodated):

ATTRIBUTE	DESCRIPTION/SOURCE
SG21 identifier	A unique identifier (note that in some cases this can comprise more than 21 digits) used by the Surveyor General to uniquely identify cadastral entities.
Town/farm name	The name of the town (from a general plan) or the farm (in the case of the farm, including the farm number and registration division).
Stand number	The parcel number (including subdivision or remainder). In the case of farm portions, the farm number and subdivision or remainder.
Extent	The geographic extent of the property, measured in square metres (m^2).
Existing land use	The existing land use should ideally originate from the land use data that informed the municipal land-use scheme. This can be updated by "rates category" from the valuation roll or the "property category" and "tariff code" from the billing system data.
Owner name	Name of the registered owner.
Customer category	From the land use field above, derive the customer category, in line with the customer classification system presented in **Table 4.9.**
Number of customers	Use the number of water and electricity meters to calculate the number of customers per property (any other available information e.g. sectional title data etc. can be used to quantify the number of customers).
Average annual income category	Poor, low, medium or high income – calculated using the annual household income category from Stats SA.
Gross residential density category	Low, medium or high density – calculated by dividing the number of households per small area (from Stats SA) by the geographic extent (in hectares) of the small area applied for residential purposes plus local roads and local communal uses such as parks, schools and other amenities.

TABLE 4.14: *Municipal customer database – data fields*

4.2.5 *Examples of outputs of the customer profile*

Once the customer database has been prepared following the eight-step process described above, it is now possible to generate a customer profile. The following are examples of the customer profiles that can be made from the customer database – note that some additional attributes were added to the customer databases for Buffalo City and Ekurhuleni.

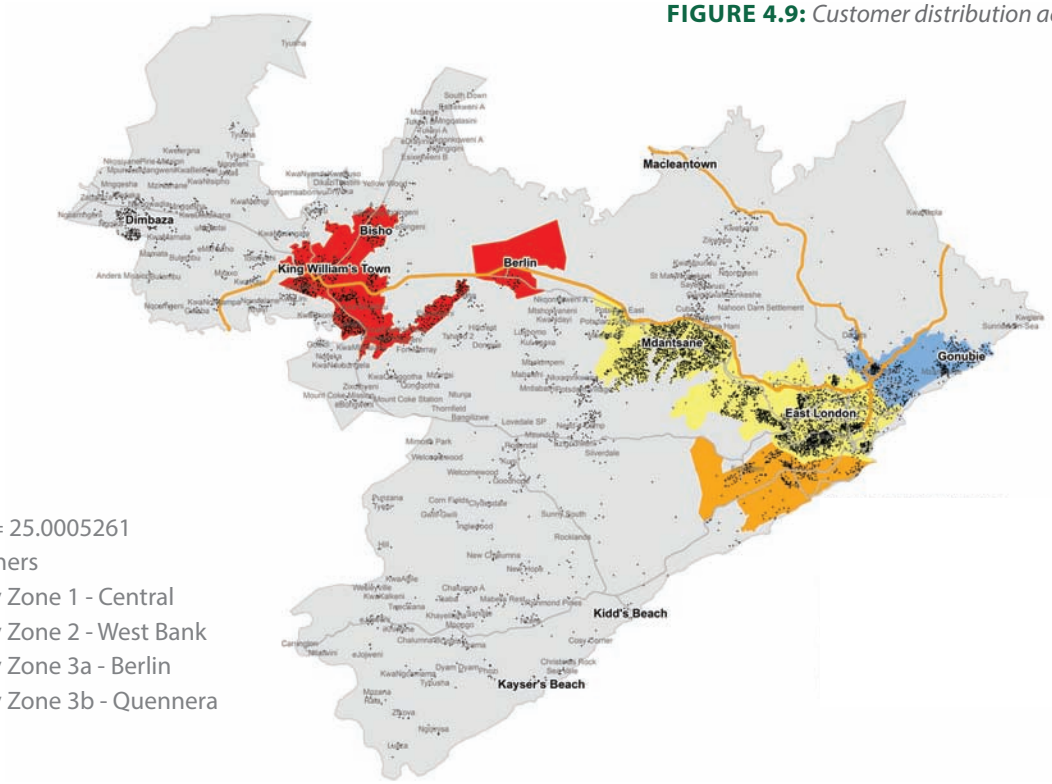
Buffalo City segmented its area of jurisdiction into five areas of intervention, each requiring nuanced spatial attention, levels of service and capital investment. The customer profile has been prepared in accordance with this spatial segmentation system as well as the customer classification system proposed in this toolkit. Table 4.15 presents the customer profile of Buffalo City: all customers per category have been quantified and allocated to each of the priority zones adopted in the spatial development framework of the city.

Figure 4.9 presents the distribution and clustering of customers across the municipal space and within the demarcated priority zones. **Figure 4.10** presents income distribution of households across the municipal space.

CUSTOMER CATEGORY	CUSTOMER GROUP	CUSTOMER TYPE	DENSITY CATEGORY	PRIORITY ZONE 1 – CENTRAL	PRIORITY ZONE 2 – WEST BANK	PRIORITY ZONE 3A – BERLIN	PRIORITY ZONE 3B – QUENNERA	RURAL	TOTAL
Residential	Formal residential	High income	High	754	26	75	229	14	1 097
			Medium	448	48	136	803	29	1 464
			Low	6 442	766	2 341	3 240	1 169	13 959
		Medium income	High	4 492	47	178	176	38	1 931
			Medium	580	76	191	631	49	1 527
			Low	7 500	941	3 048	1 816	1 402	14 707
		Low income	High	1 756	46	198	91	43	2 133
			Medium	761	97	305	417	78	1 659
			Low	8 854	794	3 318	1 132	1 993	16 090
		Poor	High	4 772	73	529	138	562	6 074
			Medium	3 890	227	1 113	631	892	6 753
			Low	55 238	3 255	17 488	4 680	34 027	114 687
	Informal residential			25 969	3 111	1 840	4 406	7 547	42 872
	Backyard shacks			5 789	467	1 295	1 392	2 391	11 334
Non-residential	Business			2 085	64	551	169	54	2 923
	Commercial and industrial			607	172	161	45	115	1 100
	Institutional			703	94	225	61	173	1 256
	Public sector infrastructure			2 380	151	512	416	251	3 710
TOTAL				130 020	10 455	33 500	20 473	50 828	245 277

TABLE 4.15: *Example of a spatially-based customer profile aligned to priority areas in the SDF*

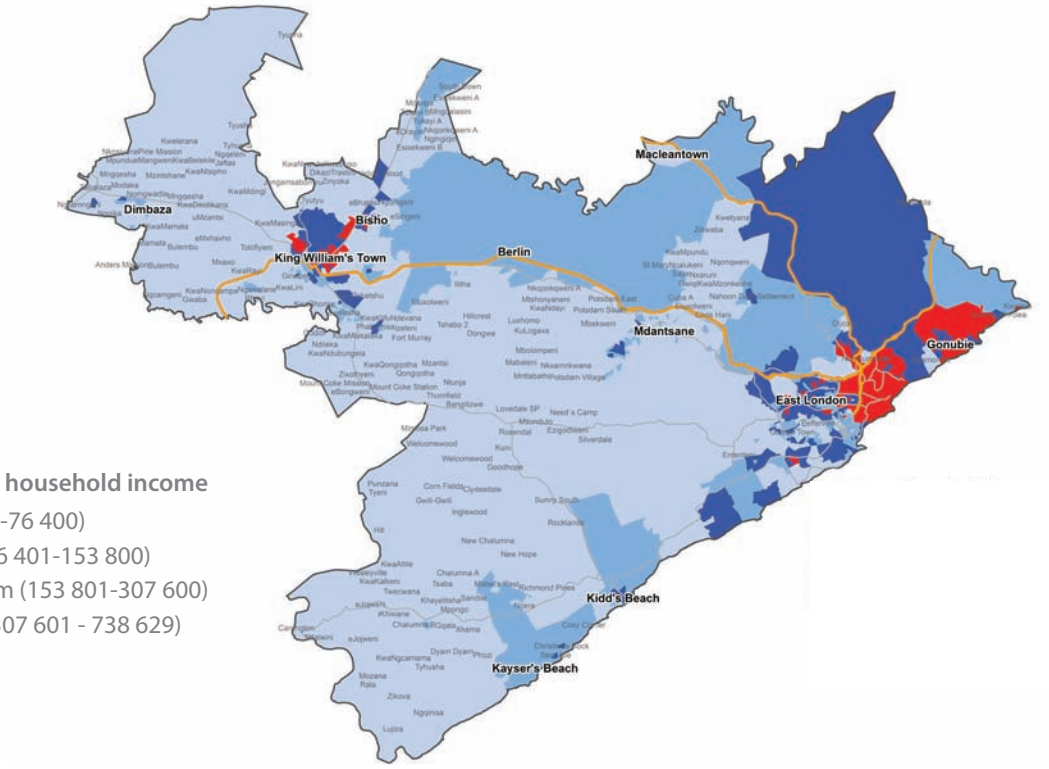
FIGURE 4.9: *Customer distribution across priority zones*



LEGEND

- 1 Dot = 25.0005261 Customers
- Priority Zone 1 - Central
- Priority Zone 2 - West Bank
- Priority Zone 3a - Berlin
- Priority Zone 3b - Quennera
- Rural

FIGURE 4.10: *Annual household income levels*



LEGEND

Ave. Annual household income

- Poor (0-76 400)
- Low (76 401-153 800)
- Medium (153 801-307 600)
- High (307 601 - 738 629)

The following figures have been compiled from the customer database of Ekurhuleni. They provide an essential layer in the spatially-based capital investment framework of a city, as required by SPLUMA, where revenue generation is deemed a strategic priority for the city.

FIGURE 4.11: *Spatial revenue profiles: net revenue generated per spatial structuring element, Ekurhuleni*

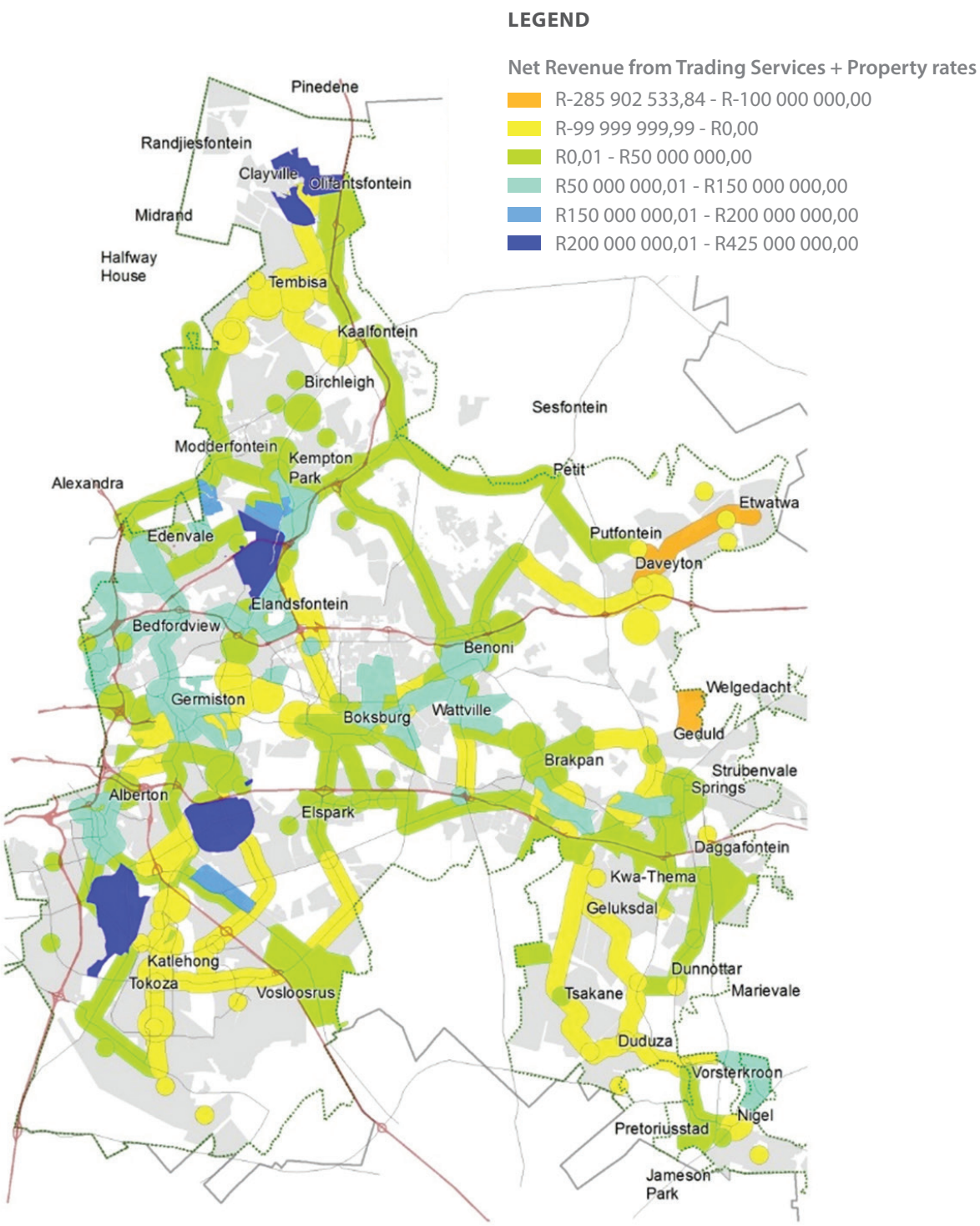
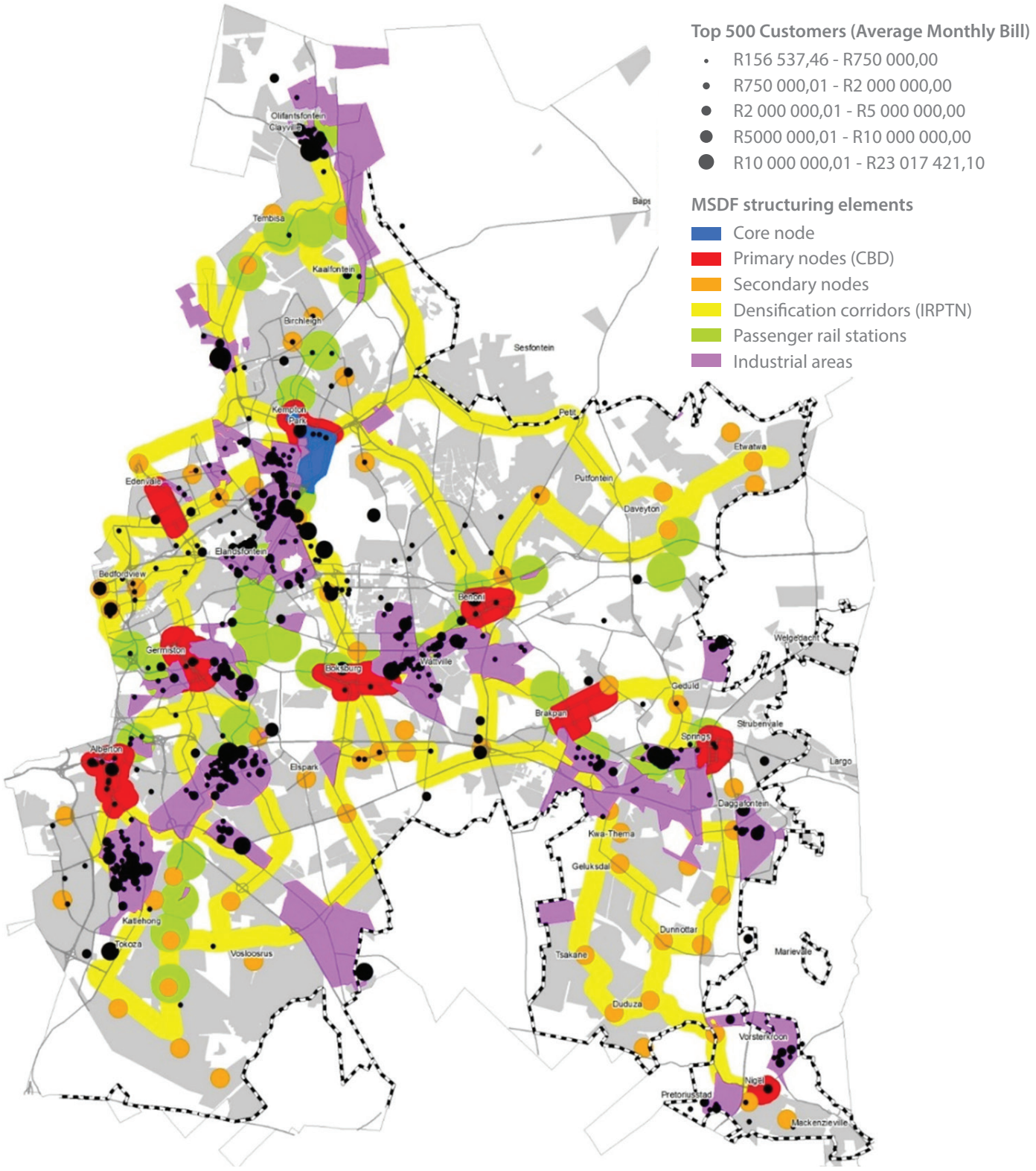


FIGURE 4.12: *Location of top 500 customers in relation to spatial structuring elements, Ekurhuleni*



Profiles as presented in Figure 4.11 and Figure 4.12 have multiple applications, some of which include:

- They provide valuable information on the strength of nodes, corridors and other spatial structuring elements, and the revenue yield of the city compared to municipal investments made in these areas. Information of this nature can also be used to rank and, where appropriate, rationalise the number of spatial structuring elements and priority investment areas.
- Information on top customers is useful in many ways, including decisions on differentiated standards of service for various areas to retain key clients and attract more investment, consideration of specially designated development zones (e.g. industrial parks), and the design of public transportation systems.

Municipal capital investment needs often seem unaffordable. Data generated from the customer database can be used to expand the revenue base of the city, and to increase revenue streams. Consider **Figure 4.13**. The traditional approach to revenue enhancement is to track and recover outstanding debt. The customer database allows this, and more. Note, for example, the large shopping centre for which no account exists in the billing system of the municipality in question, even though at the time of compiling this profile the centre has been operating for some eight months. All other properties not covered by some colour where the building structure is visible is another potential municipal customer without an account, not paying for municipal rates and services.

FIGURE 4.13: *Municipal revenue coverage and levels of outstanding debt*

4.3 SERVICE PROFILING AND DETERMINING CUSTOMER NEEDS

4.3.1 What are levels and standards of service?

LEVELS OF SERVICE

Levels of service (LOS) are statements of the range of service outputs that the municipality offers to its diverse portfolio of customers. The emphasis is on outputs, not outcomes. "Outputs" refers to the actual physical service or infrastructure provided, whereas "outcomes" refers to how the customers experience this new infrastructure – in other words, how it affects the customer. To understand this concept further, consider the following LOS for roads provision:

LOS OPTIONS	PRIMARY ROAD PAVEMENT
0	None
1	Tracks (in-situ material, compaction/grading to make passable)
2	Improved tracks non-engineered, with gravel)
3	Gravel
4	Paved
5	Paved heavy capacity

LOS OPTIONS	SECONDARY ROAD PAVEMENT
0	None
1	Tracks (in-situ material, compaction/grading to make passable)
2	Improved tracks non-engineered, with gravel)
3	Gravel
4	Paved
5	Paved heavy capacity

LOS OPTIONS	TERTIARY ROAD PAVEMENT
0	None
1	Tracks (in-situ material, compaction/grading to make passable)
2	Improved tracks non-engineered, with gravel)
3	Gravel
4	Paved
5	Paved heavy capacity

TABLE 4.16: *LOS for roads (primary, secondary and tertiary roads)*

This roads LOS hierarchy refers to the types of road on offer to customers. Road type in this context refers to class of road, pavement type (e.g. gravel or paved), carrying capacity and road width. **Defined levels of service allow a city to:**

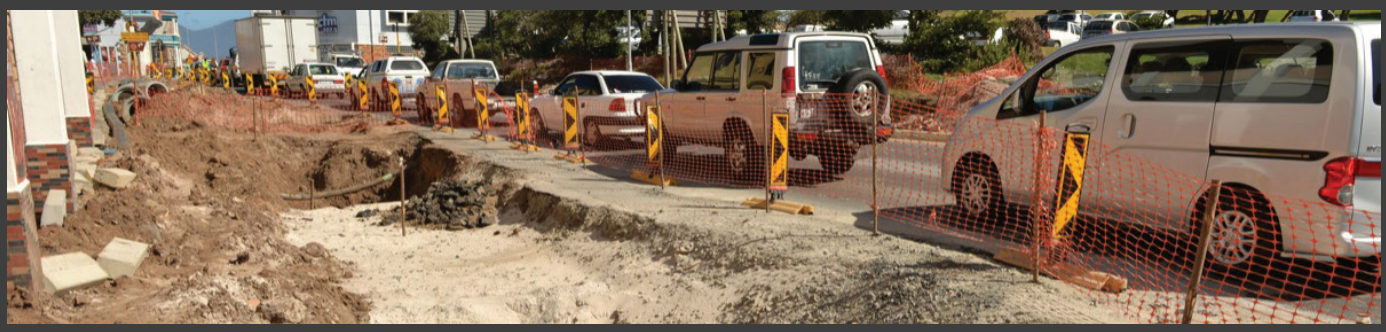
Inform and consult with customers on available service packages, as well as the costs attached to each level of service. These allow customers to make informed decisions on the levels of service they desire.

Establish level of service targets for present and future customers, and for particular spatial locations and spatial structuring elements.

Measure performance against stated levels of service, and to determine backlogs in service provision (the number of customers served at levels of service lower than the target level(s) of service), that will inform asset management strategies and plans to address backlogs.

Well-defined level of service hierarchies will meet the following criteria:

- They will include the full range of infrastructure (or social amenity) options that the city offers to its customers.
- Each level of service has a defined life-cycle and end-user cost associated with it, to allow customers to make informed decisions on what they require or are paying for, and to enable cities to cost the provision of levels of service to its customers.
- The hierarchy should also include a LOS 0: none; to allow the identification of customers not receiving or having access to any service.



STANDARDS OF SERVICE

Customers are, however, likely to require more than just the actual roads infrastructure provided (or any other type of infrastructure). **They are also likely to be concerned about outcomes such as the following:**

- A safe driving experience that includes both on-road safety as well as safety at intersections.
- Smooth travel experience without undue delays.
- A convenient, surprise-free navigation experience.

Customers generally do not have the engineering insight into how to achieve these outcomes. This necessitates giving customer performance measures in statements they understand, and technical performance measures that are criteria according to which municipalities ensure that customers receive the services they need.

CUSTOMER PERFORMANCE MEASURES	TECHNICAL PERFORMANCE MEASURES
A safe on-road driving experience	• Total no of accidents per year • % compliance with skid resistance standards • Minimum illumination level (x) lux • Replacement of existing poles with frangible columns on major roads and accident hotspots • Installation of speed cameras at accident hotspots • No of traffic-related incidents attributable to aquaplaning as a result of backed-up storm-water inlets • No of traffic-related incidents related to road-surface condition (e.g. potholes)
Safety at intersections – from hijacking and "smash-and-grab" incidents	• No fixed structures serving as visual obstructions at major intersections and traffic lights • Well-lit major intersections • Grass verges not to exceed (xx) mm in height • CCTV cameras at all major intersections
A smooth travel experience without undue delays	• Travel time or intersection delays • Synchronised system of traffic lights • Response times to attend to non-functioning robots measured in (x) no of hours of being reported
A convenient, surprise-free navigation experience	• Visible road markings • % of road signs that are in reasonable condition, providing regulatory (e.g. speed limit) and general information (e.g. directions)

TABLE 4.17: *Converting customer expectations into technical performance measures*

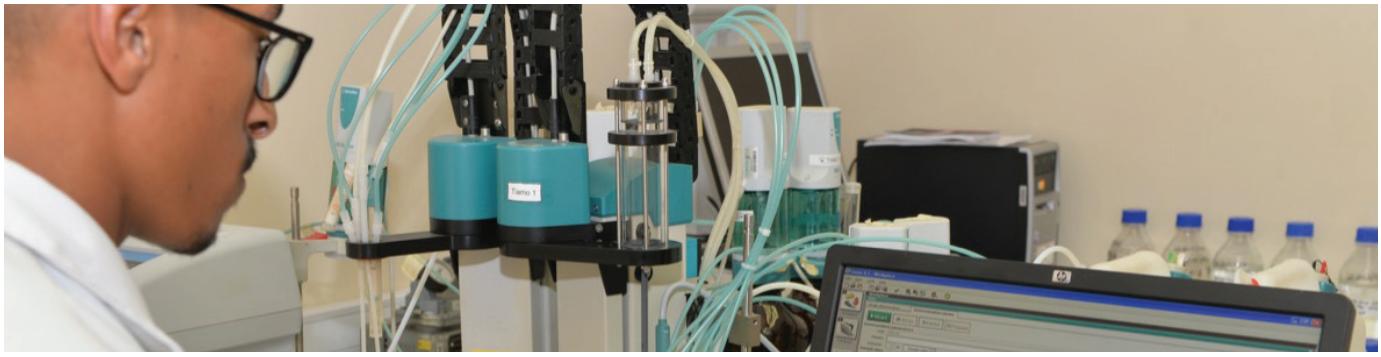
Customer performance requirements or measures are multifaceted. They are concerned with both tangible measures (e.g. the condition of the road) as well as with intangible measures such as the attitude of municipal staff receiving complaints, and how well the city reacts when dealing with complaints such as faulty robots, overgrown verges, potholes or blocked storm-water inlets. The following are some of the typical service requirements valued by customers:

- Reliability
- Quality
- Affordability or value for money
- Health and safety
- Responsiveness

Consider the following example of potable water services:

SERVICE ATTRIBUTE	STANDARD OF SERVICE/PERFORMANCE MEASURE
Reliability	No of service disruptions per annum Service disruptions not to exceed (x) no of hours per event
Quality and safety	% tests in accordance with SANS 241
Affordability or value for money	% of registered indigents receiving 6 kℓ of potable water % of unaccounted-for water not to exceed 20% Water tariffs compare favourably with other cities Frequency of meter readings % useable meter readings
Health and safety	No of incidents of waterborne diseases e.g. cholera or E. Coli 0157:H7 No of people injured No of properties damaged (e.g. due to pipe bursts)
Responsiveness	Applications for new water connections are processed within (x) no of days New connections are installed in (x) period Account queries responded to in (x) no of days Prior notice given in the event of planned interruptions

TABLE 4.18: *Standards of service for potable water services (illustrative only, not an extensive list)*



Standards of service such as those presented for water above will likely be further refined according to area, customer type and the nature of the infrastructure involved. **A city will probably adopt nuanced response times to pipe bursts, as follows:**

SERVICE DESCRIPTION	COMMITTED RESPONSE TIMES	RESPONSE CONDITIONS
Urgent water pipe bursts	2 hours	None
Larger water pipe bursts – major losses	6 hours	Not applicable between the hours of 22:00 to 06:00, subject to the incident being reported
Larger water pipe bursts – minor losses	24 hours	Not applicable between the hours of 22:00 to 06:00, subject to the incident being reported
Small water pipe bursts – major losses	12 hours	Not applicable between the hours of 22:00 to 06:00, subject to the incident being reported
Small water pipe bursts – minor losses	48 hours	Not applicable between the hours of 22:00 to 06:00, subject to the incident being reported

TABLE 4.19: *Nuanced standards of service: water pipe burst response times*

Service criteria should be SMART: Specific, Measurable, Achievable, Relevant, and Time based. Also take care not to formulate criteria, standards or targets, which are dependent on factors outside the control of the municipality.

4.3.2 *Proposed levels of service for infrastructure*

This toolkit's LOS hierarchies are intended to characterise the infrastructure provision associated with the existing levels of service that may be found in practice as well as target levels of service adopted by the cities. The numbering is not intended to suggest that any one level of service is preferable to another – indeed, a city will need to adopt different levels of service for different types of customers. This would be based on need, affordability, density, location and proximity to bulk infrastructure.

The core approach of forecasting infrastructure needs desired spatial structure, using norms-based levels of service can sometimes lead to unrealistically high budget requirements. Innovative, practical and non-asset solutions need to be explored, particularly in areas of low density (for example rural areas). More guidance on this is provided in **Module 5: Future Demand.**

Following are LOS hierarchies for infrastructure services:

LOS	DESCRIPTION
0	No electricity service: basic energy sources such as open fires paraffin/coal stoves, gas, wood and candles
1	No grid electricity service: natural and alternative energy sources such as solar (photovoltaic energy for lighting), gas or coal
2	Domestic low: grid electricity service – connected and metered (conventional and prepaid), single phase. 230 V with first 50 kWh for free with second 50 kWh lifeline for indigent and pensioners and further electricity usage charged per kWh supplied
3	Domestic high: grid electricity service – connected and metered (conventional or prepaid), single phase. 230 V
4	Commercial prepaid: grid electricity service – prepaid meters, connections to small commercial power users (<80kVA)
5	Commercial conventional: grid electricity service – conventional metered connection to small commercial power users
6	Industrial low 400 V: grid electricity service – connected and metered (conventional and prepaid). Conventional: 80 kVA and above at nominal voltage of 400V. Prepaid 50 kVA up to 150 kVA
7	Industrial high 11 kVA: grid electricity service – conventional metered connection (1MVA and <10MVA)
8	Very large power users: 11 kV and higher voltages with > 10 MVA Supply – grid electricity service – conventional metered connection

TABLE 4.20: *Electricity LOS*

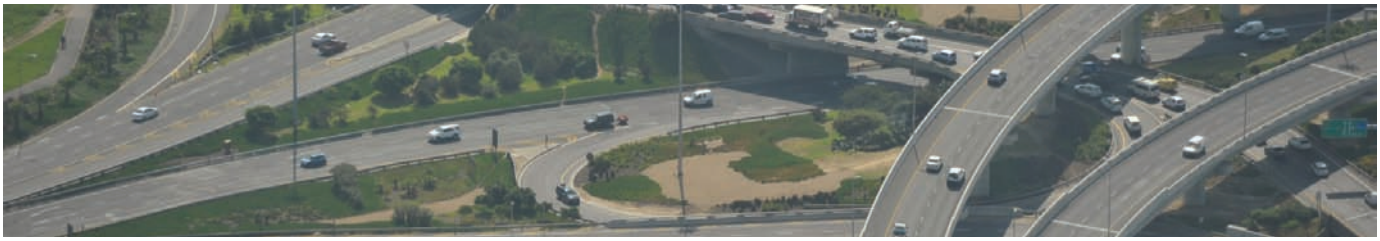
Note that for roads, grades (1 to 3) on the LOS of different roads and storm-water infrastructure elements are meant to be read independently. Access to primary and secondary roads would be coupled to the longest distance from customers.

LOS OPTIONS	PRIMARY ROAD PAVEMENT
0	None
1	Tracks (in-situ material, compaction/grading to make passable)
2	Improved tracks non-engineered, with gravel)
3	Gravel
4	Paved
5	Paved heavy capacity

LOS OPTIONS	SECONDARY ROAD PAVEMENT
0	None
1	Tracks (in-situ material, compaction/grading to make passable)
2	Improved tracks non-engineered, with gravel)
3	Gravel
4	Paved
5	Paved heavy capacity

LOS OPTIONS	TERTIARY ROAD PAVEMENT
0	None
1	Tracks (in-situ material, compaction/grading to make passable)
2	Improved tracks non-engineered, with gravel)
3	Gravel
4	Paved
5	Paved heavy capacity

TABLE 4.21: *Roads LOS (primary, secondary and tertiary roads)*



LOS OPTION	BRIDGES
0	No service
1	Nominal narrow, low, and/or limited load capacity) bridges to all roads
2	Full specification bridges to primary and secondary roads, nominal specification bridges to access roads
3	Full specification bridges to all roads

LOS OPTION	PEDESTRIAN FACILITIES
0	None
1	Isolated footpaths and islands
2	Footpaths and pedestrian islands in main areas of pedestrian movement
3	Footpaths in main areas of movement and footbridges over primary roads

LOS OPTION	CYCLE TRACKS
0	None
1	On road
2	Mix off-on and off-road cycle lanes
3	Off-road cycle lanes

LOS OPTION	STORM WATER
0	None
1	Rudimentary open systems
2	Combination of closed and open lined and unlined conduits
3	Closed conduits

TABLE 4.22: *Roads-related infrastructure LOS: bridges, pedestrian facilities and storm water*

LOS OPTIONS	DESCRIPTION
0	No formal service (no infrastructure)
1	Bucket system
2	Unventilated pit latrines and soakaways
3	Urine diversion sanitation
4	Ventilated improved pit (VIP) per stand
5	Dry composting toilet per stand
6	Communal chemical toilet per stand
7	Flushing communal toilet stand
8	Septic or conservancy tank
9	Package plant
10	Waterborne sewerage to each stand 110 mm connection (no toilet structure)
11	Waterborne sewerage to each stand 110 mm connection, with toilet structure
12	Waterborne sewer available, max connection size 150 mm or larger
13	Waterborne sewerage, discharge load is above normal limits

TABLE 4.23: *Sanitation LOS*

LOS OPTION	SOLID WASTE COLLECTION
0	None
1	Communal waste collection point
2	Weekly kerbside waste removal (bags)
3	Higher frequency than weekly waste removal from site (bags)
5	Weekly kerbside waste removal (trolleys)
6	Weekly waste removal from site (trolleys)
7	Higher frequency than weekly waste removal from site (trolleys)

LOS OPTION	SOLID WASTE SEPARATION
0	None
1	Voluntary separation
2	Enforced separation

LOS OPTION	SOLID WASTE DISPOSAL
0	None
1	Disposal of nonhazardous waste at refuse site
2	Disposal of nonhazardous waste at landfill site
3	Disposal of hazardous waste at landfill site

LOS OPTION	CLEANSING PUBLIC AREAS
0	None
1	Cleaning public areas and refuse bins

TABLE 4.24: *Solid waste LOS*

LOS OPTIONS	DESCRIPTION
0	Natural resources (no infrastructure)
1	Water point more than 200 m distance
2	Communal standpipe less than 200 m distance
3	Yard tap connection (single tap)
4	15 – 25 mm connection to building (multiple taps)
5	40 – 100 mm consumer connection
6	150 mm or larger consumer connection

TABLE 4.25: *Water LOS*

4.3.3 Levels of service for social amenities

NORMS AND STANDARDS

The following publications provide norms and standards for municipal social amenities – full publication details are provided under the References' section of this module:

- CSIR Building and Construction Technology. First Ed: August 2012. CSIR Guidelines for the Provision of Social Facilities in South African Settlements.
- Norms and Standards for Sports and Recreation Infrastructure Provision and Management (Department: Sport and Recreation South Africa)
- Primary Healthcare Facilities, Proposal V.2 (Department: Health, South Africa)
- Project Report for Costing the South African Public Library and Information Services Bill (Department: Arts and Culture).

Certain facilities and social services are of sufficient importance to warrant the establishment of national standards. The provision of fire stations and response times in case of fire, for example, are regulated by the SANS 10090:2003 Standard for Community Protection against Fire.

KEY CONSIDERATIONS IN DECIDING LEVELS OF SERVICE FOR SOCIAL AMENITIES

Deciding the types and levels of service for social amenities has become a complex and exciting activity. Multiple factors and considerations inform these decisions, including:

Accessibility	Settlement type and population threshold	Scale of planning	Locational preference

Each of these considerations are discussed in the following subsections.

01 ACCESSIBILITY

For social amenities to be of value to communities, they should be accessible. Accessibility can be measured in either time or distance, time generally being the preferred metric. **The following are possible means of determining access, and the means will be determined by considering both the customer and the nature of the service or facility:**

- Walking time
- Drive time using own vehicle
- Drive time using public transport
- Response times by emergency vehicles e.g. fire engines

Guidance on which method to use when determining access to social amenities is provided in **Table 4.28.**

02 SETTLEMENT TYPE, POPULATION THRESHOLD AND SCALE OF PLANNING

Larger settlements with greater populations typically have a greater economy of scale and the financial capacity to justify more types of social amenities, more of each type of facility and greater sophistication in each type of facility offered. For example, an international sports complex requires a population threshold of more than 750 000 people to be viable, and will therefore typically only be found in metropolitan municipalities and some secondary cities.

The CSIR differentiates between eight different settlement types (CSIR Built Environment, 2012) as follows:

HIERARCHY OF SETTLEMENTS	CATCHMENT SIZE (NO OF PEOPLE)	EXAMPLES OF SETTLEMENT TYPES
Metropolitan cities/regions	> 1 000 000	Johannesburg, eThekwini, Cape Town
Large cities/small metros	350 000 – 1 000 000	Port Elizabeth, Bloemfontein
Large towns/regional service centres	100 000 – 350 000	Nelspruit, Witbank, Krugersdorp
Small-to-medium towns/regional service centres	60 000 – 100 000	Ermelo, Harrismith, Mossel Bay
Small towns/isolated regional service centres	25 000 – 60 000	Mount Fletcher, Delareyville, Beaufort West
Dense dispersed settlements	10 000 – 100 000	Ingwavuma, Jozini, Acornhoek
Villages	5 000 – 25 000	Merweville, Stella
Remote villages	500 – 5 000	Prieska, Pofadder, Loxton, Keiskammahoek

TABLE 4.26: *Classification of settlement types and catchment sizes*

Higher-order settlements such as cities dictate that a range of levels of service is adopted per social amenity type to satisfy the needs of customers at various spatial scales. This concept is demonstrated in **Figure 4.14** by considering the provision of parks in the City of Johannesburg. **Three types of parks would likely be offered in a city of this size, these being:**

NEIGHBOURHOOD PARKS
These are local amenities within neighbourhood walking distance. The size of neighbourhood parks is typically limited to around 0.5 to 0.7 hectare. These parks should feature a basic configuration of hard and soft elements including treescaping, some playground equipment, perimeter protection, ablution facilities and some park furniture.

DISTRICT PARKS
These serve a greater population, and are sized between 12 to 20 hectares, depending on the availability of land. These should include the same elements as neighbourhood parks, but should additionally also provide parking facilities, paved walkways, lighting, irrigation and possibly braai facilities.

STRATEGIC PARKS
These are metropolitan-level parks that will include the full array of hard and soft landscaping elements, and possibly other on-site facilities such as kiosks, information centres, restaurants and facilities to host functions.

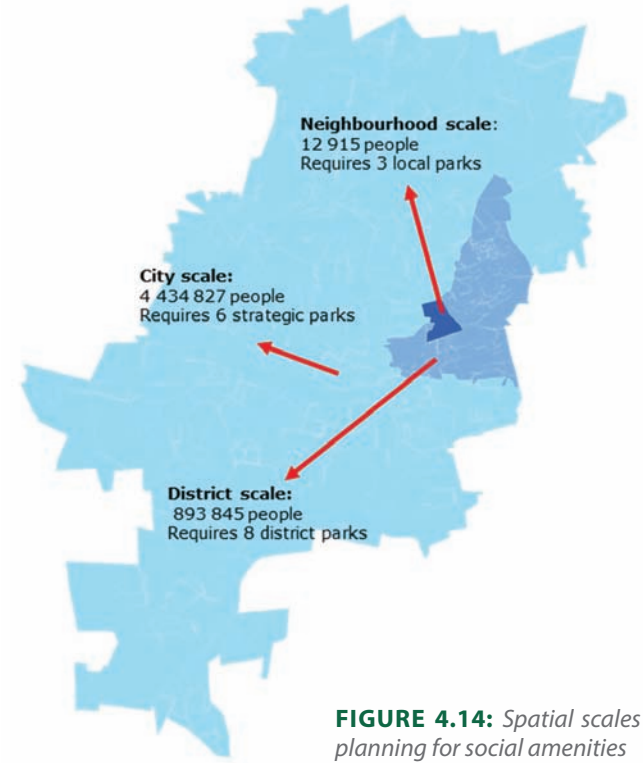
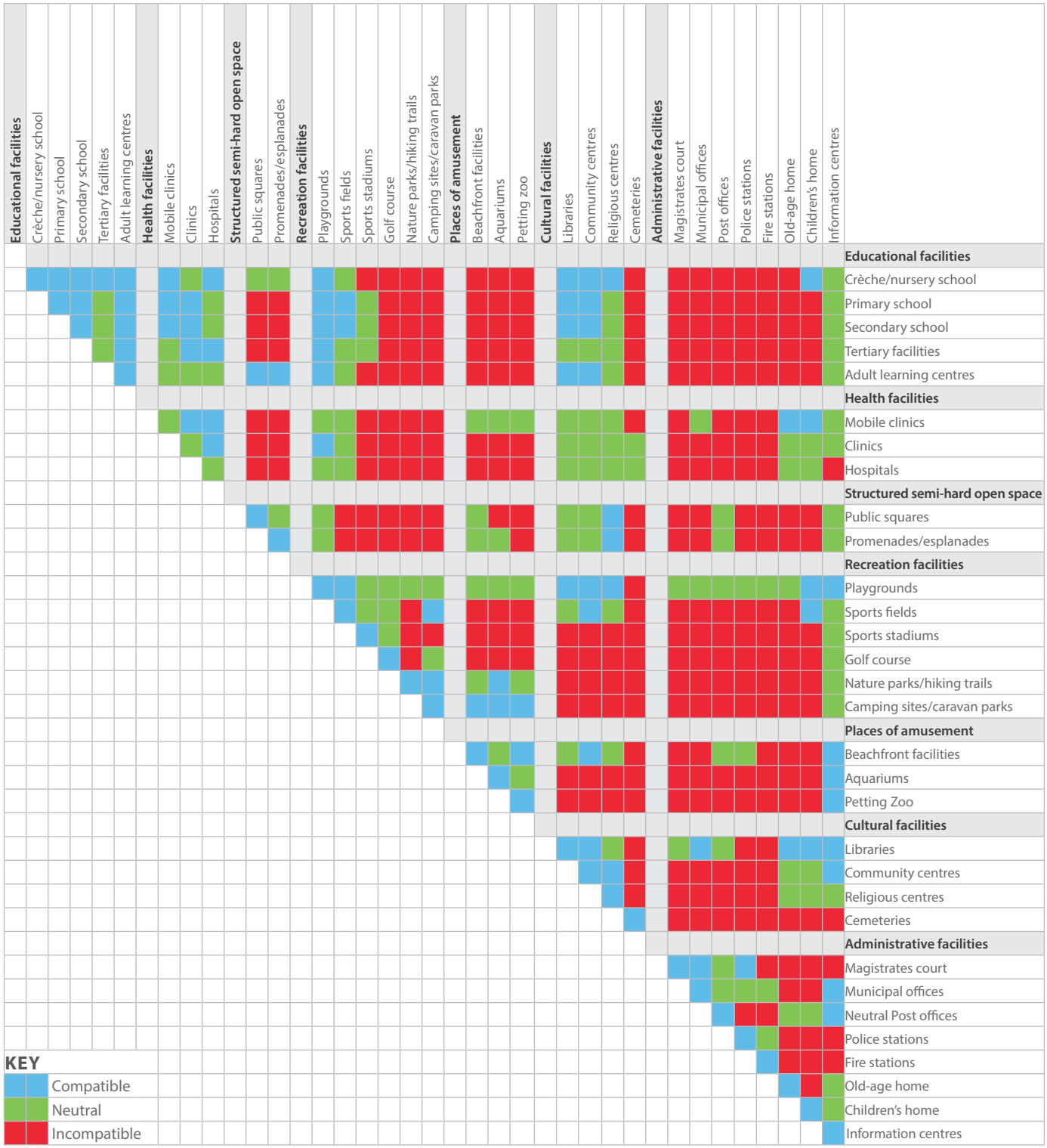


FIGURE 4.14: *Spatial scales of planning for social amenities*

03 LOCATIONAL PREFERENCE AND SPATIAL OPTIMISATION

The spatial clustering of social amenities holds many benefits and is generally considered the preferred approach, provided that the facilities to be grouped together are complementary in nature, also considering the extent of land required for some facilities. National Government promotes the sharing and clustering of facilities in the form of Thusong Centres. The Urban Networks Strategy likewise advocates the spatial clustering of facilities in identified nodes to attract people and intensify activity in identified nodes to make them economically and socially viable. Putting facilities together also allows for them to be used in many ways and resources such as a facility caretaker and security can be shared. If well-planned, this should result in land savings and trip reductions. Note that not all amenities are compatible. For obvious reasons it would be insensitive to locate an old-age home adjacent to a cemetery. The following social amenity compatibility matrix, adapted from the CSIR's Red Book for city-type amenities, illustrate which facilities are compatible with each other.

FIGURE 4.15: *Social amenity compatibility matrix*



Source: CSIR Building and Construction Technology. 2000. Guidelines for Human Settlement Planning. Volume 1. Reprint 2005. **Table 5.5.2:** Adapted to reflect additional facilities typically found in metropolitan cities.

The following matrix views each community facility in terms of its location preference. The aim is to make spatial-structuring choices that achieve a balance between liveable neighbourhoods and dense, vibrant nodes and higher-order movement networks, and to optimise the use of land. Location preference is expressed as a spatial-structuring element or zone found in a city's spatial development framework.

FIGURE 4.16: *Municipal social facilities location preference matrix*

SPATIAL-STRUCTURING ELEMENTS AND ZONES																
KEY Compatible Neutral Incompatible **FACILITY TYPE**	**INDICATIVE SIZE**	**NODES**					**MOVEMENT NETWORKS**				**ZONES**					
		CBD/anchor node	Primary node	Secondary node	Special function nodes/precincts	Neighbourhood/local nodes	Freeways/mass transit corridors	Arterials/collectors/activity corridors	High street	Local street	Urban zone	General urban (transition) zone	Suburban zone	Natural zone	Rural zone
Cemeteries																
Local basic cemetery	0.30 ha															
Local high level cemetery	3.00 ha															
Regional cemetery	15.00 – 17.20 ha															
Memorial park	0.15/1 000 head of population															
Clinics																
Mobile clinic	n/a															
Basic/intermediate urban clinic	700 – 1 500 m²															
Community health centre	5 000 m²															
Community halls and centres																
Neighbourhood community hall or centre	0.20 ha															
Regional community hall or centre	0.50 ha															
International convention centre	n/a															
Designed public open space (not parks)																
Complete street	n/a															
Promenade	n/a															
Public square	n/a															
Emergency services																
Fire and ambulance station	n/a															
Indoor sport and recreation facility																
Multipurpose sport hall (2 courts)	450 – 600 m²															
Multipurpose sport hall (4 courts)	900 m²															
Sport complex (9 – 12 courts)	1 200 m²															
Large sports complex/high performance sports complex	2 500 m²															

SPATIAL-STRUCTURING ELEMENTS AND ZONES																
KEY Compatible Neutral Incompatible		**NODES**					**MOVEMENT NETWORKS**				**ZONES**					
FACILITY TYPE	**INDICATIVE SIZE**	CBD/anchor node	Primary node	Secondary node	Special function nodes/precincts	Neighbourhood/local nodes	Freeways/mass transit corridors	Arterials/collectors/activity corridors	High street	Local street	Urban zone	General urban (transition) zone	Suburban zone	Natural zone	Rural zone
Libraries															
Mobile	n/a														
Community book units	35 m²														
Container library	55 m²														
Basic public library	225 m²														
Branch public library	500 m²														
Central public library	850 m²														
Regional public library	1 200 m²														
Municipal administrative services															
Building plan offices	n/a														
Information centre/pay point	n/a														
Municipal administrative offices	n/a														
Vehicle testing and licensing centres	n/a														
Parks															
Open space with basic improvements	n/a														
Local neighbourhood park	0.90 – 1.50 ha														
Community park	0.30 ha														
District park	2.00 ha														
Strategic park	n/a														
Public transport facilities															
Airport	n/a														
BRT station	n/a														
Bicycle parking and public cycle hiring facility	n/a														
Dedicated bicycle lanes	n/a														
Parking facilities, not covered	n/a														
Parking facilities, covered	n/a														
Taxi rank	n/a														

SPATIAL-STRUCTURING ELEMENTS AND ZONES																
KEY Compatible Neutral Incompatible		**NODES**					**MOVEMENT NETWORKS**				**ZONES**					
FACILITY TYPE	**INDICATIVE SIZE**	CBD/anchor node	Primary node	Secondary node	Special function nodes/precincts	Neighbourhood/local nodes	Freeways/mass transit corridors	Arterials/collectors/activity corridors	High street	Local street	Urban zone	General urban (transition) zone	Suburban zone	Natural zone	Rural zone
Recreational and tourism facilities															
Amusement park (e.g. a water world)	n/a														
Aquarium	n/a														
Beachfront facilities	n/a														
Camping site/caravan park	n/a														
Golf course – 18 hole	60.00 – 90.00 ha														
Nature park/hiking trail	n/a														
Skateboard facilities	n/a														
Urban jungle gyms	n/a														
Social care facilities															
Crèche/nursery school															
Old-age home															
Outdoor sports and recreation facilities: fields and stadiums															
Grassed field	n/a														
Combi-court surfaces	1.60 ha														
Sport complex	n/a														
Regional sport stadium	3.00 ha														
International sport complex	n/a														
Outdoor sports and recreation facilities: swimming pools															
District swimming pool	0.18 ha														
Neighbourhood pool	n/a														
Regional swimming pool	n/a														
Competition pool	n/a														

Note the following about the social facilities compatibility matrix:

- Strategic and regional social amenities associated with high-intensity land use are better suited for higher-order nodes and movement networks, provided that they do not take up too much space.
- Strategic and regional social amenities requiring large tracts of land, such as cemeteries, are not preferred in nodes, but should be located close to major freeways or arterial roads to facilitate wide access to such facilities. There are however some exceptions. An international airport such as the OR Tambo airport, located in Ekurhuleni, itself functions as a primary node. Coupled with an extensive road network connecting the airport and complementary land uses around the airport, the node itself becomes an aerotropolis and is thus ranked as a primary node.
- Inner-city environments should be fitted with sports and recreation facilities to ensure an active, healthy citizenry and to encourage full social participation and integration. However, due to limited space in inner city environments, such amenities are typically a combination of indoor facilities and outdoor facilities with a limited footprint.
- Due to low densities in rural areas it may be appropriate to employ mobile solutions such as mobile clinics or libraries.

LEVELS OF SERVICE FOR SOCIAL AMENITIES

Levels of service for the following social amenities are provided in Appendix 4.A:

- Beachfront facilities
- Building plan offices
- Cemeteries
- Fire stations
- Halls, theatres and centres
- Indoor sport facilities
- Libraries
- Outdoor sport facilities
- Parks
- Pay/enquiry points

4.3.4 Generating customer service profiles

Generating customer profiles requires accessibility analysis on GIS using the asset register, the customer database and the levels of service adopted by a city. In the case of accessibility to fire services, it will additionally be necessary also to consider land use and the spatial structure as different response times to fires are stipulated for various risk categories.

PREDICTABLE PRACTICE (LEVEL 4 PREDICTABLE PROCESS, CONSIDERED APPROPRIATE PROFESSIONAL PRACTICE)

The means of accessing municipal services, assumed travel times and speed as well as customer metrics (e.g. individual person or residential customer) per facility type is described in Table 4.27 and Table 4.28. Any reference to a residential customer means a household, whether formal residential or informal residential. Note the difference between "residential customer unit" and "people".

The general convention is to determine access per customer unit, as defined in Table 4.9. This approach applies to all infrastructure services. In the case of social amenities, the majority of facilities benefit residential customers (as opposed to all customer groups). In some instances, though, accessibility is determined not in terms of households, but in terms of people. This is necessary to determine capacity requirements for social facilities such as clinics. As a general rule, whenever a facility size requirements is expressed as size allocation (m^2 or hectare)/1 000 people, use people for the customer metric. Also note that beachfront facilities are not subjected to spatial accessibility analysis. Such facilities are associated with beaches that are spatially fixed by nature. The fact that a customer may live a lengthy distance away from a beach does not constitute a backlog.

SERVICE	METHOD TO DETERMINE ACCESS	STANDARD	CUSTOMER METRIC
 Water supply	• Use the latest census year as base and determine the predominant level of service per census small-area layer • Produce maps indicating level of service • Update level of service to current year • Spatially intersect customer base with level of service layer • Match municipal billing system with customer database to determine certain levels of service	Use the census "source of water" and "piped water" categories for the following levels of service: • Natural resources (no infrastructure) • Water point more than 200m distance • Communal standpipe less than 200m distance • Yard tap connection (single tap)	Number of residential customer units within a particular level of service
		For multiple house connections as well as larger water consumers (40 – 150 mm connections), use applicable tariff code from billing system as indicator of level of service	Number of residential and nonresidential customer units, with a specific tariff code indicating the size of the connection and therefore the level of service
 Sanitation	Use the latest census year as base and determine the predominant level of service per census small-area layer • Produce maps indicating level of service • Update level of service to current year • Spatially intersect customer base with level of service layer • Match municipal billing system with customer database to determine certain levels of service	Use the census "toilet facilities" categories for the following levels of service: • No formal service (no infrastructure) • Bucket system • Ventilated improved pit (VIP) • Septic or conservancy tank	Number of residential customer units within a particular level of service
		For the remainder of service levels – use applicable tariff code-billing system as indicator of level of service	Number of residential and nonresidential customer units, with a specific tariff code indicating the size of the connection and therefore the level of service
 Roads	Spatial accessibility analysis to determine the number of customers within a certain distance of each type of road (determined by the function of the road as well as the road surface). Classify each type of road by function and surface – assign the road type to the closet customer unit	For tertiary roads – assume that all customer units within 30–60 m have access to that road • For secondary roads – assume all customer units within 500 m have access to that specific road • For primary roads, assume all customers within 2 km have access to that specific road	Number of residential and nonresidential customer units with access to a specific type of road
 Electricity	• Use the latest census year as a base and determine the predominant level of service per census small area layer • Produce maps indicating level of service • Update level of service to current year • Spatially intersect customer base with level of service layer • Match municipal billing system with customer database to determine certain levels of service	Use the census "energy used for lighting purposes" categories for the following levels of service: • No electricity service – basic energy • sources such as open fires paraffin/coal stoves, gas, wood and candles • No grid electricity service – natural and alternative energy sources such as solar, gas or coal	Number of residential customer units within a particular level of service
		For the remainder of service levels – use applicable tariff code billing system as indicator of level of service	Number of residential and nonresidential customer units, with a specific tariff code indicating the size of the connection and therefore the level of service
 Solid waste	Use the latest census year as a base and determine the predominant level of service per census small-area layer • Produce maps indicating level of service • Update level of service to current year • Spatially intersect customer base with level of service layer. • Match municipal billing system with customer database to determine certain levels of service	Use the census "refuse disposal" categories, applicable tariff codes from billing system as well as municipal counts to populate the specific levels of service	Number of residential and nonresidential customer units within a particular level of service

TABLE 4.27: *Method of determining customer access to municipal infrastructure services*

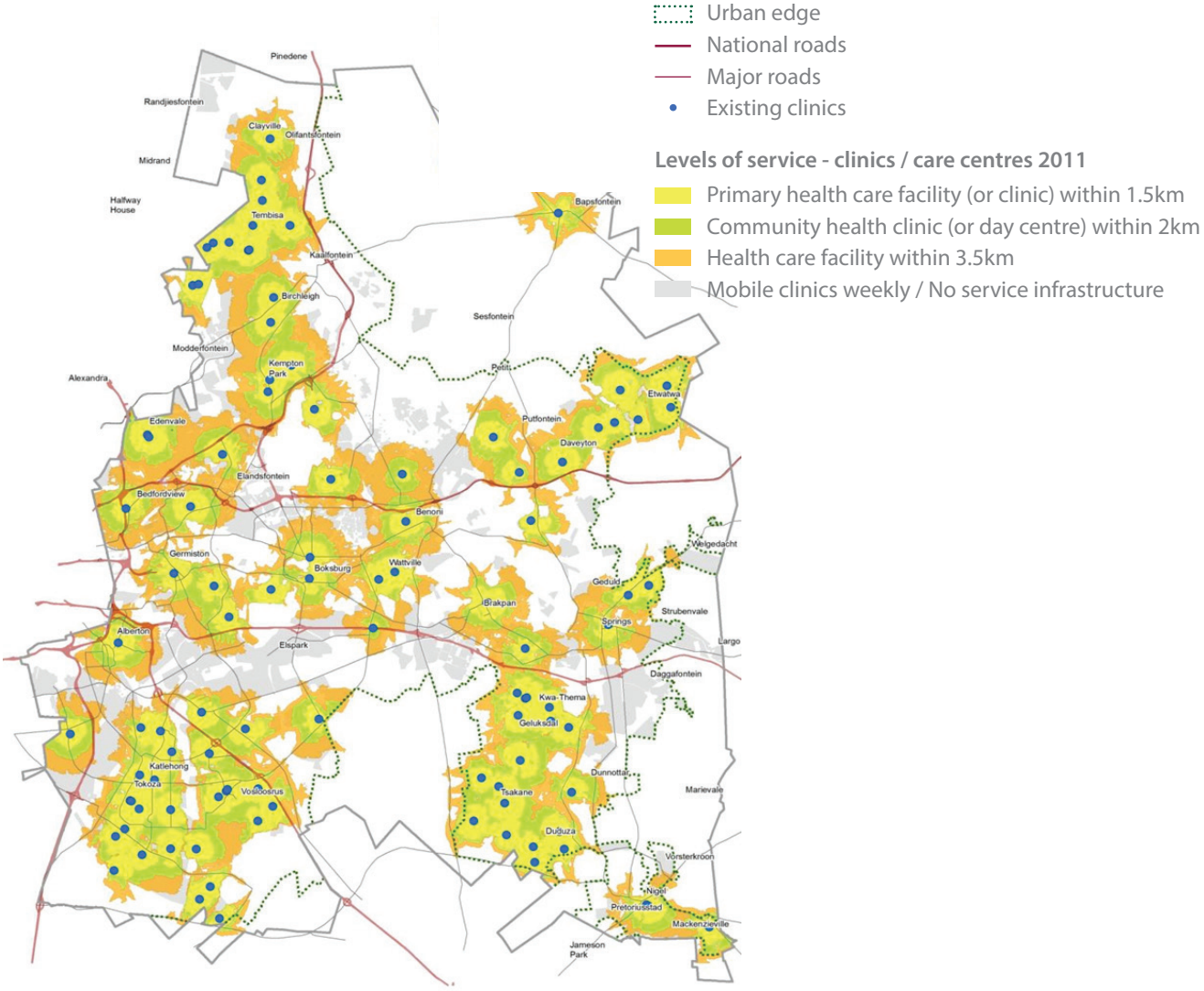
SERVICE	METHOD TO DETERMINE ACCESS	STANDARD	CUSTOMER METRIC
 Building-plan offices	Driving time analysis (using private transport)	Assume the following model speeds: Minor road = 30 km/hr Major road = 50 km/hr National road = 110 km/hr	Number of residential and business customer units within a specified distance of the facility
 Cemeteries	Driving time analysis (using private transport)	Assume the following model speeds: Minor road = 30 km/hr Major road = 50 km/hr National road = 110 km/hr	Number of people within a specified distance of the facility
 Clinics and care centres	Walking time analysis	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling	Number of people within a specified distance of the facility
 Fire stations	Driving time analysis (using emergency services vehicle)	SANS 10090:2003. Assume average speed of 50 km/hr on all roads. Risk categories as defined in the standard: A – CBDs and extensive commercial and industrial areas; B – Limited central business districts, smaller commercial or industrial areas; C – Residential areas of conventional construction; D – Rural areas of limited buildings and remote from urban areas; and E – Special risk areas	Number of customer units per risk category
 Halls, theatres and centres	Driving time analysis (using private transport)	Assume the following model speeds: Minor road = 30 km/hr Major road = 50 km/hr National road = 110 km/hr	Number of people within a specified distance of the facility
 Indoor sports	Walking time analysis	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling	Number of people within a specified distance of the facility

SERVICE	METHOD TO DETERMINE ACCESS	STANDARD	CUSTOMER METRIC
Libraries	Walking time as well as driving time analysis depending on library type	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling. Assume the following model driving speeds: Minor road = 30 km/hr Major road = 50 km/hr National road = 110 km/hr	Number of people within a specified distance of the facility
Outdoor sport	Walking time analysis	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling	Number of people within a specified distance of the facility
Outdoor sport and recreation swimming pools	Walking time as well as driving time analysis depending on pool type	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling. Assume the following model driving speeds: Minor road = 30 km/hr Major road = 50 km/hr National road = 110 km/hr	Number of people a within a specified distance of the facility
Parks	Walking time analysis	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling	Number of residential customer units within a specified distance of the facility
Pay/enquiry points	Walking time analysis	Assume walking speed of 4.2 km/hr. Note that walking along or across national roads and railway lines is not included in the modelling	Number of customer units within a specified distance of the facility
Testing stations / Driver's licence	Driving time analysis (using private transport)	Assume the following model speeds: Minor road = 30 km/hr Major road = 50 km/hr National road = 110 km/hr	Number of customer units within a specified distance of the facility

TABLE 4.28: *Method of determining customer access to social amenities*

Having applied the methodology presented above, asset management planners are now able to profile customer service provision. Following are some examples of customer service profiles.

FIGURE 4.17: *Customer service access profile: clinics and care centres, Ekurhuleni*



LEVEL OF SERVICE		DESCRIPTION OF SERVICE	EXISTING RESIDENTIAL CUSTOMERS
0	None	No service infrastructure	149 612
1	Substandard	Mobile clinic weekly	
2	Standard	Primary health-care facility (or clinic) within 1.5 km	386 216
3	Basic	Health post or satellite clinic within 1.5 km	
4	Intermediate	Community health clinic (or day centre) within 2 km	174 300
5	High	Health-care facility within 3.5 km	160 810
TOTAL NUMBER OF RESIDENTIAL CUSTOMERS			870 938

In this case the spatial accessibility analysis pointed out that 149 612 customers do not have adequate access to clinic services. This constitutes a backlog in service access to be addressed in the asset management plan.

Another benefit of spatial accessibility analysis is that it is now possible not only to determine the backlog at each level of service expressed in number of customer units or people, but also to locate on a rational basis how many additional facilities should be constructed, and where.

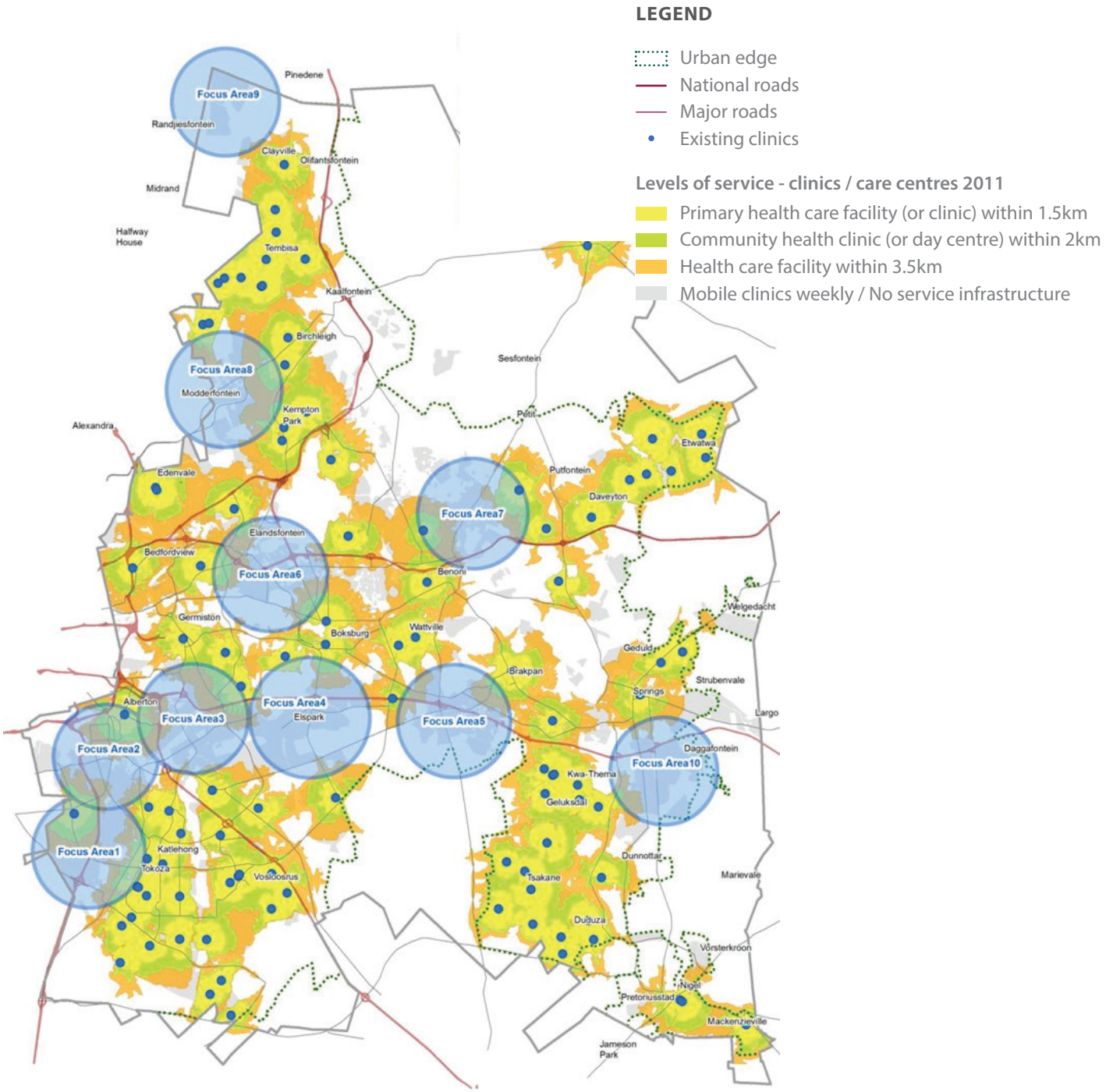


FIGURE 4.18: *Spatial identification of additional clinics and care centres required, Ekurhuleni*

A first round of customer profiling using spatial accessibility analysis very often reveals backlogs of a magnitude unaffordable to cities. **In such a case, the following process is proposed:**

1. Carefully analyse the results, and in particular investigate the following:
   - Do all areas where there is inadequate service provision have the necessary minimum population threshold to justify new facility establishment? Where there are not enough people to justify the expense, consider alternative levels of service. An example is rather to provide trolley or container library services than to construct new libraries.
   - Are all areas where backlogs have been identified areas earmarked for formal development? Some areas experiencing backlogs may be informal settlements not suitable for in-situ upgrading, and plans may be in place to relocate such communities. In such cases it would be inappropriate to construct new facilities in those locations.
   - Consider the demographics of the area. The minimum population threshold may exist to justify the construction of, say, sports and recreation facilities. Closer inspection of the demographic profile may indicate that the majority of the local community may be elderly people, who have no need for outdoor sport facilities such as combi-courts or soccer fields.
   - Consider land use trends and the spatial plans of the city. There may, for example, be areas that are changing in function from, say, residential to business or light industrial, and such a shift has been anticipated and supported in the SDF.
2. Discuss the outcomes of the spatial accessibility analysis with spatial planning officials and other decision makers or at relevant committees, and obtain further guidance on the approach to facility establishment. Urban planners may require greater levels of clustering, or may wish to prioritise certain areas for new facility establishment (e.g. in primary nodes, key corridors or other intervention areas).
3. Revisit levels of service, inclusive of norms such as accessibility (distance or time travelled) and density or minimum catchment sizes, and for different areas and spatial structuring elements, and cost the revised targets. This may be a reiterative process, and will likely involve a series of consultations.
4. Once achievable and sustainable targets have been agreed upon, update the asset management policy and strategy accordingly.

Having profiled the state of access to all municipal services and having estimated the costs of addressing backlogs, the city should be able to generate a profile such as the following – this can be narrowed down per spatial priority area or per customer type:

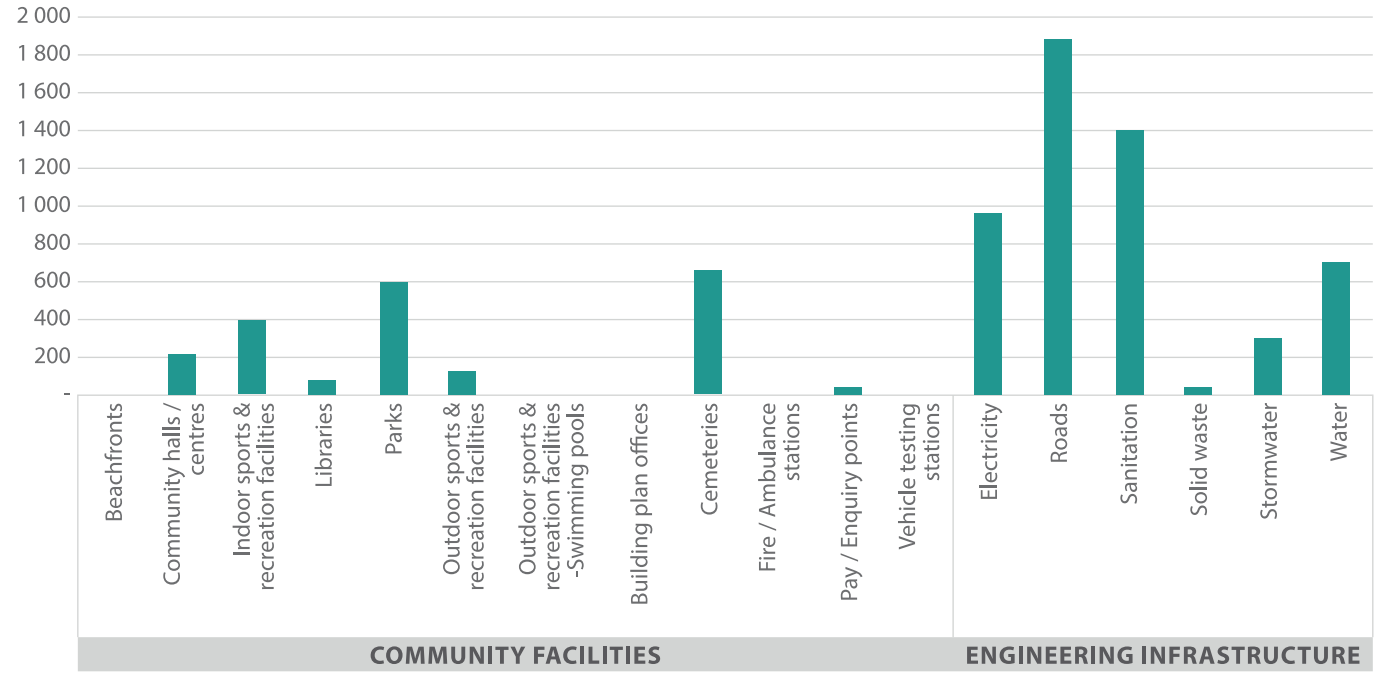


FIGURE 4.19: *Consolidated customer profile and costs of addressing service access backlogs – Buffalo City (R' million)*

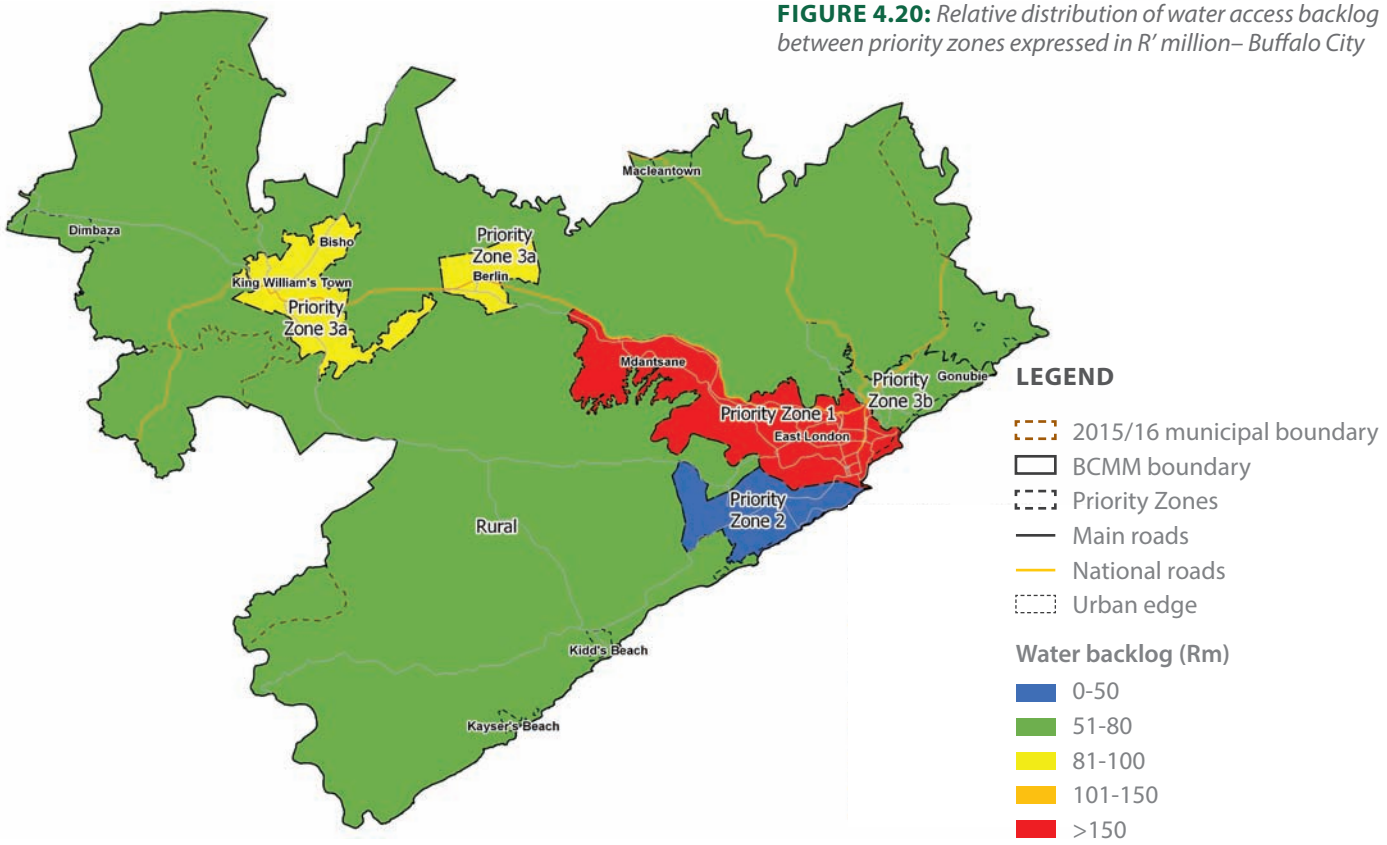
ASSET GROUPS	ASSET PORTFOLIOS	CONSUMER UNITS			COST TO ERADICATE ACCESS BACKLOGS
		ADEQUATE ACCESS	ACCESS BACKLOG	% BACKLOG	
Social amenities	Beachfronts	109 431	126 856	0 %	-
	Community halls/ centres	166 194	71 627	29 %	220
	Indoor sports and recreation facilities	187 339	50 402	21 %	388
	Libraries	222 116	15 428	6 %	67
	Parks	5 153	231 135	98 %	613
	Outdoor sports and recreation facilities	197 313	40 231	16 %	80
	Outdoor sports and recreation facilities – Swimming pools	157 772	78 516	33 %	5
	Building-plan offices	178 775	60 436	25 %	5
	Cemeteries	54 455	181 833	91 %	658
	Fire/ambulance stations	243 360	1 917	1 %	4
	Pay/enquiry points	212 018	33 259	14 %	30
	Vehicle-testing stations	244 049	1 228	0,5 %	1
Engineering infrastructure	Electricity	197 463	47 792	19 %	974
	Roads	171 531	73 745	30 %	1 875
	Sanitation	152 550	92 727	38 %	1 391
	Solid waste	205 661	39 615	16 %	41
	Storm water	167 844	77 432	32%	269
	Water	119 769	125 508	51%	679
Municipal operational facilities	Municipal offices	N / A	N / A	N / A	300
	Stores	N / A	N / A	N / A	N / A
	Workshops	N / A	N / A	N / A	N / A
	Yards	N / A	N / A	N / A	N / A
TOTAL					**7 599**

More detailed customer profile views can be generated such as the number of customers per level of service or the costs of addressing service access backlogs per spatial priority area.

WATER LEVEL OF SERVICE	LOS <2	LOS 2	LOS 3	LOS 4	LOS 5	LOS 6
Priority Zone 1 – Central	496	19 516	7 574	93 422	3 236	3 395
Priority Zone 2 – Westbank	690	2 943	0	6 147	195	330
Priority Zone 3a – Berlin	262	1 732	5 744	23 739	574	937
Priority Zone 3b – Quennera	735	3 590	881	12 737	1 839	275
Rural	7 435	25 484	9 244	7 986	86	342
TOTAL	**9 619**	**53 265**	**23 443**	**144 031**	**5 930**	**5 279**

TABLE 4.29: *Number of customer units at each LOS for water per priority area – Buffalo City*

FIGURE 4.20: *Relative distribution of water access backlog between priority zones expressed in R' million– Buffalo City*



OPTIMISING PRACTICE (LEVEL 5 OPTIMISING PRACTICE)

It is possible that a particular neighbourhood, suburb or township is well served by one type of social amenity, but not others. If some areas are poorly served compared to others, this unequal service may need specific attention. Instances of this nature can be difficult to identify by performing spatial accessibility analysis on an individual amenity basis. To address this matter, it may be useful to construct a combined social amenity accessibility index across the city.

An example of such an index, prepared for Ekurhuleni, is shown in **Figure 4.20.** Areas enjoying high access to amenities are coloured yellow. Low access to amenities are indicated in blue. The index clearly indicates the "cost" of continuous residential development around the periphery of the town. Residential areas to the south of Vosloorus and Tokoza (an area known as Palm Ridge) rate on the "medium-to-low" end of the accessibility scale – meaning that residents have to travel significant distances to reach amenities. **The process for preparing a spatial social amenity accessibility index is as follows:**

01 PERFORM ACCESSIBILITY ANALYSIS PER AMENITY TYPE

The first step in the process is to perform an accessibility analysis for each of the amenities using the methodology described earlier in this module. The result for each should be an adjoining geographic "surface" that depicts access to each of the amenities in the specific class.

02 SPATIAL OVERLAY OF ACCESSIBILITY SURFACES

During this step of the process, each of the accessibility surfaces is overlaid with each other, a process known as "union".

03 REDEFINITION

The final step in the process is to "redefine" the legend of the combination map to read as an index ranked from low accessibility to high accessibility.

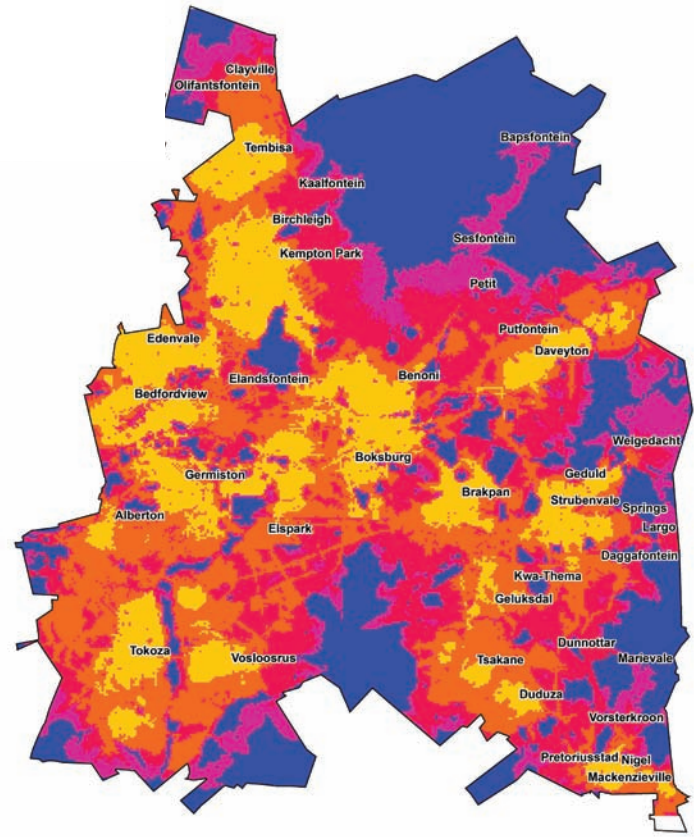


FIGURE 4.21: *Social amenity accessibility index – Ekurhuleni*

The Department of Sport and Recreation requires that each residential customer has access to at least three sport and recreation amenities within a radius of 3.5 km. A residential customer should therefore have access to, say a municipal swimming pool, a park and outdoor sports facilities such as combi-courts or tennis courts, within the stipulated radius. This requirement necessitates more advanced spatial analysis in order to determine the catchment area of each facility. Most commercial geographic information system software have the built-in capability to construct Thiessen polygons around points. Using this software enables the GIS operator to demarcate a catchment area for each facility based on the mid-point between each facility and its adjoining neighbour (see **Figure 4.22**).

When embarking on Thiessen analysis, first ensure that only the types of facilities to be considered are included. In the case of the requirement for sport and recreation facilities, for example, only such facilities should be analysed. If it is the intention to model all types of social amenities, be sure to exclude municipal operational facilities such as administrative buildings, depots, workshops, stores and yards.

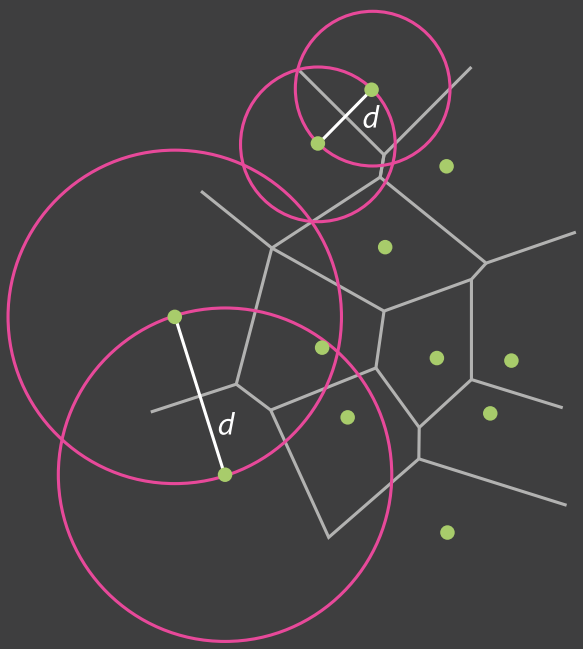


FIGURE 4.22: *GIS Thiessen polygon technique*

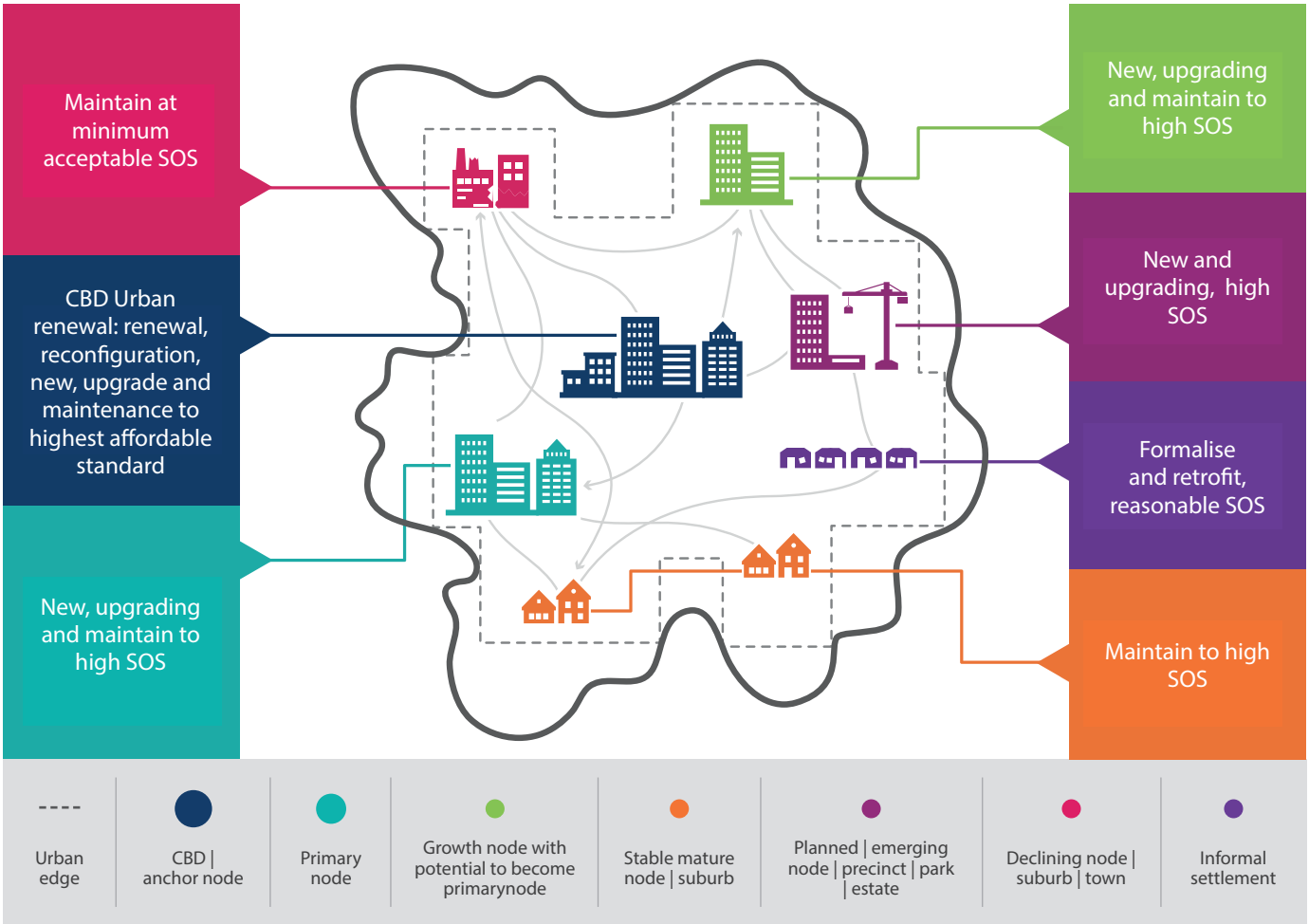
4.4 SPATIALLY-NUANCED SERVICE PROVISION

It is often assumed that all customers and areas in a city should receive high levels and standards of service. However, subspaces in cities go through cycles of investment and disinvestment (see figure below). This is a natural process, part of the urban economic cycle.

FIGURE 4.23: *Urban morphology: process of formation and transformation*

In most cities, governments do not have sufficient funding to halt the decline of all areas in the city all the time. As noted in **Module 1,** given limited fiscal and financial capacity, cities need to adopt an approach of spatial prioritisation, and focus their resources in areas and spatial-structuring elements to benefit the whole city. As a result, the asset management strategy of a city should mirror its spatial strategy, and adapt levels and standards of service based on the status of, and objectives for, each node or area.

FIGURE 4.24: *Nuanced asset life-cycle approach for nodes of various orders and in different stages of urban maturity*



This approach is visually presented in **Figure 4.24.** Accordingly, capital investment for new asset creation, upgrading and renewal is typically prioritised for the CBD, primary nodes, emerging nodes of importance to the city, and for the upgrading of informal settlements. In stable, mature nodes and declining areas the emphasis is mostly on maintenance, with limited capital investment.

4.5 SUMMARY

This module presented conventions and methodologies for segmenting, quantifying and spatially profiling customers. It offers level of service hierarchies to assist in profiling the services that customers receive, to determine service access backlogs, and to plan for the upgrading of services to meet customer or legal requirements for higher levels of service.

Civil and electrical infrastructure provide the backbone of society as we know it. Increasingly though, the value of social amenities is playing a bigger part in well-functioning, productive and socially integrated cities. The placement and clustering of social amenities are key levers in the spatial structuring or restructuring of cities, and can be used to great effect in driving urban renewal or to strengthen nodes or corridors.

This module introduced several innovations, some of which include:

- A spatially-based customer classification drawing on available data sets
- A methodology for developing spatially-based customer profiles
- Levels of service hierarchies for municipal infrastructure and social amenities
- Methodologies and conventions in spatially-based customer service profiling

The development and agreement on levels and standards of service naturally requires consultation and public participation. Guidance on public participation is extensively dealt with in a number of publication such as the IDP Guide Pack published by the Department of Cooperative Governance, and hence is not dealt with in this toolkit. This toolkit, however, provides the necessary profiles, service level options and cost implications to support informed participation.

Future versions of this toolkit will likely increasingly focus on standards of service and relating these to city-level strategic objectives, the production of customer service charters, and using standards of service as a sales tool to attract fixed capital investment and support economic growth. Additionally, levels and standards of service for municipal operational facilities such administration buildings, depots, stores and yards will likely also be addressed.

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APPENDIX 4.A: LEVEL OF SERVICE HIERARCHIES FOR SOCIAL AMENITIES

BEACHFRONT FACILITIES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Not developable	00	Natural inaccessible beaches	• Beaches not developable – inaccessible for human needs because of rocks and steep slopes • Ecologically open beaches • Beaches identified as admiralty reserves		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Basic	0	Not developed	N/A	• Beach predominantly used for angling • Beach predominantly used for snorkel diving • Beach used for walking or jogging	Mostly only some safety signage (e.g. no swimming, presence of sharks, demarcation of conservation areas)
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Intermediate	1	Basic public improved beaches	N/A	• Beach predominantly used by swimmers • Beach predominantly used by families with small children • Beach used for outdoor leisure (e.g. ball playing, surfing, bogey boarding, sun bathing, kite flying, board surfing)	• Access road • Parking facilities • Walkway to beach • Ablution facilities • Some beach furniture (e.g. fixed dustbin, some benches) • Basic signage
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
High	2	Blue flag beaches	N/A	Beach used for a wide variety of outdoor sport and leasure activities	• Access road • Parking facilities • Walkway to beach • Ablution facilities • Beach furniture • External lighting • Kiosk • Lifeguard shelter • Braai areas • General signage and specifically safety signage • Landscaping as appropriate

BUILDING-PLAN OFFICES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
None	0	No infrastructure service	-		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Basic	1	Office in municipal management region	200m²	Scope of services required (service package) include: • Record keeping of building plan approvals • Receiving building plans, check and advise • Providing up-to-date building specifications	• Waiting room area • Building- plan office attendants behind counter
			120m²		

CEMETERIES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	**FUNCTION**	**INFRASTRUCTURE**
Substandard	1	Places of burial	• Have little or no amenities that do not meet requirements for a basic local cemetery • Generally open land earmarked or used for burial purposes • Graves typically not numbered • Formal burial register mostly absent		
Basic	2a(1)	Local cemetery – Basic (capacity constrained or consumed)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			0.3 ha (MIG)	Provide burial capacity for a suburb, township or town	• Access road • Internal distributor roads • Security fencing • Parking • Public toilets • Security gate • Shower for workers (where applicable)
	2a(2)	Local cemetery – Basic (sufficient capacity)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			0.3 ha (MIG)	Provide burial capacity for a suburb, township or town	As for 2a(1)
	2b(1)	Local cemetery – High (capacity constrained or consumed)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			3 ha (MIG)	Add the following sections to the facility: • Lawn section • Berm section • Monument section	• 6 m-wide paved access road, 100m long • 4 m gravelled internal distributor • Security fencing • Administrative building • Drinking fountains • Storage space for equipment • Shelters • Wall of remembrance • Landscaping • Caretakers' house/shelter • Parking area • Security gate • Shower for workers (where applicable)
	2b(2)	Local cemetery – High (sufficient capacity)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			3 ha (MIG)	As for 2b(1)	As for 2b(1)
Intermediate	3(1)	Regional cemetery (capacity constrained or consumed)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE (MIG)**
			15 (MIG) – 17.2 ha (CSIR) but it might be distributed in the last instance	• Similar to local cemetery but serve more than one community • May need to meet diverse needs of various communities	As for 2b(1)
	3(2)	Regional cemetery (sufficient capacity)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE (MIG)**
			15 (MIG) – 17.2 ha (CSIR) but it might be distributed in the last instance	• Similar to local cemetery but serve more than one community • May need to meet diverse needs of various communities	As for 2b(1)
High	4	Memorial park	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE (MIG)**
			0.15 ha per 1 000 head of average population (MIG)	• Highly specialised • Cater for every need and desire • Memorial park should have a park-like atmosphere and tranquil ambience	As for 2b(1)

FIRE STATIONS

Refer to SANS 10090:2003 Standard for Community Protection against Fire.

HALLS, THEATERS AND CENTRES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
None	0	No infrastructure service	-		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Basic	1	Community hall –medium/small (fringe areas)	0.2 ha (CSIR) site size	• Typically serves local community • Utilised for mass meetings • Occasional hiring for private functions • Use as voting stations	• Perimeter protection • Parking • Outside bollard-type lighting • Ablution facilities • Some kitchen installations
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
High	2	Community hall – large (regional)	0.5 ha (CSIR) site size	• Occasional hiring for private functions • Use as voting stations	• Access road • Perimeter protection • Paved parking • Outside bollard-type lighting • Ablution facilities • Public address and sound system • Kitchen/catering installations
Very high	3a	Theatre	FACILITY SIZE	FUNCTION	INFRASTRUCTURE (MIG)
			N/A	• Utilised for productions • Occasional hiring for private functions • May be used for some limited art exhibition	• Access road • Perimeter protection • Paved parking • Outside bollard-type lighting • Change rooms • Ablution facilities • Public address and sound system • Internal catering installations • Kitchen installation • Bar facilities • Audio- and video-recording facilities
	3b	Convention Centre	FACILITY SIZE	FUNCTION	INFRASTRUCTURE (MIG)
				• Utilised for conferences and seminars • Utilised for private functions (i.e. year-end functions) • Utilised for meetings • Utilised for exhibitions	• Access road • Perimeter protection • Paved parking • Outside bollard-type lighting • Speaker preparation rooms • Ablution facilities • Public address and sound system • Internal catering installations • Kitchen installation • Bar facilities • Audio- and video-recording facilities

INDOOR SPORTS FACILITIES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
None	0	No infrastructure service	-		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Basic	1	Multipurpose sport hall (2 court)	• 450 – 600m² (at least 18 m long, 17 m wide and 7.6m clear ceiling height – SRSA) • Seating capacity of appr. 1 200 – 2 500 spectators	Likely basketball/ volleyball/ badminton/ squash	• A hall of 30 m x 15 m – 20 m • An area for spectators, bags and clothing • Ablution facilities • Good air circulation • Fire-fighting equipment • Parking
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Intermediate	2	Multipurpose sport hall (4 court)	• 900 m² (33 m long, 18 m wide and 8 m clear ceiling height – SRSA) • Seating capacity > 2 500 spectators	• Probably 2 basketball or 2 volleyball or 2 badminton or 2 squash • Would accommodate some sporting, recreational, commercial and entertainment activities	• A hall • An area for spectators, bags and clothing • Change rooms • Ablution facilities • Parking • Air conditioning • Fire-fighting equipment
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE (MIG)
	3	Sport complex with 9 – 12 court sport hall	• 1 377 – 1 863m² (51 – 54 m long, 27 – 34.5 m wide and 9.1 m clear ceiling height – SRSA) • Seating capacity > 5 000 spectators	• Probably basketball or volleyball or badminton or squash • Would accommodate a variety of sporting, recreational, commercial and entertainment activities	• A hall • An area for spectators, bags and clothing • Change rooms • Ablution facilities • Outside bollard-type lighting • Parking • Security • Access control • Public address and sound system • Electronic scoreboard • Air conditioning • Kiosk • Emergency treatment room • Fire-fighting equipment and sprinklers
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE (MIG)
High	4	Sport complex (medium / large)	• 2 500 m² + • Seating capacity > 5 000 spectators	• Probably basketball or volleyball or badminton or squash • Would accommodate a variety of sporting, recreational, commercial and entertainment activities	• Ticket sales office • A hall • An area for spectators, bags and clothing • Change rooms • Ablution facilities • Outside bollard-type lighting • Parking • Security • Biometric access control • Public address and sound system • Electronic scoreboard • Air conditioning • Kiosk • Emergency treatment room • Fire-fighting equipment and sprinklers • Administrative office(s)

LIBRARIES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
None	0	No infrastructure service	-		
	1b	Community book units (CBU)	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			35 m^2	• Also known as wheelie wagons • Can hold up to 2 500 books	• Large cabinet mounted on castor wheels • Lockable doors that can be opened and closed with ease
	1c	Container library	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			55 m^2	• A cost-effective way to test the demand for library services in remote rural communities • Dual-purpose libraries serving a school and the local community • In dolomitic areas where no permanent structures are permitted • In densely populated informal settlements where land is not available • Can hold up to 3 500 books	• Single or double containers OR • Prefabricated building
Facilities for urban areas	2	Basic public library	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			225 m^2	• Services include book lending service, access to computers and internet services, and photocopying services • Limited space for reading or studying • Can hold up to 5 700 books	• Municipal building or other multipurpose centres OR • Dedicated stand-alone facility • Internet access
Intermediate	3	Branch public library	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE (MIG)**
			500 m^2	• Provides core library services to large local communities • Can hold up to 8 450 books	As for 2b(1)
	4	Central public library *1 library for every 150 000 people*	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE (MIG)**
			850 m^2	• Provides a comprehensive library service • Cataloguing and distributing books to smaller libraries in its area • Can hold up to 13 800 books	• Access control • Air-conditioning • Fire-fighting equipment and sprinklers • Audible and visual emergency warning alarms • HVAC system suitable for human comfort and preservation of books • Fenestration and illumination design appropriate for reading comfort and preservation of books • Signage, inside and outside the facility • Separate store/book-sorting facility • Internet access • Audio-visual equipment • Ablution facilities
High	5	Regional public library *1 library for every 400 000 people*	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE (MIG)**
			1 200 m^2	• Comprehensive range of library services • At least one specialised reference service • Can hold up to 18 865 books	As for central public libraries

OUTDOOR SPORTS

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
None	0	No infrastructure service	-		
Informal	1	Very little infrastructure services	FACILITY SIZE	FUNCTION	INFRASTRUCTURE
			• Might have soccer goal posts • Might have rugby uprights		
Basic	2a	Grassed field	FACILITY SIZE	FUNCTION	INFRASTRUCTURE
			0.56 ha per 1 000 people (SRSA)	Would accommodate basic sporting and recreational activities	• Perimeter protection • Parking • Change rooms • Ablution facilities • Some steel stands • Irrigation
	2b	Combi court surfaces (1 cricket oval, 1 baseball, 2 softball fields)	FACILITY SIZE	FUNCTION	INFRASTRUCTURE
			1.6 ha (CSIR)	Would accommodate basic sporting and recreational activities	As for LOS 2a
Intermediate	3	Sport complex (grouping of fields and/or sport complexes)	FACILITY SIZE	FUNCTION	INFRASTRUCTURE
			See table below for sizes of fields and courts	Would accommodate a variety of sporting, recreational, commercial and entertainment activities	As for LOS 2a plus: • Access road • Dedicated area for spectators, bags and clothing • Change rooms • Floodlights
	4	Regional sport stadium	FACILITY SIZE	FUNCTION	INFRASTRUCTURE (MIG)
			3ha (CSIR)	Would accommodate a variety of sporting, recreational, commercial and entertainment activities at a standard meeting requirements as established by sporting bodies	As for LOS 3 plus: • Air-conditioned change rooms • Access control • Security • Ticket sales office • PA and sound system • Electronic scoreboards • Permanent stands • Medical room (equipped with emergency equipment for spinal, head and bone injuries) • Administration office(s) • Kiosk facilities • Entertainment or banquet hall with kitchen or catering facilities • Groundskeeper facilities
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE (MIG)
			N/A	Would accommodate a variety of sporting, recreational, commercial and entertainment activities at a standard meeting requirements as established by sporting bodies	As for LOS 4 plus: • Standby generator • Permanent stands with main pavilion • Media room with attendant communications infrastructure • Commentators booth

SIZES OF FIELDS AND COURTS

FIELD/COURT	LENGTH (M)	WIDTH (M)
Baseball diamond / basketball	28.00	15.00
Bowling green	40.00	40.00
Cricket oval	137.16	59.16
Korfball	40.00	20.00
Netball	30.50	15.25
Rugby	100.00	70.00
Soccer	105.00	65.00
Tennis	23.77	8.23
Volleyball	18.00	9.00

PARKS – DEFINED AS (DEPARTMENT OF SPORT AND RECREATION, 2010):

"Any land, square, river, including any portion hereof any facility or apparatus therein or thereon but excluding any public road or street or any building, structure, hall, room or office including any part thereof and any facility or apparatus therein which is the property of or is possessed, controlled or leased by a municipal council and to which the general public has access, whether on payment of admission fees or not."

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
Open space	1	Natural open space	• Land not developable • Generally inaccessible for human needs • Ecological open space		
Rudimentary	2	Open space with basic improvements	**FACILITY SIZE**	**FUNCTION**	**INFRASTRUCTURE**
			Discretionary	Functions will depend on the characteristics and intrinsic value of the green space, and on local needs assessment Ideally, parks should provide multiple functions, including: • Ecological functions such as stormwater and carbon trapping • Protection of flora, and where appropriate, fauna • Recreation • Leasure • Opportunities for education, learning and social integration	• Treescaping • Some playground equipment • Perimeter protection (palisade)
Basic	3	Local neighbourhood park	**FACILITY SIZE**		**INFRASTRUCTURE**
			0.5 ha – 0.7 ha (SRSA)		As for LOS 2 plus: • Lawn area • Some playground equipment • Ablution facilities • Some park furniture
Intermediate	4	Community park	**FACILITY SIZE**		**INFRASTRUCTURE**
			0.3 ha (CSIR) per 1 000 people served		As for LOS 3 plus: • Walkways • Signage of educational nature as appropriate • Parking • Irrigation • Bollard-type lighting
	5	District park	**FACILITY SIZE**		**INFRASTRUCTURE**
			2 ha (BCMM) (12 ha – 20 ha (CSIR))		As for LOS 4 plus: • Access road, where appropriate • Braai areas • Sophisticated landscaping featuring a range of hard and soft elements
High	6	Strategic park	**FACILITY SIZE**		**INFRASTRUCTURE**
			Discretionary		As for LOS 5

PAY/ENQUIRY POINTS

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Basic	1	Municipal precinct pay point	500 m^2	• Serves as a rates hall • Safekeeping of cash received • Serves as enquiry point • Serves as a referral system	• Access control • Hall or customer serving area • Security and cash-handling facilities • Serving counters • Terminals • Office space
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
High	2	Local offices pay point in town	150 m^2	• Serves as a rates hall • Safekeeping of cash received • Serves as enquiry point • Serves as a referral system	• Access control • Hall or customer serving area • Security and cash-handling facilities • Serving counters • Terminals • Office space

TESTING STATIONS AND LICENSING CENTRES

REFERENCE	LOS LEVEL	LOS DESCRIPTOR	LOS CRITERIA (FOR THE FACILITY)		
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
Basic	1	N/A	500 m^2	Generally at least one of the following services: • Theoretical examinations • Licence renewal • Enquiries • Referrals	• Depending on the scope of services offered: • Access control • Hall or customer serving area • Security and cash-handling facilities • Serving counters • Terminals • Office space • Theoretical examination centre for vehicles, heavy vehicles and motorcycles • Ablution facilities • Kitchen
			FACILITY SIZE	FUNCTION	INFRASTRUCTURE
High	2	N/A	150 m^2	• Driver's licence renewals • Learner's licence tests • Driver's licence tests • PDP applications and renewals • Motor vehicle roadworthy tests • Police clearance • Conversion of foreign driver's licences • Application and issue of instructors certificates to driving school instructors	As for LOS 1 plus: • Access road • Perimeter protection and access control • Parking facilities • Practical licence testing course for vehicles, heavy vehicles and motorcycles, inclusive of ramps • Vehicle lifts • Inspection/oil/grease pit • Other mechanical test equipment (e.g. to test shock absorbers)

CITIES' **INFRASTRUCTURE DELIVERY** AND **MANAGEMENT** SYSTEM

CIDMS