

## CITY OF JOHANNESBURG: CONSOLIDATED INFRASTRUCTURE PLAN

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### ABSTRACT

The Consolidated Infrastructure Plan (CIP) is an initiative of the City of Johannesburg to assist in the City's planning for current and future growth needs. The objective of the CIP is to consolidate and integrate planning, implementation and management of infrastructure-related programmes. The city faces a number of challenges which will continue to hamper growth and inhibit its ability to attain the vision for the city. The most critical challenges include:

- a growing population specifically in the lower income band due to migration
- geographically disintegrated in terms of transport from home to work locations resulting in prohibitively high transport costs
- lacking infrastructure to support economic development
- limited integration between city and municipal owned entities (MOE) results in unsustainable delivery practices
- limited institutional capacity curtails operational efficiency
- ineffective and unsustainable financial management practices.

The city, cognisant of its ageing infrastructure, capacity constraints and backlogs, is expected to spend in excess of R100 billion on the provision of infrastructure over the next ten years. The CIP is developed to improve the alignment of infrastructure investment with the City's Growth and Development Strategy, resulting in improved value for capital and institutional investments. The CIP models the city's growth potential and resulting demand for services by means of a standardised socio-economic baseline to ensure integration between services. Requirements for current and new infrastructure are developed for all enabling infrastructure components from the standardised baseline.

The long-term financial requirements are modelled from the infrastructure output with the objective of informing timely decision making. Additional elements are developed to support project identification and prioritisation through system development, programme management and the institutional skills assessment supplementing the core of the CIP. The complexity of the CIP is influenced by the outright size of the municipality, population demographics, structure of the local economy together with its national and international linkages, and availability of current technical information.

This required the introduction of newly developed project elements which serve to simplify the methodology:

- a standardised planning baseline used to assist in integrated infrastructure planning
- an infrastructure investment optimisation strategy to identify savings in refurbishment costs
- a management information tool to support in the infrastructure budget allocations and management of implementation and maintenance projects.

The CIP is developed to serve as a management information tool to support infrastructure budget allocations and the management of infrastructure implementation and maintenance projects.

### INTRODUCTION

This paper provides a high level framework for developing a set of planning instruments for improved service delivery in the municipal space. It addresses the key issue of coordination between different agencies by creating a platform for planning, consolidation and alignment of

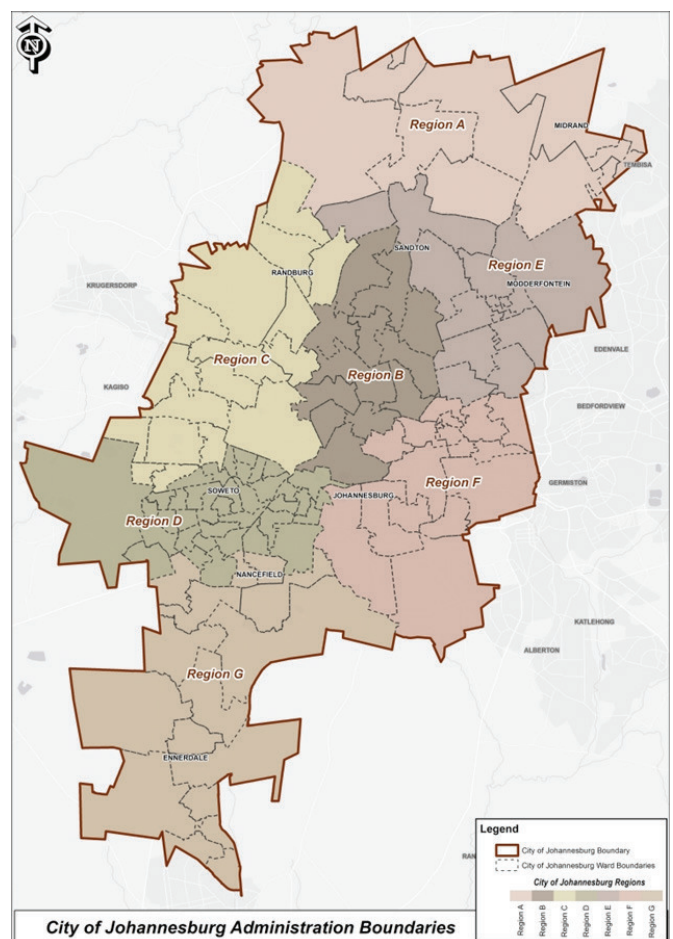
outputs to assist decision makers. The planning framework must be developed with specific objectives that are based on key principles, while taking into account the potential impact of the current challenges that the study area, the City of Johannesburg (CoJ), is facing.

The paper starts with a discussion on the development direction of the CoJ and provides details on the problem statement. The initiative is brought into context by discussing the study area, its unique features and challenges. The Consolidated Infrastructure Plan (CIP) conceptual model is discussed within the framework of integrated planning to indicate the key features of the solution. The approach and methodology of retrofitting the CIP framework for the CoJ study area is discussed as motivation for the solution. The results of the initiative are provided by indicating the tools and outcomes. The paper ends with the discussion on the positive contribution of the CIP to support a solution to the CoJ challenges.

### Development objectives

The CoJ has set itself the goal of becoming a sustainable world-class city, and creating a safe home for its inhabitants. It is acknowledged that this is a daunting task and that it has to deal with various legacies of the past. The need has therefore been identified to create a planning environment in which the various services of the city can be integrated. The funding needs to be applied in the most efficient manner, while accommodating the socio-economic needs of communities and provide the economic development environment for private sector investors.

The map in Figure 1 indicates the extent of the study that includes the CoJ metro boundary and the seven administrative regions.



**FIGURE 1** Extent of the study, including CoJ metro boundaries and administrative regions



The challenges facing the CoJ first need to be defined and understood so that an applicable approach can be defined. In order to understand these needs, the goals for CoJ should be clarified. It is understood from the CoJ Growth and Development Strategy (GDS) that the objective is to create a city in which the following principles holds true:

- sustainable – environmental, economic, personal
- caring – quality of life and protecting the vulnerable
- smart – information driven, with many learning opportunities
- democratic – participation by all communities
- financially successful – operate in the most efficient way possible
- institutionally functional – organisation with skilled resources functioning cost effectively.

The key principles to be considered in developing such a plan have been identified in the Sustainable Human Settlement Investment Potential Atlas (2009), which listed the following as cardinal to city planning:

- sustained and inclusive economic growth
- provision of basic services
- spending on fixed investment focused on economic growth
- focus on people, not places
- identification of development opportunities that can be channeled into activity corridors and/or adjacent to/or that link the main growth centres.

However, the CoJ faces a number of challenges, which will continue to hamper growth and impact negatively on the goal set above. This includes some of the following:

- it remains a disintegrated city with an extensive apartheid heritage
- the cost of transport from new townships to job opportunities is prohibitively high
- cost of bulk infrastructure is high
- current infrastructure is aging
- environmental concerns with developments
- informal settlements grow closer to economic activities when owners of RDP houses on the periphery return
- insufficient institutional capacity within the metro
- ineffective and unsustainable financial management practices.

The proposed intervention therefore focuses on defining a planning framework in which these issues can be addressed and rectified. It provides support to policy makers for improved decision making to channel funds consistent with the continued and sustainable growth of the city.

### The need for integrated planning

In order to work towards achieving the City's vision, the approach should be in line with the principles of integrated planning as defined in Local Government legislation. The support structures are in place and the processes for funding support have been established. With the challenges already overcome, a number of issues need to be focused on in order to move closer to the set goals.

The issues at hand can be summarised as follows:

- SA cities are very dispersed compared to other large metropolitan areas
  - Cost of services are high, and are unaffordable to most consumers
  - Travel time to and from work opportunities are unnecessary long
  - Infrastructure costs are too high
  - Critical mass is required to structure economic activities effectively.
- The approach should include an integrated planning framework with the following functionality:
- Has the ability to set targets for development and service levels
  - Allows officials to consider development options and scenarios
  - Assess the costs and impact of those options
  - Develop funding and financing models to support these options
  - Involve all relevant stakeholders in deciding upon the most

optimal and affordable options including communities and private sector investors.

A tool with this functionality would provide the ability to model a variety of scenarios that present the outcome for the viewer to analyse and determine the optimum result. The advantages are numerous of which, the most obvious, is the ability to see the direct outcome of input parameters as the model is adjusted according to the user's requirements.

### WORKING TOWARDS A SOLUTION

An approach needs to be defined that guides the process and methodology in order to work towards the set goals of an integrated development framework and key principles as defined under the development objectives.

The following guidelines, in terms of the approach, need to be taken into account:

- policies: set the targets to create the democratic, sustainable, economic, efficient city
- scenarios: consider different spatial models using transport, densification, growth centres, bulk services availability and capacity as development paradigms:
  - options for consideration: get people closer to jobs, utilisation of bus rapid transit for improved access, introduction of new development nodes, mixed-use developments, densification of existing areas close to jobs, take jobs close to people, new job markets
- decision model: Infrastructure investments and development of partnership options
- develop a model for predicting the required infrastructure investments: Status quo, required demands, future demands, deterioration and losses
- funding: identify capex and opex needs, address financing, PPPs, rates and taxes, incentives
  - Identify future lifecycle costs, need for funding, user pay principle (with allowance for the indigent) and investment climate for private sector partners.

In order to ensure that the process is in line with the overall approach, a number of objectives should be developed. These high level objectives can be used to set targets against which the development process can be monitored with the following aims:

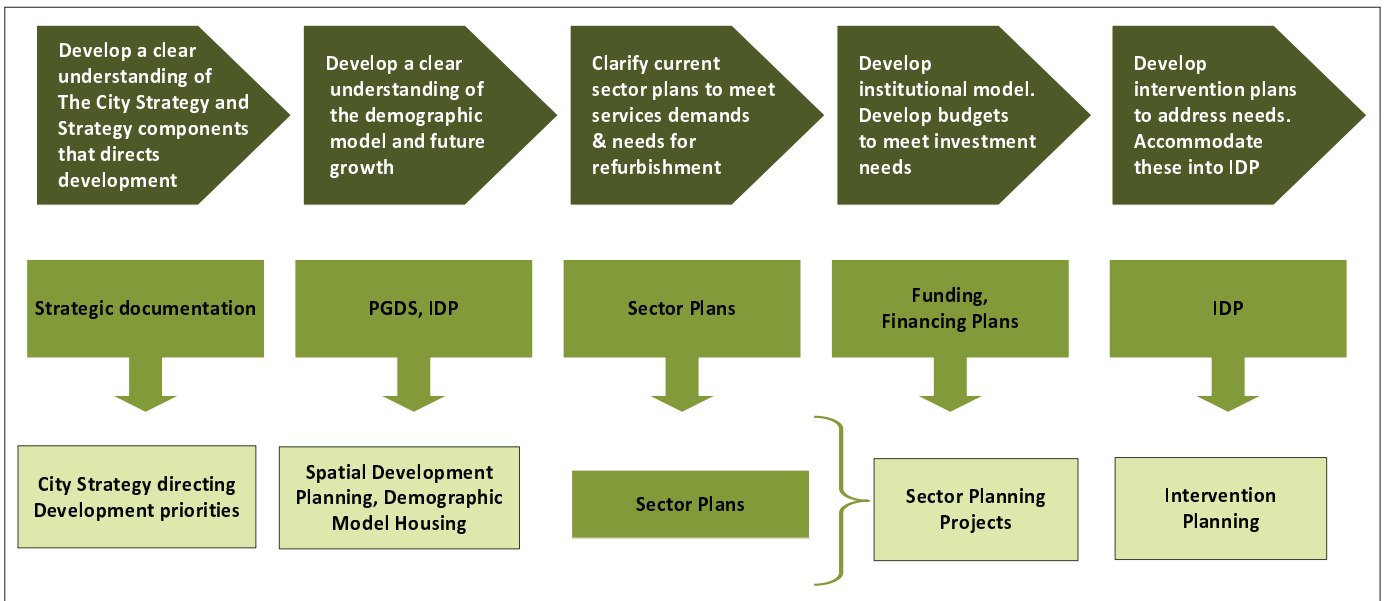
- enrich the Integrated Development Plan (IDP) process by coordinating information from different planning instruments
- build towards a plan for sustainable service delivery
- align the infrastructure needs with the institutional capacity to work towards sustainable service delivery
- identify needs for process improvements in project delivery
- inform and align the municipal budgetary process
- identify funding and financing needs from own and grant funding
- create a communication platform between entities to establish a common understanding and goal orientated approach.

### Conceptual model for the Consolidated Infrastructure Planning

Every municipality needs to compile an IDP that defines a framework for creating and sustaining integrated human settlements by providing the necessary infrastructure in a sustainable and coordinated manner.

The Department of Cooperative Governance and Traditional Affairs (CoGTA) formulated its Comprehensive Infrastructure Planning (CIP) framework to enhance the preparation of the IDP and consolidate the information and subsequent analyses from a wide range of planning instruments (Spatial Development Framework (SDF), existing IDP, Master plans, Sector plans).

The CIP had been formulated to inform the development and composition of the IDP and to inform the Medium Term Expenditure Framework



**FIGURE 2** Summary of the CIP conceptual model

(MTEF) and other funding planning mechanisms (e.g. DoRA<sup>1</sup>). The diagram in Figure 2 is a summary of the CIP conceptual model that is discussed as follows. The CIP consolidates the data at ward level<sup>2</sup> by exploring the unique needs of communities, and then formulate plans and projects for providing housing and infrastructure to service these needs. It creates the basis for confirming the alignment of the different sector plans in a particular space, overcoming the tendency of different sectors and disciplines to use their own reference framework and data for planning purposes.

It furthermore addresses the full life-cycle management of those assets by considering the refurbishment and maintenance needs, as well as ensures that the necessary skills and financial resources are available to achieve the goal of sustainable service delivery is achieved in the medium to long term. Finally, it aims at ensuring that interfaces with other service providers (e.g. those providing bulk services) are planned in a coordinated manner.

The purpose of this process is to identify those infrastructure projects required to achieve the medium to long term development goals, assist and support the planning framework, and provide input for the IDP processes and the MTEF process. The CIP also plays a valuable role in integrating multi-sectoral developments and projects, ensuring that service provision planning and implementation programmes are aligned (e.g. resource to bulk to reticulation as well as across sectors such as housing to water to sanitation to electricity and roads).

The process has been developed to entail the following key steps:

- Step 1: Develop a framework for spatial development and growth
- Step 2: Assess infrastructure needs, assets, conditions and a link to education, health, social infrastructure
- Step 3: Develop institutional arrangements for infrastructure management
- Step 4: Assess financial resources, considering income and sustainability
- Step 5: Create an intervention plan towards sustainability.

<sup>1</sup>Division of Revenue Act

<sup>2</sup>It would be possible to select another planning entity if the need so arises: however, the wards provide single point responsibility towards political buy-in by councillors, and can represent a basis for stakeholder participation

It is therefore clear that the full extent of the CIP would address the technical, institutional, and financial perspectives of infrastructure service delivery.

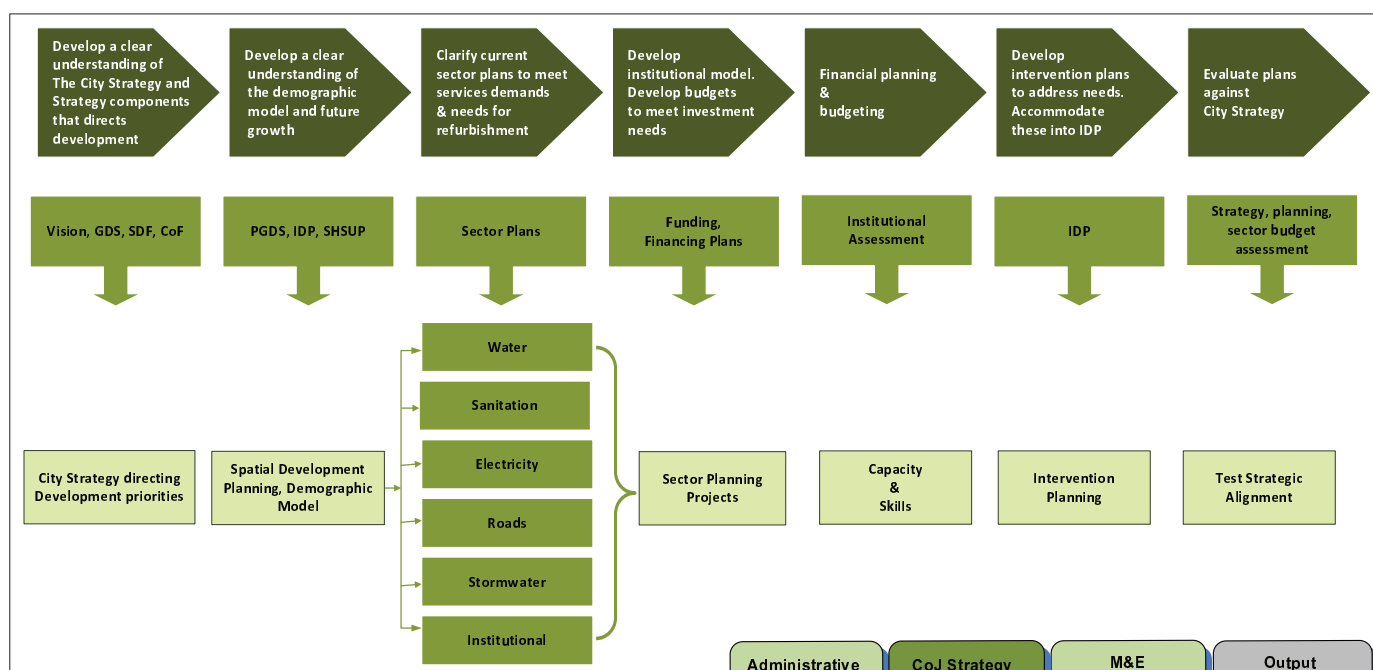
#### Approach and Methodology for implementing the CIP solution

The CoJ, Environment and Infrastructure Services Department (EISD) contracted Aurecon to implement the CIP. Through consultation between the CoJ and Aurecon the concept was assessed against the status quo in CoJ and the immediate requirements were identified to structure the initiative accordingly. The timeline, available information and related processes determined the approach and methodology. A phased approach was decided on due to the magnitude of the task and the complex multi-dimensional nature of infrastructure planning.

As indicated by the City Manager, Mr. Trevor Fowler, the City aims to spend R100 billion on infrastructure in the next 10 years. The CIP will assist by developing an Infrastructure Investment Framework that will guide the infrastructure budget allocations for the next 10 years. The infrastructure investment needs to be aligned to the City Strategy to ensure the long term objectives of the City are met.

In order to do this, the CIP concept was refined and adjusted to fit the CoJ status quo, as indicated in Figure 3. In line with the diagram, the CIP components have been designed as follows:

- understanding the City Strategy: the strategic components that include the City's vision, goals and objectives and development priorities
- developing a socio-economic planning baseline that indicates population growth per income group as well as anticipated economic activity to provide a land use take-up per residential, commercial and industrial land use types over a 20 year timeline. The baseline will be used to direct and integrate all sector master planning
- identifying the sector bulk and reticulation components for refurbishment and new infrastructure through master planning based on the socio-economic baseline
- consolidating the infrastructure investment requirements for all sectors for the specified 10 year timeline
- applying the Infrastructure Investment Optimisation Strategy (IIOS) to identify potential savings in refurbishment costs per designated planning area (Ward areas)
- modelling the future infrastructure investment: Prioritising projects according to the City Strategy to indicate the cash flow forecast for infrastructure projects for the next 10 years.



**FIGURE 3** The CIP aligns with the City Strategy

Delivering on these elements will bring the CIP closer to being a management information tool to support in the infrastructure budget allocations and management of infrastructure implementation and maintenance.

The initiative includes a number of additional components that are client specific and therefore not included in this discussion.

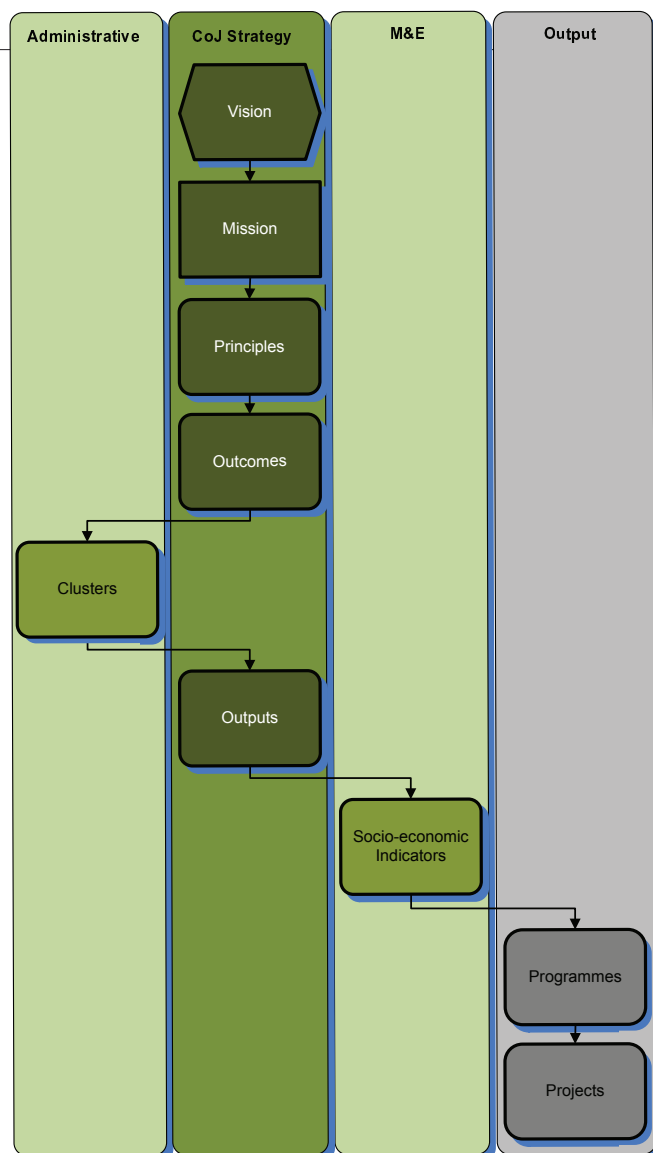
#### OUTCOME OF THE INITIATIVE

The initiative has been an ambitious undertaking but has progressed well to date with active participation and support from the main client. During the first phase in 2013/14 financial year, the following main tasks have been completed:

- city Strategy has been analysed and documented to assist in the understanding of the City's development priorities
- the socio-economic model has been developed to provide the projected population growth trajectory and the land use take-up for the next 20 years to act as the integrator for the sector master planning
- sector master planning has been completed for the bulk components; refurbishment and new infrastructure
- investment requirements for the required infrastructure projects over the next 20 years have been identified
- current capacity and potential constraints for the relevant municipal owned entities (MOE's) have been identified
- the financial requirements for infrastructure investment over the next 20 years have been consolidated.

Refinement and updating of the current tasks commenced during the 2014/15 financial year. Additional tasks were identified and included in the scope of work:

- The socio-economic model has been updated with the inclusion of the new spatial strategy of the City called the Corridors of Freedom (CoF). The strategy assists in indicating the corridors where population density will increase to accommodate population growth in the city
- Sector master planning for the reticulation/distribution of the refurbishment and new infrastructure components, including an update of the bulk components done in the first phase. This is based on the updated socio-economic baseline



**FIGURE 4** Structure of the Cities Strategy



- develop an infrastructure investment model that consolidates the financial requirements for the identified infrastructure projects over the next 20 years
- develop a capital project management system that assists in project registration, prioritisation, budget allocation and progress monitoring.

### Tools and products developed

A number of tools and products were developed to assist in the analysis and management of data and the planning and development of deliverables.

This is mostly due to the complex nature and multi-dimensional scale of the initiative. Each of the products is discussed to understand its components and value in the CIP implementation process.

### Understanding the City Strategy

The Cities Strategy, as indicated in Figure 4, is structured from its vision and mission that informs its principles and in turn the outcomes. The clusters are an administrative grouping that aligns entities within the metro to support certain outcomes.

The outputs align to the outcomes and the socio-economic indicators align to the outputs that fulfil a monitoring and evaluation function. Finally, programmes and projects are aligned to the socio-economic indicators whereby projects are grouped within programmes.

To be able to analyse the City Strategy a framework was developed that indicates the alignment between the various strategic components to better understand the City's development priorities.

Understanding of the City Strategy assists in the prioritisation process to align funding allocation to the most important projects. Programme groupings facilitate project clustering according to certain cross-cutting priorities that are part of the assessment to test funding allocation.

### Socio-economic model

The potential growth projections that form part of the model are done in line with the City's Strategy. The Stats SA Census 2011 population figures indicated a significant impact on the City's current and future infrastructure requirements, which were used as the baseline to project future growth.

Figure 5 indicates the project population growth for the next 20 years as developed from a number of sources. The CIP phase 1 trajectory indicates the baseline for the study.

The objectives of the socio-economic component entail:

- determining current population and socio-economic characteristics
- providing a framework for possible future growth estimates based on historic trends and future growth scenarios over a 20-year period
- modelling the population and economy growth to provide estimates of the future size and distribution of people and economic activities
- providing take-up rates of individual developments and densification.

The model aims to provide an outline of the factors which affect the future growth and development of the study area.

### Integrated sector master planning

The socio-economic model provides a baseline from which all sectors do their planning to ensure the integration of these sectors. The socio-economic model forms the backbone of this entire process. In most municipalities, the Spatial Development Framework (SDF) is not detailed enough to assist in integrated sector planning, which results in a non-integrated result. Such integration will ensure that funding is applied in the most efficient manner and implemented according to the City's identified needs. Infrastructure dimensions are defined as follows:

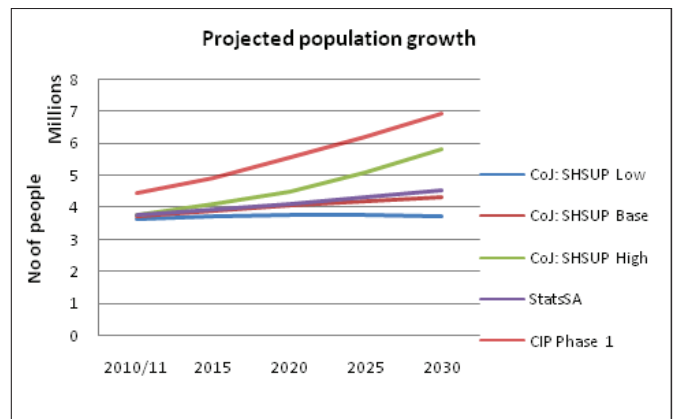


FIGURE 5 Projected population growth 2010/11-2030

- refurbishment projects are generated according to the requirement for the upkeep and replacement of outdated or worn out infrastructure
- new projects are identified to enable new development according to the projected growth in population figures and resultant land use requirements.

The output of the sector master planning is a project list per sector, location indicated in Geographic Information System (GIS), per component with the project cost over the 20 year timeline. This allows for the analysis of projects per location and integration of infrastructure investment across sectors. The map in Figure 6 indicates the requirement

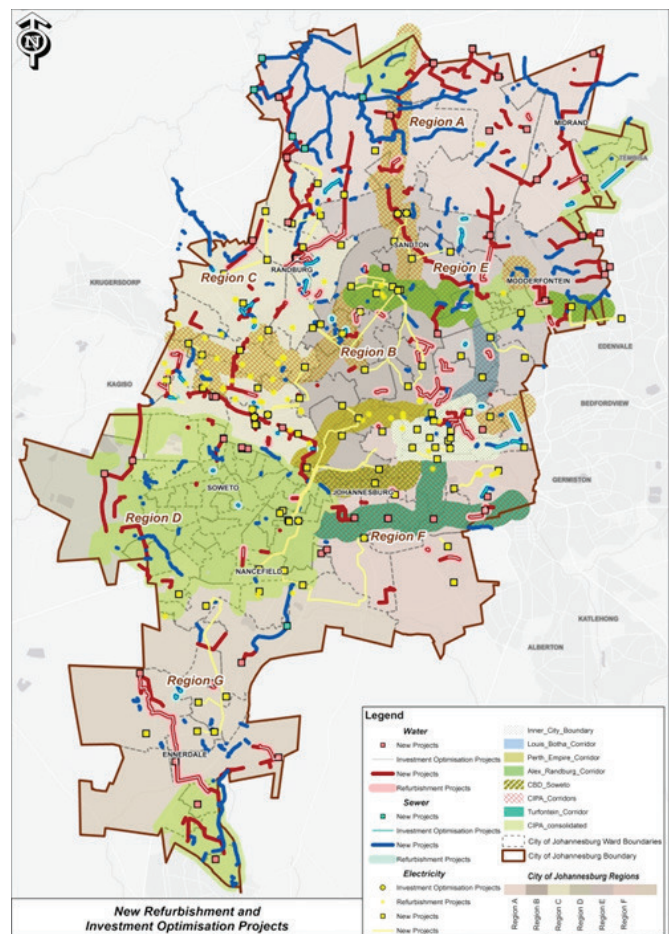
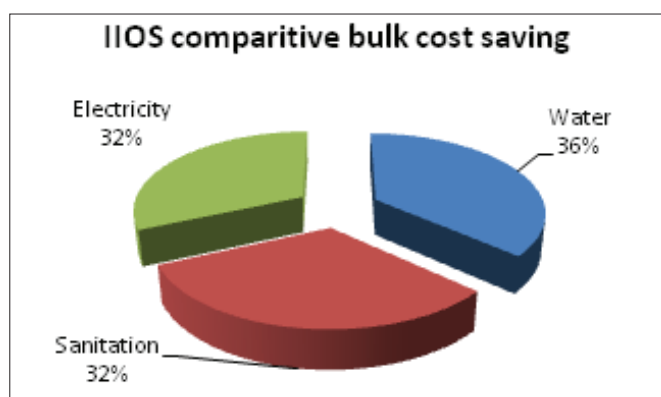


FIGURE 6 Requirement for bulk projects



**FIGURE 7** IIOS comparative bulk cost saving

for bulk projects, new and refurbishment, identified through the first phase of the project for water, sanitation and electricity projects.

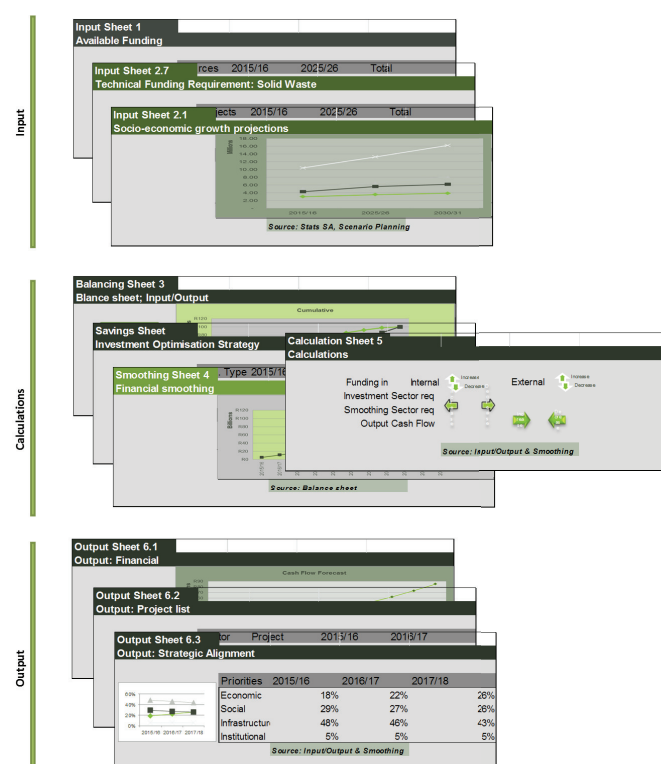
### Infrastructure Investment Optimisation Strategy

The IIOS indicates the value of aligning the timing for refurbishment with upgrades to maximise the return on investment by saving on refurbishment. The value obtained from the exercise is a direct saving in refurbishment cost which would otherwise be wasted.

The outcome of the bulk saving is as follows:

- a potential saving of 30% of the bulk refurbishment budget is possible
- adding the reticulation/distribution projects will increase the potential savings even further.

Implementation of the capital projects is critical in preventing an imminent breakdown in service; capital projects have to be implemented where refurbishment projects are not implemented



**FIGURE 8** Concept design of the Financial Model

### Financial: Infrastructure Investment Modelling

The model is developed to provide the required output to assist management to understand the Cities infrastructure investment requirement for the next 10 years, balanced with the available funding for infrastructure investment. The diagram in Figure 8 indicates the input sheets that include the available funding, growth projections, requirement for funding of infrastructure. A balancing sheet indicates the variance between the requirements for funding versus the available funding and the saving sheet is the output from the IIOS. The calculation sheet provides the function to smooth finances over financial years. The model output sheets generate the project lists per sector over the 20 year timeline, cash flow per year per sector and alignment to the cities strategy expressed in terms of budget size per socio-economic indicator.

### Institutional assessment

The purpose of the institutional assessment is to provide the beginning phases of a long-term plan to be implemented by the CoJ on an on-going basis to ensure that there is:

- sufficient manpower to deliver on its infrastructure mandate
- staff with sufficient skill levels to perform their infrastructure duties
- appropriate organisational capacity which effectively supports staff in the execution of their duties.

The status quo assessment was based on available information in terms of staff establishment, vacancies and approved structure and staff expenditure. The output from the assessment was modelled to provide Table 1, which is useful in the assessment of capacity.

The assessment is supported by a budget, communication and process assessment to include dimensions that impacts on an organisations function. The next task would be to map the potential growth according to the identified relevant sector projects.

**TABLE 1** Assessment of capacity

Position levels	Example of Metro MOE		
	Current staff establishment	Approved structure composition	Vacancies per level (% of total vacancies)
Management	105	221	116 (4.7%)
Technical	652	1 283	631 (25.3%)
Support	380	872	492 (19.7%)
Labour	689	1 943	1 254 (50.3%)
<b>Total Staff</b>	<b>1 826</b>	<b>4 319</b>	<b>2 493</b>

### Outcome of the Initiative

With an initiative of this magnitude and size it is important to be realistic with regard to what can be achieved to ensure the client's expectations are met.

A number of similar initiatives have been executed by Aurecon and the lessons learnt so far include:

- Buy-in from the client's management is crucial to the acceptance and further success of an initiative
- A strong project owner/sponsor from the client's side is vital: consultants have very little influence on the execution of initiatives
- Effective communication is needed between entities and their consultants to work towards a common goal
- The initiative requires development of new concepts and tools. Consequently, constant client interaction is required. Including the client in the 'messiness of the solution', helps with acceptance of deliverables later on
- Inclusion of domain experts from outside the company to strengthen the initiative's chances of success is crucial. It also ensures the client obtains the best possible quality deliverable

- **Planning:** It is vital to understand the client's development goals so that the development forecast can be aligned. This ensures the investment requirements are strategically relevant and aligned
- **Technical:** Sector departments are in different stages of planning with each making use of different methods and tools. Include current processes to save time, obtain buy-in and, in the process, develop product integrity for the results generated
- **Financial:** Understand the available funding and funding sources to ensure the infrastructure cost is comparable to the client's budget
- **Project side:** Don't underestimate the size of the task, resources and skills required, and time to allow for alignment of tasks. Due to the number of tasks dependent on one another managing the critical path is important to the timeous delivery of the project
- **Institutional:** Developing an institutional development plan will ensure that the identified functions can be carried out effectively and efficiently and will thereby allow the sector departments to deliver on their mandates.

#### CONTRIBUTION OF THE CIP TO THE SOLUTION

The availability of management information that flows from the CIP methodology is to be facilitated by means of the newly developed infrastructure project information management system. It allows for all required information be accessible to not only the project owners but also management that requires it for monitoring and evaluation purposes to improve decision making.

As indicated in the diagram in Figure 9, the information management system facilitates the availability of the project information between all relevant entities and departments that are responsible for and requires project information. The process starts with the registration of new projects by each of the Municipal Owned Entities (MOE). The entities act as project owners; register, update and maintain project information in terms of actual progress.

The Financial Department (FD) provides project progress information in terms of financial progress in the form of spending. Development Planning (DP) provides the socio-economic baseline for the integration

of sector projects and facilitates the administration on the system. EISD in conjunction with DP consolidates the projects captured by the entities and provides the framework for project prioritisation. The Infrastructure Programme Management Office (IPMO) accesses the information system for monitoring and progress reporting purposes.

#### CONCLUSION

Improving service delivery in the municipal space is a daunting task in a complex environment that includes a multitude of different factors that impact on the envisaged solution.

The approach of the Consolidated Infrastructure Plan is to focus on the coordination and integration factors that have been identified as the most critical challenges in infrastructure implementation and management. It provides a framework for the development of planning instruments for improved service delivery. The CIP addresses the key issue of coordination between different agencies by creating a platform for planning and consolidation of outputs to assist decision makers.

Aurecon would like to congratulate the CoJ for their vision and foresight for adopting this approach. The CoJ is the ideal operational environment for the initiative to be implemented in order to refine the methodology and to provide value to the client. The CIP is envisaged to contribute to better decision making by means of successful planning, implementation and management of infrastructure projects.

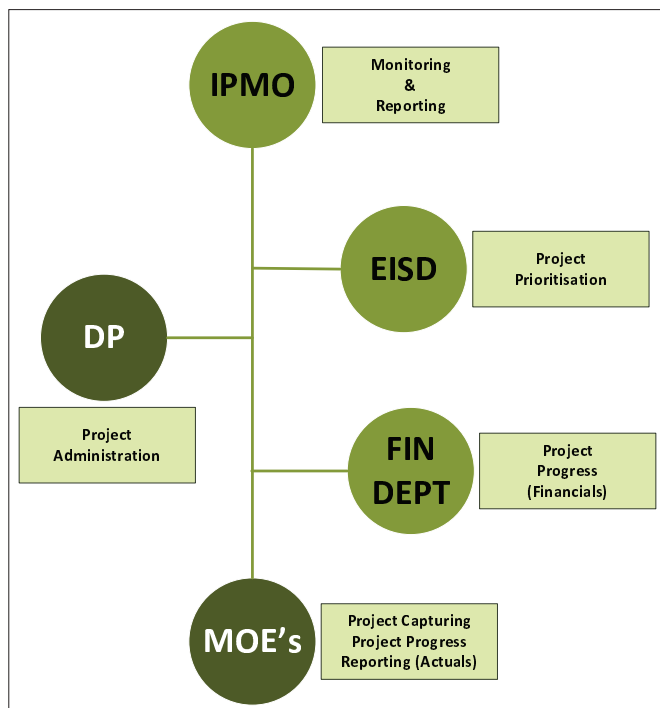


FIGURE 9 Collaboration through information sharing