

# AS-H03

## INFRASTRUCTURE CARRYING CAPACITY ASSESSMENT



An overall framework for evaluating the  
infrastructure needs of the city

*Type: Step-by-Step Guide*



# ABOUT THE ASSESSMENT TOOL

## PURPOSE

Infrastructure serves as the foundation for planning sustainable and resilient cities (Pollalis 2016). The viability and sustainability of any TOD development must, therefore, include an assessment of infrastructure to ensure the current provision is adequate and has the capacity to support growth in the future.

In World Bank client countries, infrastructure capacities are often mismatched with current needs, largely due to unanticipated rapid urban growth. A TOD development without infrastructure carrying capacity considerations may further deteriorate living conditions. Such an assessment is essential before density changes are proposed.

As transit-oriented development requires major built form and transportation development, this tool assesses the capability of regions to support infrastructure needs. Based on current municipal deficits, strategies to offset the necessary capital investment required by additional or upgraded infrastructure are explored through the creation of a capital investment needs plan.

**Disclaimer:** *The Transit-Orientated Development Implementation Resources & Tools knowledge product is designed to provide a high-level framework for the implementation of TOD and offer direction to cities in addressing barriers at all stages. As the context in low and middle-income cities varies, the application of the knowledge product must be adapted to local needs and priorities, and customized on a case-by-case basis.*

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## THIS TOOL INCLUDES:

- ➔ OVERALL INFRASTRUCTURE ASSESSMENT PROCESS
- ➔ INFRASTRUCTURE GOALS
- ➔ DETAILED INFRASTRUCTURE PLANNING PROCESSES

## VARIATION IN INFRASTRUCTURE ASSESSMENT PROCESSES FOR DEVELOPMENT CONTEXTS



### GREENFIELD

A greenfield project is one which is not constrained by prior work. It is constructing on unused land, where there is no need to remodel or demolish an existing structure.

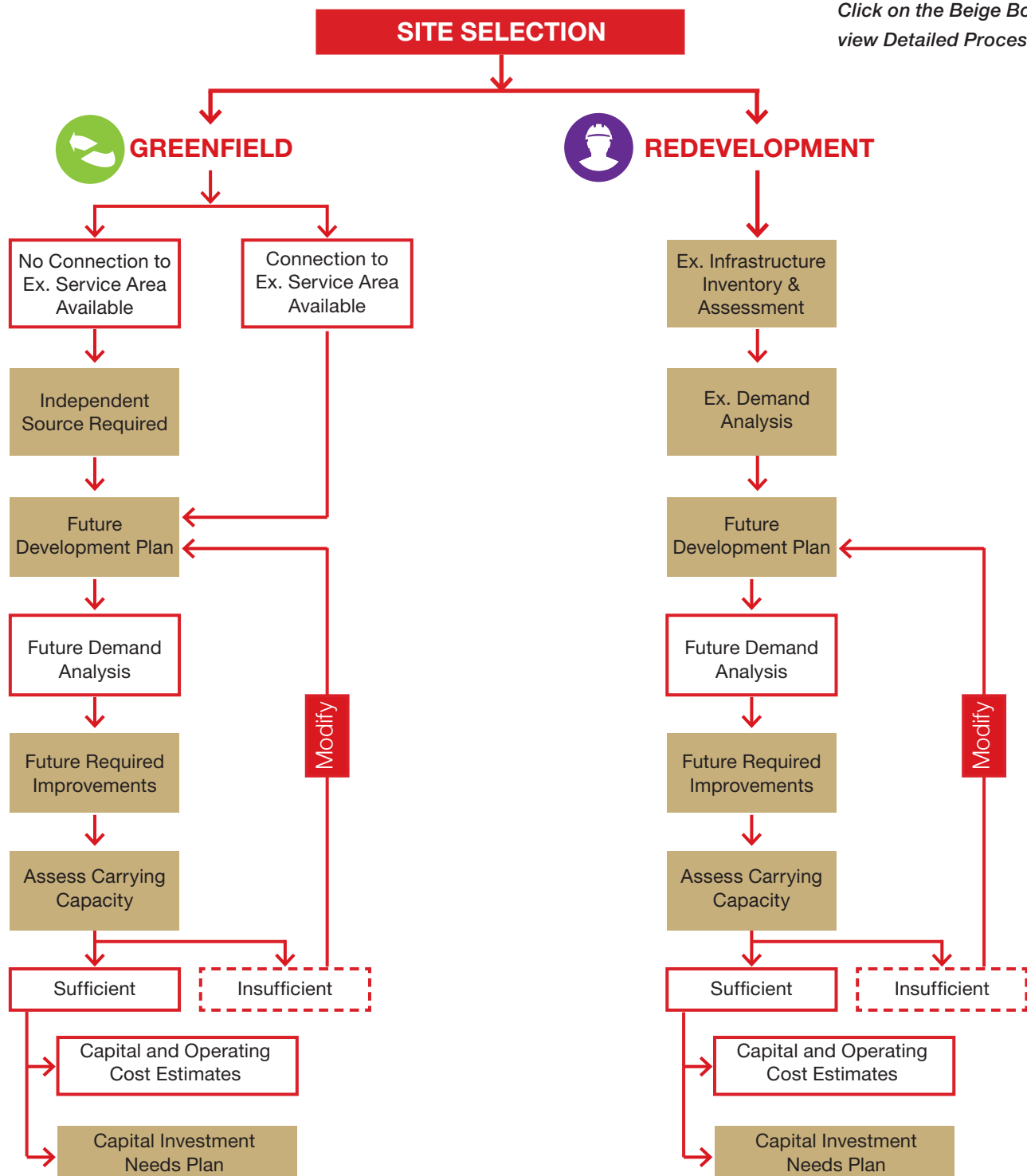


### URBAN/ SUBURBAN

Urban and suburban projects refer to site parcels within previously built areas. These areas are already served by public infrastructure and other utilities. It may also include converting an existing built property into another use.

# THE INFRASTRUCTURE ASSESSMENT PROCESS

Click on the Beige Boxes to view Detailed Processes



# INFRASTRUCTURE ASSESSMENT GOALS

## PHYSICAL INFRASTRUCTURE

Physical Infrastructure includes basic service delivery systems, such as water supply, sewage, solid waste management, energy, and landscape. Pedestrian and cycling infrastructure are also integral to physical infrastructure. These systems are high-cost investments and are vital to a city's development (Pollalis 2016).

### WATER SUPPLY

- To determine capital investment needs
- To identify the existing designed capacity and capability of serving additional densities.



### SEWERAGE

- To determine capital investment needs.
- To determine the network capacity required to serve additional densities.



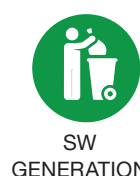
### ENERGY

- To determine capital investment and secure energy supply.
- To assess and manage existing grid capacity.



### SOLID WASTE

- To determine capital investment to treat, collect and transfer waste.
- To determine excess solid waste generation for additional densities



### INFORMATION

- To determine capital investment and secure information needs.
- To determine information need increases for additional densities



### LANDSCAPE

- To understand vulnerabilities and planning opportunities.
- To identify the ability of the landscape to provide functional requirements.



# INFRASTRUCTURE ASSESSMENT GOALS

## SOCIAL INFRASTRUCTURE

Social infrastructure is a subset of the infrastructure sector that typically includes assets that accommodate social services. It includes schools, colleges, universities, hospitals, prisons, police, fire stations, markets, etc. The quality of life in any urban center depends upon the availability of and accessibility to quality social infrastructure.

## HEALTHCARE



To determine zoning reservations and capital investment needs.



To ensure the adequacy of medical facilities to serve the additional population.



ADEQUACY



ACCESSIBILITY



AFFORDABILITY



QUALITY

## EDUCATION



To determine zoning reservations and capital investment needs.



To ensure adequacy of educational facilities to serve the additional population.



ADEQUACY



ACCESSIBILITY



AFFORDABILITY



QUALITY

## RECREATION



To determine zoning reservations and capital investment needs.



To ensure sufficient recreational zones to serve the additional needs.



ADEQUACY



ACCESSIBILITY



AFFORDABILITY



QUALITY

## POLICE/ FIRE/ OTHERS



To determine zoning reservations and capital investment needs.



To ensure adequate emergency response services to serve the additional densities.



ADEQUACY



ACCESSIBILITY



QUALITY

\*Applicable at all scales



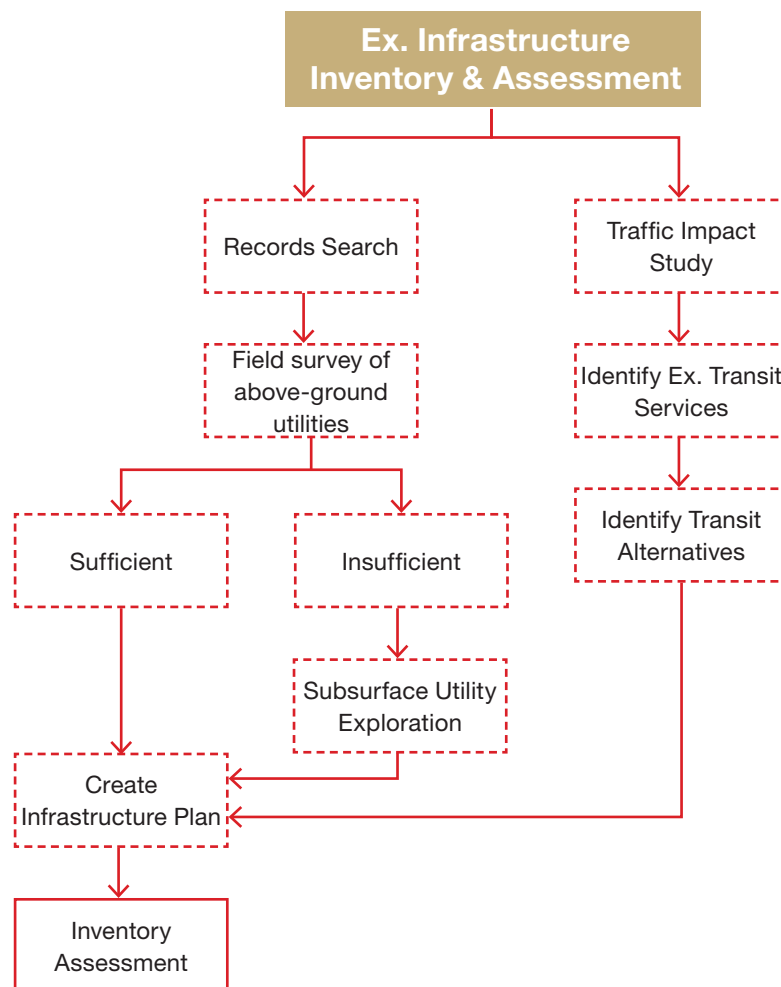
Greenfield



Urban/ Suburban

## EXISTING INFRASTRUCTURE INVENTORY

In distributing infrastructure, planned densities and population play the guiding role. Therefore, indications of population and densities served by a facility or service are considered when estimating the infrastructure needs.

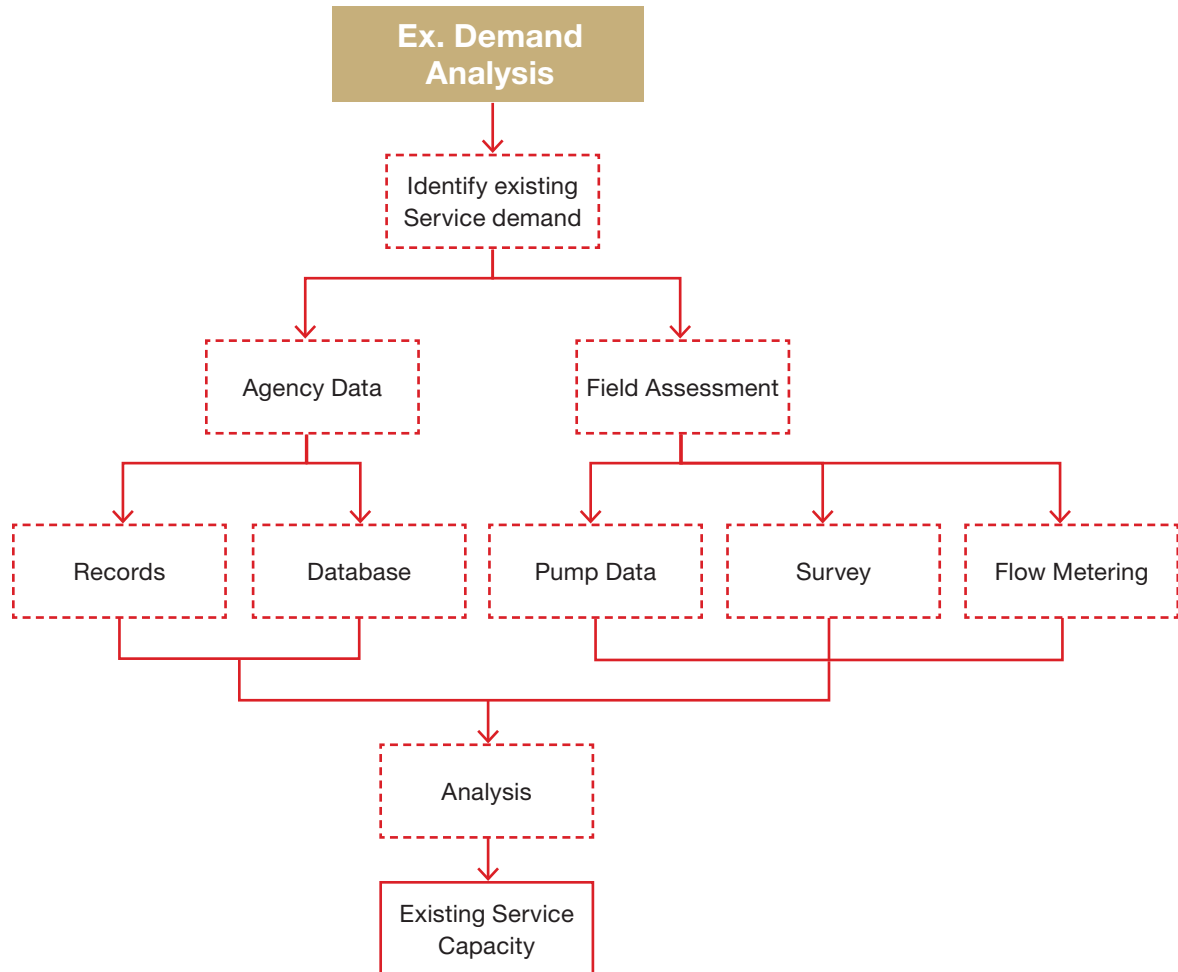


## INFRASTRUCTURE CAPACITY MEASURES

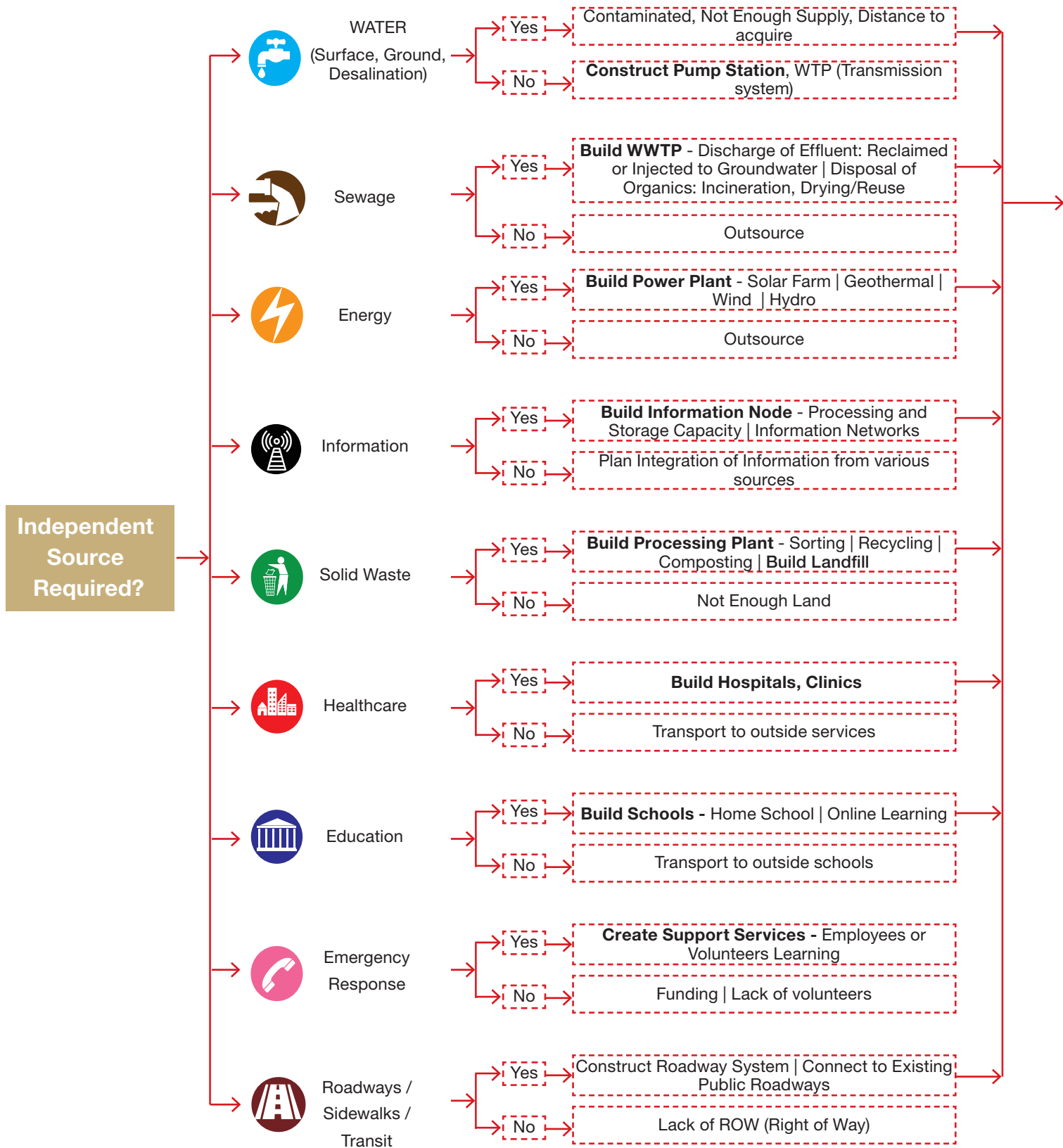
Water availability	- Installed capacity (MLD)
Source of water supply	- Within city limits or no
Water coverage	- Area served by supply network - Per capita supply (LPCD) - Supply duration
Wastewater disposal	- Wastewater generated daily - Disposal capacity (MLD) - Present Operating Capacity (MLD)
Solid waste	- Waste generated daily (tonnes/day) - Collection daily (tonnes/day)

## EXISTING DEMAND ANALYSIS

Infrastructure demand is expected to increase with an anticipated increase in densities in TOD areas. This step is intended to quantify the needs of the respective city, corridor, station area or site.



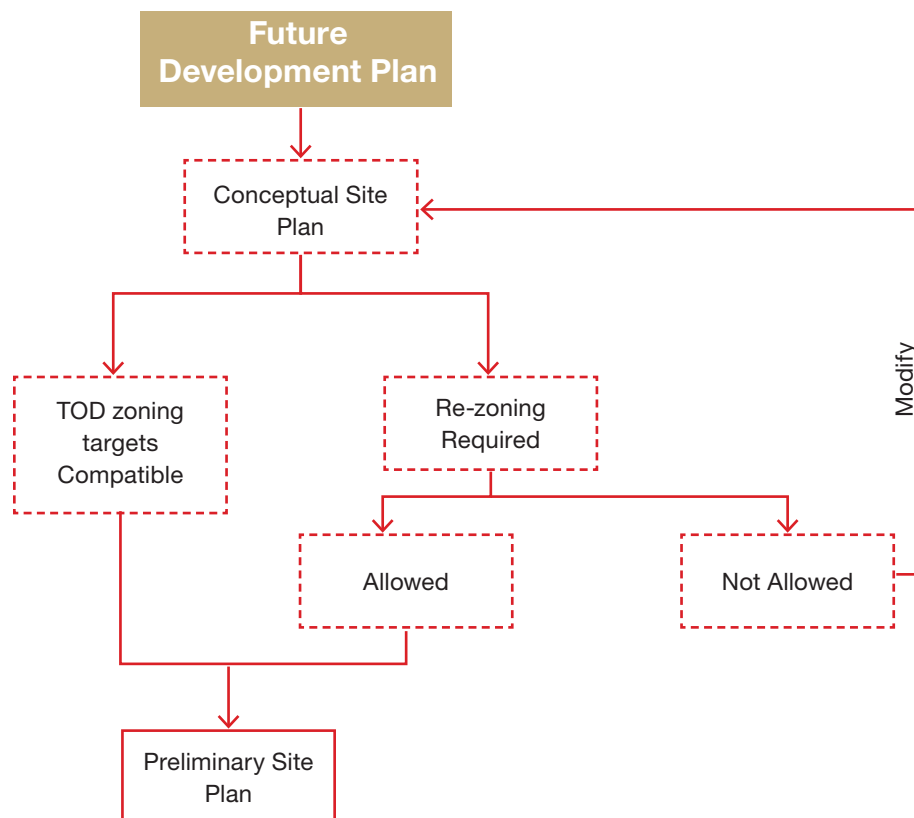
# NEW INFRASTRUCTURE SOURCE REQUIRED





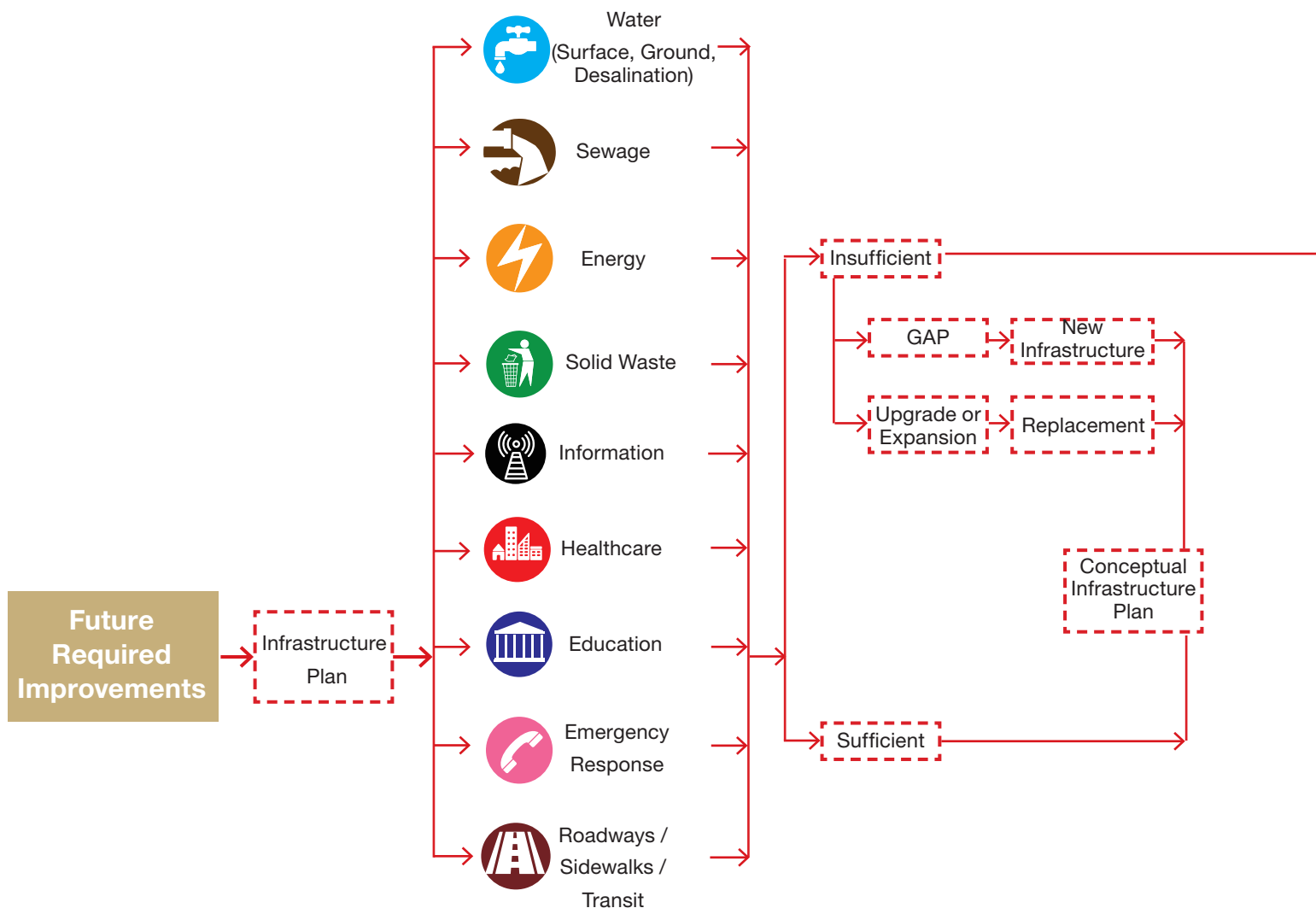
## FUTURE DEVELOPMENT PLAN

Validate the Future Infrastructure Development Plan with the Conceptual Site Plan by assessing if zoning needs and TOD targets are met. If TOD requirements are not met by the infrastructure plan, trade-offs must be decided that can allow for transit-supportive development while fulfilling infrastructure needs.



## FUTURE INFRASTRUCTURE REQUIREMENT

After calculating the infrastructure deficit, the infrastructure needs of the area must be defined with regards to new infrastructure, infrastructure upgrades and network expansion.



### NEW INFRASTRUCTURE



In any greenfield project, new infrastructure has to be provided as per planned development. This requires heavy capital investment.

### INFRASTRUCTURE UPGRADES



Upgrading infrastructure systems is required where the current capacity of the infrastructure is not sufficient enough for serving the estimated infrastructure needs. This can be undertaken where the expansion of the physical asset is costly or prohibitive due to broader physical constraints.

### NETWORK EXPANSION



In any greenfield or redevelopment project that lacks the basic infrastructure, but is within the proximity of the existing infrastructure network, a network expansion should be proposed.

## DETERMINE STRATEGIES TO OFFSET CAPITAL INVESTMENT (LOCAL/DECENTRALIZED FACILITIES)

When planning for future infrastructure needs for a TOD site area, it is necessary to consider facilities that are local or decentralized. These facilities not only reduce the pressure on the central distribution system/nodal facility, allow for higher densities and also offset/relax the heavy capital investment required for these critical infrastructure systems. The infrastructure demand can be effectively managed through the optimal use of resources and preventing/controlling any waste of resources.

### → DETERMINE STRATEGIES TO OFFSET CAPITAL INVESTMENT NEEDS?

#### 01 Identify the critical infrastructure needs and shortage

#### 02 Develop strategies for decentralization of facilities



**Water Supply:** Strategies that help reduce the consumption pattern, and produce more water resources



**Wastewater:** Strategies that help reduce wastewater generation and promote use of recycled wastewater



**Energy:** Strategies that help reduce energy consumption patterns and produce clean and renewable sources of energy



**Solid Waste:** Strategies that help reduce waste generation and help reuse/recycle it



**Landscape:** Strategies that minimize disruption of the natural landscape



**Information:** Strategies that serve as the foundation for the use of integrated information technologies



**Social Infrastructure:** Strategies that allow for multiplicity of functions in already built areas



Strategies that allow for reservation of land/BUA for social amenities in new developments



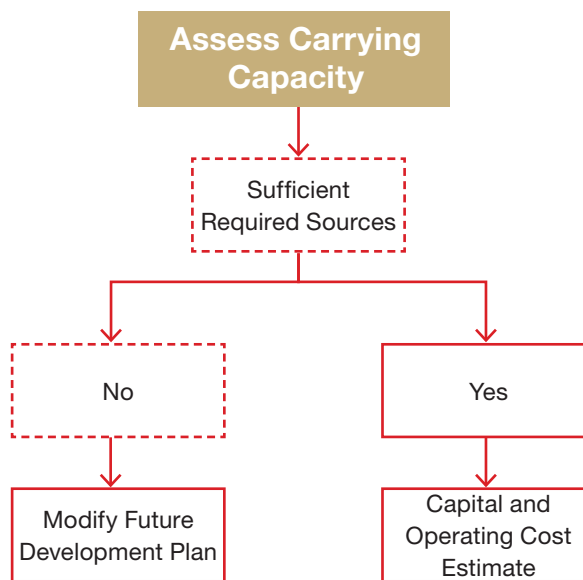
#### 03 Estimate a realistic quantity that can be offset through decentralization

#### 04 Create policy or zoning guidelines to mandate requirements for decentralized facilities by private developers

#### 05 Create incentives for additional green building compliance (LEED or equivalent)

## ASSESS CARRYING CAPACITY

Physical and social infrastructure provisions such as water treatment plants, sewage treatment plants, transformer stations, universities, hospitals, fire stations, etc. require a large portion of land. At times, land may be available, but resources may be scarce. Therefore, it is necessary to assess the land and resource capability of the region to support the city's infrastructure needs. Identification of land for infrastructure development is an essential parameter. It is necessary to earmark land for critical infrastructural facilities in a city's statutory plan.



### ASSESS CARRYING CAPACITY

#### LAND

*Is there enough land available within the study area, or in close proximity, to meet the infrastructure needs?*

#### RESOURCES

*Does the region have sufficient natural and human resources?*

1. What are the available sources of water supply in the region?
2. Does the region receive sufficient rainfall?
3. Does the region have soil with high percolation capacity?
4. Does the region have a high water table?
5. Is the groundwater contaminated/not fit for use?
5. Is there a provision for wastewater recycling or water supply mix in the region?
4. Does the climate of the region support composting of generated solid waste?
5. Does the region have any other alternate method of disposing waste?
6. Does the region have enough sources for energy production such as crude oil, petroleum, coal, natural gas, nuclear, wind, solar, geothermal, hydro, tidal energy, biomass, waste, etc.?
7. Does the region have natural and biodiversity reserves?
8. Is the region vulnerable to natural disasters?
9. Does the region have sufficient green spaces?
10. Does the region have sufficient professionals, such as doctors, teachers, etc.?

## CAPITAL INVESTMENT NEEDS PLAN

Capital investment planning is an evolving area of public management. A local government (LG) takes care of assets only if they are needed to provide municipal services to constituencies or to perform other mandatory obligations of the LG. Since the financial resources available to an LG for capital projects are limited, a process should be established to evaluate the competing needs of various municipal services to maximize the use of the financial resources in the areas of highest priority. Local financial policy needs to be formulated and enacted to define which assets to invest in, capital investment priorities and finance sources. The approach should be multi-year. Capital investment should be considered within the frameworks of life cycle costing and assessment of alternatives (for example, reducing demand for the service/facility, engaging the private sector).



SECTOR	PROJECT	CAPITAL INVESTMENTS					
		YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
WATER							
SEWAGE							
ENERGY							
SOLID WASTE							
HEALTHCARE							
INFORMATION							
EDUCATION							
EMERGENCY RESPONSE SERVICES							
ROADWAYS/ TRANSIT/ SIDEWALKS							

## REFERENCES

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