SFD Promotion Initiative

Tirupati
India

Draft Report

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SFD Promotion Initiative

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On behalf of Federal Ministry for Economic Cooperation and Development

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SFD Report Tirupati, India 2016

Produced by:

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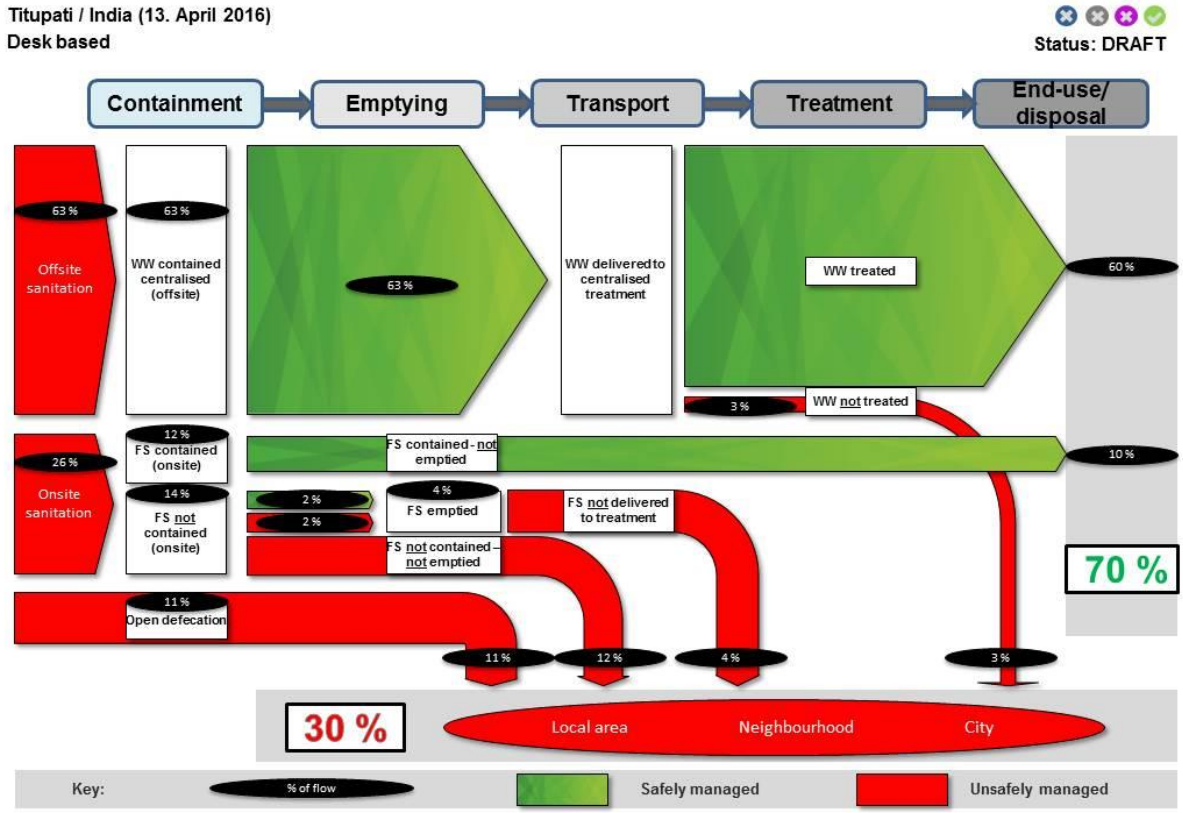
1. The Diagram



2. Diagram information

Desk or field based:

This SFD followed the desk-based approach.

Produced by:

This SFD is prepared by Lasse Roeder with the support from Rahul Sharma, Varsha Venugopal and Kanchi Nagasreenivas (all GIZ).

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3. General city information

Tirupati is situated in Chittoor district in the southern of the state of Andhra Pradesh. The town is administered by the Municipal Corporation of Tirupati (MCT) and is divided into 36 wards.

The city covers an area of about 27 km^2 with a total population of just under 375,000 (Census 2011, GIZ 2014). The current decadal growth rate lies at 26 %, which results in a population growth of 2.3 % per year (GIZ 2014). The town is a pilgrimage center and attracts a total diurnal floating population of about 55,000. During religious festivals the diurnal floating population exceeds 100,000 (MCT 2011).

Most trade and commerce activity in the city is related to pilgrims and tourists entering the town. Other economically important sectors are: textile manufacturing and agriculture (GIZ 2014).

Annual rainfall in Tirupati is about 1,000 mm with a peak in the monsoon season from July to October.

4. Service delivery context

The National Urban Sanitation Policy (NUSP) was launched 2008 by the Ministry of Urban Development (MoUD). The extensive framework supports the cities' development towards generating public awareness about sanitation, achieving open defecation free (ODF) status and an integrated, city-wide sanitation system. It concedes financial support to the states and the cities for the preparation of State Sanitation Strategies (SSSs) and City Sanitation Plans (CSPs) respectively, also including decentralized onsite sanitation solutions, to first look on septage management as of importance for public health.

The Andhra Pradesh Municipalities Act of 1965 handles the functional domain of ULBs in the state. In 2007 the Municipal Corporation of Tirupati (MCT) was formed. The transfer of responsibilities and functions is however not complete and appropriate resources are not assigned (GIZ 2014).

5. Service outcomes

The Census of India from 2011 was the first census to include a section on household sanitation facilities. The questionnaire focused on the containment technologies present in the households and did not take into account the floating population. However, also connections to the central sewer system were noted. The diagram on page I of this summary shows numbers including the diurnal floating population of about 55,000.

- Containment: According to census 96 % of all households have private toilet facilities, from which about 72 % have direct connection to the sewer network, 19 % have septic tanks installed, and 6 % rely on pit latrines or other containers (i.e. buckets), equaling 24 % of households relying on onsite sanitation systems (Census 2011). All public toilets (1 %) are pour- or flush-toilets (GIZ 2014) and are reported to be under poor maintenance (MCT 2011). 3 % of the population relies on open defecation.
- Emptying: Three agencies are estimated to be active in the business with 6 m^3 trucks (MCT 2011). Standards concerning cleaning intervals, technics of emptying and safety practices are not complied with. Also, no records of cleaning sessions are maintained. The households are charged around 1000 to 1500 Rs. per service. A survey from 2011 suggests that a majority of the households do the emptying of their septic tanks themselves. The survey also suggests the demand for less costly emptying services (MCT 2011).
- Transport: MCT operates a sewer network with a total capacity to service a population of about 450,000 people (GIZ 2014). No total sewer coverage is achieved. Only about half of the city area is covered and several wards rely on onsite sanitation, on public facilities or on open defecation. City topography partly complicates the extension of the existing sewer network.
- Treatment: MCT operates a Wastewater Treatment Plant (WWTP) situated 10 km south-west of the city which comprises stabilization and facultative ponds (GIZ 2014). The capacity of the plant is adequate to serve about 450,000 people (50,000 m^3 daily). Enough land around the WWTP is available to allow further expansion (MCT 2011). Service Level Status Reports and surveys show adequate treatment quality. No treatment facility exists for the treatment of septage deriving from onsite sanitation facilities.
- End-use/ disposal: The treated wastewater is used for irrigation purposes on agricultural lands in the downstream of the WWTP (MCT 2011). About 10 % of treated wastewater are being reused by local industry (as of 2014, GIZ 2014). Collected septage from onsite sanitation facilities (mostly septic tanks) is discharged of on open ground in peripheral areas (MCT 2011).

Two surface water bodies represent Tirupati's main water sources: the Kandaleru reservoir and the Kalyani Dam reservoir, 32 km and 17 km north from Tirupati, respectively. Several bore wells contribute little to the total of 76,000 m^3 supplied daily. Raw water is treated in rapid sand filters and distributed in the absence of flow meters.

6. Overview of stakeholders

The Indian constitution classifies questions concerning the water and sanitation sector as state subjects.

Key Stakeholders	Institutions / Organizations /
Public Institutions	Municipal Corporation of Tirupati, Public Health and Engineering Department (PHED) of the Government of Andhra Pradesh (GoAP)
Private Sector	Three private agencies operating faecal sludge suction trucks

Table 1: Key Stakeholders (GIZ 2014)

The Public Health and Engineering Department (PHED) of the Government of Andhra Pradesh (GoAP) is responsible for planning and financing of the water supply and sanitation sector. It provides technical support and guidance to the Urban Local Bodies (ULBs). Operation and Maintenance (O&M) is part of the accountability of MCT as is the tariff fixation and the collection of user charges (GIZ 2014). Public toilets are planned, constructed and built by different agencies and contractors, depending on their place and purpose. Table 2 shows an overview over the institutional framework.

	Planning	Execution	O&M	Tariff Fixation & Collection
Water Supply	PHED	PHED	MCT	MCT
Sewer-age	PHED	PHED	MCT	MCT
Public and Comm. Toilets	Multiple Agencies	MCT/ private contractors	MCT/ private contractors	MCT/ private contractors

Table 2: Institutional framework sanitation sector for Tirupati (GIZ 2014)

7. Credibility of data

Data sources:

Data concerning the containment facilities in Tirupati was drawn from the Census of India 2011. Data concerning the further steps of the sanitation chain (emptying, transport, treatment and disposal / reuse) were collected from official reports (like the Service Level Status Report), secondary literature review and the outcomes of Key Informant interviews that were already conducted during the revision of the City Sanitation Plan. This data has to be regarded as mostly qualitative. No additional Key Informant Interviews and Focus Group Discussions were conducted.

Assumptions:

- Census 2011 data was regarded as correct.
- The treatment in the existing plants is meeting the standards.
- All septage deriving from the emptying of onsite sanitation facilities is dumped on open ground or directly into water bodies.
- The proportion of faecal sludge in onsite sanitation facilities is 50%.

Annotations:

The Census 2011 was the first census to collect data relating to the household sanitation situation (only containment-data). It is expected that, because of limited experience and technical know-how from the surveyors, the resulting data is expected to be differing from the actual situation. Cross-checking with other data sources was only possible for single numbers. A comparison of the data concerning the offsite sanitation systems supported the assessment of credibility.

Some of the issues and challenges are listed below:

Data gaps:

- The major data gap identified concerns the management of onsite sanitation systems. No regular monitoring is in place so that only vague assumptions could be made.
- No reliable data on the amounts of waste water entering the treatment plants was available.
- Hydrogeological data is required for the assessment of the risk of groundwater pollution, although the hilly conditions in Tirupati do not seem to favor contamination.

8. Process of SFD development

This SFD is based on data derived from outcomes of the Census of India from 2011 and a thorough literature review. Where ever possible, Census data was cross-checked with data from secondary sources such as the City Sanitation Plan, its review and the City Development Plan.

No additional Key Informant Interviews were conducted for this SFD.

The SFD calculation tool was used to calculate the variables needed for the composition of the diagram.

After completion, the report was sent to MCT for review. However, it was not possible to gather input from TMC officials.

Limitations of SFD:

In circumstances where groundwater is a relevant environmental media that is prone to contamination detailed groundwater maps need to be used to precisely determine affected parts of town.

Further Key Informant Interviews and field-trips to sites of interest within the city have to be conducted in order to judge the compliance with the reality of the city.

9. List of data sources

Below is the list of data sources used for the production of SFD:

- Published reports:
  - Census in India 2011. HH-8 : Households by Availability of type of Latrine Facility
  - GIZ 2014. City Sanitation Plan Updation – Status Report Municipal Corporation of Tirupati
  - Ministry of Urban Development 2010. Rank of Cities in Sanitation 2009-2010 (National Urban Sanitation Strategy)
  - Ministry of Urban Development 2012. Service Levels in Urban Water and Sanitation Sector – Status Report (2010-2011). First Edition, January 2012
  - Ministry of Urban Development 2014. Guidelines for Swachh Bharat Mission (SBM). December 2014
  - Municipal Corporation of Tirupati 2011. Draft City Sanitation Plan Volume 1 – Main Report

SFD Tirupati, India, 2016

Produced by:

GIZ, Roeder, L.

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Table of Content

List of tables

List of figures

Abbreviations

CPCB	Central Pollution Control Board
GoAP	Government of Andhra Pradesh
MCT	Municipal Corporation of Tirupati
MoUD	Ministry of Urban Development
O&M	Operation and Maintenance
PHED	Public Health and Engineering Department
SBM	Swachh Bharat Mission
SLB	Service Level Baseline
SLSR	Service Level Status Report
ULBs	Urban Local Bodies
WWTP	Wastewater Treatment Plant

1 City context

Tirupati is situated in Chittoor district in the southern of the state of Andhra Pradesh. The town is administered by the Municipal Corporation of Tirupati (MCT) and is divided into 36 wards. Fig. 1 shows the outlines of Tirupati and the ward boundaries. It also shows the population densities within the wards.

Tirupati covers an area of about 27 km^2 with a total population of just under 375,000 (Census 2011, GIZ 2014). The current decadal growth rate lies at 26 %, which results in a population growth of 2.3 % per year (GIZ 2014).

The town is a pilgrimage center and attracts a total diurnal floating population of about 55,000. During religious festivals the diurnal floating population exceeds 100,000 (MCT 2011).

Economically, Tirupati mainly relies on tourism and pilgrimage. Most trade and commerce activity in the city is related to pilgrims and tourists entering the town. Other economically important sectors are: textile manufacturing and agriculture (GIZ 2014).

Annual rainfall in Tirupati is about 1,000 mm with a peak in the monsoon season from July to October. During the last years the region faced a decline in rainfall and less predictable heavy rainfall during the monsoon period (MCT 2011).

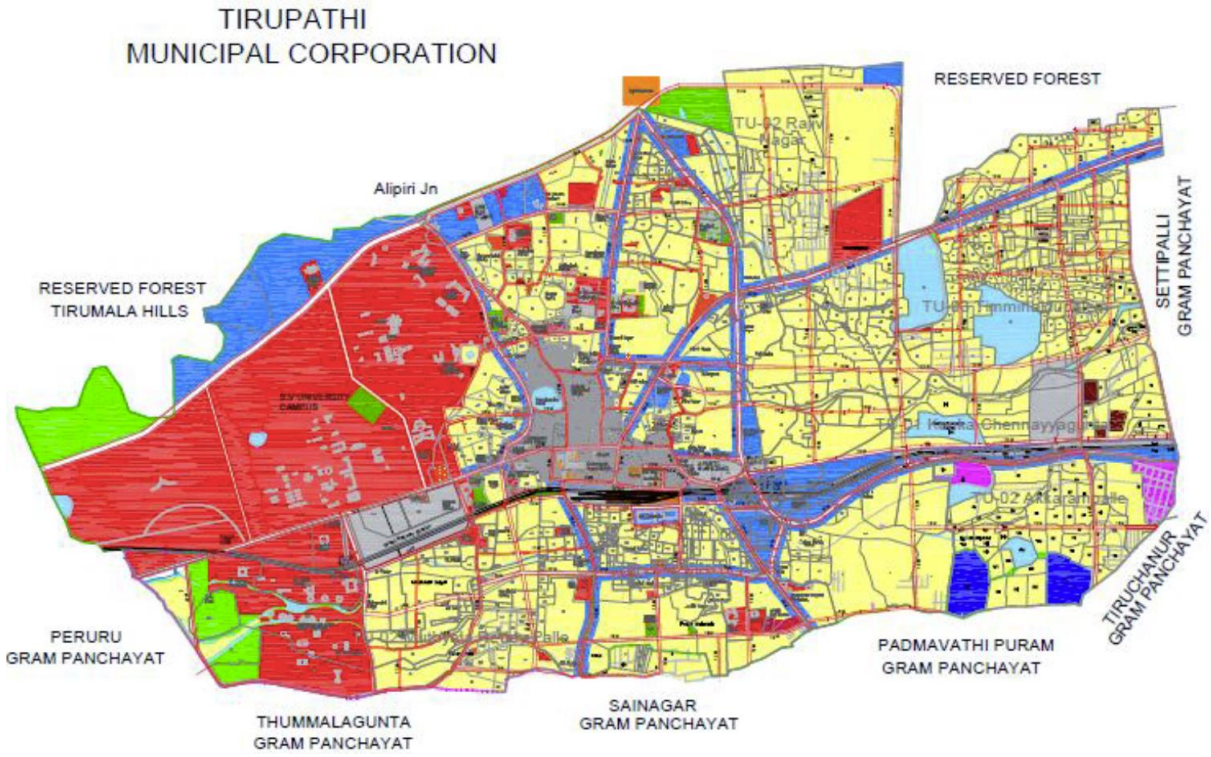


Fig. 1: Map of Tirupati Municipal Corporation area (GIZ 2014)

2 Service delivery context description

2.1 Policy, legislation and regulation

2.1.1 Policy

The recognition of the right to sanitation as part of the fundamental right to life under Article 21 of the Indian Constitution gives a strong mandate for sanitation in India. India has committed itself to meeting the Millennium Development Goal for sanitation.

The Water (Prevention and Control of Pollution) Act from 1974 and the Environmental Protection Act (EPA) from 1986 together allow the government to take appropriate measures to enforce efficient management of sewage and sewerage and also to introduce guidelines and standards for sewage effluents and septage (GIZ 2015). Most of the states of India) have, however, not used the provisions of the EPA to introduce specific rules for sewage effluents and septage (GIZ 2015).

Under the Water Act and the EPA the Indian Central Government supports programs for wastewater management in order to limit environmental pollution:

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in 2005 focused (in terms of the sanitation sector) on investments in large scale centralized sewer systems. Septage management and onsite sanitation in general were not covered.

Septage management in India is traditionally mainly regarded as a ‘private provision’ and not as concern for public health and for city-sanitation with relevance for the ULBs (GIZ 2015). The consequence is a lack of holistic planning along the sanitation chain.

It was the National Urban Sanitation Policy (NUSP) from 2008 that concedes financial support to the states and the cities for the preparation of State Sanitation Strategies (SSSs) and City Sanitation Plans (CSPs) respectively, also including decentralized onsite sanitation solutions, to first look on septage management as of importance for public health.

The Swachh Bharat Mission (SBM), launched in 2014, supports the goals expressed in the NUSP financially with a focus on the needs of the urban poor.

2.1.2 Institutional roles

The Seventh Schedule (Article 246) of the Indian constitution classifies ‘Public health and sanitation […]’ and ‘Water, that is to say, water supplies, irrigation and canals, drainage and embankments […]’ as state subjects (List II, Entry 6 and List II, entry 17, respectively).

The Andhra Pradesh Municipalities Act of 1965 handles the functional domain of ULBs in the state. In 2007 the Municipal Corporation of Tirupati (MCT) was formed.

The transfer of responsibilities and functions is however not complete and appropriate resources are not assigned (GIZ 2014). Tab. 1 shows an overview over the institutional framework.

When it comes to the water supply and sanitation sector the Public Health and Engineering Department (PHED) of the Government of Andhra Pradesh (GoAP) is responsible for planning and financing. It provides technical support and guidance to the Urban Local Bodies (ULBs). Operation and Maintenance (O&M) is part of the accountability of MCT as is the tariff

fixation and the collection of user charges (GIZ 2014). Public toilets are planned, constructed and built by different agencies and contractors, depending on their place and purpose.

Many Tirupati households rely on onsite sanitation systems, mainly septic tanks. Emptying and cleaning is not centrally organized but serviced by private agencies (MCT 2011).

Tab. 1: Institutional framework sanitation sector for Tirupati (GIZ 2014)

Urban Service	Planning	Execution	O % M	Tariff fixation and collection
Water Supply	PHED	PHED	MCT	MCT
Sewerage	PHED	PHED	MCT	MCT
Public and Community Toilets	Multiple agencies	MCT / other agencies / private contractors	MCT / private contractors	MCT / private contractors

2.1.3 Service provision

MCT provides water and sanitation services. MCT operates a sewer system and a treatment plant with a capacity to serve about 450,000 people (50 TCM daily, GIZ 2014). Appendix 7.4 shows a map with the sewer network coverage as of 2011. The treatment consists of stabilization ponds followed by several facultative lagoons. No data is available regarding onsite sanitation systems connected to sewerage system. There is also no monitoring of possible involvement of private agencies engaged in the septage business.

Two surface water bodies represent Tirupati's main water sources: the Kandaleru reservoir and the Kalyani Dam reservoir, 32 km and 17 km north from Tirupati, respectively. Several bore wells contribute little to the total of 76 TCM supplied daily. Raw water is treated in rapid sand filters and distributed in the absence of flow meters (GIZ 2014).

Tab. 2: Water and sanitation services in MCT (GIZ 2014)

	Description	unit	value
Sewerage	Length of sewer network	km	224
	Number of sewerage connections	-	20,995
	Properties connected to sewer line	-	
	Treatment capacity	TCM daily	50
Water Supply	Length of water network	km	270
	No. of total water connections	-	22,257

2.1.4 Service standards

The Service Level Status Report (SLSR), issued by the Ministry of Urban Development (MoUD), gives an overview over the compliance of the sanitation system of a city with the Service Level Benchmarks (SLBs). SLBs do only include aspects of offsite sanitation service chain. Onsite sanitation aspects are not part of the report, apart from the coverage of toilets.

Generally, the physical status of the sanitation interface (containment) is regarded as private matter and no monitoring is conducted.

Offsite sanitation

Tab. 3 shows the outcomes of the Service Level Status Report (MoUD 2012) and additional performance data for the following years that was collected for the review of the CSP in 2014 (GIZ 2014). Several villages from the adjoining area have been added to MCT limits in 2013 (Venugopal 2015). The numbers shown refer to the MCT limits before the municipal extension.

According to the latest stated status report the SLB of the parameters for collection efficiency and for adequacy of sewerage treatment capacity are met. The performance regarding the coverage of the sewer network shows particular need for improvement. Appendix 7.4 shows a thematic map with ward wise sewerage coverage as of 2011 (MCT 2011).

Onsite sanitation

No monitoring program for onsite sanitation systems is in place in MCT (GIZ 2014). Thus, performance data concerning onsite sanitation systems was only available from unofficial sources.

The physical condition of septic tanks is not monitored but seems to be weak in large parts of the city (MCT 2011). Infiltration of septage into the ground and septage entering open drains and water bodies as effluent occurs.

Emptying and cleaning of septic tanks is either done by the household individuals or by private agencies operating faecal sludge trucks on demand and very irregularly. Private agencies active in the business of septic tank emptying are reported not to comply with safety practices such as the Manual Scavengers and Construction of Dry Latrines (Prohibition) Act. 1000 to 1500 Rs. are charged per cleaning (MCT 2011).

No treatment facility for collected septage is available in MCT. Instead, dumping of septage on open (and partly agricultural) land outside the city area is currently in practice.

Floating population

The diurnal floating population is estimated to be 55,000 people, which are mostly pilgrims. Supply only covers about 1/3 of the facilities needed when the SBM norm of 250 pilgrims per toilet seat is applied (GIZ 2014, MoUD 2014). A survey from 2011 shows poor general maintenance of public toilets, independent from the operating agency / contractor (MCT 2011). Public and community toilets are all flush toilets (GIZ 2011). No information regarding the connection ratio of public toilets to the sewer system is available.

Tab. 3: Service standards for sanitation and water supply sectors (MCT 2011, GIZ 2014)

	Description	unit	SLB	SLSR 2011	Status 2011-2012	Status 2012-2013
Sewage Management	Coverage of toilets	%	100	82	76	76
	Coverage of sewer network services	%	100	42	45	45
	Collection efficiency of the sewerage network	%	100	80	88	100
	Adequacy of sewerage treatment capacity	%	100	-	100	100
	Reuse and recycling	%	20	0	5	0
	Quality of sewerage treatment	%	100	100	93	96
	Cost recovery	%	100	69	69	84
	Efficiency of collection of charges	%	90	21	60	82

Water supply	Coverage connections	%	100	40	39	51
	Per capita supply	lpcd	135	129	88	89
	Metering of connections	%	100	4	4	9
	Non-Revenue Water (NRW)	%	20	17	32	45
	Continuity of supply	hours	24	1	1	1
	Quality % treatment	%	100	95	90	89

3 Service Outcomes

3.1 Overview

This report is conducted as a desk-based-assessment of the sanitation situation in Tirupati, Andhra Pradesh, India. This SFD resorts to the City Sanitation Plan for Tirupati from 2011, its Review from 2014, the service level status report 2010-2011, and the Indian Census data from 2011. The Census 2011 data is regarded as correct.

The objective of the present SFD was to strictly follow the methodology of the BMGF-financed SFD promotion project and thereby provide the possibility to compare outcomes and conclude on improvements. An overview over the sanitary situation is provided in the following.

The Ministry of Urban Development, Govt. of India, conducted a country-wide sanitation ranking as provided by the NUSP in 2010. With 423 cities and towns being assessed, Tirupati ranked 117th with 39 out of 100 possible points. The score corresponds to the black category, highlighting ‘Cities needing considerable improvement in urban sanitation situation’. The lowest score as per percentage of the maximum score was reached in the category for ‘Output’, covering Open Defecation (OD) issues and the service delivery along the sanitation chain (MoUD 2010).

Tab. 4 shows the distribution of access to toilet facilities for households in MCT (for the old city boundaries). About 19 out of 20 households have toilet facilities within their premises, only 1 % relies on public latrines and 2 % on open defecation (see appendix 7.4 for a map of open defecation prone areas). This table does not take into account the high numbers of diurnal floating population in the city. As stated in section 2.1.4 this group of people relies on public toilets and because of a lack of public toilets on open defecation.

Tab. 4: Access to sanitation facilities for Tirupati households (Census 2011, rounded)

Origin category	unit	value
Households	%	96
Public toilets	%	1
Open defecation	%	3

The following numbers apply to the residents of Tirupati, not to the floating population. See chapter 3.2 for numbers including the diurnal floating population.

- **Containment**: Out of the 96 % of the households with private facilities, about 72 % have direct connection to the sewer network, 18 % have septic tanks installed, and 6 % rely on pit latrines or other containers (i.e. buckets), equaling 24 % of households relying on onsite sanitation systems (Census 2011).

  All public toilets are pour- or flush-toilets (GIZ 2014). Public toilets are reported to be under poor maintenance (MCT 2011). No clear numbers concerning the containment systems of public toilets are available.

- Maintenance and **emptying** of onsite sanitation systems are not managed by ULBs but serviced by private agencies through mounted vacuum based collection tanks. About three agencies are estimated to be active in the business with mostly 6 m^3 trucks. A survey from 2011 suggests that a majority of the households do the emptying of their septic tanks themselves (MCT 2011). Standards concerning cleaning intervals, technics of emptying and safety practices are not complied with. Also, no records of cleaning sessions are maintained. The households are charged around 1000 to 1500 Rs. per service. The survey also suggests the demand for less costly emptying services (MCT 2011).

- **Transport**: MCT operates a sewer network with a total capacity to service a population of about 450,000 people (GIZ 2014). No total sewer coverage is achieved. Only about half of the city area is covered and several wards rely on onsite sanitation, on public facilities or on open defecation. City topography seems to partly complicate the extension of the existing sewer network.

- **Treatment**: Collected wastewater is conveyed to the Wastewater Treatment Plant (WWTP) operated by MCT. The WWTP is situated 10 km south-west of the city and comprises of stabilization and facultative ponds (GIZ 2014). The capacity of the plant is adequate to serve about 450,000 people (50 TCM daily). It is not clear when the current capacity will be reached by the sewerage generation. However, enough land around the WWTP is available to allow further expansion (MCT 2011). Service Level Status Reports and surveys show adequate treatment quality. BOD-values of the effluent range between 49 to 89 mg/L, meeting the Central Pollution Control Board (CPCB) norm of 100 mg/L for irrigation discharge (as of 2011, MCT 2011). The national standard for discharge into surface sources of 30 mg/L is not met though (CPHEEO 2012). No facility exists for the treatment of septage deriving from onsite sanitation facilities.

- **End-use / disposal**: The treated wastewater is used for irrigation purposes on agricultural lands in the downstream of the WWTP (MCT 2011). About 4 TCM daily of treated wastewater are being reused by local industry (corresponds to more than 10 % of the wastewater treated, as of 2014, GIZ 2014). Collected septage from onsite

sanitation facilities (mostly septic tanks) is discharged into open ground in peripheral areas (MCT 2011).

3.2 SFD Matrix

The information for this SFD is mainly derived from the Census of India 2011 data, the City Sanitation Plan, its review and the Service Level Status Report. Data from the Census is regarded as correct and is used for the compilation of the SFD. In the following, assumptions made in order to produce the SFD are explained along the sanitation chain.

As Tirupati shows a relatively high diurnal floating population (mostly pilgrims, 15 % of the local population) the real sanitary situation may look different. Public latrines can only service 1/3 of the diurnal floating population of 55,000 (see section 2.1.4). As no data concerning sanitary facilities for the rest of the floating population is available, it is assumed that 2/3 relies on open defecation.

3.2.1 Containment

According to the Census 2011 72 % of all households in MCT have toilet facilities within their premises that are directly connected to the piped/ underground sewer system. It is assumed that all interfaces and all sewer connections are fully functional. Including the diurnal floating population the ratio of the population serviced by offsite sanitation systems decreases to 63 %.

18 % of households have, as per Census, septic tanks on their properties. An additional 1 % of the households rely on public toilets, which are all equipped with pour- or flush-toilets (GIZ 2014). Assuming that 1/3 of the diurnal floating population relies on public toilets and further assuming that all public toilets are connected to septic tanks (see chapter 2.1.4), the total ratio of the population relying on septic tanks increases to 21 %. No information regarding the state of private septic tanks is available. Public toilets are reported to be under poor maintenance and partly represent pollution hotspots in the city (MCT 2011).

Additionally, 2 % of households have pit latrines or other safe containment facilities on their premises (Census 2011). As per lack of information, it is assumed that 50 % of all septic tanks and pit latrines are connected to soak pits and 50 % to the open ground. This share does not change substantially by including the diurnal floating population.

Latrines without pit but with direct disposal in open drain or with a bucket that is emptied manually (called ‘Night soil’ and ‘service latrines’ in the Census) are regarded as not containing the faecal sludge and account for 3 % of the population.

The Census states an open defecation rate of 3 %. With 2/3 of the diurnal floating population practicing open defecation a total of 11 % account for this share.

3.2.2 Emptying

There is no information available on private or public septic tanks being connected to the sewer system. It is therefore assumed that 50 % of the septic tanks are connected to soak pits and 50 % to the open ground. MCT does not operate suction trucks for servicing onsite facilities and does not monitor the sector. Three private agencies are reported to be active in MCT area, operating suction trucks with volumes of 6 m^3 each (MCT 2011). An estimated 3,000 cleaning sessions are conducted per year. That means that septic tanks are cleaned

only every 4 years on average (assuming about 12,000 septic tanks stated in the census). A high percentage of septic tanks are cleaned individually by the owners (MCT 2011). No information regarding septic tanks connected to soak pits is available. As per lack of more precise data it is assumed that 50 % of the septic tanks are emptied by private agencies and 50 % by individuals. The proportion of faecal sludge in onsite sanitation facilities is assumed to be 50 %.

3.2.3 Transport

Collected wastewater is conveyed to the centralized WWTP south-east of the city. The capacity of the sewer network is currently adequate and has a total length of about 120 km (including main sewers, sub-main sewers, branch sewers, lateral sewers and sub laterals sewers, GIZ 2014).

3.2.4 Treatment

The current treatment capacity of 50 TCM daily is adequate to meet the sewerage generation projected until 2021. The quality of the treatment is reported to be 96 % (GIZ 2014).

3.2.5 End-use / disposal

The treated wastewater is used for irrigation purposes on agricultural lands in the surroundings of the WWTP (MCT 2011). About 10 % of the treated wastewater is being reused by local industry (GIZ 2014). Collected septage from onsite sanitation facilities (mostly septic tanks) is discharged of on open ground in peripheral areas (MCT 2011).

4 Stakeholder Engagement

4.1 Key Informant Interviews

Two key informants have been interviewed via mail: Kanchi Nagasreenivas, Varsha Venugopal (both working for GIZ India). Aim of the interview was the validation and the actualization of data derived from the reports. Additionally the two informants commented to a first draft version of this report. The comments have been incorporated in this report.

5 Acknowledgements

This SFD is dedicated to the citizens of Tirupati. The author would like to thank Naga Sreenivas Kanchi, Varsha Venugopal, Rahul Sharma and Dirk Walther (all GIZ India) for the support.

6 References

1. Census of India 2011. HH-8 : Households by Availability of type of Latrine Facility
2. CPHEEO 2012. Manual on Sewerage and Sewage Treatment, Part A: Engineering Final Draft, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, New Delhi

3. GIZ 2014. City Sanitation Plan Updation – Status Report Municipal Corporation of Tirupati
4. Ministry of Urban Development 2010. Rank of Cities in Sanitation 2009-2010 (National Urban Sanitation Strategy)
5. Ministry of Urban Development 2012. Service Levels in Urban Water and Sanitation Sector – Status Report (2010-2011). First Edition, January 2012
6. Ministry of Urban Development 2014. Guidelines for Swachh Bharat Mission (SBM). December 2014
7. Municipal Corporation of Tirupati 2011. Draft City Sanitation Plan Volume 1 – Main Report
8. Venugopal 2015. Personal communication with Mr. Varsha Venugopal via mail. October 2015

7 Appendix

7.1 Appendix 1: Stakeholder identification

Additionally to the key informants mentioned in chapter 4.1 city officials from MCT have been contacted via mail in order to get more up-to-date and precise data to work with and in order to discuss findings of this report. However, it was not possible to get feedback from the contacted city officials.

7.2 Appendix 2: Tracking of Engagement

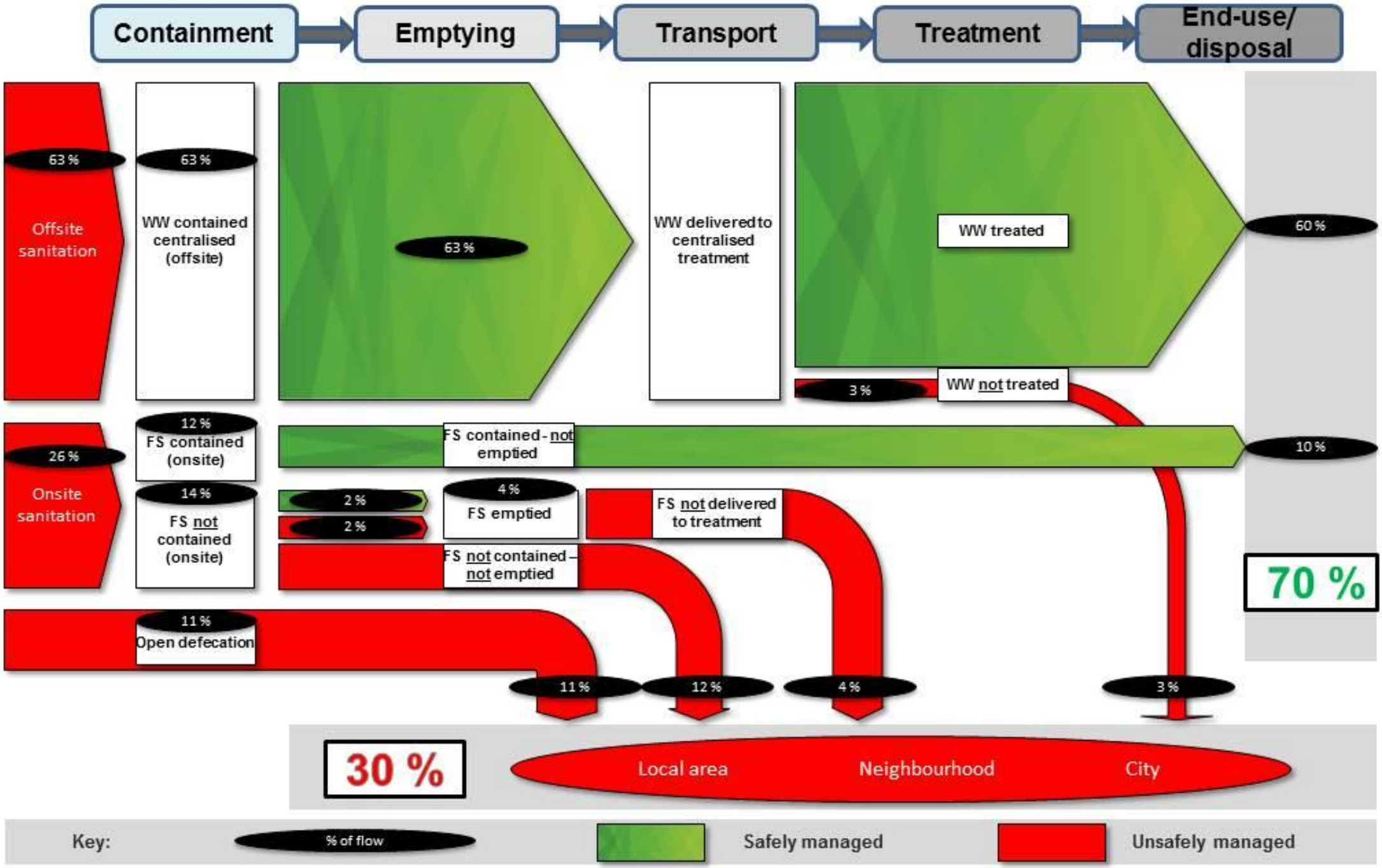
The key informants have been contacted via mail on 14th of October 2015. The main outcomes were:

- The area of Tirupati has been expanded by merging several villages in 2013.
- Concerning the policy chapter, several initiatives such as Basic Services for Poor (BSUP) and Rajiv Awas Yoiana (RAY) have been pointed out.
- The treatment plant present in Tirupati is situated at Tukivakam and consists of a stabilization pond and several facultative lagoons. The treated water is discharged into storm water canals.

7.3 Appendix 3: SFD matrix

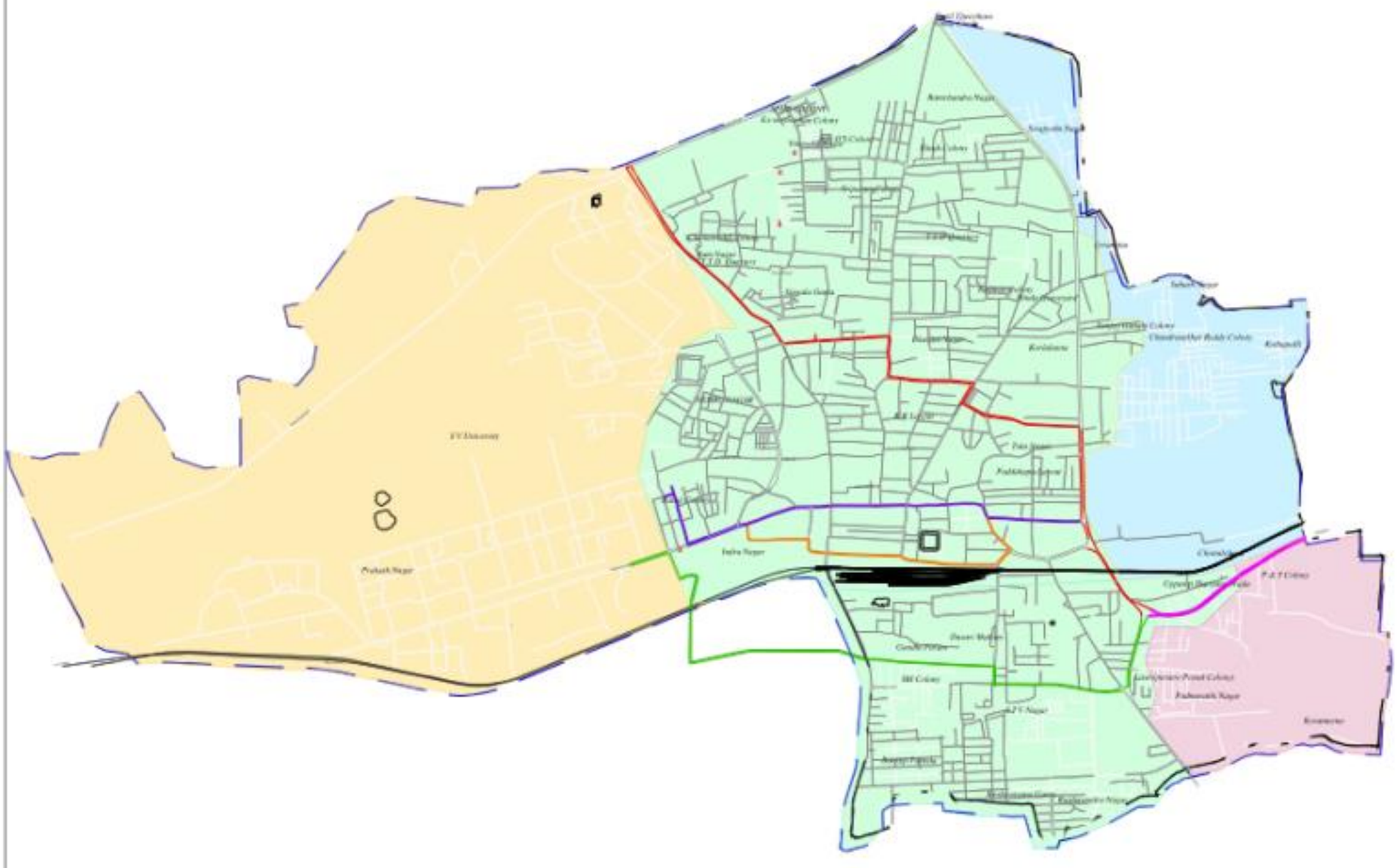
Titupati / India (13. April 2016)
Desk based

Status: DRAFT



7.4 Appendix 4: Thematic maps (old city border)

Sewerage Network Coverage Map - Tirupathi



Key map

Legend

- MUNICIPAL BOUNDARY
- ROADS
- SEWER LINE - A MAIN
- SEWER LINE - B MAIN
- SEWER LINE - G MAIN
- SEWER LINE - K MAIN
- OUTFALL LINE
- SEWER LINE

NETWORK COVERAGE TYPE

- SERVED AREA
- UNSERVED AREA - UNDER PROGRESS
- UNSERVED AREA - DUE TO TOPOGRAPHY
- UNSERVED AREA - DUE TO LACK OF NETWORK

Fig.:
Sewerage Network Coverage Map - Tirupathi

Source:
Tirupathi Municipal Corporation

Project:
City Sanitation Plan - Tirupathi

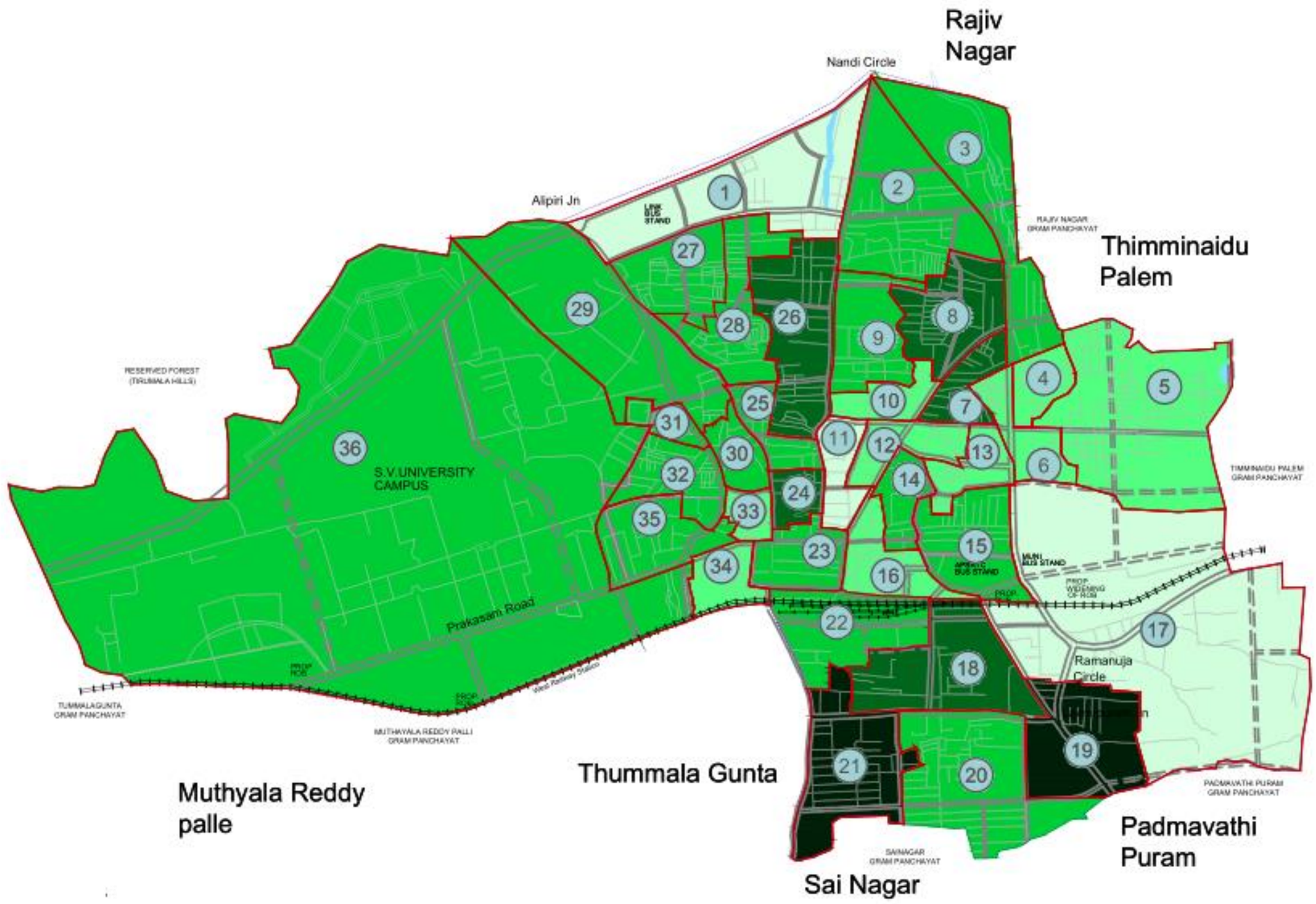
Client:
Tirupathi Municipality & GTZ

Scale:

Consultant:

ICRA Management Consulting Services Limited

Sewerage Coverage - Ward wise Percentage - Tirupathi



Key map

Legend

- MUNICIPAL BOUNDARY
- WARD BOUNDARY
- NO. WARD NO.

%AGE SEWERAGE COVER

- < 20
- 20 - 30
- 30 - 40
- 40 - 60
- > 60

Fig. :
Sewerage coverage - Ward wise %age

Source:
Tirupathi Municipal Corporation

Project:
City Sanitation Plan - Tirupathi

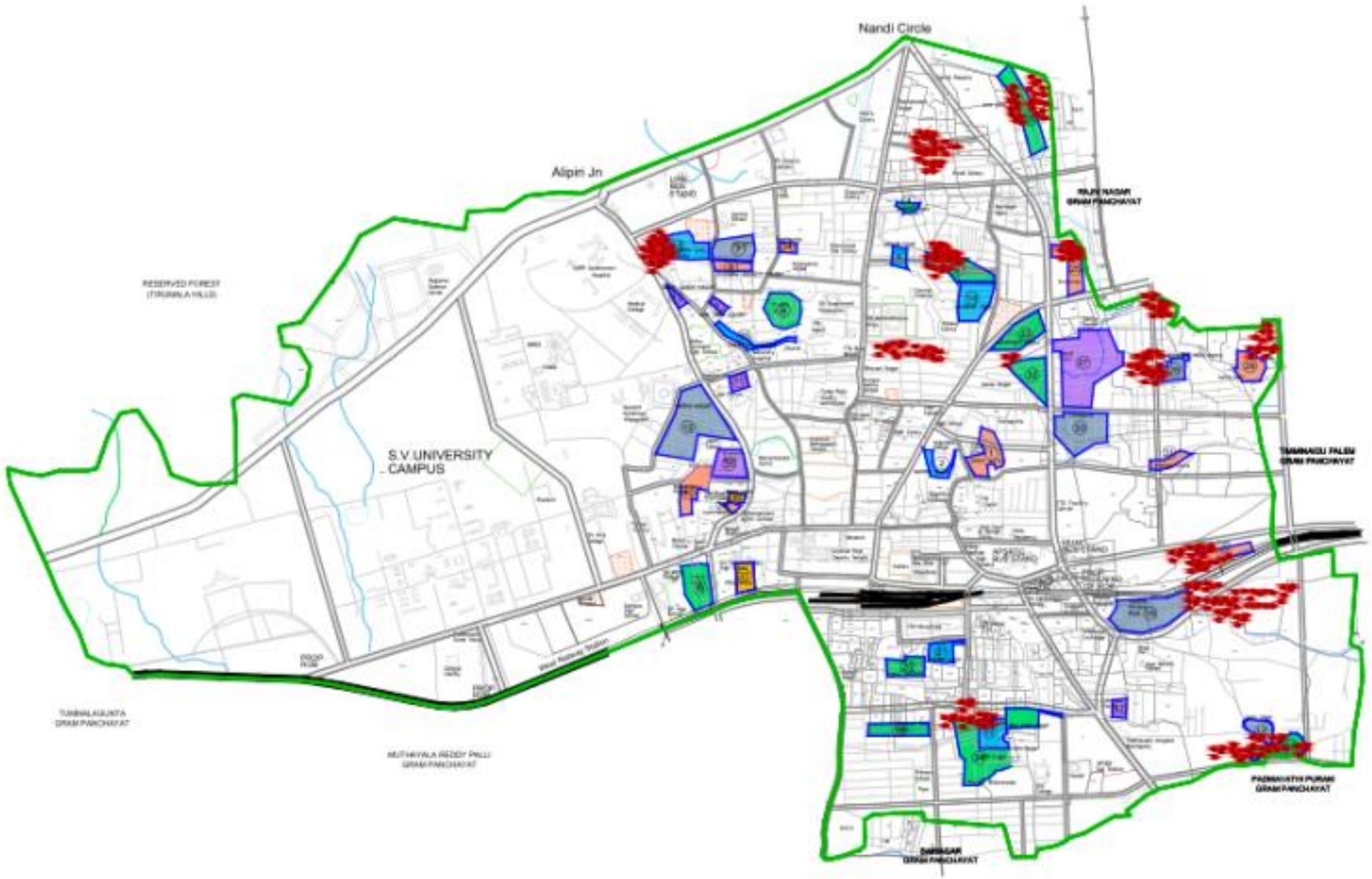
Client:
Tirupathi Municipal Corporation & GTZ

Scale:
0 0.4 0.8
0.1 0.2 0.6 1.0 km

Consultant:
iMaCS

ICRA Management Consulting Services Limited

Slum Density Map - Tirupathi



Key map

Legend

- MUNICIPAL BOUNDARY
- NON MUNICIPAL BOUNDARY
- VILLAGE BOUNDARY
- NATIONAL HIGHWAY
- STATE HIGHWAY
- ZILLA PANCHAYAT ROAD
- BROAD GAUGE RAILWAY LINE

SLUM DENSITY

- <200 pph
- 200 - 600 pph
- 600 - 1000 pph
- 1000 - 3000 pph
- 3000 - 7000 pph
- >7000 pph
- OPEN DEFECATION AREA

Fig. :
Slum Density Map - Tirupathi

Source:
Tirupathi Municipal Corporation

Project:
City Sanitation Plan - Tirupathi

Client:
Tirupathi Municipal Corporation & GTZ

Scale:
0 0.4 0.8
0.1 0.2 0.6 1.0 km

Consultant:
ICRA Management Consulting Services Limited