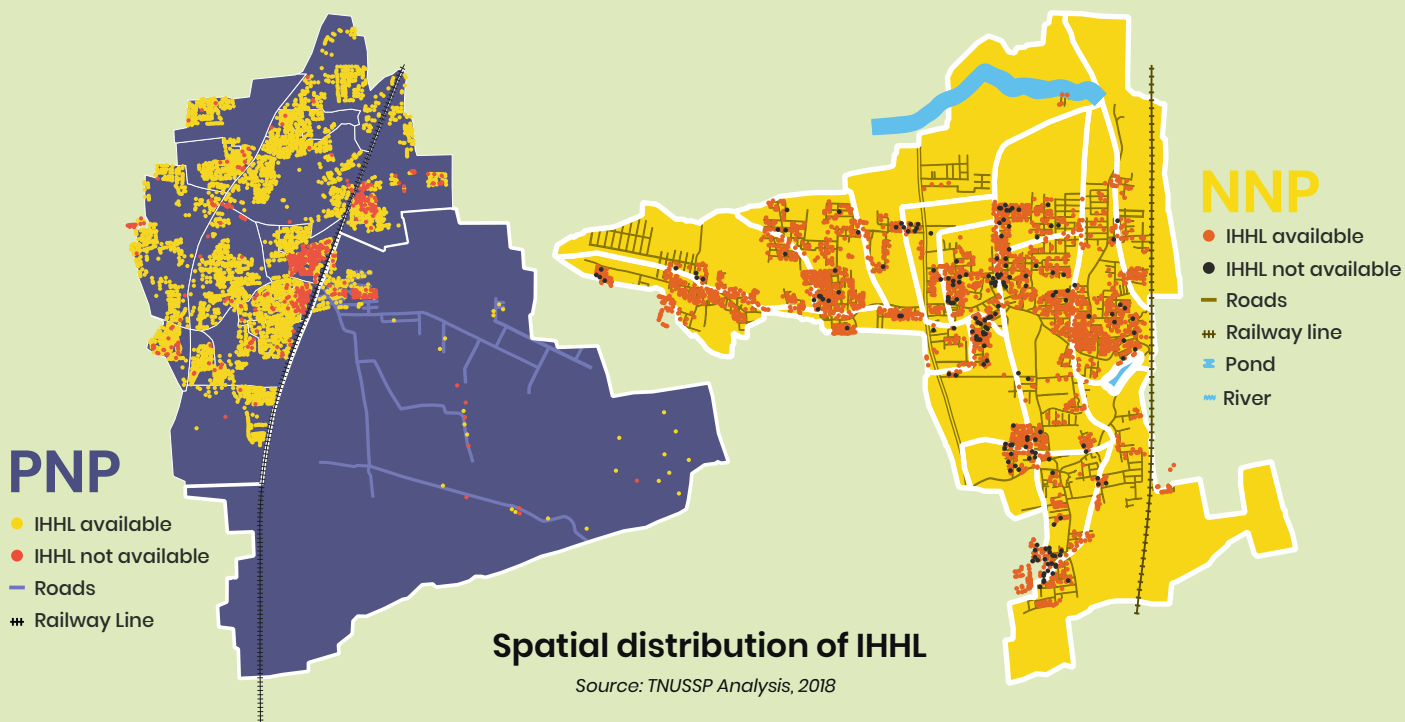




GIS MAPPING INCLUDING HOUSEHOLD AND ESTABLISHMENT STUDY IN PNP-NNP TOWN PANCHAYATS, COIMBATORE DISTRICT, TAMIL NADU

January 2019



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Document Team: Rajiv Raman, Gayathri Sarangan, Reeba Devaraj, Navamani Ramasamy, Sancy Sabastian; L. Somasundaram and Ajay R. (Akara Research & Technologies Pvt. Ltd.)

Editing: Word Lab, IIHS, Bengaluru

Administrative Support: Shaheena Manoj, Krishnapriya P., Govardhan Seshachalam

Team Leader: Kavita Wankhade

Project Director: Somnath Sen

Design and Layout: Divya Dhayalan

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Abbreviations

App	Application
BMGF	Bill and Melinda Gates Foundation
CAPI	Computer Aided Personal Interview
CDD	Consortium for DEWATS Dissemination
CPHEEO	Central Public Health and Environmental Engineering Organisation
CT	Community Toilet
DEWATS	Decentralised Wastewater Treatment Systems
FSM	Fecal Sludge Management
FSSM	Fecal Sludge and Septage Management
GIS	Geographic Information System
GoTN	Government of Tamil Nadu
HH	Household
IS	Indian Standards
MAWS	Municipal Administration and Water Supply
NNP	Narasimhanaicken-palayam
PNP	Periyanaicken-palayam
PT	Public Toilet
RCC	Reinforced Cement Concrete
TCC	Tiruchirappalli City Corporation
TNUSSP	Tamil Nadu Urban Sanitation Support Programme
TP	Town Panchayat
TSU	Technical Support Unit
ULB	Urban Local Body

Executive Summary

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Executive Summary

The Tamil Nadu Urban Sanitation Support Programme (TNUSSP) aims at making improvements along the sanitation chain in the state of Tamil Nadu and demonstrating innovations in two model urban locations: Tiruchirappalli City Corporation, and Periyanaicken-palayam (PNP) and Narasimhanaicken-palayam (NNP) town panchayats.

E1. Objective and Methods

The primary objective of the study was to conduct a geographic information system (GIS) based sanitation mapping of households and establishments in the two town panchayats of PNP and NNP, with an aim to:

- Understand the nature of containment and on-ground desludging practices to enable more effective planning
- Prepare GIS-linked database of properties (with households and establishments) and cover key FSM parameters.
- Provide spatial and non-spatial inputs for effective decision-making

A study questionnaire and an Android app was developed for data collection for both household and establishment and enumerators were trained to use them. With the project objective of provision of data for a GIS-linked database, the app included functionalities on mapping properties using the handheld device. Enumerators were trained on the questionnaire and various functionalities of the app.

All buildings in every street were visited -occupied, unoccupied or door locked; and including residential, commercial, industrial, institutional and mixed use. Within each building, each type of unit were visited, which could also be closed, unoccupied, under construction or depleted/abandoned/used. If used, consent was sought and surveyed.

In PNP, 4,682 buildings were surveyed following consent, of which 3,975 were residential and 707 were classified as establishments (including mixed use). A total of 986 buildings (17 per cent) could not be surveyed. In NNP, 3,689 buildings were surveyed following consent, of which 3,432 were residential buildings and 266 were classified as establishments (including mixed use). A total of 1,845 buildings (33 per cent) could not be surveyed.

E2. Key Findings

The study aimed to understand access to toilets, and the nature of containment and on-ground desludging practices across PNP and NNP. Although all building and occupants were visited, the response rate based on consent was 83 per cent in PNP and 67 per cent in NNP. A total of 8,001 households in PNP and 5,449 households in NNP were surveyed. Further, 1,667 establishments in PNP and 437 establishments in NNP were surveyed. Ninety-two per cent of the households surveyed were in residential buildings, while 8 per cent were in mixed use buildings in PNP. In NNP, 96 per cent of the households were in residential buildings and the rest in mixed-use.

E3. Household Findings

Portable Water

The predominant source of water in both PNP and NNP was piped water into the dwelling or yard. In PNP, more than 93 per cent of the households received piped water into their dwelling or yard, while in NNP 80 per cent reported the same.

Access to Toilets and its characteristics

In PNP, about 88 per cent of the households reported access to toilets. Of this, 80 per cent have access to toilets within their households, while the rest use toilet blocks which are available within or outside the building block but mainly used by residents of the block. Among those without household toilets in PNP, 40 per cent households had space available for toilet construction.

In NNP, 91 per cent of the household reported having access to a toilet - 87 per cent (4,749) with access to individual household toilets, and 4 per cent with access to block toilets. Of the the 13 per cent of the households in NNP without household toilets, around 57 per cent households have space to construct individual household toilets.

Toilet Characteristics

The squatting pan is the main type of toilet used in nearly half the cases, followed by western closet. There are a few cases (6-7 per cent) in both the TPs where the water seal is not intact, leading to toilet odour and insects. The location of the household toilet was inside the house in around 41 percent households in PNP, while 35 per cent had it outside the house or building but attached. In NNP, about half the toilets were inside the house/building, and in 21 per cent of the cases, the toilets were 'outside the house/building but attached. The predominant roof material of household toilets in PNP and NNP is Reinforced Cement Concrete (RCC).

Containment Characteristics

In PNP, of the 6,399 households which report access to toilets, 92 per cent of the households reported being connected to a septic tank, and 7.6 per cent reported toilets connected to single pits. In NNP, 77 per cent of households reported toilets are connected to septic tanks, while 17 per cent reported single pits. Around 58 per cent of the containments in PNP and 20 percent in NNP were full lined tanks with impermeable walls. Stone and rubble is the commonly used material to construct containment walls in both TPs. However, two thirds of households reported 'no material' used in constructing containment bases, which essentially implies they are porous structures Other materials such are RCC, brick with cement, and brickbats and aggregates are reported to be used in about a quarter of cases in both TPs. RCC is the most commonly used material for constructing the top of the containment. In PNP, only 3.2 per cent of the containment have a partition, while in NNP, 15 per cent of the containments were partitioned.

In PNP, 5 to 10 feet was the most commonly reported length (68 per cent), breadth (71 per cent) and height (58 per cent) for septic tanks. The most commonly reported diameter of single pits is less than 5 feet (34 per cent), followed by 6 to 10 feet (in 16 per cent of the cases). In NNP also, 5 to 10 feet was the most commonly reported length (58 per cent), breadth (51 per cent) and depth (42 per cent) of septic tanks. For single and twin pits, the most common diameter was less than or equal to 5 feet (43 per cent cases), followed by 6-10 feet (34 per cent). In terms of pit depth, 6-10 feet was the most common depth (52 per cent cases), followed by over 10 feet (22 percent). In PNP, 91 per cent of the households reported containment structure not being connected to any outlet, while the corresponding number is 85 per cent was NNP.

Blackwater and greywater disposal

In PNP, greywater was disposed into open drains in front of the house in 89 per cent cases, while 3 per cent cases it was directed to soak pits within their house. An equal per cent used it for plants. In NNP too, greywater was predominantly disposed of in the open drains outside the house in 62 per cent cases to separate soak pits within premises in 19 per cent cases,)and to connected septic tanks / pits in 5 percent cases.

Desludging

In PNP, only 9 per cent (502 households) reported ever having emptied the containment structure mainly, using services of private desludging operators. Access issues were not reported for desludging trucks. Of these households, 80 per cent reported accessing the pit through a removable manhole cover, while others had a slab or cover sealed with mortar that had to be broken (16 per cent), and in the rest the slab had to be broken to be opened. Unintentional leakages during cleaning was reported in 10 per cent of the cases and in 85 per cent of the cases in PNP, desludging operators do not wash their equipment before leaving. Among the households which reported emptying containments, 23 per cent of the containments had been emptied just once so far, 37 per cent were reported to be emptied as they fill up, while 3 per cent reported emptying every five years.

In NNP, just 8 per cent reported desludging their containments. Of these, 69 per cent containments had a removable manhole cover, and 15 per cent had a slab on top which must be broken, and in 10 per cent there was a pipe with junction through which a hose can be inserted. About a quarter of households reported cleaning the containment as it fills up, while 21 per cent each report cleaning once a year or after more than five years. In 8 per cent of the cases in NNP, there was unintentional spillage reported from the hose or truck and in about 65 per cent of the cases in NNP, desludging operators do not wash their equipment before leaving. About a quarter of households reported cleaning the containment as it fills up, while 21 per cent each reported cleaning once a year or in more than five years.

Distance between containment and water source

In nearly a third of the households in PNP, the distance between the containment and water source was over the safe recommended distance of 20 feet. However, in 4 per cent of the cases, it was less than 5 feet, in 14 per cent it was between 6 to 10 feet and in 27 per cent of the cases, it was between 11 to 15 feet. In NNP, in nearly 30 per cent of the households the distance between containment and water source was over 20 feet, while in 4 per cent it was less than 5 feet and in 18 per cent it was between 6 to 10 feet.

E4. Establishment Findings

Portable Water

Piped water supply into the dwelling or yard was the main source of potable water in PNP, reported by 45 per cent of establishments, followed by bottled water (42 per cent). In NNP, around 39 of establishments had piped water into dwelling or yard as the drinking water source, followed by bottled water (33 per cent).

Access to Toilets and its Characteristics

In PNP, 67 per cent of the establishments, had access to toilets - 25 per cent to unit toilets and 42 per cent to block toilets. Further, for those establishments without access to individual toilets, space was available in 11 per cent of the cases for construction. 52 per cent toilets were located outside the building but attached, 27 per cent are inside the building and 17 per cent are 'inside the building, outside the house but attached'. RCC was the most commonly used material for toilet roof construction, with the Indian squatting pan the most popular pan type. Almost all toilets were connected to either septic tanks (95 per cent) or single or twin pits (4 per cent).

Containment Characteristics

Of the 412 unit toilets in PNP, 410 were connected to septic tanks / single pits/ twin pits (95 per cent). In NNP, of 437 establishments toilets, 149 were connected to septic tanks, 32 to single pits and one was connected to twin pit. This includes 121 containments connected to unit and block toilets and 61 containments connected only to block toilets.

In PNP, septic tanks /pits were reported to be fully lined in 65 per cent of the cases, while in 33 per cent of cases information was not known about tank/ pit infrastructure. Containment walls were most commonly made of 'stone or rubble', burnt brick or RCC, while walls were plastered in 56 per cent of the containments. There was no material used for the base in 59 per cent cases, implying that the containments were porous structures. In PNP, in just 24 per cent of the cases, containments had an open manhole for cleaning purposes, while 70 per cent had no manhole. In 5 per cent of the cases, a pipe with cap was available. Nearly ten per cent of the tanks were reported to be partitioned, with 63 percent having one chamber, and 32 percent having two chambers or three chambers. In 91 per cent of the cases, the wastewater had no outlet and 16 per cent of the cases, there was space available to construct a soak pit. In PNP, information on the dimensions of two thirds of the septic tanks was not known. Of the rest, 5-10 feet was the most commonly reported length (50 per cent), breadth (56 per cent) and depth (35 per cent).

Of the containments in NNP, 20 per cent were fully lined tanks/pits (sealed tanks). Walls of the containments were mainly made of stone or rubble, followed by RCC /RCC rings, and burnt brick. Walls were plastered in 33 per cent of the containments. In two thirds of the containments, there was no material used for base, while in 13 per cent of the cases, brick with cement was used. In 96 per cent of the cases, top of the containment was made of RCC. In 38 per cent of the cases, there was 'no manhole', while in 35 per cent there was a 'manhole opening with cover' and 25 per cent of the cases 'pipe with cap' is available. In 17 establishments containments were partitioned with two chambers (15 cases). In 80 per cent of the cases, wastewater had no outlet, although in 28 per cent of the cases space was available. In NNP, information on dimensions of 28 per cent of the septic tanks was not known. Of the rest, '5-10 feet' was the most commonly reported length (54 per cent), breadth (56 per cent and depth (48 per cent) of septic tanks.

Black and greywater disposal

Wastewater from containments were not connected to any outlet in 91 per cent of the cases in PNP, while in 5 per cent of the cases, they are connected to open drains. Similarly, in NNP, in 80 per cent of the cases, containments are not connected to any outlet, while in 5 per cent of the cases, they are connected to open drains. In three were, they were also reported to be connected to water bodies. In PNP, in two thirds of the establishments, greywater was disposed of in open drains, while in 15 per cent of the cases, it was disposed off in open areas outside the house. In NNP, in nearly 40 per cent of the cases, greywater was connected to the drain outside the house, in 18 per cent to open area outside the house, in 6 per cent each to separate soak pits within premises or to septic tanks.

Emptying

Just 7 per cent of the containments (29 containments) had ever been cleaned in PNP. Of these, in 69 per cent containments had a removable manhole cover, and 29 per cent had a breakable slab. In one case there was no access point. Vehicles were reported to access nearby areas to clean the containment. In PNP, while no spillage was reported in 25 out of the 29 cleaning instances, in four cases there was unintentional leak.

In NNP, 17 per cent (31) of the containments were reported to be emptied, in all cases by private desludging operators. Of this, in 68 per cent of cases, there was a removable manhole cover, while in 19 per cent of the cases there was a pipe with a junction that the hose can be inserted into. In one sixth of the 31 instances of cleaning, there was spillage from the hose or truck which was unintentional in NNP.

Distance between Containment and Water Source

In PNP, distance between containment and water source in the establishment premises is between '20 and 40 feet in 23 per cent cases, over 40 feet in 24 per cent of the cases, and between '11 and15

feet in a quarter of the instances. In NNP, in a third of the cases, distances between containment and water source was 'between 20 and 40 feet, while in 15 per cent cases it was between 6 and 10 feet.

E5. Conclusions

The sanitation mapping of the two town panchayats reveals several deficits across the sanitation chain which need to be addressed.

Access to Toilets

Of the 20 per cent households without household toilets in PNP, there was space available for toilet construction in 40 per cent of the cases. In the 13 per cent of the households in NNP without household toilets, there was space available for construction in 57 per cent of the cases. Similarly, in establishments, for those without access to individual toilets, space was available in 11 per cent of the cases for construction in PNP, and in 14 per cent cases in NNP. The means of leveraging funds from Swachh Bharat Mission to support these households and establishments to gain access to toilets needs to be explored.

Containment Characteristics

Most households in PNP and NNP were connected to septic tanks, which were in many cases oversized when compared to the prescribed standards. The containment structures also lack safe and standard features and are in many cases not lined with any material at the base, meaning they are not watertight. Issues were also found with respect to partition walls, manhole covers, wastewater not being connected to a proper outlet etc. Given that the study has specific GIS based information on containment locations, ways of improving containment safety should be explored.

Desludging

Septic tanks need to be cleaned periodically at an interval of 2-3 years. In PNP, only 9 per cent of the households reported ever having desludged their containments, while in NNP the number was just 8 per cent. While desludging vehicles have gained access to containments, the lack of manhole cover in many containments makes access difficult. Given that containment tops are mainly made of RCC, this necessitates breaking open the structures for desludging, which increases risk of injury to the worker, besides increasing cost and time of desludging. This aspect needs to be addressed in steps taken to address sanitation deficits.

Distance between Containment and Water Source

The maximum depth of the containment structures is 30 feet in case of households and 40 feet in case of establishments in PNP, and 20 feet both for households and establishment in NNP. Given that groundwater in the area is at around 90 feet, the safe distance between containments and water source seems to be maintained.



Introduction

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1. Introduction

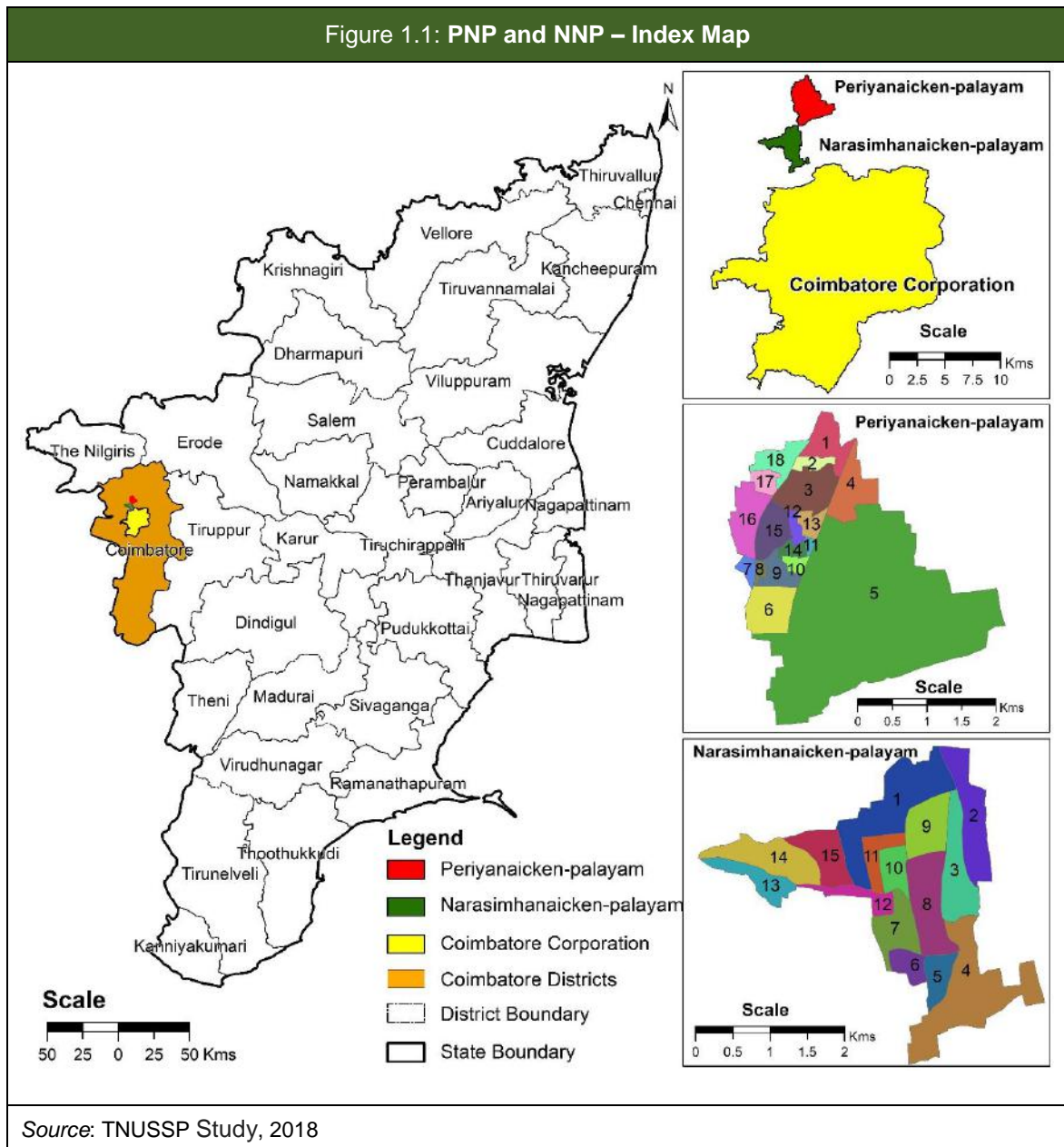
The Government of Tamil Nadu (GoTN) has been a pioneer in recognising the importance of securing the full sanitation chain as core to improved public health outcomes for all citizens. The GoTN was the first Indian state to issue the Operative Guidelines for Septage Management in September 2014, prioritising strengthening of Fecal Sludge and Septage Management (FSSM), as an economical and sustainable solution for small and medium towns, and as a supplement to network-based sewerage systems in bigger cities.

To help achieve Tamil Nadu's Sanitation Mission (Muzhu Sugadhara Tamizhagam), the Bill and Melinda Gates Foundation (BMGF) is (GoTN) by setting up a Technical Support Unit (TSU) within the Municipal Administration and Water Supply (MAWS) Department. This unit, the Tamil Nadu Urban Sanitation Support Programme (TNUSSP) aims at effecting improvements along the entire urban sanitation chain in the state of Tamil Nadu and demonstrating innovations in two model urban locations. A two-pronged approach is being adopted by the unit - working in two model urban locations to demonstrate city level transformations on-ground across the sanitation chain, while also working on creating an enabling environment, implementing statewide actions, and scaling-up of innovations. The first phase of the programme is for two years (Nov 2015 – Oct 2017). TNUSSP is being implemented by a consortium of organisations, led by the Indian Institute for Human Settlements (IIHS), comprising of Gramalaya, Keystone Foundation and Consortium for DEWATS Dissemination (CDD) Society.

TNUSSP is working on demonstrating innovations in two model urban locations in Tamil Nadu: the Tiruchirappalli City Corporation (TCC), and in two town panchayats in the Coimbatore district, Periyanaicken palayam (PNP) and Narasimhanaicken-palayam (NNP). In both locations, the programme is implementing projects and interventions along the full cycle of sanitation in consultation with key stakeholders and working closely with the TCC and PNP and NNP Town Panchayats. This study focuses on the two town panchayats of PNP and NNP.

1.1 Background of Town Panchayats

PNP is a TP in Coimbatore District of Tamil Nadu and is situated 17 km north of Coimbatore city and NNP is a neighbouring TP, situated 12 km north of Coimbatore city. Both PNP and NNP are situated alongside National Highway 67 which connects Coimbatore to Mettupalayam. The two TPs are a part of an almost fully urbanised corridor extending along the Coimbatore-Mettupalayam Road. The TPs are proximate to forest areas, and the river Kousika runs along NNP. Figure 1.1 shows the details of the location of NNP and PNP in Coimbatore and Tamil Nadu.



1.1.1. Topography and climate

Both town panchayats are proximate to forest areas and have a pleasant climate throughout the year. Kurudi Malai, which is a part of the Tadagam Forest Reserve is proximate to PNP TP (on its western side). Table 1.1 shows the maximum, minimum temperature of the TPs and the average annual rainfall.

Table 1.1: Climate Particulars of PNP and NNP

Town Panchayat	Mean Maximum Temperature	Mean Minimum Temperature	Average Annual Rainfall (in mm)
NNP	35.9 °C (97 °F) to 29.3 °C (85 °F)	23.5 °C (76 °F) to 18.2 °C (68 °F).	606
PNP	35.9 °C (97 °F) to 29.3 °C (85 °F)	23.5 °C (76 °F) to 18.2 °C (68 °F).	-

Source: City Sanitation Plan, PNP and NNP

1.1.2. Demography

According to the Census 2011, PNP is a Class III town with a population of 25,930, comprising of 7,377 households in 18 wards. NNP is a Class IV town with a population of 17,858, comprising of 5,023 households in 15 wards.

1.2 Objective of the Study

The primary objective of the study was to conduct a Geographic Information System (GIS) based sanitation mapping of households and establishment study in the two town panchayats of PNP and NNP with an aim to:

- Understand the nature of containment and on-ground desludging practices to enable more effective planning
- Prepare GIS-linked database of properties (with households and establishments) and cover key FSM parameters.
- Provide spatial and non-spatial inputs for effective decision-making

1.3 Study Implementation

TNUSSP had selected Akara Research & Technologies to undertake the study. The scope of the project can be broadly classified into three activities – study questionnaire finalisation and app development; data collection; and preparation of GIS-linked database and analysis. Specifics pertaining to each of the broad group is listed as follows:

1.3.1. Study Questionnaire Finalization and APP Development

This phase involved

- Finalisation of study instruments for households and establishments
- Developing an Android app with finalised household and establishment questionnaire (ported)

The study instrument was designed in consultation with IIHS, with designing questions to arrive at the right data flow strategy required for development of a GIS-linked database. The finalised study questionnaire pertaining to both household and establishment were translated to Tamil.

The questionnaire was designed to collect data using GIS-enabled tablets on the following aspects: building characteristics, demographic details, access to potable water, access to toilet, access to on-site sanitation system, infrastructure and dimension of on-site sanitation (OSS), desludging frequency and practice and distance between containment and on-site sanitation systems. (Refer Annexure 1 and 2 for household and establishment questionnaire).

Based on the finalised study questionnaire for both households and establishments, a Functional Analysis Document (FAD) was prepared for app development. Concurrent to development of the app, a data model for study data was developed. The unit of observation for the data model was the household or the establishment.

A training programme was conducted, where the study enumerators were trained on concepts pertaining to water and sanitation used in the study. Two levels of training were imparted to the enumerators – at the first level, a pen-and-paper training of study questionnaire was undertaken at Coimbatore. With inputs from field after a pre-test of study questionnaire, certain questions were added and modified – these were incorporated alongside existing pool of questions to arrive at a finalised study questionnaire.

The finalised study was then ported onto the Android app, and after the app was developed, the enumerators were trained on CAPI methodology and data capture process. The training highlighted aspects pertaining to user rights, data validations and checks in-built in the application.

1.3.2. Data collection

This phase involved

- Conducting the study of all households and establishments using Android app in the two ULBs of PNP and NNP
- Obtaining spatial data from the study, namely:
 - Geo-codes of households and establishment properties and other Points-of Interest
 - Geo-codes of containment location and grid-position as defined in the study
 - Public infrastructure study for mapping water bodies, storm water drains, solid waste management, public and community toilets, public water supply infrastructure, vacant plots. For mapping roads, a total station study was conducted.

Study and research personnel from Akara visited both PNP and NNP as a part of reconnaissance study to gather local intelligence. The personnel made visits to the offices of the Town Panchayat and councilor to introduce and explain the scope of project; households were visited to gather information pertaining to access to toilets and, drainage facilities. This was used for work-allotment and planning for study operations. Based on reconnaissance study, it was observed that many new areas had cropped up in both the TPs since Census 2011, which was then factored into the study.

Before starting the study, the necessary permissions were obtained from concerned officials. To ensure high response rate, a public announcements using autorickshaws were made with a recorded voice-over encouraging residents and shopkeepers to participate in the study.

All buildings in every street were visited - occupied, unoccupied or door locked; and including residential, commercial, industrial, institutional and mixed use (refer Annexure 2). Within each building, each type of unit were visited, which could also be closed, unoccupied, under construction or depleted/abandoned/ used. If used, consent was sought and surveyed. If the typology is a residential or residential within mixed use – it is analysed as a household unit. All else is reported under establishment.

In PNP, 4,682 buildings were surveyed following consent, of which 3,975 were residential and 707 were classified as establishments (including mixed use). A total of 986 buildings (17 per cent) could not be surveyed. Among the buildings which were not surveyed in PNP, in nearly half the buildings, the door being locked was the main reason for not including in the study, while in a fourth of the buildings, the occupant who was approached stated they were 'not interested'.

Table 1.2: Reasons for not including certain buildings in study				
Households by source of water	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Depleted / abandoned	6	0	11	1
Door locked	1,238	67	492	50
Not interested	260	14	259	26
Others (such as temple and bike stand)	3	0	5	0.5
Under construction	98	5	71	7
Unoccupied	126	7	72	7
Household consent not given	114	6	76	8
Total	1,845	100	986	100
<i>Source: TNUSSP Study, 2018</i>				

In NNP, 3,689 buildings were surveyed following consent, of which 3,432 were residential buildings and 266 were classified as establishments (including mixed use). A total of 1,845 buildings (33 per cent) could not be surveyed, 67 per cent of which was due to door being locked. Further, in 14 per cent of the cases, persons approached were 'not interested'.

The study of all households and establishments using Android APP in the two ULBs of PNP and NNP was conducted between the period February 2018 till May 2018.

In the process of study operations, concurrent back check processes in the study site and from Akara's Chennai office were executed. As regards data back-check process specific to containment-related questions, pointers on consistency of options on containment, verification of information pertaining to containment infrastructure, and cross-verification of presence of man-hole/pipe for access to cleaning was checked on the field.

1.3.3. Study Results

This phase involved four key activities

- Database creation of study and geo-reference data from study
- Preparation of a GIS linked database for the data obtained through primary study
- Preparation of base maps and thematic maps
- Data analysis and reporting

1.4 Challenges and Limitations

- Being a GIS-study, maps are imperative towards conduct of same. Any delay in sharing of TRIPLESAT imagery resulted in repeat checks from desk team at Chennai
- There was no systematic numbering of properties in the region, which posed a difficulty in identification of properties.
- Due to rampant theft in study areas, many respondents did not want to respond to the study.

Key Findings - Households

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2. Key Findings- Households

This chapter discusses the key findings from households in terms of water supply, drainage, toilet arrangements, and containment characteristics.

2.1 Respondent details and Household Typology

In PNP a total of 8,001 households participated in the study while in NNP, a total of 5,449 households participated¹. Of the respondents in PNP, 61 per cent were male, the rest were female, with one person not reporting gender. Majority of the households were male headed households (87 per cent). Of the respondents, 36 per cent were owners and the rest were tenants. Six per cent respondents were between 18-25 years of age, 76 per cent between 26-60 years of age, and the rest over 60 years. The average household size 3.15 members, with 96 per cent of the households having a maximum of 5 members.

Ninety two per cent of the households lived in residential buildings, while 8 per cent lived in mixed use buildings that had both residential and commercial (Table 2.1). Among residential buildings, 87 per cent were plotted housing, 4 per cent were group housing and 22 percent households were in slum housing.

In NNP, 96 per cent of the households lived in residential buildings. 57 per cent of the respondents were males and the rest were females, and 89 per cent reported male headed households. Owners represented 43 per cent of the respondents, while the rest were tenants. Six per cent respondents were between 18-25 years of age, 79 per cent between 26-60 years of age, and the rest over 60 years. Average household size was calculated as 3.41 members, with 95 per cent of the households having a maximum of five members.

Table 2.1: Building typology in PNP and NNP

	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
MIXED-USE	245	4.5	644	8
Residential with Commercial	234	4.3	601	8
Residential with Industrial Goods	9	0	34	0
Residential with public and semi-public	1	0	7	0
Residential with socio-cultural	1	0	2	0
RESIDENTIAL	5,204	95.5	7,357	92
Group Housing	574	11	336	4

¹ One residential building can have more than one household. Hence, the number of households reported here is higher than the number of residential buildings reported in Chapter 1.

Table 2.1: Building typology in PNP and NNP

	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Plotted Housing	4,585	84	6,999	87
Slum Housing	45	0	22	0
Total	5,449	100	8,001	100

Source: TNUSSP Study, 2018

2.2 Potable Water Supply

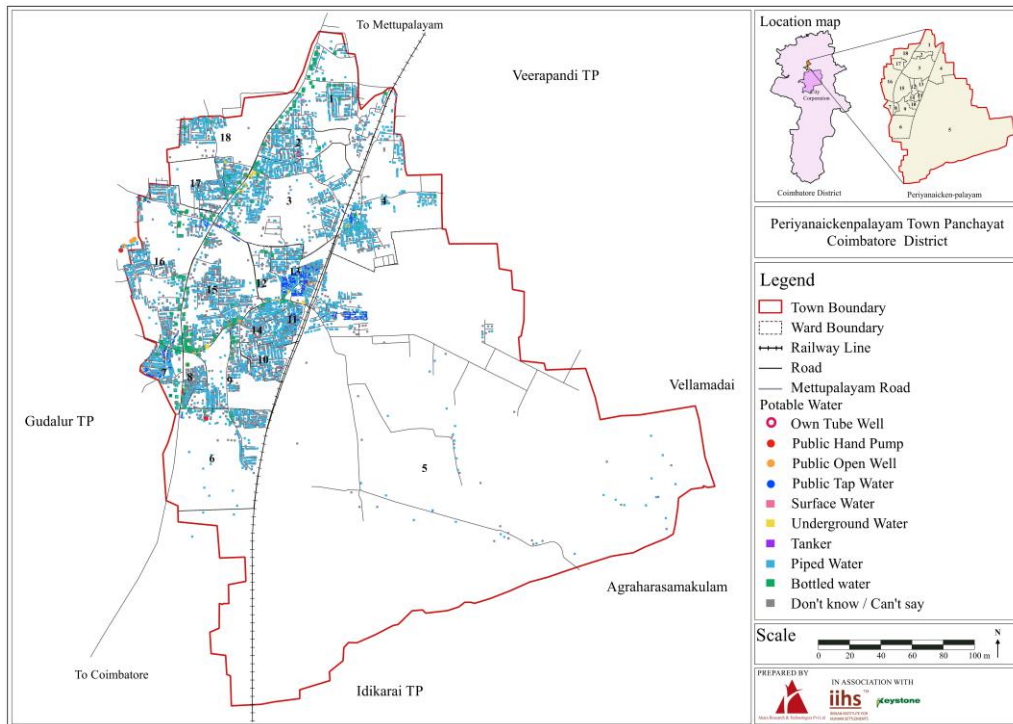
Households were asked about their main source of water for drinking and cooking, and the results are presented in Table 2.2. The predominant source of water in both the PNP and NNP is 'piped water into the dwelling or yard'. In PNP, more than 93 per cent of the households received piped water into their dwelling or yard, while in NNP 80 per cent reported the same. The next most common source was of drinking water was a public water tap, with 6 per cent of the households relying on it in PNP and 15.4 per cent in NNP. Figure 2.1 and Figure 2.2 give a spatial representation of household water supply.

Table 2.2: Household Water Availability in PNP and NNP

Households by source of water	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Only Piped Water into Dwelling/Yard	4,357	80	7,448	93
Piped Water into Dwelling/Yard and Other Sources	130	2.4	58	0.7
Own Hand Pump/Own Tube Well	45	0.8	1	0.01
Public Tap Water	839	15.4	480	6
Others	78	1.4	14	0.2
Total	5,449	100	8,001	100

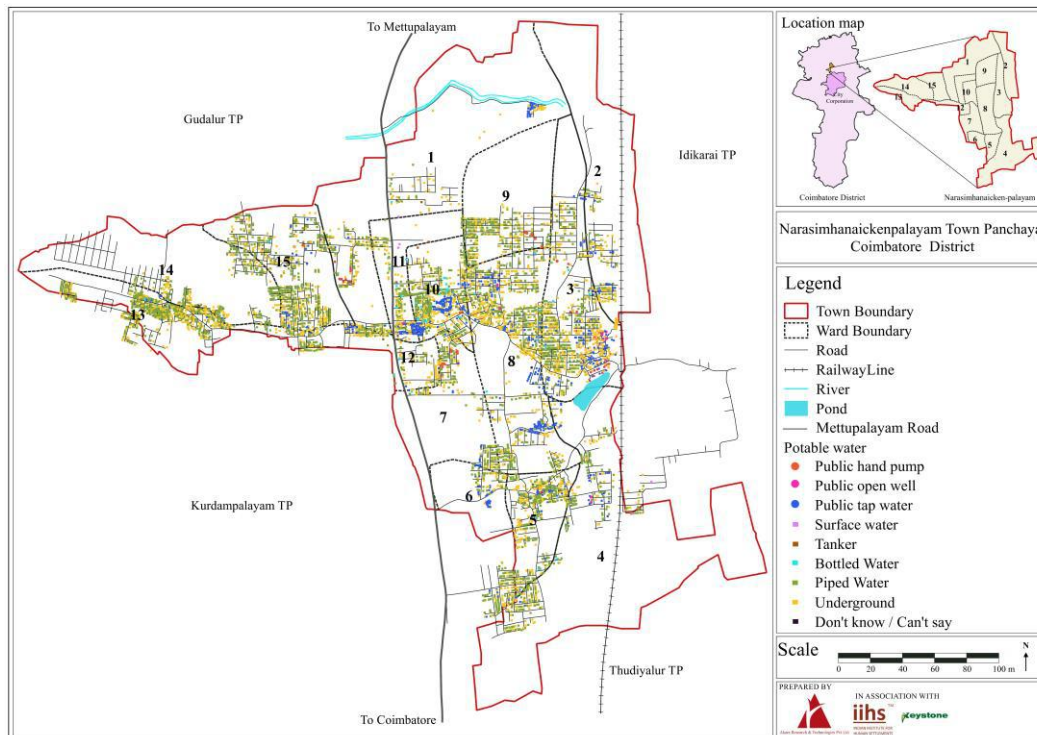
Source: TNUSSP Study, 2018

Figure 2.1 Household Portable Water Supply in PNP



Source: TNUSSP Study, 2018

Figure 2.2: Household Portable Water Supply in NNP



Source: TNUSSP Study, 2018

2.3 Access to Household Toilet

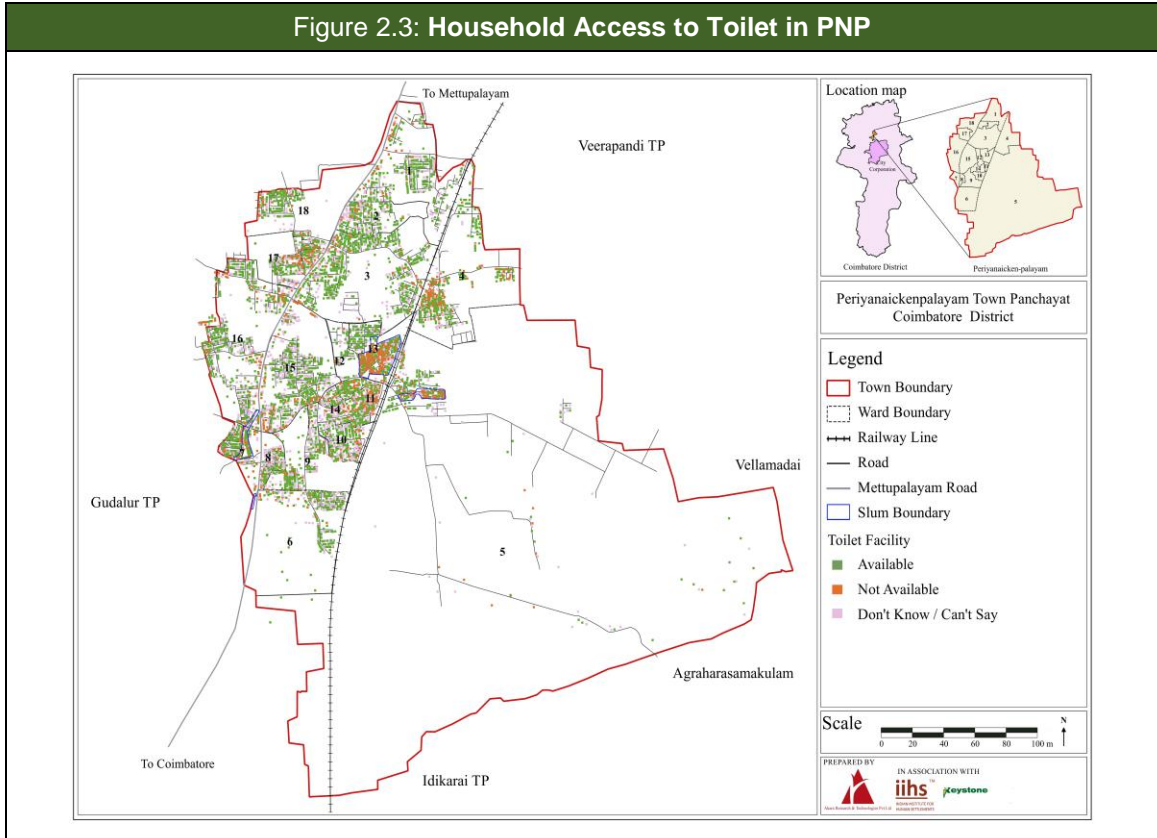
Households were asked if they have access to toilets within their house and details are presented in Table 2.3. Around 88 per cent households in PNP reported access to toilets, of which 80 per cent (6,399 households) had access to toilets within their households. Of the remaining 20 per cent, 34 per cent households reported using toilet 'block toilets' (toilets within the building but outside the house which may be shared with neighbours), 34 per cent reported using community and public toilets, 22 per cent reported using shared toilets, and 9 per cent reported open defecation along with use of community or public toilet. While an overwhelming majority of the households in PNP with toilets used it exclusively, about 2.5 per cent of the households reported sharing the facility with others. Figure 2.3 and Figure 2.4 give a spatial representation of household toilet availability.

Table 2.3: Household access to toilets In PNP and NNP				
Individual Household Toilet – Availability	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Available	4,950	91	7,012	88
Not Available	497	9	989	12
Total	5,449	100	8,001	100

Source: TNUSSP Study, 2018. Toilets in this case includes both household and block toilet used by a for group of households).

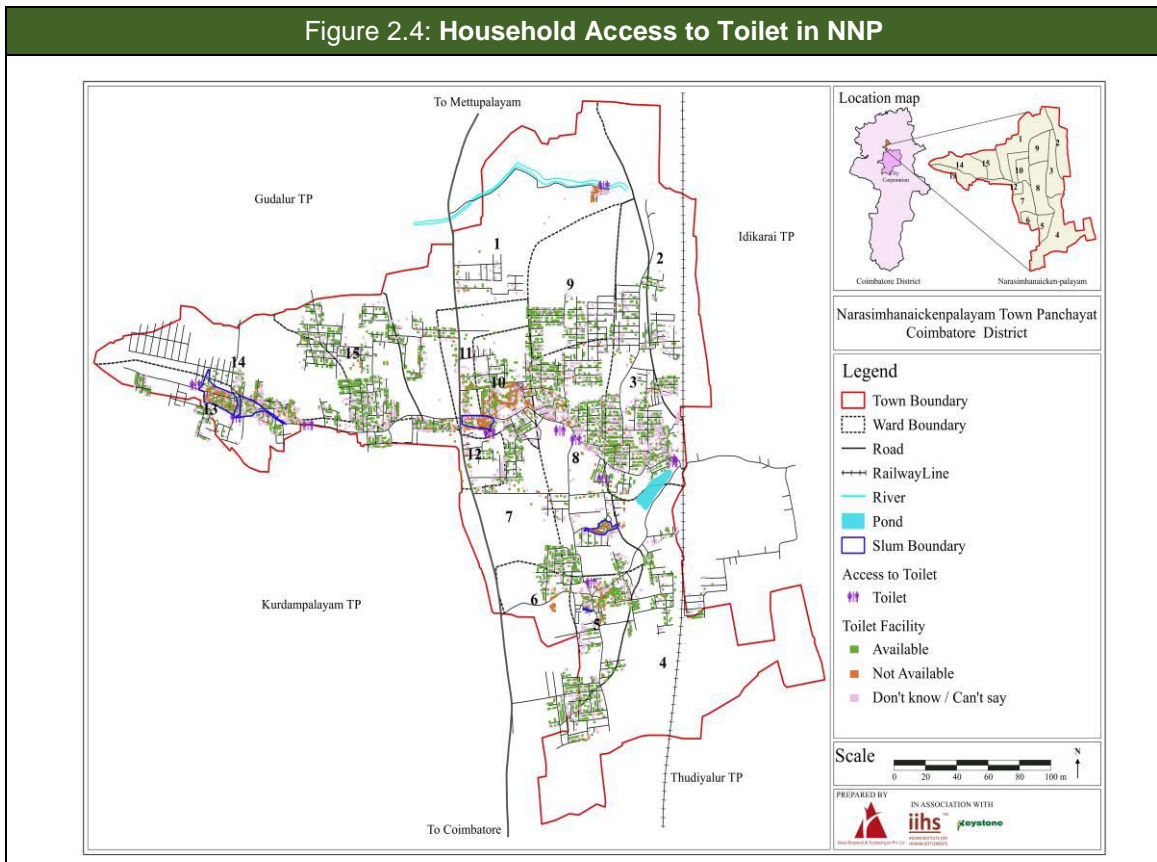
In NNP, 91 per cent of the households reported having access to a toilet - 87 per cent (4,749) access to individual household toilets, and 4 per cent have access to block toilets. Of those households with toilets, just one per cent report sharing it while the rest is for exclusive use. Further, 38 per cent of the households without access to household toilets reported, using public toilets, while 22 per cent of the household's report 'open defecation, while sometimes also using community or public toilets' (Table 2.4). Another 22 per cent of the households' report using 'building toilet' (block toilets), while 13 per cent report using shared toilets (with neighbours and relatives).

Figure 2.3: Household Access to Toilet in PNP



Source: TNUSSP Study, 2018

Figure 2.4: Household Access to Toilet in NNP



Source: TNUSSP Study, 2018

Table 2.4: Defecation pattern of households without access to toilets				
Defecation pattern of households without access to toilets	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Building Toilet	157	22	538	34
Public Toilet	265	38	525	33
Shared Toilet	60	13	349	22
Open defecation along with community toilets, public toilets and building toilet	153	22	147	9
Public toilet along with shared toilets	3	0	31	2
Community Toilet	26	4	12	1
Total	698	100	1,602	100
<i>Source: TNUSSP Study, 2018</i>				

Of the 20 per cent households without household toilets in PNP, in 40 per cent of the cases, there is space available for toilet construction. In the 13 per cent of the households in NNP without household toilets, in 57 per cent of the cases, space is available for construction of individual household toilet.

Of the 1.3 per cent households with children (infants and young child) in PNP, in half the cases, child feces are thrown in garbage, in 34 per cent of the cases, the cloth is rinsed in the latrine or the child uses latrines, and the rest did not respond. The question of infant feces disposal is relevant in 3 per cent of the NNP households. In 43 per cent of the households, infant feces are disposed along with solid waste; in 23 per cent of the cases, it is rinsed in toilet or latrine; in 14 per cent of the cases, cloth is rinsed in drain or ditch and in 10 per cent of the cases, child uses toilet.

2.4 Household Toilet Characteristics

Households were asked specific questions in terms of toilet characteristics such as the year of construction, location, material for roof and wall, type of flushing facility, plan/platform type etc. A third of the households with toilets in PNP did not know the year of toilet construction (Table 2.5). Of the rest, 18 per cent each reported that the toilet was constructed 'over 20 years back', and 'between 10 and 20 years' ago. Only 11 per cent of the households' reported constructing toilets in the five years before the study, between 2014 and 2018.

In NNP, about 27 per cent of the toilets were constructed in the last five years, and 25 per cent have been constructed between '5 and 10 years'. Nine per cent of the toilets were constructed 20 years back, 20 per cent of the respondents did not know when the toilets were constructed.

Table 2.5: Period of construction of Household Toilet				
Households by age of toilet	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
< than 5 years	262	27	672	11
5 - 10 years	318	25	1,270	20
10-20 years	945	20	1,168	18
> 20 years	412	9	1,151	18
Do not know	940	20	2,138	33
Total	4,749	100	6,399	100
<i>Source: TNUSSP Study, 2018</i>				

As regards household toilet location in PNP, around 41 per cent have it 'inside the house/building' in PNP while 35 per cent have it 'outside the house/ building but attached' (Table 2.6). Another 15 per cent report having it 'attached but inside the building, outside the house'. In NNP, about half the toilets are 'inside the house/building'. Further, in 21 per cent of the cases, the toilets are 'outside the house/building but attached' while in 20 per cent of the cases, 'inside the house/building, outside the house but attached'.

Table 2.6: Household Toilet Location				
Households by toilet location	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Inside the House/Building	2,396	50	2618	41
Outside the House/Building but Attached	1,007	21	2230	35
Inside The House/Building, Outside The House/Building but Attached	937	20	976	15
Outside The House/Building but Detached/Stand-Alone	355	7	549	9
Others	54	1	26	0.4
Total	4,749	100	6,399	100
<i>Source: TNUSSP Study, 2018</i>				

The predominant roof material of household toilets in PNP is Reinforced Cement Concrete (RCC) with 85 per cent of the households using it. This was followed by asbestos (13 per cent). Nearly all houses had their toilet wall constructed of 'burnt brick / stone / concrete block'. In NNP, the predominant material used for constructing toilet roof was also RCC (89 per cent), followed by asbestos (10 per cent). Walls of the toilets being constructed are mainly with 'burnt brick / stone / concrete block'.

Table 2.7: Household Toilet Pan Type				
Household Toilet Pan Type	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Squatting Pan With Water Seal Intact – (Indian Toilet)	2,073	44	3,159	49
Squatting Pan (Without Water Seal Intact - Indian Toilet)	270	6	469	7
Squatting Pan and Western Commode (With Water Seal Intact)	1,249	26	1,073	17
Slab with A Hole (Dry Toilet)	335	7	298	5
Western Commode (With Water Seal Intact)	754	16	1,185	19
Others	68	1.4	215	3
Total	4,749	100	6,399	100
<i>Source: TNUSSP Study, 2018</i>				

Around 49 per cent of the individual household toilets have squatting pan (Seal Intact – Indian Toilet) in PNP, while 17 per cent have Indian and western toilet with seal intact (Table 2.7). About 19 per cent of the households have western commode with seal intact, and five per cent have a dry toilet ('slab with a hole'). In terms of flushing options, 58 per cent only have pour flush, 18 per cent each have 'cistern flush' option, 'cistern and pour flush' option, and 5 per cent cases reported 'no flushing required'.

In NNP, 44 per cent of the households have an "Indian squatting pan with seal intact", 26 per cent have 'squatting pan and western closet'; 16 per cent have a western commode; and 7 per cent reported a dry toilet (slab with a hole). Flushing options in NNP include pour flush (48 per cent), cistern flush (15 per cent), cistern and pour flush (26 per cent), and five per cent reported 'no flushing required'.

2.5 Containment Characteristics

Respondents were further asked details of the containment structures toilets were connected. These details included dimensions, wastewater connection and cleaning frequency. Majority of the containments discussed below are exclusively for households, while a few containments are common to the household and block toilets.

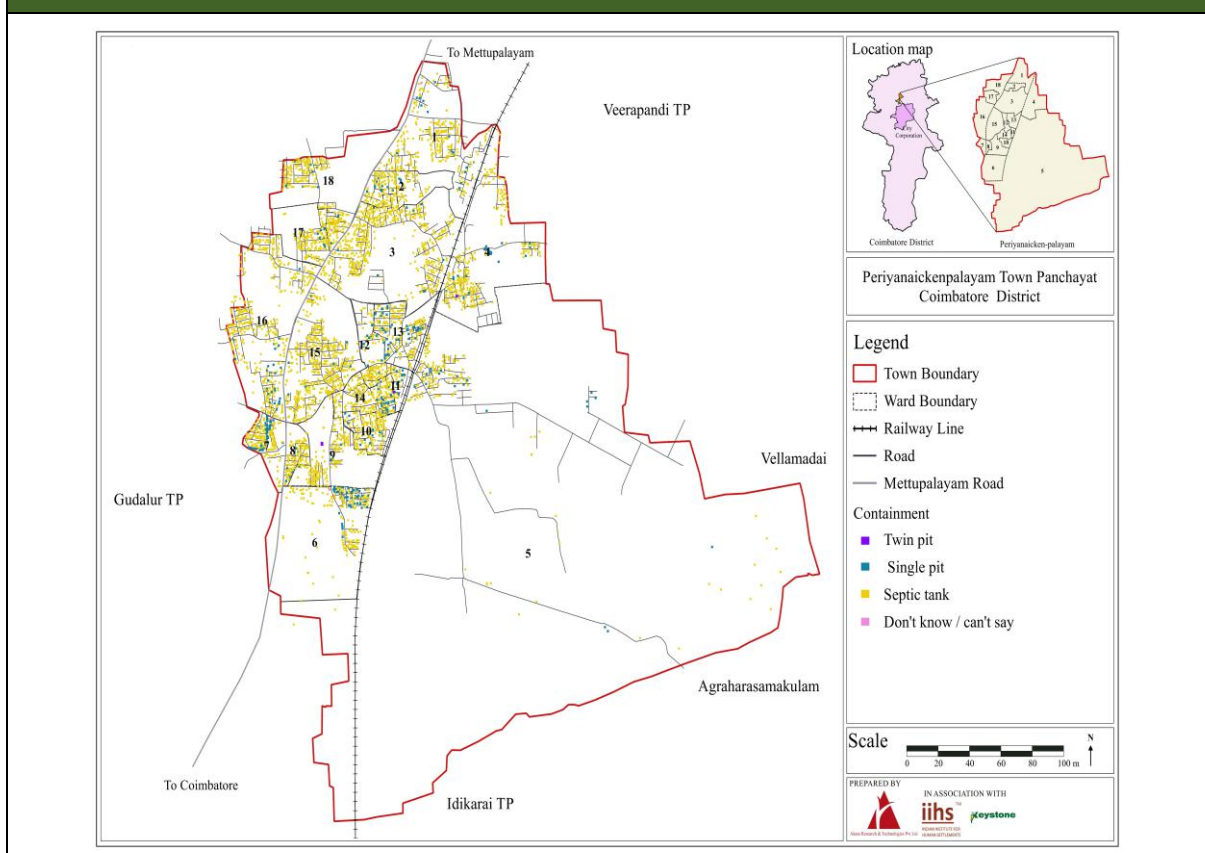
In PNP, of the 6,399 households which report access to toilets, 92 per cent of the households were connected to a septic tank, 7.6 per cent to single pits (Table 2.8). In NNP, in addition to the 4,749 household toilets, containment details of 203 block toilets were also analysed. In NNP, 77 per cent of the toilets were connected to septic tank, 17 per cent to single pits, 0.16 per cent to twin pits, and 0.04 per cent to DEWATS system. Figure 2.5 and Figure 2.6 give a spatial representation of household containment arrangement.

Table 2.8: Containment systems Households Toilets are Connected to in PNP and NNP

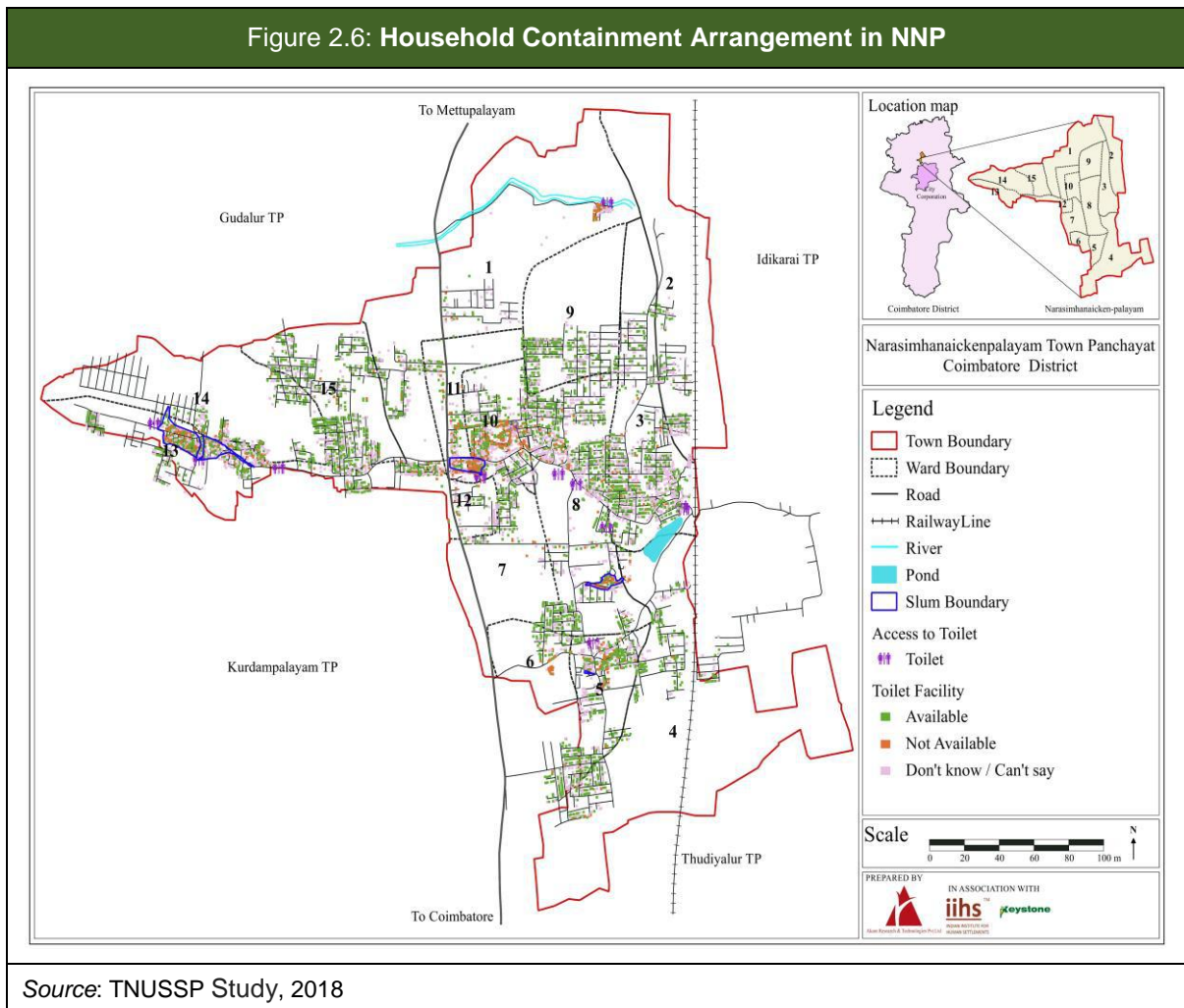
Location of Containment-Grid	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Septic Tank	3,817	77	5,880	92
Single Pit	849	17	485	7.6
Twin Pit	8	0.16	1	0.02
Do not know/ blank	274	5.6	28	0.4
DEWATS system	2	0.04	2	0.03
Drain, water body or hole in the ground	2	0.04	3	0.05
Grand Total	4,952	100	6,399	100

Source: TNUSSP Study, 2018

Figure 2.5: Household Containment Arrangement in PNP



Source: TNUSSP Study, 2018



Respondents were asked the period when containments were constructed (Table 2.9). While in PNP, in a third of the instances, information is not known, in 13 per cent of the cases, it was done less than five years before study, while in 18 percent it was constructed between 5-10 years. In NNP. While information on year of construction of nearly a quarter of containment is not known, 24 per cent are reported to be constructed in the last 5 years, while 23 per cent were constructed between 5-10 years prior to the study.

Table 2.9: Period when Containment was Constructed

Households by age of toilet	NNP		PNP	
	No of Households	Percentage of Households	No of Households	Percentage of Households
< 5 yrs	1,137	24	800	13
5 - 10 years	1,059	23	1,142	18
11-15 years	537	11	675	11
15-20 years	382	8	493	8
> 20 yrs	366	8	1,151	18
Do not know	1,195	26	2,105	33
Total	4,676	100	6,368	100

Source: TNUSSP Study, 2018

The containments in PNP were mainly located either behind the building' (44 per cent), 'in front of the building' (37 per cent) or on the 'side of the building' (9 per cent). In 7 per cent of the cases, it was 'below the pan' (Table 2.10). Similarly, in NNP majority of the containments were located either behind the building (40 per cent) or in front of the building (44 per cent), while 6 per cent of the cases it was 'on the side of the building' and in 4 per cent 'below the pan'.

Table 2.10: Containment Location				
Location of Containment-Grid	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Behind the building	1,863	40	2,797	44
In front of the building	2,065	44	2,367	37
Below the pan / platform	207	4	471	7
Side of the building	431	9	381	6
Along the Road	9	0	50	0.8
Others	1	0	4	0.07
Don't know	100	2	298	5
Total	4,676	100	6,368	100
<i>Source: TNUSSP Study, 2018</i>				

In PNP, 58 per cent of the containments were 'fully lined tanks/ with impermeable walls', while information for 41 per cent of containments was not known (Table 2.11). In NNP, information on lining/ wall was not known in 78 per cent of the cases, while in 20 per cent of containments, they were reported to be 'fully lined tanks/ with impermeable walls'

Table 2.11: Containment Infrastructure				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Full lined tanks/pits with impermeable walls (sealed tanks)	943	20	3,669	58
Holding Tanks/ cesspits (sealed tanks with no outflow)	4	0.1	14	0.2
Lined tanks/pits with precast concrete rings and an open bottom	13	0.3	41	0.6

Table 2.11: Containment Infrastructure				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Lined tanks with precast concrete rings and an open bottom	75	2	61	1
Do not know	3,641	78	2,581	40.5
Total	4,676	100	6,368	100
<i>Source: TNUSSP Study, 2018</i>				

Stone and rubble is the commonly used material (80 per cent) to construct containment walls, followed by burnt brick (9.2 per cent) in PNP (Table 2.12). Other materials reported include RCC rings, pre-cast RCC slabs and plain cement concrete. In PNP, in 47 per cent of the households the walls of the containment system were reported to be plastered.

In NNP, 'stone and rubble' was the most commonly used material for constructing containment walls (73 per cent), followed by RCC in 14 per cent of the cases. Containment walls were reported to be plastered in 45 per cent of the cases.

Table 2.12: Material Used in Containment Walls				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Stone and Rubble	3,390	73	5,082	80
Reinforced Cement Concrete	635	14	209	3.3
RCC Rings	239	5	198	3.1
Burnt brick	193	4	588	9.2
Pre-cast RCC slabs	1	0.02	1	0
Plain Cement Concrete	42	1	63	1
No Material	147	3	193	3
Other	2	0.04		
Don't know	27	1	34	0.5
Total	4,676	100	6,368	100
<i>Source: TNUSSP Study, 2018</i>				

In PNP, brick with cement, brick bats, RCC/ PCC and stone with rubble were the materials used for constructing containment base, as reported in 24 per cent of the cases (Table 2.13). However, in 66

per cent of the cases, 'no material was used,' and in 6 per cent of the cases, information was not known. In PNP, in 16 per cent of the households, the base of the containment system was reported to be plastered. Similarly, in NNP, in two thirds of the cases, 'no material was used' for construction of base, while in 16 per cent of the cases, brick with cement was reported. Containment bases were reported to be plastered in 26 per cent of the cases.

Table 2.13: Material Used in Containment Base				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
No Material	3,094	66	4,396	69
Brick with cement	731	16	601	9
Brick bats or aggregates or sand	237	5	410	6
PCC or RCC	268	6	465	7
RCC			41	1
Stone / Rubble with Cement	152	3	62	1
Others			1	0
Don't know	194	4	392	6
Total	4,676	100	6,368	100

Source: TNUSSP Study, 2018

In PNP, RCC was the most commonly reported material (97 per cent) for constructing top of containment structures (Table 2.14). About 24 per cent of the containment had manhole covers with opening, 70 per cent of the containment had no manhole cover, and in 5.3 per cent of the cases, there was a 'pipe with cap'. In NNP, as well in 94 per cent of the cases, RCC is the most commonly reported material for constructing top of the containment systems. Manhole cover with opening was available in just 26 per cent of the containments, while 58 per cent had no manhole covers, and in 15 per cent of cases, a 'pipe with cap' was available.

Table 2.14: Material Used in Top of Containment				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Reinforced Cement Concrete (RCC)	4,396	94	6,180	97
Pre-cast RCC slabs	85	2	23	0.4

Table 2.14: Material Used in Top of Containment				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Stone slabs	42	1	18	0.3
Metal sheet	13	0.3	7	0.1
Others	8	0.2		
Don't know	132	3	140	2.2
Total	4,676	100	6,368	100
<i>Source: TNUSSP Study, 2018</i>				

In PNP, just 3.2 per cent of the containment had a partition, while about 80 per cent of the structures had no partition, and in rest of the cases, the respondent did not know. Of the households which reported partition, 57 per cent had a single chamber, 30 per cent had three chambers and 13 per cent had two chambers.

In NNP, 15 per cent of the containments were partitioned, of which 83 per cent had single chamber while 14 per cent had two chambers. Majority of the containments (85 per cent) were not connected to any outlet, 7 per cent were connected to open areas/ surface drains and just 4 per cent were connected to soak pits. Also, two per cent of the containments were connected to water bodies and five containments were connected to reed bed/ plants.

2.6 Containment Dimensions

In PNP, dimensions of 28 per cent of the septic tanks was not known (Table 2.15). Of those that were known, 5 to 10 feet was the most commonly reported length (68 per cent), breath (71 per cent) and height (58 per cent) for septic tanks. About 14 per cent of the containments were reported to be between 11-15 feet in depth in PNP. Dimensions of nearly half the single pits was not known (Table 2.16). The most commonly reported diameter of pits was 'less than 5 feet' (34 per cent), while in 16 per cent of the cases, it was between 6 and 10 feet. The commonly reported depth of the pits was '6 to 10 feet', as reported in 40 per cent of the cases.

Table 2.15: Dimensions of Septic tanks in PNP and NNP				
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Length in Feet				
< 5 feet	80	2		
5-10 feet	2,209	58	4,001	68
11-15 feet	130	3	135	2
16-20 feet	23	1	103	2
20+ feet			1	0.02

Table 2.15: Dimensions of Septic tanks in PNP and NNP				
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Don't know	1,375	36	1,640	28
Total	3,817	100	5,880	100
Breadth in Feet				
< 5 feet	444	12	2	0
5-10 feet	1,929	51	4161	71
11-15 feet	49	1	34	1
16-20 feet			19	0.3
20+ feet			1	0.02
Don't know	1380	36	1,629	28
Others - Containment	15	0	34	1
Total	3,817	100	5,880	100
Depth in Feet				
< 5 feet	7	0		
5-10 feet	1,597	42	3,406	58
11-15 feet	856	22	805	14
16-20 feet	3	0	18	0.3
20+ feet			23	0.4
Don't know	1,354	35	1,628	28
Total	3,817	100	5,880	100
<i>Source: TNUSSP Study, 2018</i>				

In NNP, in nearly a third of the containments, the dimensions were not reported. The most commonly reported septic tank dimension was '5 to 10 feet' in terms of length (58 per cent), breadth (51 per cent) and depth (42 per cent). Additionally, in 22 per cent of the containments, depth was reported to be between 5-10 feet. For single and twin pits, the most common diameter was 'less than or equal to 5 feet' (in 43 per cent cases) followed by 6-10 feet (34 per cent). Six to 10 feet was the most common depth (52 per cent), while pits over 10 feet depth are reported in 22 per cent of the cases. Information of dimensions in nearly a fifth of the pits is not known.

Table 2.16: Dimensions of Single and Twin Pits in PNP and NNP

Diameter in Feet				
Dimensions	NNP number	NNP Percent	PNP number	PNP Percent
< or equal to 5 feet	370	43	166	34
6-10 feet	294	34	77	16
10+ feet	2	0	3	1
Don't know	193	23	240	49
Total	857	100	486	100
Depth in Feet				
< or equal to 5 feet	26	3	30	6
6-10 feet	444	52	192	40
10+ feet	199	23	20	4
Don't know	188	22	244	50
Total	857	100	486	100
<i>Source: TNUSSP Study, 2018</i>				

2.7 Emptying

Of the households with containment structures in PNP, only 9 per cent (502 households) reported ever having emptied the structure, 88 per cent reporting not emptying the structure and the rest did not respond. Of these households which report emptying, 80 per cent reported accessing the pit through a removable manhole cover, and in 16 per cent of the cases, there was a slab or cover sealed with mortar that must be broken. Further, in 3 per cent of the cases, there was no access point available and a hole needs be drilled to access the septic tank or pit. Of those who reported cleaning the structure, 84 per cent used the services of private operator, 12 per cent did it themselves, while 4 per cent used a ULB operated truck.

Respondents were asked details of the distance between the septic tank and the nearest access road. In 55 per cent of the cases, the distance was 'less than 10 feet', 40 per cent with distance 'between 10 and 20 feet,' and 5 per cent 'greater than 20 feet'. The access road itself was 'less than 5 feet wide' in 53 per cent of the cases, '5 to 10 feet wide' in 36 per cent of the cases, and 'greater than 10 feet' in 10 per cent of the cases. Respondents were further asked about the distance between the septic tank and the nearest location where a 5000 litre capacity can park. In about half the cases, this distance was 'less than 5 feet', in 35 per cent of the cases, it was between 'five and 10 feet, and over 10 feet in the rest.

When asked about leakages of tank contents while cleaning, in 88 per cent of the cases, no spillage was reported. However, in 10 per cent of the cases, there was unintentional spillage reported from the hose or truck and in 1 per cent of the cases, it was intentionally released from the hose or truck. In about 85 per cent of the cases in PNP, desludging operators did not wash their equipment before leaving, in 13 per cent of the cases, respondents reported that the operators returned the wash water to the septic tank /pit or leach pit.

Of the households who have desludged in PNP, 4 per cent reported paying less than Rs 1000, a third of the households paid between Rs.1,001-2,000, 24 per cent reported paying between Rs.2,001 and

Rs.3,000 and about 21 per cent reported paying between Rs.5,001 to Rs.12,000. The average reported cost was Rs.3,966 with minimum at Rs.300 and maximum at Rs.12,000 (Table 2.17).

Table 2.17: Cost of Desludging in PNP and NNP				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
< Rs. 1000	21	6	22	4
Rs. 1,001-2,000	107	28	159	32
Rs. 2,001-3,000	102	27	119	24
Rs.3,001-5,000	95	25	63	13
Rs.5,001-12,000	35	9	104	21
Don't know	16	4	35	7
Total	376	100	502	100
<i>Source: TNUSSP Study, 2018</i>				

Among the 502 households which reported emptying containments, 23 per cent of the containments had been emptied only once so far, 37 per cent reported that they emptied containments as they fill up, and 3 per cent report emptying every five years (Table 2.18). Of these households which have ever cleaned their tank, 75 per have cleaned in the last five years between 2013 and 2018, while 22 per cent have cleaned it between 5 and 0 years ago.'

Table 2.18: Frequency of Emptying Containments in PNP and NNP				
	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Emptied only once	80	21	113	23
Every year	33	9	12	3
Every two years	23	6	29	6
Every three years	22	6	46	9
Every four years	24	6	48	10
Every five years	14	4	17	3
More than 5 years	78	21	50	10
Emptied as it fills up	102	27	186	37
Total	376	100	502	100
<i>Source: TNUSSP Study, 2018</i>				

Of the houses with containment structures in PNP, just 0.8 per cent (53 households) of the households reported that containment structures had ever overflowed. The often reported causes of overflow include blockage between tank and pit (28 households), rising water table (6 households), or that structures were allowed to become full because of 'lack of money to spend on emptying' the rest did not know the reason for overflow. Of these 53 households which experienced blocks in containment structure, about half of them emptied the tank, 41 per cent attempted to clear the blockage, and the rest did not do anything.

In NNP, of the households with containments, three per cent (146 cases) reported experiencing containment overflow. Reasons for overflow reported include non-availability of desludging operators (23 per cent), blockage between toilet and tank (24 per cent), flooding on account of rising water table (11 per cent), lack of money (4 per cent), while in the rest of the cases, reasons were not known. In two thirds of the cases where containment overflow was experienced, the structure was cleaned. However, 17 per cent reported attempting to clear the blockages themselves, 2 per cent made structural improvements, and in one broke open the septic tank, to release the blockage.

In NNP, just 8 per cent (376 households) report desludging their containments. Of these, 69 per cent have a removable manhole cover, 15 per cent have a slab on top which must be broken, and in 10 per cent there is a pipe with junction through which a hose is inserted. In five per cent of the containments there is no access point. Of those households that report emptying, 81 per cent have done it in the last five years, while 9 per cent have done between 5-10 years. About a quarter of households report cleaning the containment as it fills up, while 21 per cent each report 'cleaning once a year' or 'in more than five years'. Private operators were called to empty the containment in a majority of cases (97 per cent), while in 2 per cent government truck operators were called and, in the rest, respondents reporting cleaning the tank themselves.

In about half the cases in NNP where desludging was done, the distance of the containment to the nearest road was less than 10 feet, in a quarter of the cases, the distance was between '10 and 20 feet', and the rest it was over 20 feet. The width of the nearest access road was 'less than 5 feet' in 35 per cent of the cases, between '5 and 10 feet' in 42 per cent, and more than 10 feet in the rest. The distance between the containment and the nearest place where the desludging truck could park was 'less than 5 feet' in 31 per cent of the cases, '5 to 10 feet' in 40 per cent of the cases, and more than 10 feet in the rest.

In terms of spillage, in 8 per cent of the cases in NNP, there was unintentional spillage reported from the hose or truck, in 76 per cent of the cases there was no spillage reported, and the rest did not know. In about 65 per cent of the cases in NNP, desludging operators did not wash their equipment before leaving, in 9 per cent of the cases, respondents reported that the operators returned the wash water to the septic tank /pit or leach pit. In 4 per cent, they returned the wastewater to the open or closed drain while in two per cent, they were spilled on the surface or open ground.

Of the households which have desludged in NNP, a third of the households paid anywhere between Rs.1,000-2,000, 27 per cent report paying between Rs.2,001 and Rs.3,000 and about 9 per cent report paying between Rs.5,000 to Rs.12,000. Average reported cost is Rs.3,052, with minimum at Rs.250 and maximum at Rs.10,000.

2.8 Black and Greywater Disposal

Households were further asked where the wastewater from their containment structures went (Table 2.19). In PNP, an overwhelming 91 per cent of the households' reported containment structure not being connected to any outlet. Further, 7 per cent reported connecting the containment to surface or open drains, and just 1.7 per cent of the households' report connecting to soak pits or leach pit. Of

those households without pits, in 21 per cent of the cases, there was space available to construct a soak away.

In NNP, 85 per cent of the containments had no outlet. While just 4 per cent are connected to soak or / leach pits, 2 per cent of the containments were reported to be connected to water bodies, and 7 per cent were connected to open areas/surface drains.

Table 2.19: Structures to which Wastewater is Connected to in PNP and NNP				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
No outlet	3,974	85	5,808	91
To open areas/ surface drain	330	7	417	7
To reed bed/plants	5	0.1	14	0.2
To soak/leach pit	207	4	107	1.7
Water Bodies	99	2		
Others			23	0.1
Don't know	61	1	13	0.2
Total	4,676	100	6,382	100
<i>Source: TNUSSP Study, 2018</i>				

Among all the households in PNP, 92 per cent report having a drain in front of the house, 2 per report having a closed drain and 6 per cent have no drain in front of their house. Greywater was predominantly disposed into open drains in front of the house (89 per cent), while 3 per cent directed it to soak pits within their house and an equal per cent used it for plants (Table 2.20).

IN NNP, two thirds of the households had an open drain in front of their house, 8 per cent had a closed drain while 27 per cent had no drain. Greywater was predominantly disposed of in the open drains outside the house (62 per cent), to separate soak pits within the premises (19 per cent) and to septic tanks / pits the houses were connected to (5 per cent).

Table 2.20: Structures to which Greywater is Connected to in PNP and NNP				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
To the drain outside the house	3,357	62	7,111	89
To separate soak-pit within premises	1,052	19	234	2.9
To the pits / septic tanks households are connected to	246	5	107	1.3
To open area outside the house	493	9	198	2.5
To the soak pit along with gardening and drain			80	1.0
To plants within premises along with open drains	182	3	268	3.3
Others	61	1	3	0
Don't know	58	1		
Total	5,449	100	8,001	100
<i>Source: TNUSSP Study, 2018</i>				

2.9 Distance between Water source and Containment Structures

In nearly a third of the households in PNP, the distance between the containment and water was over 20 feet (Table 2.21). However, in 4 per cent of the cases, it was less than 5 feet, in 14 per cent it was between 6 and 10 feet, and in 27 per cent of the cases, it was between 11 and 15 feet. In NNP, in 28 per cent of the households the distance between containment and water source was over 20 feet, while in 22 per cent of the cases it was less than 10 feet, and between 11-15 feet in 23 per cent of the cases.

Table 2.21: Distance between Containment and Water Source in PNP and NNP				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Less than or equal to 5	195	4	277	4
6-10	855	18	873	14

Table 2.21: Distance between Containment and Water Source in PNP and NNP

Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
11-15	1,077	23	1,696	27
16-20	728	16	1,260	20
20-40	1,144	24	2,014	32
40+	187	4	170	3
Don't know	490	10	78	1
Total	4,676	100	6,368	100

Source: TNUSSP Study, 2018

Establishments

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3 Establishments

3.1 Respondent details and Establishment Typology

This chapter discusses aspects such as toilet availability, containment and emptying pertaining to establishments in PNP and NNP.

In PNP, 83 per cent of the respondents were male, while rest were female. Nineteen per cent of the respondents to the study were owners and the rest were tenants. The majority of the establishments were mixed use establishments (51 per cent), 35 were commercial establishments, while others included socio-cultural facility such as community hall and marriage hall, factory and public and semi-public structures such as temples and library (Table 3.1).

In NNP, 74 per cent of the respondents were male, while the rest were female. About three fourths of the respondents to the study were owners and the rest were tenants. In terms of types of establishment, 57 per cent were classified as mixed-use establishments, and 28 per were purely commercial.

Table 3.1: Number and Types of Establishments in PNP and NNP

	NNP number	NNP Per cent	PNP number	PNP Per cent
Commercial	121	28	601	36
Factory	20	5	17	1
Industrial goods	33	8	89	5
Mixed use	248	57	849	51
Public and semipublic structures	7	2	97	6
Socio-cultural facility	4	1	14	1
Don't know	4	1		
Total	437	100	1,667	100
<i>Source: TNUSSP Study, 2018</i>				

The majority of the establishments in PNP and NNP employ between one and ten employees (Table 3.2).

Table 3.2: Establishments by Number of Employees in PNP and NNP

	NNP		PNP	
	No of Establishments	Percentage of Establishments	No of Establishments	Percentage of Establishments
1 to 10	404	92	1,542	93
10 to 20	11	2.5	70	4

Table 3.2: Establishments by Number of Employees in PNP and NNP

	NNP		PNP	
	No of Establishments	Percentage of Establishments	No of Establishments	Percentage of Establishments
20 and above	22	5	46	3
Total	437	100	1,667	100

Source: TNUSSP Study, 2018

3.2 Potable Water Supply

Piped water into dwelling or yard is the main source of water in PNP, with 45 per cent of establishments reporting it (Table 3.3). This is followed by bottled water, which is reported by 42 per cent of establishments. In NNP, around 39 per cent establishments had piped as the drinking water source, followed by bottled water which accounted for 33 per cent.

Table 3.3: Source of Water for Establishments in PNP and NNP

Establishments by source of water	NNP		PNP	
	No of Establishments	Percentage of Establishments	No of Establishments	Percentage of Establishments
Piped Water Into Dwelling/ Yard	170	39	753	45
Public Tap Water	44	10	45	3
Bottled Water	143	33	695	42
Others/Multiple Sources	75	17	170	10
Don't know	5	1	4	0.23
Total	437	100	1,667	100

Source: TNUSSP Study, 2018

3.3 Access to Toilets in Establishments

In PNP 67 per cent of the establishments have access to toilets - while 25 per cent report access to individual toilets, 42 per cent have access to shared toilets (Table 3.4). For those establishments without access to individual toilets, space was available in 11 per cent of the cases for construction. Among existing toilets, information on year of construction was not known in nearly 46 per cent of cases, while 30 per cent of the toilets were constructed in the last 10 years. Nine per cent reported toilets more than 20 years old. Fifty-two per cent toilets were 'located outside the building but attached', 27 per cent are 'inside the building' and 17 per cent are 'inside the building, outside the house but attached'. RCC is main the most commonly used material for toilet roof construction (79 per cent), followed by asbestos (20 per cent), while brick/stone/concrete block was the main material for

constructing walls. Squatting pans were the most commonly used pan type (65 per cent – with or without seal intact), followed by western commode (16 per cent). Pour flush was most commonly used flush type (66 per cent), followed by cistern flush (16 per cent). Almost all toilets were connected to either septic tank (95 per cent) or single or twin pit (4 per cent).

Table 3.4: Access to Toilets in Establishments in PNP and NNP

Establishments by availability of toilets	NNP		PNP	
	No of Establishments	Percentage of Establishments	No of Establishments	Percentage of Establishments
Available	272	62	1,128	67
Not Available	165	38	539	33
Total	437	100	1667	100

Source: TNUSSP Study, 2018

In NNP, toilets were available in 63 per cent of the establishments (30 per cent individual toilets and 33 per cent block toilets). Among those establishments without toilet, space for toilet construction was available only in 14 per cent cases. Information on the year of toilet construction was not available in 70 per cent of the cases, a third of the toilets were constructed in the last five years, 20 per cent 'between 5 - 10 years', 13 per cent 'between 11-15 years', 7 per cent are 'over 20 years old'. In terms of location, 34 per cent were located inside the building, 36 per cent were 'located outside the building but attached' and 22 per cent are 'outside the house/ building but stand-alone structures'. RCC was the most commonly used material for roof (76 per cent) followed by asbestos (23 per cent), while walls were all made of 'burnt brick/stone/concrete block'. Squatting pan was predominant pan type reported in 81 per cent of the establishment toilet (with or without water seal intact). Equally, in 78 per cent of the cases, pour flush was used while in 9 per cent cistern flush is used. Toilets were connected to either septic tank (76 per cent) or single (17 per cent) or twin pit (1 case).

3.4 Containment Characteristics

Of the 412 unit toilets in PNP, 410 were connected to septic tank / single pit/ twin pit (99 per cent). The 392 septic tanks also include 88 block toilets connected to them (Table 3.5). In NNP, 182 of the 437 establishments toilets were connected to septic tank (149), single pits (32) and twin pits (1). This includes 121 containments connected to unit and block toilets, and 61 containments connected only to block toilets.

Table 3.5: Containment Arrangement in Establishment Toilets in PNP and NNP

Location of Containment-Grid	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Septic Tank	149	82	392	95
Single Pit	32	17.5	17	4
Twin Pit	1	0.5	1	0

Table 3.5: Containment Arrangement in Establishment Toilets in PNP and NNP				
Location of Containment-Grid	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Don't know			2	0
Total	182	100	412	100
<i>Source: TNUSSP Study, 2018</i>				

The year of construction for about 42 per cent of the containment structures was not known. About 15 per cent have been constructed in the last five years, 11 per cent in the last five to ten years, 12 per cent in the last 11 to 15 years, and 12 per cent over 20 years old.

Septic tanks /pits were reported to be fully lined (with impermeable walls) in 65 per cent of the cases, while in 33 per cent of cases information was not known about tank/ pit infrastructure. Pre-cast concrete rings were used in one instance while in two instances they were designed as holding tanks. Containment walls were made of 'stone or rubble' (81 per cent), burnt brick (9 per cent) or RCC (3 per cent). Walls were plastered in 56 per cent of the containments, while in 41 per cent they were not. The base was comprised of just ground in 59 per cent cases, implying that the containments were porous structures. Others reported using brick with cement (22 per cent cases), brickbats /sand / aggregates (5 per cent), RCC (3 per cent), or stone rubble with cement (1 per cent) to build the base of containments. The base was reported to be plastered in 22 per cent of the cases, while it was not plastered in 69 per cent, and information was not known in 9 per cent cases. In 95 per cent of the containments, the top was made of RCC.

In PNP, only 24 per cent of the containments had an open manhole for cleaning, while 70 per cent didn't have one. In 5 per cent of the cases, pipe with cap was available.

Nearly 10 per cent of the tanks were reported to be partitioned, with 63 per cent having one chamber, 32 per cent having two chamber and 32 per cent having three chambers.

In 91 per cent of the cases, the wastewater had no outlet. In only two per cent of the cases, containments were connected to a soak pit, while in 5 per cent of the cases, they were connected to open/surface drains. In 16 per cent of the cases, there was space available to construct a soak pit.

In NNP, the year of construction of a third of containments attached to establishments was not known. Of the rest, 14 per cent were constructed in the five years prior to study, 20 per cent between 6 and 10 years, and 15 per cent were constructed over 20 years back.

Nearly half of the containments were located behind the building, 20 per cent in front of the building, and 13 per cent on the side of the building.

Of the containments in NNP, 20 per cent were fully lined tanks/pits (sealed tanks), while two were lined with precast concrete rings, and one was lined with honeycombed walls with open bottom. Walls of the containments were mainly made of stone or rubble (77 per cent), followed by RCC /RCC rings (13 per cent), and burnt brick (6 per cent).

Walls were plastered in 33 per cent of the containments. In two thirds of the containments, no material was used for the base, while brick with cement was used in 13 per cent of the cases and PCC or RCC was used in 12 per cent cases. In 96 per cent of the cases, the top of the containment is made of RCC. In 38 per cent of the cases, there is 'no manhole', while in 35 per cent there was a manhole opening with cover', and 25 per cent of the cases had a pipe with cap is available. In 17 establishments containments are partitioned with two chambers (15 cases). In 80 per cent of the cases, the wastewater had no outlet, although in 28 per cent of the cases space was available for constr.

3.5 Containment Dimensions

In PNP, information on the dimensions of 37 per cent of septic tanks was not known (Table 3.6). Of the rest, 5 to10 feet was the most commonly reported length (50 per cent), breadth (56 per cent) and depth (35 per cent). Of the 18 single and twin pits in PNP, information on ten was not known. Of the rest, two have a diameter and depth less than 5 feet, while the remaining five have diameter and depth between 5-10 feet.

In NNP, information on dimensions of 28 per cent of the septic tanks is not known (149 septic tanks). Of the rest, 5 to10 feet was the most commonly reported length (54 per cent), breadth (56 per cent) and depth (48 per cent) in septic tanks. Further, in 23 per cent of the cases, a depth of 11 to 15 feet was reported. Of the single pits and twin pits , the most commonly reported diameter was up to 5 feet (52 per cent), followed by 6-10 feet (36 per cent). The most commonly reported depth is 6-10 feet (52 per cent), while in 21 per cent of the cases, depth was between 11-15 feet and in 15 per cent of the cases, it was less than 5 feet.

Table 3.6: Dimensions of Septic tanks in Establishments In PNP and NNP				
	NNP number	NNP Percent	PNP number	PNP Percent
Length in Feet				
< 5 feet	1	1		
5-10 feet	81	54	196	50
11-15 feet	12	8	31	8
16-20 feet	13	9	15	4
20+ feet			4	1
Don't know	42	28	146	37
Total	149	100	392	100
Breadth in Feet				
< 5 feet	10	7		
5-10 feet	84	56	219	56
11-15 feet	3	2	7	2
16-20 feet			10	3
20+ feet			2	1
Don't know	10	7	146	37

Others – Circular	42	28	8	2
Total	149	100	392	100
Depth in Feet				
< 5 feet				
5-10 feet	71	48	136	35
11-15 feet	34	23	83	21
16-20 feet	1	1	9	2
20+ feet				
Don't know	43	29	164	42
Total	149	100	392	100
<i>Source: TNUSSP Study, 2018</i>				

3.6 Emptying

Only 7 per cent of the containments in PNP had ever been emptied. Of these, in 69 per cent of the cases, there was a removable manhole cover, a breakable slab in 28 per cent cases, and no access point in one case. Of the 29 containments that had been cleaned in the last ten years, 18 were cleaned by private operators, seven by government trucks, and three by the respondents themselves. Vehicles were reported to access nearby areas to clean the containment. The width of the nearest access road was less than 5 feet in 22 cases, between 5 and 10 feet in two cases and greater than 10 feet in five cases. The distance between the tank and the nearest parking location of the truck was less than 5 feet in 22 of the 29 instances where containment was cleaned, and greater than 10 feet in six instances. In PNP, only 5 of the 410 containments had overflowed for reasons including block between toilet and tank, rise in water table. Respondents either cleaned the tank or got it emptied.

While no spillage was reported in majority of the cleaning instances, in four cases there were unintentional leakage. In five of the 29 cleaning instances, desludging operators were reported to have washed the equipment and returned the washed water to the tank, while in 23 cases washing of equipment was not done. Frequency of cleaning was based on tank filling up in nearly 50 per cent of the cases, while in 7 instances, they have been cleaned only once. Cost of desludging ranged between Rs.600 to Rs.10,000, with three fourths of the respondents paying less than Rs.6,000 per cleaning.

In NNP, 17 per cent (31) of the containments were reported to have been emptied, in all cases by private desludging operators. In 21 cases, there was removable manhole cover, in six cases there was a pipe with a junction that the hose can be inserted into. In one case, the slab had to be broken open and three had no access at all, necessitating drilling of a hole. Two thirds of the containment emptied were done in the last five years, while the rest were done between 6 and 10 years. The width of the access road was between 5 and 10 feet in 14 instances, followed by greater than 10 feet (10 cases) and less than 5 feet (7 cases). The distance between the containment and the place where trucks can park, was between 5 and 10 feet in 38 per cent of the cases, greater than 10 feet in 33 per cent of the cases. In five of the 31 instances of cleaning, there was spillage from the hose or truck which was unintentional. In 5 instances, equipments' were washed and returned to either septic tanks or leach pit, or to the closed drain.

About half the containments were emptied as they fill up, while in the rest of the cases they were emptied once a year (8 cases), more than 5 years (4 cases), and once in 5 years (2 cases). Cost of desludging ranged between Rs.1,000 to Rs.8,000 with 83 per cent of the respondents paying less than Rs.6,000 per cleaning. In NNP, 15 per cent (26 cases) of the containments had overflowed on account of non-availability of desludging services (6 cases), blockage between toilet and tank/overflowing storm water drain (11 cases) and rising water table (1 case).

3.7 Greywater and Blackwater Disposal

In PNP, 86 per cent of the establishment had an open drain next to their house, while about 7 per cent had no drain, and an equal per cent had a closed drain near their house.

In NNP, about half the establishments had an open drain next to them, while 30 per cent had no drain and the rest have a closed drain.

In PNP, in two thirds of the establishments, greywater was disposed off in the open drain, while in 15 per cent of the cases, it was disposed of in open area outside the house (Table 3.7). In just 2 per cent of establishments, greywater was connected to separate soak pits and leach pits within premises, while in 1 per cent of the cases, it was connected to septic tanks and single pits. 2 per cent establishments directed greywater to plants within premises.

In NNP, in nearly 40 per cent of the cases, greywater was connected to the drain outside the house, in 18 per cent to open area outside the house, in 6 per cent each to separate soak pits within premises, and to septic tanks toilets are connected to.

Table 3.7: Disposal of Greywater in Establishments in PNP and NNP

Establishments by let-off of grey water	NNP		PNP	
	No of Establishments	Percentage of Establishments	No of Establishments	Percentage of Establishments
To the drain outside the house	170	39	1,101	66
To separate soak-pit/leach-pit within premises	25	6	37	2
To the septic tank that toilets are connected to	26	6	25	1
To open area outside property	79	18	243	15
To plants within premises	5	1	34	2
Combination of all responses above	15	3	47	3
Others	68	16	135	8

Table 3.7: Disposal of Greywater in Establishments in PNP and NNP				
Establishments by let-off of grey water	NNP		PNP	
	No of Establishments	Percentage of Establishments	No of Establishments	Percentage of Establishments
Don't know	49	11	45	3
Total	437	100	1,667	100

Source: TNUSSP Study, 2018

Wastewater from containments are not connected to any outlet in 91 per cent of the cases in PNP, while in 5 per cent of the cases, they are connected to open drains (Table 3.8). Similarly, in NNP, in 80 per cent of the cases containments are not connected to any outlet, while in 5 per cent of the cases, they are connected to open drains. In three instances, they are also reported to be connected to water bodies.

Table 3.8: Structures to which Wastewater is Connected to in PNP and NNP				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
No outlet	146	80	373	91
To open areas/ surface drain	25	14	22	5
To reedbed/plants				
To soak/leach pit	4	2	10	2
Water Bodies	3	2		
Others	1	1		
Don't know	3	2	5	1
Total	182	100	410	100

Source: TNUSSP Study, 2018

3.8 Distance between Water Source and Containment

In PNP, the distance between the containment and water source in the establishment premises as between '20 and 40 feet in 23 per cent cases, over 40 feet in 24 per cent of the cases, and between '11 and 15 feet in 25 per cent cases (Table 3.9). In 4 per cent of the cases, it was less than or equal to 5 feet, and between 6 and 9 feet in 8 per cent cases.

In NNP, in a third of the cases distances between containment and water source was between 20-40 feet, while in 15 per cent it was between 6 and 10 feet, and in 5 per cent of the cases it was less than or equal to 5 feet.

Table 3.9: Distance between Containment and Water Source in PNP and NNP				
Location of Containment	NNP		PNP	
	Number of Containments	Percentage of Containments	Number of Containments	Percentage of Containments
Less than or equal to 5 feet	9	5	17	4
6-10 feet	28	15	31	8
11-15 feet	31	17	101	25
16-20 feet	11	6	59	14
20-40 feet	62	34	93	23
40+ feet	18	10	98	24
Don't know	23	13	11	3
Total	182	100	410	100
<i>Source: TNUSSP Study, 2018</i>				

Conclusions

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4 Conclusions

The sanitation mapping of the two-town panchayat reveals several deficits across the sanitation chain which needs to be addressed.

4.1 Access to Toilets

In PNP, about 80 per cent of the households reported access to toilets while in NNP, 87 per cent of the household reported having access to individual toilets. Of the 20 per cent households without household toilets in PNP, in 40 per cent of the cases, there was space available for toilet construction. In the 13 per cent of the households in NNP without household toilets, in 57 per cent of the cases, space is available for construction of individual household toilet. Means of leveraging the funds from Swacch Bharat Mission to support these households to gain access to toilets needs to be explored. Similarly, in establishments, for those without access to individual toilets, space is available in 11 per cent of the cases for construction in PNP and in 14 per cent cases in NNP.

4.2 Containment Characteristics

In PNP, 92 per cent of the households are connected to a septic tank, and 7.6 per cent report connecting toilet to single pits. In NNP, 77 per cent of the toilets are connected to septic tank while 17 per cent are connected to single pits, while few are connected to twin pits (8) and DEWATS system (2).

According to Indian Standard Code of Practice for Installation of Septic Tanks (IS 2470 part 1 – 1985), for up to five users, the septic tank size should be of 5 feet length, 5 feet breadth and 3.3 feet deep (41.25 cubic feet). In reality the average containment size in PNP is 567 cubic feet with an average family size of 3.15 members. Similarly, in NNP, the average containment size in NNP is 606 cubic feet with an average family size of 3.41. Thus, containments in both PNP and NNP are oversized.

According to Indian Standards (IS), a septic tank is a 'watertight single storey tank in which sewage is retained sufficiently long to permit sedimentation'. Typical characteristics include presence of an inlet and outlet pipe, baffle wall, access to each compartment with cover and lifting device and air vents. Further, the floor of the septic tank should be watertight, and wall should be plastered. Also, effluent from a septic tank should not be allowed into open channel drain without adequate treatment. Overflows to soak away structures need to provide a form of subsoil infiltration.

The details of the household containment structure available in PNP and NNP reveal that they lack features of a safe containment as specified in the standards. Importantly, tanks are fully lined/impermeable walls in just 58 per cent of the containments in PNP and 20 per cent in NNP. Two thirds of the containment bases are made of 'no material' which essentially means that they are not watertight structures. In PNP, just 3.2 per cent of the containments are partitioned while in NNP, 15 per cent are partitioned. In PNP, 70 per cent of the containment had no manhole cover while in NNP, 58 per cent of the containments have no manhole cover. Wastewater from containments have no outlet in 91 per cent of the cases in PNP, and 80 per cent in NNP. Containment characteristic in establishments follow a similar pattern.

Given that the study has specific GIS based information on containment locations, ways of improving containment safety should be explored.

4.3 Emptying

As per Central Public Health and Environmental Engineering Organisation (CPHEEO) norms septic tanks need to be cleaned periodically at an interval of 2-3 years. In PNP, 9 per cent of the households report ever having desludged their containments, just 8 per cent report desludging their containments in NNP. Similar percentage for establishments in PNP and NNP are 7 per cent and 17 per cent respectively. While desludging vehicles have gained access to containments, of particular concern is the lack of manhole cover on top containments which makes access difficult. Given that containment tops are mainly made of RCC, this necessitates breaking open the structures for desludging, which increases risk of injury to the worker, besides increasing cost and time of desludging. This aspect needs to be addressed in steps taken to address sanitation deficits.

4.4 Distance between Containment and Water Source

In nearly a third of the households the distance between containment and water source was over 20 feet in PNP. However, in 4 per cent of the cases, it was less than 5 feet, in 14 per cent it was between 6-10 feet, and in 27 per cent of the cases, it was between 11-15 feet. In NNP, in 28 per cent of the households the distance between containment and water source was over 20 feet, while in 22 per cent of the cases it was less than 10 feet, and between 11-15 feet in 23 per cent of the cases.

As per IS, the safe distance between the containment and water source is based on groundwater level. If the vertical distance between the bottom of the soak pit and maximum groundwater level throughout the year is 6 feet and 7 inches or more, then the soak pit should be located at a minimum distance of 9 feet and 11 inches from the potable water source. If the vertical distance between the bottom of the soak pit and maximum groundwater level throughout the year is less than 6ft and 7 inches, then the soak pit should be located at a min distance of 33 feet from the potable water source.

The maximum depth of the containment structures in PNP is 30 feet (household) and 40 feet in case of establishments, and 20 feet in NNP both for households and establishment. Given that groundwater depth for both PNP and NNP is over 90 feet², safe distance between containments and water source seems to be maintained³.

² Tamil Nadu Public Works Department

³ Indian Standard Code of Practice for Sanitation with leaching pits for rural communities – IS: 12314-1987

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Annexures

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Annexure 1: Topography of PNP and NNP

This annexure presents maps from survey of properties, utilities and other infrastructure of PNP and NNP.

Figure A1.1 and A1.2 present the road network map of PNP and NNP respectively along with details of key landmarks in the two town panchayats such as post office, school, hospital, park etc.

Figure A1.3 and A1.4 present the building height map of PNP and NNP respectively. Of the total 4,682 buildings surveyed in PNP, 68 per cent have only ground floor, 29 per cent have first floor, 2 per cent have second floor and 0.3 per cent have third floor. Of the total 3,698 buildings surveyed in NNP, 76 per cent have only ground floor, 23 per cent have first floor, 1 per cent have second floor and 3 buildings have third floor.

Figure A1.5 and A1.6 present the building roof types of PNP and NNP respectively. Of the 4,682 building, 78 per cent of the roofs are reported to be made of reinforced Cement Concrete (RCC), 13 per cent with earthen tiles and 8 per cent with asbestos sheet. Of the 3,698 building in NNP, 80 per cent report having RCC roofs, 12 per cent have roofs made of asbestos and 6 per cent have used earthen tiles.

Figure A1.7 and A1.8 present the building use types of PNP and NNP respectively as does Table 2.1. Of the 4,682 building, 85 per cent are used as residential buildings, 7 per cent are 'mixed-use' buildings and 5 per cent are commercial. Of the 3,698 building in NNP, 93 per cent is used for residential purpose, four per cent is used as 'mixed-use', and 2 per cent is used for commercial purpose.

Table A1.1: Building Use Type				
Households by source of water	NNP		PNP	
	No of HHs	Percentage of HHs	No of HHs	Percentage of HHs
Commercial	62	2	212	5
Factory	15	0.4	14	0
Industrial Goods	28	1	72	2
Mixed use	150	4	345	7
Public/semi-public	7	0.2	53	1
Residential	3432	93	3975	85
Socio-cultural facility	4	0.1	11	0
Total	3,698	100	4,682	100

Source: TNUSSP Study, 2018

Figure A1.9 and A1.10 presents the public water supply map of PNP and NNP respectively. PNP has 7 overhead tanks of which just five are in use. Four of them have a total capacity of 1.74 million litres. Also, there are 41 borewells which are in use and five open wells which are not in use. Further, there are 4 water access points which are all in use. In NNP there are 21 overhead tanks of which just 12 are in use. Also, there are 31 borewells which are in use and six open wells which are not in use. Also, there are 46 water access points (mainly site tap) which are all in use.

Figure A1.11 and A1.12 present the storm water drain map of PNP and NNP respectively. In PNP and NNP, streams originating from the Kurudi Hills form most of the natural drainage in this area. River Kousika, is one of the main natural drains for both town panchayats. The Perumpallam Odai is the other main natural storm water drain which passes through PNP, which flows north through the towns of Veerapandi and Karanadai and and finally joins the Bhavani Sagar dam. In NNP, there is another main natural storm water drain which joins River Kousika just beyond the border of the town in the east, near Idikarai town.

Figure A1.13 and A1.14 shows the public sanitation arrangements in PNP and NNP. PNP has 12 community toilets and 1 public toilet, out of which one community toilet is in disuse. NNP has 11 community toilets and 1 male urinal of which four community toilets are in disuse.

Figure 1.15 and 1.16 presents the solid waste management sites of PNP and NNP. In PNP, there are three permanent solid waste co-composting sites, while one proposed fecal sludge treatment plants is under construction. In NNP, there are two solid waste co-composting sites and one solid waste segregation side, all three of which are temporary.

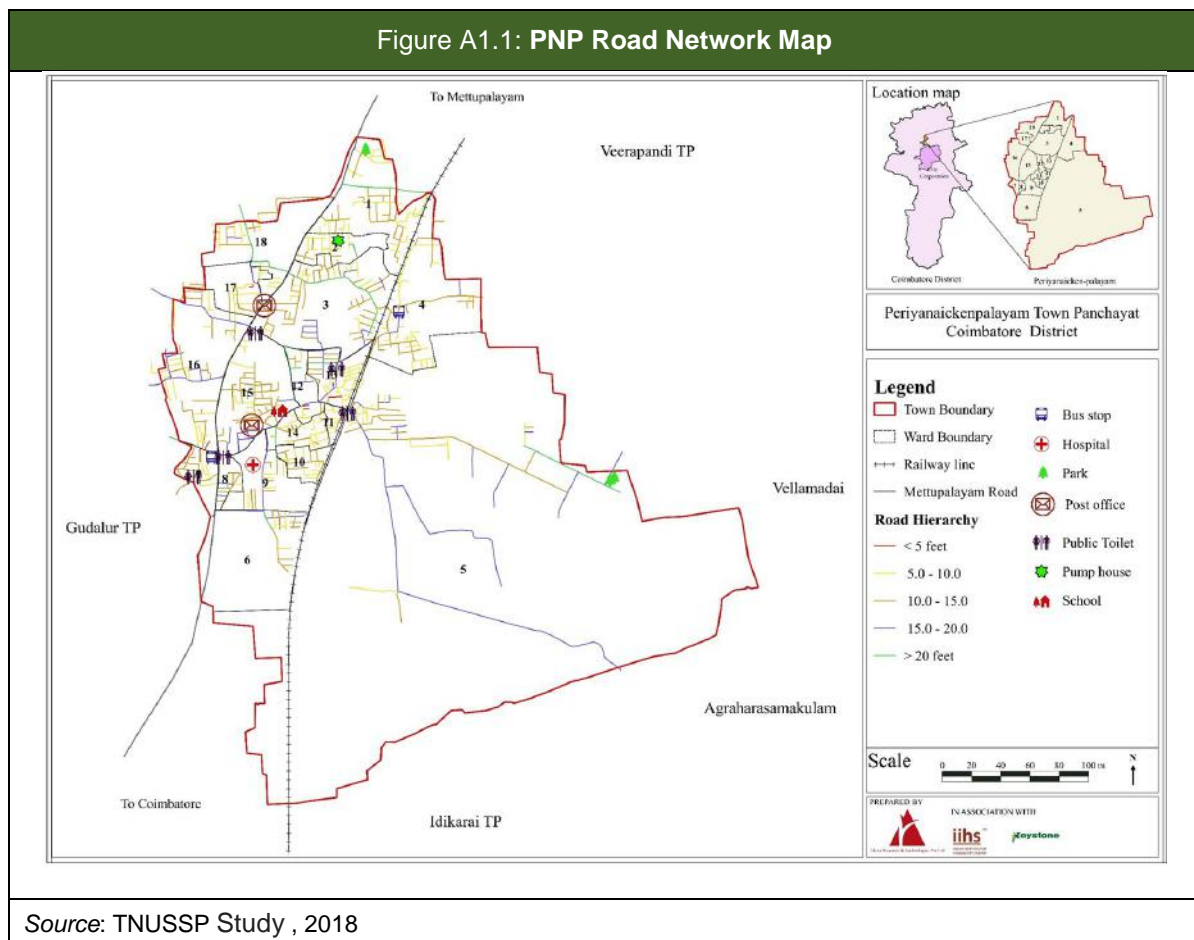
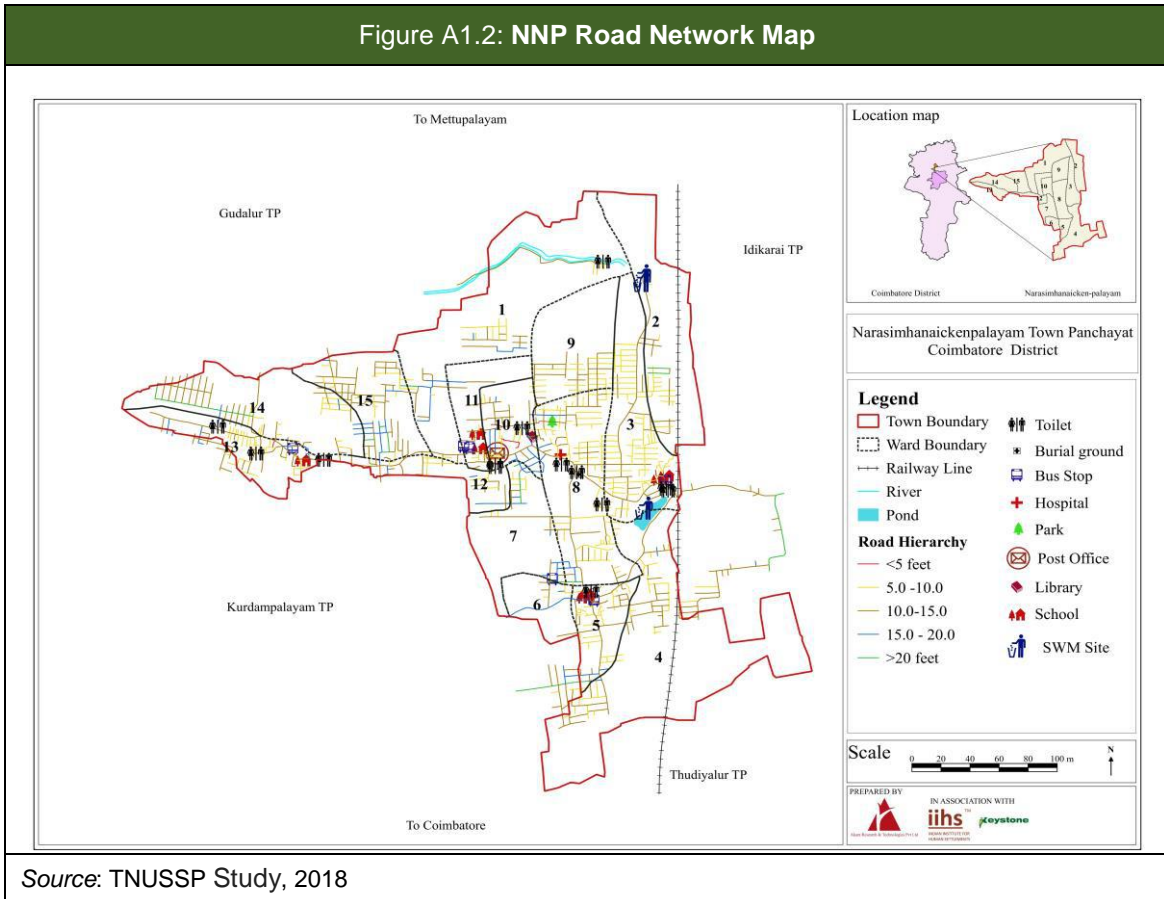
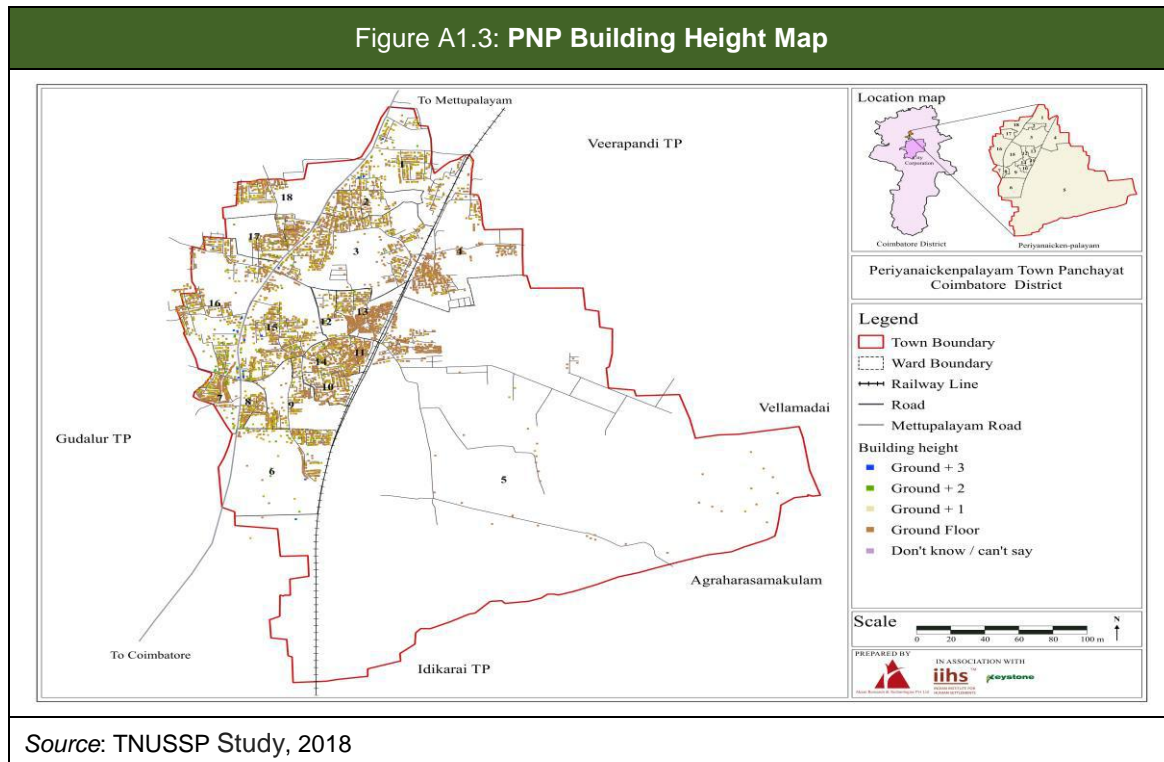


Figure A1.2: NNP Road Network Map



Source: TNUSSP Study, 2018

Figure A1.3: PNP Building Height Map



Source: TNUSSP Study, 2018

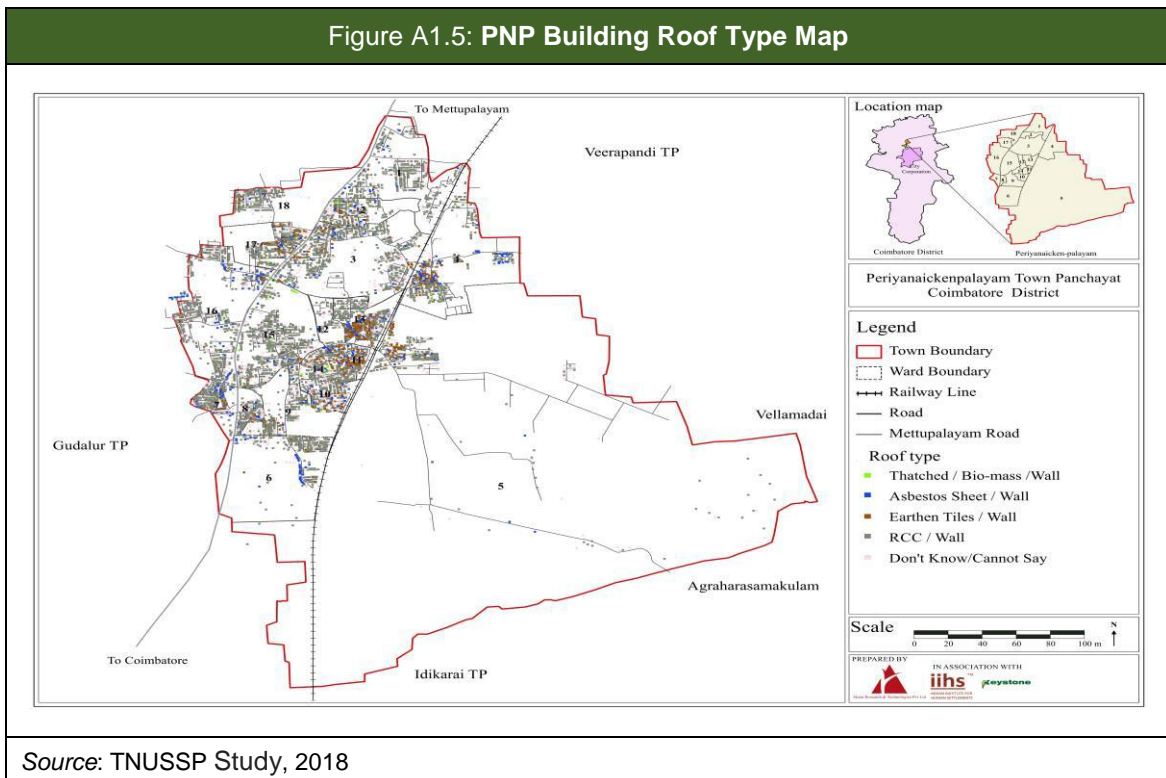
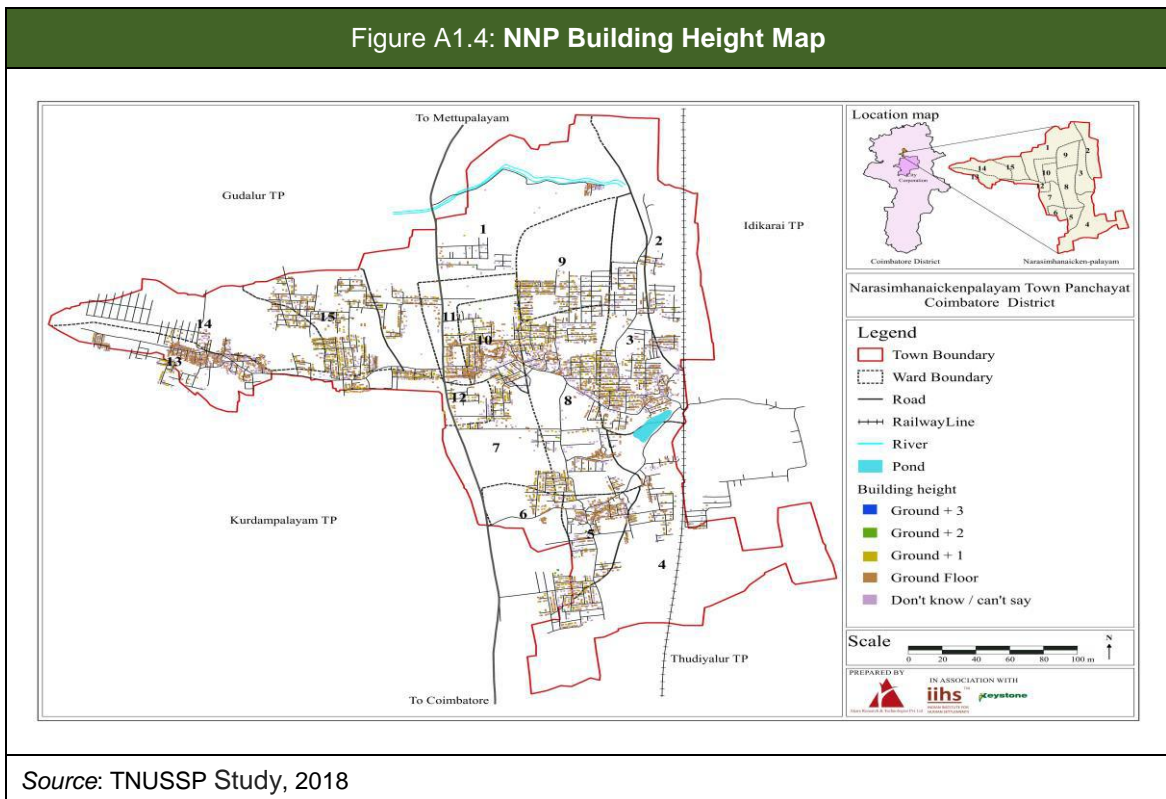


Figure A1.6: NNP Building Roof Type Map

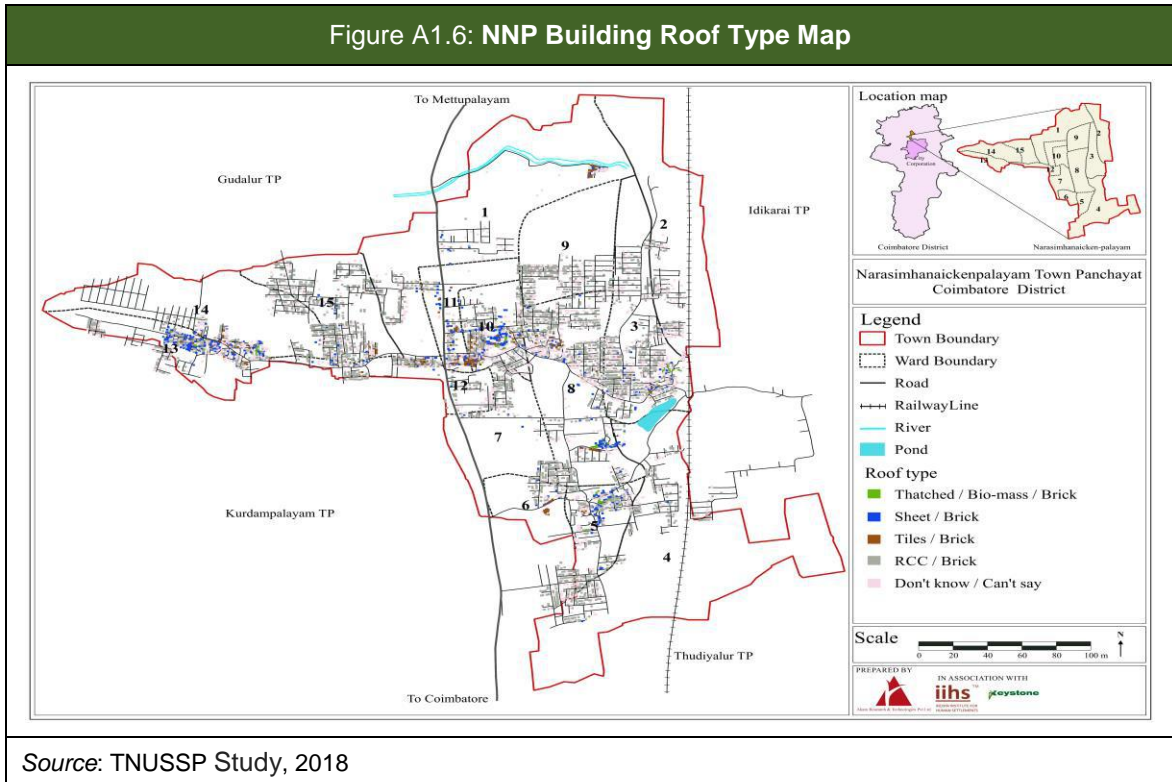


Figure A1. 7: PNP Building Use Type Map

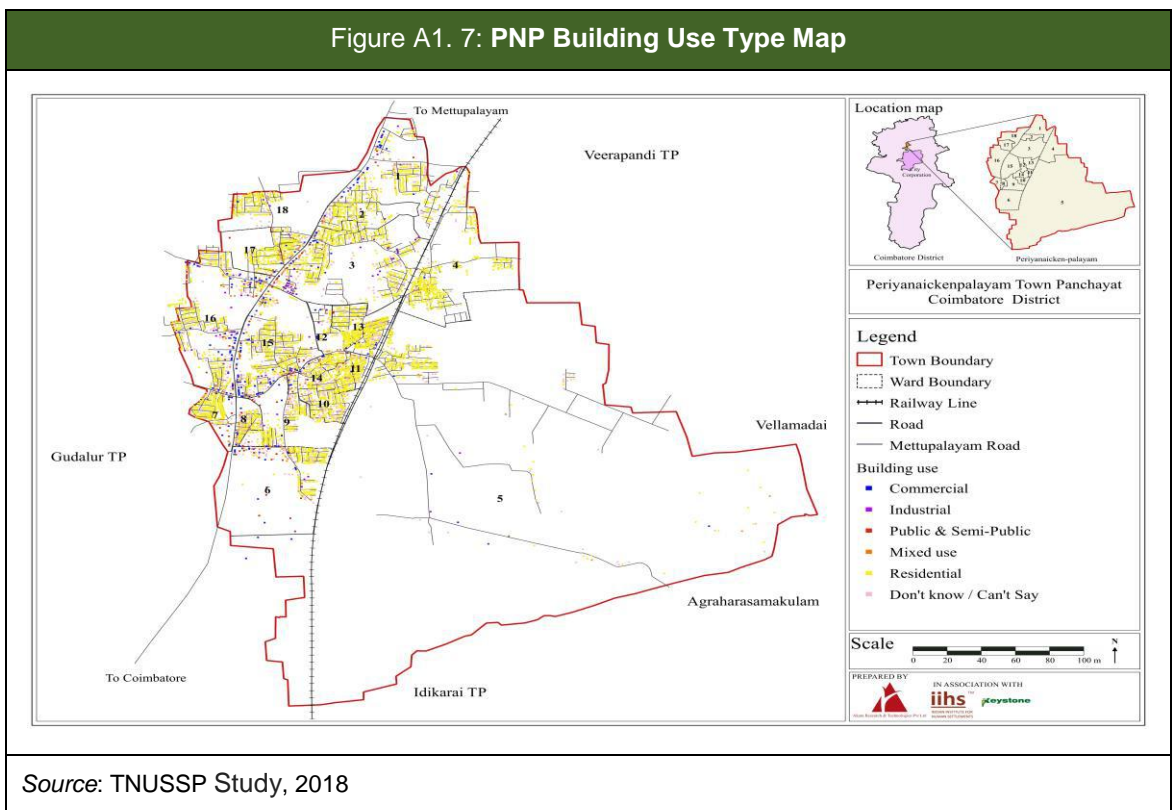
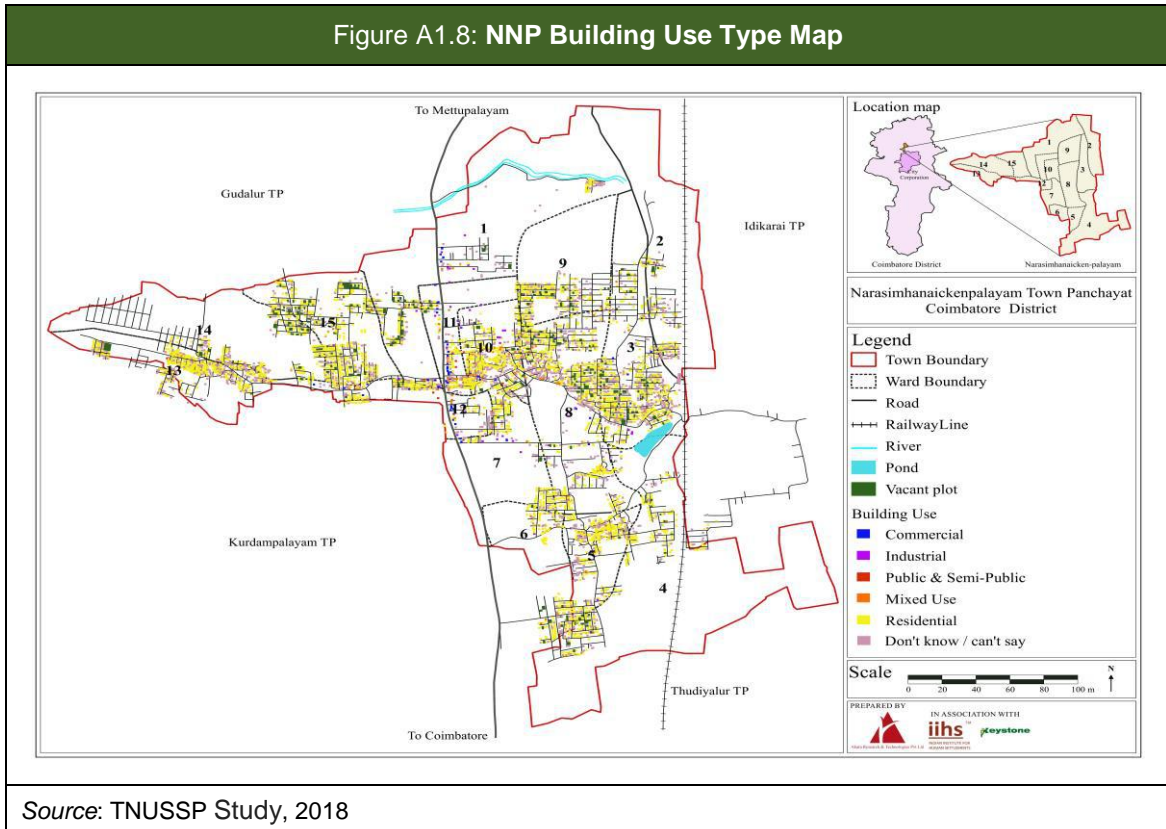
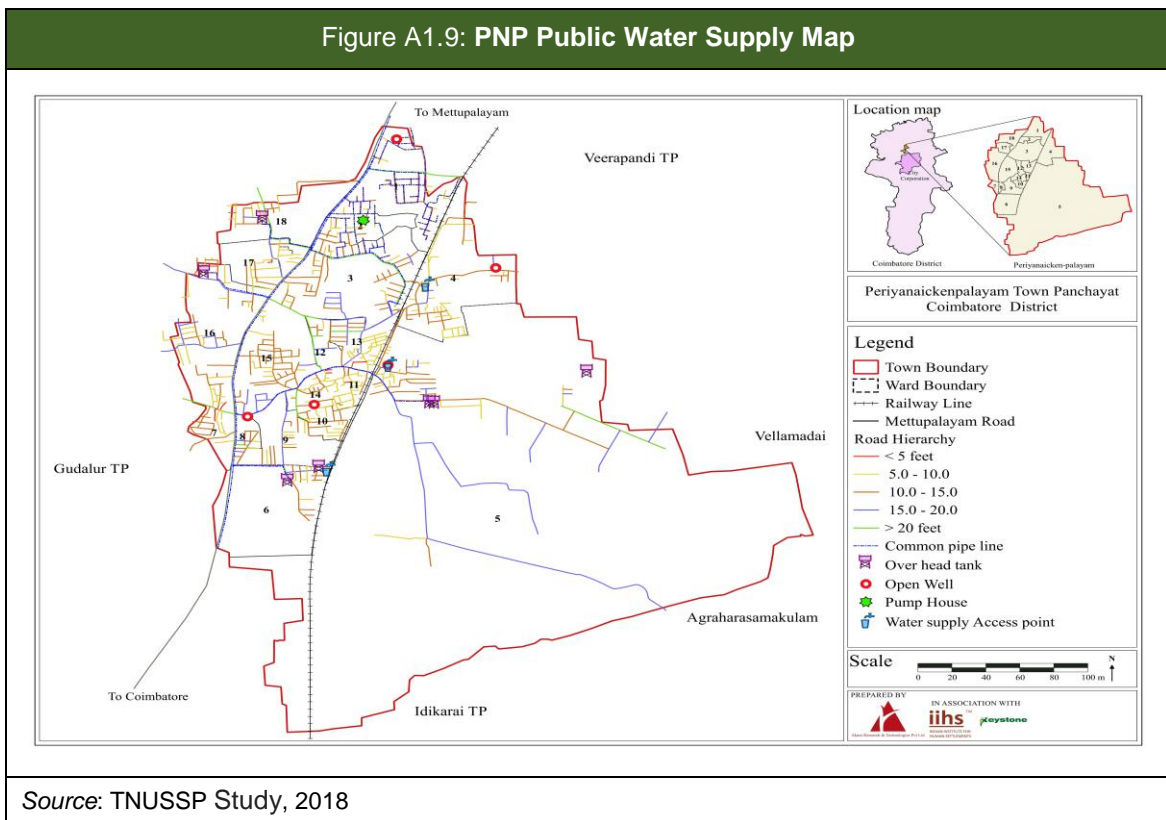


Figure A1.8: NNP Building Use Type Map



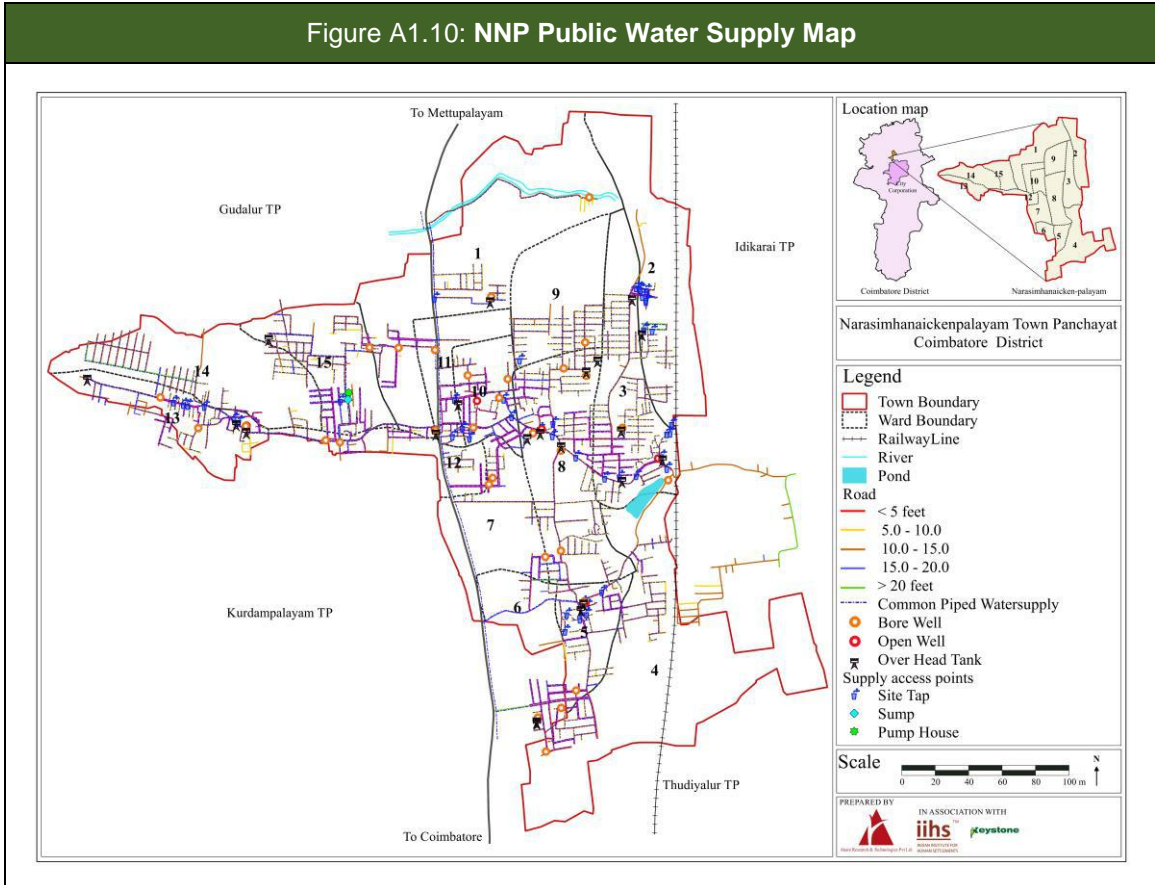
Source: TNUSSP Study, 2018

Figure A1.9: PNP Public Water Supply Map



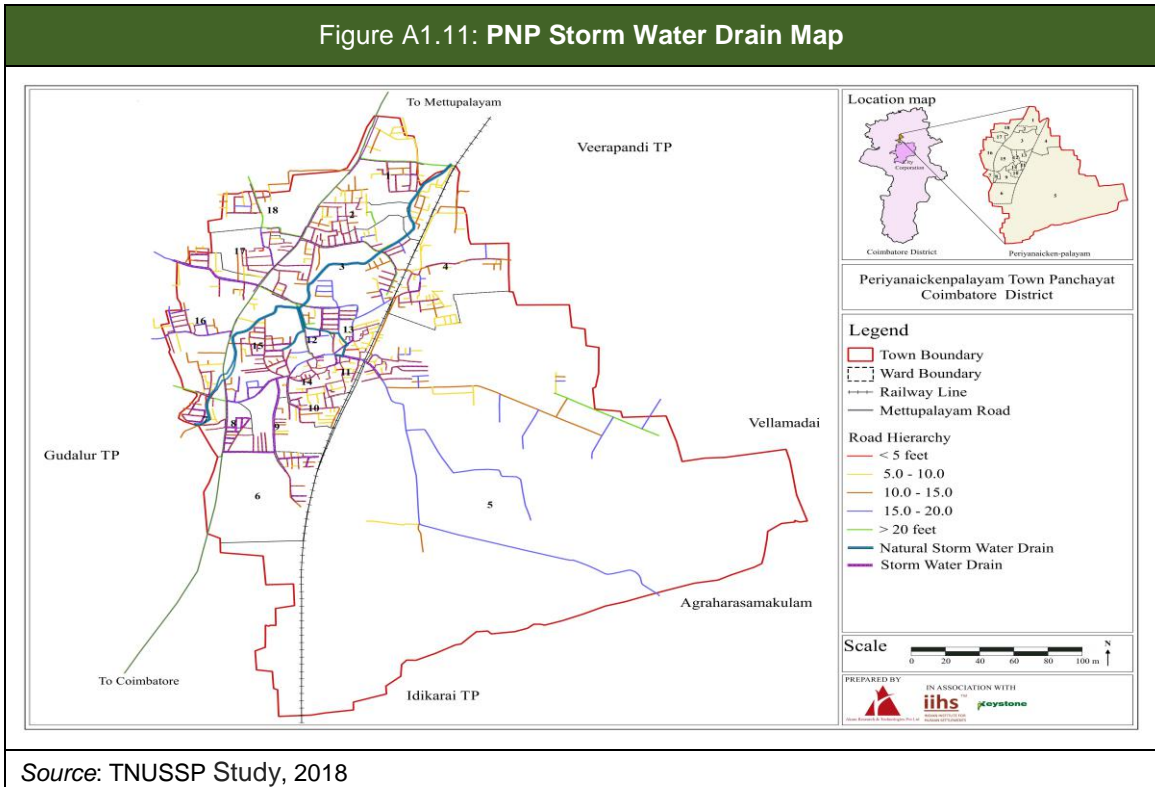
Source: TNUSSP Study, 2018

Figure A1.10: NNP Public Water Supply Map



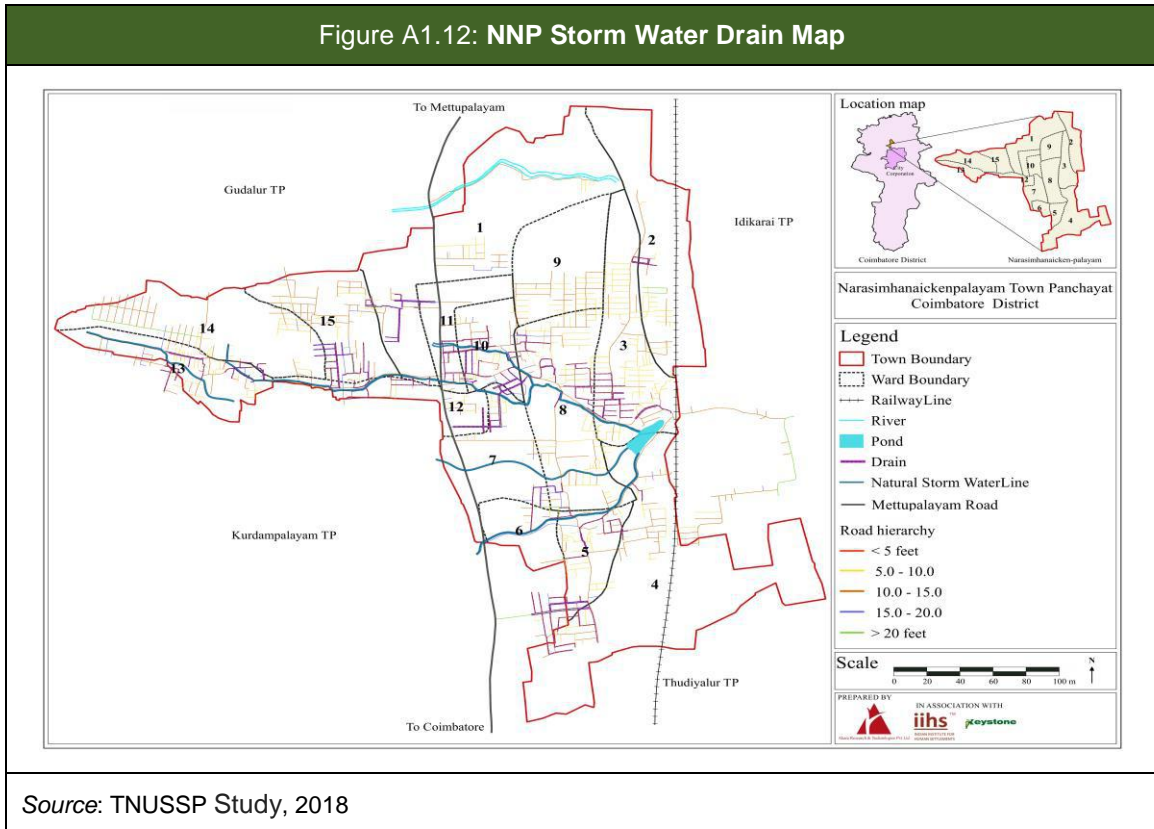
Source: TNUSSP Study, 2018

Figure A1.11: PNP Storm Water Drain Map



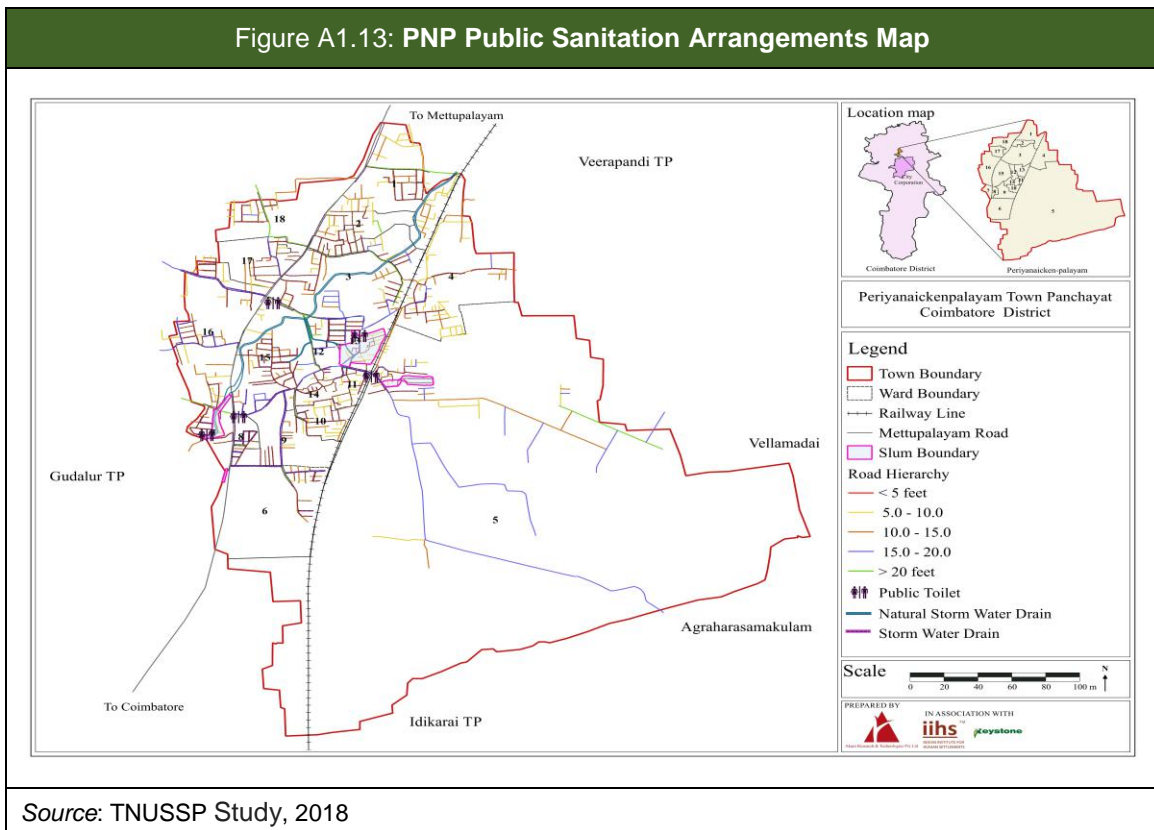
Source: TNUSSP Study, 2018

Figure A1.12: NNP Storm Water Drain Map



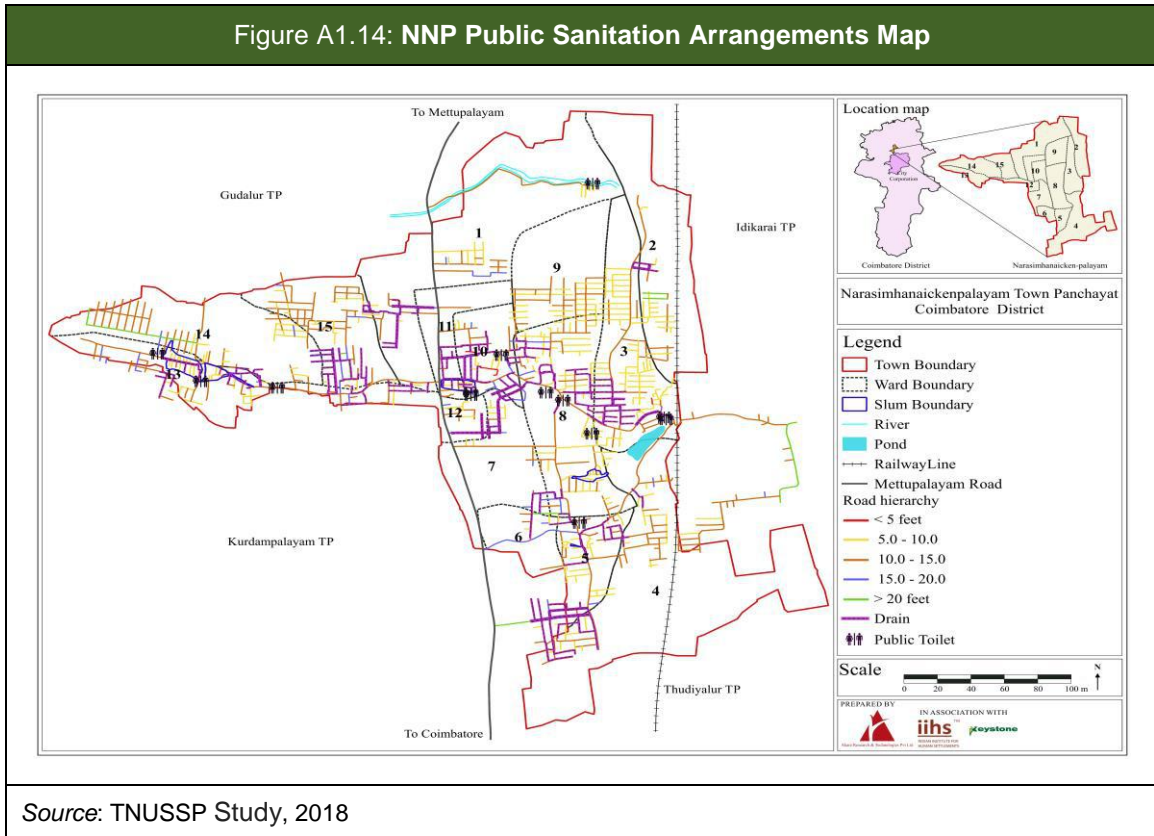
Source: TNUSSP Study, 2018

Figure A1.13: PNP Public Sanitation Arrangements Map



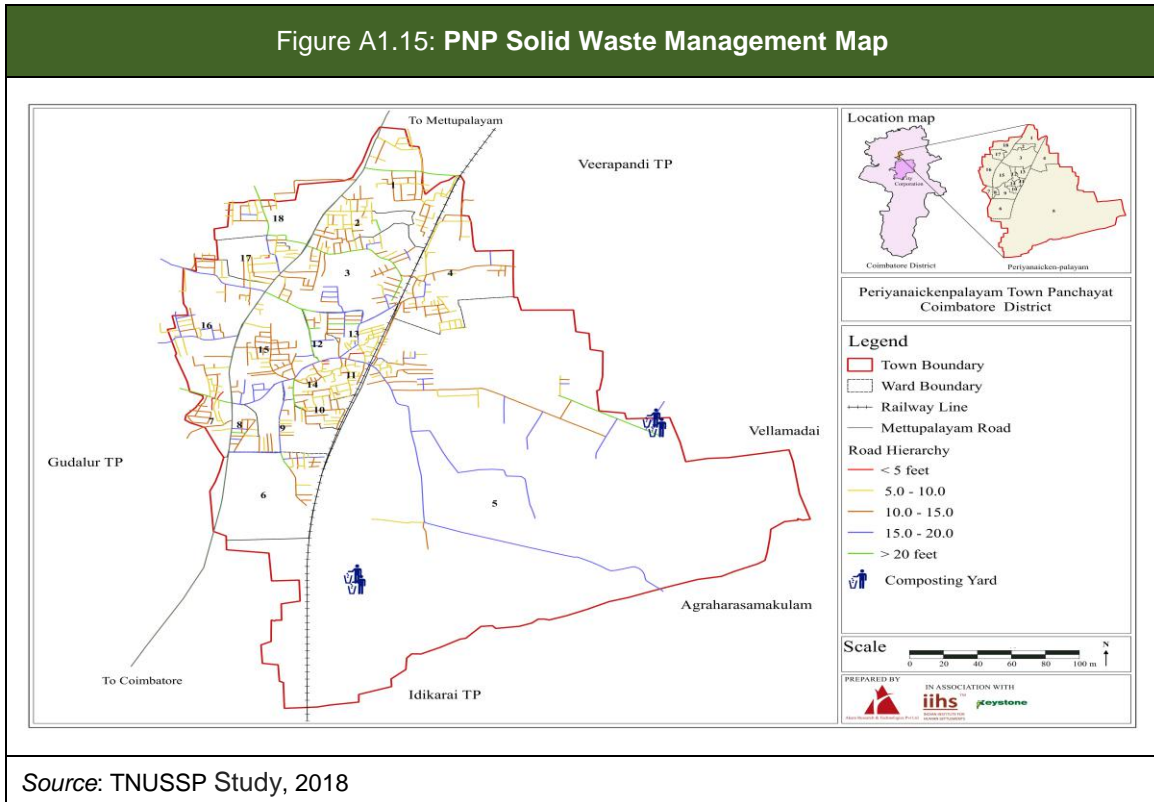
Source: TNUSSP Study, 2018

Figure A1.14: NNP Public Sanitation Arrangements Map



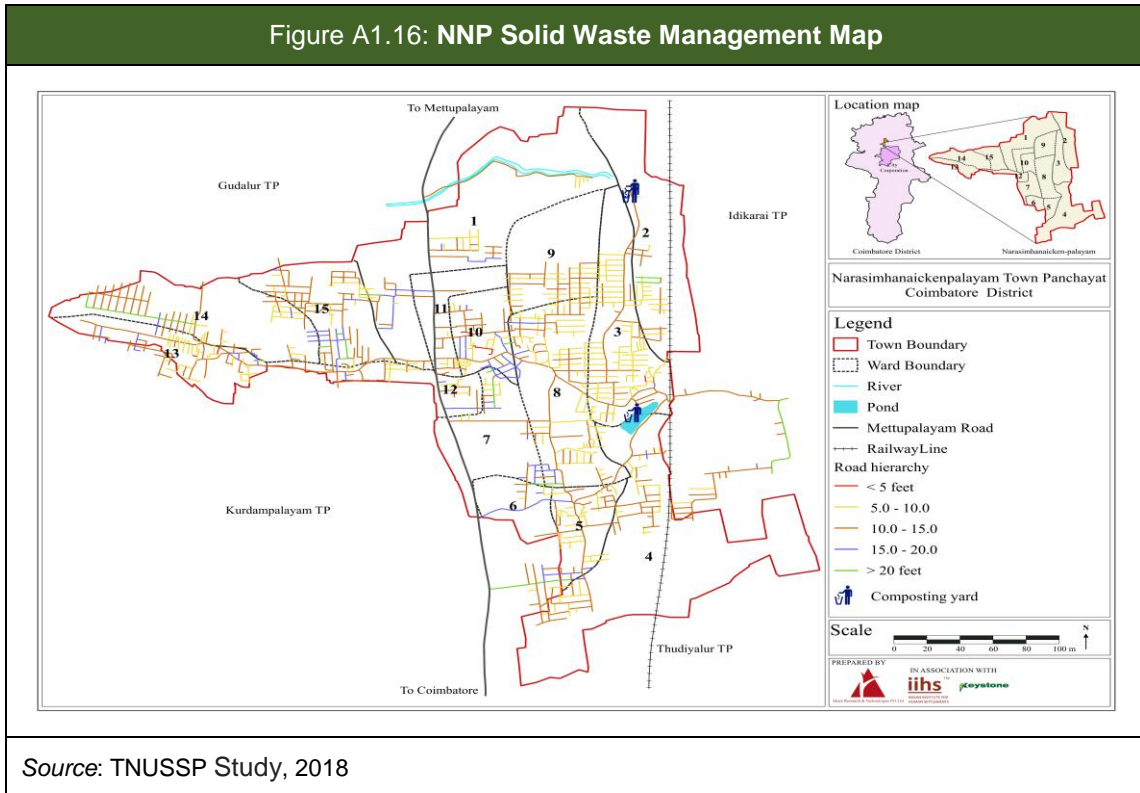
Source: TNUSSP Study, 2018

Figure A1.15: PNP Solid Waste Management Map



Source: TNUSSP Study, 2018

Figure A1.16: NNP Solid Waste Management Map



Source: TNUSSP Study, 2018

Annexure 2: Household Questionnaire

HOUSEHOLD SURVEY QUESTIONNAIRE

Schedule No:

--	--	--	--	--	--

Date:

D	D	M	M	Y	Y	Y	Y

Interview start time:

--	--

 :

--	--

Vanakkam! my name is _____ and I am from a research agency [NAME OF THE AGENCY]. We are currently doing a survey for the Indian Institute for Human Settlements, Chennai on sanitation arrangements at the household level. This survey is being conducted in all households in Periyanaickenpalayam and Narasimanaickenpalayam. The information collected from the survey will help the respective Town Panchayat to design and monitor projects that will help improve the existing sanitation conditions in your area.

The interview will last for about 20 minutes and please be assured that the information you provide us will remain confidential and will not be used for any other reason other than the study. Should you choose to participate, please remember that there are no correct or wrong answers. There are no disadvantages if you decide not to participate or not to answer certain questions. However, we would greatly appreciate your cooperation.

Thank you!

Consent obtained	Yes.....1 No.....2
------------------	-----------------------

PART A – GENERAL DETAILS			
<i>Instructions:</i>			
1. Circle the appropriate number in the coding categories given			
2. Write in the space provided for each question			
001	Name of Town		
002	Building ID		
003	Household ID		
004	Street Name		
005	GPS coordinates	a. Latitude	
		b. Longitude	

PART B – HOUSEHOLD DETAILS			
<i>Instructions:</i>			
1. Circle the appropriate number in the coding categories given			
2. Record 'Others' and units in the space provided			
Q. No	Questions	Categories	Skip to
006	Name of the Head of Household		
007	Contact Number		
008	Gender of Respondent	Male 1 Female 2 Transgender..... 3	
009	Total family members residing in this household that is, all individuals who normally live and eat their meals together in this household	a. Adults ((Age >18 years) <input type="checkbox"/> <input type="checkbox"/> b. Infants (0-12 months) <input type="checkbox"/> <input type="checkbox"/> c. Children (1-18 years) <input type="checkbox"/> <input type="checkbox"/>	d. Total <input type="checkbox"/> <input type="checkbox"/>
	Is this a owned unit? [To be asked if the unit (household) is a owned or not by the family/respondent]	a. Yes b. No	
	How long have you been residing in this house ?	<input type="checkbox"/> <input type="checkbox"/>	

PART C – WATER SUPPLY AND ACCESS TO TOILET DETAILS			
<i>Instructions:</i>			
1. Circle the appropriate number in the coding categories given			
2. Record 'Others' and units in the space provided			
Q. No	Questions	Categories	Skip to
010	What is/ are the main sources of drinking and cooking (potable) water for the household? MULTIPLE CODING POSSIBLE	Piped water into dwelling/ yard..... 1 Own hand pump/ Own tube well 2 Own well, protected 3 Own well, unprotected 4	

		Public tap water 5 Public hand pump / tube well..... 6 Public open well..... 7 Surface water (river/stream) 8 Tanker / Truck 9 Spring 10 Bottled Water..... 11 Don't Know/ Can't Say..... 12 Others (Please Specify) 13 _____ ____	
011	Do you have a toilet in your house?	Yes..... 1 No 2	→Q.014
012	If the household does not have a toilet, where do members defecate? MULTIPLE CODING POSSIBLE	Open defecation 1 Community toilet..... 2 Public toilet 3 Shared toilet [neighbours/ relatives] 4	
013	Is there space to construct toilet?	Yes..... 1 No 2	
014	ASK ONLY THOSE HOUSEHOLDS WITH INFANTS (0-12 MONTHS) REFER Q.009b Are there any infants (0-12 months) in the household?	Yes..... 1 No 2	→Q.016
015	How are the stools of infants (0-12 months) usually disposed of? MULTIPLE CODING POSSIBLE	Child uses toilet/latrine 1 Put/Rinsed into toilet/latrine..... 2 Put/Rinsed into drain/ditch..... 3 Thrown into garbage..... 4 Buried 5 Left in the open 6 Don't Know/ Can't Say..... 7 Others (Please Specify) 8 _____ ____	
016	Is there a drain next to the house?	Yes, open drain 1 Yes, closed drain 2 No drain 3	
017	Where is the greywater (wastewater from the kitchen and bathroom) disposed? MUTLIPLRE RESPONSE POSSIBLE	To the pit that toilets are connected to 1 To the septic tank that toilets are connected to 2 To separate soak-pit/leach-pit within premises 3 To separate tank within premise 4 To plants within premise..... 5	

		To the drain outside the house 6 To open area outside property 7 Don't Know/ Can't Say..... 8 Others (Please Specify) 9 _____	
THOSE CODED 1 IN Q.011 – CONTINUE			
THOSE CODED 2 IN Q.011 – THANK AND TERMINATE			
018	Do ALL household members aged four and above use the toilet exclusively when they are at home ?	Yes1 No, we also practice open defecation..... 2 No, we practice ONLY open defecation.....3 No, we also use community toilet.....4 No, we use ONLY community toilet.....5 No, we also use Public Toilet6 No, we use ONLY Public Toilet.....7 Others (Specify)8	
019	How many toilets do you have in your house?	<input type="checkbox"/> <input type="checkbox"/>	
020	Which year was the latest toilet constructed in? YYYY [Year]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Don't know/Can't remember 1	
021	Do you share this facility with other households?	Yes..... 1 No 2	→Q.023
022	If yes, how many households use this facility?	<input type="checkbox"/> <input type="checkbox"/>	
023	Where is the toilet located? [MULTIPLE CODING]	Inside the house/building 1 Outside the house/building but attached 2 Outside the house/building but detached/ stand-alone 3 Others (Please Specify) 4 _____	
024	Predominant material of roof of toilet [MULTIPLE CODING]	Reinforced Cement Concrete (RCC) 1 Burnt brick/ stone..... 2 Asbestos 3 Bamboo/ Wood..... 4 Thatch/ Biomass 5	

		Tin/ Metal sheet 6 Tarpaulin/ Cloth 7 Earthen tiles..... 8 Plastic / PVC sheets 9 No Roof..... 10 Others (Specify) 11 <hr/> —	
025	Predominant material of wall of toilet [MULTIPLE CODING]	Burnt brick/ Stone/ Concrete Block 1 Mud/ Earth 2 Bamboo/ Wood..... 3 Thatch/ Other Biomass..... 4 Tin/ Metal sheet 5 Plastic/ Cloth..... 6 Others (Specify) 7 <hr/> —	
026	What kind of flushing facility does your toilet have? [MULTIPLE CODING]	Cistern flush 1 Pour flush..... 2 Automatic Flush 3 No flush required 4 Don't know 5	
027	What is the pan/platform type in your toilet(s)? [MULTIPLE CODING]	Slab with a Hole (Dry Toilet) 1 Squatting Pan (with Water Seal intact – Indian toilet) 2 Squatting Pan (without Water Seal intact – Indian toilet) 3 Western Commode (with Water Seal intact) 4 Western Commode (without Water Seal intact) 5 Urine Diversion Dry Toilet (UDDT)/ EcoSan 6 Others (Specify)..... 7 <hr/> —	
028	What is the outlet of the pan/platform of the toilet(s) connected to: [PREDOMINANT CONTAINMENT SYSTEM]	Single Pit..... 1 Twin Pit 2 Septic Tank..... 3 Connected to Bio-Tank (DRDO) 4 Drain (Direct Discharge) 5 Open Areas (Direct Discharge) 6 Water Bodies (Canal, Pond, Lake, River etc.) 7 Dewats treatment system (Community Septic Tank) 8 Not connected (hole in the ground) 9 Not connected (Bucket/ pan is manually removed) 10	

		Do not know 11 Others (Specify)..... 12	
Q.029 TO Q.030 ONLY THOSE CODED 1 OR 2 OR 3 OR 4 IN Q.028 – REST THANK AND TERMINATE			
029	In which year was the pit/septic tank/Bio tank constructed? YYYY [Year]	□□□□ Don't know/Can't remember 1	
030	Where is the pit/septic tank/ Bio tank located?	In front of the building 1 Behind the building 2 On one side of the building..... 3 Along the road 4 Below the pan/ platform (below the building) 5 Others (Specify)..... 6 — Don't know 7	

PART D –PIT, SEPTIC TANK AND BIO-TANK INFRASTRUCTURE AND DIMENSIONS (THOSE CODED 1 OR 2 OR 3 OR 4 IN Q.028)

Instructions:

1. Circle the appropriate number in the coding categories given
2. Record 'Others' and units in the space provided

Q. No	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP TO
031	Can you provide us with the overall infrastructure details of the pit/septic tank/bio-tank?	Fully lined tanks/pits (tanks/pits with impermeable walls also referred to as sealed tank)..... 1 Lined tanks/pits with honeycombed walls and an open bottom) 2 Lined tanks/pits with precast concrete rings and an open bottom..... 3 Holding tanks/ Cesspits (sealed tanks with no outflow)..... 4 Don't Know..... 5	
032	What were the material(s) used for construction of walls of the on-site containment system?	Stone or Rubble 1 Burnt Brick 2 Plain Cement Concrete (PCC) 3 Reinforced Cement Concrete (RCC) 4 Fiber Reinforced Plastic or hard plastic..... 5 Pre-cast RCC Slabs 6 RCC Rings 7 Stone Slabs 8 No material 9	

		Don't Know.....10 Others (Specify)..... 11 _____ —	
033	Is the wall of the on-site containment system fully plastered and non-porous?	Yes 1 No 2 Don't Know.....3	
034	What is the material used for the base of the on-site containment system?	No material – just ground 1 Brick bats or aggregates or sand2 Brick with cement3 Stone/rubble with cement.....4 PCC or RCC5 Fiber Reinforced Plastic or hard plastic.....6 Don't Know.....7 Others, specify (provide space for details) .8 _____ —	
035	Is the base floor of the on-site containment system plastered?	Yes 1 No 2 Don't Know.....3	
036	What were the material(s) used for construction of the top slab of the on-site containment system?	Reinforced Cement Concrete (RCC) 1 Pre-cast RCC Slabs2 Stone Slabs 3 Metal Sheet 4 Wood or Thatch5 Don't Know.....6 Others (specify) 7 _____ —	
037	Is the top slab provided with a manhole (opening and cover) or a pipe with cap for easy access?	No 1 Yes, manhole opening with cover 2 Yes, Pipe with cap 3	
THOSE CODED 1 OR 2 IN Q.028 – GO TO Q.043 THOSE CODED 4 IN Q.028 – GO TO Q.045 THOSE CODED 3 IN Q.028 – CONTINUE			
038	Are there partition walls in your septic tank?	Yes 1 No 2 Don't know.....3	→Q.040 →Q.040

049	If yes, how many chambers are there?	One 1 Two 2 Three 3 Four 4 Don't know.....5	
040	Septic Tank Length (feet) <i>(To be specified in feet and remainder in inches. 12 inches = 1 feet)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches Don't Know	
041	Septic Tank Breadth (feet) <i>(Not more than 2 digits before and 2 digits after decimal point to capture feet and inches)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches Don't Know	
042	Septic Tank Depth (feet) <i>(Not more than 2 digits before and 2 digits after decimal point to capture feet and inches)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches Don't Know	→Q.045
Q.043 TO Q.044 THOSE CODED 1 OR 2 IN Q.028			
043	Pit Diameter (feet) <i>(Not more than 2 digits before and 2 digits after decimal point to capture feet and inches)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches Don't Know	
044	Pit Depth (feet) <i>(Not more than 2 digits before and 2 digits after decimal point to capture feet and inches)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches Don't Know	
Q.045 TO Q.060 ONLY THOSE CODED 1 OR 2 OR 3 OR 4 IN Q.030			
045	Where does the wastewater from the tank go in to?	No outlet 1 Soak/Leach Pit 2 Open/Surface Drains 3 Open Areas 4 Water Bodies 5 Reed Bed/Plants..... 6 Others (specify) 7 _____ _____	→Q.047
046	Is there space to construct a soak-away? CHECK IF THERE IS SPACE OF 1.5m X 1.5m OR 5 feet X 5 feet AVAILABLE	Yes 1 No 2	
047	Has the containment ever overflowed ?	Yes..... 1 No 2	→Q.050
048	If yes, what was the reason for it overflowing? MULTIPLE RESPONSE	Blockage between toilet and tank/pit..... 1 Flooded with rising water table (from below ground) 2 Flooded by surface water / storm water (from	

		above ground) 3 Became full and had no money to empty.... 4 Became full and desludging services not available when needed..... 5 Did not know that the containment had become full (Not aware about status of the containment)6 No Provision for removal/de-sludging.....7 Don't Know.....8 Others (Specify)..... 9 _____ —	
049	What actions did you take when the toilet overflowed? MULTIPLE RESPONSE	Attempted to clear a blockage 1 Emptied the septic tank/pit 2 Abandoned the toilet/pit..... 3 Broke the septic tank/pit to release contents to surface or drain..... 4 Made structural improvements to the toilet or septic tank/pit..... 5 Don't know 6 Others (Specify)..... 7 _____ —	
050	Has the septic tank/ pit ever been emptied?	Yes 1 No 2	→Q.059
051	How is the tank/pit accessed for emptying?	There is a removable manhole cover or slab on the top of the septic tank/pit 1 There is a slab or cover sealed with mortar that must be broken..... 2 There is a pipe with a junction that the hose is inserted through..... 3 No access point – a hole must be drilled or cut in the slab to access the septic tank/pit..... 4 Don't know 5 Others (Specify)..... 6 _____ —	
052	When was the toilet pit/septic tank last emptied (year)? Write as YYYY	□□□□	
053	Who emptied septic tank/pit last time?	Government/ULB truck 1 Private operators 2 Self with labour 3 Labour 4 Others (Specify)..... 5	→Q.057 →Q.057

054	When emptied last time, was the vehicle able to come up the house (front, back or side access)?	Yes..... 1 No, it was parked at a distance 2	
	What is the distance of the pit/septic tank/ Bio-tank to the nearest access road? Distance (in feet)	Less than 10 feet 1 10 – 20 feet..... 2 Greater than 20 feet 3	
	What is the width of the nearest access road?	Less than 5 feet 1 5 – 10 feet..... 2 Greater than 10 feet 3	
	What is the distance between the septic tank/Pit/Bio-tank and the nearest location that a truck can park? (Considering a truck of 5000 L capacity, the road width at parking should be at least 3 m.) (meters)	Less than 5 feet 1 5 – 10 feet..... 2 Greater than 10 feet 3	
055	Were any of the septic tank/pit contents spilled outside the containment system the last time it was emptied?	No 1 Yes, they spilled/leaked unintentionally from the hose or pump truck..... 2 Yes, they were intentionally released from the hose or truck (such as tapping out residual solids in the hose onto the ground) 3 Yes, some other type of spillage occurred (Specify) 4 _____ Don't know 5	
056	Did the desludging operators (emptiers) wash their equipment before leaving?	No 1 Yes, and returned the wash water to the septic tank/pit or leach pit 2 Yes, and returned the wash water to a closed drain 3 Yes, and returned the wash water to an open drain..... 4 Yes, and the wash water was spilled on the surface/open ground..... 5 Others (Specify)..... 6 _____ Don't know 7	
057	The last time you emptied the septic tank/pit, how much did you spend on emptying? [Record in Rupees]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
058	What is the interval of emptying?	Emptied only once 1 Once in a year 2	

		Once in two years 3 Once in three years 4 Once in four years 5 Once in five years 6 More than 5 years 7 Whenever it fills up 8	
059	Distance of drinking ground water source within the household premises to the pit/ septic tank (feet)	<input type="checkbox"/> <input type="checkbox"/> feet	
PART E - Photographs			
060	Two photographs to be taken: 1. Visible portion of the on-site containment structure (top view with natural tilt) 2. Front elevation of the house from the street		

Interview end time:

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Annexure 3: Establishment Questionnaire

ESTABLISHMENT SURVEY QUESTIONNAIRE

Schedule No:

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Date:

D	D	M	M	Y	Y	Y	Y

Interview start time:

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Vanakkam! my name is _____ and I am from a research agency [NAME OF THE AGENCY]. We are currently doing a survey for the Indian Institute for Human Settlements, Chennai on sanitation arrangements at the household and establishment level. This survey is being conducted in all households in Periyanaickenpalayam and Narasimanaickenpalayam. The information collected from the survey will help the respective Town Panchayat to design and monitor projects that will help improve the existing sanitation conditions in your area.

The interview will last for about 20 minutes and please be assured that the information you provide us will remain confidential and will not be used for any other reason other than the study. Should you choose to participate, please remember that there are no correct or wrong answers. There are no disadvantages if you decide not to participate or not to answer certain questions. However, we would greatly appreciate your cooperation.

Thank you!

Consent obtained	Yes 1 No.....2
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PART A – GENERAL DETAILS				
<i>Instructions:</i>				
3. Circle the appropriate number in the coding categories given				
4. Write in the space provided for each question				
001	Name of Town			
002	Building ID			
003	Establishment ID			
004	Street Name			
005	GPS coordinates	a. Latitude		
		b. Longitude		
PART B - ESTABLISHMENT DETAILS				
<i>Instructions</i>				
3. Circle the appropriate number in the coding categories given				
4. Record 'Others' and units in the space provided				
Q. No	Questions	Categories	Skip to	
006	Name of the establishment			
007	How long has been the establishment been in operation?	<input type="checkbox"/> <input type="checkbox"/> Years		
008	Contact Number			
009	Gender of Respondent	Male 1 Female 2 Transgender..... 3		
010	Type of establishment [To be available as dropdown]	Hotel..... 1 Guest house..... 2 Lodge 3 Office..... 4 Hospital 5 Clinic 6 (Including Nursing Home) Wholesale 7 Retail trades – Departmental store/shop 8 Educational institution – School..... 9 Educational Institution - College 10 Educational Institute others 11 Manufacturing industry..... 12 Handloom/Handicraft/Cottage industry 13 Others (Please Specify)..... 14 _____ _____		
011	How many persons work in your establishment on a regular basis	a. Men <input type="checkbox"/> <input type="checkbox"/>	b. Women <input type="checkbox"/> <input type="checkbox"/>	c. Total <input type="checkbox"/> <input type="checkbox"/>

(daily)?				
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PART C – WATER SUPPLY AND ACCESS TO TOILET DETAILS

Instructions:

3. Circle the appropriate number in the coding categories given
4. Record 'Others' and units in the space provided

Q. No	Questions	Categories	Skip to
012	What is/ are the main sources of drinking and cooking (potable) water for the establishment? MULTIPLE CODING POSSIBLE	Piped water into dwelling/ yard..... 1 Own hand pump/ Own tube well 2 Own well, protected 3 Own well, unprotected 4 Public tap water 5 Public hand pump / tube well 6 Public open well..... 7 Surface water (river/stream) 8 Tanker / Truck 9 Spring 10 Bottled Water..... 11 Don't Know/ Can't Say 12 Others (Please Specify) 13 _____ _____	
013	Do you have a toilet in your building?	Yes 1 No 2	→Q.014
014	If the establishment does not have a toilet, where do members defecate?	Open defecation 1 Community toilet..... 2 Public toilet 3 Shared toilet [neighbours/ relatives] 4	
015	Is there space to construct toilet?	Yes 1 No 2	
016	Is there a drain next to the building?	Yes, open drain 1 Yes, closed drain 2 No drain 3	
017	Where is the greywater (wastewater from any cleaning and washing use) disposed? MUTLIPL E RESPONSE POSSIBLE	To the pit that toilets are connected to 1 To the septic tank that toilets are connected to 2 To separate soak-pit/leach-pit within premises 3 To separate tank within premise 4 To plants within premise..... 5 To the drain outside the house 6 To open area outside property 7 Don't Know/ Can't Say 8	

		Others (Please Specify) 9 _____ _____	
THOSE CODED 1 IN Q.013 – CONTINUE			
THOSE CODED 2 IN Q.013 – THANK AND TERMINATE			
018	How many toilets do you have in your building?	<input type="checkbox"/> <input type="checkbox"/>	
019	Of these, are there any dedicated to women or transgender? (NO WILL INDICATE THAT ALL FACILITIES ARE COMMON TO ANY GENDER)	Yes 1 No 2	→Q.022
020	If yes, how many are dedicated to women/girls?	<input type="checkbox"/> <input type="checkbox"/>	
021	If yes, how many are dedicated to transgender?	<input type="checkbox"/> <input type="checkbox"/>	
022	How many urinals (dedicated) do you have in the building?	<input type="checkbox"/> <input type="checkbox"/>	
023	Of these, are there any dedicated to women or transgender? (NO WILL INDICATE THAT ALL FACILITIES ARE COMMON TO ANY GENDER)	Yes 1 No 2	→Q.026
024	If yes, how many are dedicated to women/girls?	<input type="checkbox"/> <input type="checkbox"/>	
025	If yes, how many are dedicated to transgender?	<input type="checkbox"/> <input type="checkbox"/>	
026	Which year was the latest toilet constructed in? YYYY [Year]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Don't know/Can't remember 1	
027	Do you share this facility with other building?	Yes 1 No 2	→Q.029
028	If yes, how many buildings use this facility?	<input type="checkbox"/> <input type="checkbox"/>	
029	Where is the toilet located?	Inside the house/building..... 1 Outside the house/building but attached 2 Outside the house/building but detached/ stand-alone 3 Others (Please Specify) 4 _____ _____	
030	Predominant material of roof of toilet	Reinforced Cement Concrete (RCC) 1 Burnt brick/ stone..... 2 Asbestos 3 Bamboo/ Wood..... 4 Thatch/ Biomass..... 5	

		Tin/ Metal sheet 6 Tarpaulin/ Cloth 7 Earthen tiles..... 8 Plastic / PVC sheets 9 No Roof 10 Others (Specify) 11	
Q. No	Questions	Categories	Skip to
031	Predominant material of wall of toilet	Burnt brick/ Stone/ Concrete Block 1 Mud/ Earth 2 Bamboo/ Wood..... 3 Thatch/ Other Biomass..... 4 Tin/ Metal sheet 5 Plastic/ Cloth..... 6 Others (Please Specify) 7 _____ _____	
032	What kind of flushing facility does your toilet have? (SELECT MOST COMMON FOR ESTABLISHMENTS WITH MULTIPLE TOILETS)	Cistern flush 1 Pour flush 2 Automatic Flush 3 No flush required 4 Don't know 5	
033	What is the pan/platform type in your toilet(s)?	Slab with a Hole (Dry Toilet) 1 Squatting Pan (with Water Seal intact – Indian toilet) 2 Squatting Pan (without Water Seal intact – Indian toilet) 3 Western Commode (with Water Seal intact) 4 Western Commode (without Water Seal intact) 5 Urine Diversion Dry Toilet (UDDT)/ EcoSan 6 Others (Specify)..... 7 _____ _____	
034	What is the outlet of the pan/platform of the toilet(s) connected to: [PREDOMINANT CONTAINMENT SYSTEM]	Single Pit 1 Twin Pit..... 2 Septic Tank..... 3 Connected to Bio-Tank (DRDO) 4 Drain (Direct Discharge) 5 Open Areas (Direct Discharge) 6 Water Bodies (Canal, Pond, Lake, River etc.) 7 _____ Dewats treatment system (Community Septic Tank) 8 Not connected (hole in the ground) 9 Not connected (Bucket/ pan is	

		manually removed) 10 Do not know 11 Others (Specify)..... 12 _____ —	
Q.028 TO Q.029 ONLY THOSE CODED 1 OR 2 OR 3 OR 4 or 8 IN Q.034 – REST THANK AND TERMINATE			
035	In which year was the pit/septic tank/ Dewats treatment system/ Bio tank constructed? YYYY [Year]	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Don't know/Can't remember..... 1	
Q. No	Questions	Categories	Skip to
036	Where is the pit/septic tank/ Dewats treatment system/ Bio tank located?	In front of the building..... 1 Behind the building 2 On one side of the building..... 3 Along the road 4 Below the pan/ platform (below the building) 5 Others (Specify)..... 6 _____ Don't know..... 7	
PART D –PIT, SEPTIC TANK, BIO-TANK AND DEWATS TREATMENT SYSTEM INFRASTRUCTURE AND DIMENSIONS (THOSE CODED 1 OR 2 OR 3 OR 4 OR 8 IN Q.034)			
<i>Instructions:</i>			
3. Circle the appropriate number in the coding categories given			
4. Record 'Others' and units in the space provided			
Q. No	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP TO
037	Can you provide us with the overall infrastructure details of the pit/septic tank/ Dewats treatment system/ Bio tank?	Fully lined tanks/pits (tanks/pits with impermeable walls also referred to as sealed tank)..... 1 Lined tanks/pits with honeycombed walls and an open bottom) 2 Lined tanks/pits with precast concrete rings and an open bottom..... 3 Holding tanks/ Cesspits (sealed tanks with no outflow)..... 4	
038	What were the material(s) used for construction of walls of the on-site containment system?	Stone or Rubble 1 Burnt Brick 2 Plain Cement Concrete (PCC) 3 Reinforced Cement Concrete (RCC) 4 Fiber Reinforced Plastic or hard plastic..... 5 Pre-cast RCC Slabs 6 RCC Rings 7 Stone Slabs 8 No material 9	

		Others (Specify)..... 10 _____ _____	
039	Is the wall of the on-site containment system fully plastered and non-porous?	Yes 1 No 2	
040	What is the material used for the base of the on-site containment system?	No material – just ground 1 Brick bats or aggregates or sand 2 Brick with cement 3 Stone/rubble with cement 4 PCC or RCC 5 Fiber Reinforced Plastic or hard plastic..... 6 Others, specify (provide space for details) . 7 _____ _____	
041	Is the base floor of the on-site containment system plastered?	Yes 1 No 2	
042	What were the material(s) used for construction of the top slab of the on-site containment system?	Reinforced Cement Concrete (RCC) 1 Pre-cast RCC Slabs 2 Stone Slabs 3 Metal Sheet 4 Wood or Thatch 5 Others (specify) 6 _____ _____	
043	Is the top slab provided with a manhole (opening and cover) or a pipe with cap for easy access?	No 1 Yes, manhole opening with cover 2 Yes, Pipe with cap 3	
THOSE CODED 1 OR 2 IN Q.034 – GO TO Q.049 THOSE CODED 4 IN Q.034 – GO TO Q.051 THOSE CODED 3 OR 8 IN Q.034 – CONTINUE REST GO TO Q.058			
044	Are there partition walls in your septic tank?	Yes 1 No 2	→Q.046
045	If yes, how many chambers are there?	One 1 Two 2 Three 3 Four 4	
046	Septic Tank Length (feet) <i>(To be specified in feet and remainder in inches. 12 inches = 1 feet)</i>	□□feet + □□inches	
047	Septic Tank Breadth (feet) <i>(To be specified in feet and remainder in inches. 12 inches = 1 feet)</i>	□□feet + □□inches	
048	Septic Tank Depth (feet) <i>(To be specified in feet and</i>	□□feet + □□inches	→Q.051

	<i>remainder in inches. 12 inches = 1 feet)</i>		
Q.049 TO Q.050 THOSE CODED 1 OR 2 IN Q.034			
049	Pit Diameter (feet) <i>(To be specified in feet and remainder in inches. 12 inches = 1 feet)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches	
050	Pit Depth (feet) <i>(To be specified in feet and remainder in inches. 12 inches = 1 feet)</i>	<input type="checkbox"/> <input type="checkbox"/> feet + <input type="checkbox"/> <input type="checkbox"/> inches	
Q.051 TO Q.064 ONLY THOSE CODED 1 OR 2 OR 3 OR 4 OR 8 IN Q.034			
051	Where does the wastewater from the tank go in to?	No outlet 1 Soak/Leach Pit 2 Open/Surface Drains 3 Open Areas 4 Water Bodies 5 Reed Bed/Plants..... 6 Others (specify) 7 _____	→Q.053
052	Is there space to construct a soak-away? CHECK IF THERE IS SPACE OF 1.5m X 1.5m OR 5 feet X 5 feet AVAILABLE	Yes 1 No 2	
053	Has the toilet ever overflowed	Yes 1 No 2	→Q.056
054	If yes, what was the reason for it overflowing? MULTIPLE RESPONSE	Blockage between toilet and tank/pit..... 1 Flooded with rising water table (from below ground) 2 Flooded by surface water / storm water (from above ground) 3 Became full and had no money to empty.... 4 Became full and desludging services not available when needed..... 5 Don't know 6 Others (Specify)..... 7 _____	
055	What actions did you take when the toilet overflowed? MULTIPLE RESPONSE	Attempted to clear a blockage..... 1 Emptied the septic tank/pit 2 Abandoned the toilet/pit..... 3 Broke the septic tank/pit to release contents to surface or drain..... 4 Made structural improvements to the toilet or septic tank/pit..... 5 Don't know 6 Others (Specify)..... 7	

056	Has the septic tank/ pit ever been emptied?	Yes 1 No 2	→Q.065
057	How is the tank/pit accessed for emptying?	There is a removable manhole cover or slab on the top of the septic tank/pit 1 There is a slab or cover sealed with mortar that must be broken..... 2 There is a pipe with a junction that the hose is inserted through..... 3 No access point – a hole must be drilled or cut in the slab to access the septic tank/pit..... 4 Don't know 5 Others (Specify)..... 6 _____	
058	When was the toilet pit/septic tank last emptied (year)? Write as YYYY	□□□□	
059	Who emptied septic tank/pit last time?	Government/ULB truck 1 Private operators 2 Self with labour 3 Labour 4 Others (Specify)..... 5 _____	→Q.063 →Q.063
060	When emptied last time, was the vehicle able to come up the house (front, back or side access)?	Yes 1 No, it was parked at a distance 2	
061	Were any of the septic tank/pit contents spilled outside the containment system the last time it was emptied?	No 1 Yes, they spilled/leaked unintentionally from the hose or pump truck..... 2 Yes, they were intentionally released from the hose or truck (such as tapping out residual solids in the hose onto the ground) 3 Yes, some other type of spillage occurred (Specify) 4 _____	
062	Did the desludging operators (emptiers) wash their equipment before leaving?	Don't know 5	
		No 1 Yes, and returned the wash water to the septic tank/pit or leach pit 2 Yes, and returned the wash water to a closed drain 3 Yes, and returned the wash water to an open drain..... 4 Yes, and the wash water was spilled on the surface/open ground 5	

		Others (Specify)..... 6 _____ Don't know..... 7	
063	The last time you emptied the septic tank/pit, how much did you spend on emptying? [Record in Rupees]	□□□□	
064	What is the interval of emptying?	Emptied only once 1 Once in a year 2 Once in two years 3 Once in three years 4 Once in four years 5 Once in five years 6 More than 5 years 7 Whenever it fills up 8	
065	Distance of drinking water source within the establishment premises to the pit/ septic tank (feet)	□□ feet	
PART E - Photographs			
066	Two photographs to be taken: 3. Visible portion of the on-site containment structure (top view with natural tilt) 4. Front elevation of the house from the street		

Interview end time:

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Annexure 4: Definitions of type of establishments

Hotel 1

Hotel refers to any property where food is served to customers in the premises. There are three categories:

Boarding & Lodging

Only Food.

(Please note that properties where only lodging is provided has been covered under the section "Lodge" – Refer Option 3)

Guest house 2

A premise with rooms – either as part of apartment or stand-alone which is given out for rent. Homestays are also part of this guest house category.

Lodge 3

A property where only the rooms are provided for rent.

Office 4

A property where employees assemble for work that is non-manufacture, teaching or trade. Banks are included in office.

Hospital 5

Hospital is a property where patients have the facility to get admitted for treatment. Nursing home is classified under hospital

Clinic..... 6

Clinic is a property where the doctors meet the patient for treatment, but there is no facility for admission.

Wholesale..... 7

Wholesale is a property where bulk-goods handling is taking place; there is no manufacture. Major customers are other businesses which buy goods for resale.

Retail trades – Departmental store/shop 8

Here also there is no manufacture. Trade takes place where number of customers directly purchase from the shop.

Educational institution – School9

Educational institution – School is a property where classes upto 12th standard are conducted.

Educational Institution - College10

Educational institution that offers degrees (professional, arts, sciences)

Educational Institute others.....11

Training centres such as computer training, teacher training, vocational training, diplomas

Manufacturing industry.....12

Any property including factories where value addition takes place on raw-material including activities such as processing and packaging of food which is not classified under handloom/handicraft or cottage industry. It entails employees assembling in a place – owned or rented by the owner.

Handloom/Handicraft/Cottage industry13

Essentially it is a property where the family only is involved in the business activity classified as cottage industry.

Others (Please Specify)..... 14



Tamil Nadu Urban Sanitation Support Programme (TNUSSP) supports the Government of Tamil Nadu and cities in making improvements along the entire urban sanitation chain.

The TNUSSP is implemented by a consortium of organisations led by the Indian Institute for Human Settlements (IIHS), in association with CDD Society, Gramalaya and Keystone Foundation.