Tamil Nadu Sustainable Urban Development Project (TNSUDP)

Environmental Impact Assessment and Social Impact Assessment for Water Supply Improvement Scheme to Namakkal Municipality in Namakkal District by Tamil Nadu Water Supply and Drainage Board

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ABBREVIATIONS

TWADB – Tamil Nadu Water Supply and Drainage Board

EMP – Environmental Management Plan

TNUIFSL – Tamil Nadu Urban Infrastructure Financial Services Limited

TNUDP – Tamil Nadu Urban Development Project

ESMF – Environmental and Social Management Framework

FMB – Field Measurement Book

TNPCB – Tamil Nadu pollution Control Board

PPE – Personal Protective Equipment

TDS – Total Dissolved Solids

TSS – Total Suspended Solids

ROW – Right of Way

DI pipes – Ductile Iron pipes

BOQ – Bill of Quantities

Hrs - Hours

O & M – Operation & Maintenance

KM - Kilometer

KW - Kilowatt

DO – Dissolved Oxygen Lpcd - Liters

per capita per day m - Meters mg/kg -

milligram per kilo gram MI - milliliter

MLD - Million Liters per day

MPN - Most Probable Number

RCC - Reinforced Cement Concrete

Sq. Km - Square Kilometer

WTP - Water Treatment Plant

°C - degree Celsius

ANNEXURES

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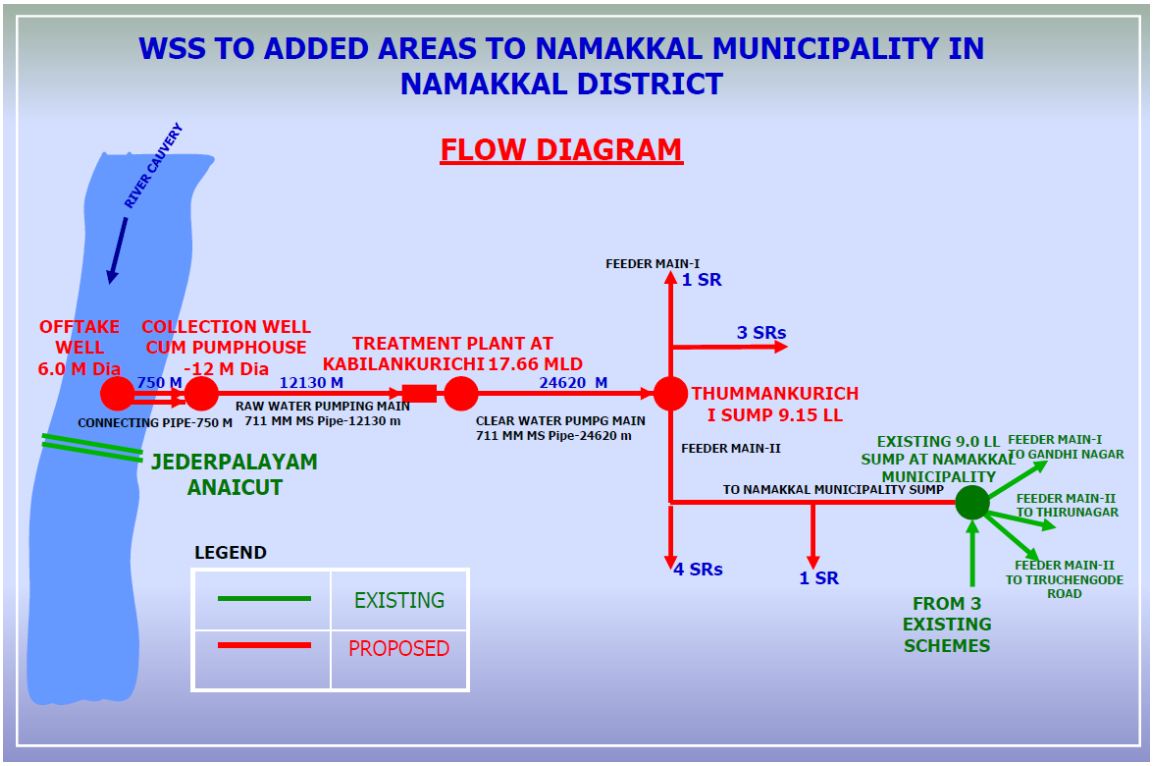
EXECUTIVE SUMMARY

INTRODUCTION

The Tamil Nadu Water Supply and Drainage Board (TWAD Board) is a statutory body corporate constituted under TWAD Board Act, 1970 on 14.04.1971. TWAD Board is entrusted with the development of Water Supply and Sewerage facilities in the State of Tamil Nadu, except Chennai Metropolitan Development Areas. TWAD Board further expanded their horizon of service to include maintenance of major CWSS also into their domain. 9 village Panchayats adjoining erstwhile Namakkal Municipality was added to Namakkal Municipality vide G.O Ms. No: 260 Dt. 25.10.2010. Further an Under-Ground Sewerage Scheme was implemented to Namakkal Municipality during 2012 and under beneficial use. Hence, it was proposed to enhance the Water supply service level in Namakkal Municipality to 135 lpcd by implementing a separate Water Supply Improvement Scheme with Head works near Jederpalayam Anaicut. The project has been proposed under the scheme of Tamil Nadu Sustainable Urban Development Project (TNSUDP) with financial assistance from World Bank.

2. PROJECT DESCRIPTION

The proposed project involves drawl of 17.66 MLD for intermediate stage (2033) for a Projected population of 158848.



2.1. Description of the proposed source:

The proposed surface water tapping point (off take well 6.0 m dia) location is selected in the Cauvery river near Jederpalayam Anaicut The Jederpalayam Anaicut has its full storage for the whole year. Hence surface water can be drawn throughout the year.

2.2 Salient Details of Head works:

The following Construction and pipe laying works are proposed at the Headworks site.

1.Construction of Off take well 6.0 m dia in the river.

2. 600 mm CI D/F Pipe Connecting Main Two Rows for about 750 m Length.

3.Silt chamber 3.5 m dia-2 Nos.

4.Collection well (12.0 m dia) cum Pump house (15.0 m dia).

5.Approach bridge 3.5 m width for about 75.0 m Length.

6.Transformer Yard near the Approach Bridge.

The site is River Poromboke located in the river bank of Cauvery Under possession of PWD.

2.3 Raw Water Main:

It is proposed to lay the raw water pumping main of 711mm dia MS pipes for a length of 12.13 m from head works to the Treatment Plant at Kabilakurichi. All The pipe lines will be laid along the berm of the road and there will not be any acquisition of private land.

2.4 Treatment Plant:

Full Scale Treatment of 17.66 MLD using Rapid Sand Filter is proposed at Kabilakurichi. The Treatment Plant comprises of Aerator, Stilling Chamber, Measuring Channel, Flash Mixer, Clarriflocculator and Filter cum Chemical House with 8 Nos of twin type Filter Beds (including 2 nos. as stand bye), Clear Water Reservoir 9.15 LL and Pump House 20.0x11.0x7.0m. Recycling of Filter bed wash water is proposed. Dry Sludge container pit at Treatment site proposed for disposal of solid waste. From the treatment Plant the clear water is pumped to Thummankurichi Booster Station by means of 3 Nos (2+1 Nos. stand bye) Vertical Turbine Pump sets of Duty 6095 lpm x24 m head. The land for WTP is Municipally owned.

2.5 Clear Water Main:

It is proposed to lay clear water pumping main of 711mm dia MS pipes for a length of 24.62 km from Treatment Plant at Kabilakurichi to Thummankurichi BS. All The pipe lines will

be laid along the berm of the road and there will not be any acquisition of private land. One no of Thirumanimutharu River Crossing will be carried out through elevated supporting structure.

2.6 Booster Station at Thummankurichi

Master Sump of capacity 9.15 LL at Thummankurichi Booster Station is Proposed. Water is pumped to all the proposed SRs by means of 2 sets (Each 2+1 no Standby) of HSC Centrifugal pump sets of duties 2004 lpm x 79 m and 4091 lpm x 51 m head installed in pump room of size 20 m x 8 m. Re chlorination is proposed at the Booster Station. The site is located in the Government land.

2.7 Feeder Mains:

Water is proposed to be pumped to all the 9 proposed SRs in Added Areas and to existing 9.0 LL Sump at Municipal Complex by means of Two Feeder Mains of DI pipes of various Sizes ranging from 500 mm dia to 100 mm dia, for a total length of 31.58 km. All The pipe lines will be laid along the berm of the road and there will not be any acquisition of private land. Two numbers of NHAI Road Crossing and 2 Nos of Railway crossing has to be carried out.

2.8. SERVICE RESERVOIRS and DISTRIBUTION SYSTEM:

Totally 9 Nos of service reservoirs are proposed to a capacity ranging from 1.0 Lakh liters to 9.1 Lakh liters with 16m staging height, for the added areas to Namakkal Municipality in addition to the existing 11 Nos of service reservoirs.

It is also proposed to lay distribution system for a length of 247.62 km in addition to the existing 88 km length. 28.92 km length of Distribution System proposed to be replaced in the existing Distribution System. Existing 57 public Fountains are being utilized.

All the construction activities will be carried out in Government/Municipal Land and there will not be any Private land acquisition.

2.9. Environmental Regulatory Requirements:

A review of National, State and Regional and World Bank environmental laws, rules and regulation relevant to the proposed project indicated that in addition to the safeguard policies of the Bank and construction safety requirements, the project would require approval from Public Works Department for drawl of water from River Cauvery and Construction works at Head works site, and NHAI and Southern Railway and Highways Department for laying conveying main.

2.10 Applicability of ESMF:

The Project proposed shall be implemented safeguarding the environmental and social concerns of the development activity. The requirements for ensuring environmental and social safeguards have been stipulated in the TNUIFSL's Environmental and Social Management Frame work exclusively prepared for TNSUDP.

3 DESCRIPTION OF THE ENVIRONMENT DIMENSION AND VISUALISATION:

The environmental entities Viz., Micrometeorology, Air, Water, Soil, Noise, Biological and Socio-Economics were assessed through a snap shot environmental Survey along with the data from the various information resources for the attributes of the ambient environment.

Micrometeorology:

The micrometeorology of the project location is typical representative of tropical Indian conditions with high temperate and moderate windy conditions and with a low annual rainfall wind. The predominant wind direction are W and SW. The average wind speed is 1-5 Km/hr.

Temperature

The minimum temperature is 21.1°C. The Maximum temperature is 44.2°C.

Relative Humidity

The relative humidity is 65-72%

Rainfall

The annual average rainfall is 610mm The climate is tropical in Namakkal. In winter, there is much less rainfall than in summer. This climate is considered to be Aw according to the Köppen-Geiger climate classification. The average temperature in Namakkal is 28.3 °C. The average annual rainfall is 764 mm.

Hydrological Environment:

Ground Water:

The surface water potential is very poor. The underground water bearing strata as aquifer are available at an average depth of 90-150m below ground level.

The ground water level in the area is around 60 m below ground level

Water Quality:

There are twelve locations identified for Ground water sampling. Surface water over River Cauvery is analyzed chronologically and it was ascertained that the raw water is not potable as the parameters like Turbidity iron and Fecal Coliform exceeds permissible limit.

Air Environment

Secondary data collected for five different location for air sampling to compile Ambient Air Quality of the project location.

Noise Environment:

The Noise level around the project location adhere to the standards for both night time and day time, but for Traffic sources.

Soil Environment:

The soil is characteristically gavel or soft rock.

The top soil is fertile with requisite combination of red soil.

All the Construction locations were chosen for assessing soil characteristics of the impact area.

Socio-Economic Environment:

A sample survey has been conducted to collect qualitative information about socioeconomic environment of the area. The population is essentially agriculture dependent. The ground water is the dependable sources for agriculture activities.

The total population of the study area is 1,20,957.

They are grouped into 39 Wards.

Total male population is 60026 and female is 600931.

Literacy rate of Namakkal city is 90.76 % higher than state average of 80.09 %.

In Namakkal, Male literacy is around 95.04 % while female literacy rate is 86.58 %.

The basic amenities like electricity, roads are available. There is shortage in the availability of treated potable water in the study area.

Ecological Environment:

Ecological survey was done to understand baseline ecological status, important floristic elements, fauna structure. As per baseline studies, there were no endangered, threatened & protected plants and animal species were recorded in the study area.
Hence, no significant adverse impact was envisaged on ecology.

The Fauna and Flora represents typical tropical rural Indian conditions.

4. ENVIRONMENTAL IMPACT ANALYSIS

The impacts on Topography, Land use pattern and Landscape Surface / Ground Water Resources Water Quality Ambient Air Quality Ambient Noise Quality Traffic and Transport Ecology will be minimal on account of the proposed mitigation measures. The construction of conveying main will be done in the berm of the road and the space required for construction will be 1.5m to 2m. There will be obstruction of traffic flow wherever the width of the road is very less.

Mitigation Measures

The impacts during the construction phase on the environment would be basically of transient nature and expected to reduce gradually on completion of the construction activities. It is proposed to Recycle Wash Water in WTP and even during operational state there will be negligible environmental impact.

Sludge handling & disposal:

It is proposed to isolate solid sludge from sludge effluent let out from Clarriflocculator through sludge sump , sludge thickener sludge drying bed and dispose the solid sludge in the sludge container pit with smooth HDPE Geomembrane as impervious lining material for sludge container pit for protection of subgrade from percolation of water through sludge deposit. Pipe carrying bridges will be proposed across Thirumanimutharu River crossing with elevated supporting Structure without affecting the water regime. Piers for the pipe carrying bridge will be constructed on suitable foundation.

Noise barrier at Thummakurichi:

Considering the nearness of school , it is proposed to construct 3.0 m height compound wall with plantation of trees all round as sound absorber and to locate the noise generating components like pump sets away from the road side

Continuous monitoring will be performed periodically to estimate the impacts in the surrounding environment and to take appropriate mitigation measures to bring down the pollution load. Laying of conveying main will be carried out in stretches so as to ensure smooth flow of traffic and safety of workers during construction phase. Proper traffic management plan will be prepared and it will be implemented only after the approval of the concerned authority.

5. ENVIRONMENTAL MANAGEMENT PLAN

As the project is proposed to be implemented by LS Contract, Contractor shall adhere to the EMP envisaged in the report. However, the contractor has to obtain approval from TWAD Board before commissioning the construction activities with due care to protect the environment. The EMP cost for the project is Rs. 408.81 Lakhs as per Table 5.3.

Environmental Management Plan for Pre-Construction Phase

SL. No	Activity	Mitigation measures	Responsible agencies
1	Clearances	All clearance required during construction shall be ensured and made available before start of work.	TWADB and Namakkal Municipality
2	Utility Relocation	Identify the common utilities to be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps etc. Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts	TWADB / Concerned departments/Contractor
3	Permissions from other departments	Railway NHAI and Road crossing PWD approval for the withdrawal of 22.09 MLD and for laying 67.5 m pipeline for river crossing.	TWADB
4	Design Criteria	All the units of Head Works, treatment plant, Sumps, Pump Rooms and SRs shall be designed in such a way that it can withstand maximum load and without compromising performance. The design shall take into consideration all the measures identified.	TWADB

Environmental Management Plan for Construction Phase

Sl.No.	Activity	Mitigation Measures	Responsible Agencies
1	Disposal of Construction debris	A suitable site should be identified for safe disposal, in relatively low lying areas, away from the water bodies etc., and got approved by the Engineer.	contractor
2	Informatory Signs and Hoardings	The contractor shall provide, erect and maintain informatory/ safety signs hoardings written in English and local language, wherever required or as suggested by the Engineer	Contractor
3	Handling of waste	All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer	Contractor
4	Safety Aspects	Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall conform to the relevant Indian standards Code and shall be regularly inspected by the PIA Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. Welder's protective eye-shields shall be provided to workers' who are engaged in welding works. Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation	Contractor and TWADB

		The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No.62 as far as those are applicable to this contract. i)The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 and adhered to. ii)The contractor shall not employ any person below the age of 18years for any work and no woman will be employed on the work of painting with products containing lead in any form.	
5	Water pollution from construction wastes	The waste water quality shall comply with the standards of TNPCB to let out into the river.	Contractor
6	First Aid	The contractor shall arrange for: A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	Contractor

7	Using of modern machineries	Using of modern machineries such as JCBs, backhoes etc, shall be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents	Contractor
8	River crossing Through elevated RCC Supporting structures with pillar and slab arrangements	Circular column for minimizing obstruction& foundation below bed for free flow of river water-	Contractor
	Conveying Main		
1	Dust Pollution near settlements	All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction shall be covered & equipped will dust collector. Construction material shall be covered or stored in such a manner so as to avoid being affected by wind direction. Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage	Contractor

2	Laying of conveying main	Adequate precautions should be taken while laying the water supply mains to avoid the possibility of cross connection with sewer lines. For the mains proposed in the bank of Cauvery River, the trenches shall be refilled and The excavated soil shall not be taken away from the site. Excess soil to be left in the river bed itself to ensure not to disturb the river profile.	Contractor
3	Traffic arrangements	Before taking up of construction activity, a Traffic Management Plan shall be devised and implemented to the satisfaction of the Engineer. Construction shall be taken phase-wise so that sections are available for traffic Temporary diversion will be provided with the approval of the engineer. The Detailed traffic control plans prepared and submitted to the engineers for approval one week prior to commencement of works shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, reflective SIGN boards, cones etc safety measures for transport of hazardous materials and arrangements of flagmen. The arrangement for the temporary diversion of the land shall ensure to minimize the environmental impacts like loss of vegetation, productive lands etc., prior to the finalization of diversion and detours. Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night.	Contractor

		The contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He shall inform local community of changes to traffic routes, conditions and pedestrians access arrangements. Traffic management plan shall be prepared by the contractor and got approved by the engineer concerned. This plan will be periodically reviewed with respect to site conditions. The temporary traffic detour will be kept free of dust by frequent application of water.	
4	Rainwater harvesting,	Construction of Rain Water Harvesting structure(Roof Collection System and Discharging through leach pit) in Structures including Service Reservoirs O&M Measures Periodical cleaning and removal of filtering media and removal of block in drainage path	Contractor and TWADB
5	Compound wall at BS	Construction of compound wall at Booster station 3.0 m height to minimize nosie impact	Contractor and TWADB
6	River crossing Through elevated RCC Supporting	Circular column for minimizing obstruction& foundation below bed for free flow of river water-	Contractor and TWADB

	structures with pillar and slab arrangements		
7	Online Monitoring System through SCADA	Installation of SCADA System for online monitoring of Water Quality, Sound/Noise level, Vibration for preventive Maintenance etc	TWADB/Contractor

Environmental Management Plan for Operation Phase

Sl.No.	Activity	Mitigation Measures	Responsible Agencies
1	Safety measures	Chlorine handling –storage facilities, storage/ handling method – safety precautions as per Annexure 9	Namakkal Municipality
2	Water & noise monitoring	Water quality control and Noise and Vibration monitoring at pumpsets in Head Works site Treatment Works site and Booster Station	Namakkal Municipality
3	O&M	Periodical cleaning of accumulation of debris in between pillars and periodical maintenance of air valves fixed in river crossing Periodical cleaning and removal of filtering media and removal of block in drainage path in Rain Water Harvesting Structures	Namakkal Municipality
4	Sludge drying bed & Sludge pit	Removal of sludge from drying bed and dumping in Sludge Container pit and periodical cleaning of drying bed	Namakkal Municipality
5	Greenbelt maintenance,	Regular watering, application of manure, protection of saplings, cleaning/ prunings, etc	Namakkal Municipality
6	Safety training	Training for operators regarding safety procedure dos and don'ts	TWADB/ Namakkal Municipality
7	Environmental Monitoring	The prospective contractor shall carry out Environmental Monitoring according to the guidelines given in the **Table 5.2**	Contractor

The EMP shall be implemented by the TWADB and will submit monthly reports on the status of compliance with ESMF requirements to TNUIFSL.

6. SOCIAL IMPACT ASSESSMENT

This project involves provision of Water Supply Improvement Scheme to Namakkal municipality in Namakkal District and involves the following components.

i) The components of the project are as follows: Construction of offtake well in Cauvery River and Collection well cum pump house at Head Works Site.

ii) Construction of 17.66 MLD WTP at Kabilakurichi

iii) Laying conveying main for a length 68.33 Km.

iv) Construction of 9 Nos of Service Reserrvoirs.

v) Construction of Pump Rooms and Erection of Pump sets at Head Works, Water Treatment Plant and Booster Station.

vi) Laying of Distribution System for 248 km.

vii) Rejuvenation of existing Head Works, pumping main Pump set and Booster Station.

There are no encumbrances or disturbances during the construction of the above work. All the lands are Owned by Local Body or Government Land , doesn't involve acquisition of private land and doesn't have any social impacts, hence the proposed sub-project has been categorized as "S3" as per ESMF of TNSUDP. However, any impacts identified during project implementation will be mitigated as per ESMF social safeguard policy provisions. Necessary provisions for traffic management to minimize public hindrance is given in **Chapter** 5 (Environmental Management Plan), **Table** – 5.3.

GRIEVANCE REDRESSAL MECHANISM

The TWADB as the project implementing agency(IA) will have Grievance Redressal mechanism to handle the grievances of the project.

A project level Grievance Redressal Committee (GRC) will be set up and the members are as follows (preferably one of them as women)

1) Executive Engineer (Convener)
2) Any one elected representative

3) A person who is publicly known in the local area
4) Commissioner, ULB
5) Municipal Engineer, ULB

The complaints will be acknowledged to the complainant. Efforts will be made by TWADB to ensure closure of complaint within a maximum period of 30 days from the date of its receipt. Serious issues shall be attended as early as possible. If not satisfied with the resolution provided by GRC, the complaints shall be handled at higher level i.e., Chief engineer of TWADB.

If there is any grievance, it involves a process of consultation and negotiation with the committee. The grievances relating to the problem will be recorded and each step in the resolution process also will be recorded. The elected representative will be involved in representing the issue and act as communication link between the persons involved. When the problems are identified, it will be taken to the personnel who respond and pass the information to the committee immediately. It is then the role of the committee to investigate and consult with the persons to evaluate the seriousness of the issues and work with the management to resolve the problem.

TWADB shall submit monthly reports on the status of compliance with the ESMF requirements to TNUIFSL.

The contact details of the Grievance redressal Committee are given below:

Executive Engineer,

Urban Division,

172.State Bank Officers' Colony,

Salem-4

Phone No: 0427-2333667
Fax No 0427-2333667

Email : eeurbanslm@gmail.com

To register complaints, contact the following phone number:

Phone No: 0427-2333667

To register complaints through internet, send mail to the following ID

eeurbanslm@gmail.com

7. PUBLIC CONSULTATION

As per the World Bank policy on access to information and disclosure, the proposed project attracts Public Hearing. The Public Hearing was arranged by the TWAD Board on 30.06.2016. Information on Public Consultation is given adequately to the Public by means of notice, personal contact, etc. Views expressed in the Public Hearing are for early implementation of proposed project.

8.IMPLEMENTATION OF THE PROPOSED PROJECT AND INSTITUTIONAL ARRANGEMENTS AT TWADB

The proposed project involves IMPLEMENTATION OF WSIS to Namakkal Municipality in Namakkal District. This project will be implemented by TWADB under the scheme of Tamil Nadu sustainable urban development project (TNSUDP) at an estimating cost of Rs.185.24 Crores.

TWADB Engineers will monitor the day to day activities.

The TWADB Engineers will monitor Environmental and social safeguards Measures for ensuring adoption and compliance of ESMF.

The environmental management plan identified for the construction will be included in the bid documents for ensuring implementation of the environmental safeguards. The management measures identified for the operation phase will be taken up by the TWADB upon completion of construction activities.

TWADB shall submit monthly reports to TNUIFSL on the status of compliance with the ESMF requirements.

9. PROJECT BENEFITS

The proposed project aims at Providing 17.66 MLD(Int) of Water Supply Improvement Scheme to Namakkal Municipality and enhancing the Service level to 135 lpcd expected to benefit 158848 population besides 23151 Nos of HSC.

1. INTRODUCTION

1. 1 PREAMBLE

Namakkal is a Selection Grade Municipality comes under Namakkal assembly Constituency and also District Head Quarters of Namakkal District bifurcated from Salem District with effect from 1.1.1997. It is situated at about 53 km. south of Salem in Salem - Karur NH-7 Road. It consists of 7 Taluks namely Namakkal, Rasipuram, Trichinous, Paramythiid Velur, Sentimentalism, Komarapalayam and Kollihills. The district is bounded by Salem on the North, Karur on the South, Trichy on the East and Erode on the West. The area of this Municipality is 55.00 sq km which lies between 11.00 and 11.360 North Latitude and 77.280 and 78.300 East Longitude. **It is the first ISO 14001-2004 certified Municipality in Asia for environmental management, specifically the provision and maintenance of water supply, solid waste and sewage management, town planning, lighting and other social services**.There are 39 Nos. of wards in this Municipality after including 9 adjacent village panchayats vide G.O. Ms No: 260 Dt.25.10.2010. The 9 village panchayats are namely Chinnmudalaipatty, Mudalaiptty, Kosavampatty, Kondisettipatty, Periyapatty, Kavettipatty, Nallipalayam, Ayyampalayam and Thummankurichi. The main occupation of the people are Agriculture and Transport body building for heavy vehicles.

1.1.1 **Existing Water Supply**

The drinking water requirement of this Municipality is met from three separate schemes with River Cauvery as source and reported to be 95,80,000 liters per day and the pro- rate supply is 90 Lpcd., as explained elaborately here as follows:

SCHEME -1:

In the year 1961, a water supply scheme was sanctioned for Namakkal Municipality at a cost of Rs. 18.01 Lakhs vide Go Ms. No. 627/Health /dt.14.03.1961 and the protected water supply was commissioned in the year 1967. This scheme consists of 2 Nos of infiltration wells at River Cauvery in Mohanur located 20 km away from Town with 3 Nos of 30 HP vertical turbine motors at Head works and 2 Nos of 30 HP Centrifugal Motors at. Aniyapuram Booster Station which is 9 km away from the town, water was conveyed through 225mm CI conveying mains and stored in a two-tier high level reservoir to the capacity of 5.44 Lakh Liter located over the Hillock in the heart of the

Town from which water was distributed through distribution mains. This scheme was designed for 1.58MLD for the intermediate population of 26,000 for the year 1976 and for an anticipated ultimate population of 35,000 for the year 1991 pro rata supply adopted in the scheme was 45 lpcd. To meet the demands of the increasing population the pumping capacity was increased from 30 HP to 45 HP at head works and from 30 HP to 40 HP at Booster stations at a cost of Rs.2.25 Lakhs in the year 1972. In the year 1981 itself the population figure was 38,792 and the supply level was quite inadequate.

SCHEME - II:

An improvement scheme was formulated in the year 1984 at a cost of Rs.1.82 Crores and revised to Rs 2.02 crores as per GO Ms. No.243/MAWS/dt.10.09.1984 on comprehensive basis combining 6 village panchayats having 26 wayside hamlets with the proposal to provide 2 Nos. of infiltration wells and infiltration galleries in the river with separate pump house of 2 Nos of 60 HP vertical turbine motors at head works and 2 Nos. of 60 HP centrifugal motors at booster station. The 12" conveying mains connected to the 3 high level reservoirs of capacity of 6.00 lakh liters at Gandhi Nagar and 2 Nos. of 3.00 lakh liter capacity at Thiruchengodu Road and Sandi Pettipudur. These reservoirs are connected with 8 km length of distribution mains of various diameters (90mm to 250mm) apart from the existing length of 19.00 km. This scheme was designed for the intermediate population of 66552 in the year 2001, in the year 2016 for the anticipated ultimate population of 88736. The total requirements at intermediate stage of works out to 3.31 Mld and 4.41 Mld for ultimate stage at the pro- rata supply of 70 lpcd through house service connections for the population of 55% and 25 lpcd through public fountain for the remaining population of 45%. This scheme was completed in the year 1990.

REJUVENATION OF NAMAKKAL MUNICIPALITY WSIS:

A rejuvenation estimate for installing new pump sets at head works and booster stations for ultimate stages had been sanctioned for Rs. 73.96 lakhs vide CEWR/CRE No. 57/98-99/dt. 8.1.1999. The ultimate designed quantity is 4.41 mld. At this stage the supply to the municipality was 2.80 mld from this scheme. The additional quantity after completion of the rejuvenation was 1.61 mld

The wayside villages covered under the above scheme is to be supplied with 55 lpcd pro-rata supply as per GO Ms. No 260/RDWSI dept./dt. 9.12.1998 and Technical committee meeting minutes dt. 22.12.1998. The additional quantity of 1.61 mld from the rejuvenation works utilized for the increased pro- rata supply to the above wayside habitations and surrounding 11 habitations of Namakkal Municipality Because of the above said reason the present supply to the Namakkal Municipality was retained as 2.80 mld only after completion of the Rejuvenation Scheme.

SCHEME III

. An improvement scheme was formulated in the year 2005 and Administratively sanctioned vide B.P. Ms. No. 12/TWAD(P&D) /dt.22.2.2005 for Rs. 990.50 lakhs for executing under UIDSSMT Programme and Revised Administrative Sanction was accorded vide GO (D) No.157/MAWS/dt.01.06.2012 at a cost of Rs.1432.09 lakhs. The scheme was completed during 12/2010.

In this scheme 3.83 mld of surface water is being tapped from the Cauvery river nearby the existing head works of Namakkal Municipality at Mohanur. Water from 6 Nos. of infiltration wells is drawn into a Collection well cum pump house. From the collection, well, water is conveyed through 300mm DI /350mm AC Pipes to a length of 9.75 Km and collected in the 3.5 LL capacity Booster sump at Aniyapuram by means of 60 HP (1993 lpm x 91m) 2 Nos. (1 No.- standby) Vertical turbine pumpset.

From the Booster sump water, will be conveyed through 400mm AC pipe to a length of 10.025 Km and collected in the 9.00 LL capacity Master sump constructed inside the Municipal Complex. As per the scope of the IIIrd Scheme, the water pumped from the previously executed two schemes are also let into the Master sump. From this Master Sump water will be pumped through 3 different feeder mains and fed to the 11 Nos. of Service Reservoirs (Existing –5 Nos., New – 6 Nos.) located at different zones in Namakkal Town and distributed through a net work of 97.29 Km of Distribution System.

The average annual rainfall is 801mm. The actual average rainfall for the past 15 years is 714.96mm only. The increase extraction of ground water for last past decade and

increase in consumption due to the population growth and consequent failure of monsoon has depleted the water level in both rivers and ground water alarmingly.

The total present water supply from the existing scheme is 9.58 MLD.

1. 2 NEED FOR THE PROJECT

WSIS to Namakkal Municipality has been proposed to be formulated in view of the following reasons.

1. Due to addition of 9 village Panchayats vide G.O Ms. No : 260 Dt. 25.10.2010 , namely 1.Chinnamudalaipatty, 2.Mudalaipatty,3.Nallipalayam, 4.Ayyampalayam, 5.Thummankurichi, 6.Kavettipatty, 7.Periyapatty , 8.Kondisettipatty, 9.Kosavampatty, it is necessary to formulate a new water supply scheme including the 9 s annexed Panchayats with Namakkal Municipality .The existing pro rata supply for the old Municipal Area is only 90 lpcd and 40 lpcd for the added areas even after taking into account the river source from 3 schemes and local sources as follows :

The added areas are now being fed by 3 schemes viz.(I) VC &RI CWSS (ii). CWSS to 2 TPs and 318 Habitations -Phase I. (iii) CWSS to 4 TPs and 1081 Habitations -Phase II. All the habitations of these 9 panchayats are located at the tail end of the above said 3 schemes. Moreover, the OHTs available in this added area are of 6.0 m or 7.50 m staging height. In order to effect House Service Connections, it is a mandatory requirement to have 16 m staging height for all SRs. Hence an improvement scheme is essential.

2. An UGSS was implemented to old Namakkal Municipality during 2012 which has been put into beneficial use. But present pro rata supply to old Namakkal Municipality is 90 lpcd only. As per CPHEEO norms, a pro rata supply of 135 lpcd is to be adopted for water supply schemes for Municipalities provided with UGSS. Hence an improvement scheme is essential.

Accordingly, the Managing Director, TWAD Board, Chennai vide Lr.No.F. Namakkal Municipality/ WSIS/ AE3/ PDC/ 2012/ dt.24.8.12 had instructed to investigate and prepare Detailed Project Report for newly added 9 Panchayats with Namakkal Municipality based on Commissioner for Municipal Administration , Chennai Lr.No.24339/ 2012/ dt.26.7.2012.

1.2. 1 Need for the Environmental Assessment Study

Rapid urbanization has resulted in a significant impact on the environment. All the concerned authorities have realized that development cannot be sustained unless the environment is protected. Therefore, most of the governments in the world have made it mandatory for project developers to carryout Environmental Assessment (EA) of their development project(s) and prepare Environmental Management Plans (EMPs) so that the environmental quality is protected.

ENVIRONMENTAL CATEGORIZATION

The proposed project of providing WSIS to Added Areas of Namakkal Municipality involving new source and construction of a new water treatment plant falls under "**E1**" category of the Environmental and Social Management Framework of TNSUDP and hence environmental assessment is to be carried out, and necessary management measures are to be prepared for implementation.

1. 3 SCOPE OF THE STUDY

- To assess the effect on Land, Air, Water and Noise environment and measures proposed and to take mitigation measure for any adverse effects.
- To assess impact on wildlife (including birds) habitat in project area, if any; Assessment of impact on flora and fauna which would possibly be affected by the project and to suggest plans for their conservation.
- To collect available water quality data; observe and analyze water quality at the project area and to collect information on known pollution sources in the area
- To evaluate the impact of the project on public health, quality of life etc. during construction and after commissioning of the project.
- To assess impact on human settlements in project area, if any. To assess impact of project on existing and proposed infrastructure including roads and to identify measures for overcoming the same.
- Analysis of Census data for demographic profile.
- Construction and operational phases identifying mitigatory measures.
- Prepare sound Environment Management plan (EMP) outlining additional control technologies to be adopted for mitigation of adverse impacts, if any.

- To assess the social impacts arising due to this project implementation and to prepare mitigation plans as per ESMF.

1. 4 METHODOLOGY

Any development activity in general is expected to cause impacts on surrounding environment at the project site during its implementation and operation phases, which can be both positive and negative. The nature and intensity of impacts on different components of environment depend on the type of project activities and geographical conditions of the study area. The impacts of the project activities on environmental components are quantified through Environmental Assessment (EA) studies within the impact zone of the project activities. The Results of EA studies form the basis for the preparation of a viable EMP for mitigation of the adverse impacts. The EA studies for the Water Supply system deals with detailed studies for the various environmental components viz. air, noise, water, land, biological and socio-economic environment.

1. 5 STUDY AREA

a. Headworks site at Jederpalayam:

The EIA study encompasses the area of the proposed Headworks site for the project. For the preparation of EIA report, the secondary baseline data and the micro climatic parameters were collected from the Governmental Organization and Information System.

b. Pumping Mains:

The raw water conveying main from Headworks site to WTP Site at Kabilakurichi for a length of 12.13 km and Clear Water Conveying main from Kabilakurichi WTP to Thummankurichi BS for a length of 24.62 km. Further the entire Municipal Boundary area comprising 31.58 km length of Feeder main, 9 Nos of SR and 247.62 km length of Distribution system. Moreover, the proposed conveying main will be laid below ground level and hence there is no disturbance to the existing overhead electric lines. The conveying main will be laid in such a manner that there won't be any possibility of cross connection either with the sewer line or water line.

1. 6 COMPONENTS OF THE STUDY

a) Air Environment

The description of the existing air environment in and around the proposed project site is based on secondary data from another scheme Internet.

b) Noise Environment

The baseline noise levels in and around 10 km radius of the proposed Project Site were established as per the Noise Pollution Level (Regulation and Control) Rules, 2000 in line with the Ambient Air Quality monitoring stations.

c) Water Environment

The baseline water environment in and around 10 km radius of the proposed Project Site were established in line with the ISO 19001 Standards. The river Cauvery at Jederpalayam Anaicut is also considered for the study.

d) Land Environment

Soil samples were collected from the HW site, WTP site and all the SR Sites and soil parameters analyzed and SBC ascertained. Secondary data of Physio-chemical properties of the soils were collected. Information on land use pattern in the study area was also collected. All the sites pertaining to the project are either owned by Municipality or Government.

e) Ecosystem

Information on eco-system within the study area was collected from the Internet. The important floral species native to the project area is enumerated and discussed in the Chapter 3.

f) Socio-Economic Environment and Occupational Health

A field survey was conducted within study area of the site and the surrounding impact zone. The parameters selected under socio-economic component were demographic structure of the study area, provision of basic amenities, industries likely to come up in the study area, welfare facilities by the project proponent, safety training and

management, community and occupational health hazards. Relevant information was collected from selected villages and analyzed.

1. 7 STRUCTURE OF THE REPORT

The report is structured as below.

- **Chapter 1 - Introduction**
- **Chapter 2 - Project Description**
- **Chapter 3 - Description of Environment**
- **Chapter 4 - Environmental Impact Analysis**
- **Chapter 5 – Environmental Management Plan**
- **Chapter 6 - Social Impact Assessment Report**
- **Chapter 7 – Public Consultation**
- **Chapter 8 - Implementation of the Proposed Project and Institutional Arrangements at TWADB.**
- **Chapter 9 - Project Benefits.**

2. PROJECT DESCRIPTION

TWADB has proposed a Water Supply Improvement Scheme to Namakkal Municipality in Namakkal District to enhance the Service Level to 135 lpcd in Namakkal Municipality. The project contemplates supplying 17.66 MLD of Treated Water in Intermediate Stage year 2033.

Project Components

The components of the project are as follows:

- Construction of offtake well in Cauvery River and Collection well cum pump house at Head Works Site at Jederpalayam Anaicut.
- Construction of 17.66 MLD Water Treatment Plant at Kabilakurichi
- Laying conveying main for a length of 68.33 Km.
- Construction of 9 Nos of Service Reservoirs.
- Construction of Pump Rooms and Erection of Pump sets at HW, WTP and BS.
- Laying of Distribution System for 248 km.
- Rejuvenation of existing HW, pumping main Pump set and BS.

Salient details of the project are as follows:

2. 1 SALIENT DETAILS OF THE SCHEME:

1.Head works	: Source - Surface water in river Cauvery Upstream of Pattanam Seerapalli CWSS – Phase II Offtake well at Jederpalayam Anaicut
Offtake Well	: 6.00 m
Collection Well	: 12.00 m Dia
Pump House	: 15.00 m dia
Connecting main	: 600mm CI D/F pipe-2 rows-750 m length.

2. Pump sets at Head works : 3 Nos (2+1 stand by) - vertical turbine pumps

6133 lpm x 76 m.

3. Raw water Main :Head works to Treatment site at Kabilakurichi

711 mm MS pipe 6.3 mm thick –12130 m

4. Treatment Plant : Capacity – 17.66 mld (Intermediate stage-2033)
(including wash water at 5%)

i) Aerator - 1 No. (Cascade type)

AV.GL : 186.000

No. of cascades proposed : 4 Nos.

Diameter of Collection tray : 8.20 m

Height of aerator : 2.00 m

Lip level : 192.00 m

No. of trays : 4

ii). Stilling Chamber

AV.GL : 186.000

Length of the stilling chamber: 6 m

Breadth of the stilling chamber: 4 m

Total depth of stilling chamber : 2.05 m

iii) Measuring channel

AV.GL : 186.000

Length of measuring channel : 10.00 m

Breadth of measuring channel : 0.90 m

Total depth of measuring channel : 0.55 m

iv) Flash mixer

AV.GL : 186.000

Diameter of flash mixer : 2.00 m

Total depth of flash mixer : 3.15

v) Dividing Chamber:

AV.GL : 186.000

Diameter of dividing chamber : 3.00 m

Total depth of dividing chamber: 4.05 m

vi. Flocculator

AV.GL OF CLARIFLOCCULATOR – I: 185.500

AV.GL OF CLARIFLOCCULATOR – II: 185.500

Diameter of flocculator : 10.00 m

depth of flocculator : 3.00 m

vii.Clarifier :

Diameter of clarifier : 24.00 m

depth @ centre : 4.80 m

Depth @ Floculator wall : 4.383 m

depth @ sludge pit periphery : 4.70 m

viii) Rapid Sand Filter

AV.GL : 185.000

Total no. of beds : 8 Nos(including 2 standby)

Length of filter bed : 6.00 m

Breadth of filter bed : 4.00 m

Depth of filter bed : 2.75

ix) Clear water reservoir

Capacity of reservoir : 9.15 LL

AV.GL : 184.500

LWL of Clear Water Reservoir : 182.000

MWL of Clear Water Reservoir : 185.000

x) Clear water pump house

Size : 20.0x11.0x 7.0m

xi) Wash water tank

Capacity : 3.50 LL

Staging Height : 12 m

AV.GL : 185.000

LWL of wash water tank : 197.000

MWL of wash water tank : 200.000

xii. Clear Water Pumpset : Vertical Turbine – 3 Nos (2+1 Nos. Standby)
6095 lpm x 24 meters

xiii. Clear Water Pumping Main : 711 mm MS pipe 6.3 mm thick 24620 m

5. Master sump at Thummankurichi

Capacity : 9.15 LL

Dia of sump : 20.00 m

Storage Depth of sump : 3.00 m

AV.GL : 180.807 m

MWL : 181.807 m

LWL : 178.807 m

6. Booster pump house at Thummankurichi :

Size - 20.00 x 8.00 m

7. Booster Pump sets at Thummankurichi

1. HSC Centrifugal – 3 Nos (2+1 No. Standby)
   2004 lpm x 79 meters

2. HSC Centrifugal – 3 Nos (2+1 No. Standby)
   4091 lpm x 59 meters

8. FEEDER MAINS :

The size and length of the Feeder Mains:

S.No	Pipe Dia and Type	Length
1	500 mm DI K7	4210 m
2	350 mm DI K9	3540 m
3.	350 mm DI K7	6740 m
4	300 mm DI K7	580 m
5	250 mm DI K7	9400 m
6	200 mm DI K7	930 m
7	150 mm DI K7	1469 m
8	100 mm DI K7	4707 m
	Total	31576 m

9.PROPOSED SERVICE RESERVOIRS

1) 1.0 Lakh Litres Capacity for Vasantham Nagar
2) 4.10 Lakh Litres Capacity for SPK Nagar
3) 2.10 Lakh Litres Capacity at SIDCO Colony
4) 7 .80 Lakh Litres Capacity at Kosavampatty
5) 3.90 Lakh Litres Capacity at Nallipalayam
6) 4.10 Lakh Litres Capacity at Mullai Nagar
7) 9.10 Lakh Litres Capacity at Swami Nagar
8) 8.0 Lakh Litres Capacity at Ponnagar
9) 8.50 Lakh Litres Capacity at Lakshmi Nagar EB colony

10.Existing Service Reservoirs(SR) :

The details of Existing SRs :

S.No	SR Location	Capacity in LL
1	Hillock Lower Tier Hillock Upper Tier	5.44
2	Gandhi Nagar	6.00
3	SP Pudur	3.00
4.	RP Pudur	4.00
5	Thiru Nagar Colony	3.00
6	Kottai Road	2.00
7	Commissioner Qtrs	3.00
8	Trichy Road	1.50
9	Mullai Nagar	1.50
10	Pathi Nagar	1.00
11	Tiruchengode Road	3.00

11. Distribution System

a) Proposed in added area -247.62 Kms

b) Proposed replacement in Existing System -28.92 km

b) Existing -88.00 Kms

2.2 PROJECT LOCATION

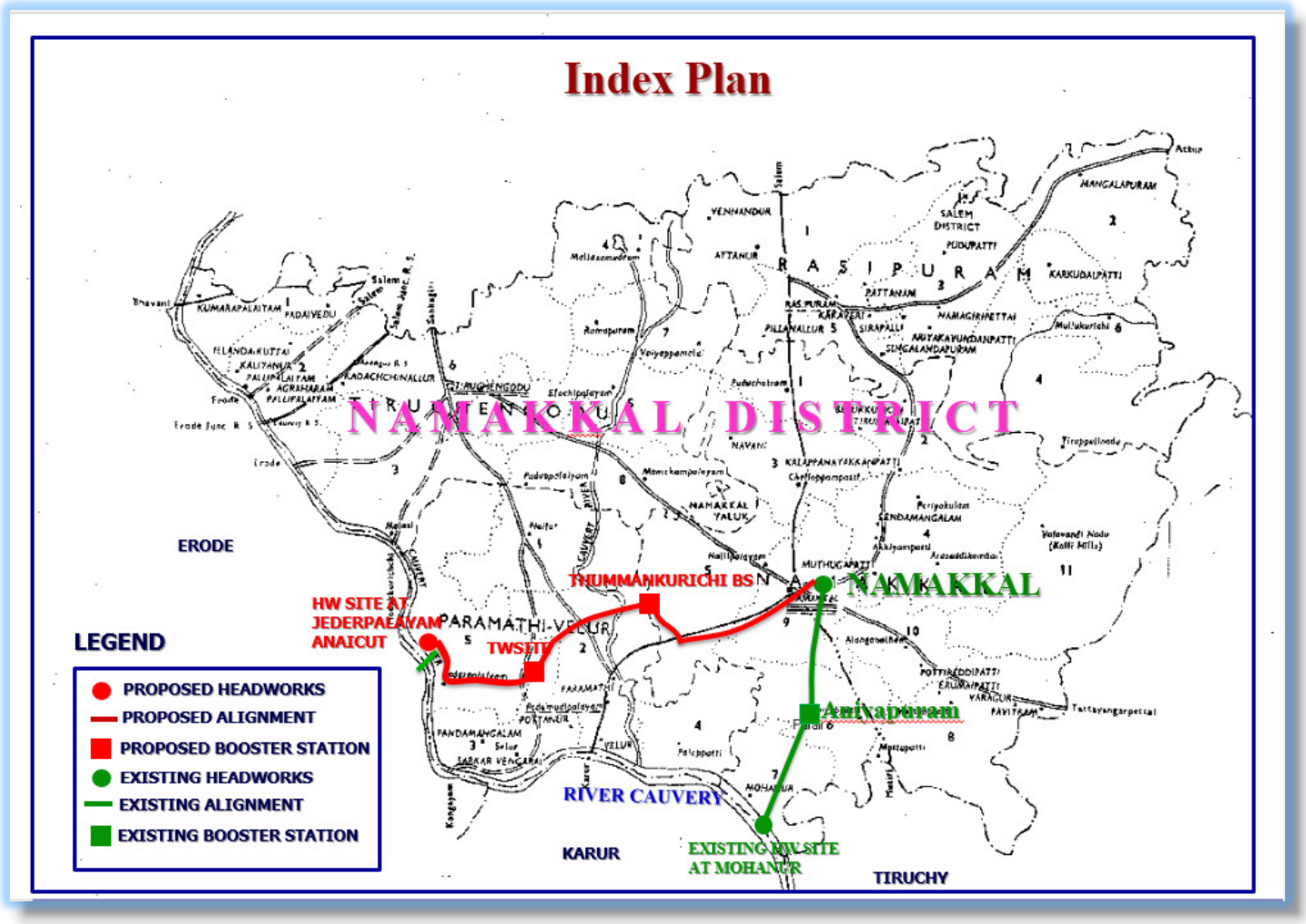


Figure 2. 2.1 – Project Index Plan

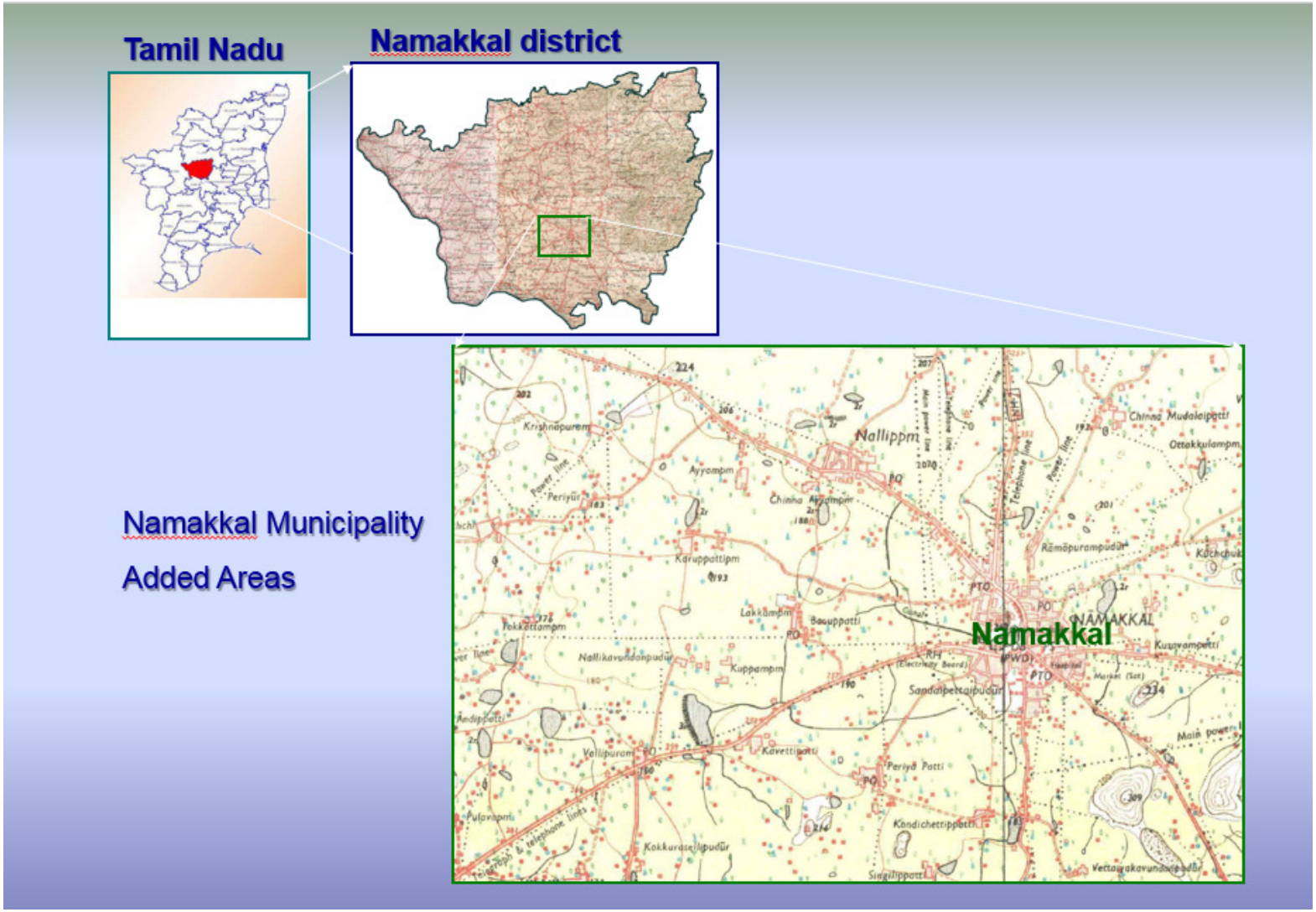


Figure 2. 2.2 – Beneficiaries Location Plan

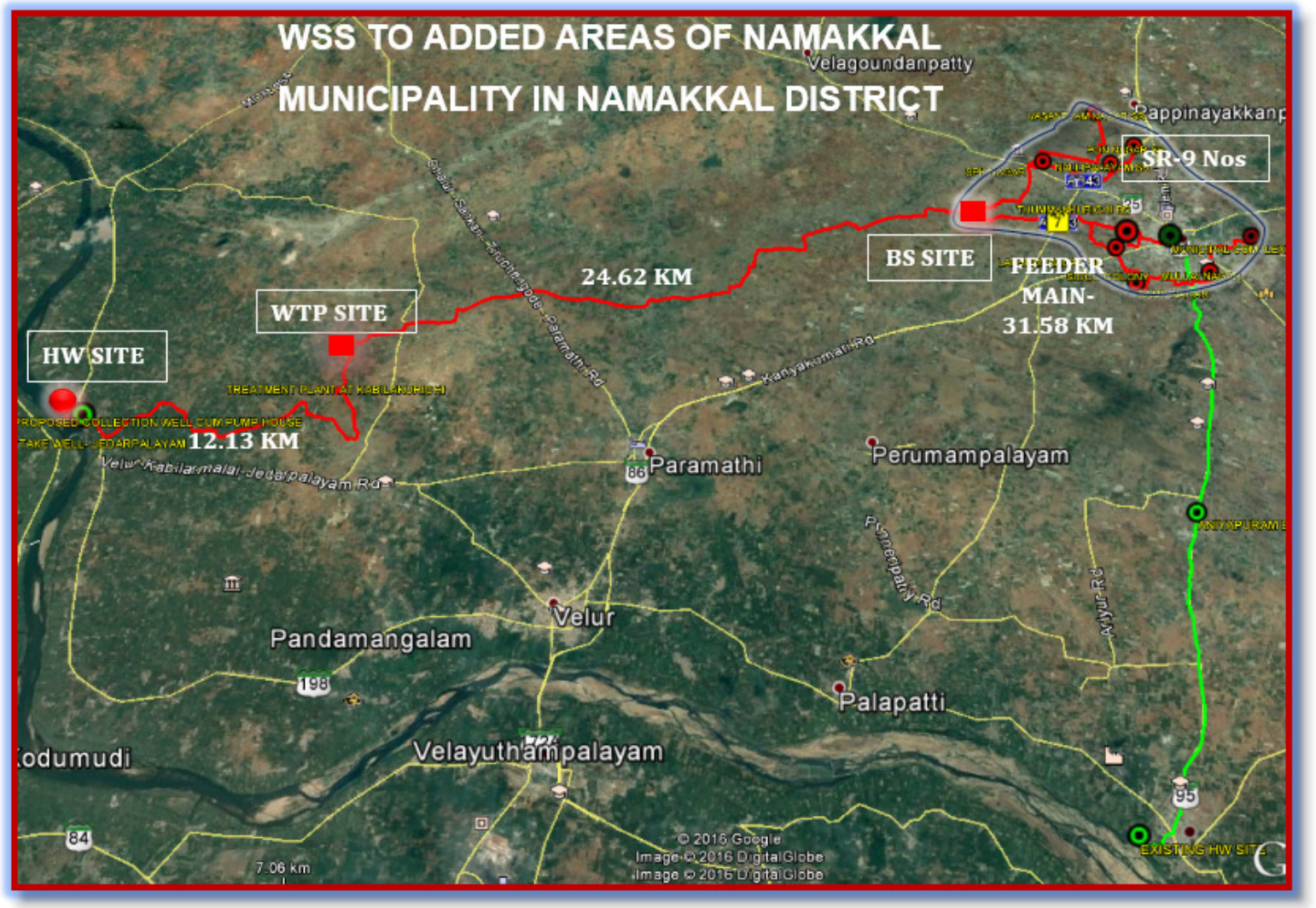


Figure 2. 2.3 - Location of Project Components

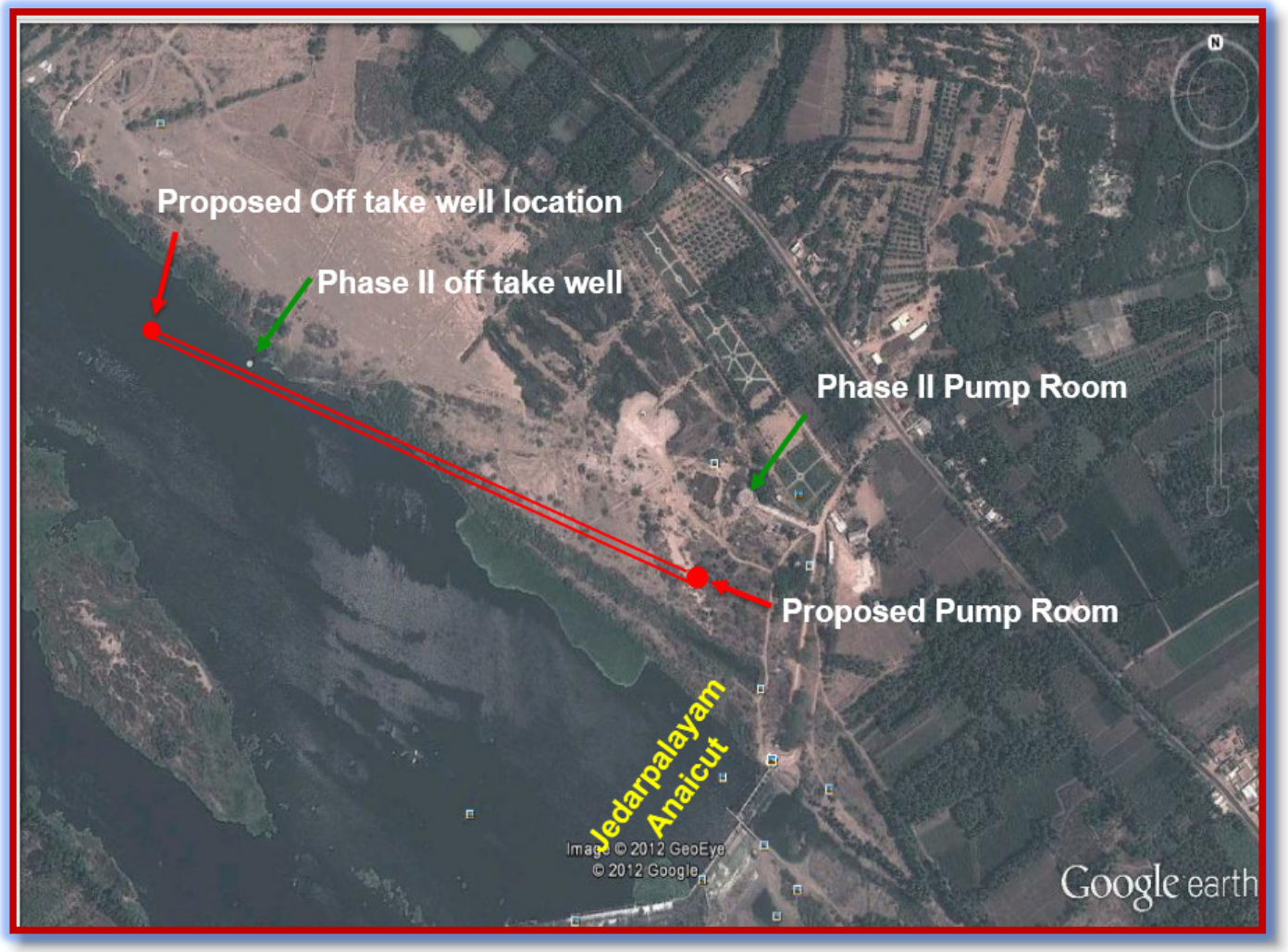


Figure 2. 2.4 - Satellite imagery of the Head Work site at Jederpalayam Anaicut

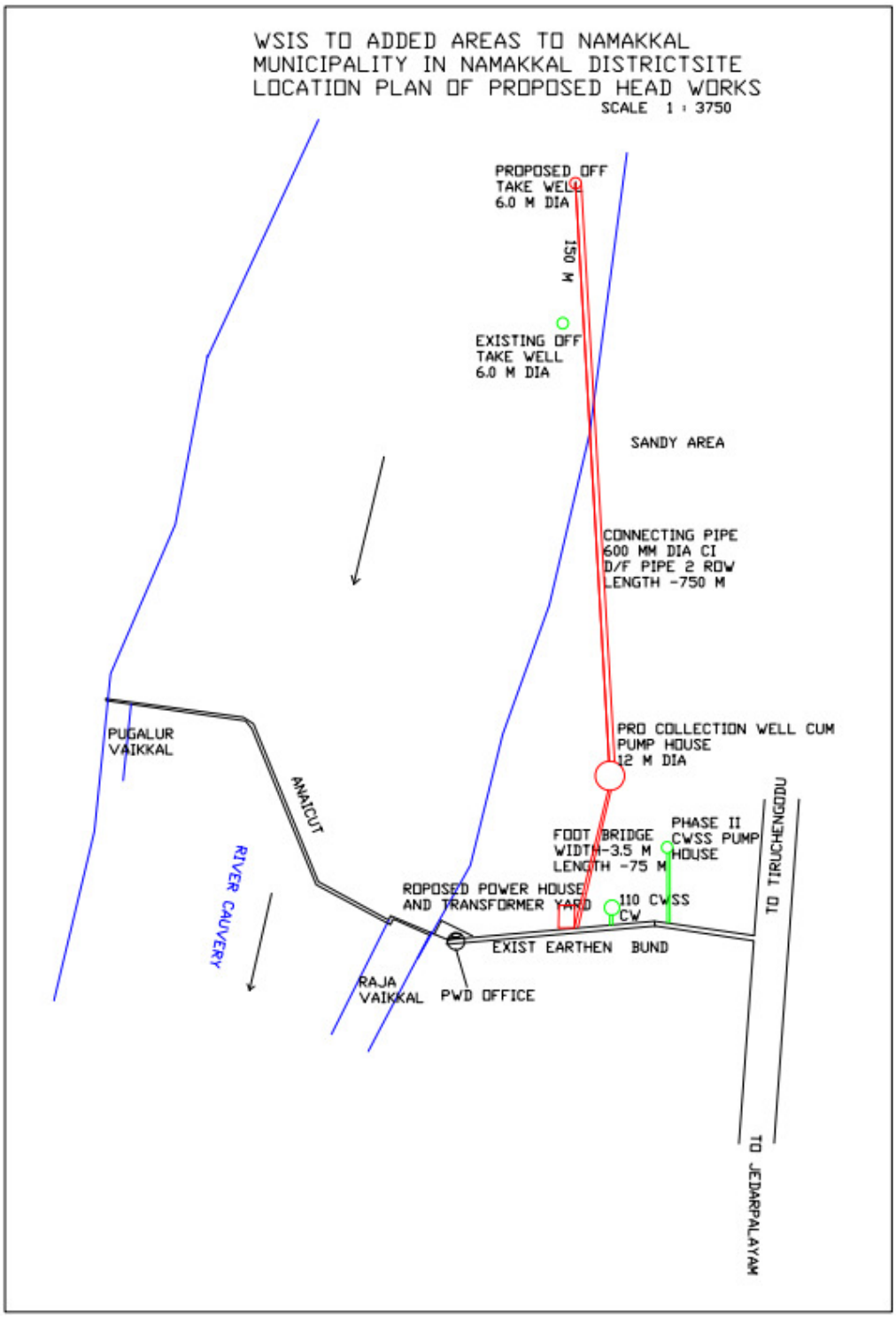


Figure 2. 2.4 – Head Works at Jedarpalayam Anaicut-Layout Plan

It is proposed to draw surface water by constructing 6m dia off take well in River Cauvery at Jederpalayam near Anaicut at about 100m upstream side of the existing off take well of CWSS to 4 Town Panchayats and 1081 Rural habitations in Namakkal District. The site is River Poromboke under the control of PWD.

2.3.RAW WATER PUMPING MAIN:

It is proposed to pump raw water from Collection well to lip of Aerator in proposed Treatment work site at Kabilakurichi , for a length of 12130 m by means of 711 mm OD,6.3mm thick MS pipe.

2. 4 WATER TREATMENT PLANT @ KABILAKURICH :

The Water Treatment Plant(WTP) is located in Kabilakurichi village in Namakkal District . The Kabilakurichi WTP proposed to be constructed in a site owned by Namakkal Municipality covering an area of 8 acres with barren land .17.66 MLD of water is proposed to be treated at Kabilakurichi WTP for the Intermediate stage(2033).

2.4.1 Demand & Assessment of Water

The projected population for the base year 2018 for the added nine panchayats including Namakkal Municipality is 1,33,013, for intermediate (2033) and ultimate (2048) are 1,58,848 and 184683 respectively considering population forecasting for core area and Added area separately.

Since Under Ground Sewerage Scheme is functioning in Namakkal Municipality, the pro-rata of supply at 135 lpcd is adopted. The present requirement including provision for collectorate (after deducting the existing water supply of 9.58 mld) is 13.23 mld. The intermediate and ultimate requirement works out to 17.66 mld and 22.09 mld respectively including 10% commercial and small industrial demand and 10% towards transmission loss. The details of requirement are tabulated below.

DESCRIPTION	BASE YEAR 2018	INT-2033	ULT-2048
POPULATION	133013	158848	184683
REQUIREMENT IN MLD	22.18	26.40	30.62
EXISTING SUPPLY	9.58	9.58	9.58
BALANCE REQUIRED in MLD	12.60	16.82	21.04
RAW WATER DEMAND AFTER ADDING 5% FOR WASH WATER REQUIREMENT in MLD	13.23	17.66	22.09

Table 2. 4.1 - Demand of water

DEMAND STATEMENT

Sl No	Description of Town	Population				Requirement @135 LPCD			Requirement for Domestic+Commercial and small Industrial and Fire Fighting demand-10%			Existing Supply			Net Requirement for Domestic+Commercial and small Industrial and Fire Fighting demand-10% including 10% Transmission Loss		
		2011	2018	2033	2048	2018	2033	2048	2018	2033	2048	2018	2033	2048	2018	2033	2048
1	Core Namakkal Municipality	55052	59439	68840	78241	8024265	9293400	10562535	8826692	10222740	11618789	9582840	9582840	9582840	-831763	703890	2239544
2	Mudalaipatty	2005	2238	2738	3238	302130	369630	437130	332343	406593	480843				365577	447252	528927
3	Ayyampalayam	1760	1965	2404	2843	265275	324540	383805	291803	356994	422186				320983	392693	464405
4	ChinnaMudalaipatty	7560	8440	10325	12210	1139400	1393875	1648350	1253340	1533263	1813185				1378674	1686589	1994504
5	Kavettipatty	3100	3461	4234	5007	467235	571590	675945	513959	628749	743540				565355	691624	817894
6	Kondichettipatty	11990	13385	16375	19365	1806975	2210625	2614275	1987673	2431688	2875703				2186440	2674857	3163273
7	Kosavampatty	12240	13664	16716	19768	1844640	2256660	2668680	2029104	2482326	2935548				2232014	2730559	3229103
8	Nallipalayam	5850	6531	7990	9449	881685	1078650	1275615	969854	1186515	1403177				1066839	1305167	1543495
9	Periapatty	15800	17639	21579	25519	2381265	2913165	3445065	2619392	3204482	3789572				2881331	3524930	4168529
10	Thumbankurichi	5600	6251	7647	9043	843885	1032345	1220805	928274	1135580	1342886				1021101	1249138	1477175
11	Provsion for collectorate					300000	300000	300000	300000	300000	300000				330000	330000	330000
12	Institutional Demand					985625	985625	985625	985625	985625	985625				1084188	1084188	1084188
	Total	120957	133013	158848	184683	19242380	22730105	26217830	21038059	24874555	28711054				12600739	16820887	21041037
	Adopting 24 hours pumping/day for Raw water pumping														**8751 LPM**	**11681 LPM**	**14612 LPM**
	ADD 5% FOR WASH WATER														630037	841044	1052052
	Raw water Requirement														13230776	17661931	22093089
	Adopting 24 hours Raw water pumping/day														**9188 LPM**	**12265 LPM**	**15342 LPM**
	Treatment plant capacity														**13.23 MLD**	**17.66 MLD**	**22.09 MLD**
	Adopting 23 hours pumping/day for Clear water pumping														**9131 LPM**	**12189 LPM**	**15247 LPM**

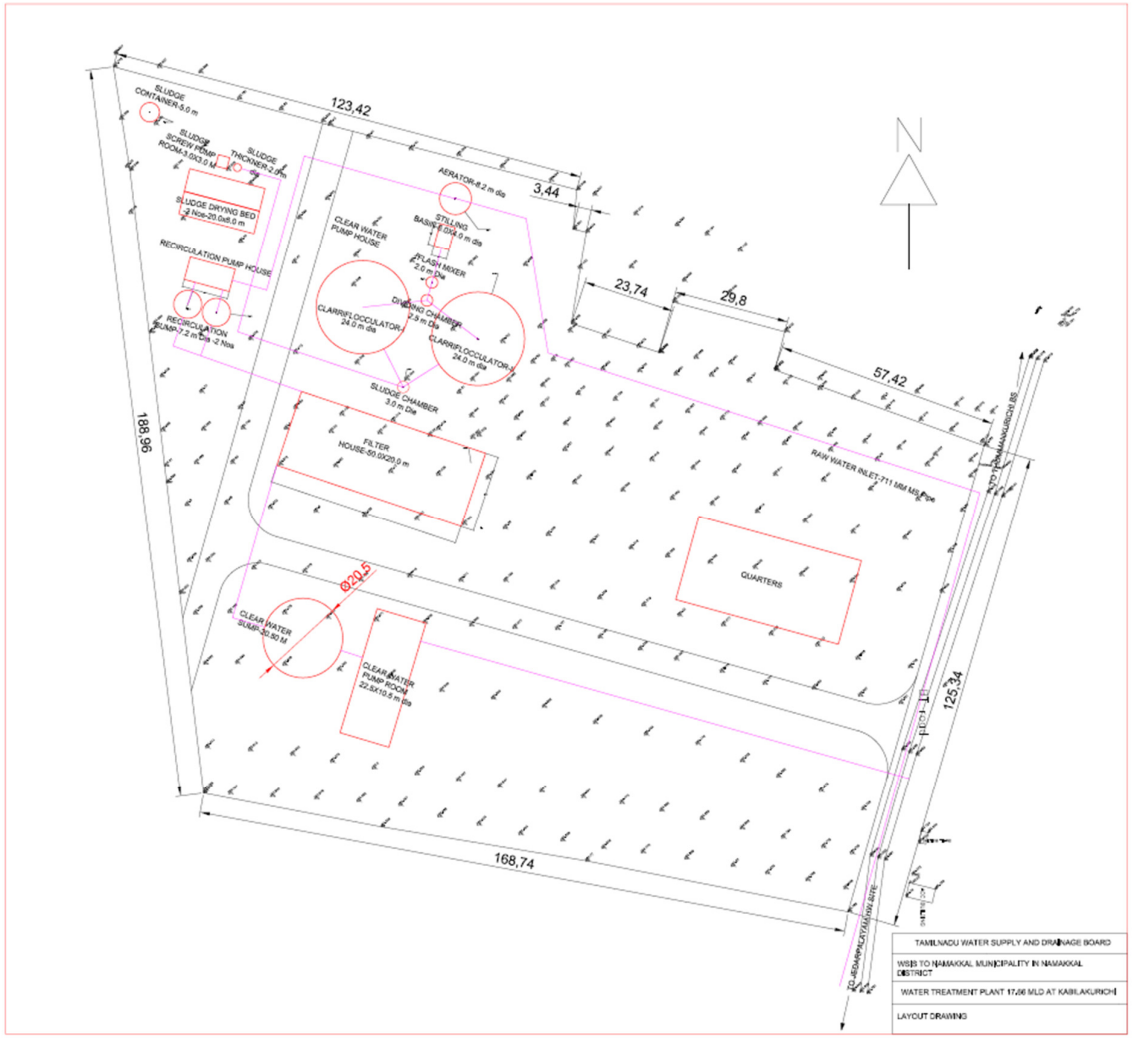


Figure 2. 4.1 – WTP at Kabilakurichi-Layout Plan

2. 5 CLEAR WATER PUMPING MAIN :

It is proposed to pump clear water from Clear Water Reservoir to Thummankurichi Booster , by means of 711 mm outer dia,6.3mm thick MS pipes for a length of 24.62 Km.

Thirumanimutharu River is proposed to be crossed through elevated supporting structure with 10 Nos of Circular columns minimizing obstruction of river flow.

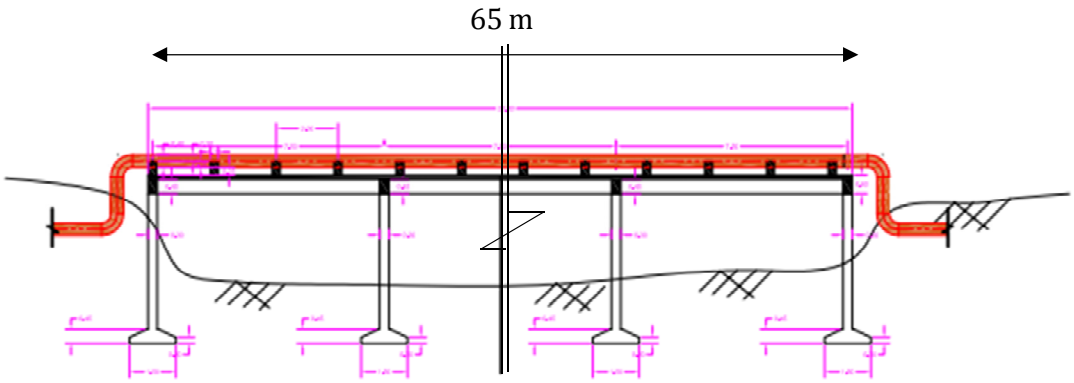


Figure 2. 5.1 – Thirumanimutharu River Crossing-Section

2. 6 CONSTRUCTION OF BOOSTER SUMP AT THUMMANKURICHI:

It is proposed to construct Master sump of capacity 9.15 LL at Thummankurichi to store the entire required quantity. From this sump , the water is pumped to all 9 panchayats i.e added areas to Namakkal Municipality, Collectorate and balance requirement to core Municipality, by means of three feeder mains .

2. 7 LAYING OF FEEDER MAINS :

Two feeder Mains have been proposed from this Thummankurichi Booster

1. From Thummankurichi Booster, the water is pumped to the SRs at SPK Nagar, Nallipalayam, Ponnagar and Vasantham Nagar, through the following pipelines as follows:

The size and length of the Feeder Main – I and Branches

S.No	From LS	To LS	Length in m	Size of the Pipe	Feeder Main/Branch Mains
1	0	2640	2640	350 mm DI K 7	Br to SPK Nagar
2	2640	6420	3780	300 mm DI K 7	Br to Nallipalayam
3.	6420	10100	3680	250 mm DI K 7	Br.To Pon nagar
4	10100	12200	2100	100 mm DI K 7	SR at Vasantham nagar
5	0	2920	2920	200 mm DI K 7	SR at SPK Nagar
6	0	350	350	200 mm DI K 7	SR at Nallipalayam
7	0	40	40	250 mm DI K 7	SR at Ponnagar
	TOTAL		**15510 m**		

2 .From Thummankurichi Booster, the water is pumped to the SRs in SIDCO Colony, Swaminagar, Mullainagar Lakshminagar, Kosavampatty and to the existing sump at Municipal complex through the following pipelines as follows:

The size and length of the Feeder Main – II and Branches

S.No	From LS	To LS	Length in m	Size of the Pipe	Feeder Main/Branch Mains
1	0	4140	4140	500 mm DI K 7	Br to Lakshminagar
2	4140	6800	2660	400 mm DI K 7	Br to SIDCO colony
3	6800	10200	3400	400 mm DI K 7	Br to Swaminagar
4	10200	11810	1610	300 mm DI K 7	Br To Mullainagar

5.	11810	14925	3115	250 mm DI K 7	SRat Kosavampatty
6.	0	600	600	300 mm DI K 7	Br to Sump at Municipal complex
7	600	900	300	250 mm DI K 7	SR at Lakshminagar
8	0	1980	1980	150 mm DI K 7	Sump at Municipal complex
9	0	150	150	100 mm DI K 7	SR at SIDCO colony
10	0	30	30	250 mm DI K 7	SR at Swaminagar
11	0	250	250	150 mm DI K 7	SR at Mullainagar
	TOTAL		**18235**		

2 Nos of NHAI Crossing and 1 No of Railway crossing to be carried out in feeder mains.

2. 8 CONSTRUCTION OF SERVICE RESERVOIRS :

9 Nos of Service Reservoir are proposed as detailed below.

1)1.00 Lakh Litres Capacity for Vasantham Nagar
2) 4.10 Lakh Litres Capacity for SPK Nagar
3) 2.10 Lakh Litres Capacity at SIDCO Colony
4) 7 .80 Lakh Litres Capacity at Kosavampatty
5) 3.90 Lakh Litres Capacity at Nallipalayam
6). 4.10 Lakh Litres Capacity at Mullai Nagar
7) 9.10 Lakh Litres Capacity at Swami Nagar
8.) 8.00 Lakh Litres Capacity at Ponnagar
9.) 8.50 Lakh Litres Capacity at Lakshmi Nagar EB colony

All the SR sites are either owned by Municipality or by Government.

2. 9 PROVIDING DISTRIBUTION SYSTEM::

The core Municipal area with existing 11 No. of service reservoirs are re-zoned so that equitable distribution with 135 lpcd will be ensured after the completion of the project. Necessary provision has been made in the estimate for improving the service of the existing distribution network of the core Municipal area. For other areas water distribution will be done from the newly proposed 9 Nos. of service reservoirs. For Distribution system in added areas HDPE Pipes are proposed for diameter upto 200 mm and DI Pipes are proposed for sizes above 200 mm Diameter.

The details of Distribution system required are as follows:

1. Existing Distribution System available	:	88.00 km
2. Length of the proposed Distribution System	:	254.73 km

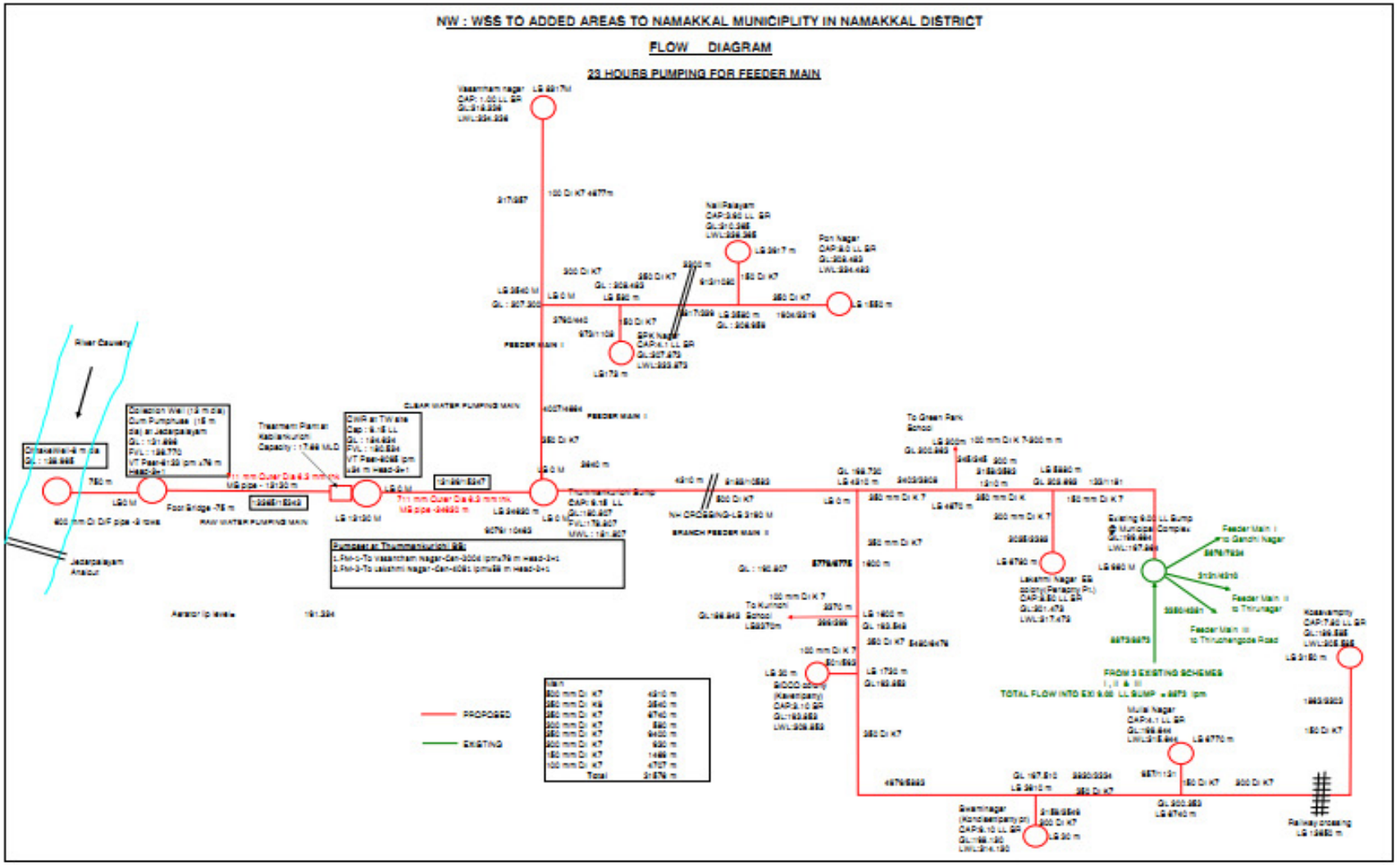


Figure 2. 9.1 – Feeder Main and SR Flow Diagram

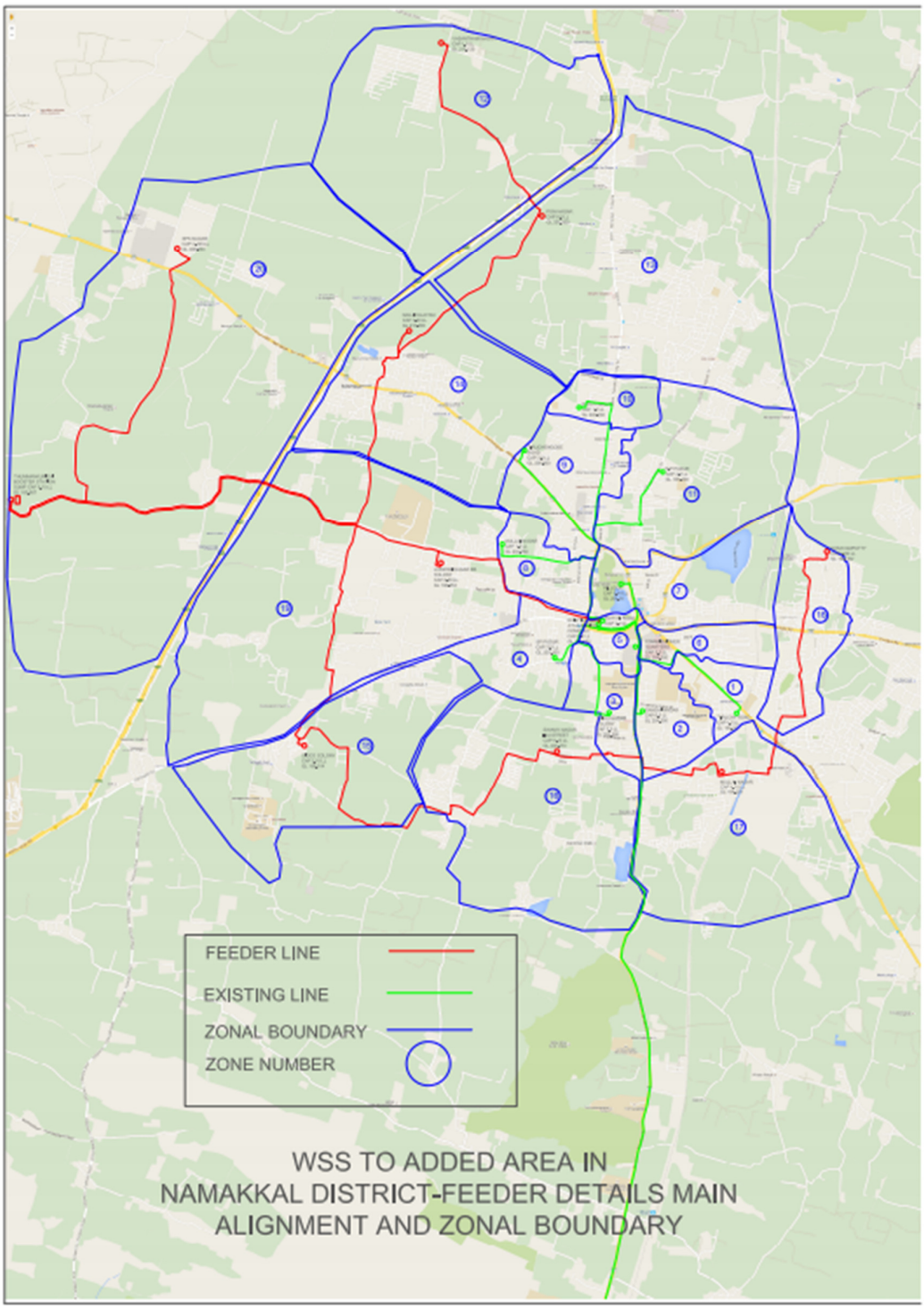


Figure 2. 9.2 – Feeder Main and SR Flow Diagram

2. 10 PROJECT COST

The estimated Project cost for providing Water Supply Improvement Scheme to Namakkal Municipality based on the prevailing market rates for Electrical and Mechanical works and the TWAD Board schedule of rates for the year 2016-17 for civil works worked out to Rs. 185.24 Crores including provision for charges payable to Tamil Nadu Electricity Board for getting Electricity connection, provision towards Value Added Tax, Service Tax, and Tamil Nadu Construction Labor Welfare Fund unforeseen items centage DPR investigation charges etc . ,

2. 11 LAND REQUIREMENTS

2.11.1 Head works site:

At the Headworks site of Jederpalayam Anaicut the following components are proposed.

1.Construction of Off take well 6.0 m dia in the river.

2. 600 mm CI D/F Pipe Connecting main Two Rows for about 750 m Length.

3.Silt chamber 3.5 m dia-2 Nos.

4.Collection well(12.0 m dia) cum Pump house(15.0 m dia).

5.Approach bridge 3.5 m width for about 75.0 m Length.

6.Transformer Yard near the Approach Bridge.

The proposal for permission for Drawal of the Ultimate requirement of 22.09 MLD and permission for construction of structural components was sent to Chief Engineer/WRO/Trichy vide Lr No and the proposal is under Scrutiny.

2.11.2 WTP site at Kabilakurichi:

The WTP Site proposed at Kabilakurichi is under possession by Municipality and it is owned by the Municipality. The following components are proposed in the WTP Site.

- Aerator
- Stilling Basin
- Dividing Chamber
- Flash Mixer

- Clarriflocculator
- Filter House
- Clear water Sump
- Pump House
- Sludge Chamber
- Sludge Thickener
- Sludge Screw Pump Room
- Sludge Drying bed
- Sludge Container Pit
- Wash water Recirculation Sump
- Recirculation Pump Room
- Transformer yard
- Staff Quarters
- Compound wall
- Internal Roads etc.,

8.0 Acres of Land is available at WTP Site and 5.0 acres only proposed to utilize for WTP and it is adequate for the present capacity and future expansion.

No land acquisition and cost is involved. The details of land requirements , possession and transfer of Government Lands are stated below.

Table 2. 11.1 – land requirements , possession Details

Sl. No.	Component	Location	Available Extent	Required Extent	Land Classification	Ownership	Acquisition/ Transfer/ Alienation Status	Remarks
1	Headworks site	Cauvery River			River Porompoke	PWD		Proposal Under Scrunity at CE'S Office/WRD/Trichy
2	Treatment Plant site -17.66 MLD	Kabilakurichi	8.0 Acres	8.0 Acres	Own Land	Munici-pality		
3	Booster Station 9.15 LL Sump 20x8 m Pump Room	Thummankurichi	6.0 Acres	0.62 Acres	Natham Poromboke	Revenue	Alienation	Land Transferred to Commissioner Namakkal Municipality
4	1.00 LL SR	Vasantham Nagar	1.19 Acres	6.40 cent	Common Usage Land	Munici-pality		
5	4.10 LL SR	SPK Nagar	36 cent	14.2 cent	Common Usage Land	Munici-pality		
6	2.1 LL SR	SIDCO Colony	0.43 Acres	7.1 cent	Govt Poromboke	Revenue	Alienation	Request sent to District Collector on 14.06.2016

Sl. No.	Component	Location	Available Extent	Required Extent	Land Classification	Ownership	Acquisition/Transfer/ Alienation Status	Remarks
7	7.80 LL SR	Kosavampatty	1.95 Acres	16.7 cent	Kunru Porompoke	Revenue	Alienation	Request sent to District Collector on 30.11.2015
8	3.90 LL SR	Nallipalayam	0.45 Acres	14.2 cent	Govt Poromboke	Revenue	Alienation	Request sent to District Collector on 30.11.2015
9	4.10 LL SR	Mullai Nagar	1 Acre	14.2 cent	Public Use	Munici-pality	-	
10	9.10 LL SR	Swami Nagar	2.66 Acres	16.7 cent	Govt Porompoke	Revenue	Alienation	Request sent to District Collector on 14.06.2016
11	8.00 LL SR	Ponnagar	1.23 Acres	15.3 cent	Govt Poromboke (Palikuttai)	Revenue	Alienation	Request sent to District Collector on 30.11.2015
12	8.50 LL SR	Lakshmi Nagar	0.44 Acres	16.7 cent	Govt Poroboke Kalam	Revenue	Alienation	Request sent to District Collector on 14.06.2016

Table 2. 11.1 – land requirements , possession Details Contd..

2.11.3 Raw Water conveying main

The alignment of the RW pumping main from Head works at Jederpalayam to WTP at Kabilakurichi is a long road owned by Panchayats, and State High ways for a length of 12.13 km by means of 711 mm OD,6.3mm thick MS pipe.

There is no land acquisition or PAP involved.

Pipeline will be laid along the berm of the road and thus does not require any private land acquisition. It will have minimal impact temporarily due to stacking of excavated earth. However the impact will be minimized by planned refilling and proper diversion . Damages occurred for concrete and BT Roads will be restored. Damages caused to the existing service lines will be restored with minimal time lag.

Table 2.3 - Land Ownership of the roads for the Proposed for Raw water Conveying main

S.N o	Location	Size of Main (mm)	Start Chain age	Final Chain age	Length (m)	Right of way Availab le	Regulatory ry Authority y	Approval Status
1	P.W.D. Concrete Road	700 mm MS Main	0	256	256	7.00 m	PWD	Application is Submitted
2	High waysRoad	700 mm MS Main	256	956	700	10.00m	Highways Department	Application is Submitted
3	Panchayat BT Road	700 mm MS Main	956	2556	1600	6.00m	Rural Development Department	Approval to be obtained
4	Panchayat road concrete Road	700 mm MS Main	2556	2796	240	3.00 m	Rural Development Department	Approval to be obtained
5	Panchayat road Mud Road	700 mm MS Main	2796	3156	360	6.00 m	Rural Development Department	Approval to be obtained

6	Panchayat road Mud Road	700 mm MS Main	3156	4056	900	8.00 m	Rural Development Department	Approval to be obtained
7	Panchayat BT Road	700 mm MS Main	4056	4856	800	6.00 m	Rural Development Department	Approval to be obtained
8	Panchayat BT Road	700 mm MS Main	4856	5156	300	7.00 m	Rural Development Department	Approval to be obtained
9	Panchayat road Mud Road	700 mm MS Main	5156	7856	2700	8.00 m	Rural Development Department	Approval to be obtained
10	High ways Road	700 mm MS Main	7856	8406	550	8.00 m	Highways Department	Application is Submitted
11	Panchayat BT Road	700 mm MS Main	8406	11896	3490	7.5 m	Rural Development Department	Approval to be obtained
12	Premise of WTP	700 mm MS Main	11896	12130	234	-	Own Land	-

Permission for laying conveying main in the right of way of the existing roads in High ways have to be obtained from the concern authorities as detailed in the **Table 2.3**.

2.11.4 Clear water conveying main

The alignment of the CW pumping main from WTP at Kabilakurichi to BS at Thummankurichi is along road owned by Panchayats , and State High ways for a length of for a length of 24.62 km by means of 711 mm OD,6.3mm thick MS pipe.

There is no land acquisition or PAP involved.

Pipeline will be laid along the berm of the road and thus does not require any private land acquisition.

Table 2.4 - Land Ownership of the roads for the Proposed for Clear water Conveying main

	CLEAR WATER MAIN							
S.No	**Location**	**Size of Main (mm)**	**Start Chainage**	**Final Chainage**	**Length (m)**	**Right of way Available**	**Regulatory ry Authority y**	**Approval Status**
1	Panchayat BT Road	700 mm MS Main	0	700	700	8.00 m	Rural Development Department	Approval to be obtained
2	Panchayat road Mud Road	700 mm MS Main	700	2000	1300	6.00 m	Rural Development Department	Approval to be obtained
3	Panchayat BT Road	700 mm MS Main	2000	3500	1500	7.5 m	Rural Development Department	Approval to be obtained
4	Panchayat road Mud Road	700 mm MS Main	3500	3800	300	6.00 m	Rural Development Department	Approval to be obtained
5	Highways Road	700 mm MS Main	3800	5900	2100	7.5 m	Highways Department	Application is Submitted
6	Panchayat Mud Road	700 mm MS Main	5900	8200	2300	8.00 m	Rural Development Department	Approval to be obtained
7	Highways Road crossing	700 mm MS Main	8200	8215	15	15.00 m	Highways Department	Application is Submitted
8	Panchayat BT Road	700 mm MS Main	8215	11600	3385	7.5 m	Rural Development Department	Approval to be obtained
9	Highways Road crossing	700 mm MS Main	11600	11610	10	10.00 m	Highways Department	Application is Submitted

10	Panchayat BT Road	700 mm MS Main	11610	12000	390	7.5 m	Rural Development Department	Approval to be obtained
11	Panchayat concrete Road	700 mm MS Main	12000	12065	65	8.5 m	Rural Development Department	Approval to be obtained
12	River crossing	700 mm MS Main	12065	12130	65	8.00 m	P.W.D. Department	Approval to be obtained
13	Panchayat BT Road	700 mm MS Main	12130	14300	2170	7.5 m	Rural Development Department	Approval to be obtained
14	Highways Road	700 mm MS Main	14300	17200	2900	8.00 m	Highways Department	Application is Submitted
15	Panchayat Mud Road	700 mm MS Main	17200	18600	1400	7.00 m	Rural Development Department	Approval to be obtained
16	Panchayat BT Road	700 mm MS Main	18600	20600	2000	7.50 M	Rural Development Department	Approval to be obtained
17	Highways Road	700 mm MS Main	20600	24600	4000	7.50 M	Highways Department	Application is Submitted
18	Premise of Booster Station	700 mm MS Main	24600	24620	20	-	Own Land	-

2.12 ANALYSIS OF ALTERNATIVES

The raw water alignment at Head worksite is proposed to be carried out along the concrete road via the PWD Park to the Jederpalayam main Road. PWD has insisted alternate alignment via the backside of PWD Park leading to the Jederpalayam main Road. As the recommended alignment involves crossing private land the original alignment proposed was adopted with provision for restoration of concrete road likely to be damaged during pipe laying works inside the PWD Premise.

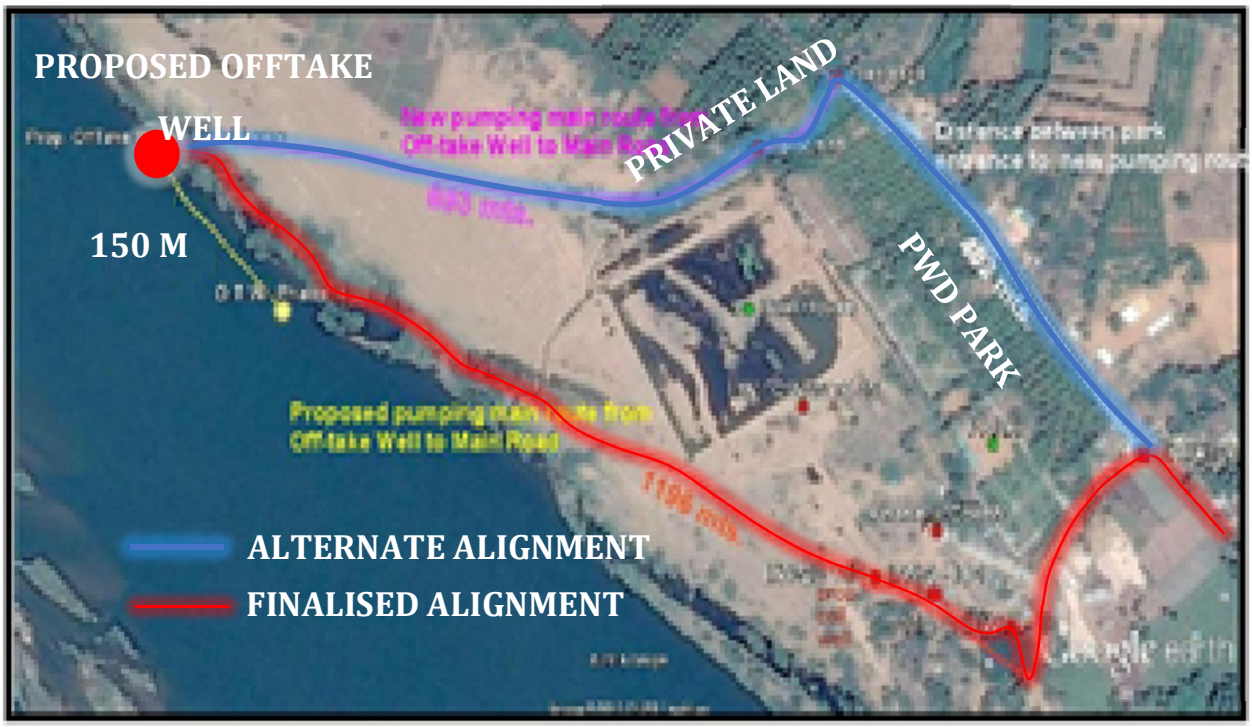


Figure 2.12.1 Alternate Alignment at HW Site

It was proposed to Construct 2 Nos of BS AT Thummankurichi and Kavettipatti to have effective and efficient feeding of SRs with multiple feeder lines. However, to minimize number of pump sets and pumping lines for easy maintenance and cost effectiveness it is now proposed to feed the SRs through 1 No of Booster station at Thummankurichi with two feeder mains.

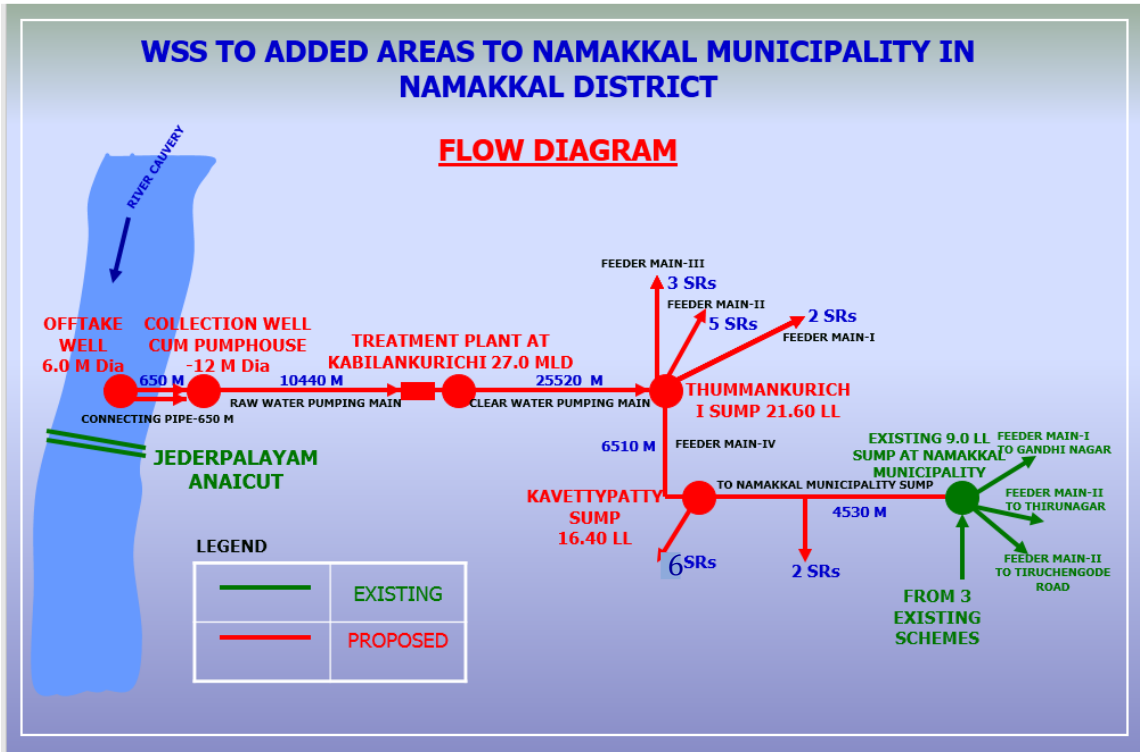


Figure 2.12.2 Flow diagram with contemplation of 2 Booster Station and 18 SRs

18 Nos of SRs were proposed with hamlet centered SR Locations. However, taking into account the contour availability and Zonal Boundary as NHAI Road and Major HW Road the SRs are relocated and only 9 Nos of SRs proposed with sub zones in SR. 2 Nos of SR Site in Public Park has been relocated.

2. 13 OPERATION & MAINTENANCE COST

The expenditure for operation and maintenance of the proposed new components of the Scheme including salary to the staffs, cost of chemicals, spares, replacement, repair work, power consumption charges, structure maintenance etc. is Rs.287.00 lakhs per year which will be met out by the Local Body.

2. 14 FUNDING

The entire project cost of Rs 185.24 Crores has been proposed under the scheme of Tamilnadu Sustainable Urban Development Project (TNSUDP) with financial assistance from World Bank.

Table 2.4 - Project cost for providing WSIS to Namakkal Municipality in Namakkal District

	GENERAL ABSTRACT	
Sl. No.	**Description of work**	**Amount (Rs.)**
1	Head Works at Jederpalayam	90249248
2	Raw water Main From Head works to Treatment plant at Kabilakurichi	165535712
3	Treatment plant-17.66 MLD	99512498
4	Clear water Main from Treatment plant at Kabilakurichi to Thummankurichi Booster Station	326347364
5	Booster station at Thummankurichi	28944628
6	Feeder mains	146440851
7	Service Reservoirs	76268561
8	Distribution System including HSC	331750096
9	SCADA	110073143
10	Rejuvenation of Existing Schemes	168915885
11	Maintenance of the Scheme for 1 Year Excluding cost of Electrical Energy but including cost of Establishment and Chemicals	4670081

12	Shifting of underground utilities (WS main, telephone line and other components) @ 0.5% of(sum of 1 to 11	7743540
	Base Cost	**1556451607**
13	Physical Contingencies and Unforeseen Items @ 2.5 % of Base Cost	38911290
14	Labour welfare fund @ 1% of Base Cost	15564516
15	Provision for Price escalation @ 5 % of Base Cost for 1st year	77822580
16	Provision for Price escalation @ 5 % of Base Cost for 2nd year(70% of 1st Year)	54475806
	TOTAL	**1743225800**
17	Centage charges @ 5% of TOTAL	87161290
18	Provision for Road Restoration charges to SH,NHAI, EB and Railway including 1% Service charges	11876847
19	Provision for third party quality check for materials @0.23% [B.P. Ms. No. 10 / (COM Wing) / Dt. 25.2.2013]	1353807
20	Provision for Quality check for materials by TWAD Lab	1000000
21	Provision for Investigation charges @ 0.5% of Base Cost	7782258
	PROJECT COST	**1852400002**
	Rs.	**185.24 Crores**

The EMP cost is included in the respective sub head as a part and proposed in the BOQ.

2.15 TECHNICAL DESCRIPTION OF THE PROJECT

2.15.1 Headworks site:

1. Offtake Well :

It is proposed to draw surface water by constructing 6m dia off take well in River Cauvery at Jederpalayam near Anaicut at about 100m upstream side of the existing off take well of CWSS to 4 Town Panchayats and 1081 Rural habitations in Namakkal District. The details of offtake well is as follows:

Dia of offtake well : 6.00 m

Depth of offtake well : 4.35 m

AV.GL : 128.965 m

MWL : 130.765 m

LWL : 126.415 m

A quantity of 22.09 mld of water is required for a full fledged WSIS to Namakkal municipality for ultimate stage in addition to the present supply. Such a huge quantity of water could not be tapped from the limited ground water resources as well as from subsurface water from the River Cauvery. Hence surface water resources from River Cauvery have been contemplated.

Hence a location (proposed off-take well location 11°09'55.191"N and 77°52'40.269"E) 150m upstream of Phase II Headworks in Jederpalayam Anaicut of Cauvery River is considered for tapping surface water by means of off take well and treated water may be supplied to Namakkal Municipality. The proposed source location is about 35 km west of Namakkal Town.

The Jederpalayam Anaicut has an average width of about 600m and the average length of water spread is about 3000m and the average water depth is about 3 m. On the eastern bank of River Cauvery near Jederpalayam Anaicut, a stretch of approximately 2000m and 300m width of alluvial sand deposit is available. In this pocket ,6 infiltration wells have been created tapping sub-surface water for 4 CWSS and one off-take well is located in the dam about 700m upstream of Anaicut to tap surface water to provide water supply for Phase II scheme.

Head work details in Jederpalayam Anaicut Areas

Sl.No	Name of Scheme	Type of Source	Well Location GPS coordinates	Designed quantity in mld
1	CWSS to110 rural villages in Kabilarmalai and Paramathi Union	3 IW	1)11°09'43.002"N 77°53'02.343"E 2)11°09'44.927"N 77°53'00.959"E 3)11°09'44.756"N 77°53'02.353"E	3.69
2	CWSS to Vettuvampalayam and 15 wayside habitations in Kabilarmalai Union	1 IW	11°09'47.133"N 77°53'03.099"E	0.157
3	CWSS to Karupam palayam and 14 villages in Kabilarmalai Union	1 IW	11°09'45.551"N 77°53'02.982" E	0.43
4	Kothamangalam CWSS in Kabilarmalai Union			
5	CWSS to 35 rural habs in Kabilarmalai union	1 IW	11°09'49.034"N 77°52'59.263"E	0.548
6	CWSS to 4 TPs and 1081 rural habitations – Ph II	Surface water Off-take well	11°09'52.808"N 77°52'44.029"E	28.595

Jedarpalayam Anicut storage details

The maximum length of water spread: 3000m

Average width of water spread : 600m

Average water depth : 3m

Average static potential of water in the dam : 3000* 600*3

: 5400000 Cum or 5.4 mcm

: 190.7 Mcufeet

Static water potential in Sandy Area

Length of sandy Area : 2000m

Average width of sandy Area : 300m

Average saturated sand thickness; 3m

Porosity : 20%

Static potential of water in sandy Area : 2000*300*3*0. 2

:360000 Cum or 0.36 Mcm or 12.71 Mcufeet

Total static water potential available in this stretch: 5.4mcm +0.36 Mcm

:5.76 mcm or 203.41 Mcufeet

Water supply Head works details in this stretch

Total quantity of water pumped from 6 Infiltration wells (Designed quantity) located in the sandy stretch : 4.825 mld

Surface water tapping from the anaicut for Phase II (Designed quantity) ; 28.595 mld

Total quantity of water pumped from this Anaicut Area per day :4.825 +28.595

33.42 mld or 0.0334 Mcm/day

The designed quantity for the proposed WSIS to Namakkal Municipality (Ultimate)
: 22.09 mld or 0.0221 Mcm/day

Total quantity of water pumped (present + proposed) : 0.0555 Mcm/day

Number of days that this static storage could provide water for water supply schemes (30 %)
(5.76*.3)/0.0555) : 31 days

The source is sustainable and drawl of water for other scheme will not be affected due to the drawl for proposed scheme.

2.15.2.**Connecting Pipe** :

It is proposed to lay two rows of connecting pipe of 650 m length each of size 600 mm dia CI D/F pipe , from offtake well to Collection well .The water flows by gravity from offtake well to collection well.

2.15.3 **Silt Removal Chambers**:

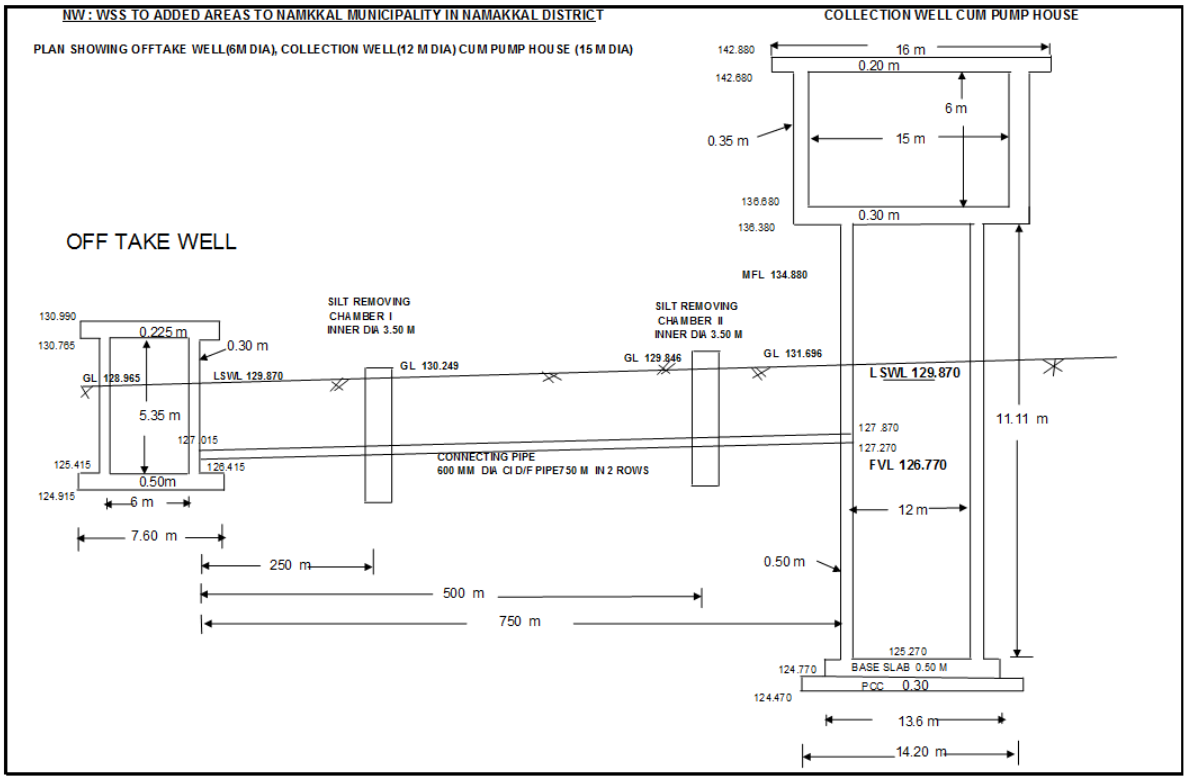
It is proposed to construct two silt removal chambers , one at LS 150m and another at LS 400 m from offtake well , in order to remove all the debris matters, floating matters etc. Necessary provision has been given for screening arrangements in the silt removal chambers.The details of silt removal chambers is as follows:

Dia of silt removal chamber : 3.50 m

Depth of silt removal chamber : 4.50 m

AV.GL for NO 1 : 130.249

AV.GL for NO 2 : 129.846



2.15.4. Collection well cum Pump house :

It is proposed to construct collection well cum pumphouse at a distance of 160 m from the road to Jedarpalyam Anaicut.

The details of collection well cum pumphouse is as follows:

Dia of collection well : 12.00 m

Dia of pump House : 15.00 m

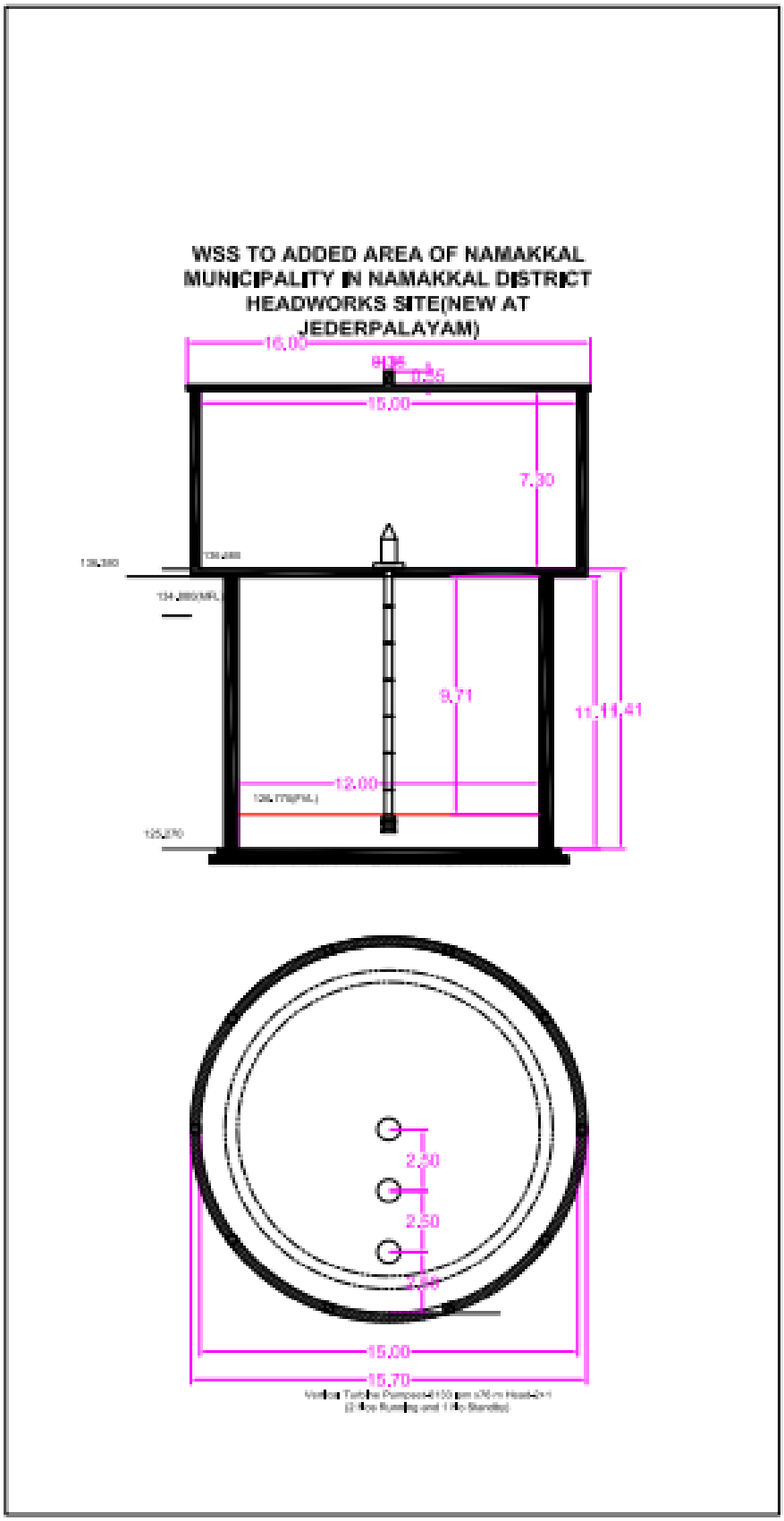
Depth of collection well : 12.465 m

Depth of pump House : 7.30 m

AV.GL : 131.696 m

MFL : 134.880 m

FVL : 126.77 m


WSS TO ADDED AREA OF NAMAKKAL MUNICIPALITY IN NAMAKKAL DISTRICT HEADWORKS SITE(NEW AT JEDERPALAYAM)
16.00
0.35
15.00
7.30
9.71
11.41
12.00
2.50
2.50
2.50
15.00
15.70

2.15.5.Raw Water Pumpset :

It is proposed 3 nos (2+1 stand by) of energy efficient Oil lubricated surface discharge vertical turbine pumps, each capable of discharging 6150 lpm of raw water against a head of 66 m.

2.15.6.Raw Water Pumping Main:

It is proposed to pump raw water from Collection well to lip of Aerator in proposed Treatment work site at Kabilakurichi , for a length of 10440 m by means of 711 mm OD,6.3mm thick MS pipe. Necessary valves, thrust blocks etc. are proposed in the raw water pumping main.

2.15.7. Foot Bridge :

It is proposed to construct the foot bridge of width 3.50 m and length 75 m from the road to collection well .

2.15.8TREATMENT PLAN :

Raw water and Treated Water Analysis

The raw water parameters are given below:

Sl.No	**Parameter**	**Range**	**Limits (IS:10500:2012)**
I	PHYSICAL		
1	Turbidity NT units - NTU	11-26	10
2	Total Dissolved Solids mg/lit.	277-539	500
3	Elect. Cond. Micro ohm/cm	395-770	-
II	CHEMICAL		

1	PH	7.02-8.15	6.5-8.5
2	Total Alkalinity	96-156	200
3	Total Hardness as CaCO3	84-124	300
4	Calcium as Ca	21-30	75
5	Magnesium as Mg	8-12	30
6	Sodium as Na	55-96	-
7	Potassium as K	16-24	-
8	Iron as Fe	.4-1.3	0.3
9	Nitrate as No2	6-9	45
10	Nitrite as No3	0	-
11	Chloride as CI	60-104	250
12	Fluoride as F	0-.8	1
13	Sulphate as SO4	27-72	200
III	BIOLOGICAL		
1	Fecal Coliform per 100 ml	30-70	-

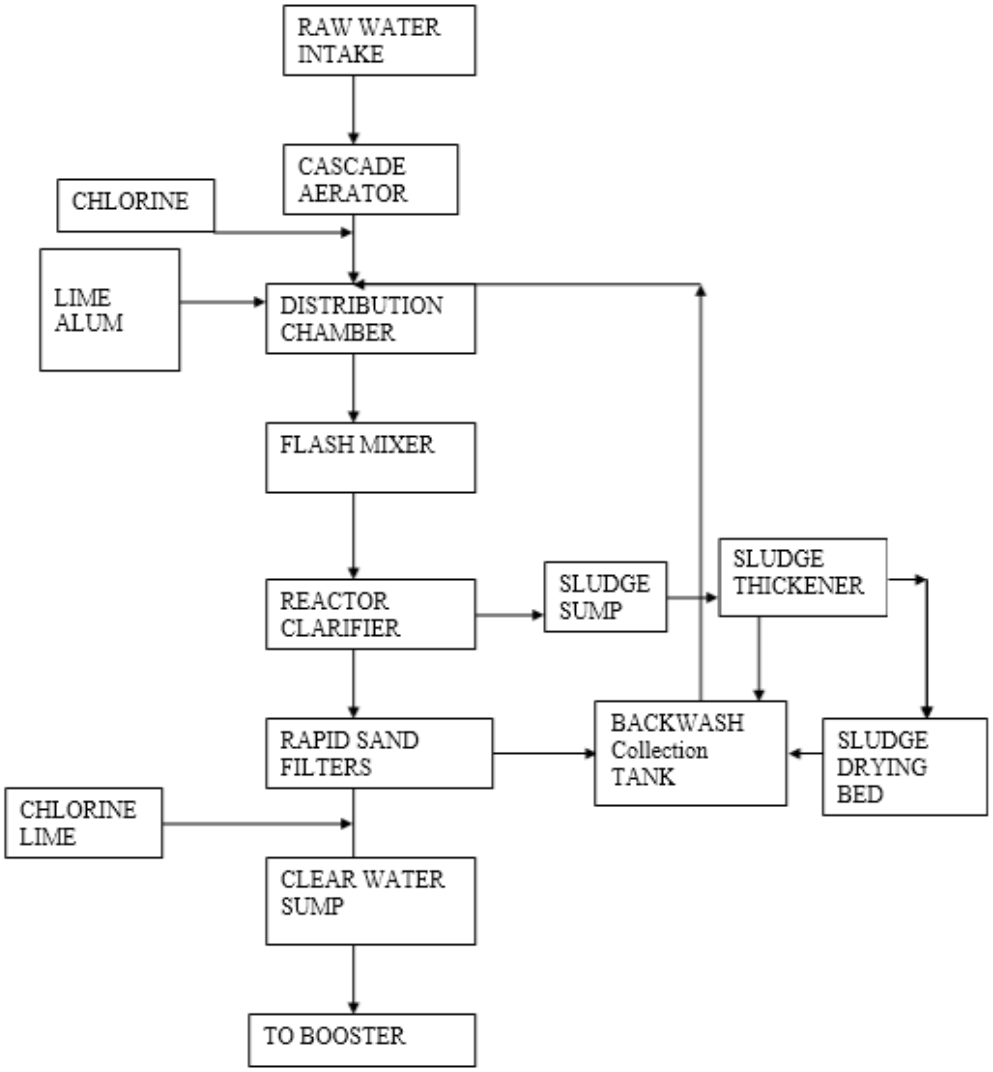
It is seen that the characteristics of raw water has to treated with full scale treatment confirming to within the respective permitted range of CPHEEO Manual for water supply.

Expected quality of water after treatment is as below.

Sl.No	Parameter	Range
I	PHYSICAL	
1	Turbidity NT units	<1
2	Taste and Odour	Unobjectionable
3	Colour	Not Exceeding 5 Hazen
4	Aluminum Al	Not exceeding 0.2 mg/l as Al
5	PH	7-8.5
6	Iron Fe	Not exceeding 0.3 mg/l
7	Manganese	Not exceeding 0.1 mg/l
8	Free Chlorine	Not less than 0.5 mg/l
9	Total Coliform Bacteria	Nil in any 100 ml sample

Treatment Process

The treatment process has been illustrated below.



- *Pre chlorination*

In order to keep the treatment plant units in disinfected condition and also to kill the algae in the raw water, it is proposed to provide pre-chlorination.

- *Aeration*

The raw water contains traces of Iron and will get removed in aeration process. Cascade aeration has been proposed.

- *Coagulant dosing (Lime and Alum)*

Lime, alum dosing has been proposed to aid coagulation of suspended solids. The exact dosing has to be arrived by conducting jar test. During major portion of the year, lime addition may not be required but provision has been made for the same to provide for any contingency for pH addition

- *Flash mixing*

  For effective mixing of the coagulants.

- *Flocculation*

  To aid formation of flocs before allowing to settle in the clarifiers.

- *Clarification*

  Clarriflocculator with Alum dosage is proposed for removal of suspended solid through gravity settlement

- *Filtration*

  Rapid sand filters will be provided to bring down the turbidity to less than 1 NTU.

- *Post chlorination*

  The treated water shall be further chlorinated to maintain the minimum residual chlorine level in the treated water up to the entry to the city.

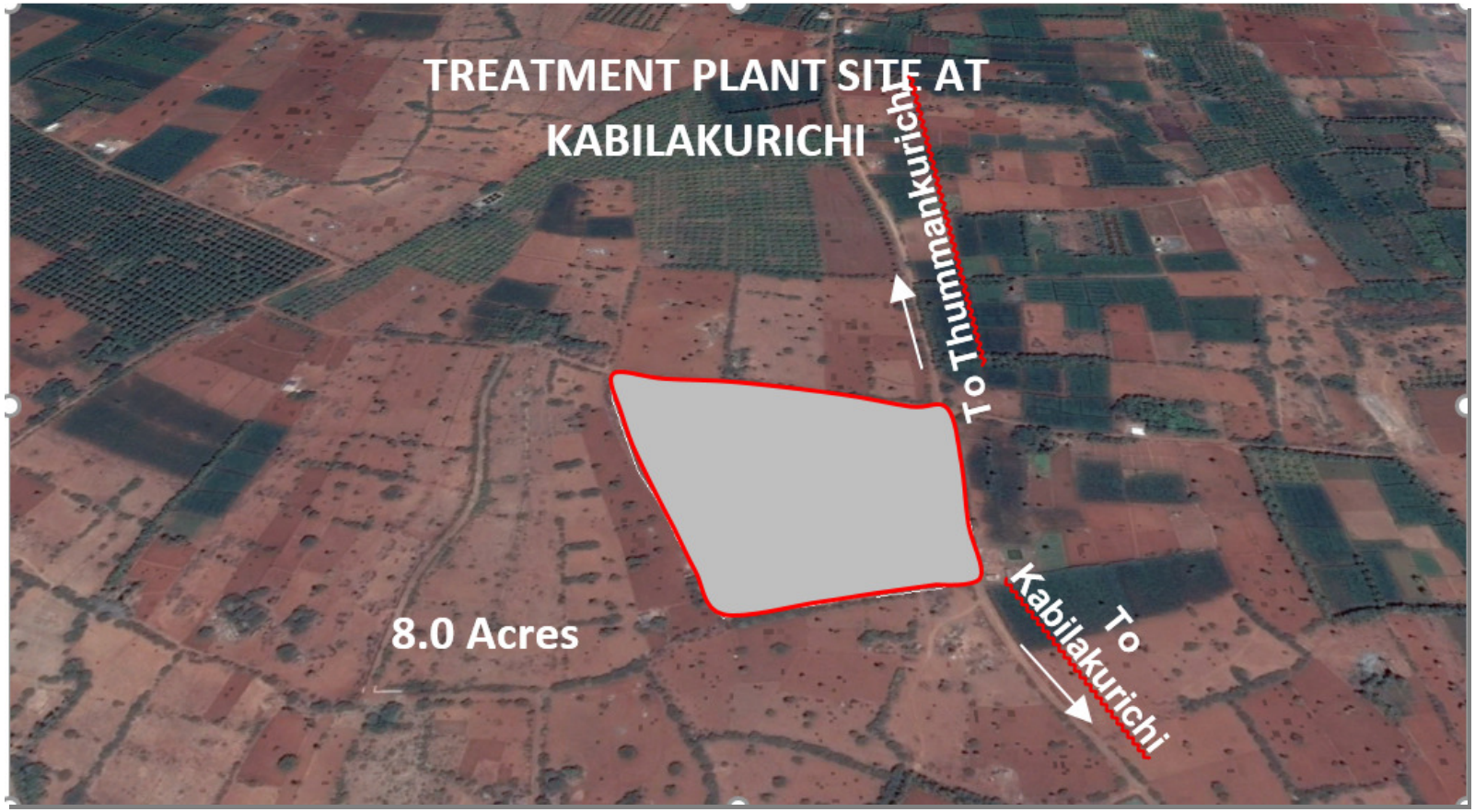
- *Chlorine contact tank/ clarified water sump*

  The treated water sump shall be provided with minimum 30 minutes detention time to serve the dual purpose of chlorine contact time and treated water storage.

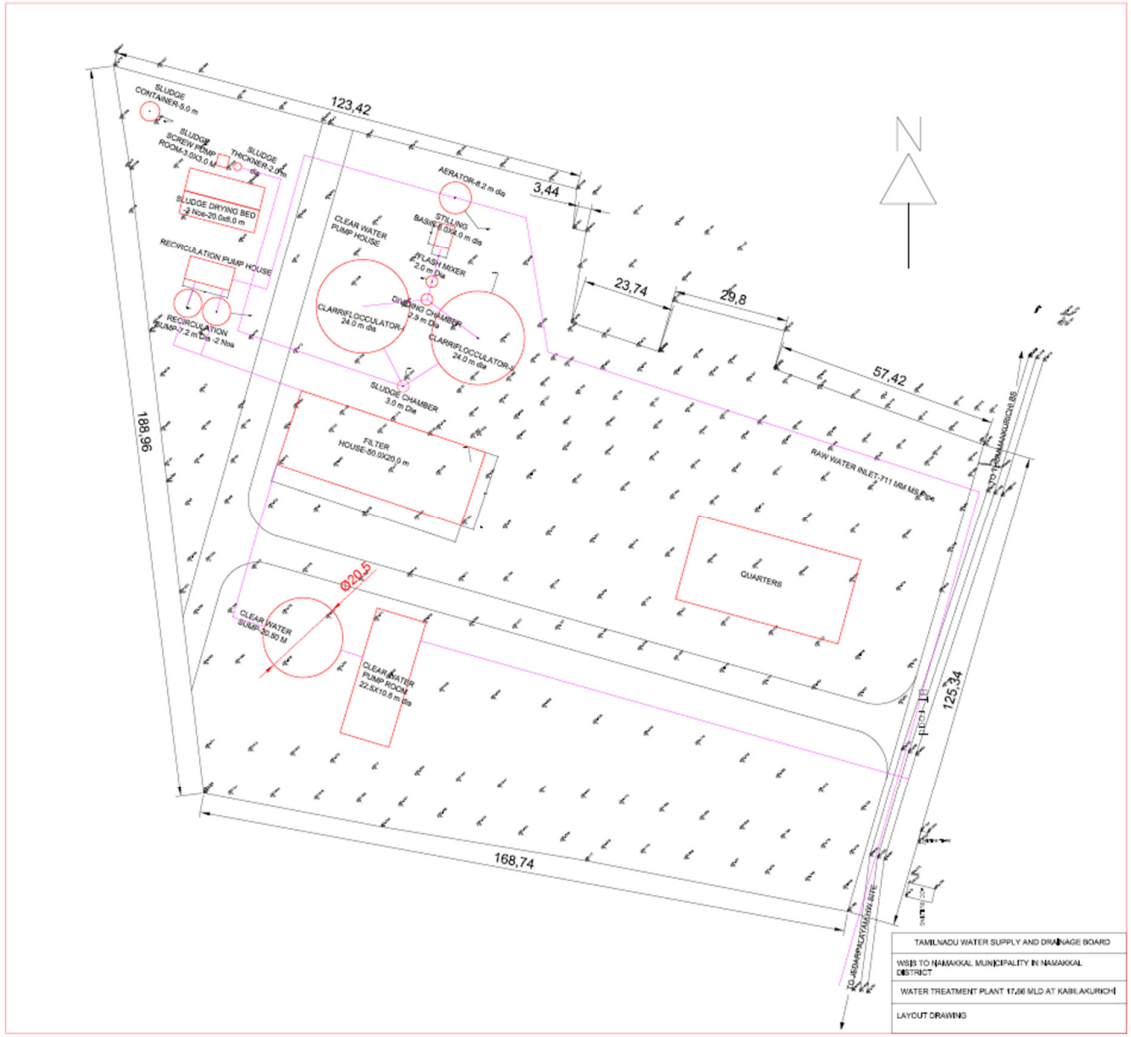
  The treated water stored in the clear water sump will be pumped to the transmission main using Vertical turbine pumps.

Size of Smaller Units like Aerator Stilling Basin Flash Mixer Dividing Chamber etc arrived at considering Ultimate requirement and Major Units like Clarriflocculator Filter bed are arrived for Intermediate requirement with expansion in future during Ultimate Stage. Plantation all along boundary proposed

WTP SITE


TREATMENT PLANT SITE AT
KABILAKURICHI
To Thummankurichi
To
Kabilakurichi
8.0 Acres

WTP Layout


123,42
3,44
23,74
29,8
57,42
188,96
168,74
125,34
N
SLUDGE CONTAINER-5.0 m
SLUDGE SCREW PUMP ROOM-3.0X3.0 M
SLUDGE THICKNER-2.0m
SLUDGE DRYING BED 2 Nos-20.0x6.0 m
RECIRCULATION PUMP HOUSE
RECIRCULATION PUMP-7.2 m³/m - 2 Nos
AERATOR-8.2 m dia
STILLING BASIN-6.0 m dia
FLASH MIXER 2.0 m Dia
CLEAR WATER PUMP HOUSE
CLARRIFLOCCULATOR 24.0 m dia
DIVIDING CHAMBER 2.3 m Dia
CLARRIFLOCCULATOR-2 24.0 m dia
SLUDGE CHAMBER 3.0 m Dia
FILTER HOUSE-60.0X20.0 m
RAW WATER INLET-711 MM MS Pipe
TO NAMAKKAL 8/S
QUARTERS
Ø20.5
CLEAR WATER SUMP-30.50 M
CLEAR WATER PUMP ROOM 22.5X10.5 m Dia
TO ERAMPRATTAMPALAYE
TAMILNADU WATER SUPPLY AND DRAINAGE BOARD
WSSS TO NAMAKKAL MUNICIPALITY IN NAMAKKAL DISTRICT
WATER TREATMENT PLANT 17.06 MLD AT KABILAKURICHI
LAYOUT DRAWING

- *Sludge/ back wash water*

Sludge from the Water treatment plant is proposed to be dried in the sludge drying beds after thickening by sludge thickener. The dried sludge is proposed to be disposed in the sludge container pit proposed inside the WTP Premise in the boundary away from working Units . Water from sludge drying bed under drain is re-circulated in to recirculation sump. The supernatant water from Sludge Thickener will be sent to re-circulation sump. The back wash from the Rapid Gravity filter beds and the filtrate from sludge drying bed will be sent to the raw water distribution chamber through recirculation sump.

1. Aerator:

It is proposed to provide cascade type of aerator .The details of aerator is as follows:

AV.GL : 186.00

No. of cascades proposed : 4 Nos.

Diameter of Collection tray : 8.20 m

Height of aerator : 2.00 m

2. Stilling Chamber :

It is proposed to provide rectangular type of stilling aerator. The details of stilling chamber is s follows:

AV.GL : 186.00

Length of the stilling chamber : 6 m

Breadth of the stilling chamber : 4 m

Total depth of stilling chamber : 2.05 m

3.Measuring Channel :

A rectangular channel is proposed for conveying the raw water from stilling chamber to flash mixer. The channel will be provided with baffle walls in a staggered fashion to facilitate

effective mixing of coagulants during the course of treatment and also prior to flash mixing. The details of measuring channel is as follows :

AV.GL : 186.000

Length of measuring channel : 10.00 m

Breadth of measuring channel : 0.90 m

Total depth of measuring channel : 0.55 m

4.Flash Mixer :

The circular type of flash mixer is proposed .The details of flash mixer is as follows :

AV.GL : 186.000

Diameter of flash mixer : 2.00 m

Total depth of flash mixer : 3.15 m

5.Dividing chamber :

The circular type of dividing chamber is proposed .The details of dividing chamber is as follows :

AV.GL : 186.000

Diameter of dividing chamber : 3.00 m

Total depth of dividing chamber : 4.05 m

6.Flocculator :

Two Circular Clarriflocculator with the central flocculator and peripheral clarifier is proposed. Water entering the Clarriflocculator is first flocculated and then clarified.

The details of flocculator is as follows :

AV.GL OF CLARIFLOCCULATOR – I : 185.500

AV.GL OF CLARIFLOCCULATOR – II : 185.500

Diameter of flocculator : 10.00 m

depth of flocculator : 3.00 m

7.Clarifier :

Diameter of clarifier : 24.00 m

Depth @ centre : 4.80 m

Depth @ Flocculator wall : 4.383m

depth @ sludge pit periphery : 4.70 m

8.Rapid Sand Filter :

It is proposed to provide twin type of beds .

The dimensions of beds are as follows :

AV.GL : 185.000

Total no. of beds : 8 Nos(including 2 standby)

Length of filter bed : 6.00 m

Breadth of filter bed : 4.00 m

Depth of filter bed : 2.75 m

9. Wash Water Tank :

Back wash with air system is proposed. It is proposed to construct 3.50 LL SR with 12 m staging height, 3.00 m as storage depth , as wash water tank. The details of wash water tank is as follows :

AV.GL : 185.000

LWL of wash water tank : 197.000

MWL of wash water tank : 200.000

10. Clear Water Reservoir:

It is proposed to construct 9.15 LL sump as Clear Water Reservoir. The details of Clear Water Reservoir is as follows:

AV.GL : 184.500

LWL of Clear Water Reservoir : 182.000

MWL of Clear Water Reservoir : 185.000

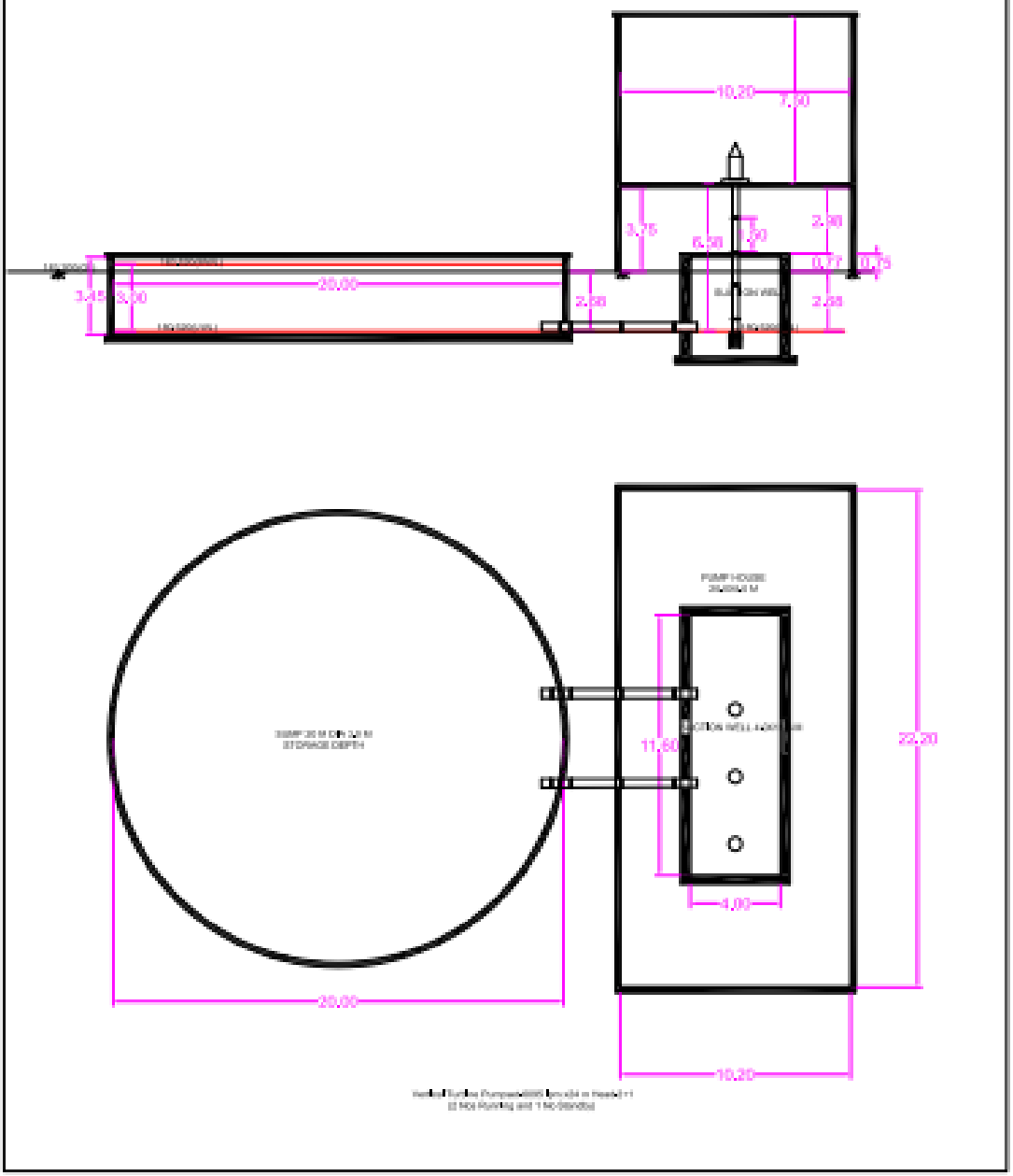
11. Clear Water Pumpset **:**

It is proposed 3nos. (2+1 stand by) of Horizontal Split Casing centrifugal pumpset capable of discharging the required quantity of 6100 lpm against a head of 38 meters, to pump the treated water from clear water reservoir to the Master sump of 9.15 LL capacity proposed at Thummamkurichi.

12 : Clear Water Pumphouse :

It is proposed to construct a pump room of size 20x11x 7m at Treatment Work site to install all the pumpsets proposed to pump water to Thummankurichi Booster Station.

WSS TO ADDED AREA OF NAMAKKAL
MUNICIPALITY IN NAMAKKAL DISTRICT
TREATMENT PLANT SITE



2.15.9 Clear Water Pumping Main :

It is proposed to pump clear water from Clear Water Reservoir to Thummankurichi Booster , by means of 711 mm outer dia,6.3mm thick MS pipes for a length of 25520m. Necessary valves, thrust blocks etc. are proposed in the clear water pumping main.

2.15.10 Master sump at Thummankurichi :

It is proposed to construct Master sump of capacity 9.15 LL at Thummankurichi to store the entire required quantity. From this sump , the water is pumped to all 9 panchayats i.e added areas to Namakkal Municipality, Collectorate and balance requirement to core Municipality, by means of three feeder mains .

1. 9.15 LL Sump :

The details of 9.15 LL sump is s follows:

Dia of sump : 20.00

Storage Depth of sump : 3.00 m

AV.GL : 180.807 m

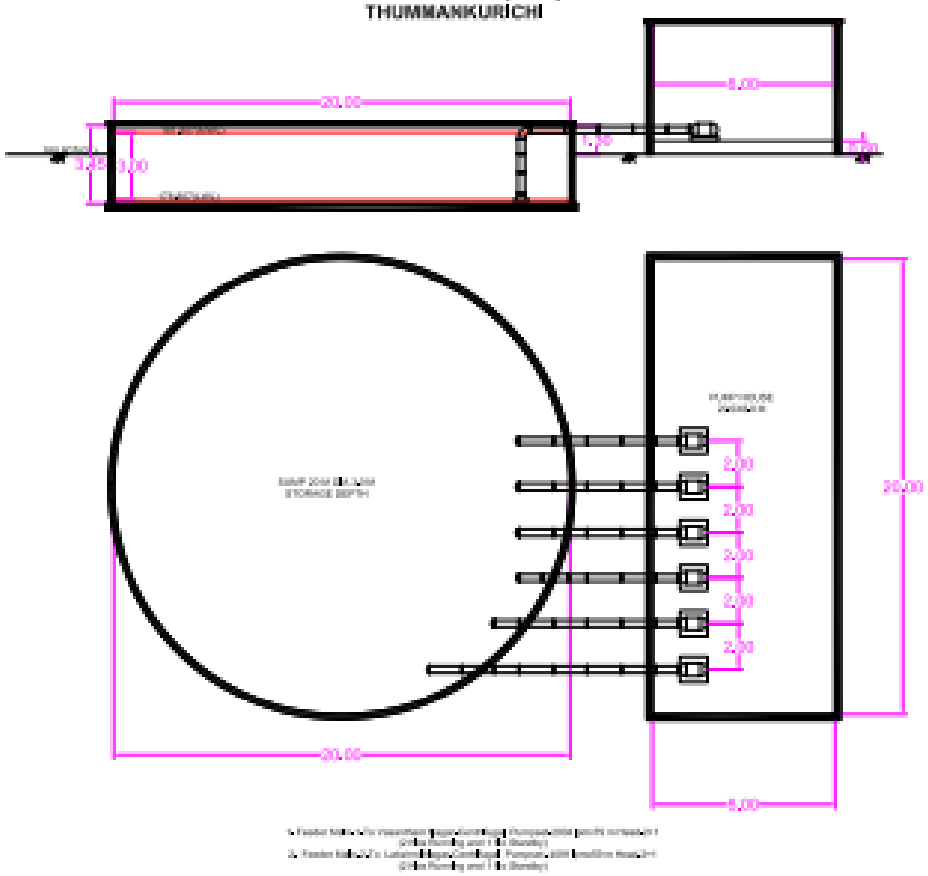
MWL : 181.807 m

LWL : 178.807 m

2. Pumphouse :

It is proposed to construct a pump room of size 20 mx 8m at Thummankurichi Booster Station to install all the proposed pumpsets to pump water to the entire project area.

WSS TO ADDED AREA OF NAMAKKAL
MUNICIPALITY IN NAMAKKAL DISTRICT
BOOSTER STATION (NEW) AT
THUMMANKURICHI



3. Pumpsets at Sump at Thummankurichi :

a) It is proposed to provide 3(2+1) nos. of Horizontal Split Casing centrifugal pumpset capable of discharging the required quantity of 4091 lpm against a head of 60 meters, to pump the treated water from the Master sump of 9.15 LL capacity proposed at Thummankurichi to Kosavampatty SR .

b) Also it is proposed to provide 3(2+1) nos. of Horizontal Split Casing centrifugal pumpset capable of discharging the required quantity of 2004 lpm against a head of 85 meters, to pump the treated water from the Master sump of 9.15 LL capacity proposed at Thummankurichi to Vasantham Nagar.

It is also proposed to construct the compound wall for the area 50mx50m at Thummankurichi booster site.

2.15.11 FEEDER MAINS :

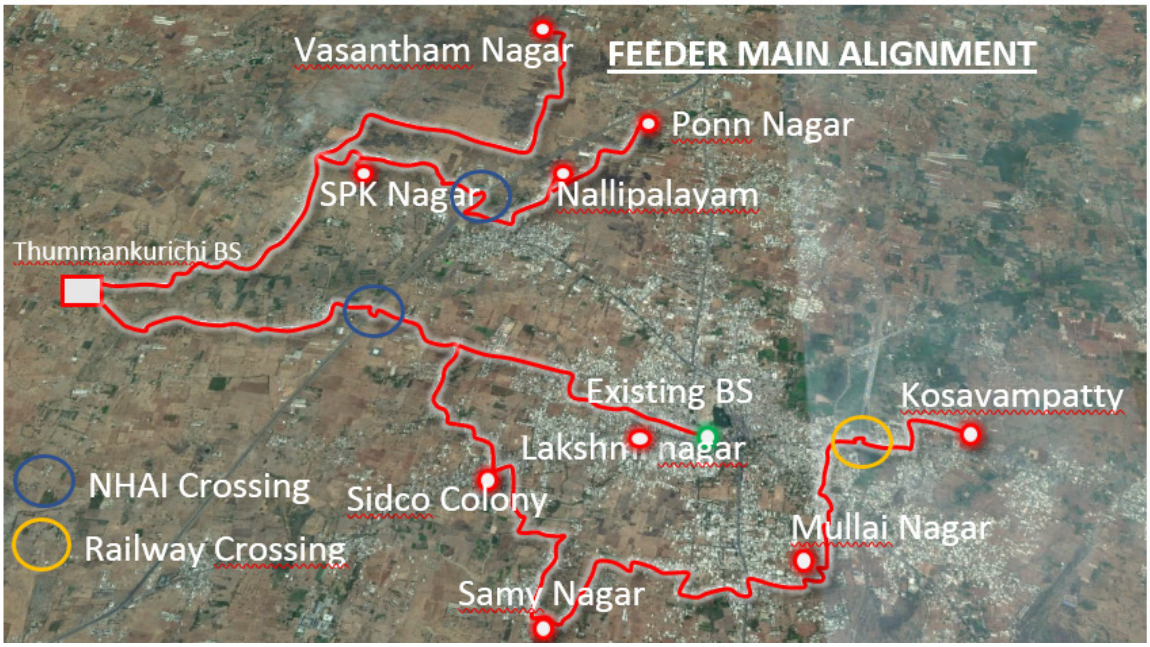
Two feeder Mains have been proposed from this Thummankurichi Booster

1. From Thummankurichi Booster, the water is pumped to the SRs at SPK Nagar, Nallipalayam, Ponnagar and Vasantham Nagar, through the following pipelines as follows:

The size and length of the Feeder Main – I and Branches

S.No	From LS	To LS	Length in m	Size of the Pipe	Feeder Main/Branch Mains
1	0	2640	2640	350 mm DI K 7	Br to SPK Nagar
2	2640	6420	3780	300 mm DI K 7	Br to Nallipalayam
3.	6420	10100	3680	250 mm DI K 7	Br.To Pon nagar
4	10100	12200	2100	100 mm DI K 7	SR at Vasantham nagar
5	0	2920	2920	200 mm DI K 7	SR at SPK Nagar

6	0	350	350	200 mm DI K 7	SR at Nallipalayam
7	0	40	40	250 mm DI K 7	SR at Ponnagar
	TOTAL		**15510 m**		



2 .From Thummankurichi Booster, the water is pumped to the SRs in SIDCO Colony, Swaminagar, Mullainagar Lakshminagar, Kosavampatty and to the existing sump at Municipal complex through the following pipelines as follows:

The size and length of the Feeder Main – II and Branches

S.No	From LS	To LS	Length in m	Size of the Pipe	Feeder Main/Branch Mains
1	0	4140	4140	500 mm DI K 7	Br to Lakshminagar
2	4140	6800	2660	400 mm DI K 7	Br to SIDCO colony
3	6800	10200	3400	400 mm DI K 7	Br to Swaminagar

4	10200	11810	1610	300 mm DI K 7	Br To Mullainagar
5.	11810	14925	3115	250 mm DI K 7	SRat Kosavampatty
6.	0	600	600	300 mm DI K 7	Br to Sump at Municipal complex
7	600	900	300	250 mm DI K 7	SR at Lakshminagar
8	0	1980	1980	150 mm DI K 7	Sump at Municipal complex
9	0	150	150	100 mm DI K 7	SR at SIDCO colony
10	0	30	30	250 mm DI K 7	SR at Swaminagar
11	0	250	250	150 mm DI K 7	SR at Mullainagar
	TOTAL		**18235**		

The DI pipes have been proposed due to the following reasons.

i) Hard Rock terrain in the Namakkal Municipality.

ii) There are major State Highways Roads crossing the Municipality boundary,as follows:

1. Namakkal - Mohanur Road
2. Namakkal - Trichy Road
3. Namakkal – Thuraiyur Road
4. Namakkal – Tiruchengode Road

iii One NHAI Road (NH -7)

iv One Railway Route

v. Moreover heavy vehicular traffic due to commercial activities and floating population of the town.

2.15.12 Service Reservoirs :

9 Nos of Service Reservoir are proposed in addition to the existing 11 Nos of SRs..

The capacity of Service Reservoirs are arrived in such a way that one third requirement of intermediate stage i.e in the year 2033 including the industrial, commercial and institutional demands. The Municipality has furnished a list of institutions with required demand. The re-zoning of existing distribution network of 11 Existing SRs in the old Municipal Area are done taking into account of the capacities available to cater 135 lpcd as these SRs have already been constructed in the previous three Schemes. Due to re-zoning and considering the contour variation, the proposed SRs are relocated in the high command area . A major portion of the delinked distribution system from the core area is to be served by a newly proposed SR at Anbu Nagar located in the core area and the capacities of 9 other newly proposed SRs at added areas are arrived by including the other delinked portions of the distribution system from the core area. .

The capacities with locations of newly proposed service reservoirs with 16 m staging height are as furnished below:

1)1.00 Lakh Litres Capacity for Vasantham Nagar
2) 4.10 Lakh Litres Capacity for SPK Nagar
3) 2.10 Lakh Litres Capacity at SIDCO Colony
4) 7 .80 Lakh Litres Capacity at Kosavampatty
5) 3.90 Lakh Litres Capacity at Nallipalayam
6). 4.10 Lakh Litres Capacity at Mullai Nagar
7) 9.10 Lakh Litres Capacity at Swami Nagar
8.) 8.00 Lakh Litres Capacity at Ponnagar
9.) 8.50 Lakh Litres Capacity at Lakshmi Nagar EB colony

2.15.13 DISTRIBUTION SYSTEM:

The core Municipal area with existing 11 No. of service reservoirs are re-zoned so that equitable distribution with 135 lpcd will be ensured after the completion of the project. Necessary provision has been made in the estimate for improving the service of the existing distribution network of the core Municipal area. For other areas water distribution will be done from the newly proposed 9 Nos. of service reservoirs. For Distribution system in added areas HDPE Pipes are proposed for diameter upto 200 mm and DI Pipes are proposed for sizes above 200 mm Diameter.

The details of Distribution system required are as follows:

1. Existing Distribution System available : 88.00 km

2. Length of the proposed Distribution System : 254.73 km

3 LEGAL, POLICY & ADMINISTRATIVE FRAME WORK

This section reviews the policies, regulations and administrative framework within which the project is to be implemented. The review includes the Environmental and Social framework of TNUIFSL, operational policies / directions of the World Bank and sector-specific environmental policies and regulations of the Govt. of India and Govt. of Tamilnadu.

a) The Water (Prevention and control of pollution) Act, 1974

These laws seek to control pollution of water and enhance the quality of water. Under this law, it is mandatory to treat the Effluent to meet the discharge standards stipulated by TNPCB before discharge into the Canal or on land for irrigation. Consent of TNPCB is to be obtained this paying consent fees stipulated as applicable for local bodies viz., Town Panchayat, Municipality, Corporation which are causing water pollution.

b) The Air (Prevention and control of pollution) Act, 1981 amended in 1987

This Act provides prevention, control and abatement of air pollution. With a framework similar to the Water Act, the Air Act gave the central and State Board's authority to issue consents to industries operating within the designated air pollution control areas. The State also prescribes emission standards for stationary and mobile sources.

c) The Environment Protection Act 1986, & Notifications

In order to create national environmental legislation, the EPA articulates a policy for environmental protection covering air, water and land and provide a framework for Central Government to coordinate between Central and State Authorities established under various laws, including the Water Act and Air Act. Under this umbrella Act, the Central Government must set National Ambient and Emissions Standards, establish procedures for managing hazardous substances, regulate industrial sites, investigate and research pollution issues and establish laboratories and collect and disseminate information.

Among other relevant legislation, the Public Liability Insurance Act (PLIA) of 1991 mandates that business owners operating with hazardous substances take out insurance

policies covering potential liability from an accident and establish Environmental Relief Funds to deal with accidents involving hazardous substances. The National Environmental Appellate Authority Act of 1997 requires the Central Government to establish an authority to hear appeals on area restrictions where operations will not be carried out or will be carried out with certain safeguard measures.

d) National Archaeological sites prevention Acts

The Ancient Monuments and Archaeological Sites and Remains Act, 1958 In order to bring the legislation on par with constitutional provisions and providing better and effective preservation to the archaeological wealth of the country, The Ancient Monuments and Archaeological Sites and Remains Act 1958 (No 24 of 1958) was enacted on 28th August 1958. This Act provides for preservation of ancient and historical monuments and archaeological sites and remains of national importance, for regulation of archaeological excavations and for protection of sculptures, carvings and other like objects. Subsequently, the Ancient Monuments and Archaeological Sites and Remains Rules 1959 were framed. The Act along with Rules came into force with effect from 15 October 1959. This Act repealed The Ancient and Historical Monuments and Archaeological Sites and Remains (Declaration of National Importance) Act, 1951.

e) The Treasure Trove Act, 1878

The Indian Treasure Trove Act, 1878 (Act No. VI of 1878) was promulgated to protect and preserve treasure found accidentally but having the archaeological and historical value. This Act was enacted to protect and preserve such treasures and their lawful disposal. In a landmark development in 1886, James Burgess, the then Director General succeeded in prevailing upon the Government for issuing directions forbidding any person or agency to undertake excavation without prior consent of the Archaeological Survey and debarring officers from disposing of antiquities found or acquired without the permission of the Government.

f) The Antiquities and Art Treasures Act, 1972

The Antiquities and Art Treasures Act 1972 (No. 52 of 1972) is the latest Act enacted on 9th September 1972 for effective control over the moveable cultural property consisting of antiquities and art treasures. The Act regulates export trade in antiquities and art treasures, provides for prevention of smuggling of, and fraudulent dealings in, antiquities, authorizes

compulsory acquisition of antiquities and art treasures for preservation in public places and provides for certain other matters connected therewith or incidental or ancillary thereto. This Act was supplemented with The Antiquities and Art Treasure Rules 1973. The Act and Rules have been in force with effect from 5th April 1976. This legislation repealed The Antiquities Export Control Act, 1947 (Act No. XXXI of 1947).

g) The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002

In order to curb the growing problems of noise pollution, the government of India has enacted the noise pollution rules 2000 that includes the following main provisions:

- The state government may categorize the areas as industrial or commercial or residential.
- The Ambient air quality Standards in respect of Noise for different areas has been specified.
- The State government shall take measures for abatement of noise including noise emanating from vehicular movement and ensure that the existing noise levels do not exceed the ambient air quality standards specified under these rules.
- Areas not less than 100 m around Hospitals, Educational institutions and Court is declared as silence area under these rules.
- A person found violating the provisions as to the maximum noise permissible in any particular area shall be liable to be punished for it, under the provision of these rules and any other law in force.

h) The Manufacture, Storage and import of Hazardous Chemical Rules, 1989 amended in 2000

According to these rules, the user of hazardous chemicals has to follow procedures as stipulated in the rules to prevent and control hazards from such chemicals and to ensure safety and permission has to be obtained from the authority concerned for such activity. The list of chemicals and threshold limits of handling falling under the purview of these rules is provided in the schedule to the rules. Chlorine used for disinfection of water is categorized as hazardous chemical as according these rules and its usage above 10 tons attracts the provisions of these rules and requires permission from Directorate of Industrial Safety and Health.

Gas Cylinders Rules 2004

Storage of more than 5 cylinders filled with toxic gas requires license to be obtained from The Petroleum and Explosives Safety Organisation. The proposed usage of Chlorine cylinders for the project is 4 Nos and hence the no license is to be obtained

i) Environmental and Social Management Framework (ESMF)

The Policy of TNUDF is to promote the principles of Environmental sustainability and Social relevance in the projects funded by TNUDF. The urban infrastructure projects depending on location and the nature of project activities will have varying impacts on urban environment which largely depends upon the complexities of project activities. To facilitate effective screening, TNUDF has categorized the projects in to different categories – E1, E2 and E3 linked to severity of impacts and regulatory requirements. Based on the social impacts projects are categorized as S1, S2 and S3 as per ESMF of TNSUDP.

The proposed water supply improvement to Namakkal Municipality involving new headworks in River Cauvery and WTP at Kabilakurichi falls under E -1 category as per the guidelines provided in ESMF and hence requires carrying out environmental assessment and preparation of Environmental Management Plan.

The proposed water supply improvement to Namakkal Municipality does not involve any social impact for both the construction of WTP & OHTs and laying of conveying main. Hence the project falls under S3 as per ESMF of TNSUDP.

Operational Policies and directives of World Bank:

- OP 4.01 for safeguard policies of World Bank which provides for the environmental assessment guidance for the lending operations is applicable. This OP 4.01 requires the borrower to screen projects for potential impacts and through appropriate EA assess, minimize and mitigate potentially adverse impacts from the project.

  The Environmental Assessment (EA) leads to be integrated in the project development process such that timely measures can be applied to address the identified impacts.

- Environmental Health and Safety guidelines of the World Bank are applicable for the project which shall be ensured during project implementation.

k) Clearances/ NOC Required from Competent Authority -Table 3.1

S.NO	Activity	Clearance / NOC Required	Statutory Authority	Status
1	Drawal of 22.09 MLD Water from River Cauvery	Clearance from Water Utilisation Committee	PWD	Application is submitted
2	Clear water main Crossing at Thirumanimutharu River	Clearance from PWD	PWD	Application to be submitted
3	Pipe laying works along and across Highways Road	Permission from Highways Department	Highways Department	Will be obtained
4	NHAI Road crossing 2 Nos	Clearance from NHAI Authority	NHAI	Site inspection by NHAI Authority completed. Application to be submitted
5	Railway crossing in feeder main-1 No	Clearance from Railway Authority	Southern Railway	Registration and Joint inspection completed. Payment for Estimate preparation remitted.

3. DESCRIPTION OF THE ENVIRONMENT

3. 1 INTRODUCTION

Baseline Environmental Studies have been conducted to determine the existing status of various Environmental attributes viz., Climatic and Atmospheric conditions, Air, Water, Noise, Soil, Hydro geological, Land use pattern, Ecological and Socio-Economical environment, prior to setting up of the proposed project. This study would help to undertake corrective mitigation measures for protection of the environment on account of any change deviation of attributes due to activities of the proposed project.

The environmental entities Viz., Micrometeorology, Air, Water, Soil, Noise, Biological and Socio-Economics were assessed through a snap shot environmental Survey along with the data from the various information resources for the attributes of the ambient environment.

3.2 Micrometeorology :

The micrometeorology of the project location is typical representative of tropical Indian conditions with high temperate and moderate windy conditions and with a low annual rainfall wind. The predominant wind direction are W and SW. The average wind speed is 1-5 Km/hr.

Temperature

The minimum temperature is 21.1°C.

The Maximum temperature is 44.2°C.

Relative Humidity

The relative humidity is 65-72%

3.3 Rainfall

The annual average rainfall is 610mm

The climate is tropical in Namakkal. In winter, there is much less rainfall than in summer. This climate is considered to be Aw according to the Köppen-Geiger climate

classification. The average temperature in Namakkal is 28.3 °C. The average annual rainfall is 764 mm.

NAMAKKAL DISTRICT - RAIN FALL DETAILS - 2016

Normal Annual Rainfall 775.70 mm

Sl. No.	RAINGAUGE STATIONS	NORMAL RAINFALL in mm	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
1	**Tiruchengode**	**729.80**	0.00	0.00	0.00	0.00	32.80	10.00	103.00	34.00					179.80
2	**Komarapalayam**	**792.00**	0.00	0.00	0.00	1.20	7.20	35.84	183.80	23.60					251.64
3	**Namakkal**	**751.14**	0.00	0.00	0.00	0.00	97.00	38.50	78.00	69.10					282.60
4	**Sendamangalam**	**840.50**	0.00	0.00	0.00	11.00	83.00	15.00	191.00	70.40					370.40
5	**Mohanur**	**596.27**	0.00	0.00	0.00	20.00	78.70	8.00	53.00	5.00					164.70
6	**Erumapatty**	**484.73**	0.00	0.00	0.00	0.00	56.00	7.00	105.00	32.50					200.50
7	**Rasipuram**	**873.00**	0.00	0.00	0.00	9.20	128.50	69.60	160.00	65.62					432.92
8	**Mangalapuram**	**837.60**	0.00	0.00	0.00	36.00	98.50	36.00	84.00	68.20					322.70

9	**Paramathy Velur**	**691.07**	0.00	0.00	0.00	0.00	152.00	15.00	90.20	64.00					321.20
10	**Puduchatram**	**490.02**	0.00	0.00	0.00	0.00	12.00	3.50	16.00	10.00					41.50
	Total		0.00	0.00	0.00	77.40	745.70	238.44	1064.00	442.42					2567.96
	Actual Rainfall		**0.00**	**0.00**	**0.00**	**7.74**	**74.57**	**23.84**	**106.40**	**44.24**	**0.00**	**0.00**	**0.00**	**0.00**	**256.80**
	Normal Rainfall		**8.10**	**9.40**	**13.4**	**47.10**	**90.80**	**42.90**	**60.80**	**104.20**	**108.30**	**162.90**	**95.00**	**32.80**	**376.70**

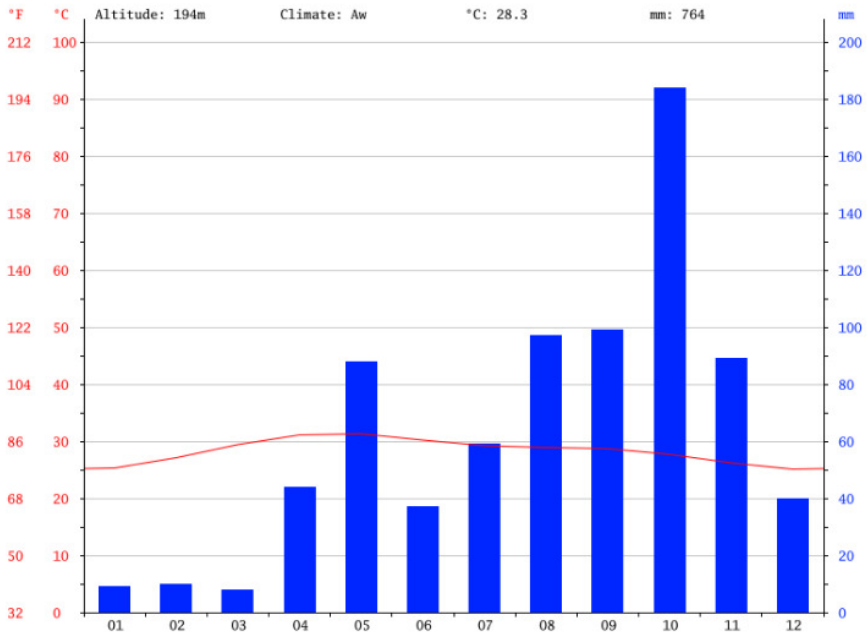
Year	Rainfall in mm	% of deviation	Classification
2007	**680.26**	**- 12.30%**	**Normal Rainfall**
2008	**924.30**	**+ 19.16%**	**Normal Rainfall**
2009	**599.97**	**- 22.65%**	**Deficient Rainfall**
2010	**907.62**	**+ 17.01%**	**Normal Rainfall**
2011	**730.16**	**- 5.87%**	**Normal Rainfall**
2012	**426.04**	**- 45.08%**	**Deficient Rainfall**
2013	**534.54**	**- 31.09%**	**Deficient Rainfall**
2014	**554.38**	**- 28.53%**	**Deficient Rainfall**
2015	**731.78**	**- 5.66%**	**Normal Rainfall**
2016	**256.80**	**- 31.83 %**	**Deficient Rainfall**

> + 20	**Excess**
+19 to -19	**Normal**
-20 to -59	**Deficient**
-60 to -99	**Scanty**

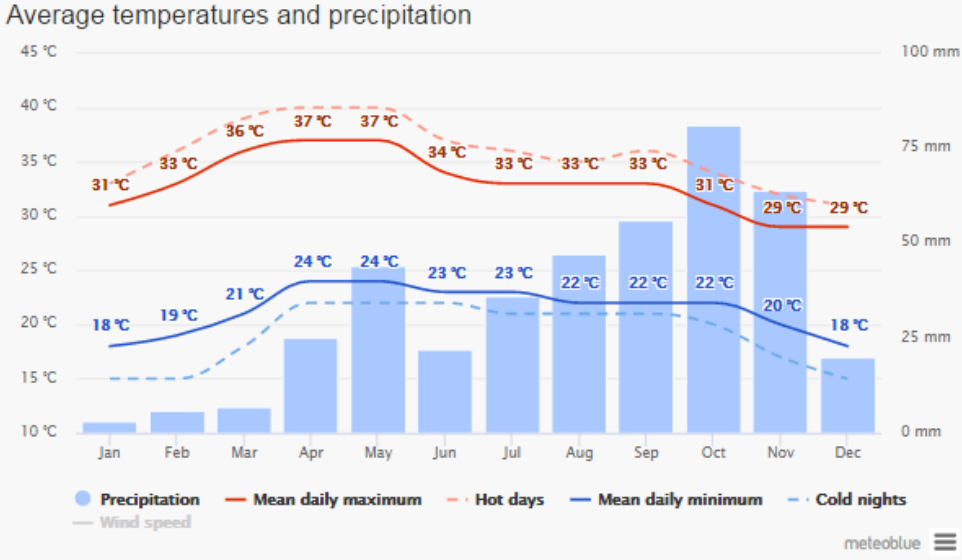
ACTUAL **256.80** **31.08.2016**

NORMAL **376.70**

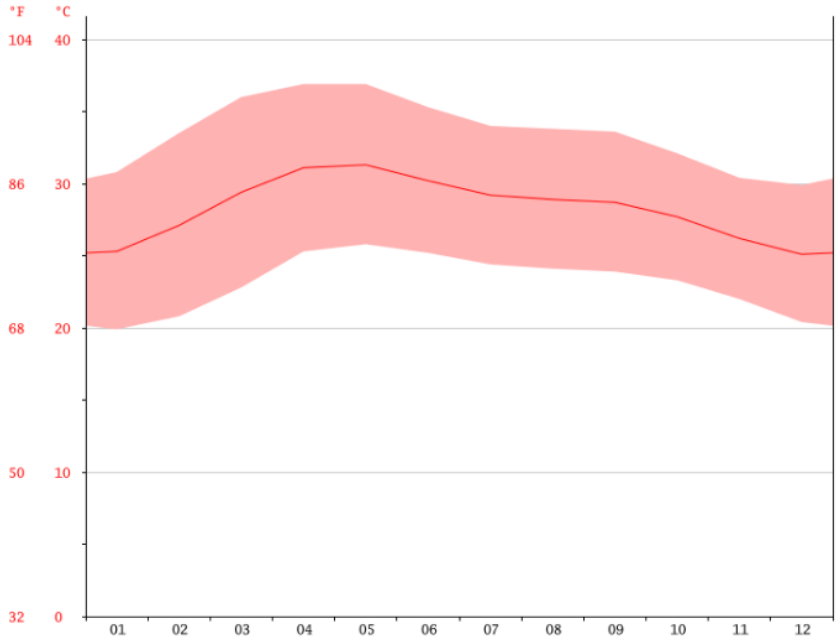
CLIMATE GRAPH NAMAKKAL



The driest month is March. There is 8 mm of precipitation in March. Most precipitation falls in October, with an average of 184 mm.



TEMPERATURE GRAPH NAMAKKAL



With an average of 31.3 °C, May is the warmest month. In December, the average temperature is 25.1 °C. It is the lowest average temperature of the whole year.

CLIMATE TABLE // HISTORICAL WEATHER DATA NAMAKKAL

month	1	2	3	4	5	6	7	8	9	10	11	12
mm	9	10	8	44	88	37	59	97	99	184	89	40
°C	25.3	27.1	29.4	31.1	31.3	30.2	29.2	28.9	28.7	27.7	26.2	25.1
°C (min)	19.9	20.8	22.8	25.3	25.8	25.2	24.4	24.1	23.9	23.3	22.0	20.4
°C (max)	30.8	33.5	36.0	36.9	36.9	35.3	34.0	33.8	33.6	32.1	30.4	29.9
°F	77.5	80.8	84.9	88.0	88.3	86.4	84.6	84.0	83.7	81.9	79.2	77.2
°F (min)	67.8	69.4	73.0	77.5	78.4	77.4	75.9	75.4	75.0	73.9	71.6	68.7
°F (max)	87.4	92.3	96.8	98.4	98.4	95.5	93.2	92.8	92.5	89.8	86.7	85.8

The precipitation varies 176 mm between the driest month and the wettest month. The average temperatures vary during the year by 6.2 °C.

3.4 Hydrological Environment :

Ground Water:

The surface water potential is very poor. The underground water bearing strata as aquifer are available at an average depth of 90-150m below ground level.

The ground water level in the area is around 60 m below ground level

Water Quality:

There are twelve locations identified for Ground water sampling. The locations of water sampling stations the characteristics of water occupation are presented in Table 3.3.1.

TABLE-3.4.1-Ground water Sampling

SL No	Water Sample Station	Type of Source	pH	Total Alkalinity	Total Hardness	Nitrate	Chloride	Fluoride
1	Vadagarsiattur	BW	6.62	368	428	18	328	0.6
2	Kabilakurichi	BW	7.9	352	400	20	232	0.2
3	Jederpalayam	BW	7.1	232	368	28	172	0.6
4	Vasanthapuram	BW	7.5	400	580	45	410	1.5
5	RP PUDUR ANBU NAGAR	BW	6.5	260	400	45	450	1
6	Nallipalayam	BW	6.5	230	150	20	100	0.5
7	Mudalaipatty	BW	7.5	200	180	20	70	0.5
8	Ayyampalayam	BW	7	150	200	20	180	
9	Thummankurichi	BW	7.5	320	450	45	250	1
10	Periyapatty AR	BW	7	200	270	20	230	0.5

11	Thillaipuram	BW	8	300	360	20	270	1
12	Periyapatty	BW	7	200	260	20	180	0.5

Surface water over River Cauvery is analyzed chronologically and the characteristics of Raw water at Headworks site are presented in Table 3.4.2.

Sample Source : River Cauvery Raw water from Jederpalayam Anaicut

BIS 10500 : 2012 **I. PHYSICAL EXAMINATION.**	**Acceptable limit**	**Permissible limit in the absence of alternate source**	**27.03.2015**	**10.04.2015**	**22.05.2015**	**16.06.2015**	**1.7.2015**
1. Appearance	-	-	**Slightly Brownish**	**Brownish**	**Brownish**	**Turbid**	**Turbid**
2. Colour (pt.co-scale)	**5**	**15**				**Slightly Brownish**	**Slightly Brownish**
3. Odour	**Agreeable**	**Agreeable**	**Slightly earthy odour**	**Slightly earthy odour**	**Slightly earthy odour**	**Earthy odour**	**Earthy odour**
4. Turbidity NT Units	**1**	**5**	**16**	**18**	**12**	**16**	**13**
5. Total Suspended Solids - mg/L	-	-	-	-	-	-	-
6. Total dissolved Solids mg/L	**500**	**2000**	**425**	**450**	**430**	**405**	**350**
7. Total Solids	-	-					
8. Electrical Conductivity Micro mho/cm	-	-	**612**	**643**	**620**	**580**	**504**

II.CHEMICAL EXAMINATION:							
9. pH	**6.5-8.5**	**6.5-8.5**	**7.41**	**7.05**	**7.02**	**7.29**	**7.03**
10. Ph. Alkalinity as $CaCo_{3\ mg/L}$	**-**	**-**	**0**	**0**	**0**	**0**	**0**
11. Total Alkalinity. as $CaCo_{3\ mg/L}$	**200**	**600**	**136**	**136**	**132**	**132**	**120**
12. Total Hardness as $CaCo_{3\ mg/L}$	**200**	**600**	**108**	**112**	**108**	**104**	**88**
13. Calcium as Ca mg/L	**75**	**200**	**26**	**26**	**25**	**26**	**21**
14. Magnesium as Mg mg/L	**30**	**100**	**11**	**12**	**11**	**10**	**9**
15. Sodium as Na mg/L	**-**	**-**	**80**	**80**	**80**	**76**	**64**
16. Potassium as K mg/L	**-**	**-**	**24**	**20**	**22**	**22**	**16**
17. Iron as Fe mg/L	**0.3**	**0.3**	**0.4**	**0.5**	**0.6**	**0.8**	**0.5**
18. Manganese mg/L	**0.1**	**0.3**	**0**	**0**	**0**	**0**	**0**
19. Free Ammonia as $NH_{3\ mg/L}$	**0.5**	**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
20. Nitrite as $NO_{2\ mg/L}$	**-**	**-**	**0**	**0**	**0**	**0**	**0**
21. Nitrate as $NO_{3\ mg/L}$	**45**	**45**	**8**	**8**	**8**	**9**	**8**
22. Chloride as Cl mg/L	**250**	**1000**	**96**	**104**	**96**	**96**	**80**
23. Fluoride as F mg/L	**1.0**	**1.5**	**0.8**	**0.6**	**0.8**	**0.4**	**0.4**
24. Sulphate as $SO_{4\ mg/L}$	**200**	**400**	**52**	**60**	**58**	**36**	**27**
25. Phosphate as $PO_{4\ mg/L}$	**-**	**-**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
26. Tidys Test 4 hrs.as $O_{2\ mg/L}$	**-**	**-**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
27. Residual chlorine	**-**	**-**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Bacteriological Examination:							
28.Feacol Coliform	**0/100**	**0/100**	**70/100 ml**				

BIS 10500 : 2012 **I. PHYSICAL EXAMINATION.**	**Acceptable limit**	**Permissible limit in the absence of alternate source**	**11.8.2015**	**29.10.2015**	**3.2.2016**	**17.3.2016**	**24.05.2016**	**7.06.2016**
1. Appearance	**-**	**-**	**Turbid**	**Slightly Turbid**	**Turbid**	**Turbid**	**Turbid**	**Slightly Turbid**
2. Colour (pt.co-scale)	**5**	**15**	**Slightly Brownish**	**Slightly Brownish**	**Slightly Brownish**	**Slightly Brownish**	**Slightly Brownish**	**Slightly Greenish**
3. Odour	**Agreeable**	**Agreeable**	**Earthy odour**	**None**	**Earthy odour**	**Earthy odour**	**Earthy odour**	**Algal Odour**
4. Turbidity NT Units	**1**	**5**	**21**	**16**	**21**	**13**	**11**	**26**
5. Total Suspended Solids - mg/L	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
6. Total dissolved Solids mg/L	**500**	**2000**	**425**	**277**	**410**	**355**	**380**	**539**
7. Total Solids	**-**	**-**						
8. Electrical Conductivity Micro mho/cm	**-**	**-**	**612**	**395**	**588**	**510**	**544**	**770**
II.CHEMICAL EXAMINATION:								

9. pH	**6.5-8.5**	**6.5-8.5**	**7.44**	**8.15**	**7.28**	**7.32**	**7.32**	**7.35**
10. Ph. Alkalinity as $CaCo_3$ mg/L	**-**	**-**	**0**	**0**	**0**	**0**	**0**	**0**
11. Total Alkalinity. as $CaCo_3$ mg/L	**200**	**600**	**140**	**96**	**140**	**112**	**120**	**156**
12. Total Hardness as $CaCo_3$ mg/L	**200**	**600**	**112**	**92**	**108**	**84**	**92**	**124**
13. Calcium as Ca mg/L	**75**	**200**	**26**	**22**	**26**	**21**	**21**	**30**
14. Magnesium as Mg mg/L	**30**	**100**	**11**	**9**	**11**	**8**	**10**	**12**
15. Sodium as Na mg/L	**-**	**-**	**80**	**55**	**74**	**64**	**68**	**96**
16. Potassium as K mg/L	**-**	**-**	**24**	**16**	**22**	**16**	**20**	**16**
17. Iron as Fe mg/L	**0.3**	**0.3**	**0.8**	**0.9**	**0.9**	**1.3**	**0.9**	**1.2**
18. Manganese mg/L	**0.1**	**0.3**	**0**	**0**	**0**	**0**	**0**	**0**
19. Free Ammonia as NH_3 mg/L	**0.5**	**0.5**	**0.0**	**0.0**	**0**	**0**	**0**	**2.5**
20. Nitrite as NO_2 mg/L	**-**	**-**	**0**	**0**	**0**	**0**	**0**	**0**
21. Nitrate as NO_3 mg/L	**45**	**45**	**8**	**9**	**8**	**8**	**8**	**6**
22. Chloride as Cl mg/L	**250**	**1000**	**96**	**60**	**92**	**92**	**96**	**92**
23. Fluoride as F mg/L	**1.0**	**1.5**	**0.6**	**0.0**	**0.6**	**0.8**	**0.0**	**0.0**
24. Sulphate as SO_4 mg/L	**200**	**400**	**44**	**37**	**41**	**29**	**33**	**72**
25. Phosphate as PO_4 mg/L	**-**	**-**	**0.0**	**0.0**	**0**	**0**	**0**	**1.5**

26. Tidys Test 4 hrs.as O_2 mg/L	**-**	**-**	**0.00**	**0.00**	**0**	**0**	**0**	**2.48**
27. Residual chlorine	**-**	**-**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Bacteriological Examination:								
28.Feacol Coliform	**0/100**	**0/100**		**40/100 ml**		**60/100 ml**	**30/100 ml**	**60/100 ml**

3.5 Air Environment

Secondary data available is incorporated for study .There are five different locations where Secondary data collected to compile Ambient Air Quality of the project location. The locations of air sampling stations are presented in

Table 3.5.1.

TABLE 3.5.1 LOCATION OF AAQ STATIONS

Sl No	AAQ Station	Location
1	A1	Namakkal sewage Treatment Plant
2	A2	Vettampadi (Near PGP School)
3	A3	Samy Hagar
4	A4	Namakkal Bus Stand
5	A5	Trichy Road (Near Selvam School)

Secondary data available for Ambient Air Quality Data is presented below.

TABLE 3.5.2 AMBIENT AIR QUALITY DATA

Sl. No.	Pollutant	Maximum	Minimum	Average	98 Percentage
1	Suspended Particulate matter (SPM)µg/m^3	29.85-40.20	26.28-29.50	27.35-35.50	25.40-35.00
2	Sulphurdi oxide (SO_2) µg/m^3	5.10-8.8	5.50-6.25	5.17-7.09	5.78-8.14
3	Nitrogen oxides NO_x µg/m^2	7.10-10.45	6.00-7.10	7.01-9.57	6.95-9.89

3.6 Noise Environment:

The Noise level around the project location adhere to the standards for both night time and day time, but for Traffic sources. The location of noise observatory station is presented in Table 3.6.1. The observed noise levels in the sampling stations are presented in Table 3.6.2

Table 3.6.1-Location of Noise Sampling Station

Stations	Sampling Station	Location
1	A1	Sendamangalam Road
2	A2	Namakkal Town

Table 3.6.2-Ambient Noise Level in the observatory Stations

Stations	*Day Time*			*Night Time*			*dB(A) standard*	
	Max. dB(A)	*Min. dB(A)*	*Avg. dB(A)*	*Max. dB(A)*	*Min. dB(A)*	*Avg. dB(A)*	*Day time*	*Night time*
N1	40	36	38	38	35	36	55	45
N2	42	38	40	40	35	37	55	45

3.7 Soil Environment:

The soil is characteristically sandy at Headworks site and gravel, SDR ,DMR and HR in other project Area.

Soil core was collected at HW Site and soil characteristics ascertained. Soil exploration was carried out in WTP Site, Booster Station and all SR sites. Soil characteristics and Test results are presented in Annexure -III

3.8 Socio-Economic Environment:

A sample survey has been conducted to collect qualitative information about socioeconomic environment of the area. The population is essentially agriculture dependent. Though there are two surface

water sources, the ground water is the dependable sources for agriculture activities.

The total population of the study area is 1,20,957.

They are grouped into 39 Wards.

Total male population is 60026 and female is 600931.

Literacy rate of Namakkal city is 90.76 % higher than state average of 80.09 %.

In Namakkal, Male literacy is around 95.04 % while female literacy rate is 86.58 %.

Table 3.8.1 Ward wise House Assessment and HSC

SL NO	Ward NO	Existing House Assessment	Existing HSC	Proposed HSC
1	1	1169		1169
2	2	1253	746	507
3	3	1488	1031	457
4	4	2437	1866	571
5	5	2048	786	1262
6	6	703		703
7	7	1913	9	1904
8	8	574	373	201
9	9	1002	414	588
10	10	672	467	205
11	11	670	356	314
12	12	1249	356	893
13	13	491	338	153
14	14	1042	660	382
15	15	1308	786	522

16	16	784	692	92
17	17	2896	114	2782
18	18	1303		1303
19	19	584	449	135
20	20	1296	611	685
21	21	194	126	68
22	22	559	391	168
23	23	828	282	546
24	24	809	468	341
25	25	886	492	394
26	26	662	427	235
27	27	843	611	232
28	28	694	516	178
29	29	1054	769	285
30	30	1678	1407	271
31	31	1096	822	274
32	32	918	291	627
33	33	685	239	446
34	34	1418	1080	338
35	35	791	589	202
36	36	963	840	123
37	37	1598		1598
38	38	2218	973	1245
39	39	1472	720	752

The basic amenities like electricity, roads are available. There is shortage in the availability of treated potable water in the study area.

3.9 Ecological Environment :

Ecological survey was done to understand baseline ecological status, important floristic elements, fauna structure. As per baseline studies, there were no endangered, threatened & protected plants and animal species were recorded in the study area.
Hence, no significant adverse impact was envisaged on ecology.

The Fauna and Flora represents typical tropical rural Indian conditions with no significant disturbances pattern Table 3.9.1 and Table 3.9.2.

Table 3.9.1 FLORA SPECIES PRESENT IN THE STUDY

Sl.No.	Botanical Name	English/Hindi Name	Family
	I: TREES		
1.	*Polyalthia longifolia*	Ashoka	Anonaceae
2.	*Anona sguamosa*	Seethapal	Anonaceae
3.	*Saccopetalum tomentosum*	Ashoka	Anonaceae
4.	*Mangnifere indica*	Mango	Anacardiaceae
5.	*Wrightia tinctoria*	Hale Nelli	Apocynaceae
6.	*Tamarindus indica*	Tamarind	Caesalpiniaceae
7.	*Casurina eguistifolia*	Casurina	Casurinaceae
8.	*Emblica officinalis*	Nelli	Euphorbiaceae
9.	*Bambusa bamboo*	Bamboo	Gramenae
10.	*Jydia calycina*	Pula	Malvaceae
11.	*Azadirachta indica*	Neem	Meliaceae
12.	*Cocus nucifera*	Coconut	Palmaceae
13.	*Citrus limonum*	Vambu	Rutaceae
	II: SHRUBS		
1.	*Saccharum officinarum*	Sugar cane	Graminaceae
2.	*Ocimum grabissium*	Tulasi	Labsiatae
3.	*Hybiscus rosasinensis*	Sembaruthi	Malvaceae
4.	*Sida rhombifolia*	Sembaruthi	Nakvaceae
5.	*Solanum melangiana*	Brinjal	Solanaceae
6.	*Solanum anuvum*	Mirch	Solanaceae
7.	*Jasmium sessiliflorum*	Sooman (Jasmin)	Oleaceae
8.	*Terminalia arjuna*	Arjuna	Combrytaceae
	III: CLIMBERS		
1.	*Cucuta reflexa*	---	Conocovulaceae
2.	*Jasminum sessiliflorum*	---	Oleaceae
3.	*Cucurbita pepo*	Pumpkin	Cucurbitaceae
4.	*Nymphaca stellata*	Lilly	Nympheaceae
	IV: HERBS/GRASSES		
1.	*Buttea superba*	Palasbel	Papilionaceae
2.	*Cassiatora*	Chakunda	Ceasalpineae
3.	*Eragrostis tremula*	Chirka	Graminae

Table 3.9.2 FAUNA OBSERVED IN THE IMPACT AREA

I	**PHYLUM : ARTHROPODA**
	A. CLASS : MYRIOPODA 1. *Centipede scolopendra* 2. *Millipeda spriostreptus* B. CLASS : INSECTA 3. *Periplanata americana* (Cockroach) 4. *Glossina domestricca* (Fly) 5. *Musca domestica* (House Fly) Makki 6. *Anabillus* sp. (Mosquito) C. CLASS : ARACHINDA 1. *Palamaeus swammerdami* (Scorpion)
II	**MOLLUSCA** 1. *Pila globosa* (Apple Snail) 2. *Lamellidens marginalis* (Fresh Water Mussel)
	VERTEBRATE
III	**PHYLLUM CHORDATA** **I. AMPHIBIA** 1. *Rana hexadactyla* (Frog) 2. *Rana tigrina* 3. *Bufo* sp. (Toad Frog) 4. *Cacopus* sp. **II. REPTILIA** 5. *Sitana poticeriana* (Small Lizard) 6. *Chameleon* sp. (Green Lizard) 7. *Calotes verticolour* (Garden Lizard) 8. *Testudo elegans* (Tortoise)
I	**Sub Class : SNAKES**
	9. *Naga raja* (Cobra) 10. *Vipera russelli* 11. *Dryophis* sp. (Eye Plucker) 12. *Bangarus* sp. (Krait) 13. *Echis carinata* **III. BIRDS** 1. *Kudagnamys scolopacea* 2. *Sarkidiornis fulva* 3. *Malvus migrams* 4. *Aecedo meinting* 5. *Passer deomesticus* 6. *Corvus splendens* 7. *Psittaciformes* sp. 8. *Alledo meninting* **IV. MAMMALIA** 1. *Oryctolagus cuniculus* 2. *Suncus caeruleus* 3. *Pteropus medius* 4. *Macaca radiata* 5. *Funambulus palmarum*

3.10 ENVIRONMENTAL IMPACT ANALYSIS

The impacts on Topography, Land use pattern and Landscape Surface / Ground Water Resources Water Quality Ambient Air Quality Ambient Noise Quality Traffic and Transport Ecology will be minimal on account of the proposed mitigation measures. The construction of conveying main shall be done in the berm of the road and the space required for construction will be 1.5m to 2m. There will be obstruction of traffic flow wherever the width of the road is very less.

Mitigation Measures

The impacts during the construction phase on the environment would be basically of transient nature and expected to reduce gradually on completion of the construction activities. It is proposed to Recycle Wash Water in WTP and even during operational state there will be negligible environmental impact.

Pipe carrying bridges will be proposed across Thirumanimutharu River crossing with elevated supporting Structure without affecting the water regime. Piers for the pipe carrying bridge will be constructed on suitable foundation.

Continuous monitoring will be performed periodically to estimate the impacts in the surrounding environment and to take appropriate mitigation measures to bring down the pollution load. Laying of conveying main will be carried out in stretches so as to ensure smooth flow of traffic and safety of workers during construction phase. Proper traffic management plan shall be prepared and it shall be implemented only after the approval of the concerned authority.

3.11 ENVIRONMENTAL MANAGEMENT PLAN

As the project is proposed to be implemented by LS Contract, Contractor shall adhere to the EMP envisaged in the report. However the contractor has to obtain approval from TWAD Board before commissioning the construction activities with due care to protect the environment. The EMP cost for the project is Rs. 297.02 Lakhs (Table 5.3)

3.12 Observations

B) Surface Water Resources

- The pH of surface water is slightly alkaline in nature in the range of 7.02-8.15
- Iron value is in the range of 0.4-1.3 exceeding the permissible limit of 0.3
- Fecal Coliform per 100 ml is in the range of 30-70
- Based on the physic-chemical analysis, the surface water samples are unacceptable for drinking purposes.

4. ENVIRONMENTAL IMPACT ANALYSIS

4. 1 INTRODUCTION

Environmental Impact can be defined as "any alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration". Generally, environmental impacts can be classified as primary or secondary impacts. Primary impacts are those, which are attributed directly by the project while secondary impacts are those, which are induced by primary impacts and include the associated investments and changed patterns of the social and economic activities by the action.

This section identifies and assesses the potential changes in the environment that could be expected from the proposed project. The impacts have been predicted for the proposed activities assuming that the impact due to the existing activities has already been covered under base line environmental monitoring and continue to remains same till the operation of the project. The proposed project activities would create impact on the environment in two distinct phases i.e., construction and operation phases. Impacts are identified, predicted and evaluated based on the analysis of the information collected from following:

- Project information (as discussed in Chapter-2); and
- Baseline information and site visits of the study area (as discussed in Chapter-4); This section also describes mitigation measures, which have been suggested for the adverse impacts likely to be caused due to activities of both construction and operation phases of the project.

The identification of likely impacts during construction and operational phases of the proposed project has been done based on likely activities having their impact on one or another environmental parameters. The details of the activities and their impacts have been worked out in the following sections.

4. 2 IDENTIFICATION OF LIKELY IMPACTS

Every activity and operation has either adverse or beneficial impacts on the environmental. The environmental impact identification has been done based on proposed project activities. All the activities from construction phase to operational phases of the project have been broadly covered, which is given in **Table 4.1** and **4.2**. The activities and operations are considered on the basis of proposed process as described in the project description **section 2.**

Table 4. 1 - Activity-Impact Identification Matrix for Construction Phase of the Proposed Project

Construction phase		Potential impacts													
Main Activities	**Sub Activities**	Land use	**Landscape**	**Land/Soil environment**	**Surface /Ground**	**Water Quality**	**Air Quality**	**Solid waste generation**	**Ambient Noise level**	**Traffic and transport**	**Resource use Energy)** (	**Ecology**	**Socio economic**	**Culture/ Heritage**	**Agriculture in the**
Site Preparation	Site Clearing & Cleaning Ground leveling Waste handling and its transportation Soil Compaction	✓	✓				✓	✓	✓			✓			
Labour deployment camp siting	Construction of Labour sheds to accommodate labour Supply of water Supply of fuel/ Energy Waste handling & its		✓	✓	✓	✓	✓	✓			✓		✓	✓	

	disposal Sewage disposal														
Excavation	Moving of Heavy Machinery Soil Extraction and Slacking Soil Loading and Transportation for Disposal Various Tools Like Crow Bar Foundations for heavy machinery installation Construction Power through onsite Diesel Generators			✓			✓	✓	✓	✓	✓				✓

Material handling & Storage	Transportation and Unloading of material from trucks Storage &Handling of steel sheets, metals, Fabricated structure, Cement, Concrete, Bricks, Steel etc. Conveyance of material within the project site			✓		✓	✓		✓	✓	✓		✓		
Plant Building construction	Transportation of material to construction site Preparation/ Mixing of construction material Supply of water Operation of construction machinery (like cranes, Concrete Mix Plant, Floor Developer,		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

	Forklift etc,) Handling and disposal of construction wastes , Diesel Generator Operation														
Erection of sheds, installation of Machinery Building Fittings &Furnishing	Erection of sheds - welding/ cutting onsite Installation .of heavy machinery, pumps Mechanical installation and Electrical installation Drilling and Fixing Painting/ White washing Disposal of Wastes (empty paint cans, containers, electrical waste, wooden and metal waste etc.)						✓	✓	✓		✓				

Demobilization of construction equipment	Dismantling of temporary support construction structures/ equipments Removal of constructio n machinery Transportation of Construction/ Dismantled waste Site cleaning/ washings			✓			✓	✓	✓	✓					
Site Commissioning	Trials functioning of Production &Warehousing units, Conveying and packing system, plumbic fixtures, Electrical gadgets, Fire fighting system, Effluent treatment plant, Lifts etc., Recruitments				✓	✓	✓	✓							
Laying Conveying Main		✓	✓				✓	✓	✓			✓			

Table 4. 2 - Activity: Impact Identification Matrix for Operation Phase of the Proposed Project

Potential Activities	Air quality	Water quality Surface	water resource	Ground water resource	Land and soil quality	Noise quality	Traffic volume	Ecological	Land use pattern	Socio economic	Air quality	Cultural impact	tourism	Onsite risks-hazards
Transportation of man and utilities materials	✓				✓	✓	✓							✓
Operation of Assembly and Packaging units including labeling, storage and utilities functioning.	✓	✓	✓		✓	✓		✓			✓			✓
Storage of Flammables like High Speed Diesel etc.	✓				✓									✓
Water demand for domestic purposes & utilities etc.,			✓							✓	✓			
Waste water disposal		✓	✓	✓	✓									
Wastes-packaging & other solid waste disposal					✓		✓			✓	✓			✓
Hazardous material and Waste storages	√	√			√		✓			✓				✓
Employment							✓			✓				✓

4. 3 IMPACTS IDENTIFIED

Based on activity – impact interaction matrix for construction and operation phase of the proposed project as shown in **Table 4.1 & 4.2** respectively, following impacts have been identified:

i. Construction phase of proposed project would have impacts on the followings:

- Topography, Land use pattern and Landscape
- Land / Soil Environment
- Surface / Ground Water Resources
- Water Quality
- Ambient Air Quality
- Ambient Noise Quality
- Traffic and Transport
- Ecology
- Socio-economic

ii. Operation phase of the project would have likely impacts on the following

- Air Quality
- Water Quality
- Ground water Resources & Surface water Resources
- Land and Soil Quality
- Noise Quality
- Traffic Volume
- Ecological
- Socio-economic
- Onsite Risks – Hazards

4.3. 1 Construction Phase

The proposed facility is being developed at Namakkal, Tamil Nadu. The development period for the initial phase is considered as 1.5 to 2 years. Design of pipe carrying bridge will be done so as to avoid any obstruction in the flow of Thirumanimuthaaru River.

The likely temporary and permanent changes on the topography of the site would be following:

- Local labors will be employed hence shelter not required.
- Temporary – Movement of construction vehicles like excavators, pay loaders, trucks, other vehicles for bringing construction material and construction work may bring minor temporary change in the land use in and around the site by parking the vehicles on the open spaces and roads near the site and
- Permanent – Erection and installation of the various plant structures and establishment of plant building (manufacturing block, warehouse, office etc.,) and utilities will bring permanent change to the local land use of the site.

a) Impact on Air Quality

- Air quality in and around the project site would be impacted to some extent due to construction and construction related activities. The main impact will be during site leveling, excavation, construction material handling etc., the likely emissions from construction activities would include the following:
- Fugitive dust emissions from excavation work, digging, stacking of soils, filling, handling of construction material, transportation of material, emission due to movement of tires and plying of heavy construction machinery etc.,
- Traffic movement at the site and also increase in traffic volume on the connecting roads will rest in increase in vehicular emissions and
- Gaseous emissions from operation of diesel generators for power requirement during construction phase.
- However, the fugitive and other emissions due to the construction activities will most likely remain localized and confined to the project area, but adequate

mitigation measures would be required to reduce the pollutant concentration and prevent their spread around the site.

b) Impact on Noise Quality

Noise is atmospheric pollution. Noise is an unwanted sound dumped into the atmosphere without regard to the adverse effect it may have. Noise not only interferes with the communications but also affects peace of mind, health and behavior. Sudden loud sound can cause acute damage to the eardrum and the tiny hair cells in the internal ear whereas prolonged noise result in a temporary loss of hearing or even permanent impairment. It not only causes headache and irritability but also affect the sensory and nervous system of the body.

Any behavioral changes are recorded as a result of exposure to high-level noise not only in human being but also in animals. The undesired sound may cause annoyance. Noise can cause tension in muscles, nervous irritability and strain. Several birds have been observed stop-laying eggs; animal's changes their places, and also stop migration of birds.

The major sources of noise due to construction activities can be classified under three heads.

- Use of heavy machineries and vehicles during construction and demolition.
- Use of transportation during building operation period.
- Operation of D.G. sets.

Noise pollution is the results of the inefficient design of the engines in the vehicles and also the close vicinity of heavy traffic. The short distances between roads and buildings increase the effect of pollution on the buildings and users.

Table 4. 4 - Noise level of Construction Machinery

Construction machinery	d BA at 2m distance	Mitigation Measures
Truck	85	Operators of heavy machinery and workers in near vicinity should be provided with ear plugs and other safety gears.
Crane	85	
Permissible level	55	

It is envisaged that operation of these construction material will generate noise levels between 75-80 dB (A). The combined effect of these noise sources may cross 90 dB (A) at the construction site, however noise dissipates as it spreads in area beyond the site boundary. There will be requirement of providing adequate mitigation measure so that at the boundary of the construction site, the noise level can be kept less than 75 dB (A).

c) Impact on Water Quality

During the construction process, it is necessary to use pure drinking water to prepare lightweight concrete; In the absence of pure water, the seawater may be used with hydraulic lime and cement. It helps in preventing too quick drying of the-mortar.

However, it is not advisable to use sea water in making pure lime mortar or surkhi mortar because it will lead to efflorescence.

It is assumed that no wastewater will be generated onsite during construction activities except domestic sewage from campsite. While laying 700m pipeline, there will be no contamination of ground water. A major source of terrestrial water quality impact will be run-off from storm water, and site construction activities associated with construction works. Minimal water quality impact is anticipated for lying of inlet pumping mains.

The laying of conveying main will be carried out in the existing road. So, the hydrology and quality of sub surface water will not be affected.

The anticipated impact from the construction of terrestrial components would be insignificant. Nevertheless, for good site practice and appropriate mitigation measures are recommended to be implemented during construction of new facilities

d) Impact on Land - Solid/Hazardous Waste Storage

The following solid wastes are likely to be generated during the initial construction phase:

General Site Wastes

Materials and equipment used on site would produce packaging and container wastes. The volume of general site wastes generated will be dependent on the Contractor's operating procedure and practices. With the implementation of the recommended

mitigation measures (including site practices), the potential environmental impacts resulting from the storage, handling and transportation of general site wastes would be minimal.

e) Workforce Wastes

Throughout construction, the workforce would generate general refuse, comprising food scraps, paper, empty containers etc., The amount of general refuse which is likely to arise will be largely dependent on the size of the workforce employed by the contractor. Though with the implementation of waste management practices at the site, it is not expected that there would be any adverse environmental impacts arise from the storage, handling and transportation of workforce wastes.

f) Maintenance and Chemical Wastes

Chemical wastes arising during the construction phase may pose serious environmental, health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the Chemical Waste Regulations (CWR). These hazards include:

- Toxic effects to workers;
- Adverse impacts from spills on water gathering ground and other ecological sensitive areas; and
- Fire hazards.

Substances generated are likely to include some chemical wastes such as cleaning fluids, solvents, lubrication oil and fuel. Equipment maintenance activities would also involve the use of a variety of chemicals, oil and lubricants, including heavy-duty cleaners, organic solvents, degreasers, brake fluids, battery acid and soldering fluids.

g) Ecology

There is no activity of tree cutting for the proposed project sites (WTP, BS and SRs) or for alignment . Hence, no impact is envisaged on the vegetation in the project site.

h) Socio-economic

As the proposed project is formulated with no land acquisition, no negative impact is envisaged on the socio-economic status of the area in terms of acquisition of agriculture

land or displacement of people etc, However, the construction phase will require construction workers, which will largely be drawn from the local population and nearby towns. Thus, it will provide temporary employment to number of families and that will be a positive impact due to the proposed project.

The proposed project will also employ skilled people and that may be sought from outside. These people will largely be based in nearby small towns.

Overall, the construction phase will have positive impact on socio-economic condition of the people in the area, as it will provide direct and indirect revenues of income generation.

i) Impact on Traffic

The construction of conveying main shall be done in the berm of the road and the space required for construction will be 1.5m to 2m. There will be obstruction of traffic flow wherever the width of the road is very less.

4.4 MITIGATION MEASURES DURING CONSTRUCTION PHASE

The impacts during the construction phase on the environment would be basically of transient nature and expected to reduce gradually on completion of the construction activities. There will be beneficial impact due to the implementation of WSS scheme as it will enhance water supply service level of Namakkal Municipality. Proposed green belt all around Treatment plant will enhance air quality and aesthetic aspects. In order to mitigate them, the following measures are proposed.

4.4.1 Air Environment

- The impact of emissions both from tyre movements and vehicular exhaust emissions required to be minimized by proper maintenance of vehicles, sprinkling of water on unpaved roads at the construction site and planned movement of vehicles.
- Drawn conclusion is that no significant impact on air quality is envisaged due to construction and related activities. Any impact on air quality will likely be restricted within the localized area. Application of adequate mitigation measures by the

Construction Management Contractors will further reduce the intensity of such impacts.

- Wherever materials (aggregates, sand, etc.) are more likely to generate fine airborne particles during operations, nominal wetting by water could be practiced. Workers / labor should be given proper air masks and helmets.
- Stockpiles of imported material kept on site shall be contained within hoarding, dampened and/or covered during dry and windy weather.
- Material stockpiled alongside trenches should be covered with tarpaulins.
- Stockpile of cement should be covered entirely by impermeable sheeting.
- All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to keep the dusty materials wet.
- Water sprays shall be used during the delivery and handling of sands aggregates and the like.
- Pipes will be brought to the site in well maintained trucks.

ii) Mitigation measures for dust control

- Paving
- Applying Dust Suppressants
- Graveling
- Using Water Sprays
- Reducing Vehicle Speed
- Material storages/warehouses
- Cleaning Up Spills Promptly

4.4.2 Water Environment

- Proper mitigation measures (like provision of sewage collection tank and soak pit for treatment and disposal will be required for the sewage generated onsite during the construction phase. This will minimize any potential impact owing to the escape/discharge of untreated sewage into the nearby land or drain.

- Contaminated runoff from storage should be captured in ditches or ponds with an oil trap at the outlet. Contaminated plastic sheeting should be packed and disposed off site.

- The construction site would be provided with sufficient and suitable toilet facilities for workers to maintain proper standards of hygiene. These facilities include provision of septic tank followed by soak pit and maintained to ensure minimum impact on nearby water bodies and environment; Noise Environment

  - It is also advisable that on site workers using high noise equipment adopt noise personal protective devices;

  It is proposed to maintain Vehicle periodically and avoiding idling of vehicles at work sites Noise generation through vehicle will be minimized.

4.4.3 Land environment

- Mitigation measures should include provision of a collection area where waste can be stored and loaded prior to removal from the site.
- Rapid and effective collection of site wastes will be required to prevent waste materials being blown around by wind, flushed or leached into the environment, and odour nuisance.

- Delivery of material on site must be done over a durable, impervious and level surface, so that first batch of material does not mix with the site surface. Availability of covered storage should be assured. Mobile and covered storage boxes with easy drawing and filling mechanism can be used, which can be used over a number of sites.

4.4.4 Handling of wastes

- Materials classified as chemical wastes will need special handling and storage arrangements before removal for appropriate treatment at the chemical waste treatment facility. Wherever possible opportunities should be taken to reuse and recycle materials. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts should not result.

- Construction is more of management. Proper estimate of material is a very first measure to minimize the undue wastage.
- Bitumen emulsion should be used wherever feasible. Contractors should be encouraged to heat with kerosene, diesel or gas to gradually substitute fuel wood. Fuel wood usage for heating should be limited to unsound log i.e. dead and fallen trees.
- Bitumen should not be applied during strong winds to avoid danger of forest fire. Bitumen emulsion should not be used in rains. No bitumen must be allowed to flow into the side drain. The bitumen drums should be stored in a designated place and not be scattered along the roadside.
- Rubbish, debris and bitumen wastes remaining after blacktop works should be cleaned and disposed off in a safe place. Materials wasted on site should be reused at the same place. For example, use of excavated earth in landscaping, or use of waste pieces of floor tiles in floor of porch or outdoor spaces, or use of remaining pieces of glass from window panes into ventilators, skylights and boundary wall, or reuse of ply and other timber pieces into furniture etc.,
- These practices suggest the measures for reduction of waste. However, each type of waste needs special attention and specific kind of management, as the wastes from different activities poses different characteristics.
- Hazardous materials must not be stored near surface waters and should be stored near plastic sheeting to prevent leaks and spills.
- Demolished brick masonry and concrete is a good material for filling. Steel from RCC must be carefully segregated and rest of the material should be crushed on site only. Crushed masonry and concrete is even good for manufacture of synthetic aggregate.
- The recyclable items like metal, plastic should be sent to recyclable industry, and rest of this scrap should be stored in a covered area.

4.4.5 Traffic

- During construction phase there may be temporary traffic diversion. But this may be only for short duration. Necessary Barricades, sign board will be erected for the convenience of pedestrians and motorists.

- The construction work near the school shall be completed as quickly as possible.
- The conveying main will be laid using trenchless technology in NHAI and Major Highways Crossing like Tiruchengode Road ,Salem Road, Mohanur Road and Trichi road in addition to Railway crossing.

  For laying pumping main and distribution lines in congested areas within the municipal limits or along pumping main, traffic management plan shall be prepared by the contractor in consultation with the officials concerned and necessary permission from Traffic Department shall be obtained by the contractor prior to start of work in such locations.

4.5 OPERATIONAL PHASE

4.5.1 Impact on Air Quality

The key potential air quality impact during the operational phase of the scheme would be the emissions arising from the operation of JCBs and the fumes / vapors from the storage/handling of chemicals. No impact on Air quality is anticipated along the conveying main.

The use of D.G. sets is anticipated only during power failure and hence is temporary and requires standard measures.

4.5.2 Impact on Noise Environment

- The major noise generating equipment during operational phase is the air blowers, ventilation fans, water pumps and DG Sets.
- All equipments are likely to be operated simultaneously during operational phase except DG Set, which is used as a power backup during power failure at pump station.
- All these are expected to result in increase in existing noise levels within the plant premises and in the immediate surroundings.

Table 4. 3 - Potential Impacts on Noise Environment due to the Proposed Facility

Phase	Potential Noise Sources

Construction	Site Preparation ➢ Heavy Earth moving equipment at site ➢ Soil compaction by vehicles ➢ Construction Activity ➢ Vehicle Movement
Operational	➢ Vehicle movement ➢ Proposed WTP and Booster Station Pumpsets

4.5.3 Impact on Water Environment

The possible impacts from the project on the water environment may be due to the impact on other users due to withdrawal from the source, disposal of back wash water and sludge into waterbodies, wastage of water due to overflow in service reservoirs and line bursts due power failure, etc. To avoid such impacts surface drawl is proposed and back wash water recycling and disposal of sludge into sludge container pit is proposed. The alignment of main is fixed away from existing structures in such a way not to disturb any existing structures.

Impact of TDS on Ground water:

As there is no let out of water except Rain water harvesting into the Ground the system will have negligible effect on Ground water characteristics.

4.5.4 Impacts Due to Waste Generation

Small amount of domestic waste from site management office, chemical waste from equipment maintenance are expected during operation of the WTP. Improper onsite storage of domestic waste can rise the adverse environmental impact such as odour nuisance, vermin and pests, water quality impacts, and adverse visual impacts. Spent oil from generators considered to be hazardous waste and it shall be sent to Tamil Nadu Pollution Control Board approved recyclers

4.5.5 Safety

WTP operation requires use of Alum and Chlorine for coagulation and during the operation phase and can cause safety issues due to improper storage or handling. In addition, there are safety requirements for maintenance activities such as provision of Hand rails mechanical lifting arrangements interconnection of structural components etc.,.

4. 5.6 Impact on Heritage or Cultural Aspects

There are no historical monuments and structures in the proposed area and insignificant impact is envisaged from the proposed project on heritage or cultural aspects in the study area.

4.5.7 Social Impact Assessment

For assessing the social impacts as per ESMF, a study was carried out and it was observed that the project activities do not involve any land acquisition or encroachment removal. During construction there may be minimal temporary issues like safety to public and construction laborer, traffic disturbance, etc., which have been addressed in the Environmental Management Plan. Detailed information on the social Impact Assessment is given in **Chapter 6.**

4.5.8 Emergency Overflow

As SCADA online monitoring is proposed , no emergency overflow is anticipated.

4. 6 MITIGATION MEASURES

4.6.1 Air Environment

- The gaseous pollutants will be generated mainly from Diesel Fuel combustion from diesel generators, material handling and also from operation of transportation vehicles. Diesel generators will be operated only for emergency power backup. The emission' source diesel generators will have adequate stack height will

conformance to the set norms of CPCB and regular maintenance of diesel engines has to be ensured.

- A part from the above, the possible sources of dust emission will be the transportation vehicles. These will mainly contribute to NOx and Carbon Monoxide. Since the truck trips are less, vehicular emissions will be insignificant. However, management will ensure that all the private and commercial vehicles entering into the site are in proper condition and there is no visual sign of major emissions from the vehicles. Also it is to be ensured that all the vehicles are regularly holding valid Pollution under Control Certificates.

4.6.2 Noise Environment

In operational stage, Pump sets will be installed in pump house. Two sources of noise in project – WTP & BS. For All other sites including SR with distribution system there is no scope for noise generation and consequent noise disturbance

AMBIENT NOISE STANDARDS

Ambient Noise Standards	L Day	L Night
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

The mitigation measures proposed are

- WTP:

- Design of downstream equipments for blowers at WTP site.
- Strong and Heavy-duty steel base frame shall be provided for housing Pumpset.
- The motors and pumps are selected in such a way that the noise levels will be in the range of 40 – 55 dB. and sound and Vibration measuring meters are proposed to be added in the Pumpsets and incorporation in SCADA System for efficient online Monitoring and triggering critical events for noise control and preventive maintenance.

- Ear plugs and Ear muffs will be provided for the workers near noise generating sources.
- Thick canopy type of trees will be planted to attenuate noise any arising from the Pumpsets. The greenbelt will be developed along the Treatment plant boundary

- Booster Station:

  - The school is at 30 m from the Proposed site. Pump room in the BS was proposed to be located within the BS away from compound wall next to sump for minimizing noise level. Distance between Pump room and School is 55 m .Actual noise levels from BS will be below 50 dB and , and anticipated levels at plant boundary 40 dB.

  - Plantation width within site proposed is 3 m

  - The top level of the window is 2.1 m Proposed compound wall height is 3.0 m from GL. Hence to minimize noise level within permissible limit Compound wall height raised and Tree plantation proposed for sound absorption. Location of pump room finalized away from the School within the available boundary.

4.6.3 Water Environment

The Regional Scientific Source Finding Committee(RSSFC) has cleared the proposed source location vide Lr No F.RSSFC/AE(M)/CE/2013/dt 15.02.2013 taking into account the Hydrology , water assessment , rainfall , static water potential at the coordinate of 11□□□'55.191''N 77□□□'40.269''E Upstream of Jederpalayam Anaicut of Cauvery River. Water is proposed to be drawn from river into this Offtake well by gravity and then to Collection well cum Pump House by 600 mm Pipe in 2 Rows for a length of 750 m by gravity. Subsequently from Collection well it is proposed to be pumped to Booster Station 12.13 km away from Head Works Site for subsequent pumping.

- The rejects arising from the operation of back wash water will be recycled .

The following components are proposed for recycling:

Recirculation Sludge settling sump-7.2 m-2 Nos

Recirculation Sludge Recirculation Pumpset Pump room-12.0x6.0 m

Sludge Pumpset-40 lpm x 10 m head

Sludge screw Pump Room-3.0x3.0m

Sludge thickner-2.0 m Dia

Sludge Drying Bed-20.0 mx6.0 m-2 Nos

- Sludge container pit-5.0 m dia 3.0 m depth with polymer impermeable membrane for protection of Ground water environment. River crossing is proposed in Thirumanimuthaaru. Foundation will be taken down 1.5 m below bed level for eliminating obstruction of flow in river. The width of river is 67.5 m and it is proposed to cross the river by constructing elevated RCC Structure with 10 Nos of 0.3 m dia Supporting circular pillar with 9 Nos of 7.5 m span. Due to the provision of Circular pillar , the obstruction to the flow of water will be minimum and higher span is adopted for minimizing No of Pillars. The foundation is proposed to be taken 1.5 m below the River bed level so as to have no obstruction in the water flow in the river bed. The alignment of Pipeline is so oriented to minimize the disturbance of existing system. The height of the bridge is proposed to be at 2.5 m which is above MFL 0.5 m. There will not be any impact on the existing structure due to this crossing.

- Rain water harvesting system will be provided in all the project sites i.e., WTP, BS and SR sites.
- Prevention of wastage of water – online monitoring / SCADA is proposed with Level Element for monitoring overflow and consequent wastage of water . Pressure monitoring and flow measurement are proposed in both inlet and outlet point of the system for possible detection of leakage in pipe line and for water auditing .
- The sewage from the toilets in the quarters and office building will be properly let out. A septic Tank of 2.5 m x 1.3 m x1.5 m size is proposed for Quarters inside the WTP Premise with Brick masonry and RCC Cover slab .
- To avert burst in the pumping main, Surge pressure release measures and sufficient air relief valves will be installed in all the pumping mains. This will result in conservation of treated water and prevent flooding.

- Pressure monitoring system in pipe line is incorporated in SCADA System for early leak detection and preventive maintenance. SCADA is proposed with Level Element for monitoring overflow and consequent wastage of water with intelligence logic and automation system for control and regaining of equilibrium and there is no possibility of overflow in the system.

Source sustainability:

The Regional Scientific Source Finding Committee(RSSFC) has cleared the proposed source location vide Lr No F.RSSFC/AE(M)/CE/2013/dt 15.02.2013 taking into account the Hydrology , water assessment , rainfall , static water potential at the co-ordinate of 11□□□'55.191''N 77□□□'40.269''E Upstream of Jederpalayam Anaicut of Cauvery River. As surface drawal is proposed , the drawl of required quantity of water will not affect the existing Water Supply system with source in the proposed Head works site. Volumetric availability has been ascertained for the required quantity. Existence of Jederpalayam Anaicut downstream of the source enhance the source sustainability even during the lean period and is the primary factor for selection of the site for the source. A detailed study of requirement of other Water Supply system and availability was carried out and found feasible. No solid liquid and gas wastes and effluents are generated and disposed in the river and Terrestrial area and the environmental and ecological system is maintained as such.

Handling of wastes:

Sludge from WTP is proposed to be separated out in the process of Recycling and proposed to be disposed in the sludge container proposed in the low level area of WTP Premise.

Sanitary waste from offices are proposed to be collected by local Collection system and disposed off Periodically.

Handling of chemicals

Safety measures – Hand rails are proposed all-round the Clarifier unit around the edge and necessary interconnection arrangements were proposed to minimize repeated

access from ground during day to day operations. It is proposed to provide Alum Storage area in the Ground Floor and to lift the required quantity to the First Floor through Chain Pulley Block through opening for easiness of operation and safety. Chlorine cylinder is proposed to be stored in open place with railing arrangements for mechanical loading and lifting and easy mobility.

Safety equipments Safety appliances like fire extinguishers, lightening arrester, Rechargeable energy light , rubber mat , glows first aid box are proposed.

For Chlorine storage safety eye washer , Face Mask with Oxygen cylinder for emergency maintenance and Leak Alarm are proposed.

4.6.4 Safety Measures

- WTP , BS and SR sites will be protected with compound wall to prevent unauthorized entry.
- Handrails and guards will be installed around tanks, trenches, pits, stairwells, and other hazardous areas.
- Storage and handling of chemicals shall be as per the applicable code of safety issued for the chemicals.
- Hazardous chemicals used in the operation shall comply with the Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
- It is a Stand Alone Scheme and the Scheme will be handed over to Local Body after completion for further maintenance after trial Run and Contractor's Maintenance Period of 1 Year. Necessary training to the personnel will be provided periodically by the Engineering Officials for the Operators.
- EHS guidelines of the World Bank shall be ensured during project implementation.

4.6.5 Measures for Operation of Scheme:

- Wherever necessary stand-by units / equipments shall be provided to ensure smooth operation of the scheme.
- Recycling and reuse within the plant will be provided to the maximum extent possible.

c) COMMISSIONING AND O&M SPARES

- Draining arrangements shall be provided for all units as necessary
- Adequate storage and standby arrangements will be provided for treated water to provided uninterrupted water supply to the public even during maintenance or other eventualities like power failure etc.

d) Facility for Workers

Within the plant site during construction phase, the base emanating such as toilet, drinking water, electricity health, first aid facility and safety gadgets will be provided.

4.6.6 Social Environment

During implementation of the proposed project adequate measures will be undertaken based on the observations specific to the alignment of the transmission line (Pumping main).

1. It is observed that there is common utilities like telephone cables, Electrical cables, Water lines along the alignment of the transmission main and sufficient care to be taken during execution.
2. No trees and no Endangered/ Rare flora are found along the alignment of the transmission main.
3. Construction debris will be minimized by balancing the cut and fill requirements.
4. Top soil will be protected and compacted after completion of work.
5. It is also verified that there will not be any possibility of cross connection with sewer line.
6. Construction will be taken place phase wise so that sections are available for smooth flow of traffic.

4.6.7 Green Belt Development

No Trees are proposed to be cut. However Green belt is proposed to implement in the WTP site. 33% of area earmarked for greenbelt trees of native species are proposed to be planted. Trees naming Vembu, Magizhamaram, Pongai, Ornamental ficus tree, Tulasi,

Araucaria Tree,Poovarasu, Arali, HibiscusAlamanda, Royal Palm, Ravenala, Creepers are proposed. Local body and Voluntary organisations are proposed to be entrusted with the maintenance of Trees. Gardening and Tree Plantation also provided in Booster Station at Thummankurichi for Sound absorption and environmental enhancement. Trees proposed to be planted inside the project premises will be maintained by the operating personnel engaged by contractor during maintenance period of one year and by the Namakkal Municipality subsequently.

4.6.8 Emergency Preparedness Plan

Various alarms will be also provided within the treatment facility and these alarms will also be tied into the main control panel at the Emergency Response Center. When emergencies arise within the treatment facility, the on-duty operator immediately reports the condition to the facility in-charge person. Appropriate personnel respond to the emergency with the necessary resources. When emergency condition notices are received by telephone at the Emergency Response Center, the operator on duty should ensure all pertinent information surrounding the emergency is accurately recorded. The contractor shall prepare emergency preparedness plan and emergency announcement procedures for local residents.

The following are the mitigation measures to be followed in case of Power Loss/Equipment Failure, chemical leakage, explosion and pipeline burst

- Implementation of prevention measures as required – particularly mutual aid agreements.
- Providing portable lighting at night.
- Checking spare parts inventory.
- Use of original equipment quality replacement parts.
- Usage of appropriate lifting and hoist equipment.
- Checking for bearing seizure due to overheating or insufficient lubrication.
- Always lubricate before restart of Motors.
- To determine if the power loss is local or area-wide.
- If loss is local, check out all electrical circuits for shorts or system overload.

- If the loss is area-wide, contact the power company and coordinate repair and startup operations with them.

Surge protection system:

Surge Protection System will be provided to absorb sudden raise of pressure, as well as to quickly provide extra water during a brief drop in pressure. No surge Tank is proposed as per surge Analysis and Surge protection devices like Disc valve and Surge Anticipating Relief Valves in the main are proposed along the alignment. Pressure is monitored online through SCADA System.

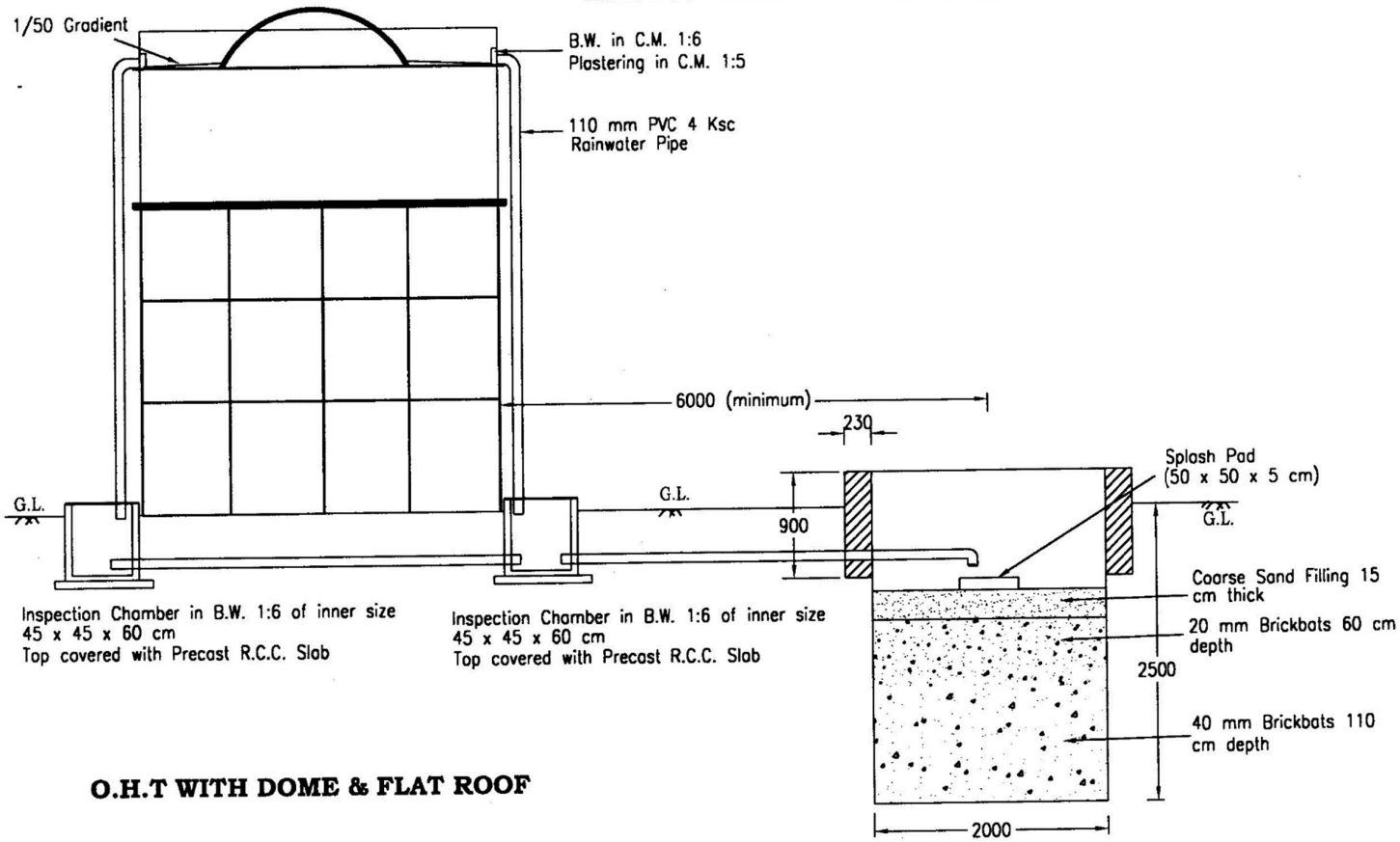
All other instruments like pressure gauges, pressure relief valves, level indicators, compound gauges, etc. as required for safe & trouble free operation of the system shall be provided. The contractor shall prepare an emergency preparedness plan ensuring all the necessary steps that avoid accidents.

During a major emergency, the water treatment plant and distribution system may suffer major damage resulting in very little flow of wastewater reaching the treatment facility. For this reason, careful coordination with the local water supply system is necessary; since it may well be that the waterworks restoration has priority over the wastewater treatment plant. Contractor shall prepare Emergency preparedness plan prior to the respective stages.

Details of Rain water harvesting in Project sites:

It is proposed to construct rain water harvesting Structures in all the roof top of buildings including Service Reservoirs for enhancing Ground water Storage. It is proposed to filter the rain water through natural media like sand brick bats etc., for maintaining the quality of Ground water. Typical cross section of Rain water Harvesting Structure is as below.

Rain Water Harvesting with Recharge / Soakpit for O.H.T. with Dome & Flat Roof.

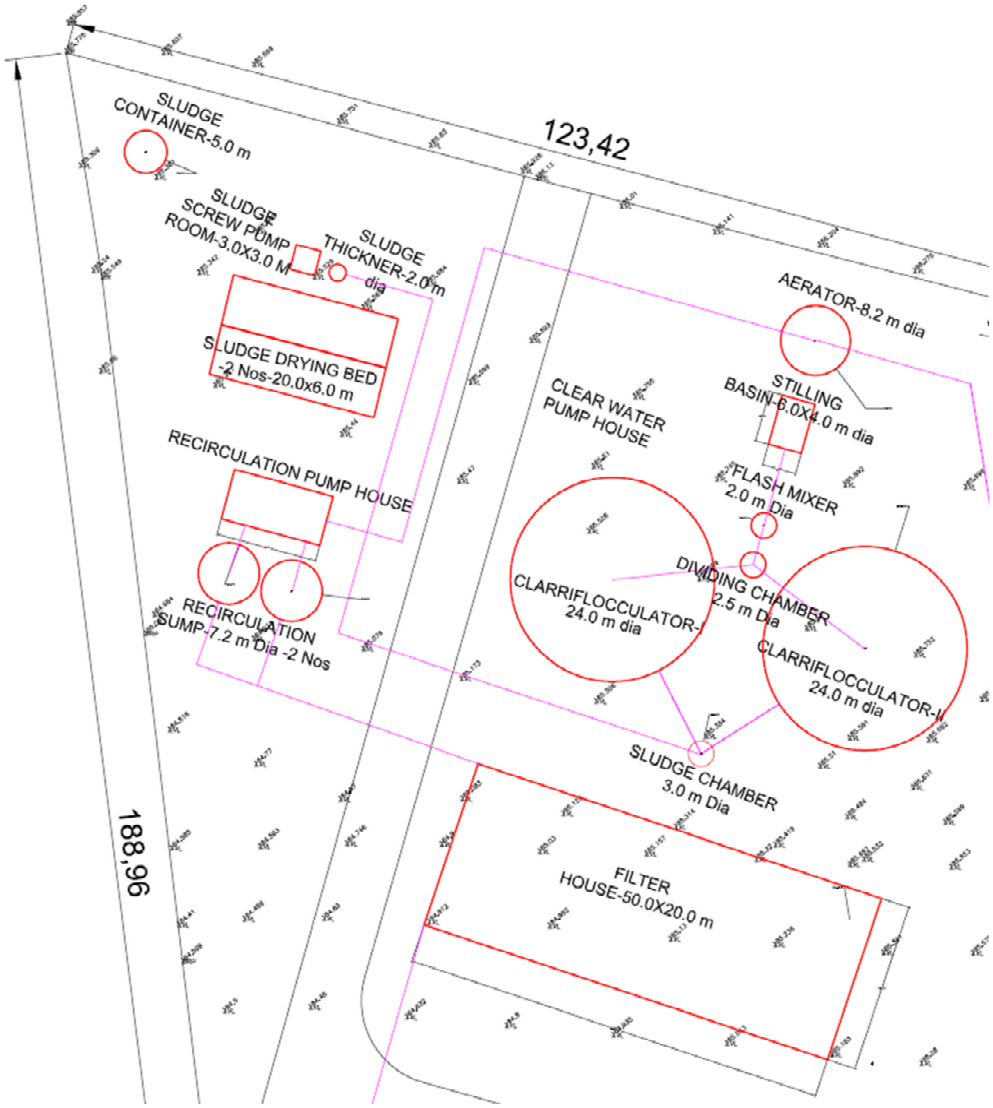


O.H.T WITH DOME & FLAT ROOF

RECHARGE / SOAK PIT

ALL DIMENSIONS ARE IN MM
NOT TO SCALE

It is proposed to collect Sludge from Clarriflocculator in Sludge chamber 3.0 m Dia and to pump the collected sludge with water to Sludge Thickener 2.0 m dia and through Screw pump Thickened sludge lifted to Sludge Drying bed 2 Nos 20.0x6.0 m size. Dried sludge contained in sludge container Pit of 3.0 m height and average 5 m dia. The sludge pit would be sufficient for a period of 1 year for an average dosing of 10 ppm of alum and Namakkal Municipality shall dispose the sludge from the sludge container pit to their solid waste yard annually.



Safety measures and training

During the contractors maintenance period operators will be trained for safety measures for operations of various mechanical items and handling of chemicals and handling of Chlorine cylinders. Earthing proposed for all electrical equipments. Rubber mat in electrical operation area proposed. First Aid Box made available in the site. Electronic protection for short circuiting is proposed to be incorporated. Manual handling of Alum and Chlorine Cylinder avoided by installing RSJ Chain Pulley Block arrangements for physical lifting and movement for unloading and stacking at storage place. Training on sequence of Operation suiting to the equipment's need is proposed for the operating persons. Time period of operation like filter bed back wash based on loss of head , sludge disposal from Clarriflocculator based on sludge bleeding telescopic arrangements etc is proposed. Training on routine maintenance of Pump set motor parts like bearing through lubricant injection and Transformer system is proposed.

Chlorine Cylinders are proposed to be stored in separate open storage area adjoining filter bed with exposure to open atmosphere with RSJ Chain Pulley Block arrangements for Unloading and stacking avoiding manual handling leading to Hazardous events. Details of digitized action depicted in Annexure -9

During leakage to hand repair and Valve closure face mask with Oxygen Cylinder is proposed. As an additional safety arrangement eye shower is proposed with source of water from wash water tank as operation of plant is likely to be stopped during leak detection stage.

Leak alarm is proposed for avoiding unnoticed chlorine gas leak and to generate automatic alarm for immediate attention and action.

Display of instructions :Display of instructions during critical situation like chlorine leak detection , Electrical shock state etc will be displayed through display boards. Dos and Don'ts. Will be displayed for the equipment's operation like sequence of valve closure sequence of electrical switch operation DATA feeding and

retrieval from SCADA System through operational manuals with technical support from the equipment manufacturers.

Training programme will be conducted for the operating personnel like electricians filer bed operators maintenance Assistants Turn cock system operators half yearly focusing on avoidance of problems occurred in the past with positive feedback . Adding additional logic in SCADA System incorporating past problematic period for avoidance in due course will be finalized.

5. ENVIRONMENTAL MANAGEMENT PLAN

5. 1 OBJECTIVES

The Environmental Management Plan (EMP) is required to manage environmental impacts from the proposed project. It is a site-specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment. Site-specific EMP is formulated to mitigate significant adverse environmental impacts that are identified and quantified in the process of baseline and impact assessment. An EMP also ensures that the resources are utilized to maximum extent, waste generation is minimized, residuals treated adequately and by-products are recycled to the extent possible.

5. 2 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

Environmental Management and Monitoring Plan is essential for effective implementation of identified mitigation measures during the operation phase. Construction of WTP and pumping stations will be carried out by the contractor. The contractor will be selected by the competent authority of TWADB based on the technical capability and price quoted. The successful contractor will train the technical staff of the concern local bodies and TWADB during the construction and operation phase of sewerage scheme. Once the contractual obligation is over, then the trained technical personnel will undertake the job of operation and maintenance of the entire scheme.

Table 5.2.1 EMP for various project implementation

Sl. No.	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
	Pre- Construction			
1	Clearances	All clearance required during construction shall be ensured and made available before start of work. List of clearances required along with the status are provided in Table under section 3.1. Permissions will be obtained before start of the works	Before start of construction	TWADB and Namakkal Municipality
2	Tree cutting	No tree cutting may be required at Pumping Main alignment. The PIA shall try to avoid tree cutting. However more numbers of trees cut if any at Pumping Main shall be planted in WTP & Booster stations	During construction	TWADB
3	Utility Relocation	Identify the common utilities to be affected such as: telephone cables, electric cables, electric	Before start of construction	TWAD Board / Concerned departments

		poles, water pipelines, public water taps etc. Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts		
	During Construction			
1	Baseline parameters	Adequate measures shall be taken and checked to control the Baseline parameters of Air, Water and Noise pollution. Base line parameters recorded shall be used for monitoring and conformance be ensured.	During Construction	TWADB/Contractor
2	Planning of temporary traffic arrangements	The activities are limited to the project sites and right of way. Hence does not require any traffic arrangements. However, in case of any need in the site, necessary permissions for temporary diversion shall be obtained. Signings and safety measures including	During construction	TWADB/Contractor

		flagmen be provided at the site.		
3	Storage of materials	The contractor shall identify site for temporary use of land for construction sites / storage of construction materials, etc.	Before start of construction	-Contractor
4	Construction of labor camps	Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp). i)The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction. The construction will commence only upon the written approval of the Engineer. The contractor shall maintain necessary living	During construction	Contractor

		accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be planned. Adequate health care is to be provided for the work force. The layout of the construction camp and details of the facilities provided should be prepared and shall be approved by the Engineer		
5	Safety Aspects	Adequate precautions shall be taken to prevent the accidents and from the machineries. All machines used shall conform to the relevant Indian standards Code and shall be	During construction	Contractor

		regularly inspected by the PIA Where loose soil is met with, shoring and strutting shall be provided to avoid collapse of soil. Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc. Welder's protective eye-shields shall be provided to workers' who are engaged in welding works. Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs. The contractor will comply with all the precautions as required		

		for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No.62 as far as those are applicable to this contract. i)The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 and adhered to. ii)The contractor shall not employ any person below the age of 18years for any work and no woman will be employed on the work of painting with products containing lead in any form.		
6	Disposal of construction debris and	A suitable site should be identified for safe disposal, in relatively low lying areas, away from the	Pre-construction and Construction	TWADB/Contractor

	excavated materials	water bodies etc., and got approved by the Engineer.		
7	Barricading site	The activities would be restricted to project sites and right of way for alignment. However barricading with adequate marking, flags, reflectors etc. shall be provided along the alignment for safety of restricted traffic movement and pedestrians.	During construction	Contractor
8	Clearing of construction camps and restoration	Contractor to prepare site restoration plans, the plan is to be implemented by the contractor prior to demobilization On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	After completion of Construction	TWADB/Contractor

9	Pollution from Fuel and Lubricants	i) The contractor shall ensure that all construction vehicle parking location, fuel / lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500m from rivers and irrigation canal / ponds ii) All location and layout plans of such sites shall be submitted by the Contractor prior to their establishment and will be approved by the Engineer iii) Contractor shall ensure that all vehicle / machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground.	During Construction	Contractor

		iv) Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines. v) Engineer will certify that all arrangements comply with the guidelines of PCB / MoEF or any other relevant laws		
10	Pollution from Construction Wastes	All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer	During Construction	Contractor
11	Storage of chemicals and other	A suitable site should be identified/construct for the safe storage and handling of chemicals and other hazardous materials	During Construction	Contractor

	hazardous materials	with proper display of requirements and marking as protected area.		
12	Informatory signs and Hoardings	The contractor shall provide, erect and maintain informatory/ safety signs hoardings written in English and local language, wherever required or as suggested by the Engineer	During Construction	Contractor
13	First Aid	The contractor shall arrange for: i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	During Construction	Contractor
14	Risk from Electrical Equipments	The contractor shall take all required precautions to prevent danger from	During Construction	Contractor

		electrical equipment and ensure that- i) No material will be so stacked or placed as to cause danger or inconvenience to any person or the public ii) All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standard (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer		
15	Waste Disposal	i) The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as	During construction	Contractor

		per the Comprehensive Solid Waste Management Plan approved by the Engineer. ii) Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Engineer will have to be provided by the contractor		
16	Pollution from Construction wastes	All waste arising from the project is to be disposed off in the manner that is acceptable by the Engineer The engineer shall certify that all liquid wastes disposed off from the sites meet the discharge standard	During construction and post-construction	TWADB/Contractor

17	First Aid	The contractor shall arrange for: i) A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. ii) Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital iii) All the project sites such as RI, WTP, BS, SRs should have first aid box	During construction	Contractor
	Water Treatment Plant/ Booster Pumping Stations/GLSR/ ESR			
1	Protection of top soil & Environmental enhancing	Top soil from the WTP area should be stored in stock piles and that can be used for gardening purposes at WTP site which will be an environmental enhancing measure	During construction	TWADB/ Contractor

2	Restoring river bed / water source	Ensure the restoring of river bed to its natural shape free from any debris or construction junk material that may obstruct the flow.	Construction and Post Construction	TWADB/ Contractor
3	Downstream users (impacts arising due to coffer dams, etc.)	Ensure that the flow stream is not obstructed, affecting the downstream users due to construction of coffer dams, etc. Coffer dam shall be removed upon completion of construction.	During construction	TWADB/ Contractor
4	Permissions from other departments	Raliway NHAI and Road crossing	construction	TWADB
		PWD approval shall be obtained for the withdrawal of 22.09 MLD and for laying 67.5 m pipeline for Thirumanimuthaaru River crossing.	Before commencement of work	TWADB

5	Disposal of waste water	i) The waste water quality shall comply with the standards of TNPCB to let out into the river. ii) Ensure efficient working condition of treatment plant iii) Sludge from the WTP shall be dried in the sludge drying beds and disposed in the Sludge container pit proposed in the WTP Premise. iv) Filter backwash, supernatant from Sludge Thickener and filtrate from the sludge drying beds shall be collected in re-circulation sump and pumped to raw water distribution channel.	During commissioning and Trial run	TWADB/ Contractor
6	Tree plantation	Trees shall be grown in the site for WTP along the boundary, and in the sites of booster stations,. (Section 4.6.7)	During construction	TWADB/Contractor

7	Noise Management	The pumps shall adhere to the standards of noise. Regular maintenance shall be carried out to restrict the noise levels. Staffs entering the pump room shall be provided with PPEs.	During operation	TWADB/ Contractor/Namakkal Municipality
	Safety in Sites			
8	Transportation and storage of hazardous chemicals	Guidelines and procedures in Motor vehicle Act 1986 for transportation ; Manufacture , Storage and import of Hazardous Chemicals Rules 1989 to be followed for storage and handling of Hazardous chemicals : Insurance covers to be taken for accidents and cost of cleanup operations.	During Operation	TWADB/ Contractor/Namakkal Municipality
9	Handling of Chemicals	The unit shall provide necessary safety measures for the storage of Chlorine cylinders and provide emergency repair kit and personal safety kit like full body cover, face mask,	During Construction	TWADB & contractor/Namakkal Municipality.

		body and eye shower etc. at the site. The unit shall install Chlorine gas leak detector system (Chlorine Gas Sensor) at the site.		
10	Additional safety measures	The structures shall be provided with easy access ladders, and handrails, interconnections between all units with proper safe walkway platforms for movement to avoid falling of human and materials. Electrical cables are going to be laid in cable trenches. Open spaces at height will be covered with parapet walls and handrails.	During construction	TWADB & contractor.
11	Environmental Monitoring	The water quality of the source shall be monitored periodically. The quality of treated water shall be monitored at various points prior to distribution – clear water sump, booster stations, MBR, OHTs etc.	Pre-construction and Construction	TWADB & contractor-

		Monitoring of noise levels shall be carried out at WTP and booster stations sites. Monitoring of survival rate of the greenbelt shall be carried out at the project sites every three months. Detailed monitoring plan provided and record shall be maintained. Periodical report shall be sent to the Engineer.		
12	Other Management measures at Sites	WTP (i) Providing equipments like ear plugs to workers near the noise source. (ii) Providing PPEs for safe working of personnel in critical areas like chlorination plant shall be ensured. (iii) Display boards on safety measures and emergency measures to be installed.	During operation	TWADB & contractor

		(iv) Regular training for the staffs operating the WTP with various aspects of maintaining water quality and safety. (v) Regular maintenance of the greenbelt and the entertainment facilities at the site. Booster Pumping Stations a. PPEs for the workers exposed to high noise. Regular maintenance of the greenbelt. GLSR / ESR Regular maintenance of the landscaping made at the site.		
	Construction of Pumping Mains /Transmission Mains			
1	Protection of top soil	The top soil to be protected and compacted after completion of work, where the pipelines run,	During construction	TWADB/Contractor

		including open lands and agricultural lands		
2	Laying of pipeline	Adequate precautions should be taken while laying the water supply mains to avoid the possibility of cross connection with sewer lines. For the mains proposed in the bank of Cauvery River, the trenches shall be refilled and The excavated soil shall not be taken away from the site. Excess soil to be left in the river bed itself to ensure not to disturb the river profile.	During construction	TWADB/Contractor
3	Traffic diversion	Before taking up of construction activity, a Traffic Management Plan shall be devised and implemented to the satisfaction of the Engineer. Construction shall be taken phase-wise so that	During construction	TWADB/Contractor / Namakkal Municipality

		sections are available for traffic Temporary diversion will be provided with the approval of the engineer. The Detailed traffic control plans prepared and submitted to the engineers for approval one week prior to commencement of works shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, reflective SIGN boards, cones etc safety measures for transport of hazardous materials and arrangements of flagmen. The arrangement for the temporary diversion of the land shall ensure to minimize the environmental impacts like loss of vegetation, productive lands etc.,		

		prior to the finalization of diversion and detours. Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night. The contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He shall inform local community of changes to traffic routes, conditions and pedestrians access arrangements. Traffic management plan shall be prepared by the contractor and got approved by the engineer concerned. This plan will be periodically reviewed with respect to site conditions.		

		The temporary traffic detour will be kept free of dust by frequent application of water.		
4	Temporary flooding due to excavation	Proper drainage arrangements to be made, to avoid the overflowing of existing drains due to excavation during the laying of mains.	During construction	TWADB/Contractor
5	Using of modern machineries	Using of modern machineries such as JCBs, backhoes etc., shall be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents	During construction	Contractor
6	Dust pollution near settlements	i) All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction shall be covered & equipped will dust collector. ii) Construction material shall be covered or stored in such a manner so as to avoid	During construction	Contractor

		being affected by wind direction. iii) Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day iv) Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage		
7	Protection of residential sensitive receptors	i) Noisy construction operations in residential and sensitive areas should be done only between 7.30 am and 6.00 pm ii) Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise iii) Provision of enclosing generators and	During construction	Contractor

		concrete mixers at site. iv) Sound barriers in inhabited areas shall be installed during the construction phase. v) Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc. to be ensured		
8	Vehicular noise pollution at residential / sensitive receptors	i) Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas. ii) Stationary construction equipment will be kept at least 500 m away from sensitive receptors.	During construction	Contractor

		iii) All possible and practical measures to control noise emissions during drilling shall be employed. The PI A may direct to take adequate controls measures depending on site conditions.		
9	Noise from vehicles, plants and equipments	i) Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. ii) Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum	During construction	Contractor
10	Storage of construction materials	Site for storage of pipes and construction materials to be identified,	During construction	Contractor

		without affecting the traffic and other common utilities		
11	Pollution from Construction wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during construction (e.g., during the testing of pipeline) from entering into streams, water bodies or the irrigation system.	During construction and post-construction	Contractor
	Rainwater harvesting,	Construction *Construction of Rain Water Harvesting structure(Roof Collection System and Discharging through leach pit) in Structures including Service Reservoirs* O&M Measures Periodical cleaning and removal of filtering media and removal of block in drainage path ,	During Construction During Operation	TWADB/Contractor Namakkal Municipality

	Sludge drying bed & Sludge pit,	Removal of sludge from drying bed and dumping in Sludge Container pit and periodical cleaning of drying bed	During Operation	Namakkal Municipality
	compound wall at BS,	Construction of compound wall at Booster station 3.0 m height to minimize noise impact	During Construction	TWADB/Contractor
	river crossing Through elevated RCC Supporting structures with pillar and slab arrangements	*Circular column for minimizing obstruction& foundation below bed for free flow of river water-*	During Construction	TWADB/Contractor
	O&M	Periodical cleaning of accumulation of debris in between pillars and periodical maintenance of air valves fixed in river crossing	During Operation	Namakkal Municipality
	Water & noise monitoring	Water quality control and Noise monitoring at pumpsets in Head Works site Treatment Works site and Booster Station	During Operation	Namakkal Municipality

	Greenbelt maintenance,	Regular watering, application of manure, protection of saplings, cleaning/ pruning etc.,	During Operation	Contractor During Maintenance period of one year and Namakkal Municipality for Subsequent period.
	Safety measures,	Chlorine handling – storage facilities, storage/ handling method – safety precautions as per Annexure 9 .	During Operation	Contractor During Maintenance period of one year and Namakkal Municipality for Subsequent period.
	Safety training	Training for operators regarding safety procedure dos and don'ts	During Operation	TWADB/ Namakkal Municipality

5.3 Maintenance and Monitoring

Maintenance arrangement shall be made for watering and protection of the plants. Monitoring of of survival of the plants shall be done once every three months and the dead plants shall be replaced with new plants. Records would be maintained for the status of greenbelt.

Table 5.2 Environmental Monitoring Plan

S.No.	Monitoring Requirement	Specifications	Responsible Entity
	Operation Phase Impacts		TWAD/Contractor
1	Raw Water quality at intake point and WTP	All physical, chemical and bacteriological parameters for drinking water	

		Seasonal	Contractor
2	Clear Water quality	All physical, chemical and bacteriological parameters for drinking water (i) WTP outlet – Daily (ii) Residual chlorine and bacteriological quality, monthly (@ 5 locations)	(i) Contractor (ii) Namakkal Municipality
4	Raw water and Treated water quality at WTP site	Chemical quality, Bacteriological quality daily.	TWADB & Contractor/Namakkal Municipality
5	Noise Monitoring	One location at WTP and one location at Thummankurichi BS site - Periodically	TWADB& Contractor/Namakkal Municipality
6	Sludge Monitoring	Quarterly	TWADB & Contractor/ULB
7	Greenbelt maintenance at WTP and booster pumping station sites	The greenbelt survival to be monitored and watered regularly.	TWADB& Contractor/Namakkal Municipality

8	Monitoring of safety	Quarterly review of all necessary safety measures shall be carried out.	TWADB & Contractor/Namakkal Municipality
9	On line monitoring of Noise Vibration Temperature for preventive Maintenance through SCADA	Monitoring and triggering Critical Events when the value of Parameters exceeds boundary value through Message alert , Terminal Display , Report generation for the following Parameters through SCADA by online monitoring 1)Multifunction Energy Meter for Energy Audit 2)Sound/Noise data 1.0 m away from source like Motor and Pumpset 3) Pump 3 Axis Vibration 4) Pump Seal Temperature 5)Motor Bearing Temperature 6) Motor 3 Axis Vibration	Contractor During Maintenance period of one year and Namakkal Municipality for Subsequent period.

		7) Motor 3 Winding Temperature 8)Water Quality Analyser for monitoring pH Turbidity TDS	

The cost for the management measures proposed have been estimated and is provided in the table below.

Table 5.3 Cost Estimates for EMP

Sl No	**Description**	Amount in Lakhs	Remarks
1)a	**HEAD WORKS-Shoring and Strutting**	4.08	Included in BOQ
b	**Coffer Dam including removal of debris**	3.63	Included in BOQ
2)	**RAW WATER MAIN**		
a)	Restoration of Concrete Road	8.42	Included in BOQ
b)	Restoration of Existing pipe (Damaged pipe)	15.48	Included in BOQ
3)	**CLEAR WATER MAIN**		
a)	Restoration of Concrete Road	2.49	Included in BOQ
b)	Restoration of Existing pipe (Damaged pipe)	5.32	Included in BOQ
4)	**TREATEMENT PLANT**		
a)	Recirulation Arrangements, sludge drying bed and Sludge Pit	66.12	Included in BOQ

b)	Provision for turfing and gardening	4.66	Included in BOQ
c)	Development of green belt	0.75	Included in BOQ
d)	Construction of Compound Wall around Treatment Plant	39.05	Included in BOQ
e)	Septic Tank with Pipe connection works	0.90	Included in BOQ
5)	**Booster Station at Thummankurichi**		
a)	Construction of 3m high Compound wall of Size 45M X 40 M	12.86	Included in BOQ
b)	Gardening for reducing the noise	0.75	Included in BOQ
	Chlorine Leak Detection/Alarm eye showers Mask with Cylinder etc	1.40	Included in BOQ
6)	**FEEDER MAIN**		
a)	Provision for Restoration of existing Water utilities for feeder main	1.05	Included in BOQ
7)	**Distribution System**		
a)	Restoration of Existing water utilities for the proposed Distribution system	30.22	Included in BOQ
b)	Restoration of road surfaces for the proposed Distribution system	26.31	Included in BOQ
8)	**Rejuvenation of Existing Schemes**		
A)	Rejuvenation of Existing D system		
a)	Restoration of Existing water utilities for the existing Distribution system	30.04	Included in BOQ
b)	Restoration of road surfaces for the existing Distribution system	74.98	Included in BOQ

B)	REJUVUNATION OF EXISTING PUMPING MAIN FROM MOHANUR TO ANIYAPURAM AND ANIYAPURAM TO MUNICIPAL COMPLEX SUMP		
a)	Provision for Restoration of existing Water utilities for Existing pumping main	14.24	Included in BOQ
9	Compound wall for SRs	64.32	Included in BOQ
10	Barricading for Pipe line works including watch and ward showing danger Lights etc		Included in general Specification for Pipe laying works
11	Rain water Harvesting Structures	1.74	Included in BOQ
	Online monitoring Monitoring of Water quality and Noise & vibration		Included in BOQ for SCADA
	Total	408.81 Lakhs	

The Environmental Management measures identified for the project are included as part of the BOQ in the respective components for which cost is inbuilt in the project. The applicable measures shall be carried out by the TWADB and prospective contractor during construction and upto one year after completion. Subsequently, after handing over, Namakkal Municipality shall ensure implementation of the measures.

Online Monitoring of critical parameters through SCADA is proposed for effective maintenance of scheme enabling preventive maintenance of the project ensuring sustainability through triggering of critical events when the parameter exceeds boundary values with logical inference for the parameters listed below.

- Multifunction Energy Meter readings for Energy Audit
- Sound/Noise data 1.0 m away from source like Motor and Pumpset
- Pump 3 Axis Vibration

- Pump Seal Temperature
- Motor Bearing Temperature
- Motor 3 Axis Vibration
- Motor 3 Winding Temperature
- Water Quality Analyzer for monitoring pH Turbidity and TDS.

For ensuring reliability of the system Solar energy backup system with redundancy in network system is proposed

All these Parameters monitoring system is incorporated in SCADA Components BOQ as a part.

6. SOCIAL IMPACT ASSESSMENT REPORT

6.1 PROJECT BRIEF

TWAD Board has proposed a Water Supply Improvement Scheme to Namakkal Municipality in Namakkal District for enhancing service level of Water Supply to 135 lpcd. This project is proposed to be taken up under Tamil Nadu Sustainable Urban Development Project with an estimated cost of Rs.185.24 Crores. The proposed project involves drawl of 17.66 MLD in river Cauvery at Jederpalayam Anaicut for intermediate stage(2033) for a Projected population of 158848.

Beneficiary Assessment:

This sub project will provide protected Water Supply proposed to directly benefit 23151 Nos of households as they are proposed to provide house service connections. At present water is being supplied at the rate of 90 lpcd for core area and 40 lpcd for Added Area and implementation of this project will increase 135 lpcd of water supply to the citizens. Further, frequency of water being supplied presently will be increased.

Project Components:

This sub-project involves the following project components

6.1.1 Head works site@ River Cauvery at Jederpalayam:

At the Headworks site of Jederpalayam Anaicut the following components are proposed.

1.Construction of Off take well 6.0 m dia in the river.

2. 600 mm CI D/F Pipe Connecting main Two Rows for about 750 m Length.

3.Silt chamber 3.5 m dia-2 Nos.

4.Collection well(12.0 m dia) cum Pump house(15.0 m dia).

5.Approach bridge 3.5 m width for about 75.0 m Length.

6.Transformer Yard near the Approach Bridge.

The proposal for permission for Drawal of the Ultimate requirement of 22.09 MLD and permission for construction of structural components was sent to Chief Engineer/WRO/Trichy and the proposal is under Scrutiny.

6.1.2 Construction of Water Treatment Plant at Kabilakurichi:

The WTP Site proposed at Kabilakurichi is under possession by Municipality and it is own land. The following components are proposed in the WTP Site.

- Aerator
- Stilling Basin
- Dividing Chamber
- Flash Mixer
- Clarriflocculator
- Filter House
- Clear water Sump
- Pump House
- Sludge Chamber
- Wash water Recycling Units
- Transformer yard
- Sludge containment pit
- Staff Quarters
- Compound wall
- Internal Roads etc.,

8.0 Acres of Land is available at WTP Site and is adequate for the present capacity and future expansion and this site is free from encumbrances.

The details of land for construction of project facilities and its possession and alienation of Government Lands are stated below. Table 6. 1 – land requirements , possession Details

Table 6. 1 – land requirements , possession Details

Sl. No.	Component	Location	Available Extent	Required Extent	Land Classification	Ownership	Acquisition/ Transfer/ Alienation Status	Remarks
1	Headworks site	Cauvery River			River Poromboke	PWD		Proposal Under Scrutiny at CE'S Office/WRD/Trichy
2	Treatment Plant site -17.66 MLD	Kabilakurichi	8.0 Acres	8.0 Acres	Own Land	Municipality		
3	Booster Station 9.15 LL Sump 20x8 m Pump Room	Thumman-kurichi	6.0 Acres	0.62 Acres	Natham Poromboke	Revenue	Alienation	Land Transferred to Commissioner Namakkal Municipality
4	1.00 LL SR	Vasantham Nagar	1.19 Acres	6.40 cent	Common Usage Land	Municipality		

5	4.10 LL SR	SPK Nagar	36 cent	14.2 cent	Common Usage Land	Municipality		
6	2.1 LL SR	SIDCO Colony	0.43 Acres	7.1 cent	Govt Poromboke	Revenue	Transfer	Request sent to District Collector on 14.06.2016

Table 6. 2 – land requirements , possession Details-Contd..

Sl. No.	Component	Location	Available Extent	Required Extent	Land Classification	Ownership	Acquisition/ Transfer/ Alienation Status	Remarks
7	7.80 LL SR	Kosavampatty	1.95 Acres	16.7 cent	Kunru Porompoke	Revenue	Transfer	Request sent to District Collector on 30.11.2015
8	3.90 LL SR	Nallipalayam	0.45 Acres	14.2 cent	Govt Poromboke	Revenue	Transfer	Request sent to District Collector on 30.11.2015
9	4.10 LL SR	Mullai Nagar	1 Acre	14.2 cent	Public Use	Municipality	-	
10	9.10 LL SR	Swami Nagar	2.66 Acres	16.7 cent	Govt Poromboke	Revenue	Transfer	Request sent to District Collector on 14.06.2016
11	8.00 LL SR	Ponnagar	1.23 Acres	15.3 cent	Govt Poromboke (Palikuttai)	Revenue	Transfer	Request sent to District Collector on 30.11.2015

12	8.50 LL SR	Lakshmi Nagar	0.44 Acres	16.7 cent	Govt Poromboke Kalam	Revenue	Transfer	Request sent to District Collector on 14.06.2016

6.1.3 Raw water conveying main

The alignment of the Raw Water pumping main from Head works at Jederpalayam to WTP at Kabilakurichi is along road owned by Panchayats , and State High ways for a length of 12.13 km by means of 711 mm OD,6.3mm thick MS pipe. The RoW available is sufficient to lay the pipe lines and doesn't have any social impacts.

There is no land acquisition or PAP involved.

Pipeline will be laid along the berm of the road and thus does not require any private land acquisition. (Strip Map enclosed as annexure no9)

Table 6.3 Land Ownership of the roads for the Proposed for Raw water Conveying main

S.No	Location	Size of Main (mm)	Start Chainage	Final Chainage	Length (m)	Right of way Available	Regulatory Authority	Approval Status
1	P.W.D. Concrete Road	700 mm MS Main	0	256	256	7.00 m	PWD	Application is Submitted
2	High ways Road	700 mm MS Main	256	956	700	10.00m	Highways Department	Application is Submitted
3	Panchayat BT Road	700 mm MS Main	956	2556	1600	6.00m	Rural Development Department	Approval to be obtained
4	Panchayat road concrete Road	700 mm MS Main	2556	2796	240	3.00 m	Rural Development Department	Approval to be obtained

5	Panchayat road Mud Road	700 mm MS Main	2796	3156	360	6.00 m	Rural Development Department	Approval to be obtained
6	Panchayat road Mud Road	700 mm MS Main	3156	4056	900	8.00 m	Rural Development Department	Approval to be obtained
7	Panchayat BT Road	700 mm MS Main	4056	4856	800	6.00 m	Rural Development Department	Approval to be obtained
8	Panchayat BT Road	700 mm MS Main	4856	5156	300	7.00 m	Rural Development Department	Approval to be obtained
9	Panchayat road Mud Road	700 mm MS Main	5156	7856	2700	8.00 m	Rural Development Department	Approval to be obtained
10	High ways Road	700 mm MS Main	7856	8406	550	8.00 m	Highways Department	Application is Submitted
11	Panchayat BT Road	700 mm MS Main	8406	11896	3490	7.5 m	Rural Development Department	Approval to be obtained
12	Within WTP Premise	700 mm MS Main	11896	12130	234	Within WTP Premise	Namakkal Municipality	Own Land

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Permission for laying conveying main in the right of way of the existing roads in High ways have to be obtained from the concern authorities as detailed in the **Table 2.3**.

6.1.4 Clear water conveying main

The alignment of the Clear Water pumping main from WTP at Kabilakuruchi to BS at Thummankurichi is along road owned by Panchayats , and State High ways for a length of for a length of 24.62 km by means of 711 mm OD,6.3mm thick MS pipe.

There is no land acquisition or PAP involved.

Pipeline will be laid along the berm of the road and thus does not require any private land acquisition.

Table 6.4 - Land Ownership of the roads for the Proposed Clear water Conveying main

	CLEAR WATER MAIN							
S.No	**Location**	**Size of Main (mm)**	**Start Chainage**	**Final Chainage**	**Length (m)**	**Right of way Available**	**Regulatory Authority**	**Approval Status**
1	Panchayat BT Road	700 mm MS Main	0	700	700	8.00 m	Rural Development Department	Approval to be obtained
2	Panchayat road Mud Road	700 mm MS Main	700	2000	1300	6.00 m	Rural Development Department	Approval to be obtained
3	Panchayat BT Road	700 mm MS Main	2000	3500	1500	7.5 m	Rural Development Department	Approval to be obtained
4	Panchayat road Mud Road	700 mm MS Main	3500	3800	300	6.00 m	Rural Development Department	Approval to be obtained
5	Highways Road	700 mm MS Main	3800	5900	2100	7.5 m	Highways Department	Application is Submitted

6	Panchayat Mud Road	700 mm MS Main	5900	8200	2300	8.00 m	Rural Development Department	Approval to be obtained
7	Highways Road crossing	700 mm MS Main	8200	8215	15	15.00 m	Highways Department	Application is Submitted
8	Panchayat BT Road	700 mm MS Main	8215	11600	3385	7.5 m	Rural Development Department	Approval to be obtained
9	Highways Road crossing	700 mm MS Main	11600	11610	10	10.00 m	Highways Department	Application is Submitted
10	Panchayat BT Road	700 mm MS Main	11610	12000	390	7.5 m	Rural Development Department	Approval to be obtained
11	Panchayat concrete Road	700 mm MS Main	12000	12065	65	8.5 m	Rural Development Department	Approval to be obtained
12	River crossing	700 mm MS Main	12065	12130	65	8.00 m	P.W.D. Department	Approval to be obtained
13	Panchayat BT Road	700 mm MS Main	12130	14300	2170	7.5 m	Rural Development Department	Approval to be obtained
14	Highways Road	700 mm MS Main	14300	17200	2900	8.00 m	Highways Department	Application is Submitted
15	Panchayat Mud Road	700 mm MS Main	17200	18600	1400	7.00 m	Rural Development Department	Approval to be obtained

16	Panchayat BT Road	700 mm MS Main	18600	20600	2000	7.50 M	Rural Development Department	Approval to be obtained
17	Highways Road	700 mm MS Main	20600	24600	4000	7.50 M	Highways Department	Application is Submitted
18	Within Booster Station Premise	700 mm MS Main	24600	24620	20	Within Booster Station Premise	Namakkal Municipality	Own Land

A pipe carrying bridge will be constructed at Thirumanimuthaaru River crossing. The pipe carrying bridge will be supported on piers without affecting water flow. Hence no negative impact is anticipated. However, permission will be obtained from PWD for constructing pipe carrying bridge (PCB). The width of river is 67.5 m and it is proposed to cross the river by constructing elevated RCC Structure with 10 Nos of 0.3 m dia Supporting circular pillar with 9 Nos of 7.5 m span. Due to the provision of Circular pillar , the obstruction to the flow of water will be minimum and higher span is adopted for minimizing No of Pillars. The foundation is proposed to be taken 1.5 m below the River bed level so as to have no obstruction in the water flow in the river bed. The alignment of Pipeline is so oriented to minimize the disturbance of existing system. Sufficient space is available for the approach of Pipe Line.

Required right of way (ROW): Minimum 1.5 m all along the alignment is available. (Strip Map enclosed)It is observed that during construction phase there will not be any impact or hindrance to the settlements as the pumping main will be laid on the berm . Restoration of concrete road inside the HW Site pertaining to PWD is proposed. It has observed that two wheelers & cycles are mostly used by the residents. Since the earthwork will be carried out without affecting traffic & people, there will not be any significant impact on the traffic. Short term interruptions are expected as a result of specific types of works.

Temporary diversion will be provided with the approval of the engineer. Detailed traffic control plans will be prepared and submitted to the engineers for approval, one week prior to commencement of works.

The traffic control plans shall contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of wok each day, SIGNAGES, safety measures for transport of hazardous materials and arrangement of flagmen.

The conveying main will be laid using trenchless technology at the junction of NHAI and Major Highways crossings in Trichy Road, Tiruchengode Road, Salem Road and Mohanur Road . Proper traffic management plan will be prepared and it will be implemented only after the approval of the concerned authority.

In all roads where pipeline is going to be laid enough space is available for transportation, as only 1.5 to 2 m will be required for laying pipelines

The construction work near the school shall be completed as quickly as possible.

In fact the bushes & weeds will be cleared along the side of road which is in turn it will be beneficial to the local people besides employment opportunities. Dust generation during earthwork will be suppressed by the water spraying. If at all any negative impact occurred it will be temporary only which would be attended immediately.

During construction phase adequate provision for installing air release valves, scour valves will be installed in the pumping main to avoid any bursting.

There is no need for any displacement of tenement or disturbance to the local community. Social impacts due to implementation of the proposed project are assessed and the same are given below:

1. There is no loss of land and assets.
2. There is no loss of shelter or Homestead land
3. There is no loss of income or means of livelihood
4. There is no loss of access to productive resources, shelter and residences

5. There is no loss of collective impacts on groups such as loss of community, assets, common properties, resources and other sources.

6. Establishment of Construction Camps does not require any land acquisition as the camps will be established within the plant premises if required.

Based on the above this sub project falls under the Social Category of **S3** as per the ESMF of TNSUDP.

6.2 UNIDENTIFIED IMPACTS

The Social Impacts during Project implementation will be captured through the monthly Progress/Compliance Report and the unforeseen impacts if any identified during implementation will be mitigated as per ESMF Policy.

6.3 **Readiness of Sites.**

At present 5 nos of sites are under the possession of Namakkal Municipality and 6 nos of sites requires Enter Upon Permission from Revenue Department, 1 no of sites requires Enter Upon Permission from PWD, All these activities will be completed prior to award of contracts.

Prior to award of contracts, the borrowers shall submit the Readiness Certificate duly certified by the Commissioner of concerned ULB fulfilling the requirements of Social Safeguards. The Readiness certificate shall confirm the availability of sites, and RoW required for the project, payment of compensation for the Land to the Title holders, R&R assistance to PAPs or credited in the escrow account in the event of non-acceptance of the compensation or due to legal issue or people not available to accept the compensation. [ESMF Para 52]

SOCIAL IMPACTS AND MEASURES

POSSIBLE IMPACTS	MITIGATION MEASURES
• Due to Influx of Labour Safety of the Population during construction of all the sub • components Health of the population • resulting from project activities Impact on access/movement of the population during construction	• Unskilled labour will be preferentially recruited from the Local Residents. • Development of a code of conduct for camp workers, camp rules and disciplinary procedures. HIV/AIDS Awareness, medical • facilities, first aid box etc shall be made available in the labour camps. Construction of temporary drainage channels - • to control the direction and movement of any run-off. All stockpiled materials to be suitably covered - to prevent dust generation by wind action. • Restriction of work hours - to minimise the noise impact on local residents. • In order to avoid unauthorized entry and to ensure safety for public movement and necessary sign boards will be erected for any traffic diversion at appropriate places. • A strict Project speed limit will be enforced for Project vehicles using unmade tracks. • The selection of any further access roads to Project working areas will aim to avoid sensitive receptors such as centres of communities, hospitals, clinics and schools as far as practicable.

These Social Management Measures were incorporated in EMP (Table 5.2.1) and Translated into bid documents for Implementation.

Pipeline will be laid along the berm of the road and thus does not require any private land acquisition.

6.4 IMPLEMENTATION ARRANGEMENTS AND MONITORING

At Present this project is being looked after by a sub division of TWAD Board at Namakkal and comprises of 1 Assistant Executive Engineer and 1 Assistant Engineer under the control of Executive Engineer , Urban Division, Salem . This project is proposed to be implemented as a single Package.

The Executive Engineer will issue a Readiness Certificate which contains the details of the site to the Contractor.

During the project execution TWAD Board will submit monthly progress report to TNUIFSL regarding social impacts. Social Screening Form is attached as **Annexure V.**

6.5 GRIEVANCE REDRESSAL MECHANISM

TWAD Board Engineers will monitor Environmental and social aspects of the project and supervise the day to day activities.

The TWAD Board will also monitor activities of Environmental and social safeguards for ensuring adoption and compliance of ESMF.

The TWAD Board will have Grievance Redressal mechanism to handle the grievances of the project.

A project level Grievance Redressal Committee (GRC) will be set up and the members are as follows (preferably one of them as women)

1.Executive Engineer (convener)

2.Any one elected representative

3.A person who is publicly known in the local area

4.Commissioner Namakkal Municipality (TWADB)

5.Municipal Engineer, Namakkal Municipality

The complaints will be acknowledged to the complainant. Efforts will be made by TWADB to ensure closure of complaint within a maximum period of 30 days from the date of its receipt. Serious issues shall be attended as early as possible. If not satisfied with the

resolution provided by GRC, the complaints shall be handled at higher level i.e, Chief engineer of TWADB.

If there is any grievance, it involves a process of consultation and negotiation with the committee. The grievances relating to the problem will be recorded and each step in the resolution process also will be recorded. The elected representative will be involved in representing the issue and act as communication link between the persons involved. When the problems are identified, it will be taken to the personnel who respond and pass the information to the committee immediately. It is then the role of the committee to investigate and consult with the persons to evaluate the seriousness of the issues and work with the management to resolve the problem.

TWADB shall submit monthly reports on the status of compliance with the ESMF requirements to TNUIFSL.

The contact details of the Grievance Redressal Committee are given below:

Executive Engineer,

Urban Division,

172.State Bank Officers' Colony,

Salem-4

Phone No: 0427-2333667
Fax No 0427-2333667

To register complaints, contact the following phone number:

Phone No: 0427-2333667

To register complaints through internet, send mail to the following ID

eeurbanslm@gmail.com

7. PUBLIC CONSULTATION

Information on Public Consultation are given adequately to the Public by means of notice, personal contact, etc,. The minutes of public consultation are as follows:

Proceedings of the Public Hearing/Stake Holders Meeting conducted on 30/06/2016 at Namakkal Municipality in connection with the Water Supply Improvement Scheme to Namakkal Municipality in Namakkal District

As per the World Bank policy on access to information and disclosure, the proposed project attracts Public Hearing. The Public Hearing was arranged by the Namakkal Municipality. The concerned persons having plausible stake in the Scheme were requested to attend the meeting. Wide canvassing through public representatives and office personals carried out.

Public Hearing/Stake Holders Meeting conducted on 30/06/2016 at 11.00 AM in Namakkal Municipality and about 60 people attended the meeting.

The following officers were present during the public meeting

1. Mr. T.Chandrasekaran, Executive Engineer , TWAD Board
2. Mr. C.Mathiyalagan, Asst Executive Engineer , TWAD Board
3. Mr. C.Varatharaju, Assistant Engineer, TWAD Board

Mr. T.Chandrasekaran, Executive Engineer , TWAD Board delivered a speech on scope and Technicalities of the Project and implementation methodologies. A power point presentation was given narrating salient details of the proposed scheme. Public cooperation was requested for implementation of the scheme. Public and representatives interacted well. They expressed eagerness to know the pipe line alignment , Location of tanks and pipe sizes etc.,. They insisted for adoption of Higher size of inlet for SRs. It was informed that adequate size of pipe as per design requirement will be provided. Further they insisted for refilling of pipeline trenches then and there without undulation. It was assured that scheme will be implemented with minimal disturbance to public. . A statement showing list of participants present during the public hearing is provided in the Annexures.

8. IMPLEMENTATION OF THE PROPOSED PROJECT AND INSTITUTIONAL ARRANGEMENTS AT TWADB

The proposed project involves implementation of WSIS to Namakkal Municipality in Namakkal District. This project will be implemented by TWADB under the scheme of Tamil nadu sustainable urban development project (TNSUDP) at an estimating cost of Rs.185.24 Crores.

At Present this project is being looked after by a sub division of TWAD Board at Namakkal and comprises of 1 Assistant Executive Engineer and 1 Assistant Engineer under the control of Executive Engineer , Urban Division, Salem . This project is proposed to be implemented as a single Package.

The project is proposed to be implemented by LS contract. The management measures identified for contractor will be included in the bid document for ensuring implementation of the environmental safeguards..
Implementation of the management measures by the contractor shall be ensured by TWAD Board and report on ESMF compliance shall be submitted to TNUIFSL periodically.

The management measures identified for operation phase will be taken up by the TWAD Board & contractor upon completion of construction activities for the Contractor's Maintenance period of one year and by the Namakkal Municipality for Subsequent period.

Any social impacts identified during the implementation of the project the contractor to intimate the same to TWADB and TWADB shall communicate the same to ULB, TNUIFSL for mitigation.

8.1 ENVIRONMENTAL MANAGEMENT CELL

The contractor will form his own Environmental Management Cell.

8.2 GRIEVANCE REDRESSAL MECHANISM

TWAD Board Engineers will monitor Environmental and social aspects of the project and supervise the day to day activities.

The TWAD Board will also monitor activities of Environmental and social safeguards for ensuring adoption and compliance of ESMF.

The TWAD Board will have Grievance Redressal mechanism to handle the grievances of the project.

A project level Grievance Redressal Committee (GRC) will be set up and the members are as follows (preferably one of them as women)

1.Executive Engineer (Convener)

2.3Any one elected representative

3.A person who is publicly known in the local area

4. commissioner, Namakkal Municipality.

5.Municipal Engineer, Namakkal Municipality

The complaints will be acknowledged to the complainant. Efforts will be made by TWADB to ensure closure of complaint within a maximum period of 30 days from the date of its receipt. Serious issues shall be attended as early as possible. If not satisfied with the resolution provided by GRC, the complaints shall be handled at higher level i.e, Chief engineer of TWADB.

If there is any grievance, it involves a process of consultation and negotiation with the committee. The grievances relating to the problem will be recorded and each step in the resolution process also will be recorded. The elected representative will be involved in representing the issue and act as communication link between the persons involved. When the problems are identified, it will be taken to the personnel who respond and pass the information to the committee immediately. It is then the role of the committee to investigate and consult with the persons to evaluate the seriousness of the issues and work with the management to resolve the problem.

TWADB shall submit monthly reports on the status of compliance with the ESMF requirements to TNUIFSL.

The contact details of the Grievance Redressal Committee are given below:

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9. PROJECT BENEFITS

9.1 PROJECT BENEFITS & FUTURE SCENARIO

The proposed project aims at Providing Water Supply to Namakkal Municipality in Namakkal District. Some of the major project benefits are given below:

- 158848 population to be benefitted
- Direct benefits in terms of providing No. of 23151 House Service Connections
- Enhanced service level of Protected equitable Water Supply to 135 lpcd after Implementation with quality and required hydraulic parameters
- Increased Water Supply to Educational Institutions
- Provision of Water Supply to Small industries and commercial establishments..
- Provision of Water Supply for fire fighting.
- The availability of water is sustainable irrespective of the season throughout the year.
- Enhanced Hygienic condition of Public
- Protected Water Supply at affordable cost
- Minimization of Social imbalance due to equitable supply
- Reduction in usage of Ground Water improving ground water Level and hence enhanced environmental conditions.

ANNEXURES

Annexure 1 Environmental screening Form

PART A (to be prepared by Urban Local Body for each sub – project loan)

Name of the applying urban local body : Namakkal Munucipality

Project location : Namakkal District

Sub project : Namakkal Water Supply Scheme

Project Components		
S.No	**Component**	**Remarks**
1	Brief description of the project proposal	Supplying 22.09mld (Ultimate) of drinking water to Namakakl Mpty with source at River Cauvery in Jaderpalayam Anaicut.
2	Number of project sites and Project components	HW- Jaderpalayam Anaicut WTP- Kabilakuruchi Booster station– Thumamkuruchi 9nos of OHT- various locations Pumping Mains- 36.00Km Feeder Mains – 35.54Km D-system- 255Km
3	Alignment length	36.00km
4	Location of the Project Sites & Current Use	As per Annexure 3
5	Nearby land uses and distance – residences, schools, hospitals, drinking water source, upstream and downstream uses of rivers etc.,	Intake arrangements are near River Cauvery. WTP & Booster station are in alignment away from developments.

		OHTs are in the midst of developments.

S.No	Component	Remarks
6	Distance of sites from Sea	258km
7	MSL of Project Sites	129.87 at Head works and 199.66 m at tail end in Namakkal
8	Distance from nearest Water Body (River, Canal, Lake, Streams etc.,)	Head works in bank of River Cauvery. 42km of alignment in the east bank of River Cauvery.
9	MFL of the Project Sites	134.88m at Head works
10	Distance of nearest drinking water source	Head works in River Cauvery.

Climate Change related Parameters (General)

S.No	Component	Remarks
11	Mean Temperature in the project town	28.30C
12	Annual Rainfall in the project town	555.60mm
13	Monsoon Period in the project town	North East Monsoon 2015-270.70mm
14	Nearest Weather Warning System	Chennai

Biological Environment				
Sl. No	**Components**	**Yes**	**No**	**Remarks / Identified Problems**
15	Are there according to background research / observations any threatened / endemic species in the project area that could be affected by the project?		No	
16	Will the project directly[1] or indirectly affect: 1.1 Natural forest types? 1.2 Mangroves / wetlands / Estuaries 1.3 Other SEC's as Listed in ECSMF		No	
17	Will the project involve tree cutting?		No	
18	Will there be any potential risk of habitat fragmentation due to the clearing activities? (eg. Hindrance to the local bio diversity like disturbing the migratory path of animals/ birds etc.)		No	

1

Direct impacts are those which are induced directly by the project (e.g. Impact on water quality, air and noise etc…) where as the Indirect impacts are those which are indirectly induced by the project (e.g. Traffic diversion during project construction etc…)

Physical Environment				
Sl.no	**Components**	**Yes**	**No**	**Remarks / Identified Problems**
19	Water quantity? Estimated usage of water quantity for the project			22.09 mld for drinking water supply
20	Will the project affects the River flow pattern, stream pattern or any other irrigation canal?		No	
21	Is the project area is free from flood prone area/ low-lying area, if yes what is the average flood level recorded for recent years?	Yes		MFL for headworks 134.88. However components designed for 136.38m.
Geology / Soils				
Sl.no	**Components**	**Yes**	**No**	**Remarks / Identified Problems**
22	Does the project activity involve cutting and filling/ blasting etc…?		no	
23	Will the project cause physical changes in the project area (e.g., changes to the topography) due to excavation, earthwork etc…?		No	
24	Will local resources, such as rocks, sand, gravel, or groundwater be used?		No	

	Estimated quantity of materials required?			
Pollution				
Sl.no	**Components**	**Yes**	**No**	**Remarks / Identified Problems**
25	Will the project use or store dangerous substances (e.g., large quantities of hazardous materials like Diesel, Petroleum products etc…)?	Yes		Chlorine. Necessary safety precautions would be provided.
26	Will the project produce solid or liquid wastes?	Yes		Sludge will be dried and disposed in container pit Filter back wash water will be recirculated into the treatment system.
27	Will the project cause air pollution?		No	
28	Will the project generate noise?	Yes		Noise generated at work place will be limited within the permissible of 75dB. In booster station, noise will be maintained for residential standards.
29	Will the project generate water pollution (water bodies/ groundwater)?		No	

30	Will the project cause construction Hazard to workers/ residents		No	
Climate Change Adaptation and Mitigation Measures				
Sl.no	**Components**	**Yes**	**No**	**Remarks / Identified Problems**
31	Energy Consumption during operation phase			620 kw
32	Is the project design included use of energy saving machineries, equipments	Yes		

	for the sub-project,			
33	Is the project design included energy saving measures in the distribution/collection systems	Yes		Energy efficient motors have been adopted.
34	Is the project considering energy recovery options?			
35	Is the project considering waste minimization or waste reuse/recycle options?	Yes		Filter back wash water will be recirculated into the treatment system.
36	Is the project structures are designed considering the maximum flood levels of the project site.	Yes.		Headworks designed for above MFL.
37	Is the project design has considered RWH structures.	Yes		RWH proposed in Booster Station sites.
38	Is the project design has considered extreme events, drought, flood, natural disasters	Yes		Design has been made considering all extreme events

- Any other features of the projects that could influence ambient environment: Nil
- Has any Environmental Assessment (EA) been carried out (if yes, please provide the EA documents along with the form)

M. Senthil Murugan
Commissioner,
Namakkal Municipality

Date: 31.1.17

Signature and name of the officer responsible

Note:

1. Environmental Screening sheet must be completed by all Urban Local Bodies/ Government Department applying for a loan from Tamil Nadu Urban Development Fund (TNUDF).
2. Provide maps with the geographical location of the project; and an appropriately-scaled map clearly showing the project area and project sites with land use, existing buildings, infrastructure, vegetation, adjacent land use, utility lines, access roads and any planned construction.

Annexure 2 Social Screening Form

PART A (to be prepared by Urban Local Body for each sub – project loan)

Name of Applying Urban Local Body: Namakkal Municipality in Namakkal District

Name of the Sub-component: Water Supply Improvement Scheme

Name of Sub-project: WSIS to Namakkal Municipality

Geographical areas covered by Sub-Project : Namakkal District

Implementing Agency: TWAD BOARD

Name and address of Officer responsible:

Land Use, Resettlement, and/or Land Acquisition				
Sl.no	**Components**	**Yes**	**No**	**If Yes provide details**
1	Does the sub-project involves acquisition of private land?		No	
2	Alienation of any type of Government land including that owned by Urban Local Body?		No	Alienation of Government land belongs to Revenue and PWD departments, etc.,
3	Clearance of encroachment from Government/ Urban Local body Land?		No	
4	Clearance of squatting from Government/ Urban Local Body Land?		No	
5	Number of structures, both authorized and/or unauthorized to be acquired/ cleared/		No	
6	Number of household to be displaced?		No	
7	Details of village common properties to be alienated Pasture Land (acres) Cremation/ burial ground and others specify?		No	

8	Describe existing land uses on and around the project area (e.g., community facilities, agriculture, tourism, private property)?			The land use varies from site to site.
9	Will the project result in construction workers or other people moving into or having access to the area (for a long time period and in large numbers compared to permanent residents)?			The construction workers are basically migrant workers involving different type of skill required for each of the stage of the project.
10	Are financial compensation measures expected to be needed?		No	
	Loss of Crops, Fruit Trees, Household Infrastructure and livelihood			
Sl.no	**Components**	**Yes**	**No**	**If Yes provide details**
11	Will the project result in the permanent or temporary loss of		No????	
11.1	Crops?		No	
11.2	Fruit trees / coconut palms? Specify with numbers		No	
11.4	Loss of Agriculture Land? Specify with numbers		No	
11.5	Petty Shops		No	
11.6	Vegetable/Fish/Meat vending		No	
11.7	Cycle repair shop		No	
11.8	Garage		No	
11.9	Tea stalls		No	
11.10	Loss of Grazing		No	

11.11	Loss of access to forest produce (NTFP)		No	
11.12	Any others - specify		No	
	Welfare, Employment, and Gender			
Sl.no	**Components**	**Yes**	**No**	**If Yes provide details**
12	Is the project likely to provide local employment opportunities, including employment opportunities for women?	Yes		Temporary employment during construction
13	Is the project being planned with sufficient attention to local poverty alleviation objectives?	Yes		By generation of employement oppurtunity
14	Is the project being designed with sufficient local participation (including the participation of women) in the planning, design, and implementation process?	Yes		Consultation with Local body and conducting stack holders meeting
	Historical, Archaeological, or Cultural Heritage Sites			
Sl.no	**Components**	**Yes**	**No**	**If Yes provide details**
	Based on available sources, consultation with local authorities, local knowledge and/or observations, could the project alter:			
15	Historical heritage site(s) or require excavation near the same?		No	

16	Archaeological heritage site(s) or require excavation near the same?		No	
17	Cultural heritage site(s) or require excavation near the same?		No	
18	Graves, or sacred locations or require excavations near the same?			

M. Senthil Murugan
Commissioner,
Namakkal Municipality

Date: 31.1.17

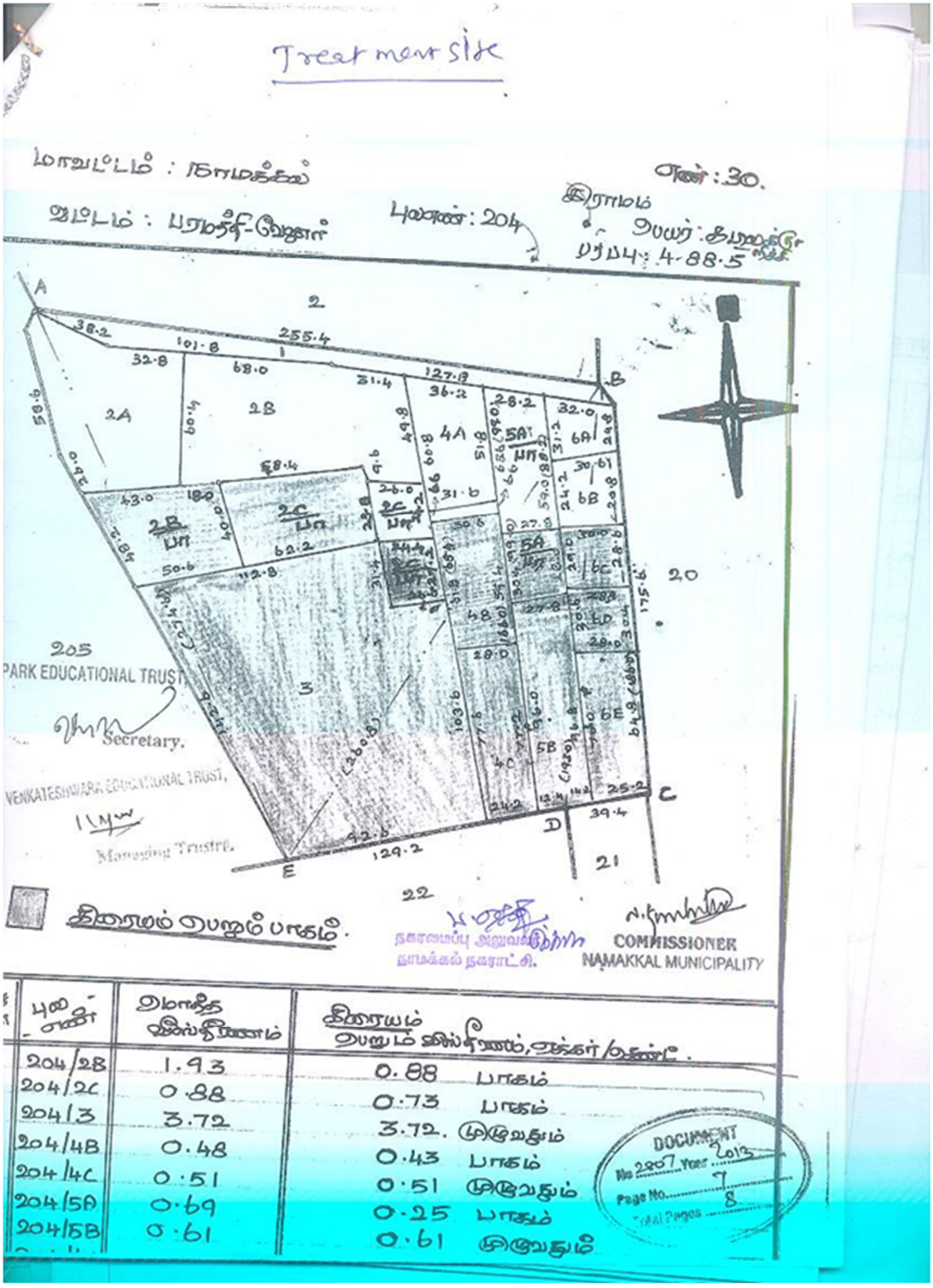
Signature and name of the officerresponsible

Note:

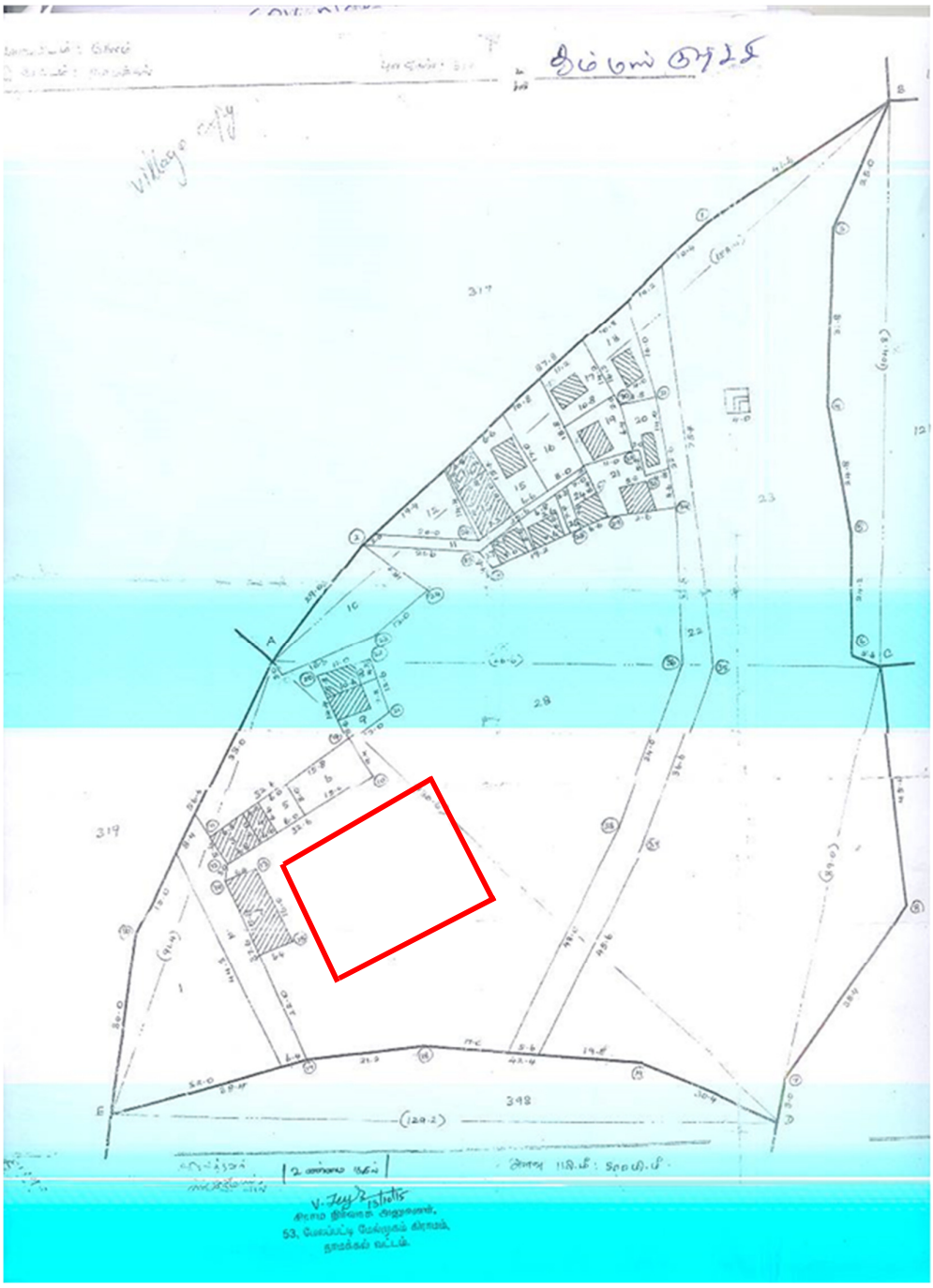
1. Social screening sheet must be completed by all urban local bodies/ government department applying for a loan from Tamil Nadu Urban Development Fund (TNUDF) for any sub-projects involving land alienation of any Government land under different tenure including "Poramboke" land "owned" by the Urban Local Body or any other Government institution/department/organization which are alienated in favour of project activity, when encroachments/encroachers are cleared and when community assets such as places of worship, burial/cremation grounds etc., are required to be cleared from the execution of project activity.
2. The land details for the project components shall be annexed with details such as location, survey numbers, extent available and required, land use classification, current land use, land ownership, alienation/acquisition status along with FMB extracts while submitting the Social Screening Form.

Annexure -3

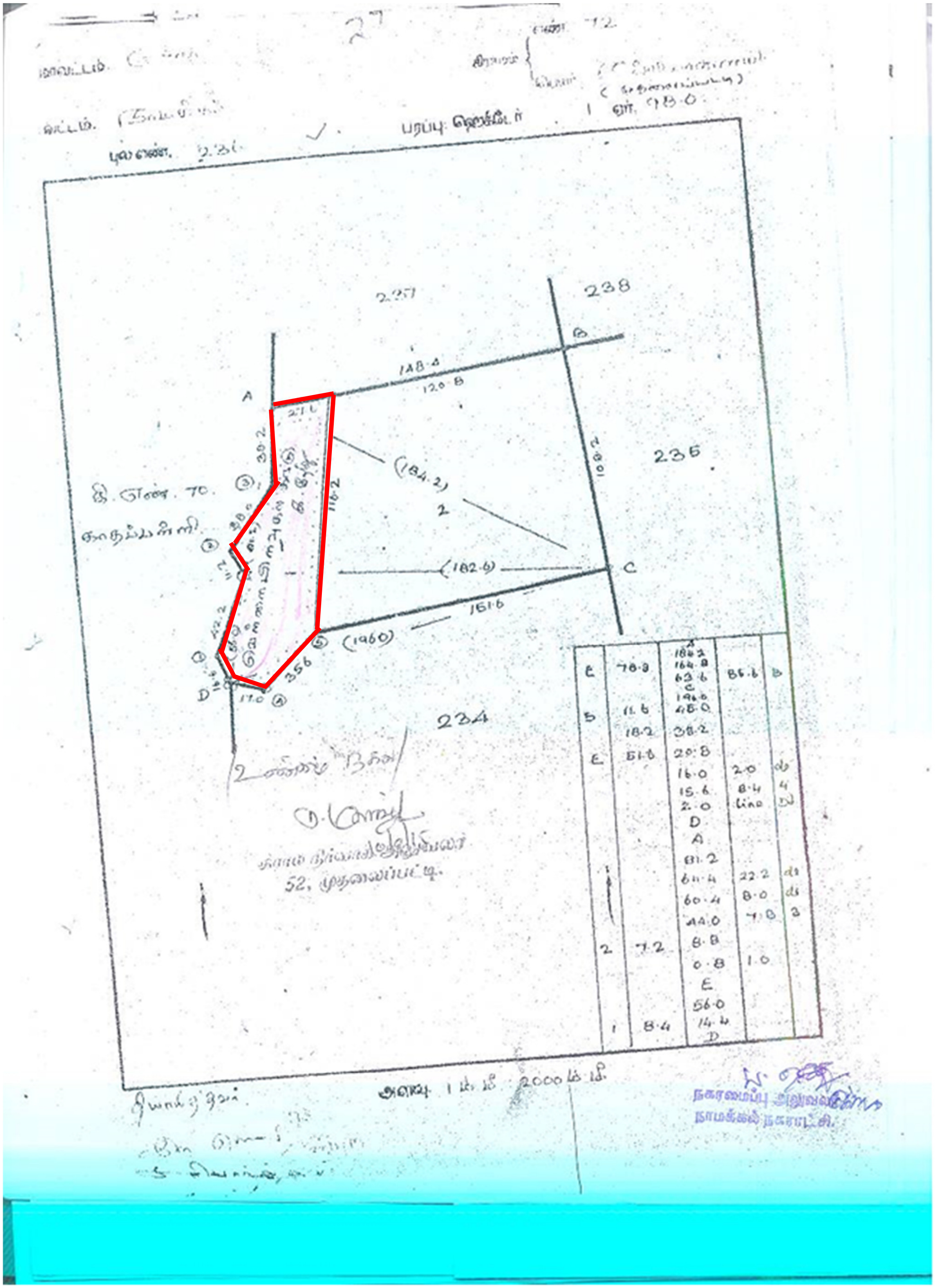
FMB EXTRACT



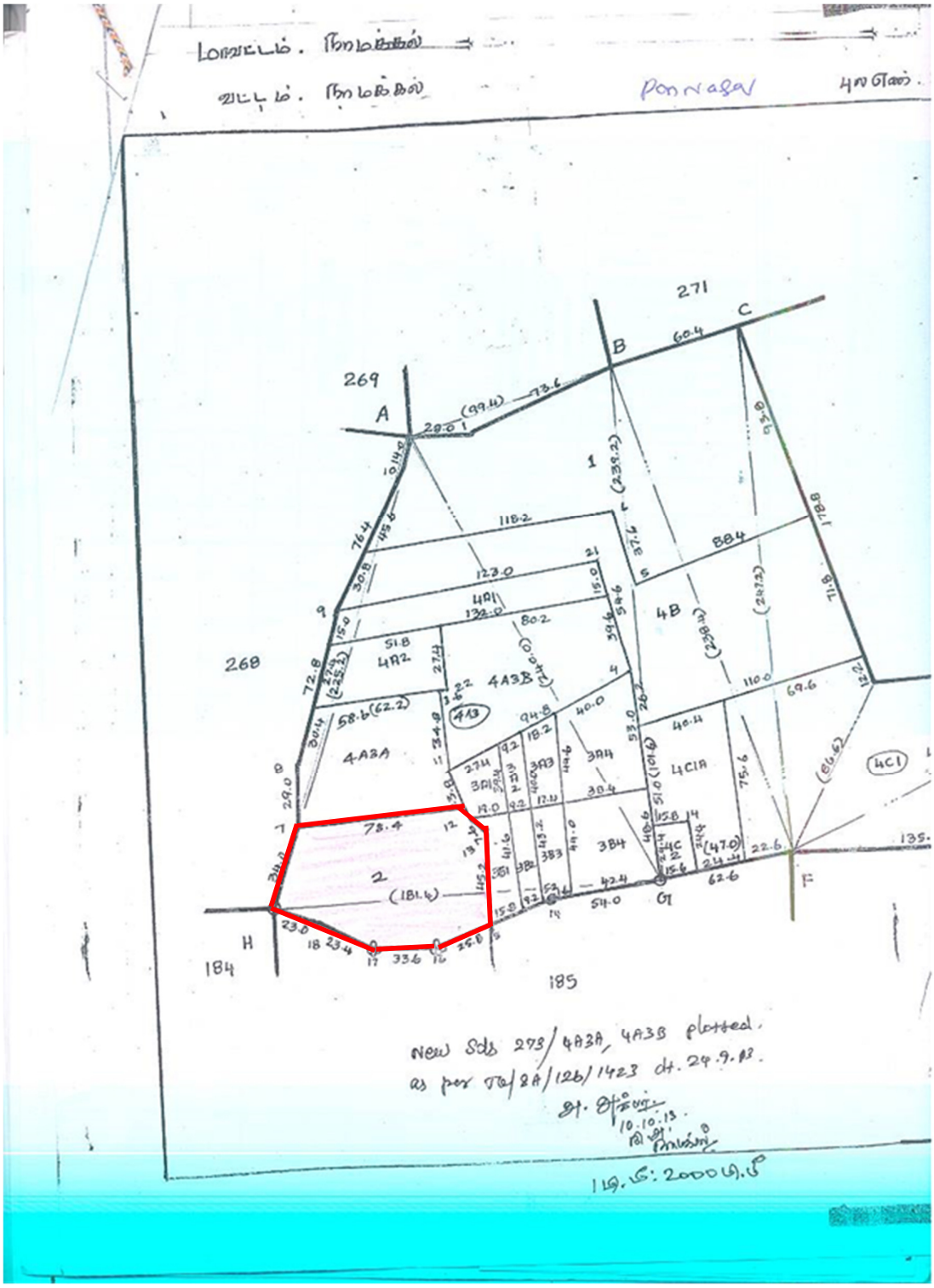
WTP SITE AT KABILAKURICHI



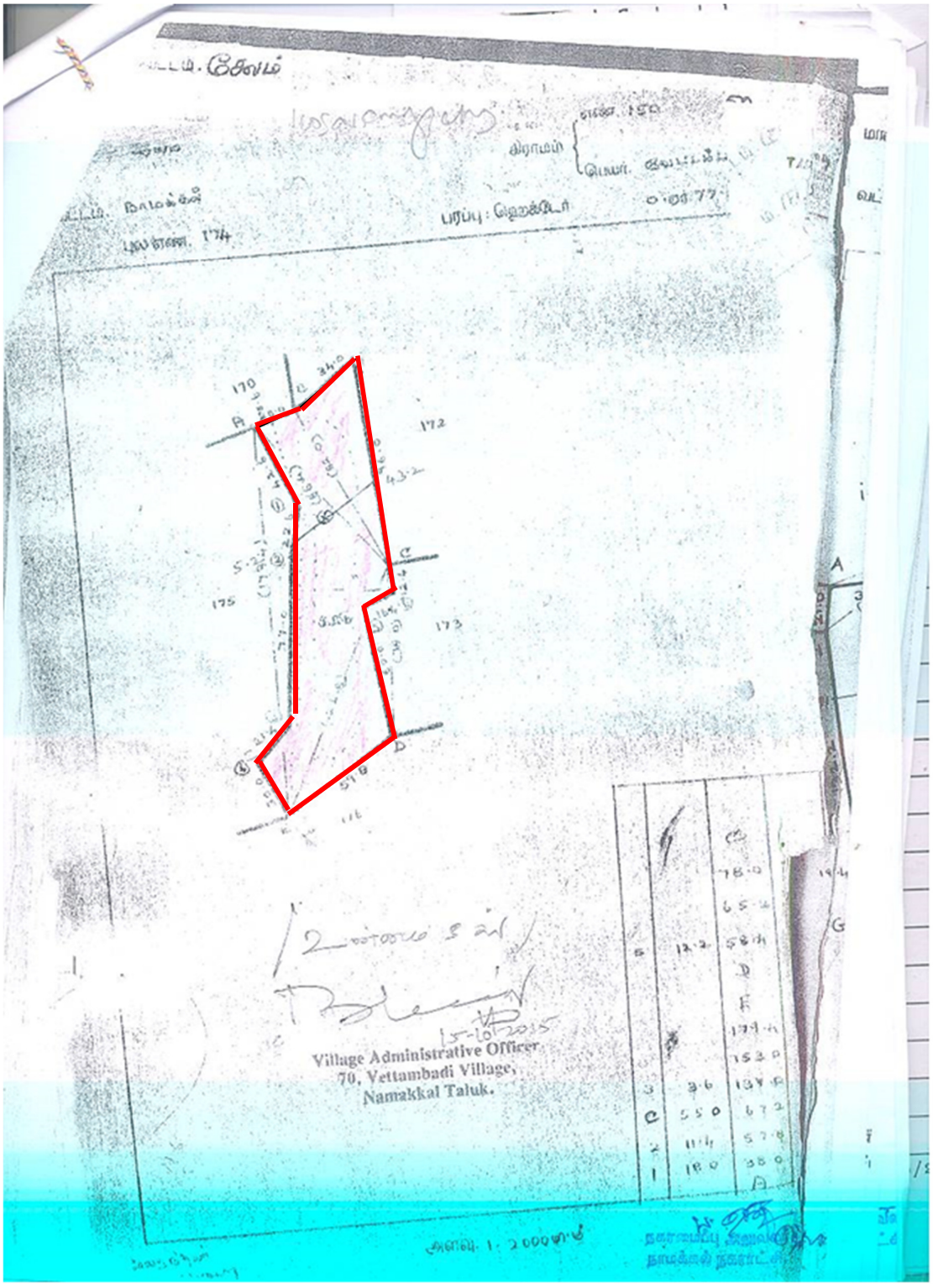
BS AT THUMMANKURICHI SITE



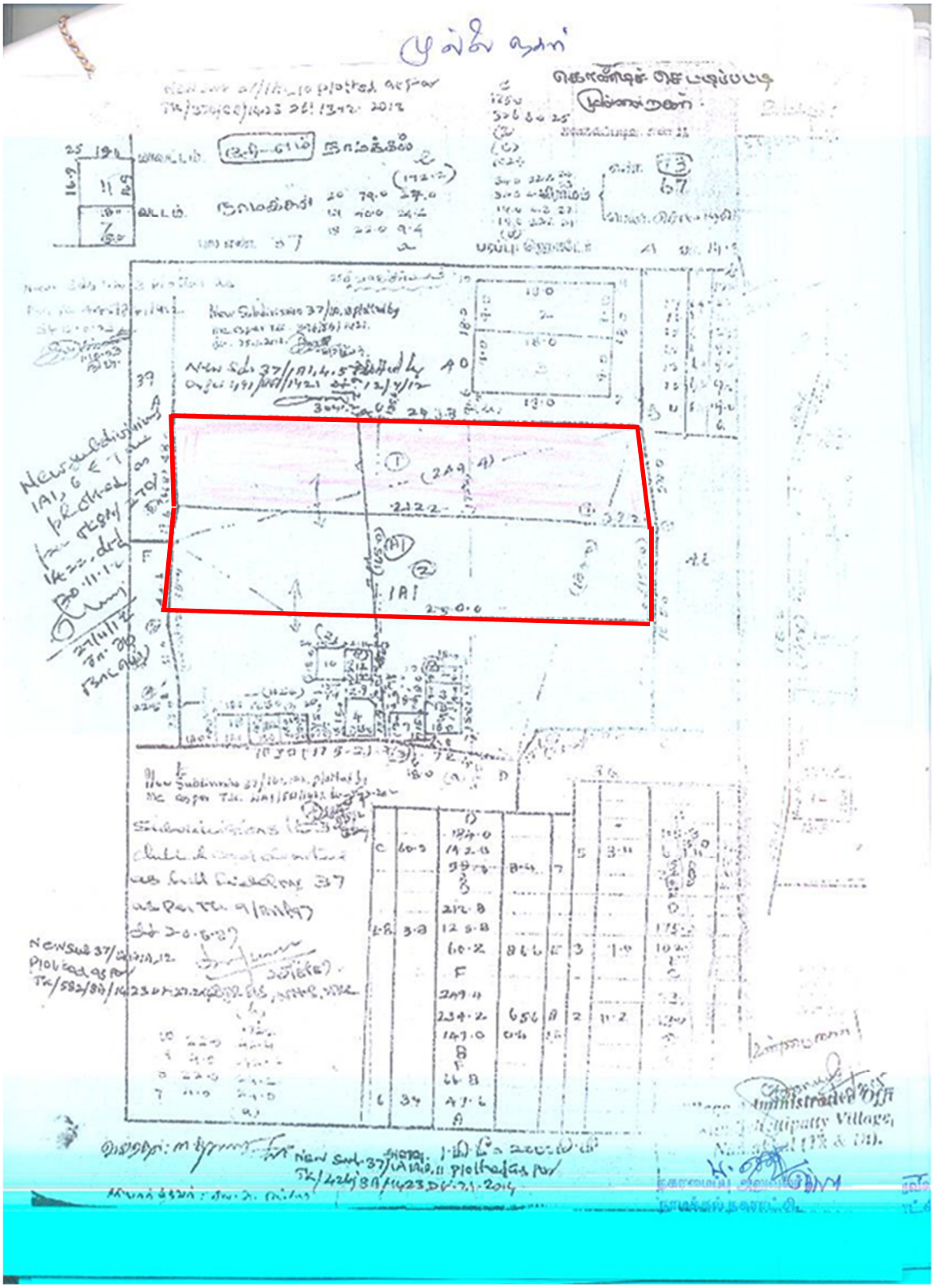
SR SITE AT VASANTHAM NAGAR



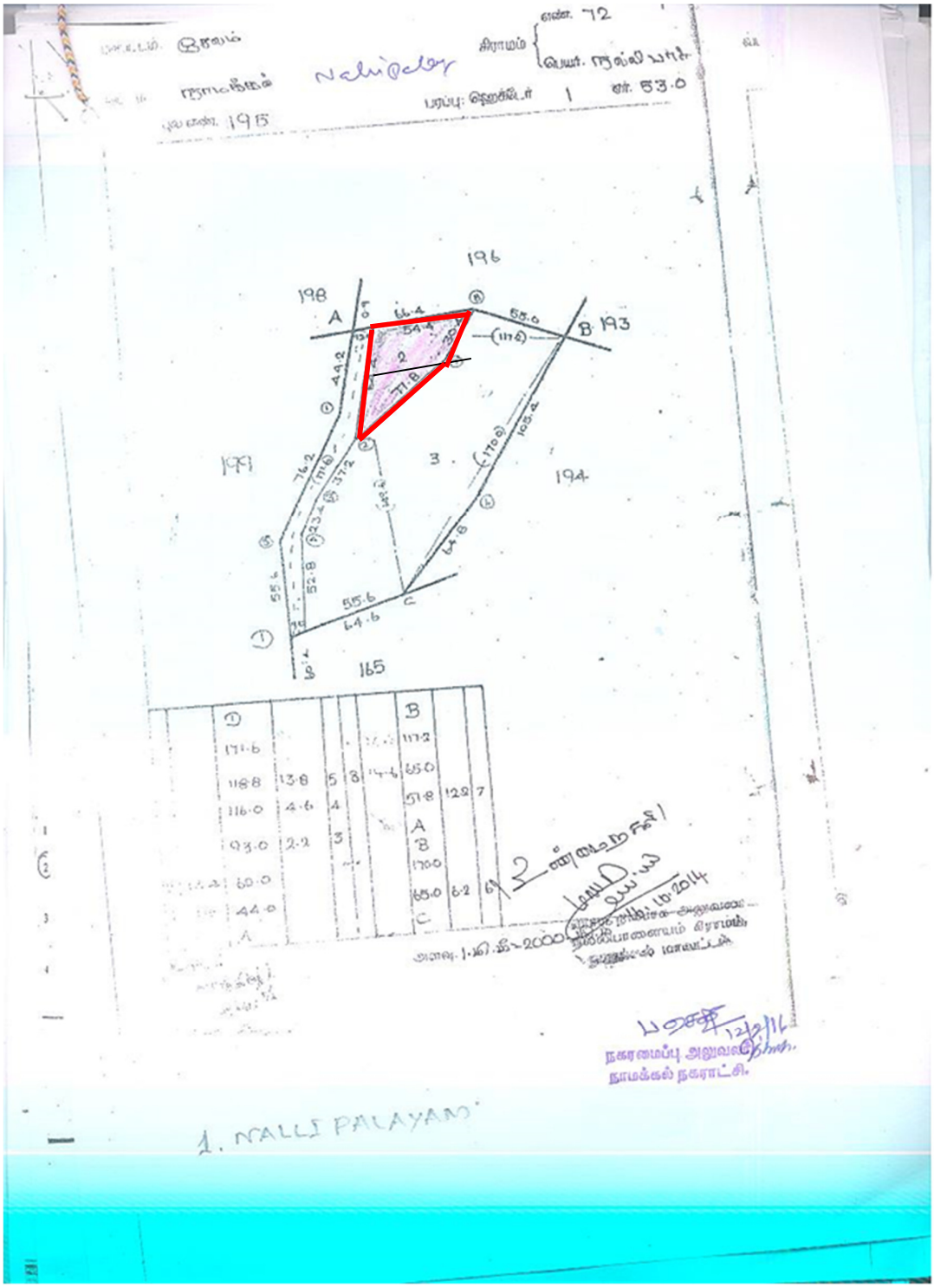
SR SITE AT PON NAGAR



SR SITE AT KOSAVAMPATTY

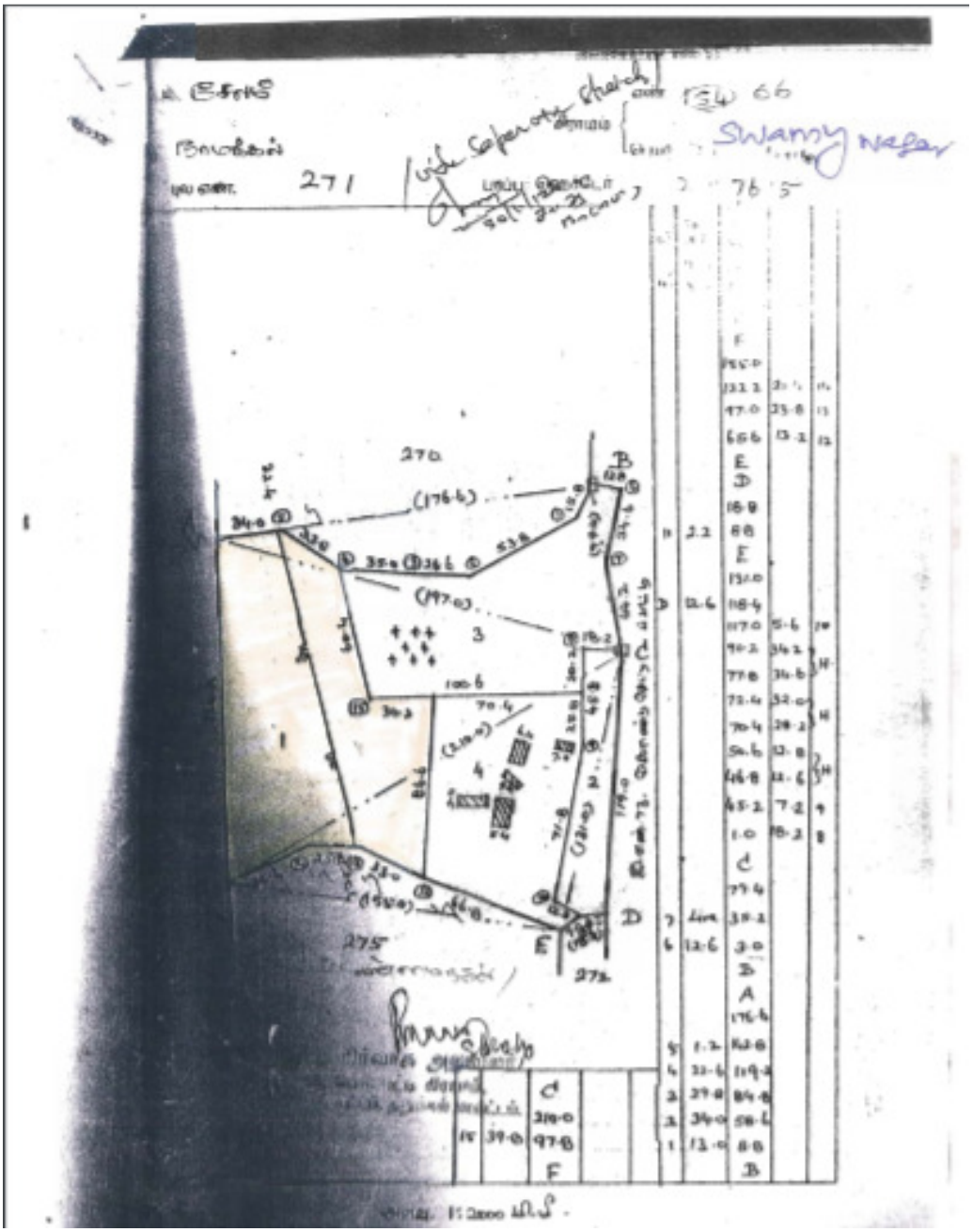


SR SITE AT MULLAI NAGAR

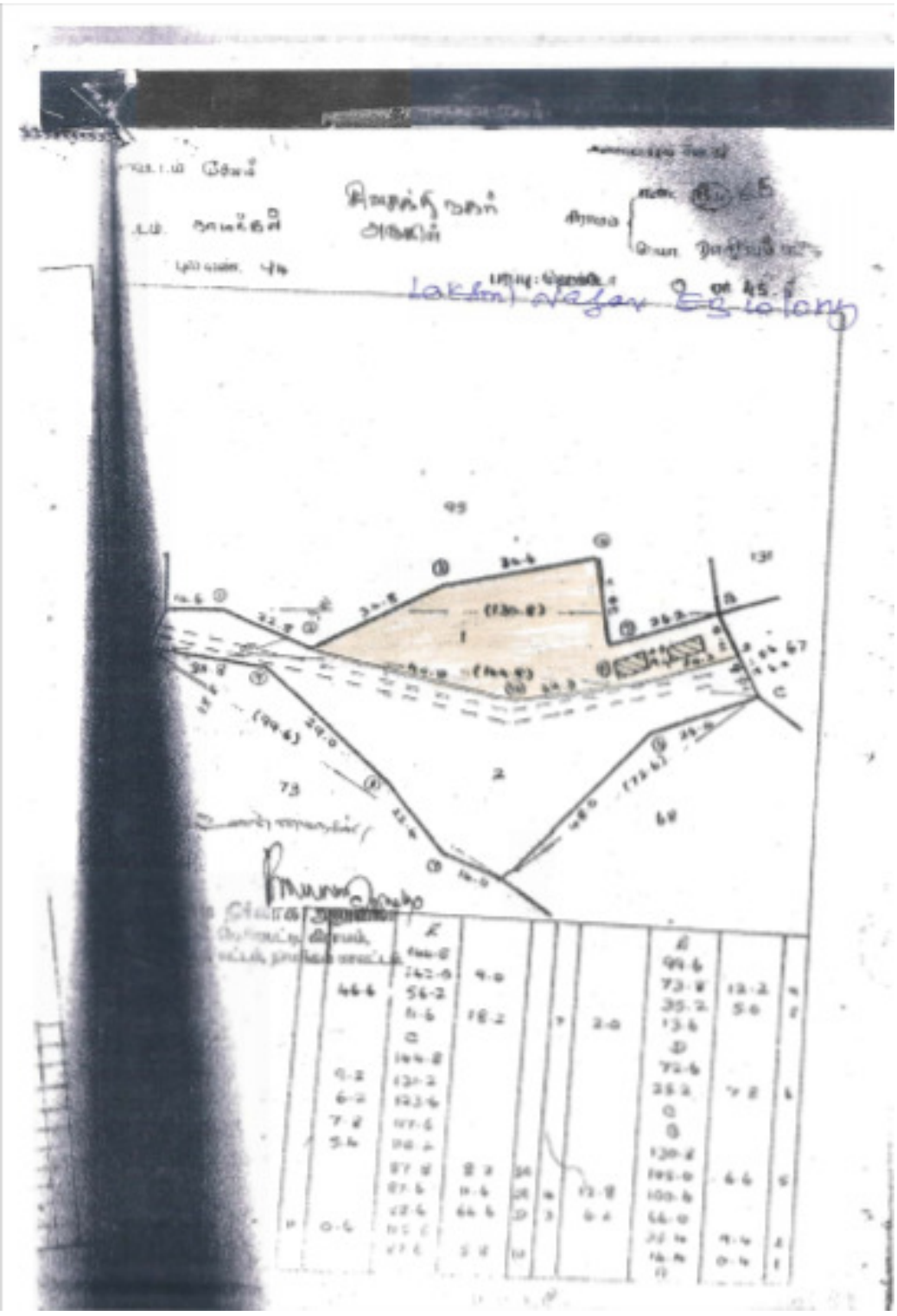


SR SITE AT NALLIPALAYAM

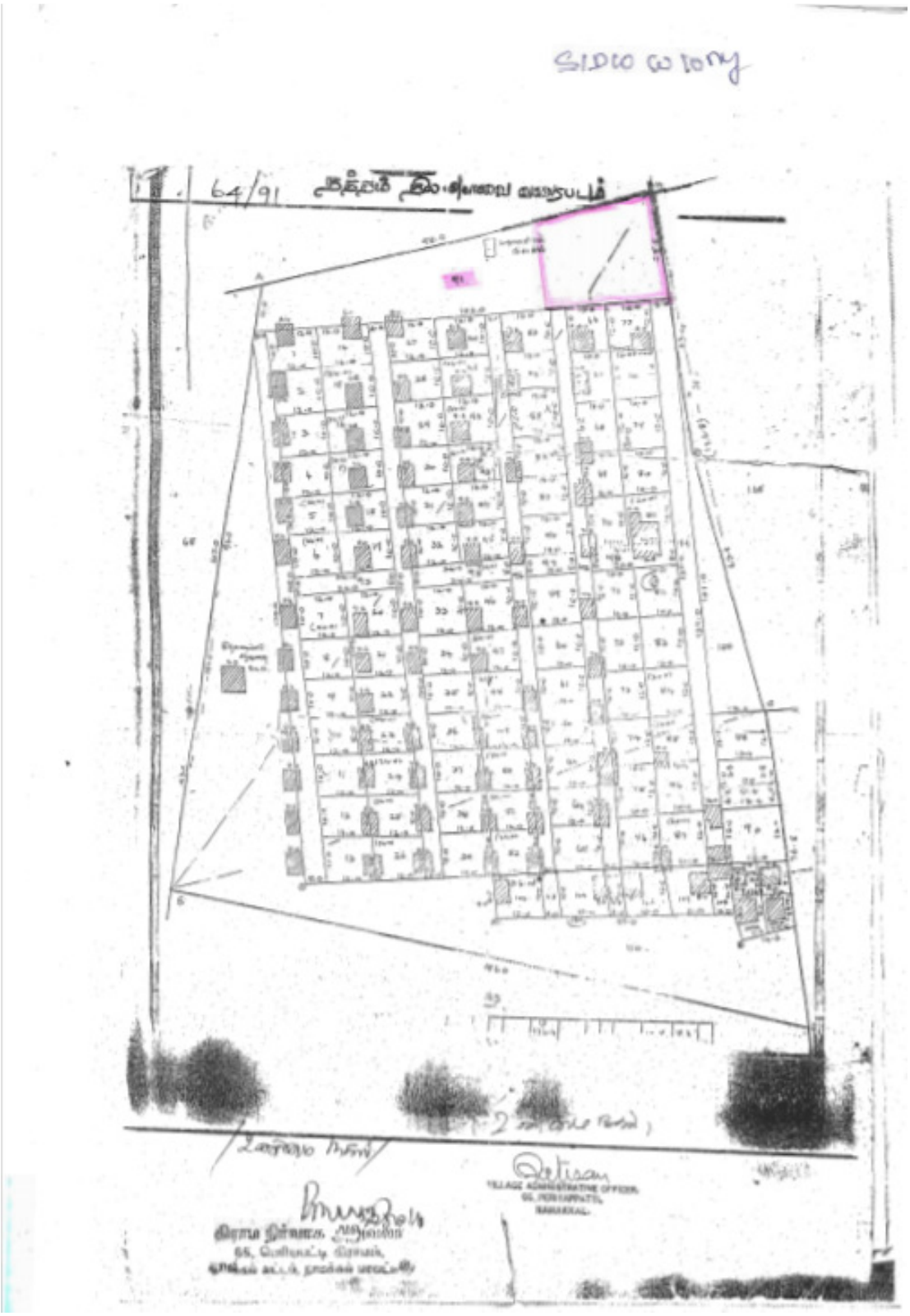
SR SITE AT SPK NAGAR



SR SITE AT SAMY NAGAR

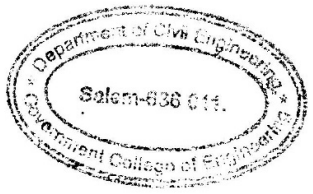


SR SITE AT LAKSHMI NAGAR EB COLONY



SR SITE AT SIDCO COLONY

SOIL INVESTIGATION REPORT



Construction of Head Works at intake well, Collection Well cum pump house and Approach bridge near Cauvery River at Jedarpalayam in Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-12/GCE / SLM / Civil / Soil Lab / 2016 Dt.: 05.07.2016.

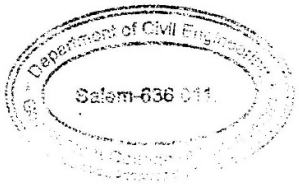
Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Head works at intake well, collection well cum pump house and Approach bridge about 6 m each near Cauvery River Jedarpalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District.

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Head works at intake well, collection well cum pump house and Approach bridge about 6 m each. Near Cauvery River Jedarpalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following faculty members of the Department of Civil Engineering, Government College of Engineering, Salem on 02.07.2016.

Dr.G.Vimala Rosaline, Professor of Civil Engineering

Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.



Test location No.1

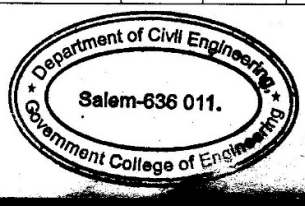
The test point is located at 25 m from PWD Anaicut Road of the proposed site for Construction of Head works at intake well, collection well cum pump house and Approach

bridge about 6 m each, near Cauvery River Jedarpalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District

Soil Stratification/Bore log:

Hand operated Auger has been used for soil exploration up to a depth of 7.30 m at that site. The top layer is of sandy soil for a depth of 6.50 m. A layer of Sandy Soil with pebbles for about 0.80 m is available immediately below the top layer and followed by a layer of Dense medium rock (DMR) below 7.30m depth, which appears to continue for considerable depth.

Depth below G.L (R.L)	Soil Profile	Description of soil	Thickness of layer (m)	Standard penetration Test Data		SBC	Cohesion C	Angle of internal friction φ
				Depth at which test is conducted	Corrected N-value Depth of penetration For 30 cm	kN/m^2		
		Sandy Soil	6.50m	2.50m	5	60	0	37°57′
6.50m				5.00m	7	110	0	38°32′
7.30m		Sandy Soil with Pebbles	0.80m	7.30m	N>51	350	0	40°21′
		Dense Medium Rock						



Water Table

The ground water table was encountered at a depth of 4.90m in Bore hole No.1 at the time of testing.

Standard Penetration Test (SPT)

The test measures the penetration resistance of the split spoon sampler. The N-value, which is the number of blow required to achieve 300 mm penetration of the soil. The test is described in IS-2131-191. The split spoon sampler is attached to guide pipe assembly. A standard blow consists of dropping a mass of 65 kg free fall through 760 mm on to anvil at the top of the spoon.

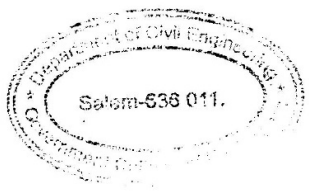
The standard penetration test was conducted at a depths of 2.50 m, 5.00m and 7.30m below the existing ground level and the corrected SPT N value recorded was 5 blows,7 blows and refusal to penetration for 300 mm penetration respectively.

Safe Bearing Capacity

Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **60 kN/m^2 , 110kN/m^2 and 350 kN/m^2** at a depth of 2.50m, 5.00m and 7.30 m respectively

Test location No.2

The test point is located at 60 m from PWD Anaicut Road of the proposed site for Construction of Head works at intake well, collection well cum pump house and Approach bridge about 6 m each, near Cauvery River Jedarpalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District



Soil Stratification/Bore log:

Hand operated Auger has been used for soil exploration up to a depth of 6.20 m at that site. The top layer is of sandy soil for a depth of 4.80 m. A layer of Sandy Soil with pebbles for about 1.40 m is available immediately below the top layer and followed by a layer of Dense medium rock (DMR) below 6.20m depth, which appears to continue for considerable depth.

Depth below G.L (R.L)	Soil Profile	Description of soil	Thickness of layer (m)	Standard penetration Test Data		SBC	Value of Cohesion C	Value of angle of internal friction φ
				Depth at which test is conducted	Corrected N-value Depth of penetration For 30 cm	kN/m^2		
		Sandy Soil	4.80m	2.00m	6	65	0	35°30′
				4.00m	10	120	0	38°39′
4.80m								
		Sandy Soil with Pebbles	1.40m					
6.20m				6.20m	N>51	350	0	40°15′
		Dense Medium Rock						

Water Table

The ground water table was encountered at a depth of 4.10m in Bore hole No.2 at the time of testing.

Standard Penetration Test (SPT)

The test measures the penetration resistance of the split spoon sampler. The N-value, which is the number of blow required to achieve 300 mm penetration of the soil. The test is described in IS-2131-191. The split spoon sampler is attached to guide pipe assembly. A standard blow consists of dropping a mass of 65 kg free fall through 760 mm on to anvil at the top of the spoon.

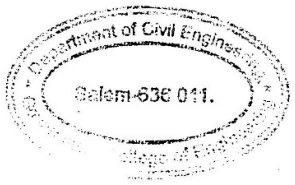
The standard penetration test was conducted at a depths of 2.00 m, 4.00m and 6.20m below the existing ground level and the corrected SPT N value recorded was 6 blows, 10 blows and refusal to penetration for 300 mm penetration respectively.

Safe Bearing Capacity

Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **65 kN/m^2 , 120kN/m^2 and 350 kN/m^2** at a depth of 2.00m, 4.00m and 6.20 m respectively

Test location No.3

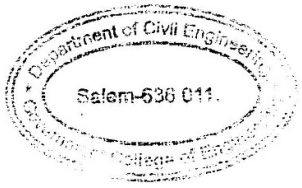
The test point is located at 90 m from PWD Anaicut Road of the proposed site for Construction of Head works at intake well, collection well cum pump house and Approach bridge about 6 m each, near Cauvery River Jedarpalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District



Soil Stratification/Bore log:

Hand operated Auger has been used for soil exploration up to a depth of 6.40 m at that site. The top layer is of sandy soil for a depth of 5.20 m. A layer of Sandy Soil with pebbles for about 1.20 m is available immediately below the top layer and followed by a layer of Dense medium rock (DMR) below 6.40m depth, which appears to continue for considerable depth.

Depth below G.L (R.L)	Soil Profile	Description of soil	Thickness of layer (m)	Standard penetration Test Data		SBC	Value of Cohesion C	Value of angle of internal friction φ
				Depth at which test is conducted	Corrected N-value Depth of penetration For 30 cm	kN/m^2		
		Sandy Soil	5.20m	2.20m	8	80	0	37°05′
				4.30m	9	115	0	38°40′
5.20m								
		Sandy Soil with Pebbles	1.20m					
6.40m				6.40m	N>51	350	0	40°10′
		Dense Medium Rock						



Water Table

The ground water table was encountered at a depth of 3.90m in Bore hole No.3 at the time of testing.

Standard Penetration Test (SPT)

The test measures the penetration resistance of the split spoon sampler. The N-value, which is the number of blow required to achieve 300 mm penetration of the soil. The test is described in IS-2131-191. The split spoon sampler is attached to guide pipe assembly. A standard blow consists of dropping a mass of 65 kg free fall through 760 mm on to anvil at the top of the spoon.

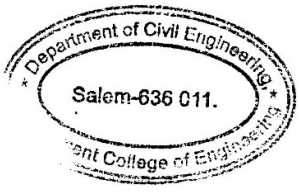
The standard penetration test was conducted at a depths of 2.20 m, 4.30m and 6.40m below the existing ground level and the corrected SPT N value recorded was 8 blows, 9 blows and refusal to penetration for 300 mm penetration respectively.

Safe Bearing Capacity

Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **80 kN/m^2 , 115kN/m^2 and 350 kN/m^2** at a depth of 2.20m, 4.30m and 6.40 m respectively

Test location No.4

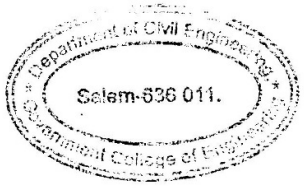
The test point is located at 120 m from PWD Anaicut Road of the proposed site for Construction of Head works at intake well, collection well cum pump house and Approach bridge about 6 m each, near Cauvery River Jedarpalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District



Soil Stratification/Bore log:

Hand operated Auger has been used for soil exploration up to a depth of 6.10 m at that site. The top layer is of sandy soil for a depth of 5.40 m. A layer of Sandy Soil with pebbles for about 0.70 m is available immediately below the top layer and followed by a layer of Dense medium rock (DMR) below 6.10m depth, which appears to continue for considerable depth.

Depth below G.L (R.L)	Soil Profile	Description of soil	Thickness of layer (m)	Standard penetration Test Data		SBC	Value of Cohesion C	Value of angle of internal friction φ
				Depth at which test is conducted	Corrected N-value Depth of penetration For 30 cm	kN/m^2		
		Sandy Soil	5.40m	1.80m	6	60	0	36°31′
				3.90m	8	110	0	38°10′
5.40m								
		Sandy Soil with Pebbles	0.70m	6.10m	N>51	350	0	4))
6.10m								
		Dense Medium Rock						



Water Table

The ground water table was encountered at a depth of 3.80m in Bore hole No.4 at the time of testing.

Standard Penetration Test (SPT)

The test measures the penetration resistance of the split spoon sampler. The N-value, which is the number of blow required to achieve 300 mm penetration of the soil. The test is described in IS-2131-191. The split spoon sampler is attached to guide pipe assembly. A standard blow consists of dropping a mass of 65 kg free fall through 760 mm on to anvil at the top of the spoon.

The standard penetration test was conducted at a depths of 1.80 m, 3.90m and 6.10m below the existing ground level and the corrected SPT N value recorded was 6 blows, 8 blows and refusal to penetration for 300 mm penetration respectively.

Safe Bearing Capacity

Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **60 kN/m^2 , 110kN/m^2 and 350 kN/m^2** at a depth of 1.80m, 3.80m and 6.10 m respectively

Recommendations:

It is recommended that safe bearing capacity of soil shall be taken as **60 kN/m^2** depth of 2.00m, **110 kN/m^2** at a depth of 4.00m for the above proposed site of construc for design purpose.

It is recommended that safe bearing capacity shall be taken as **350 kN/m^2.** Dense Medium Rock (DMR) strata is available .

The details furnished are based on the representative bore hole. If any chan the soil strata is observed during excavation for foundation, it is requested that the SBC may be re-ascertained.

Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Professor of Civil Engineering

Dr.G. VIMALA ROSALINE, M.E., Ph.D
Professor of Civil Engineering
GOVT. COLLEGE OF ENGINEERING
Salem-636 011

SOIL INVESTIGATION REPORT

Construction of Treatment Plant
at
Kabilakurichi
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-11/GCE / SLM / Civil / Soil Lab / 2016 Dt.: 05.07.2016.

Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Treatment Plant at Kabilakurichi for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Treatment Plant at Kabilakurichi for providing WSS to added are Namakkal Municipality in Namakkal District by the following staff members o Department of Civil Engineering, Government College of Engineering, Salem on 02.07.2

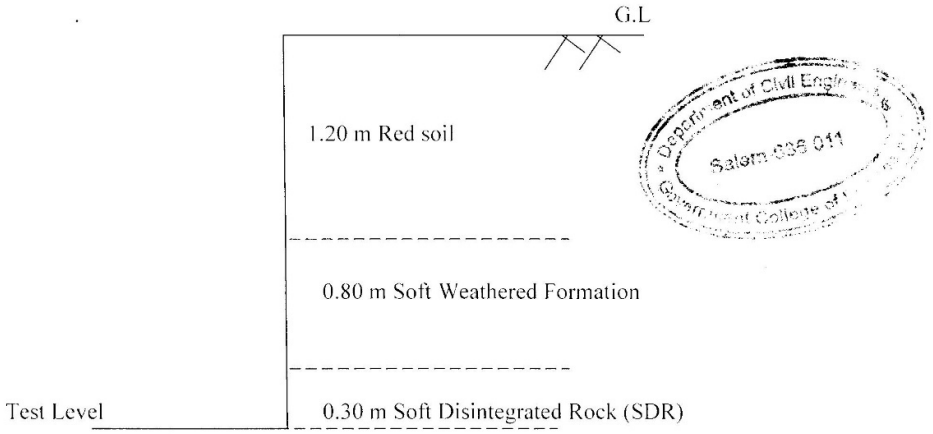
Dr.G.Vimala Rosaline, Professor of Civil Engineering.

Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.

Test Pit No.1:

The test pit is located at North side of the proposed site for the Construct Treatment Plant at Kabilakurichi for providing WSS to added areas in Nat akkal Munici in Namakkal District. A depth of 2.30 m is available for mapping the soil stratification at that site. The top soil is of Red Soil for a depth of 1.20m. A layer of Soft Weathered Formation for

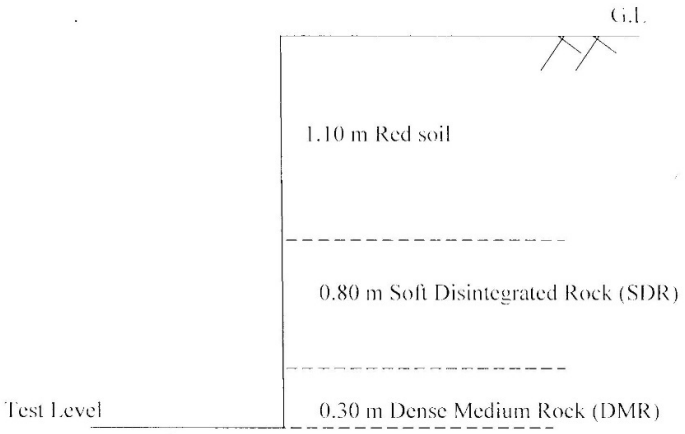
about 0.80 m is available immediately below the top soil and followed by a layer of Soft Disintegrated Rock (SDR) for the remaining depth of the test pit which appears to continue for a considerable depth.



The standard penetration test was conducted at a depth of 2.30 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **270 kN/m^2.**

Test Pit No.2:

The test pit is located at centre of the proposed site for the Construction of Treatment Plant at Kabilakurichi for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 2.20 m is available for mapping the soil stratification at the site. The top soil is of Red Soil for a depth of 1.10m. A layer of Soft Disintegrated Rock (SDR) for about 0.80 m is available immediately below the top soil and followed by a layer of Dense Medium Rock (DMR) for the remaining depth of the test pit which appears to continue for a considerable depth.

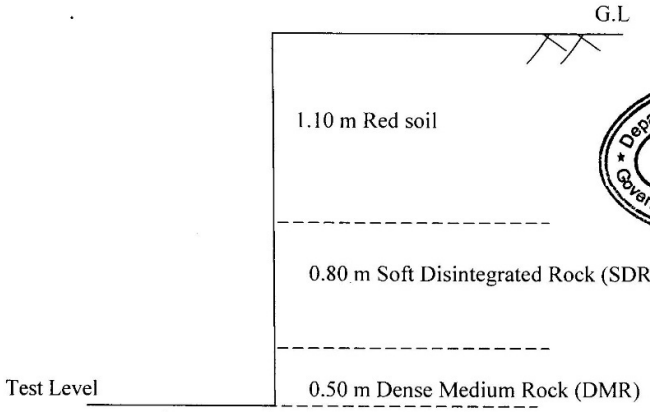


SBC=**300 kN/m^2**

The standard penetration test was conducted at a depth of 2.20 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **300 kN/m^2.**

Test Pit No.3:

The test pit is located at South Side of the proposed site for the Construction of Treatment Plant at Kabilakurichi for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 2.40 m is available for mapping the soil stratification in the site. The top soil is of Red Soil for a depth of 1.10m. A layer of Soft disintegrated rock (SDR) for about 0.80 m is available immediately below the top soil and followed by Hard Dense Medium Rock (DMR) for the remaining depth of the test pit which is spread over for a considerable depth.



SBC=**320 kN/m^2**

The standard penetration test was conducted at a depth of 2.20 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **320 kN/m^2.**

Recommendations:

It is recommended that **250 kN/m^2** shall be taken as safe bearing capacity of soil in above proposed site of construction for design purpose.

It is recommended that the depth of foundation shall be decided during excavation and the foundation shall be placed only on Soft Disintegrated Rock (SDR) or Hard Stratum only.

The details furnished are based on the representative test pits. If any change in the soil strata is observed during excavation for foundation, it is requested that the SBC value may be re-ascertained.

Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

SOIL INVESTIGATION REPORT

Construction of Booster Station
at
Thummankurichi
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-10/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Booster Station at Thummankurichi for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

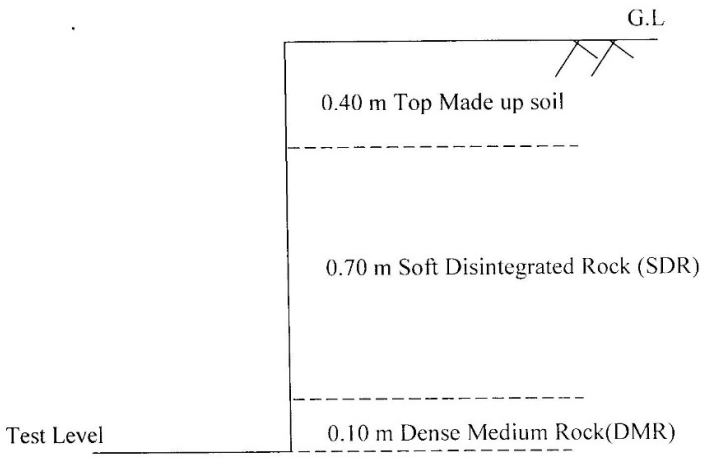
The soil investigation has been carried out in the location at the proposed site for the Construction of Booster station at Thummankurichi for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

Dr.G.Vimala Rosaline, Professor of Civil Engineering,
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.

Test Pit:

The test pit is located at centre of the proposed site for the Construction of Booster Station at Thummankuruchi for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 1.20 m is available for mapping the soil stratification at that site. The top soil is made up for a depth of 0.40m. A layer of Soft Disintegrated Rock (SDR) for about 0.70 m is available immediately below the top soil and followed by a layer of Dense

Medium Rock (DMR) for the remaining depth of the test pit which appears to continue for a considerable depth.



SBC=**300 kN/m^2**

The standard penetration test was conducted at a depth of 1.20 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **300 kN/m^2.**

1/7/2016

Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM 636 011

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

Department of Civil Engineering
Salem-636 011.
Government College of Engineering

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
9.10 LL Capacity
at
Swami Nagar
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-9/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party : The Executive Engineer,
Urban Division,
172, State Bank Officers' Colony,
Salem-4

Reference : Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm
Dt.:20.01.2016

Name of work : Construction of Over Head Tank of 9.10 LL capacity at Swami Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 9.10 LL capacity at Swami Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

Dr.G.Vimala Rosaline, Professor of Civil Engineering
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.

Rock Out crop was found at the ground level throughout the proposed site for the Construction of Over Head Tank of 9.10 LL capacity at Swami Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District.

The standard penetration test was conducted at the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **320 kN/m^2.**

1/7/2016

Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

Department of Civil Engineering
Salem-636 011.
Government College of Engineering

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
8.50 LL Capacity
at
Lakshmi Nagar EB Colony
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-8/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Over Head Tank of 8.50 LL capacity at Lakshmi Nagar EB Colony for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 8.50 LL capacity at Lakshmi Nagar EB Colony for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

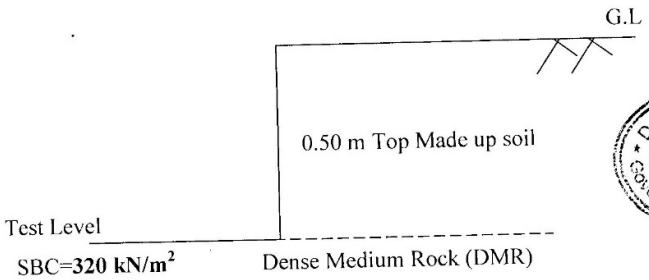
Dr.G.Vimala Rosaline, Professor of Civil Engineering

Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.

Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 8.50 LL capacity at Lakshmi Nagar EB Colony for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 0.50 m is available for mapping the soil stratification at that site. The top soil is made up for a depth of 0.50m. A layer of Dense

Medium Rock (DMR) is available immediately below the top soil at the bottom of the test pit, which appears to continue for a considerable depth. Rock Out crop was found throughout the site.



Department of Civil Engineering, Government College of Engineering, Salem-636 011.

The standard penetration test was conducted at a depth of 0.50 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **320 kN/m^2.**

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

17/2/16
Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
2.10 LL Capacity
at
SIDCO Colony
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-5/GCE / SLM / Civ5l / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Over Head Tank of 2.10 LL capacity at SIDCO Colony for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 2.10 LL capacity at SIDCO Colony for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

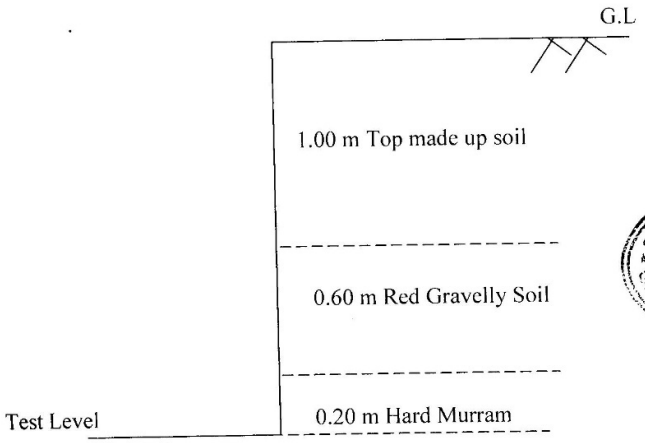
Dr.G.Vimala Rosaline, Professor of Civil Engineering,
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.

Department of Civil Engineering
Salem-636 011.
Government College of Engineering

Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 2.10 LL capacity at SIDCO Colony for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 1.80 m is available for mapping the soil stratification at that site. The top soil is made up for a depth of 1.00m. A layer of Red

Gravelly Soil for about 0.60 m is available immediately below the top soil and followed by a layer of Hard Murram for the remaining depth of the test pit.



SBC=**250 kN/m^2**

The standard penetration test was conducted at a depth of 1.80 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **250 kN/m^2.**

Department of Civil Engineering
Salem-636 011.
Government College of Engineering

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

7/7/16
Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
1.00 LL Capacity
at
Vasantham Nagar
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU
GOVERNMENT COLLEGE OF ENGINEERING – SALEM
DEPARTMENT OF CIVIL ENGINEERING
SOIL MECHANICS LABORATORY
CONSULTANCY REPORT

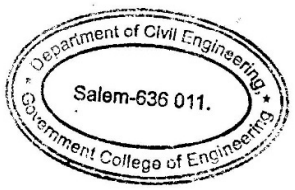
Lr.No.: C-937-3/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Over Head Tank of 1.00 LL capacity at Vasantham Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 1.00 LL capacity at Vasantham Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

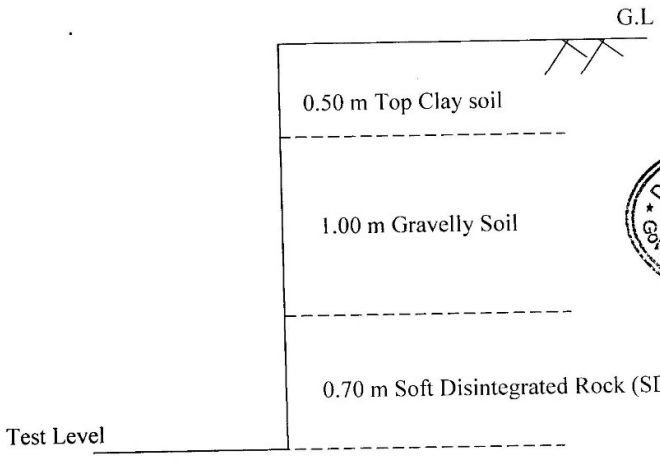
Dr.G.Vimala Rosaline, Professor of Civil Engineering,
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.



Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 1.00 LL capacity at Vasantham Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 2.20 m is available for mapping the soil stratification at that site. The top soil is made of clay soil for a depth of 0.50m. A layer of

Gravelly Soil for about 1.00 m is available immediately below the top soil and followed by a layer of Soft Disintegrated Rock (SDR) for the remaining depth of the test pit which appears to continue for a considerable depth.



SBC=**250 kN/m^2**

The standard penetration test was conducted at a depth of 2.20 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **250 kN/m^2.**

Department of Civil Engineering, Government College of Engineering, Salem-636 011.

1/2/16

Dr. G. ARUN KUMAR, M.E., Ph.D
Asst. Prof. In Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
3.90 LL Capacity
at
Nallipalayam
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-2/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

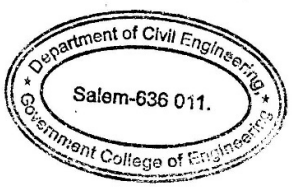
Name of the Party	: The Executive Engineer, Urban Division, 172, State Bank Officers' Colony, Salem-4
Reference	: Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm Dt.:20.01.2016
Name of work	: Construction of Over Head Tank of 3.90 LL capacity at Nallipalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 3.90 LL capacity at Nallipalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

Dr.G.Vimala Rosaline, Professor of Civil Engineering

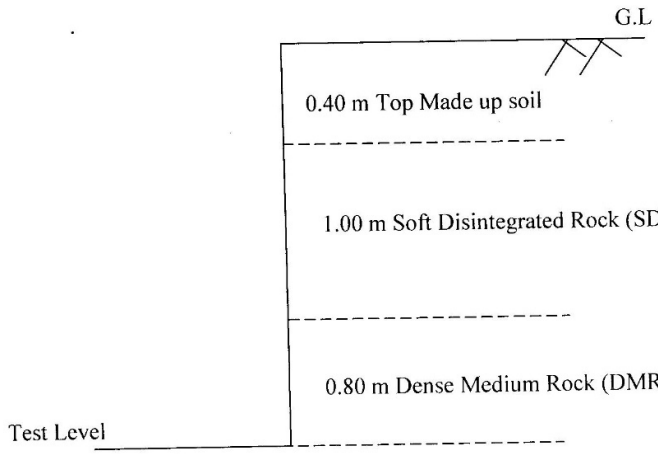
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.



Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 3.90 LL capacity at Nallipalayam for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 2.20 m is available for mapping the soil

stratification at that site. The top soil is made up for a depth of 0.40m. A layer of Soft Disintegrated Rock (SDR) for about 1.00 m is available immediately below the top soil and followed by a layer of Dense Medium Rock (DMR) for the remaining depth of the test pit, which appears to continue for a considerable depth. Rock Out crop was found in the North west corner of the proposed site.



SBC=**300 kN/m^2**

The standard penetration test was conducted at a depth of 2.20 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **300 kN/m^2.**

Department of Civil Engineering, Government College of Engineering, Salem-636 011.

7/2/16

Dr. G. ARUN KUMAR M.E., Ph.D
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
7.80 LL Capacity
at
Kosavampatty
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-7/GCE / SLM / Civ5l / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party : The Executive Engineer,
Urban Division,
172, State Bank Officers' Colony,
Salem-4

Reference : Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm
Dt.:20.01.2016

Name of work : Construction of Over Head Tank of 7.80 LL capacity at Kosavampatty for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 7.80 LL capacity at Kosavampatty for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

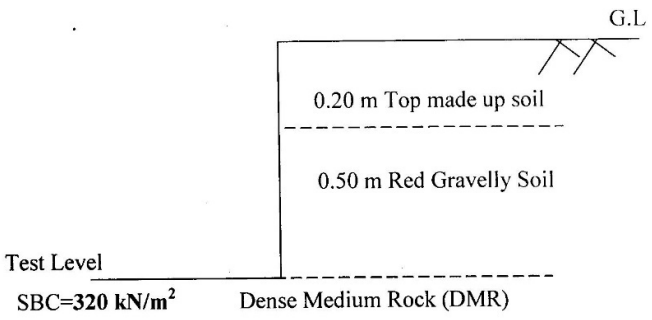
Dr.G.Vimala Rosaline, Professor of Civil Engineering,
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.

Department of Civil Engineering
Salem-636 011.
Government College of Engineering

Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 7.80 LL capacity at Kosavampatty for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 0.70 m is available for mapping the soil stratification at that site. The top soil is made up for a depth of 0.20m. A layer of Red Soil for

about 0.50 m is available immediately below the top soil and followed by a layer of Dense Medium Rock (DMR) at the bottom of the test pit which appears to continue for a considerable depth. Rock Out crop was found throughout the site.



The standard penetration test was conducted at a depth of 0.70 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **320 kN/m²**.

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E., Ph.D.
Professor of Civil Engineering,
GOVT. COLLEGE OF ENGINEERING,
Salem-636 011.

1/7/2016
Dr. G. ARUN KUMAR, M.E., Ph.D.
Asst. Prof. in Civil Engg.
Govt. College of Engineering
SALEM - 636 011

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

Department of Civil Engineering
Salem-636 011.
Government College of Engineering

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
4.10 LL Capacity
at
SPK Nagar
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-4/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party : The Executive Engineer,
Urban Division,
172, State Bank Officers' Colony,
Salem-4

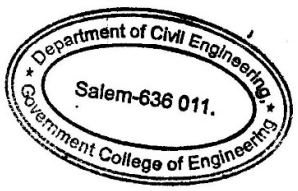
Reference : Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm
Dt.:20.01.2016

Name of work : Construction of Over Head Tank of 4.10 LL capacity at SPK Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 4.10 LL capacity at SPK Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016.

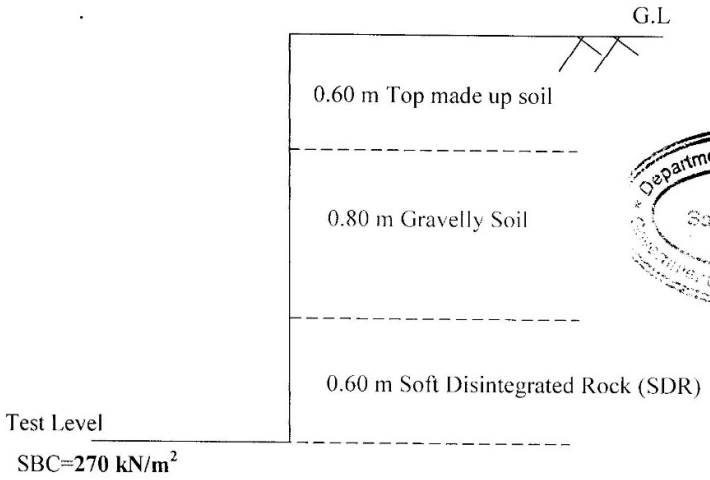
Dr.G.Vimala Rosaline, Professor of Civil Engineering,
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.



Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 4.10 LL capacity at SPK Nagar for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 2.00 m is available for mapping the soil stratification at that site. The top soil is made up for a depth of 0.60m. A layer of Gravelly

Soil with lime contentfor about 0.80 m is available immediately below the top soil and followed by a layer of Soft Disintegrated Rock (SDR) for the remaining depth of the test pit which appears to continue for a considerable depth.



SBC=**270 kN/m^2**

The standard penetration test was conducted at a depth of 2.00 m below the existing ground level and there was a refusal to penetration (N>51). Based upon the field investigation, laboratory test and also by considering the water table effect at the test level, it is recommended that the safe bearing capacity of the soil may taken as **270 kN/m^2.**

Dr. G. ANBU KUMAR M.E., Ph.D
Asst. Prof. in Civil engg
Govt. College of Engineering
SALEM - 636 011

Professor of Civil Engineering
Dr.G. VIMALA ROSALINE, M.E.
Professor in Civil Engineering
GOVT. COLLEGE OF ENGINEERING
Salem-636 011.

Note:

The detail furnished is based on the representative pit. If any change in the soil strata is observed during excavation for foundation, you are requested to ascertain the SBC value.

SOIL INVESTIGATION REPORT

Construction of Over Head Tank
of
8.00 LL Capacity
at
Ponnagar
in
Namakkal District

DEPARTMENT OF CIVIL ENGINEERING
GOVERNMENT COLLEGE OF ENGINEERING
SALEM-636 011

DEPARTMENT OF TECHNICAL EDUCATION- TAMIL NADU

GOVERNMENT COLLEGE OF ENGINEERING – SALEM

DEPARTMENT OF CIVIL ENGINEERING

SOIL MECHANICS LABORATORY

CONSULTANCY REPORT

Lr.No.: C-937-1/GCE / SLM / Civil / Soil Lab / 2016 Dt.:01.07.2016.

Name of the Party : The Executive Engineer,
Urban Division,
172, State Bank Officers' Colony,
Salem-4

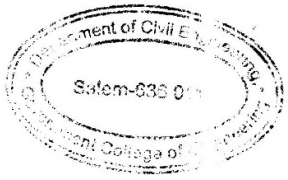
Reference : Your Lr.No.: 2016/F.Namakkal AA/JDO2/2015/U/Slm
Dt.:20.01.2016

Name of work : Construction of Over Head Tank of 8.00 LL capacity at Ponnagar for providing WSS to added areas in Namakkal Municipality in Namakkal District

Field investigations:

The soil investigation has been carried out in the location at the proposed site for the Construction of Over Head Tank of 8.00 LL capacity at Ponnagar for providing WSS to added areas in Namakkal Municipality in Namakkal District by the following staff members of the Department of Civil Engineering, Government College of Engineering, Salem on 18.06.2016

Dr.G.Vimala Rosaline, Professor of Civil Engineering
Dr.G.Arun Kumar, Assistant Professor in Civil Engineering.



Test Pit:

The test pit is located at centre of the proposed site for the Construction of Over Head Tank of 8.00 LL capacity at Ponnagar for providing WSS to added areas in Namakkal Municipality in Namakkal District. A depth of 1.35 m is available for mapping the soil stratification at that site. The top soil is made up for a depth of 0.20m. A layer of Red Gravelly Soil for about 0.65 m is available immediately below the top soil and followed by a

ANNEXURE-5 :RAW WATER SAMPLE ANALYSIS RESULT

TEST WATER BEFORE USE

TAMIL NADU WATER SUPPLY AND DRAINAGE BOARD

From
R. Ravindran,
Junior Water Analyst,
TWAD Board,
District Water Testing Laboratory,
Namakkal.

To
The Assistant Executive Engineer,
TWAD Board,
Urban Sub-division,
Namakkal.

Lr.No. F.Lab/JWA/TWAD/NKL/2016/dated 13.6.2016

Sir,

Sub: Examination of Water Sample report -furnished - reg.
Ref : 1. The Asst.Exe.Engr.'s Lr.No. F.WS/Add.NKL/AEE/U/NKL/dt.7.6.16
2. T.O Invoice No. 12725/dt.7.6.2016

***

The result of analysis for the water sample sent under reference is furnished below.

Date of Collection : 7.6.16
Date of Receipt : 7.6.16

Source : River Cauvery
Location: 35046 & 35047 : Jedarpalayam Anicut Upstream (150 m away from Phase II intake well.

Sample collected by: Er. C.Varadharaju, Asst.Engr.

BIS 10500 : 2012 I. PHYSICAL EXAMINATION.	Acceptable limit	Permissible limit in the absence of alternate source	Result 35046
1. Appearance	-	-	Slightly Turbid
2. Colour (pt.co-scale)	5	15	Slightly Greenish
3. Odour	Agreeable	Agreeable	Algal odour
4. Turbidity NT Units	1	5	26
5. Total dissolved Solids mg/L	500	2000	539
6. Electrical Conductivity Micro mho/cm	-	-	770
II.CHEMICAL EXAMINATION:			
7. pH	6.5-8.5	6.5-8.5	7.35
8. Ph. Alkalinity as $CaCo_{3\ mg/L}$	-	-	0
9. Total Alkalinity. as $CaCo_{3\ mg/L}$	200	600	156
10. Total Hardness as $CaCo_{3\ mg/L}$	200	600	124
11. Calcium as Ca mg/L	75	200	30
12. Magnesium as Mg mg/L	30	100	12
13. Sodium as Na mg/L	-	-	96
14. Potassium as K mg/L	-	-	16
15. Iron as Fe mg/L	0.3	0.3	1.2
16. Manganese mg/L	0.1	0.3	0
17. Free Ammonia as $NH_{3\ mg/L}$	0.5	0.5	2.5
18. Nitrite as $NO_{2\ mg/L}$	-	-	0
19. Nitrate as $NO_{3\ mg/L}$	45	45	6
20. Chloride as Cl mg/L	250	1000	92
21.Fluoride as F mg/L	1.0	1.5	0
22. Sulphate as $SO_{4\ mg/L}$	200	400	72
23. Phosphate as $PO_{4\ mg/L}$	-	-	1.5
24. Tidys Test 4 hrs.as $O_{2\ mg/L}$	-	-	2.48
25.Residual chlorine			0
Bacteriological Examination:			35047
26.Feacal Coliform	0/100 ml	0/100 ml	60/100 ml

Report: 35046: The water is physically and chemically not potable due to appearance, odour, excess Turbidity and Iron.

Report: 35047: The water is bacteriologically contaminated.

13/6/16

Junior Water Analyst, TWAD Board,
District Water Testing Lab, Namakkal.

13/6/16

Annexure -6 Attendance of Public Meeting

W/S I S TO NAMAKKAL ADDED AREA IN NAMAKKAL MUNCIPALITY IN NAMAKKAL DISTRICT.

STACK HOLDES MEETING ON 30-6-2016

S.No	Name	Name of Post	Sign
1	R. K[illegible]	[illegible] MC	[illegible]
2	P. [illegible]	Councilor 21	[illegible]
3	D. Poongothi	Councilor - 13	B. Komalam
4	B. Komala - (13)	Councilor - 24	[illegible]
5	S. Geetha	Councilor 23	S. [illegible]
6	S. [illegible]	Councilor 28	S. Saritha
7	S. Saritha	Councilor 20	K. Sathya
8	K. Sathya	[illegible] (9)	B. Jayalakshmi
9	B. Jayalakshmi	Coun: (12)	M. [illegible]
10	M. [illegible]	Councilor 1	K. Elamani
11	K. Elamani		
12	S. SOMSS (S. SAMPATH)	Councilor (16)	S. SOMSS
13	R. KUPPUSAMY	Councilor (15)	R. Kuppusamy
14	L. RAJA.	Councilor (10)	L. [illegible]
15	S[illegible] (S. [illegible])	Counciler (21)	[illegible]
16	T. [illegible]	T. Vadivel Kumar. MC Councilor. (5)	[illegible]

Annexure-7-Public Meeting Photographs

nimum 25 | Namakkal Maximum 33 Minimum 25 | Salem Maximum 33 Minimum 25

ortable morning. A cloudy sky is easant night.

Salem Tomorrow 33°C

A cloudy sky is expected to persist over the region. The morning will be easy. A warm afternoon.

Namakkal municipality to implement Rs. 190.40 crore water scheme

S.P. SARAVANAN

NAMAKKAL: Namakkal municipality, the first ISO 14001-2004 certified municipality in Asia for environmental management, is all set to implement the Rs. 190.40 crore Water Supply Improvement Scheme (WSIS) for residents in all the 39 wards. The town was extended by adding nine village panchayats in 2010 and the total population stood at 1,20,957 in 2011. Hence, to face the growing water needs, Chief Minister Jayalalithaa during the Collectors' conference on December 13, 2013 announced a new water scheme for the municipality. The year 2018 was taken as base year when the expected population would be 1,33,013 with the requirement worked out at 22.18 million litres per day.

A project was prepared by Tamil Nadu Water Supply and Drainage Board (TWAD Board) under Tamil Nadu Sustainable Urban Development Programme (TNSUDP) of the World Bank to supply 135 Litres per Capita per Day (LPCD) to residents in all the wards.

Raw water would be pumped from River Cauvery at Jedarpalayam Dam in Mohanur and transmitted through 700 mm diameter pipeline for 10.44 km to reach the 17.66 million litres per day (MLD) treatment plant at Kabilakkurichi. The treated water would again be transmitted to the clean water tank in Thummankurichi, which is located 25.52 km away.

From there it would be carried through feeder main to the master sump at municipal complex and distributed to the households through the distribution system.

The scheme has bulk provision for collectorate, 10 per cent provision for industries and commercial establishments and can be expanded to meet the expected population of 1.58 lakh in 2033 and 1.84 lakh in 2048. A stakeholders meeting was held at the municipality on Thursday, in which officials said that a Detailed Project Report was already submitted to World Bank for approval. After the approval, funding pattern will be worked out and tender process will be initiated. The project is expected to be commissioned in 2018.

NAMAKKAL MUNICIPALITY TO IMPLEMENT WATER SCHEME

- Scheme: Water Supply Improvement Scheme (WSIS) to added areas to Namakkal municipality
- Tamil Nadu Water Supply and Drainage Board (TWAD Board)
- Cost of scheme: Rs. crore
- Cost per 1,000 litres: Rs.
- Funding:
- Proposed supply: Litres per Capita per Day
- Beneficiaries: lakh population in 2018
- Scheme details: Head works at , booster station at Aniyapuram and master sump at municipal complex
- Project execution period: years (proposed)

Girl succumbs to burns

STAFF REPORTER

SALEM: Aarthi, five-year-old girl, who suffered burns and was battling for life at the Government Mohan Kumaramangalam Medical College Hospital, died on Thursday.

Anburaj in Gangavalli police station limits in an inebriated condition doused kerosene on himself and his two children and set all on fire on Monday. While his two-and-half-year-old son Siva succumbed to burns, Anburaj and his five-year-old daughter Aarthi suffered more than 80 per cent burns and were admitted to the hospital. Anburaj died on Tuesday. The incident took place after Anburaj picked a quarrel with wife Revathi on Sunday.

நாமக்கல் மாவட்

நாமக்கல் நகராட்சியில்

ரூ.190.40 கோடியில் புதிய குடிநீர் திட்டம்

மதிப்பீடு ஆய்வு பணிகள் நிறைவு

நாமக்கல், ஜூலை.1-

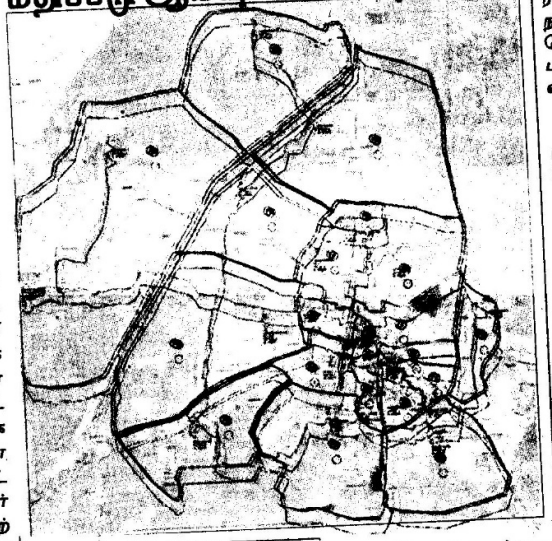
நாமக்கல் நகராட்சியில் ரூ.190.40 கோடியில் புதிய குடிநீர் திட்டம் செயல்படுத்தப்பட உள்ளது. இதற்கான திட்ட மதிப்பீடு ஆய்வு பணிகள் நிறைவு பெற்றுள்ளதை அடுத்து, வருகிற 8-ந் தேதி திட்ட மதிப்பீடு அரசிடம் சமர்பிக்கப்பட இருப்பதாக அதிகாரிகள் தெரிவித்தனர்.

தினசரி 90 லிட்டர் குடிநீர்

2011-ம் ஆண்டு கணக்கெடுப்பின்படி, நாமக்கல் நகராட்சியின் மக்கள் தொகை 55 ஆயிரத்து 52 ஆகும். இவர்களுக்கு தற்போது நாள் ஒன்றுக்கு நபர் ஒருவருக்கு 90 லிட்டர் வீதம் 3 தனித்திட்டங்களின் வழியாக 10.87 மில்லியன் லிட்டர் (ஒரு மில்லியன் லிட்டர் என்பது 10 லட்சம் லிட்டர் அளவு) குடிநீர் காவிரி ஆற்றில் இருந்து வழங்கப்பட்டு வருகிறது.

இதேபோல் நாமக்கல் நகராட்சியுடன் புதிதாக இணைக்கப்பட்ட 9 ஊராட்சிகளின் மக்கள் தொகை 65 ஆயிரத்து 905 ஆகும். இந்த ஊராட்சிகளுக்கு நாள் ஒன்றுக்கு நபர் ஒருவருக்கு காவிரி குடிநீர் மற்றும் இதர நீராதாரங்கள் மூலமாக நபர் ஒருவருக்கு 40 லிட்டர் வீதம் குடிநீர் வழங்கப்பட்டு வருகிறது.

நாமக்கல் நகராட்சி மற்றும் புதிதாக இணைக்கப்பட்ட பகுதிகளுக்கு நாள் ஒன்றுக்கு நபர் ஒருவருக்கு 135 லிட்டர் காவிரி குடிநீர் வழங்க புதிதாக குடிநீர் திட்டம் நிறைவேற்ற சென்னை நகராட்சி நிர்வாக ஆணையர் மூலம் கேட்டுக் கொள்ளப்பட்டது. இதை தொடர்ந்து தமிழ்நாடு குடிநீர் வடிகால் வாரிய மேலாண்மை இயக்குனர் மூலம் ஆய்வு பணிகள் மேற்கொண்டு விரிவான திட்ட மதிப்பீடு தயாரிக்க அறிவுறுத்தப்பட்டது.



புதிய குடிநீர் திட்டத்திற்கான மாதிரி வரைபடத்தை படத்தில் காணலாம்.

புதிய குடிநீர் அபிவிருத்தி திட்டம்

நாமக்கல் நகராட்சியின் தற்போதைய மக்கள் தொகை 1 லட்சத்து 20 ஆயிரத்து 957 ஆகும். 2048-ம் ஆண்டு 1 லட்சத்து 84 ஆயிரத்து 682 பேர் இருப்பார்கள் என கணக்கிடப்பட்டு உள்ளது. தற்போது நாள் ஒன்றுக்கு நபர் ஒருவருக்கு 135 லிட்டர் வீதம், தற்போதைய தேவை 13.23 மில்லியன் லிட்டர், 2048-ம் ஆண்டு குடிநீர் தேவை 22.09 மில்லியன் லிட்டர் ஆகும்.

இந்த தண்ணீரை ஜேடர்பாளையம் அணைக்கட்டு பகுதியில் இருந்து எடுக்க புதிய குடிநீர் அபிவிருத்தி திட்டம் உருவாக்கப்பட்டு உள்ளது. இந்த திட்டம் குறித்து நேற்று தமிழ்நாடு குடிநீர் வடிகால் வாரிய நிர்வாக பொறியாளர் சந்திர சேகரன் நேற்று நகராட்சி அதிகாரிகள் மற்றும் கவுன்சிலர்களுக்கு விளக்கம் அளித்தார்.

அப்போது அவர் கூறியதாவது:-

இந்த திட்டத்தில் காவிரி ஆற்றில் உள்ள நீர் சேகரிப்பு கிணற்றில் இருந்து 700 மில்லி மீட்டர் எம்.எஸ்.குழாய் மூலம் நீர் உறிஞ்சப்பட்டு, சுத்திகரிக்கப்படுகிறது. நீரானது சுத்திகரிப்பு நிலையத்தில் இருந்து பைப்-லைன் மூலம் கொண்டு வரப்பட்டு, தும்மங்குறிச்சியில் உள்ள 9.15 லட்சம் லிட்டர் அளவுள்ள தரைமட்ட நீர்த்தேக்க தொட்டிக்கு ஏற்றப்படும். இந்த தொட்டியில் இருந்து 4 நீர் உந்துக் குழாய் மற்றும் 2 துணை நீர் உந்து குழாய்கள் மூலம் புதிதாக உத்தேசிக்கப்பட்டு உள்ள 9 மேல்நிலை நீர்த்தேக்க தொட்டிகளுக்கு நீர் ஏற்றப்பட்டு, 255 இலோ மீட்டருக்கு பகிர்மான குழாய்கள் மூலம் குடிநீர் வினியோகிக்க உத்தேசிக்கப்பட்டு உள்ளது.

ரூ.190.40 கோடி

இந்த திட்டத்தின் மதிப்பு ரூ.190 கோடியே 40 லட்சம் ஆகும். இந்த திட்டம் நிறைவடையும் போது நகராட்சியில் உள்ள அனைத்து பயனாளிகளுக்கும் நாள் ஒன்றுக்கு நபர் ஒருவருக்கு 135 லிட்டர் வீதம் காவிரி குடிநீர் கிடைக்கும். 25 இருக்காது. இந்த திட்டம்

மாவட்ட வேலைவாய்

உதவி இயக்குனராக

நாமக்கல் மாவட்ட வேலைவா
யாற்றி வந்தவர் மகேஸ்வரி. இவர் கட
மாதம் 30-ந் தேதி நாமக்கல்லில் பொ
தற்போது அவர் வேலைவாய்ப்பு
ராக பதவி உயர்வு பெற்று தர்மபுரிக்
நாமக்கல் மாவட்ட வேலைவாய்ப்
கோவை மாவட்ட வேலைவாய்ப்பு
பாக கவனித்து வருவதாக வேலைவ
லர்கள் தெரிவித்தனர்.

படைவிடு அரசு

மாணவர்களுக்கு வ

குமா

நாமக்கல் மாவட்டம், படைவீடு
யில் 6-ம் வகுப்பில் புதிதாக சேர்க்க
களுக்கு வரவேற்பு விழா பள்ளி த
பாகரன் தலைமையில் நடந்தது.
ஊக்கம் மற்றும் உற்சாகம் ஊட்டும்
பிரியங்கா, பள்ளி மாணவத்தலை
ஆசியோர் வரவேற்று பேசினார்க
ரியைகள் மற்றும் மாணவ, மாணவ
முடிவில் ஆசிரியர் குழு உறுப்
கூறினார்.

நாமக்கல் மண்

கறிக்கோழி விலை கிலோ

நாமக்கல் மண்டலத்தில் கறிக்
பணை செய்யப்பட்டு வந்தது.
இந்த நிலையில் நேற்று பல்ல
டத்தில் நடந்த கறிக்கோழி
ஒருங்கிணைப்பு குழு கூட்டத்
தில் இலோவுக்கு ரூ.2 உயர்த்த
முடிவு செய்தனர். எனவே
கறிக்கோழி விலை இலோ
ரூ.105 ஆக உயர்ந்து உள்ளது.
இதனால் பண்ணையாளர்கள்
மகிழ்ச்சி அடைந்து உள்ள
னர்.

முட்டை கொள்முதல் விலை 435 காசுகளாகவும், முட்டைக்கோழிவிலை இலோ ரூ.81 ஆகவும் நீடிக்கிறது. அவற்றின் விலைகளில் மாற்றம் செய்யப்படவில்லை என பண்ணையாளர்கள் தெரிவித்தனர்.

நிறைவேற்றப்பட உள்ளது. இதற்கான திட்ட மதிப்பீடு ஆய்வு பணிகள் நிறைவு பெற்றுள்ளது. இந்த திட்ட மதிப்பீட்டை வருகிற 8-ந் தேதி அரசிடம் சமர்பிக்க உள்ளோம்.

இவ்வாறு அவர் கூறினார்.

திட்டம் பற்றிய முழு விவ

லர்கள், பணியாளர்களுக்கு

ஜேடர்பாளையம்- நாமக்கல் இடையே குடிநீர்த் திட்டப் பணிகள் விரைவில் தொடக்கம்

நாமக்கல் நகர்மன்றத் தலைவர் கரிகாலன்

கூட்டத்தில் பேசுகிறார் நகர்மன்றத் தலைவர் இரா.கரிகாலன்.

நாமக்கல், ஜூன் 30: ஜேடர்பாளையம்- நாமக்கல் இடையே குடிநீர்த் திட்டப் பணிகள் விரைவில் தொடங்கப்படும் என்று, நாமக்கல் நகர்மன்றத் தலைவர் இரா. கரிகாலன் தெரிவித்தார்.

வியாழக்கிழமை நடைபெற்ற நாமக்கல் நகர்மன்றக் கூட்டத்திற்கு இரா.கரிகாலன் தலைமை வகித்தார். ஆணையர் எம்.செந்தில்முருகன், துணைத் தலைவர் தே.சேகர் உள்ளிட்டோர் பங்கேற்றனர்.

வெங்கடேசன்: பேருந்து நிலையத்தில் அண்மையில் ஆக்கிரமிப்புகள் அகற்றப்பட்டன. ஆனால், அந்த இடங்கள் மீண்டும் ஆக்கிரமிக்கப்பட்டுள்ளன. இந்த ஆக்கிரமிப்புகளை நிரந்தரமாக அகற்ற நடவடிக்கை எடுக்க வேண்டும். நகரில் நாய் தொல்லை அதிகரித்துள்ளது. இதை கட்டுப்படுத்த நடவடிக்கை எடுக்க வேண்டும்.

ஷேக்நவீத்: குடியிருப்புப் பகுதிக்குள் மக்களுக்கு இடையூறாக உள்ள விலங்குகளை கூட்டுக் கொல்ல மத்திய அரசு உத்தரவு பிறப்பித்துள்ளது. அதன் அடிப்படையில் நாமக்கல் நகரில் நாய்களை கூட்டுக் கொல்ல அரசிடமிருந்து உரிய உத்தரவை நகர்மன்ற நிர்வாகம் பெற வேண்டும்.

சந்தியா: தில்லைபுரம் பகுதியில் ஏராளமான குறுக்குச்சாலைகள் உள்ளன. இதனால், அங்கு அடிக்கடி விபத்துகள் நிகழ்வதால், கூடுதல் வேகத் தடைகள் அமைக்க வேண்டும்.

எ.பி.சரவணன்: மழைக் காலத்தில் நாமக்கல் குட்டைத்தெரு பகுதியில் தண்ணீர் வெளியேற முடியாமல் குடியிருப்புகளுக்குள் புகுந்து விடுகிறது. இங்கு மழை நீர் வெளியேறும் வகையில் புதிய பாலங்கள் அமைக்க வேண்டும்.

குப்புசாமி: 39 வார்டுகளிலும் புதிதாக தெருவிளக்குகள் அமைப்பது குறித்து 6 மாதங்களுக்குள் மன்றக் கூட்டத்தில் விவாதிக்கப்பட்டது. ஆனால், இதுவரை ஒரு இடத்தில் கூட தெருவிளக்குகள் அமைக்கவில்லை.

உறுப்பினர்களின் கேள்விகளுக்குப் பதிலளித்து நகர்மன்றத் தலைவர் இரா.கரிகாலன் பேசியது:

காவிரி ஆற்றில் ஜேடர்பாளையத்திலிருந்து நாமக்கல் நகருக்கு ரூ.200 கோடி மதிப்பில் புதிய குடிநீர்த் திட்டம் செயல்படுத்தப்படுகிறது. இந்த பணி விரைவில் தொடங்கப்படும். இதன்மூலம் நாமக்கல் நகராட்சி மற்றும் இணைக்கப்பட்ட 9 ஊராட்சிகளுக்கும் குடிநீர் விநியோகம் செய்யப்படும். இந்த குடிநீர்த் திட்டம் நாமக்கல் நகரின் அடுத்த 25 ஆண்டுகளுக்கான குடிநீர்த் தேவையை கருத்தில் கொண்டு செயல்படுத்தப்படவுள்ளது என்றார்.

முன்னதாக மீண்டும் தமிழக முதல்வராகப் பொறுப்பேற்றுள்ள ஜெயலலிதாவுக்கு மன்ற கூட்டத்தில் தலைவர் மற்றும் உறுப்பினர்கள் சார்பில் வாழ்த்து தெரிவிக்கப்பட்டது. இதே போல, நாமக்கல் மாவட்டத்தில் பி.தங்கமணி, வி.சரோஜா ஆகியோரை அமைச்சர்களாக நியமித்த முதல்வருக்கு நன்றி தெரிவித்தும், இரண்டாவது முறையாக நாமக்கல் தொகுதி சட்டப்பேரவை உறுப்பினராக கே.பி.பி.பாஸ்கரை தேர்வு செய்த வாக்காளர்களுக்கு நன்றி தெரிவித்தும் தீர்மானம் நிறைவேற்றப்பட்டது.

தினமும் 135 லிட்டர் விநியோகம்

புதிய குடிநீர்த் திட்டப் பணிகள் குறித்து தமிழ்நாடு குடிநீர் வடிகால் வாரிய செயற்பொறியாளர் டி.சந்திரசேகரன், நிர்வாகப் பொறியாளர் சி.மதியழகன் ஆகியோர் கூட்டத்தில் விளக்கமளித்தனர்

இந்தத் திட்டம் குறித்து அவர்கள் கூறியது: நகராட்சிப் பகுதியில் தற்போது நபர் ஒருவருக்கு தினமும் 90 லிட்டர் குடிநீர், இணைக்கப்பட்ட பகுதிக்கு 40 லிட்டர் குடிநீர் விநியோகம் செய்யப்படுகிறது.

ஜேடர்பாளையம் குடிநீர்த் திட்டம் செயல்படுத்தப்பட்டால் அனைவருக்கும் தினமும் 135 லிட்டர் காவிரி குடிநீர் விநியோகம் செய்யப்படும். மேலும், இப்போது நாமக்கல் நகருக்கு மோகனூர் காவிரி ஆற்றில் இருந்து 3 குடிநீர்த் திட்டங்கள் மூலம் நாமக்கல் நகருக்கு குடிநீர் விநியோகம் செய்யப்பட்டு வருகிறது.

இப்போது தனித்தனியாக உள்ள 3 குடிநீர்த் திட்டங்களையும் ஒருங்கிணைத்து ஒரே குடிநீர்த் திட்டமாகச் செயல்படுத்த புதிதாக குடிநீர் குழாய் அமைக்கும் பணி நடைபெற்று வருகிறது. இதற்காக அணியாபுரத்தில் இப்போது உள்ள நீரேற்று நிலையம் அருகில் புதிதாக சுமார் 2 லட்சம் லிட்டர் கொள்ளளவு கொண்ட தரைமட்ட நீர்த் தேக்கத் தொட்டி கட்டப்படும் என்றனர்.

மொத்தம், 500 மூட்டை பாக்கி, ஐந்து லட்சம்

துவங்கிய பட்டயத்தேர்வில் பங்கேற்று தேர்வு எழுதிய தேர்வர்கள்.

ரூ.200 கோடி மதிப்பில் குடிநீர் திட்டம்: நகராட்சி சேர்மன் தகவல்

நாமக்கல், ஜூலை 1–

நாமக்கல் நகராட்சியில், 200 கோடி ரூபாய் மதிப்பில், புதிய குடிநீர் திட்டம் செயல்படுத்தப்பட உள்ளதாக, நாமக்கல் நகராட்சி கூட்டத்தில் தலைவர் பேசினார்.

நாமக்கல் நகராட்சி கவுன்சில் கூட்டம், தலைவர் கரிகாலன் தலைமையில் நடந்தது.

கூட்டத்தில் கவுன்சிலர் பேசிய விவரம்:

வெங்கடேசன் (அ.தி.மு.க.,): பஸ் நிலையத்தில், சில நாட்களுக்கு முன் ஆக்கிரமிப்புகள் அகற்றப்பட்டன. ஆனால், சில மணி நேரத்திலேயே அந்த இடங்கள் மீண்டும் ஆக்கிரமிக்கப்பட்டுள்ளன.

ஷேக்நவீத் (காங்.,): குடியிருப்பு பகுதிக்குள், மக்களுக்கு இடையூறாக உள்ள விலங்குகளை சுட்டுக்கொல்ல மத்திய அரசு உத்தரவு பிறப்பித்துள்ளது. இதன்படி, நாமக்கல் நகரில் நாய்களை சுட்டுக்கொல்ல அரசிடமிருந்து உரிய உத்தரவை நகராட்சி நிர்வாகம் பெற வேண்டும்.

சந்தியா (அ.தி.மு.க.,) : தில்லை புரம் பகுதியில் ஏராளமான குறுக்குச்சாலைகள் உள்ளன. இங்கு, அடிக்கடி விபத்துகள் நடப்பதால், வேகத்தடைகளை ஏற்படுத்த வேண்டும்.

சரவணன் (தி.மு.க.,): மழைக்காலத்தில், குட்டைத்தெரு பகுதியில் தண்ணீர் வெளியேற முடியாமல் குடியிருப்புகளுக்குள் புகுந்து விடுகிறது.

குப்புசாமி (அ.தி.மு.க.,): புதிதாக தெருவிளக்குகள் அமைப்பது குறித்து, மன்றக் கூட்டத்தில் விவாதிக்கப்பட்டது. ஆனால், தெருவிளக்குகள் அமைக்கவில்லை.

சேர்மன் கரிகாலன்: உறுப்பினர்கள் கோரிக்கைகள் குறித்து, அதிகாரிகளிடத்தில் பேசி நடவடிக்கை எடுக்கப்படும். காவிரி ஆற்றில், ஜேடர்பாளையத்திலிருந்து நாமக்கல் நகருக்கு, 200 கோடி ரூபாய் மதிப்பில் புதிய குடிநீர் திட்டம் செயல்படுத்தப்பட உள்ளது.

இவ்வாறாக விவாதம் நடந்தது.

மலர்

டி.வி. ராமசுப்பையர்

ரோடு, கோயம்புத்தூர், திருச்சி, மதுரை, திருநெல்வேலி, நாகர்கோவில் ◆ 300 காசு ◆ மலர் 65 ◆ இதழ் 297

ரூ.200 கோடியில் குடிநீர் திட்டம்

நாமக்கல்லுக்கு விரைவில் வருது

நாமக்கல், ஜூலை 1-

நாமக்கல் நகராட்சிக்கு உலக வங்கி நிதியுதவியுடன் ரூ.200 கோடி மதிப்பீட்டில் புதிய குடிநீர் திட்டம் விரைவில் துவக்கப்படும் என்று நகராட்சித் தலைவர் கரிகாலன் தெரிவித்தார்.

நாமக்கல் நகராட்சி நகர் மன்றக்கூட்டம் அதன் தலைவர் கரிகாலன் தலைமையில் நடைபெற்றது. நகராட்சிக்கூட்டம் நிறைவில் நாமக்கல் நகராட்சிக்கு தமிழக அரசு ஒப்புதல் அளித்துள்ள புதிய குடிநீர் திட்டம் குறித்த ஆலோசனைக் கூட்டம் நடைபெற்றது. தமிழ் நாடு குடிநீர் வாரிய செயற் பொறியாளர் சந்திர சேகரன், உதவி பொறியாளர் மதியழகன் ஆகியோர் முன்னிலையில் நகராட்சி கவுன்சிலர்களுக்கு புதிய குடிநீர் திட்டப்பணிகள் குறித்து வீடியோப்படம் மூலம் விளக்கம் அளிக்கப்பட்டது. நிகழ்ச்சியில் நகராட்சித்தலைவர் கரிகாலன் பேசியதாவது:

நாமக்கல் நகராட்சியில் ஏற்கனவே 30 வார்டுகள் இருந்தன. கடந்த 2010ம் ஆண்டு நகராட்சியுடன் 9 பஞ்சாயத்துக்களை இணைக்க [illegible] நிலையத்திற்கு போருக்கும் தேவையான குடிநீர் வழங்குவதற்காக புதிய குடிநீர் திட்டம் வழங்க வேண்டும் என்று நகராட்சிக் கூட்டத்தில் தீர்மானம் நிறைவேற்றப் பட்டு தமிழக அரசுக்கு அனுப்பி வைக்கப் பட்டது.

மேலும் கடந்த 2013ம் ஆண்டு சென்னையில் நடைபெற்ற கலெக்டர்கள் மாநாட்டில் இத்திட்டத்தின் தேவை குறித்து மாவட்ட கலெக்டர் தட்சிணாமூர்த்தி வேண்டுகோள் விடுத்தார். அமைச்சர் தங்கமணி, நாமக்கல் எம்எல்ஏ பாஸ்கர் ஆகியோரும் இத்திட்டத்தின தேவை குறித்து தமிழக அரசுக்கு வேண்டுகோள் விடுத்தனர். இதைத் தொடர்ந்து நாமக்கல் நகராட்சிக்கு ஜேடர்பாளையம் காவிரி தடுப்பணையில் இருந்து புதிய குடிநீர் திட்டத்தை நிறைவேற்ற தமிழக முதல்வர் ஜெயலலிதா ஒப்புதல் அளித்தார்.

இத்திட்டத்திற்காக கபிலர்மலை அருகே 8 ஏக்கர் பரப்பில் குடிநீர் சுத்திகரிப்பு மையம் அமைக்க நன்கொடையாளர்கள் மூலம் நிலம் பெறப்பட்டுள்ளது. பின்னர் அங்கிருந்து தும்மங்குறிச்சியில் அமைக்கப்பட உள்ள புதிதாக இணைக்கப்பட்ட பகுதிகளில் அமைக்கப் பட உள்ள 9 மேல்நிலைத் தொட்டிகளுக்கும், ஏற்கனவே உள்ள நகராட்சிப் பகுதியில் உள்ள 11 மேல் நிலைத் தொட்டிகளுக்கும் குடிநீர் ஏற்றப்பட்டு பொது மக்களுக்கு குடிநீர் விநியோகம் செய்யப்படும். நாமக்கல் நகராட்சிக்கு ஏற்கனவே மோகனூர் காவிரி ஆற்றில் இருந்து 3 குடிநீர் திட்டங்கள் மூலம் குடிநீர் கொண்டு வரப்பட்டு விநியோகம் செய்யப்படுகிறது.

நாமக்கல் - மோகனூர் ரோடு விரிவாக்கம் செய்யப்படுவதால் இந்த 3 குடிநீர் திட்டங்களும் ஒருங்கிணைக்கப்பட்டு ஒரே பைப்லைன் மூலம் குடிநீர் கொண்டுவர ஏற்பாடுகள் செய்யப்பட்டு வருகிறது.

கடந்த 5 ஆண்டுகளில் தமிழகத்தில் எந்த நகராட்சிக்கும் இல்லாத வகையில் நாமக்கல் நகராட்சிக்கு ரூ.200 கோடி மதிப்பிலான புதிய குடிநீர் திட்டத்திற்கு தமிழக முதல்வர் ஜெயலலிதா அனுமதி அளித்துள்ளார். இந்த திட்டம் உலக வங்கி நிதி உதவியுடன் நிறைவேற்றப்பட உள்ளது. கடந்த வாரம் சென்னையில் உலக வங்கி [illegible] திட்டம் குறித்து 99 சதவீதம் உலக வங்கி அலுவலர்கள் ஒப்புதல் அளித்துள்ளனர். வருகிற ஜூலை 7ம் தேதி சென்னையில் உலக வங்கி அதிகாரிகளுடன் நடைபெறும் கூட்டத்தில் இத்திட்ட மதிப்பீடு குறித்து இறுதி செய்யப்படும்.

அதன்பிறகு தமிழக முதல்வரின் ஒப்புதல் கிடைத்தவுடன் புதிய குடிநீர் திட்டம் துவக்கப்படும். அதைத்தொடர்ந்து விரைவில் இத்திட்டப் பணிகள் நிறைவேற்ற நடவடிக்கைகள் எடுக்கப்படும்.

இந்த புதிய குடிநீர் திட்டம் நிறைவேற்றப் பட்டால் வருகிற 25 ஆண்டுகளுக்கு நாமக்கல் நகராட்சிப் பகுதியில் வசிக்கும் அனைவருக்கும் தினசரி 135 லிட்டர் வீதம் தடையின்றி குடிநீர் வழங்கப்படும். இவ்வாறு நகராட்சித்தலைவர் கரிகாலன் கூறினார்.

Annexure-9

Chlorine handling –storage facilities, storage/ handling method – safety precautions /Safe Work Practices

Tasks that require safe work procedures include

• Cylinder change

• Leak detection and control

• Container repair and use of the repair kit

• Checking on a worker working alone

• Respirator program

• Disposal of damaged containers

• Routine maintenance of equipment (for example, chlorinators, piping, and steam heating systems)

Changing chlorine cylinders:

1. Turn on the light and visually ensure that the room is safe to enter (there may be visible signs of damage).

2. Put on appropriate personal protective equipment (be specific about the type of equipment). This procedure requires a respirator other than an escape respirator.

3. Turn on the exhaust ventilation before entering the room.

4. Close the main chlorine container valve.

5. Allow the system to purge itself of chlorine. Ensure that the float drops to the bottom of the feed-rate indicator (rotameter). Verify that

there is a high vacuum and that the weigh scale reads zero.

6. Loosen the chlorinator (auxiliary valve or vacuum regulator) and remove it from the empty cylinder.

7. Replace the cylinder cap on the empty chlorine cylinder and remove the cylinder to secured storage.

8. Secure the new cylinder into place.

9. Remove the protective hood from the new cylinder.

10. Ensure that there is no chlorine leaking from the packing gland. Use ammonia vapour from the ammonia test bottle, which contains a strong ammonia solution

11. Ensure that the cylinder valve is closed. Do not open the valve yet.

12. Remove the cylinder outlet cap and check that the cylinder outlet face is clean and smooth.

13. Using a new washer, connect the vacuum regulator or the yoke assembly (be specific for the system in use) to the valve outlet using the supplied wrench only.

Note: Never use oil-based material or water to clean the mating surfaces.

14. Crack open the chlorine cylinder valve and then quickly close it again. This will let enough chlorine into the lines to charge them. The valve should open with no more than a sharp rap from the heel of your hand. Never use a “helper” wrench or a larger wrench than the one supplied. If the valve will not open, carefully loosen the packing gland slightly.

15. Check all the connections you have made to ensure there are no leaks. Use the vapor from the ammonia test bottle (see step 10). If a leak is indicated, activate the leak control procedure

16. When no leaks are indicated, open the chlorine cylinder valve no more than half a turn and leave the cylinder wrench on the valve.

17. Open any additional system valves (be specific for your facility) and test for leaks as each stage is charged with chlorine.

18. Check for leaks again with the ammonia test bottle to be sure that everything is in order.

19. Ensure that the alarm system is functioning.

20. Turn off the exhaust ventilation and lights and close the door when you leave.

21. Remove your respirator and other personal protective equipment.

Leak detection and control

Steps to be taken if a leak is indicated after a cylinder change and what to do if the chlorine alarm is activated during routine operation of the system.

If the ammonia test indicates a leak after a cylinder change, follow these steps. Note that the worker will already be wearing a respirator:

1. Worker should wear respirator.

2. Immediately close the main cylinder valve.

3. Open (and close) the main cylinder valve and repeat the ammonia test.

4. If a leak is still indicated, make a third and final attempt to get a good seal using a new lead washer.

5. If the leak cannot be corrected after three attempts, remove the cylinder from service and contact the supplier. Ensure that there is no leak from this cylinder with the main valve closed. A different cylinder must be connected to the chlorination system.

6. Leave the chlorine room and remain nearby to restrict access to the room or provide other assistance, as directed, until the chlorine alarm has automatically shut off.

If the chlorine alarm has been activated during routine operation of the system, at least two people must respond. Follow these steps:

1. Approach the location cautiously.

2. If chlorine gas can be smelled in the open, immediately leave the area and activate full emergency procedures. Do not attempt to turn on the exhaust ventilation.

3. If there is no smell of chlorine gas outside the room, put on respiratory protection and check the monitor readout.

4. If the chlorine concentration is less than 10 ppm:

• Put on the appropriate personal protective equipment.

• Enter the room and close the main cylinder valve.

• Turn on the ventilation system and leave the area until the alarm stops.

• While still wearing the respirator, enter the room after the alarm has stopped, isolate the leak, and perform necessary repairs.

Remember that all chlorine lines must be free of oil, grease, and

moisture before re-opening the chlorine cylinder.

5. If the continuous monitor indicates a chlorine concentration greater than 10 ppm, immediately leave the area and activate full emergency procedures. Do not turn on the ventilation system and do not wait downwind of the building for help to arrive.

Note: Never apply water to a chlorine leak. Moist chlorine is more corrosive than dry chlorine and the leak will worsen rapidly if water is applied to it.

Employers must follow these requirements for eye wash and shower facilities:

• Ensure that the facilities have a supply of tempered water — not running cold water. Ensure that workers cannot mistakenly turn on hot water alone.

• Determine the most appropriate location for emergency equipment. It is inappropriate, for example, to install emergency equipment inside the chlorine room because a worker trying to use the emergency equipment during a chlorine leak risks further exposure.

• Take into account the geographical location of the facility when deciding whether or not an outdoor location will be practicable during the winter.

• Do not locate emergency equipment where the public may access and possibly damage it.

First aid kits

Workers must have immediate access to an appropriate first aid kit at each chlorine location. First aid kits may be permanent on-site kits or may be transported to the site by the worker for each visit. In some instances, the first aid kit may need to be located in the worker's vehicle and carried by the worker to the chlorine location.

Storing chlorine

This section describes what you must and must not do when storing chlorine.

Location

• Use signs to clearly identify all areas where chlorine is used or stored. Only qualified personnel are permitted to enter these areas.

• Store chlorine cylinders and containers in a cool, dry, and relatively isolated area, protected from weather and extreme temperatures. If storing cylinders and containers outside, shield them from direct sunlight, unless they are specifically designed for unshaded, outdoor storage.

Note: Never apply heat to pipes, containers, or container valves unless they have been thoroughly purged of chlorine.

• When storing chlorine containers inside, store the containers in a well ventilated building, away from any heat sources

• Store chlorine containers on the lowest working level but not below grade.

• Do not store chlorine near busy roadways or anywhere else where vehicles operate. Chlorine reacts with carbon monoxide to produce

phosgene, an extremely poisonous gas.

• Store cylinders upright and secure them against falling. Cylinders will discharge vapor when upright and discharge liquid when upside-down.

• Store ton containers on their sides, on steel or concrete supports. The supports should be equipped with trunnion wheels so that, if chlorine leaks from the bottom valve, the container can be quickly rotated with the leak at the top to minimize leakage. Discharge ton containers while they are horizontal, with the two valves in a vertical line (vapour from the top valve, liquid from the bottom).

Housekeeping

• Do not store materials that may react violently with chlorine in the same room as chlorine (for example, hydrogen, ammonia, acetylene fuel gases, ether, turpentine, and most hydrocarbons, such as solvents, greases or oils, finely divided metals, and organic matter).

• Store containers with enough room between them to allow for complete accessibility during an emergency.

• Use cylinders and containers on a “first-in, first-out” basis.

• Clearly tag or mark empty cylinders and separate them from full cylinders.

Note: Never assume a container is empty and therefore non-hazardous even though it may weigh empty.

Handling chlorine

This section describes what you must and must not do when handling chlorine.

Moving containers

• Handle containers with care while moving or storing them. Do not allow containers to strike objects and do not drop containers.

• Do not use slings or magnetic devices to move chlorine containers.

• Use new gaskets as recommended by the chlorine supplier each time a cylinder or container is connected.

• Follow the chlorine supplier's recommended disposal procedures for leaking containers.

• Do not modify, alter, or repair containers and valves. Only the supplier should carry out these tasks.

Valves

• Ensure that cylinders have valve protection hoods in place when not connected to a system.

• Do not lift a cylinder by its valve protection hood. The hood is not designed to carry the weight of a cylinder.

• If possible, open valves by applying a steady force to a 200 mm (8 in.) wrench, without applying an impact force and without using an extension on the wrench. If this does not work, apply a light impact force by smacking the wrench with the heel of your hand.

• Do not use a wrench longer than 200 mm (8 in.) to open or close valves. Do not use tools such as pipe wrenches or hammers. This

will help prevent valve damage that could cause leaks. Valves on cylinders and ton containers are designed to deliver full volume after one complete counterclockwise turn. Valves may be damaged if turned beyond this point. Immediately return containers with damaged or inoperable (but not leaking) valves to the supplier.

• If the valve is very difficult to open, loosen the packing nut slightly. Tighten the packing nut after the valve is opened or closed.

Repair and maintenance

Employers are responsible for providing written preventive maintenance procedures and written emergency procedures to any person who works on a chlorine system. Workers should be familiar with these procedures before carrying out repairs or maintenance on the chlorine system. Qualified workers must supervise the cleaning and repairing of chlorine systems. Workers must be familiar with all the hazards and the safeguards necessary to perform the work safely.

Hazard alert: Moisture causes chlorine to rupture steel pipe There was enough moisture in a chlorine line for the chlorine to react with the mild steel pipe. The pipe ruptured, releasing over 45 kg (100 lb.) of chlorine. The entire delivery pipe was replaced with schedule 80 carbon steel to prevent a recurrence. The chlorine system must be shut off before cleaning or repairing it, and all piping and other equipment must be thoroughly purged with dry air or nitrogen. Vacuum systems can be purged by drawing the remaining chlorine into the process. Do not weld any part of a chlorine system until it has been purged with dry air or nitrogen. After repair or maintenance work and before using the system, the pressurized part of the chlorine system must be pressurized to 150 psi with dry air or nitrogen and tested for leaks by applying soap solution to the outside of joints. Once detectable leaks are repaired, the system must be retested.

Hazard recognition

When repairing or maintaining a chlorine system, taking proper precautions will help avoid a number of hazards. Written procedures for the repair or maintenance of chlorine systems must consider the following hazards and include procedures that will help workers avoid these hazards.

Moisture

Chlorine reacts with moisture to form corrosive acids. Every precaution must be taken to keep chlorine and chlorine equipment free of moisture, including the following steps:

• Close pipes, lines, valves, and containers tightly when not in use to keep moisture out of the system.

• Avoid contact between chlorine and any residual material that drips from the equipment when pipes or lines are being dismantled before repair.

• Dry pipes and lines before use by purging with dry air (air that has a dew point of at least -40°C) or nitrogen.

Foreign material

Pipes, lines, and fittings must have all cutting oils, grease, and other foreign material removed from them before use. Trichloroethylene or other recommended chlorinated solvents may be used; however, follow Regulation requirements and take special precautions because these solvents can produce serious health effects. Never use hydrocarbon or alcohol solvents for cleaning because they can react vigorously with chlorine.

The following may be used as a lubricating pipe dope for threaded joints:

• Linseed oil with graphite or white lead

• Freshly mixed glycerin and litharge

• Teflon tape

A number of available commercial products may also be used. If Teflon tape is used, all remnants must be removed before joints are remade.

Heat

Because iron and steel will ignite in chlorine at about 230°C (450–500°F), all welding or burning must only be done after the chlorine equipment is completely emptied and purged with dry air or nitrogen.

Preventing and controlling exposure

Engineering and administrative controls are the first line of defense against exposure to chlorine. Proper building design and ventilation are important engineering considerations. Alarm systems are also essential in preventing chlorine exposure.

Personal protective equipment is the last line of defense. It is vital in controlling exposure when a chlorine leak has occurred or there is a possibility of such a leak. Personal protective equipment includes eye, skin, and respiratory protection. It also includes emergency equipment such as eye wash and shower facilities and first aid kits.

storage facility:

• Shipping containers and equipment containing chlorine should be located indoors in a suitable, fire-resistant building. If a separate

building is not provided, containers and equipment must be located in a separate enclosure with fire-resistant floors and walls. If possible, chlorine containers should be housed in a room separate from the area where the chlorination equipment is located.

• Chlorine storage enclosures must be designed so that chlorine containers and equipment are located at the lowest level. Sub-surface locations should be avoided. During any new construction, work areas should not be located below the chlorine system.

• Storage rooms with floor areas larger than 19 square meters (rooms approximately 20 ft. x 10 ft.) must have two or more exit doors to ensure accessible escape routes.

• All exit doors must open outwards and must be fitted with panic hardware (a crash bar for easy exit).

• Doors should not be self-locking.

• Each room or building housing chlorine containers or equipment should have a viewing window at least 30 cm (12 in.) square or larger that will provide a clear view of the container and distribution system.

• All openings in chlorination rooms (for example, in walls or ceilings) must be tightly sealed, including electrical conduits.

• Chlorine containers and equipment must not be overheated if heating is provided to prevent freezing, to reduce humidity, or simply for comfort.

• Hoses used to transfer chlorine should be lined with materials that are resistant to chlorine, and constructed with an appropriate structure

braiding layer.

Ventilation

A suitable fan, providing at least 15 air changes per hour, must ventilate the chlorine storage room. Regulations concerning swimming pools, spray pools, and wading pools require at least 30 air changes per hour in the chlorinator room. All ventilation fans must include switches outside the chlorine room or building, even when an inside switch is installed. Because chlorine gas is much heavier than air and tends to collect at floor level, ventilation fan suction must be located at or near floor level. Air inlets must be located to provide cross-ventilation using outside air. Chlorine must not be discharged into areas where it may cause damage or injury, such as schools, worksites, private homes, or shopping centres. Ventilation exhaust must not be positioned where it can be captured by the air intake system of the same or another building.

Administrative controls

Administrative controls include alarm systems and hand-held chlorine detection systems (detector tubes).

Alarm systems

Basic alarm system requirements

• The system must be installed according to the manufacturer's instructions. Routine maintenance procedures and tests must follow a strict timetable, and records must be kept.

• Qualified workers must test and calibrate the system using the

manufacturer's instructions. Systems must be tested for proper operation at least monthly and calibrated at least annually. Systems must also be tested and calibrated after any significant exposure. See the manufacturer's instructions to determine what a significant exposure is.

• Workers must know the alarm level (the chlorine concentration that triggers the alarm). This information must be clearly posted outside the building.

• The pre-set alarm level must be at or below 0.5 ppm. Alarm response procedures must account for minor leaks — action is required at concentrations above 0.25 ppm — that may not require the services of an emergency response team.

• The system must include a visible and audible alarm at the chlorine location, preferably connected to a radio or telephone system to alert the operator in case of emergency.

• In most circumstances the chlorine alarm system will turn off any activated ventilation system. Circumstances in some remote locations, however, allow for exhaust ventilation to be triggered automatically.

Multi-gas instruments

Many portable multi-gas instruments are available that can detect chlorine. Workers must be trained in the proper calibration and use of these devices.

Several hand-held chlorine detection systems are available. These systems use detector tubes to give a direct reading of the chlorine concentration. Workers must be properly trained in detector tube use and maintenance.

Unused detector tubes should be discarded after two years (refrigerated) shelf life. The pump must be checked before each use, using an unopened detector tube.

When taking measurements to determine the extent and severity of a leak outside the enclosure, workers must wear appropriate respiratory protection.

Personal protective equipment

Controlling exposure requires strict attention to chlorine exposure limits. Appropriate eye, skin, and respiratory protection are essential. Workers must be familiar with and understand the requirements of their employer's written exposure control program.

Eye protection

When chlorine gas is in the air, safety glasses and face shields will not protect the eyes. Workers in an area that contains a chlorine concentration that may irritate the eyes (for example, greater than 0.5 ppm) must wear eye protection with a tight seal around the eyes or face to prevent chlorine gas entering the eyes. At this concentration, eye protection will be worn with the required respiratory protection

Skin protection

Emergency response workers who are controlling a serious chlorine leak must have access to full-body protective suits.

First aid

When someone is injured in a chlorine-related incident, first aid can

help reduce the impact of their injuries and prevent further injuries from occurring. The following steps apply to any situation in which someone is injured:

1. Do not panic.

2. Ensure that there is no more danger to yourself or the victim.

3. Using appropriate safety gear, remove the victim from the contaminated area.

4. Send for medical help.

Chlorine inhalation

Someone who has inhaled chlorine may be unconscious, and may have difficulty breathing or may have stopped breathing completely. Follow these steps when treating a victim of chlorine inhalation:

1. Assess the victim's breathing:

• If breathing has stopped, begin artificial respiration and continue until the victim resumes breathing. Pocket masks are recommended for artificial respiration, although the mouth-to mouth method may also be used.

• If the victim is having difficulty breathing (for example, gasping or coughing), place the victim in the most comfortable position, usually semi-sitting.

2. If an oxygen therapy unit and trained personnel are available, administer oxygen at a 10-litre flow.

3. Ensure that the victim is transported to hospital in case the victim

suffers a delayed reaction in the form of pulmonary edema. Any physical exertion, excitement, or apprehension increases the chance and severity of a delayed reaction. Keep the victim warm and completely at rest. Reassure the victim while waiting for assistance and transportation to hospital.

Skin contact

Skin contact with chlorine can result in severe burns. Before attempting to flush a victim's contaminated skin, make sure the victim is breathing properly. Follow these steps:

1. Assess the victim's breathing:

• If breathing has stopped, begin artificial respiration and continue until the victim resumes breathing.

2. As soon as the victim resumes breathing, flush the victim's contaminated skin and clothing with large amounts of water for 30 minutes.

3. Remove all contaminated clothing while flushing.

4. Continue flushing until all traces of chlorine have been removed.

5. Dress obvious burns with sterile gauze and bandage them loosely. Apply insulated cold packs to help reduce pain.

6. Get the victim to hospital.

Notes:

1. Do not attempt to neutralize the chlorine with other chemicals.

2. Do not apply salves, ointments, or medications unless prescribed by

a doctor.

3. Skin contact with liquid chlorine coming straight out of a cylinder can result in frostbite.

Eye contact

Eye contact with chlorine (liquid or gas) for even a short period can cause permanent disability. Flushing must begin within 10 seconds.

Follow these steps:

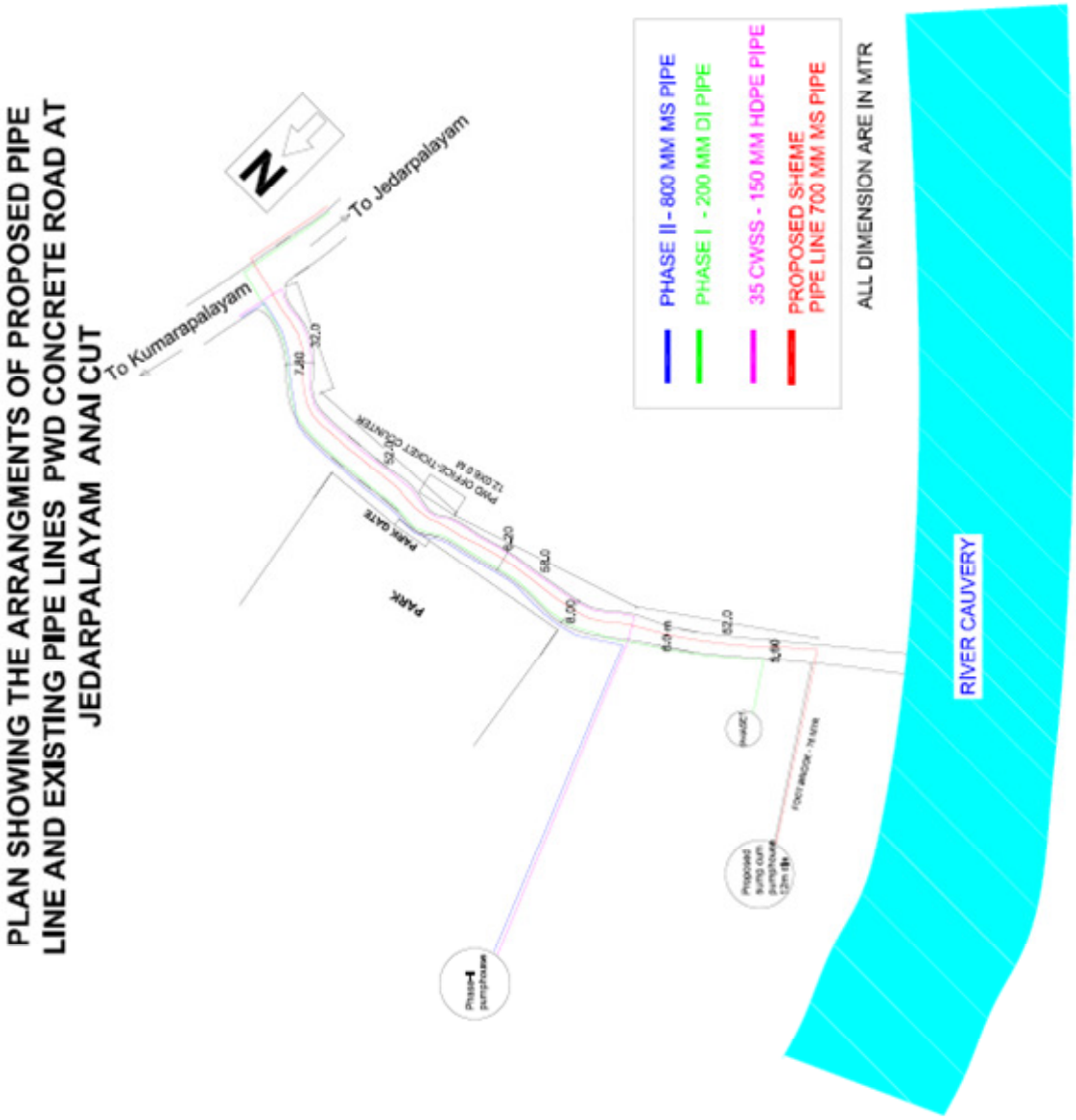
1. Flush the eyes immediately with large amounts of running water (preferably lukewarm) for 30 minutes. Hold the eyelids forcibly apart to ensure full flushing of the eyes and eyelids.

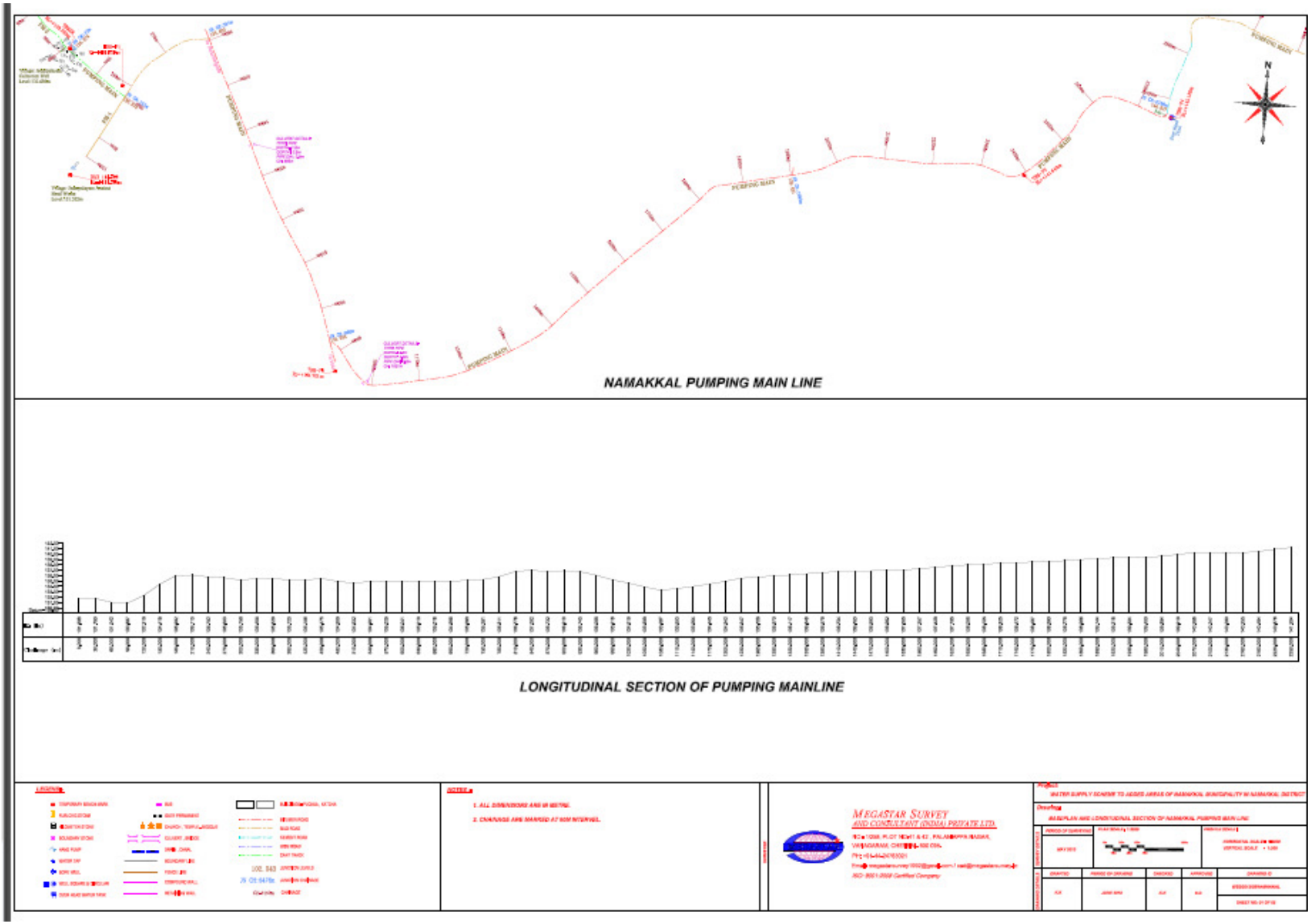
2. After flushing has removed all traces of chlorine, cover both eyes with moistened sterile gauze pads and bandage, enough to keep light out.

3. Apply insulated cold packs to help reduce pain.

4. Get the victim to hospital.

Annexure-10-Strip Plan




NAMAKKAL PUMPING MAIN LINE
LONGITUDINAL SECTION OF PUMPING MAINLINE
LEGENDS
NOTES
1. ALL DIMENSIONS ARE IN METRE.
2. CHAINAGE ARE MARKED AT 50M INTERVEL.
MEGASTAR SURVEY
AND CONSULTANT (INDIA) PRIVATE LTD.
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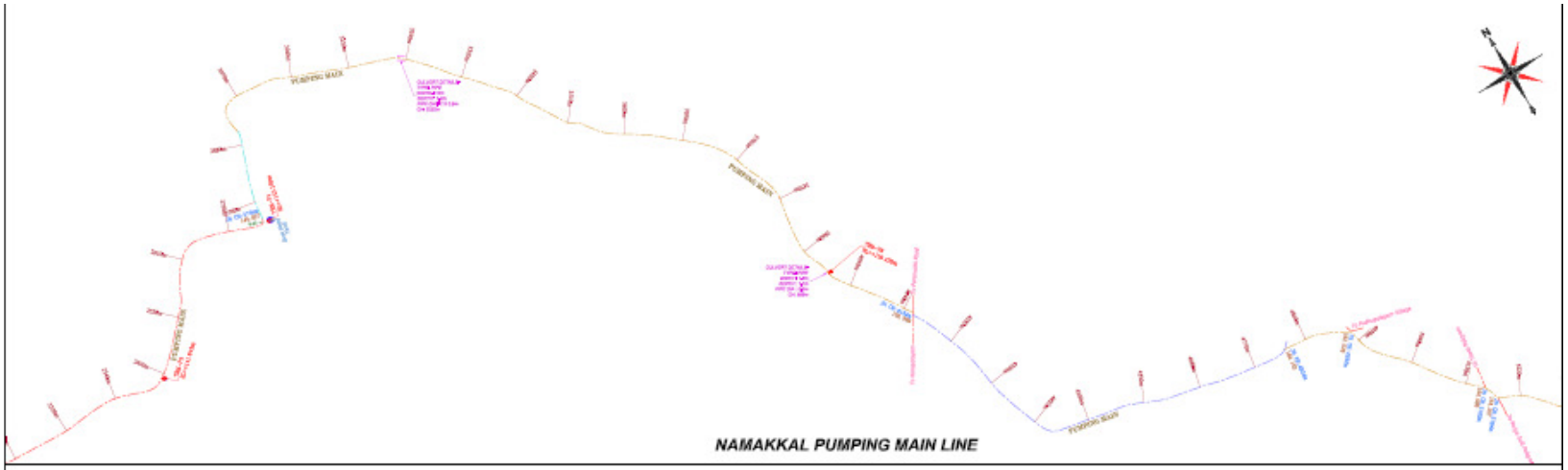
PLAN AND LONGITUDINAL SECTION OF NAMAKKAL PUMPING MAIN LINE



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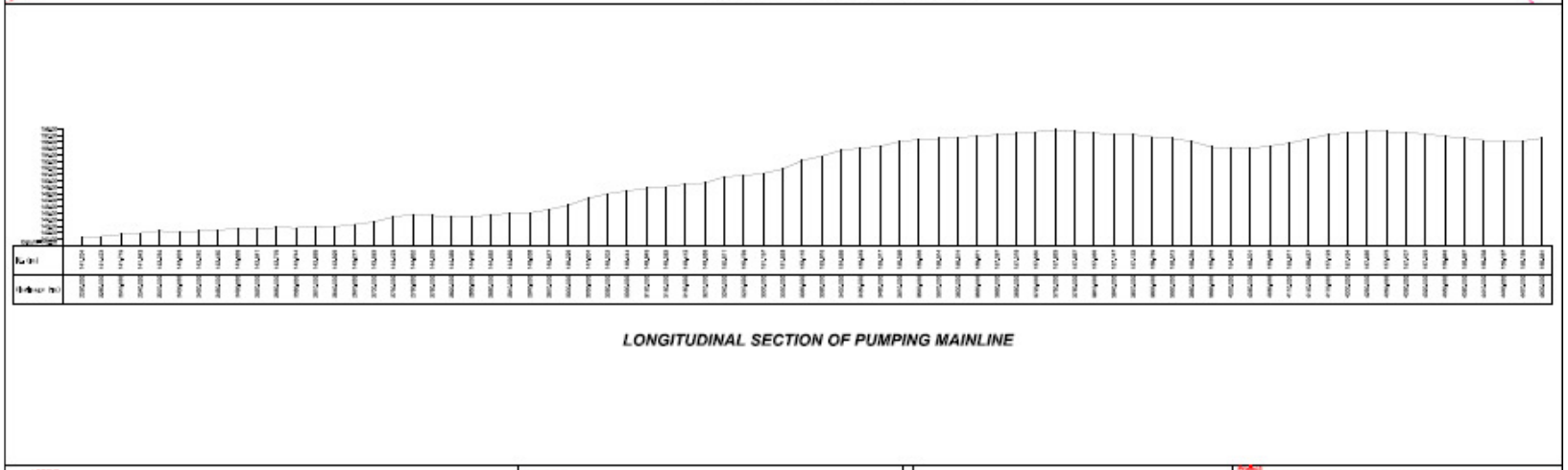

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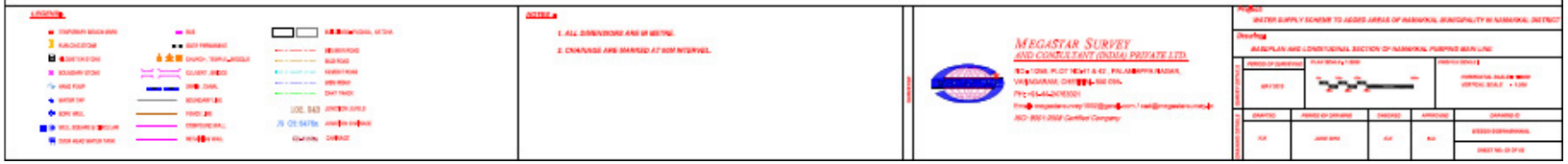

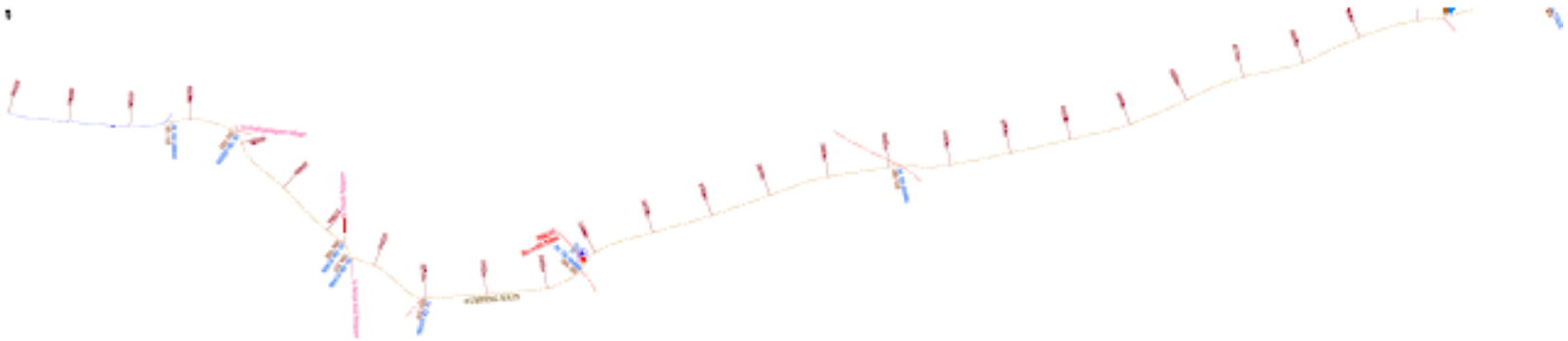

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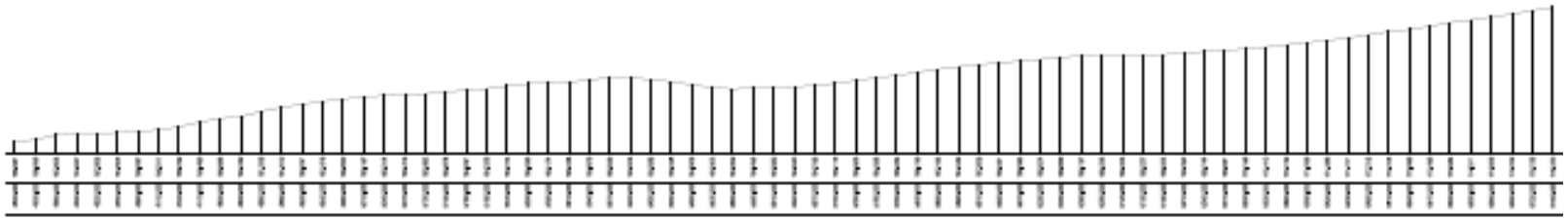

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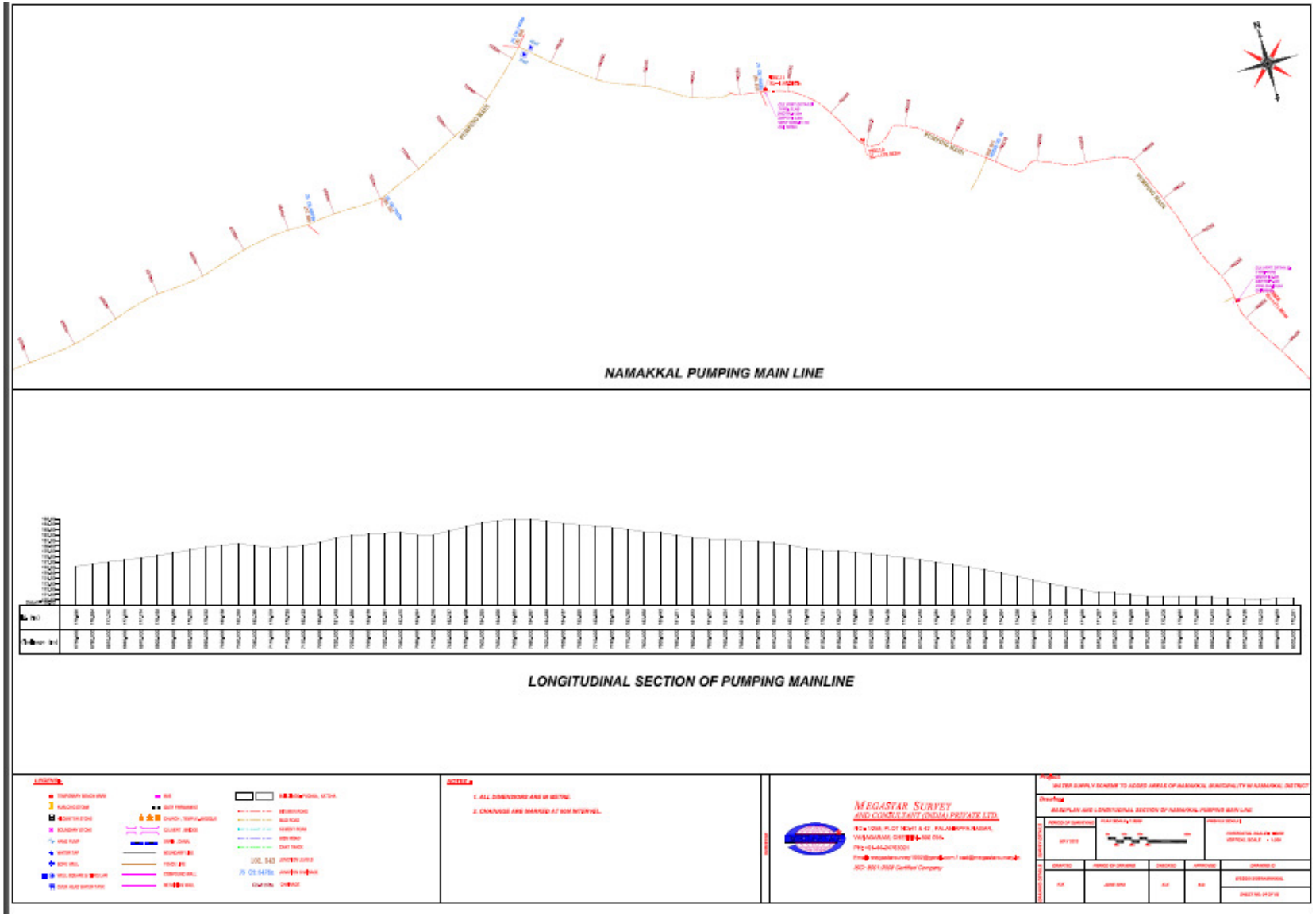
NAMAKKAL PUMPING MAIN LINE
LONGITUDINAL SECTION OF PUMPING MAINLINE
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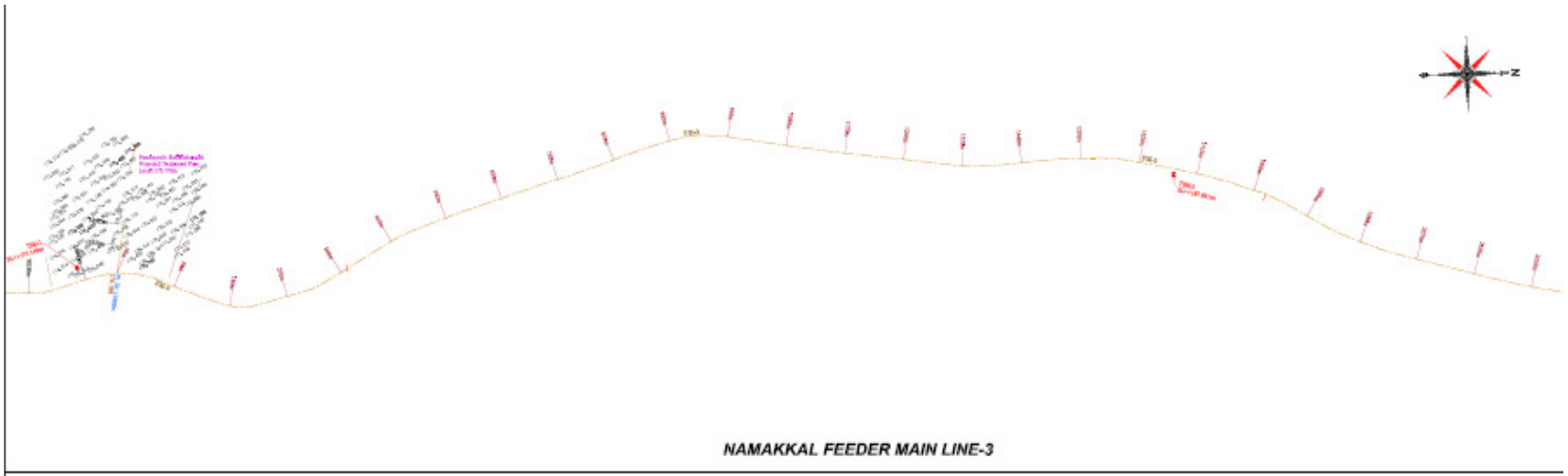
AND CONSULTANT (INDIA) PRIVATE LTD.

NAMAKKAL PUMPING MAIN LINE

LONGITUDINAL SECTION OF PUMPING MAINLINE



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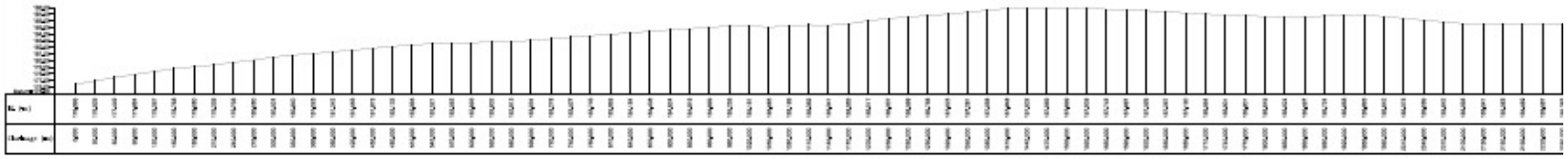

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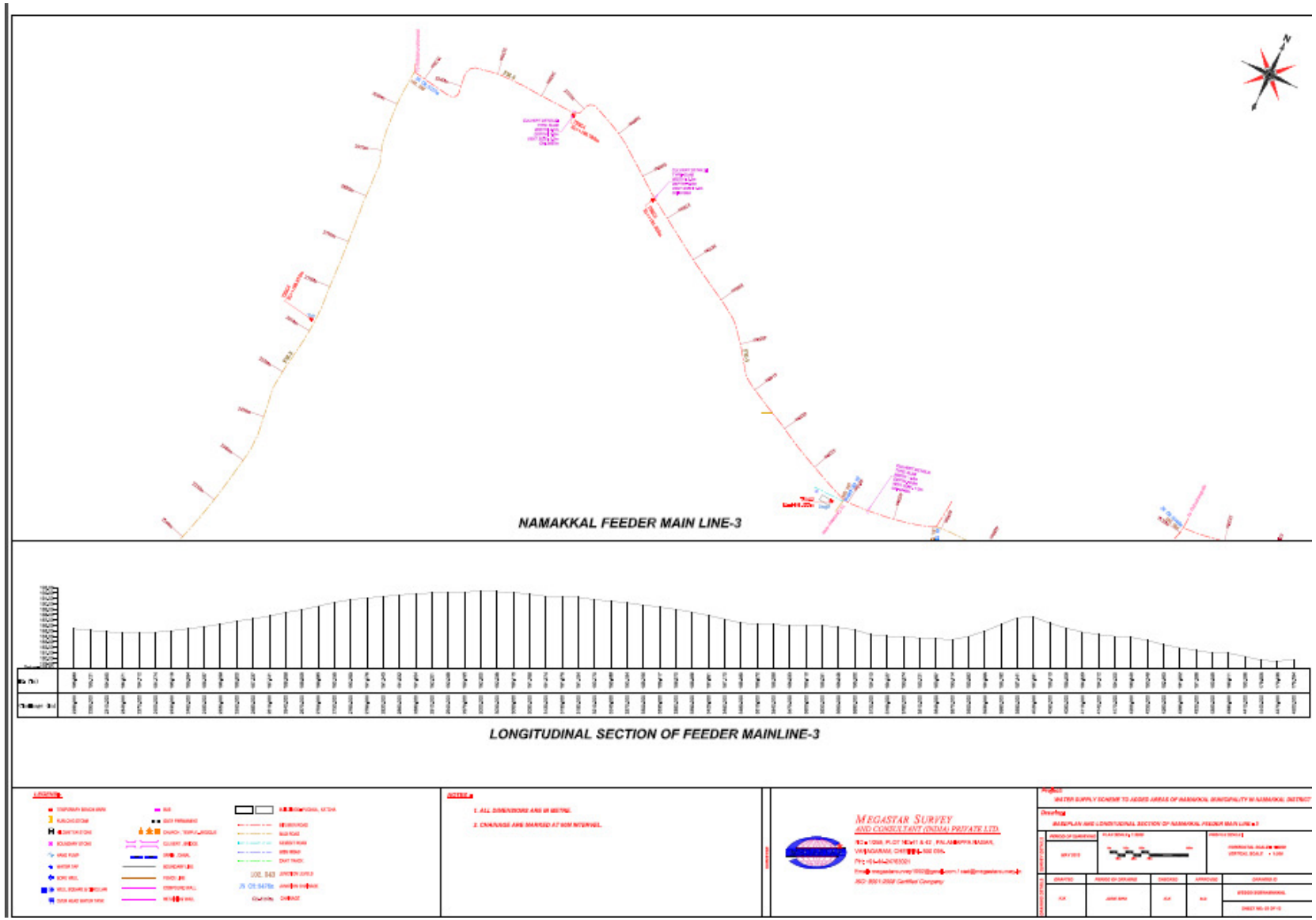
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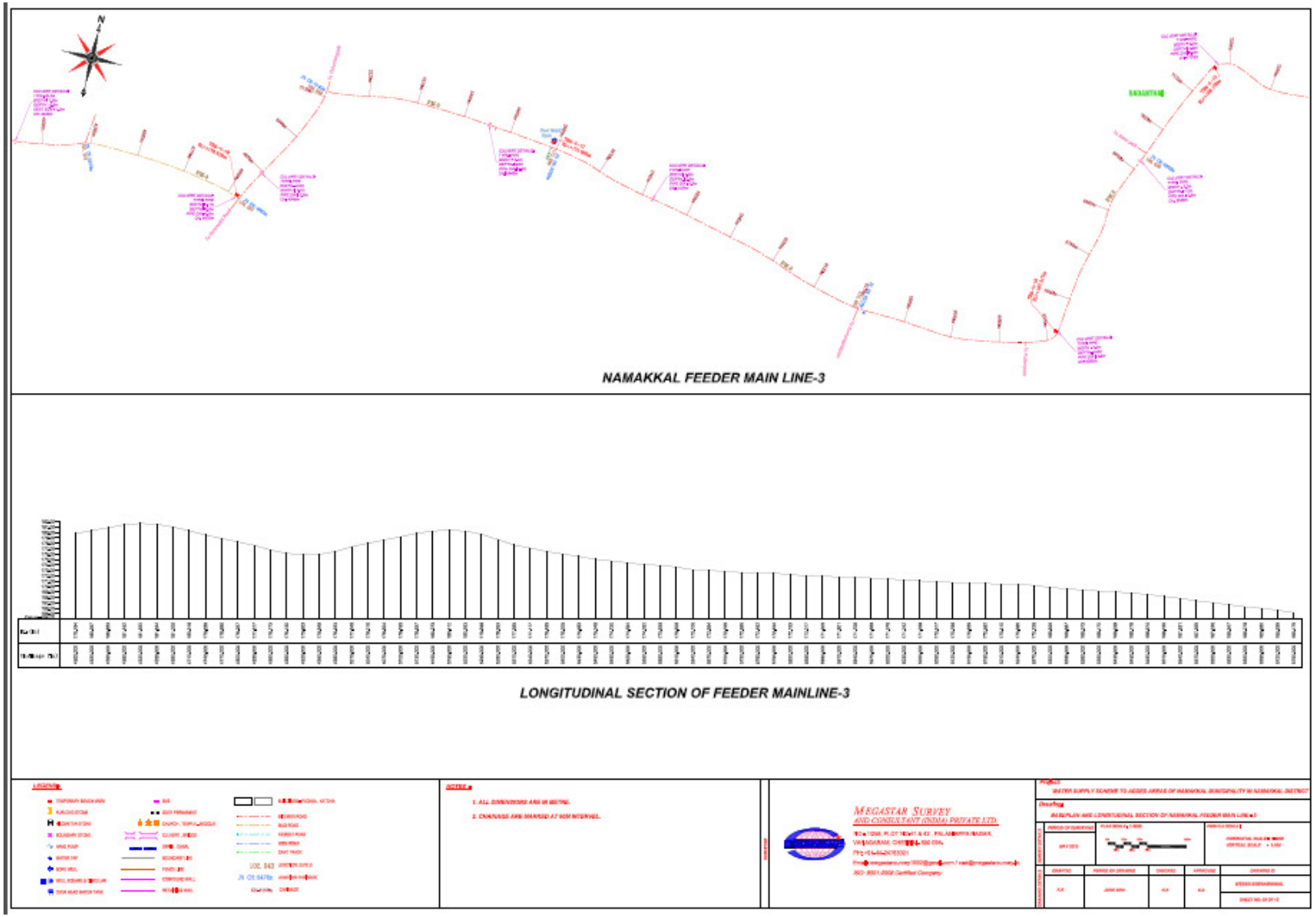
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NAMAKKAL FEEDER MAIN LINE-3
LONGITUDINAL SECTION OF FEEDER MAINLINE-3
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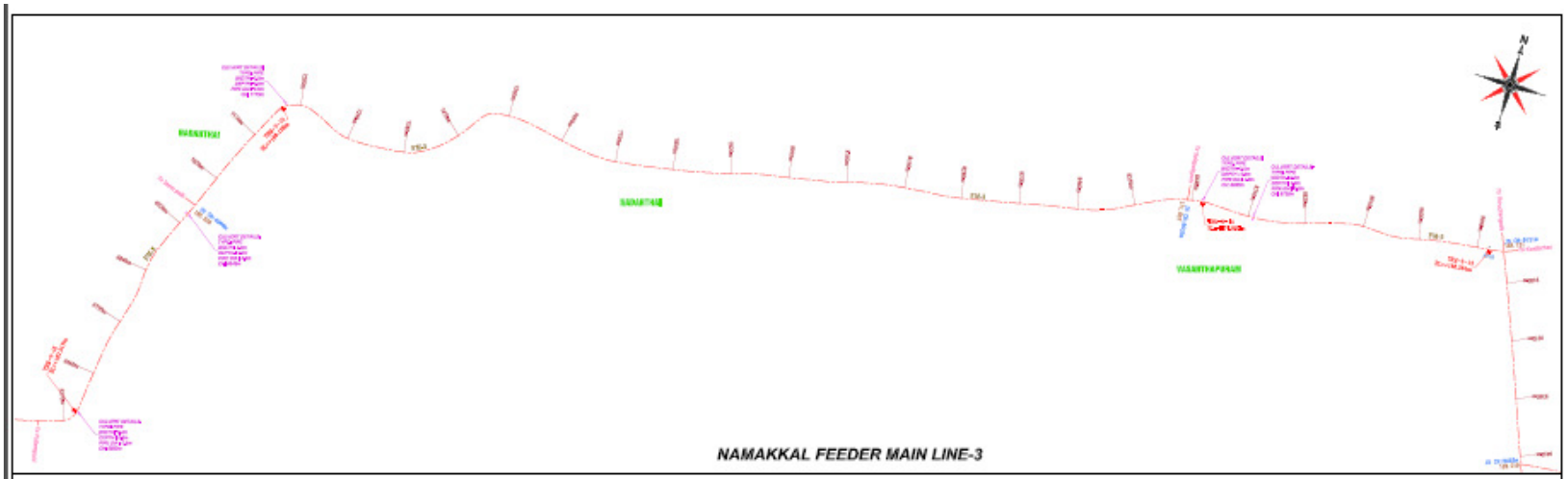
MEGASTAR SURVEY
AND CONSULTANT (INDIA) PRIVATE LTD.



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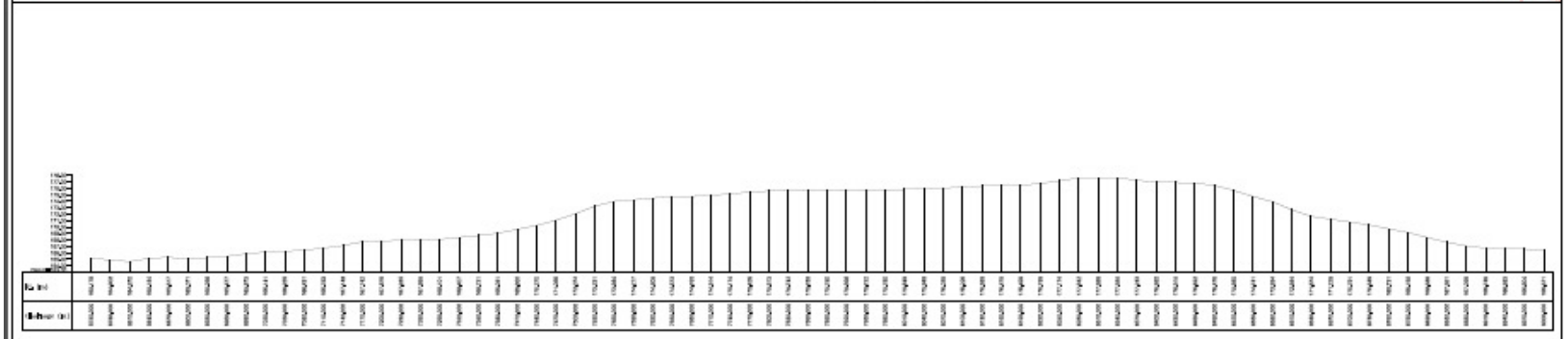

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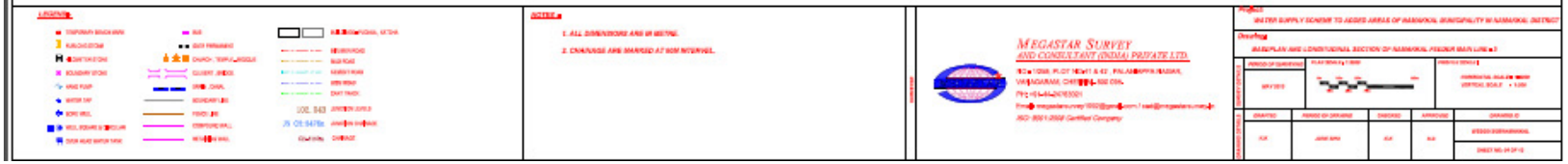

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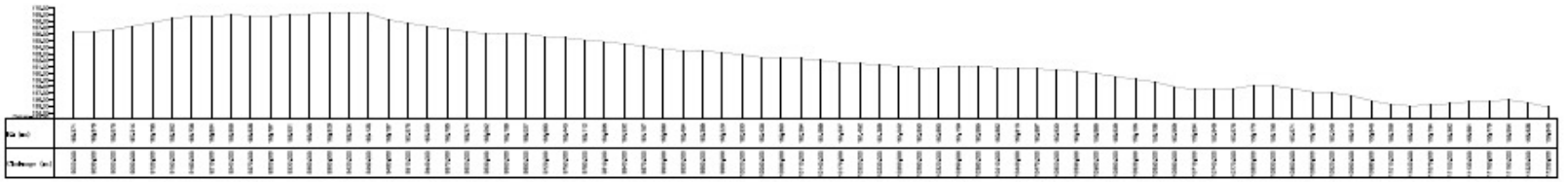

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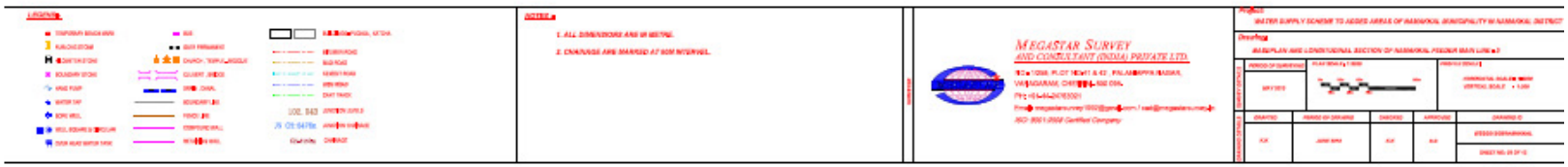

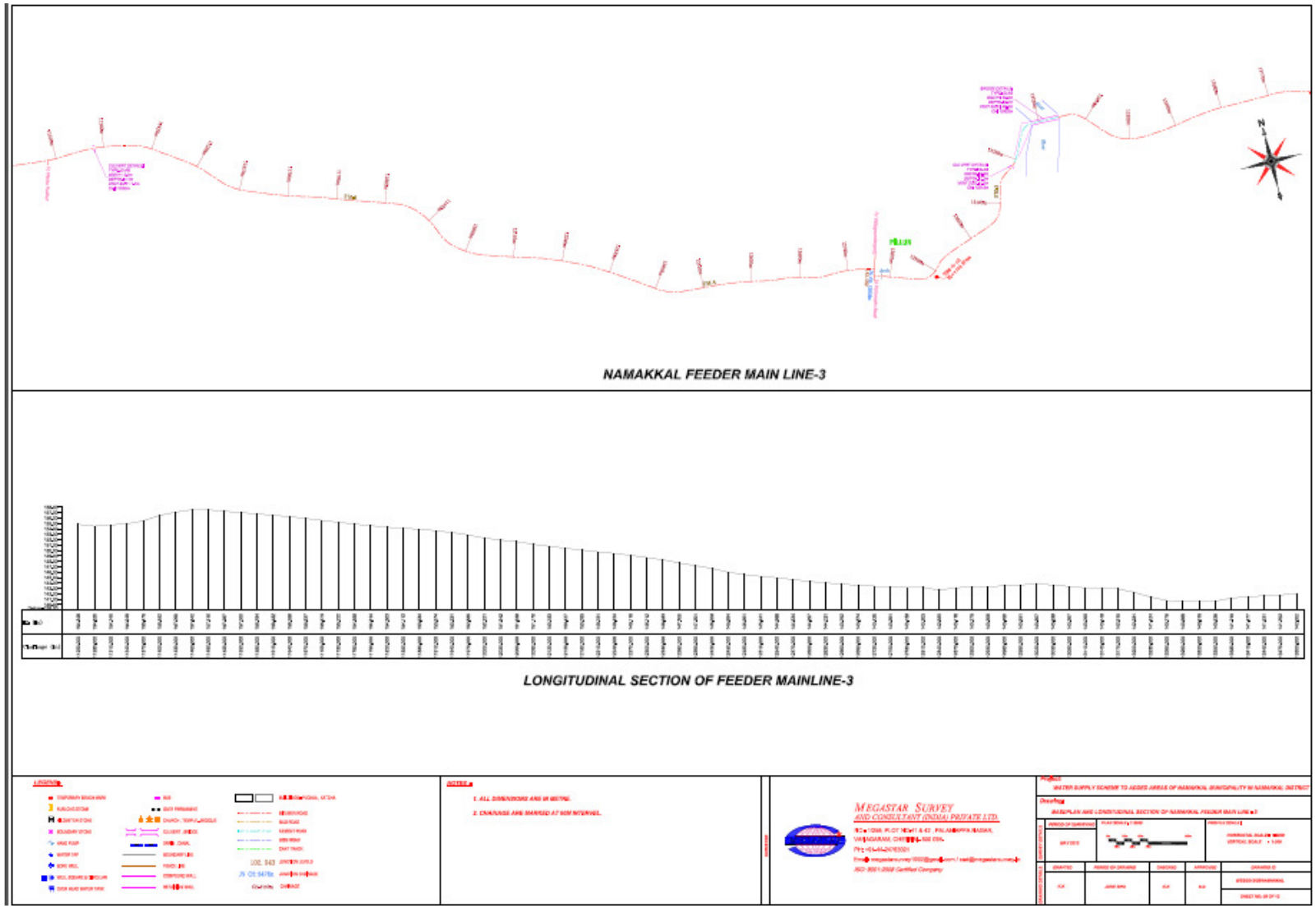
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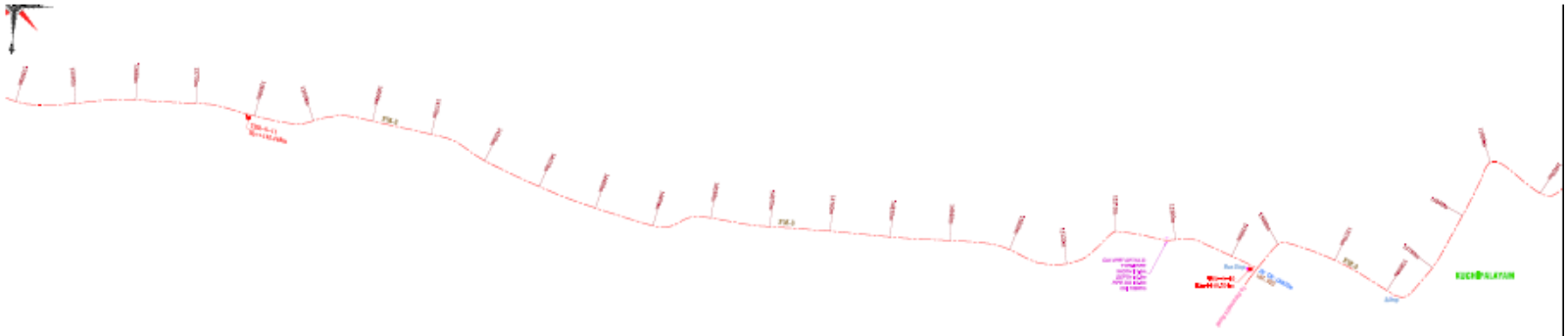
AND CONSULTANT (INDIA) PRIVATE LTD.



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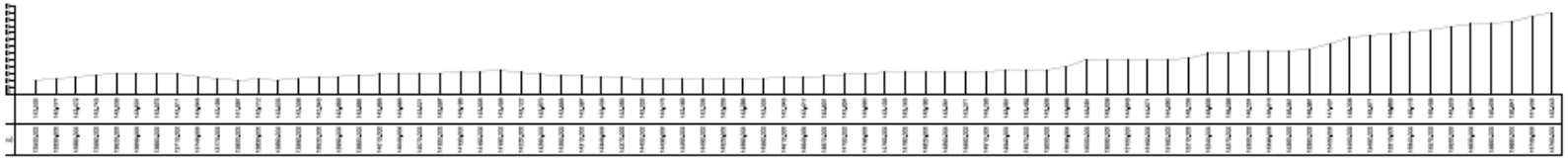

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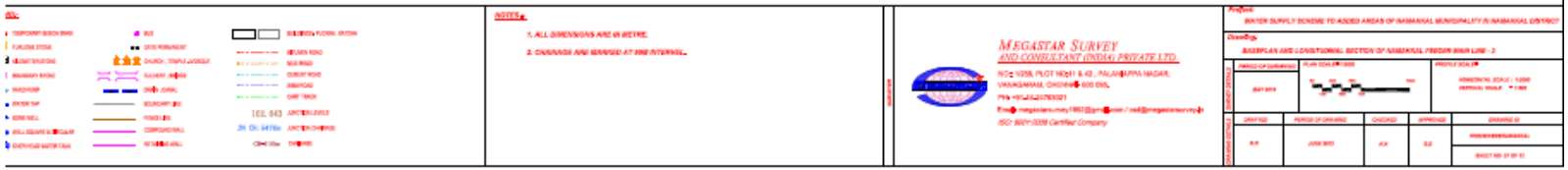

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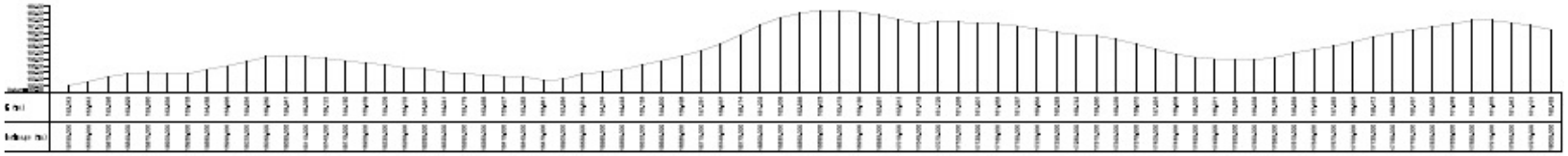

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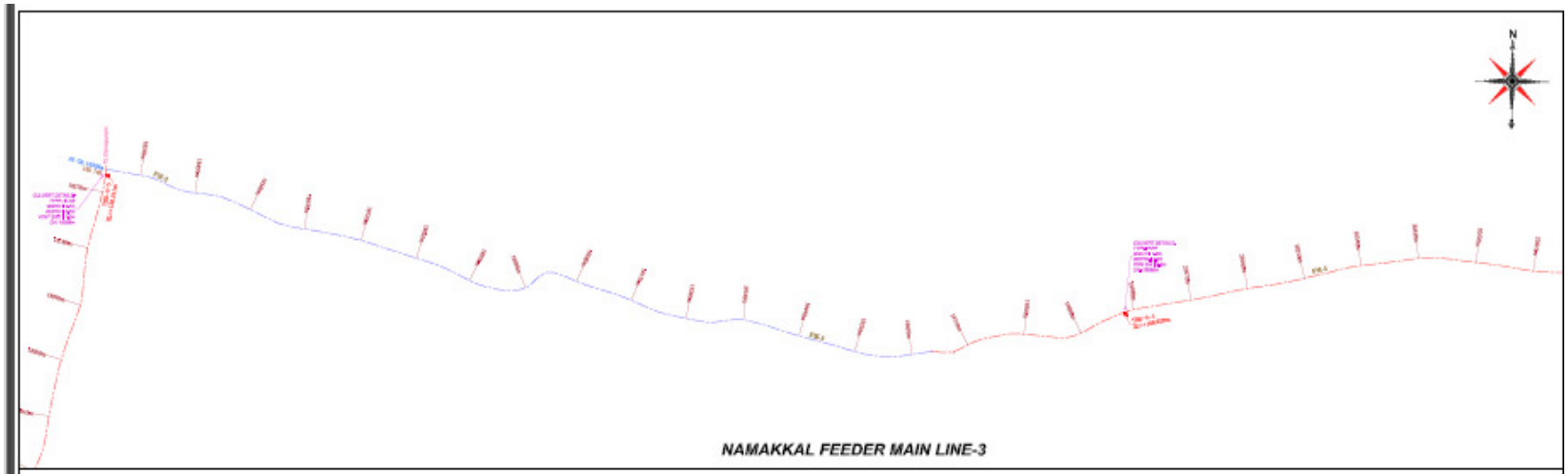

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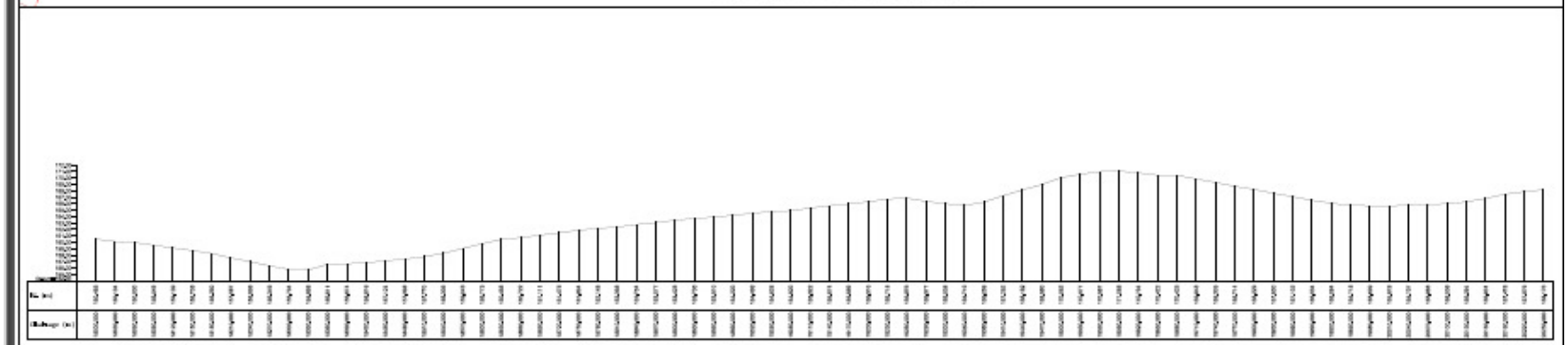

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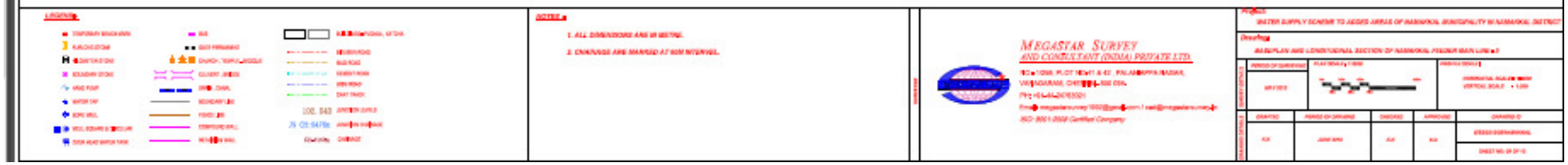

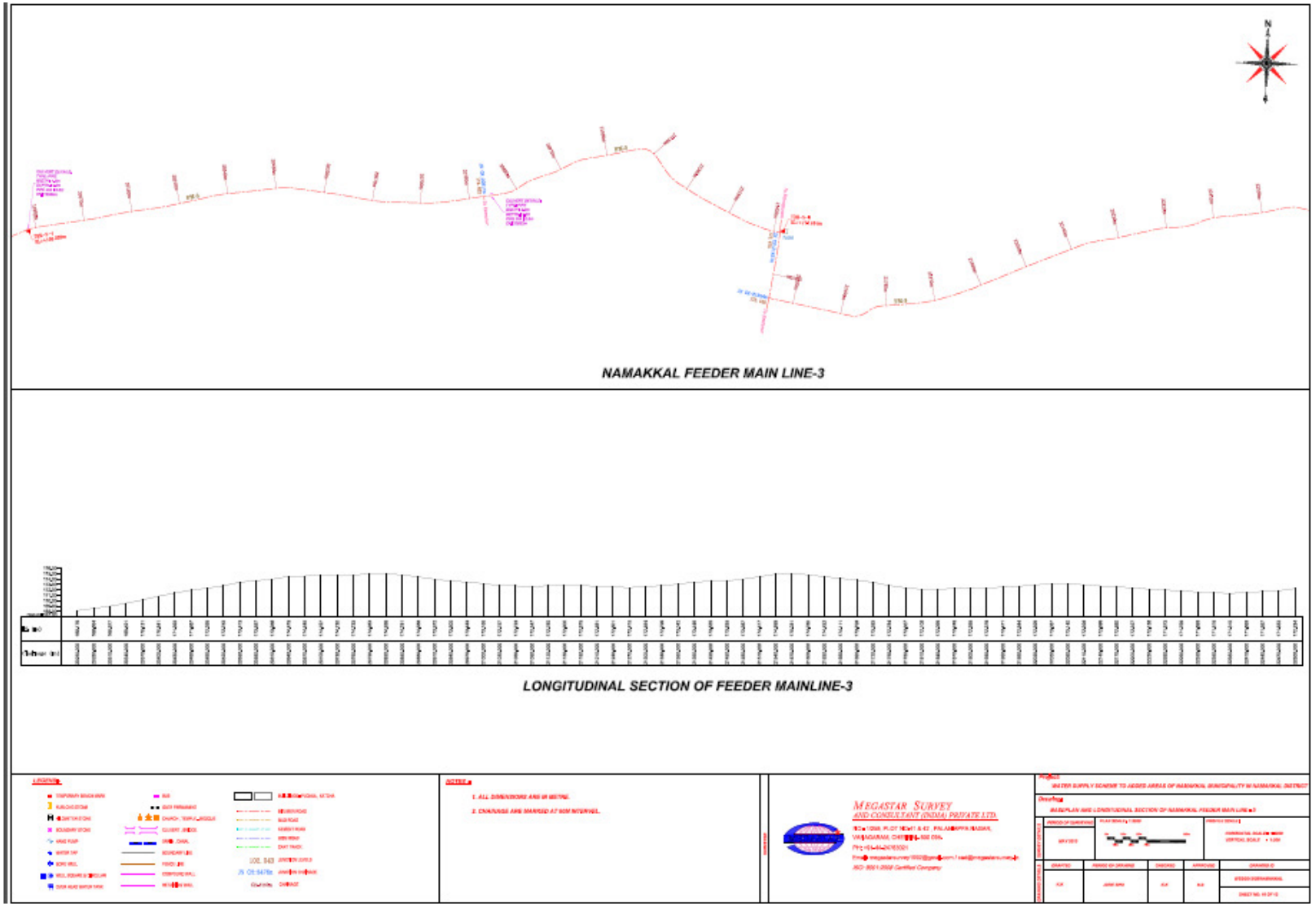

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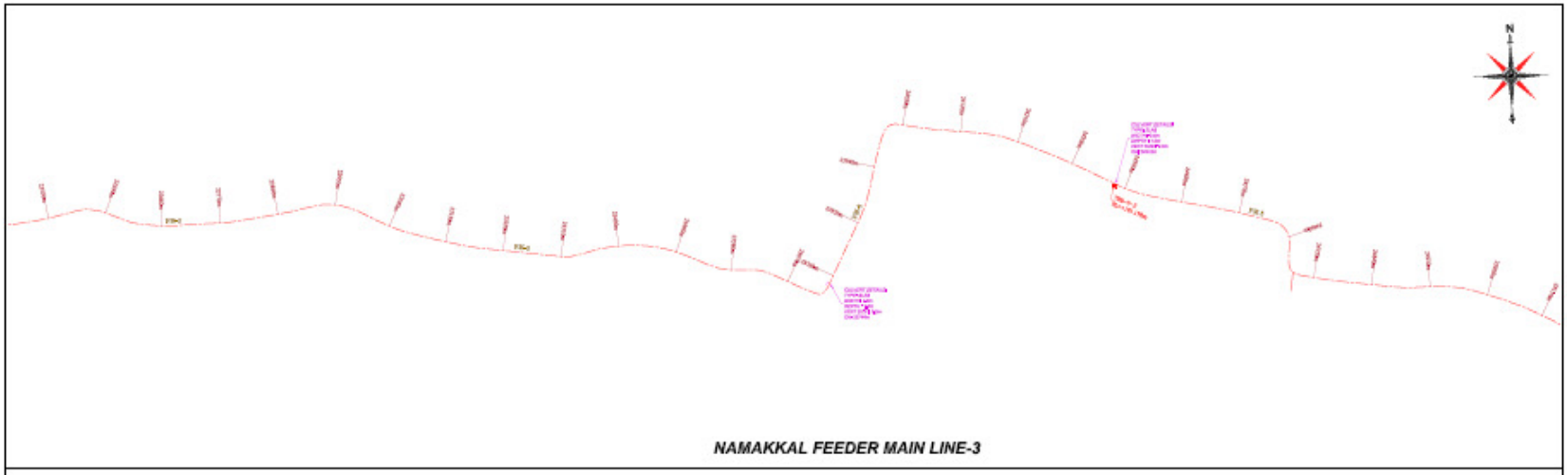

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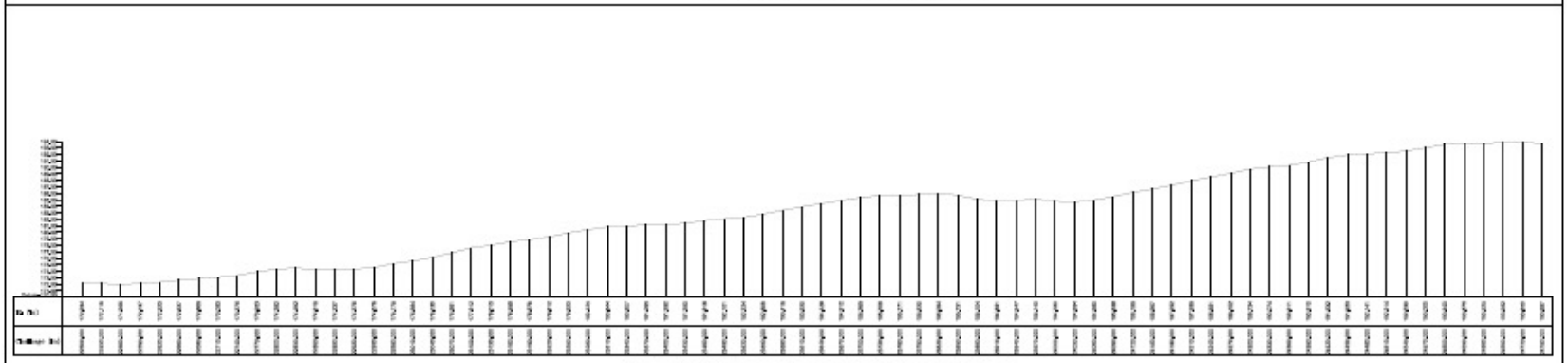

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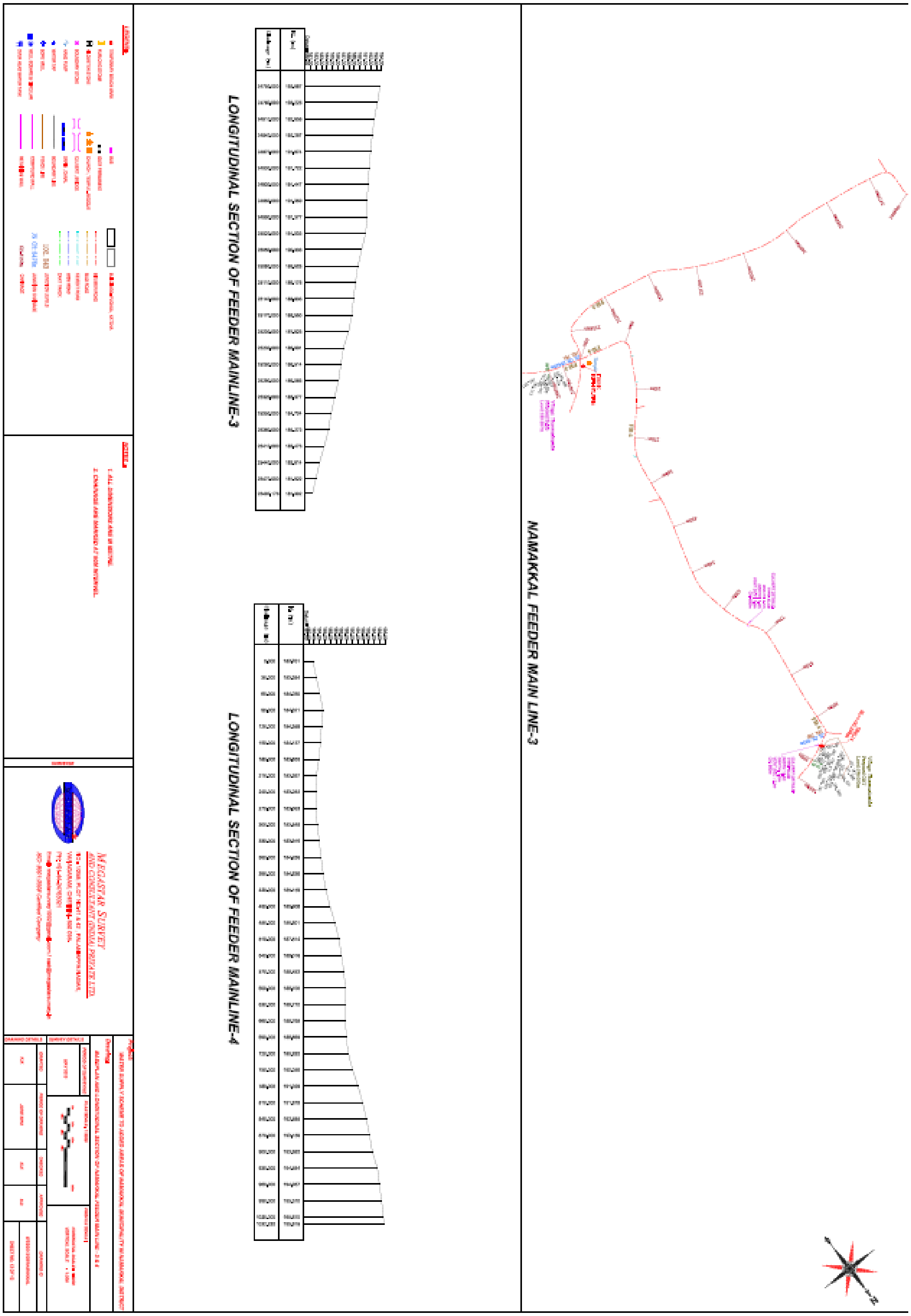
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