Andhra Pradesh Urban Finance and Infrastructure Development Corporation (APUFIDC)

Atal Mission for Rejuvenation and Urban Transformation

DETAILED PROJECT REPORT FOR SEPTAGE MANAGEMENT/ SEWAGE TREATMENT PLANT OF 5 MLD CAPACITY FOR MACHILIPATNAM MUNICIPALITY (REVISED)

OCTOBER 2016

AECOM

Executive Summary

1. Ministry of Urban Development, Government of India has rolled out the flagship mission of Atal Mission for Rejuvenation and Urban Transformation (AMRUT). It is proposed under AMRUT that State/ ULBs may appoint "Project Development and Management Consultant/s (PDMC/s) which has been envisaged as end to end consultant/s, supporting States/ ULBs. In order to provide effective and efficient PDMC services to the ULBs the AMRUT Towns are grouped into 2 regions on the basis of geographical convenience and one PDMC has been appointed for each region. Region I including Srikakulum, Vizianagaram, Visakhapatnam, East & West Godavari, Krishna & Guntur districts (16 ULBs) have been awarded to AECOM Asia Company Ltd.

2. The scope of PDMC under the proposed mission will be divided into four broad components namely *Planning, Design and Supervision and Project Management*. The PDMC's scope includes among others, preparation of City Wide Concept Plan, Service Level Improvement Plan (SLIP) and State Annual Action Plan (SAAP). PDMC will identify projects on the basis of SLIP framework, and carry out required investigation, design, procurement and implementation. The PDMC will also ensure compliance and monitoring of the project activities using PMIS / latest IT tools and techniques such as online monitoring of work sites with the aid of cyber tools.

3. Machilipatnam is a special grade municipality established in 1866. Machilipatnam is located at 16^{o} 11' North Latitude and 81^{o} East Longitude. Machilipatnam municipality has an area of 26.67 sq km with 42 revenue wards. The population of Machilipatnam town is 1,69,892 as per 2011 census. Geometrical Progression Method is adopted for population projection considering rapid growth of town in near future. The population was projected considering base year 2018, prospective year 2033 and ultimate year 2048.

4. The town has no sewerage system. The town lacks organised sewerage system and treatment facilities. The town predominantly depends on kutcha storm water drains for disposal of waste water. Hence, the sewage collected through the storm water drains is being let into the Siva Ganga Canal which runs on the periphery of the town.

5. The sewage flows generated in the town are shown below:

Year	Population	Sewage flow (MLD)
2018	187129	21.94
2033	230182	26.97
2048	283140	33.18

The septage volume produced in the town for intermediate year 2033 is 48.34 cum/day i.e. 17643.45 cum/year.

6. The details of the proposed STP scheme are as follows:
    - The town has been delineated into 5 sewerage zones.

- Anticipated Sewage Generation in Zone 1 for Base year (2018) is about 4.06 MLD, for Intermediate year (2033) is about 4.91 MLD and ultimate year (2048) is about 5.96 MLD.
- Zone 1 is proposed with 5 MLD STP under AMRUT SAAP 2016-2020.
- The treatment scheme offered is aerobic biological treatment using Extended Aeration.
- The project location is at survey No 186 near Kendriya Vidyalaya with an available space of an area of 1.0 acres.

7. The treatment scheme proposed is split into three distinct parts:

   Pre-treatment: this comprises of coarse, fine screening and grit removal tank. After pre-treatment the sewage shall be taken to biological treatment plant at uniform rate.
   Biological treatment: comprising anoxic tank and aeration tank. The sludge from the secondary clarifier will be recycled back to anoxic tank for denitrification.
   Sludge Handling and disposal: Excess sludge produced in biological treatment process shall be collected in sludge tank and digested aerobically. The excess sludge dewatered in centrifuge and finally disposed or used as organic manure.

8. The proposed location of STP is decided in co-ordination with ULB and Government land available at proposed STP location is 1 acre.

9. Cost Summary:

Sl. No.	Quantity	Unit	Description of the Component	Est. Amount (Rs)	IBM Amount (Rs.)	Remarks
CAPEX						
1	5	MLD	Design, Procurement and Construction of STP with all peripheral infrastructure like road, boundary wall, external lighting etc., inclusive of all taxes	67500000	67500000	Based on Quotation
2			Cost of Interception and diversion works	2229000	2229000	
3			Site Improvement works	3118219	3118219	
4			Strengthening of Lead channel to STP	985000.00	985000	
5			Express Feeder Main works	790650	790650	
6			Provisional sum for Deposits for Electricity, Roads(Cr)	5000000	5000000	
7			IBM Value for CAPEX	79622869	79622869	

OPEX						
1	10 years (INCLUDING 2 years DLP)	YEARS	O&M for 10 years consumable and energy charges for O & M period (excluding of power cost)	56355479	56355479	Refer : Table 12.2
			Total IBM Value = (CAPEX + OPEX)	135978348	135978348	
			Provision for Works Contract VAT 5%	3981143		
			Labour Cess 1%	796229		
			Provision for Seigniorage charges @ 0.5%	398114		
			Provision for scrutiny charges 1%	796229		
			Provision for NAC 0.1%	79623		
			Provision for Contingencies 0.5%	398114		
			Total Taxes & LS Provisions outside IBM	6449452		
			IBM of the Scheme (CAPEX + OPEX)	142427801		
			Cost of Power Charges for 10 Years	99038378		
			Total Project Cost (IBM + Taxes & LS Provisions)	241466178		
			Total cost in Cr	24.15		

10. Funding pattern

Sl No	Agencies	Amount in Cr
1	Special assistance from APPCB @ 25% of STP cost	2.44
2	Proportionate Allocation of Rs.100.00 Cr. under budget for Sewerage/Septage	4.55
3	Government of India Share	1.25
4	Government of State Share	0.68
6	ULB Share	0.83
	Total	9.75

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Chapter 1

INTRODUCTION

1.1 Background

In order to rejuvenate and transform urban India, the Ministry of Urban Development, Government of India has rolled out the flagship mission of Atal Mission for Rejuvenation and Urban Transformation (AMRUT). It is proposed under AMRUT that State/ ULBs may appoint "Project Development and Management Consultant/s (PDMC/s) which has been envisaged as end to end consultant/s, supporting States/ ULBs.

In order to provide effective and efficient PDMC services to that ULBs the AMRUT Towns are grouped into 2 regions on the basis of geographical convenience and one PDMC will be appointed for each region. The details of the regions and respective ULBs are furnished below:

Table 1.1: List of Region

Region I (Srikakulam, Vizianagaram, Visakhapatnam, East & West Godavari Dist,) (Krishna & Guntur Dist.) (16 ULB's)		Region II (Prakasam, Nellore, Chittoor & Kadapa Dist.)(Anantapur & Kurnool Dist.) (15 ULB's)	
Regional Office at Rajahmundry		Regional Office at Tirupathi	
1. Srikakulam	9. Vijayawada	1. Tirupathi	9. Hindupur
2. Vizianagaram	10. Machilipatnam	2. Ongole	10. Dharmavaram
3. Visakhapatnam	11. Gudivada	3. Nellore	11. Tadipatri
4. Kakinada	12. Guntur	4. Chittoor	12. Guntakal
5. Rajahmundry	13. Tenali	5. Madanapalli	13. Nandyal
6. Eluru	14. Chilakaluripeta	6. Kadapa	14. Adoni
7. Tadepalligudem	15. Narasaraopeta	7. Prodduttoor	15.Kurnool
8. Bhimavaram	16. Amaravathi	8. Ananthapur	

In this context, bids were invited by APUFIDC "Project Development and Management Consultant/s (PDMC/s) and after detailed review, AECOM has been appointed as PDMC AMRUT (Region-1).

1.2 Scope of Work

The scope of PDMC under the proposed mission will be divided into four broad components namely *Planning, Design and Supervision and Project Management*. The PDMC's scope includes among others, preparation of City Wide Concept Plan, Service Level Improvement Plan (SLIP) and State Annual Action Plan (SAAP). PDMC will identify projects on the basis of SLIP framework, and carry out required investigation, design, procurement and implementation. The PDMC will also ensure compliance and monitoring of the project activities using PMIS / latest IT tools and techniques such as online monitoring of work sites with the aid of cyber tools.

The consultant will carry out a multi-stage exercise in close collaboration with the ULB / State Government and other stakeholders. The proposed project has been taken up for improvement / introduction of Urban Infrastructure including ensuring delivery of services. Without limiting the scope, the PDMC has to work in close liaison with the *Municipal Corporation / Council of the City /*

Urban Development Department of the State and will be responsible for the following tasks. The scope of service of PDMCs excludes the component of parks & development of open spaces.

1.3 General

The objective of treatment of sewage through a combination of physical, chemical and/or biological processes is to stabilize decomposable organic matter and remove other harmful contaminants prior to discharge onto a land or waterway or water body. The degree of treatment depends on the desired waste water quality.

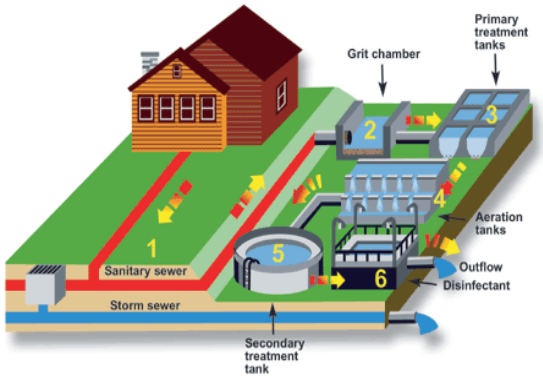


Figure 1.1: Flow Diagram of STP

Raw sewage collected from household through a sewerage network is to be processed through a series of operations, so as to ensure its disposable quality suiting to the standards proposed by the pollution control board or regulatory authorities. The treatment of sewage can be stated under three stages. The primary treatment is the first stage of treatment where in all the physical matters are removed through screening, primary settling and through degritting.

The secondary treatment removes all the biological matters through biological decomposition of degradable matters either through aerobic or anaerobic process or through combination of aerobic and anaerobic processes. The secondary treatment also comprises of sludge handling, management issues with disposal aspects. The tertiary Treatment process comprises of disinfection of treated sewage and its recycling proposals.

There are many technologies available for treating the sewage to the desirable levels of its requirement for reuse. Some of treatment processes that have been adopted in India are discussed in the successive sections with their merits and demerits.

CHAPTER 2
PROJECT AREA

2.1 Location & Significance

Machilipatnam is a special grade municipality established in 1866. Machilipatnam is located at 16° 11' North latitude and 81° East longitude. Machilipatnam municipality has an area of 26.67 sq km with 42 revenue wards. The town has an average elevation of 3 meters. It is located at a distance of 72 km to the south-east of Vijayawada city, 78 km to west of Bhimavaram town and 82 km south of Eluru City. The nearest airport Gannavaram is at a distance of about 80 km from Machilipatnam Town.

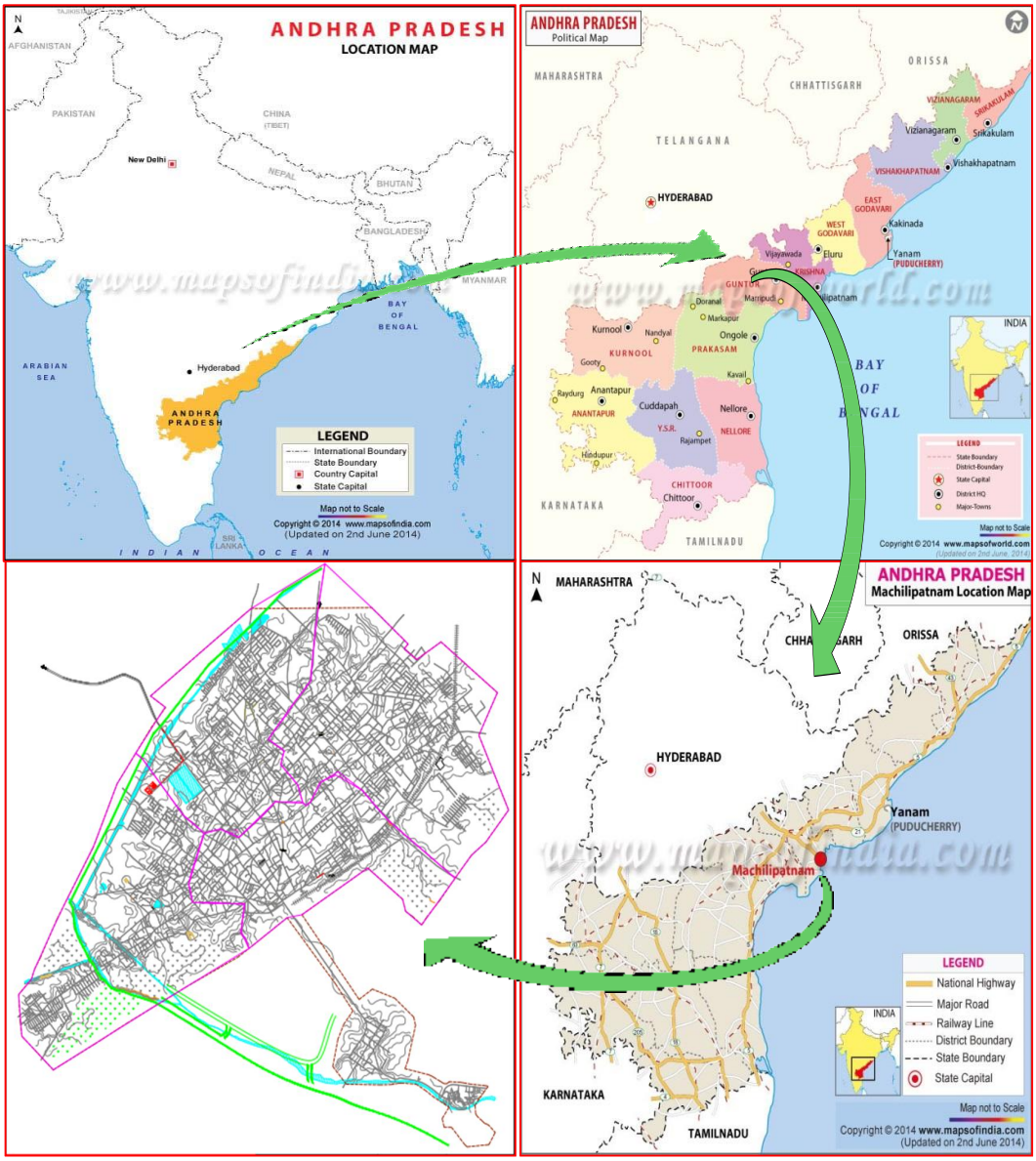


Figure 2.1: Index Map of Machilipatnam Town

2.2 Topography

The town is located on the East coast in the Krishna district at Delta region at a distance of about 6.40 km from the sea. Machilipatnam is situated on a generally flat terrain with a level difference of about +2.0 to +3.0 meters between the maximum and minimum elevations. The town is situated at a level of about 0.6 meter to 1.0 meter above MSL. The digital elevation map of Machilipatnam town is shown in Figure 2.2. The Bandar canal passes through the outskirts of the town. The natural ground slope of the town is generally from south-east direction towards Bay of Bengal.

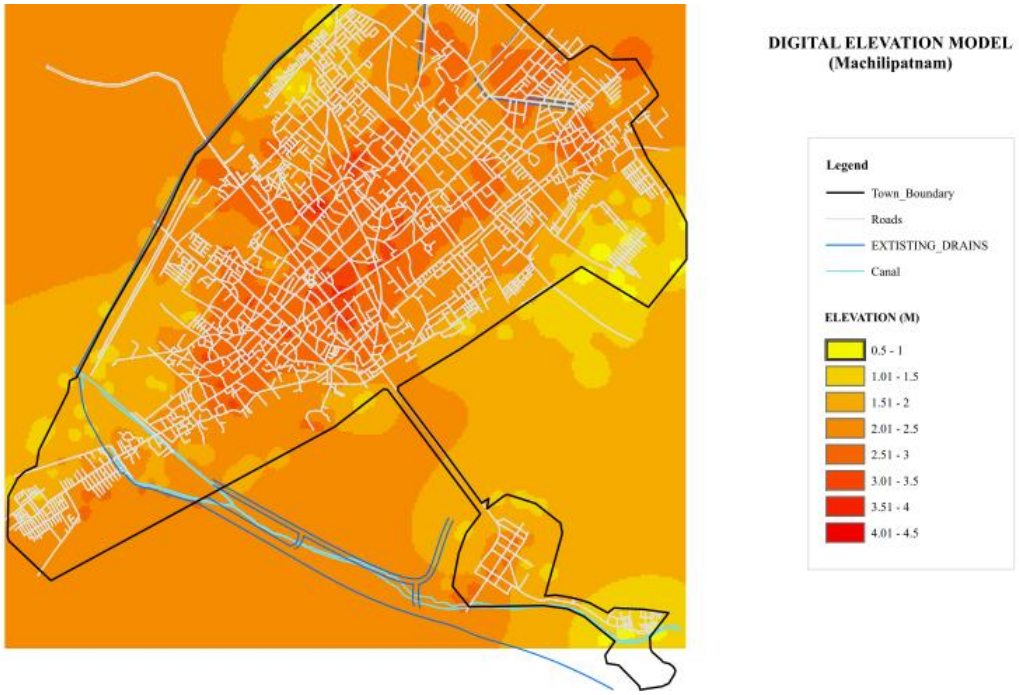


Figure 2.2: Digital Elevation Map of Machilipatnam Town

2.3 Climate and Rainfall

Machilipatnam town has a tropical climate with hot summer and moderate winter. The hottest months are between April and June. The average annual rainfall in the town is 959.00 mm. The rainfall during South West monsoon is about 50% of the annual rainfall and during the North East monsoon is about 50% of the annual rainfall. The period from November to mid-February is the coolest part of the year.

Table 2.1: Seasonal Variation of Temperature

Season	Month (extreme condition)	Mean Daily Temperature	
		Maximum Value	Minimum Value
Winter	December	33°C	18°C
Summer	May	45°C	30°C

Source: Indian Meteorology Department

2.4 Demography

As per 2011 census Machilipatnam has a population of 1,69,892. The total population constitutes 83,594 males and 86,298 females - a sex ratio of 1032 females per 1000 males. The average literacy rate stands at 82.43% with 1,27,917 literates. The CAGR of the town from 2001 to 2011 is 1.04% as seen in the table 2.2.

Table 2.2: Historical Population Data of Machilipatnam Town

Years	Population	Decadal Growth (%)	CAGR
1961	101417		
1971	112612	11.04	1.05%
1981	138530	23.02	1.57%
1991	159110	14.86	1.51%
2001	179353	12.72	1.44%
2011	169892	-5.28	1.04%

Source: Census of India 2011.

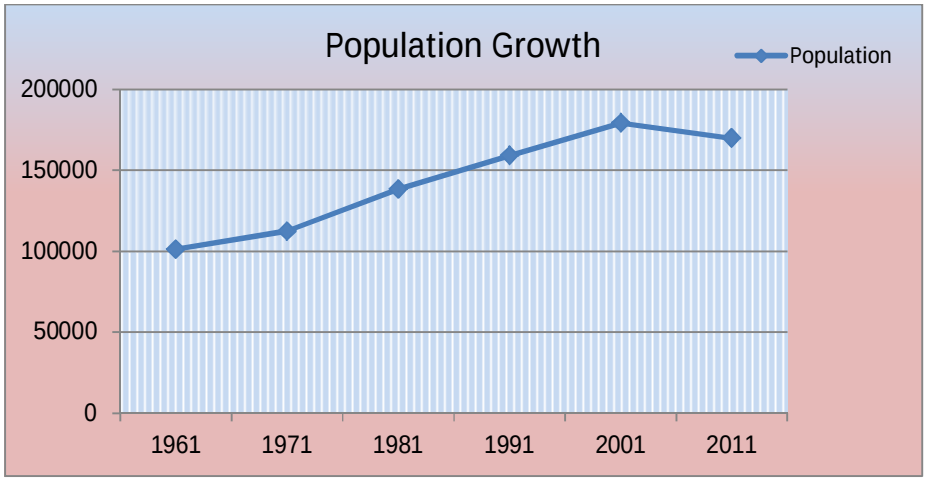


Figure 2.3: Population growth of Machilipatnam town

2.5 Municipal Area and Ward wise Details:

Machilipatnam is the district headquarters of Krishna District. For administrative purposes, Machilipatnam falls in Bandar revenue division of Krishna District. Machilipatnam is a parliament constituency in Andhra Pradesh. It is governed by the Collector and the District Magistrate of Krishna District. It is one of the earliest municipalities in Andhra Pradesh. The town has an area of 26.67 sq km and having 42 wards.

The ward wise population details of Machilipatnam town are shown in table 2.3 below. The densely populated and sparsely populated wards can be identified which will be useful for the design of proposed water supply & sewerage schemes.

Table 2.3: Ward Population Density, 2011

Ward No.	Population	Area in Ha	Density ppha
1	3546	73.79	48
2	4258	41.91	102
3	4661	51.86	90
4	3960	49.95	79
5	4734	81.48	58
6	3625	52.75	69
7	4081	30.59	133
8	3966	41.32	96
9	3742	41.28	91
10	4386	35.57	123
11	4054	9.71	418
12	4166	45.23	92
13	3748	15.76	238
14	3688	19.46	190
15	4653	25.87	180
16	3501	17.52	200
17	4565	31.38	145
18	3909	10.68	366
19	3561	16.83	212
20	3466	12.96	267
21	4288	21.93	196
22	4211	12.51	337
23	4386	20.28	216
24	3471	5.82	596
25	4279	27.39	156
26	3859	30.26	128
27	4371	30.36	144
28	3630	24.12	150
29	4287	26.87	160
30	4036	15.17	266
31	4156	12.82	324
32	3597	20.1	179
33	4073	17.98	227
34	3973	37.5	106
35	3873	21.83	177
36	3663	14.67	250
37	4087	18.48	221
38	4133	16.98	243
39	4092	15.36	266
40	4066	19.34	210
41	4524	35.79	126
42	4567	22.75	201

Source: Machilipatnam municipality

Table 2.4: Population Density Range in Wards 2011

Density Range (persons/hectare)	Number of Wards	List of Wards
500 and above	1	24
300 to 500	4	11,18,22,31
225 to 300	7	13,20,30,33,36,38,39
150 to 225	13	14,15,16,19,21,23,25,28,29,32,35,37,40,42
75 to 150	14	2,3,4,7,8,9,10,12,17,26,27,34,41
Up to75	3	1,5,6

2.6 Soil and Geology

The soil of the town is mainly black cotton in nature. Sand is found to be fringed with sand dunes or sand blown by the action of the waves. The ground water table in the town is found to be very high and on average ground water table is found to be only 1.0 m below ground level.

CHAPTER 3
OVERVIEW OF EXISTING SEWERAGE/SEPTAGE SYSTEM & SURVEY INVESTIGATIONS

3.1 Existing Wastewater Collection/Septage and Treatment

The town has no sewerage system. The town lacks organised sewerage system and treatment facilities. The town predominantly depends on kutcha storm water drains for disposal of waste water. Hence, the sewage collected through the storm water drains is being let into the Siva Ganga Canal which runs on the periphery of the town. With respect to sanitation system, 73% of the town's households are covered with individual toilets. A small proportion of the slum population defecate in the open. The details of the existing sewage system are presented in Table 3.1 below.

Table 3. 1: Details of Existing sewage system

Sl.No	Description of item	Total Number
1	Total number of Households	45,429
2	Total number of Households with individual/community toilets	33,163
3	Total number of Households without individual/community toilets	12,266
4	Total number of toilets with septic tanks	11,680
5	Total number of toilets with leach pits	17,516
6	Total number of toilets connected to drains	2,200
7	Total number of community toilets	23

3.2 Problems Relating to the Existing Sewer System

1. There is no Sewage collection/Septage management and Treatment system in the town.
2. Some of the houses are provided with individual septic tanks. Sewage flows into the septic tanks and its supernatant overflows in to storm water drains.
3. The sewage, sullage and storm water from the residential areas are presently discharged into open drains/channels which in turn join water bodies, ultimately polluting the fresh water bodies available within the town limits.
4. Individual Latrines: There are 33163 private latrines existing in the town. There are no latrines in 12266 houses and the residents use public latrines or defecate in the open. The effluent of septic tanks is flushed into the open drains or low lying areas.

Areas with no Latrine:

Isolated areas and some other areas in the town, does not have any latrine, and so people answer the nature's call in the open. Sewerage facility will have to be designed to take care of the Town in the following aspects.

- To provide a lasting solution to the problem of effective handling of sullage and sewage

generated by implementing an underground sewerage system for the areas duly considering the requirements for the next 30 years.

- As per the decision of the clients the sewage flowing in the drain will be diverted and connected to the treatment plant. The sludge from the septic tanks will be collected by the ULB operator and taken to STP.
- Providing sewage treatment plant to take care of year 2033 demand and constructing it at suitable location so that entire sewage can be drained into the plants as far as possible by gravity.
- As per the grant available, Zone I proposed for the construction of the STP and required land is also available for construction of STP. The Zone-1 sewage demand for intermediate year is 4.91 MLD.

Treatment facilities:

At present, there is no Sewage Treatment plant in the town. Different alternatives have been studied for Machilipatnam town and the best feasible option is considered.

The estimated average sewage flow for Zone-1 for intermediate stage (2033) is 4.91 MLD. The treatment facility of 5 MLD is required by 2033 and it is proposed to provide 5 MLD treatment capacities for the Zone-1. The Municipal council informed that the land is available for construction of the STP and location of STP shown on Google map in Drawing No. ACM-PDMC1-DPR-MPN-STP.

3.3 Lead Drain to STP

At present, there are gaps in the drain which is leading drain to the STP. The gaps identified are listed below in table 3.2 and photographs are shown below. The gaps to be filled with same size of existing drains so that sewage can flows freely without obstructions to STP locations. The gaps are considered in cost estimation for strengthen the lead drain.

Table 3. 2: Details of Gaps in Leading drain to STP

Sl.No	Location of Gap Construction	Size of the Drain in m	Length of the Gap in m
1.	Gaps at B E L company road (Edepalli)	2.5 X 1.20	25
2.	Gap at Sakthi Gudi road	3.0 X 1.2 0	7
3.	Gap at Nizampeta Road	3.0 X 1.20	10
4.	Gap at Narayanapuram road	3.5 X 1.20	15
	Total gap length in m		57

All the gaps in the drain are shown below in photographs.

2. Gap at BEL company

1. Gap at Sakthi Gudi road

4. Gap at Nizampeta Road

3. Gap at Narayanapuram road

3.4 Topographical Survey

Detailed topographical survey has been conducted for STP Plant, Lead drain and Outfall drain with total station. The Survey work is carried out from the bench mark at kendriya Vidhyalayam School. The benchmark is the reference for the entire survey for STP and Elevation of the bench mark is noted as RL.3.72 m.

Total station survey has been carried out along the alignment of the leading drain and the spot levels are captured at every 30m interval and STP has been carried out block level survey at 5m interval. While carrying out the survey, all the prominent features of the road network (type of road, width of road (between the property boundaries) are captured.

3.5 Geotechnical Investigation

The geo technical investigations are under progress for the town. As part of the soil investigation, the safe bearing capacity (SBC) carried out at proposed STP location to find out the SBC of the soil and other soil parameters. Based on field and laboratory tests on soil samples, the general sub-soil profile effective for the proposed structures will be determined. The result of the test is enclosed in Annexure-III

3.6 Sullage water Quality

Sullage water sample collected from the drain and water quality test has been carried out. The parameter analysed are BOD, COD, TSS, Total Nitrogen, etc. The test report is enclosed in Annexure-IV

CHAPTER 4
POPULATION PROJECTIONS

4.1 Demography

Demography is the statistical study of all populations. It can be a very general science that can be applied to any kind of dynamic population, that is, one that changes over time or space. It encompasses the study of the size, structure and distribution of populations, and spatial and/or temporal changes in them in response to birth, migration, aging and death.

Demographic analysis can be applied to whole societies or to groups defined by criteria such as education, nationality, religion and ethnicity. In academia, demography is often regarded as a branch of either Anthropology, economics, or sociology. Formal demography limits its object of study to the measurement of population processes, while the broader fields of social demography population studies also analyze the relationships between economic, social, cultural and biological processes influencing a population. The term demographics is often used erroneously for demography, but refers rather to selected population characteristics as used in government, marketing or opinion research, or the demographic profiles used in such research.

4.2 Methods of population forecast

Numerous methods are prescribed by Manual to forecast the population for a particular town. It depends which type of method is suitable for the project area depends on the past growth, future developments in the town, probable industrialization etc., hence forecasting were made using different methods as prescribed below.

- Arithmetic Progression Method.
- Geometric Progression Method.
- Incremental Increase Method.
- Growth Method
- Graphical Methods
    - Linear Method
    - 2nd Order Polynomial Method
    - 3rd Order Polynomial Method
    - Exponential Method

As per the census of 2011, the population of the town is 1,69,892. The percentage rate of growth is shown in the following Table 4.1 considering the population figures from 1961 to 2011. The population growth rate had been very fluctuating in the town. The town has experienced firstly increase in growth rate and then decrease in growth rate.

Table 4.1: Population growth rate of the town

Years	Population	Increase in population (X)	Incremental Increase (Y)	Decadal % Increase in population	Compounded Annual Growth
1961	101417				
1971	112612	11195		11.04	1.05
1981	138530	25918	14723	23.02	1.57
1991	159110	20580	-5338	14.86	1.51
2001	179353	20243	-337	12.72	1.44
2011	169892	-9461	-29704	-5.28	1.04
Total		68475	-20656	62	6.61
Average		13695	-5164	15	1.30

4.2.1 Population Projections

With a precedence of past and current trends of population growth in Machilipatnam, an analysis has been carried out with an objective of estimating population for next decades using various methods which includes Arithmetic Increase Method, Incremental Increase Method, Geometric progression method, exponential methods. Results of the analysis are shown in the table 4.2 below and the detailed analysis is given in the Annexure-I.

Table 4.2: Population projection by different methods

Sl. No	Population Projection Method	Years			
		2011	2018	2033	2048
1	Arithmetic Progression Method	169892	179479	200021	220564
2	Geometrical Progression Method	169892	187129	230182	283140
3	Incremental Increase Method	169892	176406	181844	175663
4	Growth Method	169892	193677	244644	295612
5	Graphical Method				
	a) Linear Method	169892	194978	219114	243251
	b) 2nd Order Polynomial Method	169892	178501	175979	163335
	c) 3rd Order Polynomial Method	169892	146636	22359	-233734
	d) Exponential Method	169892	204633	244110	291202

Conclusions:

1. Machilipatnam Municipality is to be converted into Municipal Corporation and a Major port is going to be constructed at Machilipatnam and expecting the town to see the rapid growth. The decrease in population in year 2011 is due to migration of some of the residents to the rural area located at the outskirts of the town where they were given house sites.

2. Population projection by Arithmetic & Incremental Increase & Polynomial method gives lower values and Growth method & Exponential method gives very high values. Hence Geometrical progression method is adopted for population projection of Machilipatnam town.

4.2.2 Ward wise population Projection

The town has been delineated in 42 wards and the ward-wise population has been shown in the Table 2.3 below. Ward number 5, which covers the largest area in the town, has the highest proportion of population. It is clearly visible that ward no. 24, 11 and 18 are very densely populated wards as compared to other wards.

4.2.3 Municipal ward density analysis

Municipal ward areas are analyzed to compute the ward wise densities of the population. The details of the ward wise areas, population are given in the Annexure-I.

CHAPTER 5
DESIGN CRITERIA & FLOWS

5.1 Design Period

The sewer network and other civil works are designed for 30 years requirement. The prospective and ultimate sewage flows are assessed for the years 2033 and 2048 respectively, considering 2018 as the base year.

5.2 Population

The population projections are made based on census data and the flows for each tributary area and sewer reach are calculated in accordance with the projected population for the given area as presented in Chapter 4.

5.3 Water Consumption Per Capita

The quantity of wastewater generated, to be transported and treated will depend on population and per capita water use. Per capita water supply for domestic needs is proposed to be 135 LPCD and 45 LPCD considered for Institutional demand.

5.4 Per Capita Waste Water Flow

The amount of water returned as sewage will be 80% in accordance with the CPHEEO Manual. This will result in a per capita waste water flow of 108 LPCD.

5.5 Peak Factor

The Peak Factor is the ratio of maximum to average daily flow and is a function of service area population. This factor is applied to the average daily waste water flows to account for higher than normal daily flows. Design peak factors are summarized in Table 5.1 with reference to contributory population.

Table 5.1: Peak Factor Considerations

Item	Contributory Population (Capita)	Peak Factor
1	Up to 20,000	3.00
2	20,000 to 50,000	2.50
3	50,000 to 7,50,000	2.25
4	Above 7,50,000	2.00

5.6 Ground Water Infiltration

The Ground water Infiltration is considered as 5% of designed flows.

5.7 Sewage Flows

The proposed sewage flows are worked out on the basis of the projected population & per capita sewage generation of 108 litres per day. The infiltration allowance is considered as 5% of design flows. The peak factor has been considered as per the recommended design parameters. The projected wastewater flows generated in Machilipatnam are 26.97 MLD and 33.18 MLD for the years 2033 and 2048 respectively. The town is divided into 5 zones and the waste water flows calculated for the zones. The projected design sewage flows for present, prospective and ultimate years for the five Zones are given in the table 5.2 below.

Table 5.2: Projected Sewage Flow for Machilipatnam Town

Zonewise Sewage Calculation for STP													
Zone No.	Wards Covered	Population			Avg Flow in MLD			Total Avg flow in MLD including 10% losses			Peak Flow in MLD		
		2018	2033	2048	2018	2033	2048	2018	2033	2048	2018	2033	2048
1	1P, 35P, 37, 38 , 39, 40P, 41P, 42P	34609	41883	50874	3.74	4.52	5.49	4.06	4.91	5.96	10.14	12.27	14.90
Institutional Demand -10%		3461	4188	5087	0.12	0.15	0.18						
Total		38070	46071	55961	3.86	4.67	5.68						
Total including Infiltration -5%					4.06	4.91	5.96						
2	1P, 2P, 3P, 41P, 42P	13031	17033	21734	1.41	1.84	2.35	1.53	2.00	2.55	3.82	4.99	6.37
Institutional Demand -10%		1303	1703	2173	0.05	0.06	0.08						
Total		14334	18736	23907	1.45	1.90	2.43						
Total including Infiltration -5%					1.53	2.00	2.55						
3	2P, 3P , 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17P, 19, 20, 21, 22, 23, 24, 25P, 29P, 31, 33P, 35P, 40P	99345	122533	150905	10.73	13.23	16.30	11.64	14.36	17.68	26.19	32.31	39.79
Institutional Demand -10%		9935	12253	15091	0.36	0.44	0.54						
Total		109280	134786	165996	11.09	13.67	16.84						
Total including Infiltration -5%					11.64	14.36	17.68						

4	25P, 26, 27,28, 29, 30P, 31P, 32, 33P, 34P	32582	39988	49310	3.52	4.32	5.33	3.82	4.69	5.78	9.54	11.71	14.45
Institutional Demand -10%		3258	3999	4931	0.12	0.14	0.18						
Total		35840	43986	54240	3.64	4.46	5.50						
Total including Infiltration -5%					3.82	4.69	5.78						
5	17P, 18	7561	8745	10318	0.82	0.94	1.11	0.89	1.02	1.21	2.66	3.07	3.63
Institutional Demand -10%		756	875	1032	0.03	0.03	0.04						
Total		8317	9620	11350	0.84	0.98	1.15						
Total including Infiltration -5%					0.89	1.02	1.21						

5.8 Actual discharge in drain at proposed STP site

Float method has been used to measure the discharge in the drain at the proposed STP site.

The amount of water passing a point on the stream channel during a given time is a function of velocity and cross-sectional area of the flowing water given by equation:

$$Q = AV$$

where Q is stream discharge (volume/time), A is cross-sectional area, and V is flow velocity

Apparatus required:

- tape measure
- stop-watch
- rod, yard or meter stick to measure depth
- at least three highly visible buoyant objects such as drifting branches or logs, pine cone, coffee stir sticks, half-filled bottles, or oranges (objects buoyant enough not to be effected by the wind)
- stakes for anchoring tape measure to stream banks
- waders

Float method theory:
This method is adopted as it is simple and inexpensive one to measure surface velocity. Mean velocity is obtained using a correction factor. The basic idea is to measure the time taken by the the object to float a specified distance downstream.

$$V_{surface} = \text{travel distance/ travel time}$$
$$= L/t$$

Result:

The flows at proposed location of STP site have been measured at peak flow hour and normal flow hour and the average flow was computed as shown in table below.

Table 5.3: Actual discharge in drain at proposed STP location

Actual Drain Discharge for Machilipatnam Town				
Location	Proposed STP			
Method	Float Method			
Time	8.00	AM	11.00	AM
Length of the drain	10	m	10	m
Width of the drain	2	m	2	m
Water depth	0.08	m	0.07	m
Time	31	sec	34	sec
Area	0.16	m^2	0.14	m^2
Velocity	0.32	m/s	0.29	m/s
Discharge	0.05	m^3/s	0.04	m^3/s
Discharge per day	*4.46*	*MLD*	*3.56*	*MLD*
Average discharge per day	*4.01*		*MLD*	

5.9 Capacity of Sewage Treatment Plant

Based on topography of the site the city is divided into 5 sewage zones for entire Town. Most of the area in two zones namely zone-1 & zone-3 are covered with existing drainage system where sullage water is collected from household and discharged to open drains. The Zone-1 is proposed for construction of Sewage Treatment Plant of capacity of 5 MLD as per the availability of land and fund.

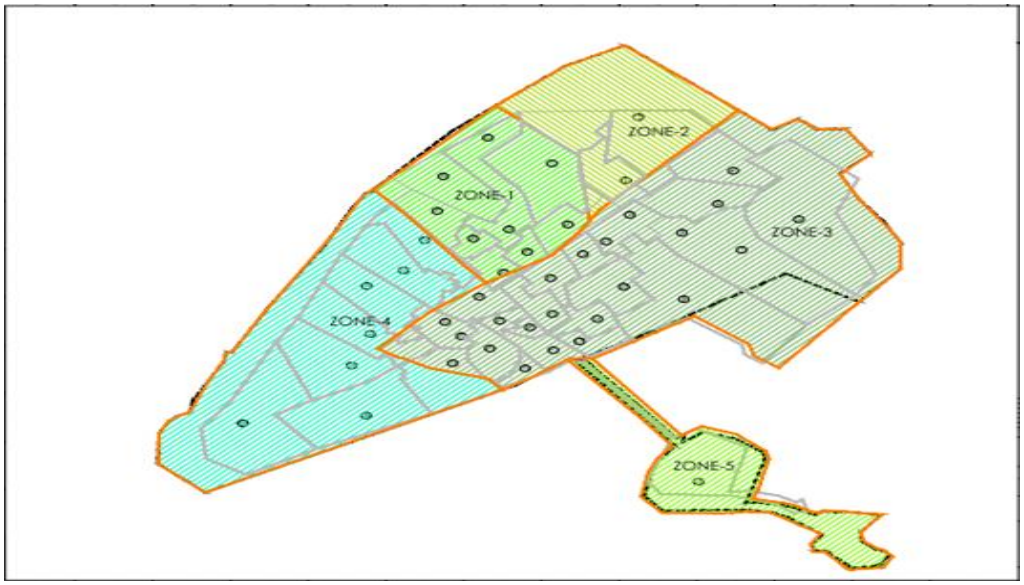


Figure 5. 2 : Zones Delineation of Machilipatnam

CHAPTER 6
SEPTAGE MANAGEMENT

"Septage" is the liquid and solid material that is pumped from a septic tank, cesspool, or other treatment facility after it has accumulated over a period of time. A septic tank will usually retain 60 to 70% of the solids, oil, and grease that enter it. The scum accumulates on top and the sludge settles at the bottom, comprising 20% to 50% of the total septic tank volume when pumped. Septage has an offensive odour and appearance and contains significant levels of grease, grit, hair, and debris. It is a host for many disease-causing organisms. Septage management Plan covers the entire service chain starting from design of septic tank, collection, conveyance, safe treatment and reuse or safe disposal of septage. Proper treatment and management of faecal sludge is integral to safe sanitation practices.

The objective of this guideline is to facilitate all ULBs in Andhra Pradesh to prepare an integrated faecal sludge management plan and implement a full septage management service in their cities. This would cover aspects across the service chain of on-site sanitation including safe collection, conveyance, treatment and disposal/reuse of the treated faecal sludge for all type of residential and non-residential properties (except industrial properties). These guidelines for seek to provide urban local bodies with knowledge and procedures of preparing a septage management plan. These guidelines also discuss other aspects related to regulation, monitoring and awareness generation that are needed in sustainable implementation of septage management in their cities. The septage management plan would help ULBs improve overall sanitation in the town.

6.1 Guideline for ULBs for effective implementation of Septage Management Plan:

Septage management Plan covers the entire service chain starting from design of septic tank, collection, conveyance, safe treatment and reuse or safe disposal of septage. The objective of these guidelines is to help city achieve improved sanitation situation in the city through implementation of septage management plan.

The following figure proposed framework for action to achieve improved sanitation through Septage management.

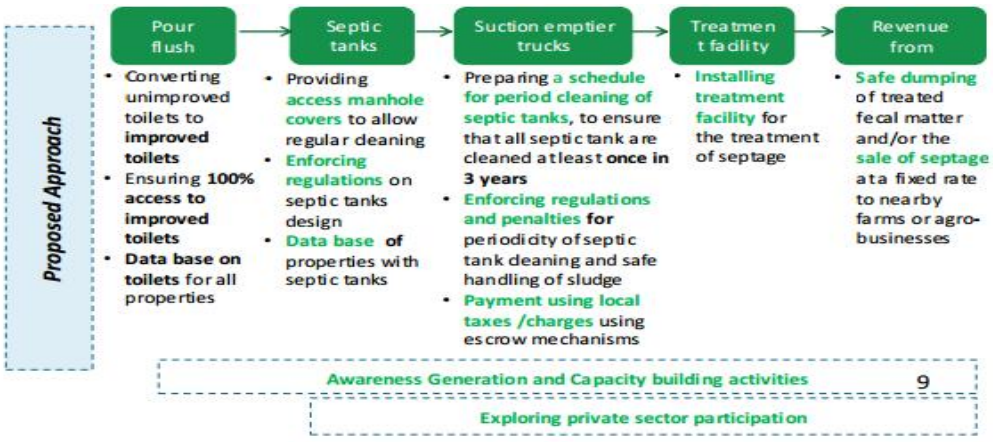
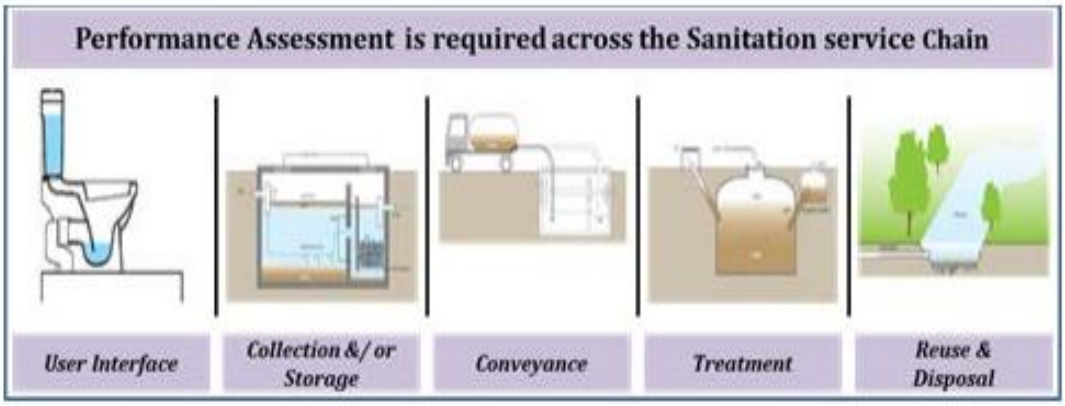


Figure 6. 1 : Proposed Approach for Septage Management

6.2 Step by step guide for effective implementation of septage management plan

- Existing situation assessment across sanitation service chain

Assessing service performance across the service chain through a city level assessment is the first step in planning process. It is an important exercise, which provides an initial sense of the state of septage facility in the city, helps in understanding the context and identifying gaps in key services.
The sanitation service chain considers the following 5 stages:



Access & Collection:

Access describes the type of toilet and captures if the HH uses individual, shared or community facility. The choice of User Interface will depend on the availability of water. At city level it also measures the availability of public toilets. For sullage disposal, it captures access to bathroom facilities and drainage outlets.

Collection and Storage/Treatment describes the ways of collecting, storing, and sometimes treating the excreta, grey water generated at the User Interface. The toilet may be connected to sewerage system; onsite systems like septic tank with soak pits, pits or may be functioning as Ecosan / composting toilets. Similarly for grey water disposal, the HHs may be connected to sewerage system or drains of any kind (Open/covered).

Conveyance

Conveyance describes the transport of products across the service chain. ULB should plan for scheduled septic tank emptying services for effective implementation of septage management plan, prior to plan for the same.

ULB shall first assess its role and capacity for implementation of septage management plan. ULB should assess various aspects of septic tank empting like how many septic tanks required to be emptied annually as per CPHEEO norm versus how many are emptied in a year, how many vacuum emptying trucks/ capacity of trucks are required if number of septic tank emptied as per CPHEEO norm versus how many trucks are available/working with capacities of emptier trucks, assessing the cost per emptying visit,

method of maintaining the register for septic tank emptying services database etc. If private player is involved in septic tank emptying business in the city, then, ULB shall also review the role of private septic tank emptier and assess their capacity in lines with the number of septic tank empting annually, charges/fees for empting services, location of disposal, registration/licensing with ULB or not etc.

Treatment and disposal

Treatment: ULB must not dispose the septage collected from septic tank without any treatment and ULB must comply with CPCB and MPCB norms before disposal of septage. ULB should assess the load of septage and assess the requirement of capacity for treatment plant. ULB should first try and assess the possibility of setting up septage treatment facility at the solid waste treatment/disposal site and at the STPs within the city or in nearby city.

Reuse/disposal refers to the methods in which products are ultimately returned to the environment, as either useful resources or reduced-risk materials. The treated septage can be used as a soil enricher or as filling material at construction sites. ULB should carry out primary assessment for availability of market and demand for reuse.

6.3. Septage Quantity

The average daily quantity of septage to be treated will be depends on volume of digested sludge in septic tank and sludge withdrawal frequency. The references have been taken from IS: 2470. The values of septage quantity and trips required for its transportation are presented in table 6.1 below

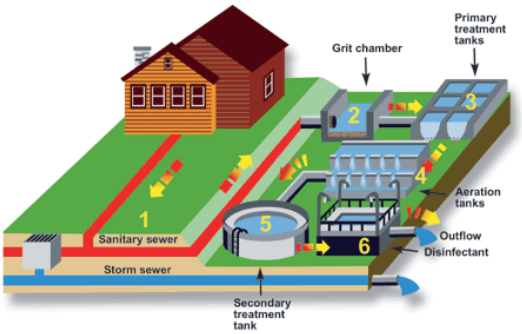
Table 6. 1: Calculation of septic tank sludge for entire town

Calculation of Septic Tank Sludge			
S No	Particular	Unit	Value
1	Population	nos	230182
2	Volume of digested sludge*	cum/capita/d	0.00021
		cum/d	48.34
		cum/year	17643.45
3	Septic Tank Cleaning Frequency **	year	1
4	Septage volume	cum/year	17643.45
		cum/day	98.02
5	Capacity of Truck	Litres	4000
6	Trips/day	nos	24.50
		Say	25

Note: * As per IS 2470: Part I; Clause 3.4.3.3,
** As per recommendations given in IS 2470: Part I

CHAPTER 7
SEWAGE TREATMENT TECHNOLOGIES

7.1. Objectives



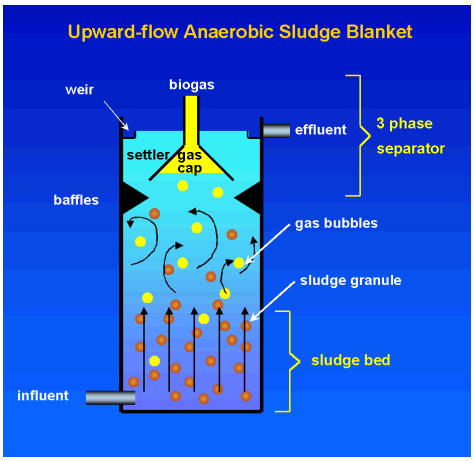
The objective of treatment of sewage through a combination of physical, chemical and/or biological processes is to stabilize decomposable organic matter and remove other harmful contaminants prior to discharge onto a land or waterway or water body. The degree of treatment depends on the desired waste water quality. Raw sewage collected from household through a sewerage network is to be processed through a series of operations, so as to ensure its disposable quality suiting to the standards proposed by the pollution control board or regulatory authorities. The treatment of sewage can be stated under three stages. The primary treatment is the first stage of treatment where in all the physical matters are removed through screening, primary settling and through degritting. The secondary treatment removes all the biological maters through biological decomposition of degradable matters either through aerobic or anaerobic process or through combination of aerobic and anaerobic processes. The secondary treatment also comprises of sludge handling, management issues with disposal aspects. The tertiary Treatment process comprises of disinfection of treated sewage and its recycling proposals. There are many technologies available for treating the sewage to the desirable levels of its requirement for reuse. Some of treatment processes that have been adopted in India are discussed in the successive sections with their merits and demerits.

7.2. Available Technologies for Sewage Treatment

Sewage treatment is nothing but the degradation of organic molecules present in the wastewater. Present day practice is to degrade the biological mass either by using aerobic, anaerobic or by using facultative methods. i.e., the microbial organisms, microbes that are being generated in the aerobic or anaerobic or facultative states, degrade the biological mass. There are many technologies in today's practice to treat the sewage aerobically or anaerobically or in combination. In this chapter, few treatment technologies which have proven track records of treating sewage to desirable standards of disposal or for its reuse. A brief description of those options with merits & demerits has been provided. They are,

- Up flow Anaerobic Sludge Blanket (UASB) Technology
- Activated Sludge Process (ASP) Technology
- Extended Aeration (EA) Technology
- Sequencing Batch Reactors
- Waste Stabilization Ponds
- Moving Bed Bio Reactor
- Membrane Bio Reactor
- Soil Based technology

7.3. Up Flow Anaerobic Sludge Blanket (UASB) Technology



The principle of UASB reactor is to introduce raw sewage at the bottom of the UASB reactor. This helps in maintaining a sludge blanket, the incoming sewage passes through the blanket and fine suspended particles are filtered and soluble components are absorbed in the Biomass. This Biomass converts the waste into the Biogas and some new Biomass. The gas leaves the blanket in bubbles and provides necessary mixing .The settled sludge is digested in the bottom zone.

The main units are UASB reactor in which most of the Biodegradation takes place, Sludge Drying Beds for dewatering and drying of sludge, Biogas Holder where bio-gas generated from UASB reactors is collected, Polishing Unit to remove the balance BOD and Secondary Clarifier.

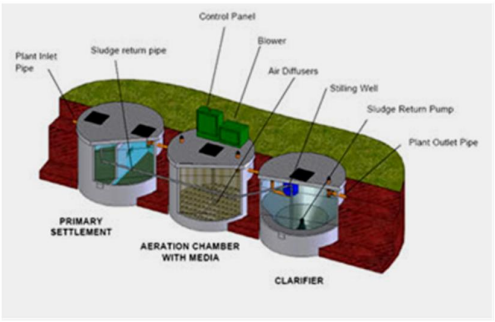
UASB technology is relatively new and there are very few operational plants in India. These plants require large quantity of organic matter to operate efficiently and hence not very successful for domestic sewage. The space required to accommodate plants based on UASB is however less than that required for conventional treatment.

UASB is able to bring down the BOD load to a tune of 100 – 70 mg/L requiring a secondary aerobic treatment to enable to meet discharge standards. The UASB effluent will be highly alkaline and has high oxygen demand. It also produces much of the sum which may interfere in aerobic process in successive stages if properly not handled. Due reduction in COD, the gas yield is 0.35 cum/kg of COD reduced. There is no reliability for gas generated.

7.4. Activated Sludge Process Technology

Majority of conventional Sewage Treatment Plants presently in use are based on the Activated Sludge Process technology. An activated Sludge plant essentially consists of

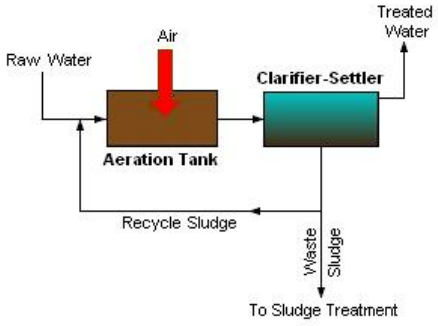
- Primary Treatment Units comprising of Bar screen, Grit Collection Wells, Primary settling tank
- In the Secondary Treatment, Aeration tank in which air is supplied continuously, Secondary Settling tanks are with activated Sludge Recirculation system
- Secondary sedimentation tank to separate and thicken activated sludge
- Sludge Digestion and Excess sludge dewatering and disposal facilities
- Aeration Blower or Fixed Surface Aerators will transfer oxygen

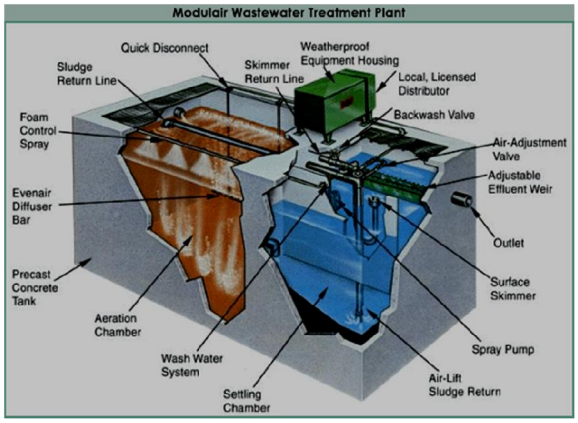


The system can be installed in modules and the capacity can be increased by constructing the modules as and when required. The main advantages being that it is easy to operate, modular construction is possible, can absorb shock loading and all equipment and spare parts are indigenously manufactured. The major drawback being that it requires larger areas and high power requirement.

7.5. Extended Aeration Technology

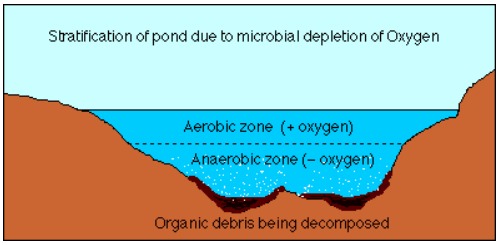
The Extended aeration Process is very similar to the Activated Sludge Process except that the Primary settling tank is omitted. All the physical treatment units (primary treatment units) will be followed by Aeration tank & secondary clarifier and along with the disinfection units as tertiary treatment. The production of sludge is less but the oxygen requirement is very high.





This is a proven technology, the system can be installed in modules, and the capacity can be increased by constructing the modules as and when required. The main advantages being that it is easy to operate, can absorb shock loading and all equipment and spare parts are indigenously manufactured. However, the system requires a large area but comparatively little less to activated sludge process.

7.6. Waste Stabilization Ponds



A wastewater stabilization pond is a relatively shallow body of wastewater contained in an earthen basin which is designed to treat wastewater. ("Oxidation pond" is a synonymous term.) They are used to treat a variety of wastewaters, from domestic wastewater to complex industrial waters, and they function under a wide range of weather conditions, i.e., tropical to arctic. Ponds can be used alone or in combination with other treatment processes. If sufficient land is available, ponds are a cost-effective means to provide wastewater treatment. In addition, their operation is easy and their maintenance requirements are minimal. They are usually the most preferred system in hot climate zones.

Types of ponds

The classifications of ponds are based on type of influent, method of effluent flow management, oxygenation method, and type of biological activity. This last classification scheme is the best because it describes the dominant feature, i.e., the type(s) of biological activity occurring in a pond. However, to fully describe the different types of ponds, the effluent flow management method should also be noted.

S. No	*Basis*	*Classification*
1	*Type of Influent*	*Untreated Wastewater*
		Screened Wastewater
		Settled Wastewater
		Activated Sludge Effluent
2	*Effluent Flow Management*	*Intermittent*
		Continuous
3	*Oxygenation Method*	*Photosynthesis*
		Surface Transfer
		Mechanical Aerator
		Complete mix
		Partial Mix
4	*Biological Activity*	*Aerobic*
		Anaerobic
		Facultative

7.7. Sequencing Batch Reactors

Sequencing batch reactors (SBR) or sequential batch reactors are processing tanks for the treatment of wastewater. SBR reactors treat waste water such as sewage or output from anaerobic digesters or mechanical biological treatment facilities in batches. Oxygen is bubbled through the waste water to reduce biochemical oxygen demand (BOD) and chemical oxygen demand (COD) to make suitable for discharge into sewers or for use on land. While there are several configurations of SBRs the basic process is similar. The installation consists of at least two identically equipped tanks with a common inlet, which can be switched between them. The tanks have a flow through system, with raw wastewater (influent) coming in at one end and treated water (effluent) flowing out the other. While one tank is in settle/decant mode the other is aerating and filling. In one option of SBR there is at the inlet a section of the tank known as the bio-selector. This consists of a series of walls or baffles which direct the flow either from side to side of the tank or under and over consecutive baffles. This helps to mix the incoming Influent and the returned activated sludge, beginning the biological digestion process before the liquor enters the main part of the tank. Another option uses the same tank for mixing, mixing being done by a dedicated mixer. There are four stages of treatment in sequencing the treatment of sewage. In the first stage sewage will be filled in the container for aeration purpose. This stage can be further divided ad mixed fill and react fill. In the second stage, the aeration of sewage will be carried to decompose biological mass and in third stage suspended biological masses will be made to settle to the bottom of the tank. Final stage involves the decanting operation that disposes supernatant liquid from the tank.

Advantages of SBR

a) Complete treatment in a single basin: Separate chambers are not required as in the case of an ASP based STP.
b) Control of reactor environment: The different phases of the system operation are fully controlled by a PLC depending the on the requirement of the waste water parameters.
c) Shock loads: The Tanks can tolerate hydraulic and organic shock loads.
d) Flexible aeration: The aeration of the basin can and is controlled throughout the application of air. This property enhances energy reduction.
e) Increasing Settling area: Since the entire settling happens in the same basin, more complete settling occurs. Since there is no clarifier to accumulate sludge, there is no odour developed.

7.8. Membrane Bio Reactor (MBR)

The Membrane Bioreactor is combination of the activated sludge treatment process and the membrane filtration process. The wastewater enters the wastewater treatment facility and passes through the usual Preliminary Treatment and Primary Treatment processes. A very fine screen prefer 2 – 3 mm clear opening is need to place prior to the MBR reactors to remove small suspended particles. This step is designed to reduce the potential fouling of the membranes with these fine particles.

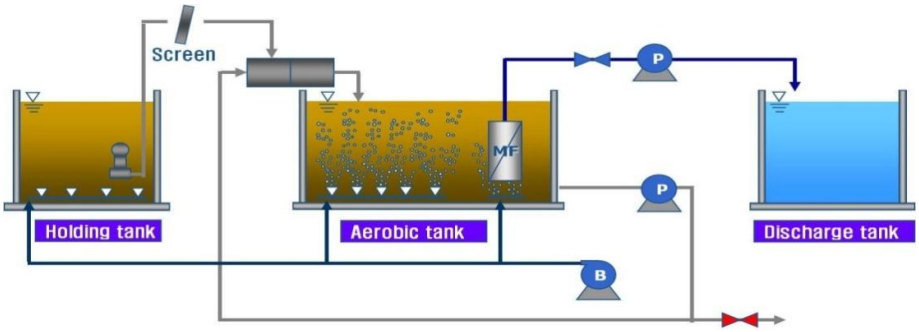
The dissolved BOD (sugars, starches, carbohydrates, etc) that is in the wastewater is then consumed by

the microbes in the aeration basin, and subsequently converted into additional microorganisms, or becomes attached to the biological floc.

The Mixed Liquor Suspended Solids (MLSS) is usually fairly high in MBR units, around 10,000 mg/L 15000 mg/l. This high MLSS concentration allows for lower hydraulic retention times (HRT) which equates to smaller aeration basins. This also equates to an activated sludge that may be fully nitrifying, as the Mean Cell Residence Time (MCRT) is usually well above 10 days. Pumps are attached to the membrane modules, and pull a slight vacuum that pulls water from the tank through the perforations in the membranes leaving the microorganisms behind in the tank.

Most all of the MBR facilities utilize fine bubble aeration in the aeration tanks, except for those areas that will have the MBR modules. These membrane module areas will usually have coarse bubble diffusers installed beneath them.

Some facilities may use the single tank MBR process, or the double tank MBR process. In the single tank the filtration modules are placed near the opposite end from where the primary effluent enters the tank. In a double tank configuration, designers may have an aeration tank without a filtration module in it, followed by an aeration basin with the membrane filtration unit in it. The treatment process goal in both designs is to allow for suitable time for the conversion of BOD/COD into microbial cells or at least be absorbed/flocculated with the cellular masses prior to being placed near the membrane filtration units.



Advantages of Membrane Bio Reactor

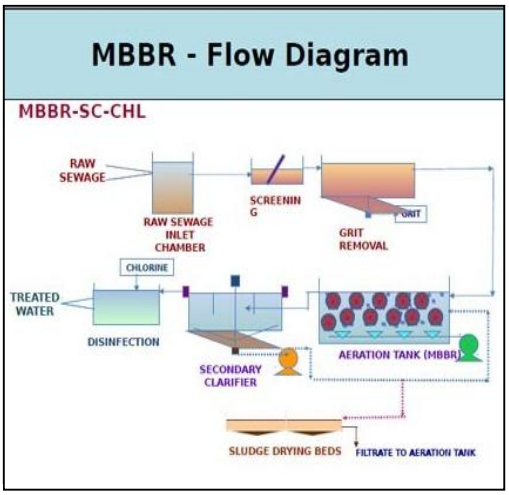
- The effluent is of very high quality, very low in BOD (less than 5 mg/l), very low in turbidity and suspended solids.
- The “simple filtering action” of the membranes creates a physical disinfection barrier, which significantly reduces the disinfection requirements.
- The treatment process also allows for a smaller “footprint” as there are neither secondary clarifiers nor tertiary filters which would be required to achieve similar water quality results. It also eliminates the need for a tertiary backwash surge tank, a backwash water storage tank, and for the treatment of the backwash water.

Disadvantages of Membrane Bio Reactor

- The membrane modules will need to be replaced somewhere between five (5) and ten (10) years
- Energy consumption is very high.
- Fouling is troublesome, and its prevention is costly.

7.9. Moving Bed Bio Reactor (MBBR)/ Fixed Aerated Bioreactor

Moving Bed Bio Reactor (MBBR) / Fixed Aerated Bioreactor (FAB) With the moving bed bio reactor (MBBR) an economically solution is offered for waste water treatment if the "bulk" of the pollution load must be disposed of (as means of cost reduction) or if applicable discharge regulations are not as strict. With this application we offer advanced waste water treatment solutions for the industrial and municipal markets. These solutions significantly increase the capacity and efficiency of existing waste water treatment plants, while minimizing the size of new plant deployments.



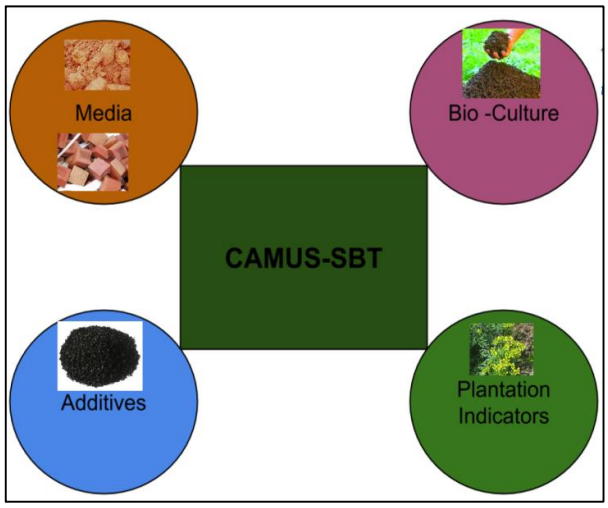
This method makes it possible to attain good efficiency results of disposal with low energy consumption. This process is used for the removal of organic substances, nitrification and denitrification.

The MBBR system consists of an activated sludge aeration system where the sludge is collected on recycled plastic carriers. These carriers have an internal large surface for optimal contact water, air and bacteria.

Advantages of the MBBR system over other activated sludge processes are:

- Reduced footprint for the aeration tank (MBBR reactor) and overall plant footprint Relatively stable and can withstand shock loads
- Low sludge production
- Mother Liquor Suspended Solids (MLSS) is not a design parameter so no need for Return Activated Sludge (RAS) and the associated
- pumps/pumping facilities
- Modular design, easy to expand
- Utilizes medium/coarse bubble diffusers, instead of more expensive fine bubble systems
- May be used to retrofit or upgrade existing conventional activated sludge plants without need for new tanks

7.10. Soil Based Technology



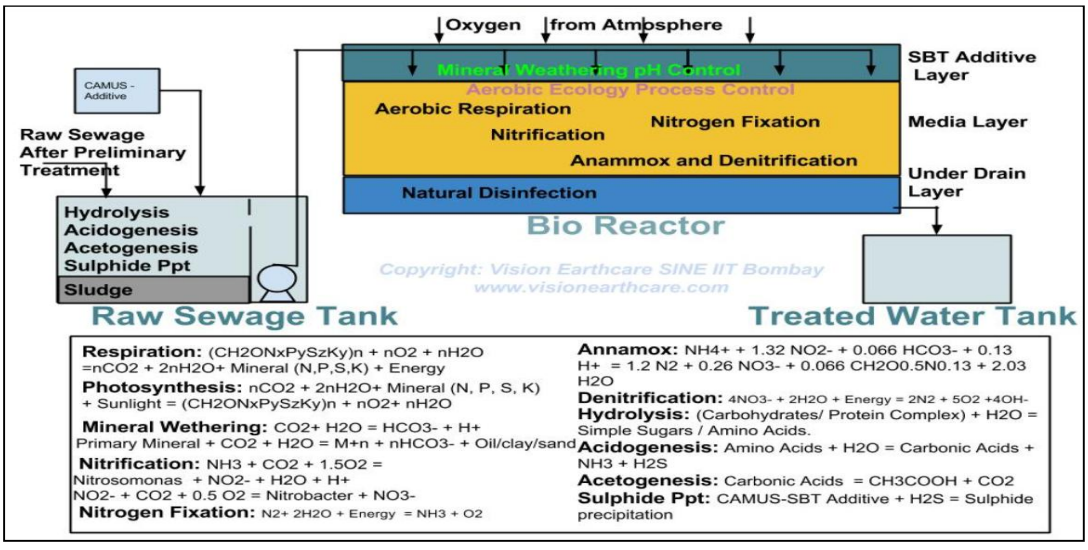
Media: Locally available construction materials serves as media, advanced manufactured media material is also under development by technology provided. Media is the home where bacteria and higher organisms live and work.

Bio Culture: Bio Culture is combination of catalyst that increases the oxygen transfer capacity of the Media and Culture which consists of micro and macro biological strains that catalyze and grow during the processes of COD reduction via aerobic respiration, Nitrification, Denitrification and Methanogenesis for production of CH4 in the anaerobic digesters where provided.

Additives: The CSBT process uses additives which help in pH control; engages catalysts to enhance oxygen supply, Also additives are used to bring about Coagulation and Flocculation of suspended solids. Additives are used both in the primary treatment step, anaerobic process equipment, top of the bioreactors or commonly called bio-mound.

Plantation: Soil plant ecosystems provide good environment for organisms to work. Plantations engaged consist of generic plants (any landscaping plantation) whose roots system survive only in CSBT environment of high oxygen conditions on top of Bio Mounds visual inspection of which provide a bio-indication of stability and performance of process

PROCESS CHEMISTRY OF SBT



Respiration

This is the primary process of removal of COD from wastewater. The dissolved COD in wastewater is captured by the media by the process of absorption and adsorption. Typically the media is selected for low adsorption energy so that the adsorbed COD can be accessed by biology and converted to CO_2.

Mineral Weathering

Mineral weathering is reaction between primary mineral and CO_2 is one of the fundamental reactions of soil to regulate pH. It is integrated into bioreactors to balance pH to near neutral conditions so that biology is most effective.

Nitrification

Ammoniacal Nitrogen in the wastewater is partially converted to Nitrites and Nitrates. This is achieved by Nitrobacter and Nitrosomonas species of bacteria.

Denitrification

Denitrification by bacteria using Nitrates and Nitrites as oxidant rather than Oxygen it's particularly to convert the Ammonia and Nitrites to Nitrogen gas and there by removing the Nitrogenous components in wastewater.

Annamox

Also another form of denitrification but through another pathway .It is now believed that all denitrification go through this pathway.

Nitrogen Fixation

In certain nitrogen deficient wastewaters the SBT system is able to use the power of nitrogen fixing bacteria to convert dinitrogen to ammonia.

Phosphate Removal

Phosphate of the order of 2-3 mg/L is removed in the Bio Mounds typically by precipitation as calcium hydroxyapatite. However most of the removal takes places in the flocculation and coagulation step in the primary clariflocculator and subsequent accumulation in the anaerobic digesters

Redox Potential and its Role in CSBT

It is known knowledge that pH is a measure of proton activity while pH is a measure of electron activity. Redox is expressed as redox potential. In CSBT oxygen is the primary electron acceptor. Redox potential is a measure of oxygen availability. Available thermodynamic data suggests that that nitrification occurs at redox 800 mV and above; aerobic respiration between 300-800 mV; denitrification and annamox 100-300 mV; biomethanation (-) 100 mV or lower. Healthy soils show redox levels of 800-1000 mV. (Ref Stumm& Morgan Aquatic Chemistry John Wiley New York)

CSBTs are unique with low shear rates so that biological reactions can take place at their natural rates; so that process can be tuned to favour one or more of the above reactions. This is achieved by adjusting hydraulic loading to vary holdup and hence redox levels can be adjusted. This tuning is not possible with

aquatic technologies such as WSP SBR MBBR MBR ASP Root Zone Phytorid etc. So CSBTs versatility enables its deployment for a great variety of applications in waste treatment solid liquid or gaseous.

Process Design Criteria

CAMUS-SBT is designed to process municipal sewage to high quality treated water as per client specifications. Typical specifications for inlet and outlet is given below

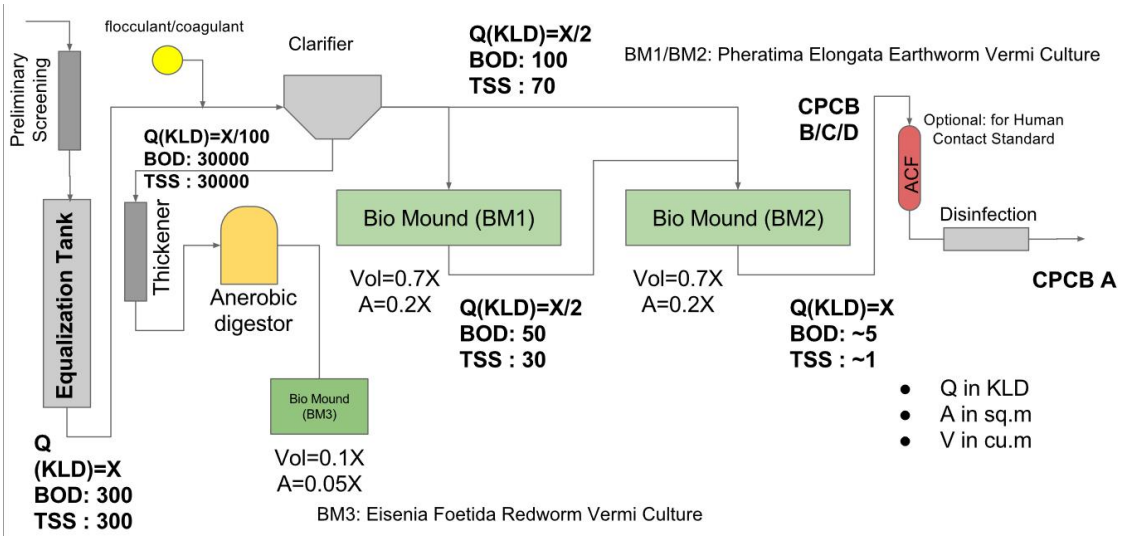
S. No	Parameter	Raw Sewage	Irrigation standards	Surface Discharge	Toilet Flushing*	CSBT Treated Water **
1	Biological Oxygen Demand (BOD) (mg/L)	150-300	Less than 100	30	Less than 10	Less than 10
2	Chemical Oxygen Demand (COD) (mg/L)	450-600	Less than 250	100	Less than 50	Less than 50
3	pH	5.5-9.0	5.5-9.0	5.5-9.0	6.5-9.0	6.5-9.0
4	Oil & Grease (mg/L)	20	Less than 10	Less than 10	Less than 10	Less than 10
5	Total Residual Chlorine (mg/L)	NA	NA	Less than 1	Less than 1	Less than 1
6	Ammonical Nitrogen (N) (mg/L)	35-50	NA	NA	Less than 5	Less than 5
7	Total Kjeldahl Nitrogen (as NH3) (mg/L)	NA	NA	NA	Less than 10	Less than 10
8	Nitrate Nitrogen (mg/L)	NA	NA	Less than 10	Less than 10	Less than 10
9	Total suspended solids (mg/L)	250-500	Less than 100	Less than 100	Less than 20	Less than 20
10	Dissolved Oxygen (mg/L)	Nil	NA	NA	Greater than 4	Greater than 4
11	Fecal Coliforms	10^8-10^9	NA	<1000	<1000	<1000
12	Total Nitrogen - N mg/L					<10
Note:- http://cpcb.nic.in/GeneralStandards.pdf						
*Treated water characteristics based for toilet flushing based on CPCB is CPCB vide order no A-19014/43/06-MON/709 dated 21.04.2015.						
** Treated without using any tertiary treatment like Dual Media Filters, Sand Beds etc.						

CAMUS-SBT PROCESS EQUIPMENT

The CAMUS SBT System consists of following major Equipment's.

- Preliminary Screening a) Fine Screening (FS) b) Grit Separation (GS)
- Equalization Tank
- Suspended Solid Separation a) Clarifloculator / Tube Settler b) Thickener
- Anaerobic Digester
- Bio Mound 1 + Collection Tank 1 (BM1+CT1)
- Bio Mound 2 + Collection Tank 2 (BM2+CT2)
- Bio Mound 3 : Vermicomposting Bed (BM3)
- Disinfection System

Process Description for CAMUS-SBT Wastewater Treatment System



- Fine Screen

Fine Screens made of SS 304 with mesh size of 10 mm is being chosen to remove particle such as plastics and stringy materials that typically cause problems in pumping operations. The Screens are placed at an angle of 60 degrees in open channel. Fine Screens operate at the peak flow

- Grit Separators

Municipal Sewage especially those collected from open nallahs have a very large silt load. Typical inlet Total Suspended Solids (TSS) 300-500 mg/L is observed in Indian conditions of which Inorganic SS (TISS ~ silt/grit) is around 200 mg/L and Organic SS of 300 mg/L. It is critical to prevent silt from entering the process. Grit separators are provided in order to remove the silt load. Typically the grit separation takes place in an open channel provided with a chute to collect the grit at the bottom. Grit Separators are designed to remove silt particles of high density > 1.6g/cc at a surface overflow rate of 30 m/hr. The separated grit is raked upwards by a screw type or rocking arm type grit scrapper mechanism. The wetted components are made of SS306. In larger units (10 MLD+) an integral compressor for air scrubbing of the grit is also provided. The air scrubbing washes off the organics adhering to the grit. The collected grit in

this case is allowed to dry in the Bio Mound 3 where residual organics are also processed via vermicomposting.

- Equalization Tank

The Equalization tank is designed to have an active volume of 2-3 hours at Peak Flow. This allows the process to buffer the expected peak flows incoming from the municipal wastewater source and allow the rest of the system to operate at average flow. The tank is provided with a sump to allow it to be completely drained. The top is covered supported from the bottom by Beams and Columns. The top of the Equalization tank is engineered to be the Bio Mound 3 (BM3) so that any leachate/drip outs from processing in BM3 to be recycled to the Equalization tank by gravity. In CAMUS-SBT system provision for aeration not necessary since septic conditions do not affect the SBT bio mounds. The sump in the Equalization tank is designed for multiple pumps to pump the water to Clarifier. Small amount of lime may be introduced to manage the pH and Alkalinity if necessary.

- Clariflocculator / Tube Settler

The pumped output from the Equalization tank is dosed with a Coagulant typically at a rate of 30mg/L of FeCl3 and a polymeric flocculants at the rate of 0.5 mg/L in the pump line of equalization tank to the clarifier. The coagulant and flocculants dosing rates are adjusted to achieve optimum separation of SS from the Clariflocculator. Typical inlet Organic SS free of inorganics of 200-300 mg/L is flocculated and coagulated and allowed to settle at a design surface overflow rate of 1.5-2.0 cum/sqm/hr. Flocculated Primary sewage is typically fast settling dense sludge and is thickened to 3% slurry at the bottom of the Clariflocculator. In deep clarifiers further thickening to 5% is possible. The Clariflocculator effluent at the top of the Clariflocculator.is collected in an overflow weir and transported by gravity to the Bio Mound 1 and Bio Mound 2. The 3-5% Slurry from the bottom of the Clariflocculator is pumped to a thickener.

Instead of circular clariflocculator a Gould type rectangular settling tank or Tube Settlers can be considered. Tube settlers packings enhance the settling area and reduce the tank sizes. Rectangular settling tanks units can utilize common wall construction to save on cost particularly when there are multiple Settlers that are needed for a particular project.

Nearly 70% of the Phosphate load is removed from the water into the slurry stream in this process and upto 50-70% of the organic load is separated

- Thickener

The Thickener chosen is typically a mechanical screw thickener. The thickener will convert 3-5% slurry to 10-12% slurry before introduction into an anaerobic digester. Typically the thickener is located such that the thickened slurry can flow into the anaerobic digester by gravity. The excess liquid from the thickener is returned to Equalization tank.

- Anaerobic Digester

The Anaerobic digester is designed as a CSTR with 15-20 day hydraulic retention time. The System is designed as an enclosed RCC structure and an expandable Balloon type gas holder. Internally the system

is provided with a mixing pump to maintain CSTR conditions. The reactor is designed to sustain the water pressure and the bio gas pressure generated. It is expected that the anaerobic digester will produce upto 400 Kg of raw gas per ML of sewage. In many plants the anaerobic digester will also be designed to handle Septage loads from nearby areas. After digestion the spent slurry will be dewatered by a filter press and put on Bio Mound 3 for composting. The Phosphates in the slurry are accumulated in Phosphate Accumulating bacteria.

- Bio Mound 1

About 40 to 50% of Clear water from the Clariflocculator is transferred by gravity to the Bio Mound 1 which is designed to Oxidise Ammoniacal Nitrogen to Nitrites and Nitrates and Remove BOD. The Nitrified water is collected in a collection tank CT1. The Bio Mound are populated with a Pheratima Elongata earthworm culture to manage the biomass ecology as the top predator.

- Bio Mound 2

Rest of the Clear Water from Clariflocculator and the water from CT1 is distributed on top of the Bio Mound 2. The mix of Nitrites and Ammoniacal water is denitrified and the residual BOD is removed in this reactor and water reaches the quality standards specified and is collected in CT2. The Bio Mound is populated with a Pheratima Elongata earthworm culture to manage the biomass ecology as the top predator. It is also possible to integrate Bio Mound 1&2 suitably as per site conditions.

- Bio Mound 3

The slurry from the anaerobic digester is dewatered in a filter press and applied on this Bio Mound for composting. The Bio Mound are populated with a Eisenia Fetidared worm culture to manage the biomass ecology as the top predator. The Grit from the grit separator is also added here.

- Disinfection System

The clear treated water is disinfected using a UV or Ozone or Chlorine disinfection system. If the receiving water body is a river or a pond then a UV disinfection system would be ideal since the residual chlorine or Ozone is detrimental to aquatic ecology. Typically for most purposes the treated water from the CSBT process does not require any disinfection since the residual high dissolved oxygen content of around 5mg/L provides a natural disinfection capability.

CHAPTER 8
TREATABILITY STANDARDS

8.1 General

The Raw sewage if disposed untreated will influence the surrounding environment directly or indirectly creating imbalances in health & hygiene, environmental sanitation, etc., Hence, Standards have been set by the Bureau of Indian Standards, BIS to dispose the sewage after its treatment. These limiting values have been fixed in consideration to the self-purification capacity of streams and the assimilative, digestive capacity of surrounding land. The standards for disposal of treated sewage into public sewers system, inland waterways and landscape irrigation are provided in Table 8.1.

Table 8.1: Standards for disposing sewage into Inland Surface Water, Public Sewers & for Landscape Irrigation

Sl. No.	Parameter	Standards		
		Inland Surface Water	Public Sewers	Land for Irrigation
		(a)	*(b)*	*(c)*
1	Colour and odour	See footnote	-	See Footnote
2	Suspended solids mg/1, Max	100	600	200
3	Particle size of suspended solids	Shall pass 850 micron IS Sieve		
4	PH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5	Temperature	Shall not exceed 5°C above the receiving water temperature	-	-
6	Oil and grease mg/1 Max	10	20	10
7	Total residual chlorine mg/1 Max	1.0	-	-
8	Ammoniacal nitrogen as (N) mg/1	50	50	-
9	Total Kjeldahl nitrogen (as N) mg/1 Max	100	-	-
10	Free ammonia (as NH_3) mg/1, Max	5.0	-	-
11	Biochemical oxygen demand (5 days at 20°C), mg/1 Max	30	350	100
12	Chemical oxygen demand mg/1, Max	250	-	-
13	Arsenic (as As) mg/1	0.2	0.2	0.2
14	Mercury (as Hg) mg/1 Max	0.01	0.01	-
15	Lead (as PB) mg/1 Max	0.1	0.1	-

Sl. No.	Parameter	Standards		
		Inland Surface Water	Public Sewers	Land for Irrigation
		(a)	*(b)*	*(c)*
16	Cadmium (as Cd) mg/1, Max	2.0	1.0	-
17	Hexavalent chromium (as Cr+6) mg/1, Max	0.1	2.0	-
18	Total chromium (as Cr) mg/1, Max	2.0	2.0	-
19	Copper (as Cu) mg/1, Max	3.0	3.0	-
20	Zinc (as Zn) mg/1, Max	5.0	15	-
21	Selenium (as Se) mg/1, Max	0.05	0.05	-
22	Nickel (as Ni) mg/1, Max	3.0	3.0	-
23	Cyanide (as CN) mg/1, Max	0.2	2.0	0.2
24	Fluoride (as F) mg/1, Max	2.0	15	-
25	Dissolved phosphates (as P) mg/1, Max	5.0	-	-
26	Sulphide (as S) mg/1, Max	2.0	-	-
27	Phenolic compounds (as C_6H_5OH) mg/1, Max	1.0	5.0	-
28	Radioactive materials (a) Alpha emitters micro-curie mg/1, Max (b) Beta emitters micro-curie, mg/1, Max	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}
29	Bio-assay test after 96 hours in 100% effluent	90% survival of fish	90% survival of fish	90% survival of fish
30	Manganese (as Mn)	2 mg/1	2 mg/1	2 mg/1
31	Iron (as Fe)	3 mg/1	3 mg/1	3 mg/1
32	Vanadium (as V)	0.2 mg/1	0.2 mg/1	-
33	Nitrate nitrogen	10 mg/1	-	-

- These standards shall be applicable for industries, operations or processes other than those industries, operators or process for which standards have been specified in Schedule I.
- All efforts should be made to remove colour and unpleasant odour as for as practicable.

Source: Schedule VI of Environment (Protection) Third Amendment Rules, from Manual on sewerage and sewage treatment, Ministry of Urban development, CPHEEO, New Delhi, 1993.

As per the new Guide lines of Central Pollution control board vide lr no A-14011/1/2015-MON/5245 Dated 09-10-2015 the standard for treated effluent of Sewage Treatment plant is given below for reference.

Table 8.2: Standards for treated effluent of Sewage Treatment Plants

S. No	Industry	Parameters	Standards for New STPs (Design after notification date)*
1	Sewage Treatment Plant	pH	6.5-9
2		BOD, mg/l	10
3		COD, mg/l	50
4		TSS, mg/l	10
5		NH_4-N, mg/l	5
6		N-total, mg/l	10
7		Fecal Coliform (MPN/100 ml)	<230
8		PO_4-P, mg/l	2
Note: (i) These standards will be applicable for discharge in water resources as well as for land disposal. The standards for Fecal coliform may not be applied for use of treated sewage In industrial purposes. Achievements of Standards for existing STPs within 5 years from date of notification.			

8.2 Salient Features of Technologies Reviewed

Table 8.3: Comparative statement of the salient features of the technologies reviewed

S. No.	Description	Extended Aeration	CSBT	MBBR	SBR	MBR	Waste Stabilization Pond	UASB+EA
1.	Technology for low capacity plant i.e. less than 5 - 10 MLD	Most suitable technology for any capacity plant	Most suitable technology for not only 5-10 MLD but also higher capacities.	Most suitable technology for low capacity plant	Prefer for high capacity plant i.e. more than 10 MLD.	Suitable of low and high level capacity plant	Simple suitable to any capacity	Prefer for high capacity plant i.e. more than 10 MLD, wherein the COD load is high.
2.	Expected Parameter after Secondary Treatment	BOD : 10 -20 mg/l TSS : 10 - 20 mg/l pH: 6.5 – 8.0	BOD : <10 mg/l TSS : <10 mg/l 600 mg/l pH: 6.5 – 8.0	BOD : 10 -20 mg/l TSS : 10 - 20 mg/l pH: 6.5 – 8.0	BOD : 10 - 15 mg/l TSS : 10 - 15 mg/l pH: 6.5 – 8.0	BOD : <5 mg/l TSS : < 2 mg/l pH: 6.5 – 8.0	BOD : 45-50 mg/l TSS : 90-95 mg/l pH: 6.5 – 8.0	BOD : 20-30 mg/l TSS : 20-30 mg/l pH: 6.5 – 8.0
3.	Expected Parameter after Tertiary Treatment	BOD : <10 mg/l TSS : <10mg/l pH: 6.5 – 8.0	No tertiary treatment required	BOD : <10 mg/l TSS : <10 mg/l pH: 6.5 – 8.0	BOD : <10 mg/l TSS : <10 mg/l pH: 6.5 – 8.0	Not Required, as taken in the main process.	The tertiary treatment requirement shall be a complete plant	BOD : <10 mg/l TSS : <10 mg/l pH: 6.5 – 8.0
4.	Main Biological Controls	Biomass activities and settle ability characteristics.	Self-control process. Bio Media Sufficient to deliver the Oxygen demand to be installed	Self-control process. Only Dissolved oxygen has to me maintained	1.0 Time control of each biological reaction and physical step of a sequence 2.0 Biomass activities and settle ability characteristics.	MLSS Dissolved Oxygen	It is natural process for wastewater treatment that employs a combination of macrophytic plants, substrates and microorganisms to treat wastewater.	This is an anaerobic process. BOD reduction takes place by converting organic matter to methane/ carbon di-oxide and other gases, through bacterial synthesis.
5.	Efficiency & Degree of Treatment	Very Good (BOD Removal of approx. 90 - 95%) after tertiary treatment	Very Good (BOD Removal of approx. 97 - 99%) after secondary treatment	Very Good (BOD Removal of approx. 96 - 97%) after tertiary treatment	Very Good (BOD Removal of approx. 96%-97%) without tertiary treatment	Excellent (BOD and suspended solid Removal of approx. 99%) tertiary treatment not required.	BOD Removal of approx. 70-75%.	BOD Removal of approx. 85-90% after tertiary treatment

S. No.	Description	Extended Aeration	CSBT	MBBR	SBR	MBR	Waste Stabilization Pond	UASB+EA
6.	Skill of operating Team	Skill Persons are Required. operated through PLC/ SCADA	Semi Skill Persons are Required. self-regulating system	Skill Persons are Required. operated through PLC/ SCADA	Though operated through PLC/ SCADA. Skilled Persons are required for the operation of SBR.	Though operated through PLC/ SCADA. Skilled Persons are required for the operation of MBR	No skilled persons required	Skill Persons are Required. operated through PLC/ SCADA
7.	Maintenance	No Major Maintenance Required. The regular maintenance of equipment shall be required.	Only Pumps to be maintained	Major Maintenance Required	Maintenance required	Maintenance Required	No Major Maintenance Required. Only Cleaning sludge periodically.	Maintenance required
8.	Space Requirement including tertiary treatment M^2/ MLD	750 - 900 M^2	650-750 M2	550-650 M^2	550 - 650 M^2	450-500 M^2	6000-6200 M^2	1100-1200 M^2
9.	Life of Membrane/ Media	No Media use	30 years	10- 15 years	No media used	<10 years	No media used	No media used
10.	Installation Cost Lac / MLD	Less than 100	100 – 125	100 – 125	100 – 150	180 - 200	35-40	Less than 100
11.	For Tertiary Treatment with Pressure/gravity sand filter and activated carbon filter with Disinfection (Lac / MLD)	30-35	0-5 (disinfection system only)	30-35	30-35	Tertiary Treatment Not Required.	Full Plant shall be required, hence not advised for present scenario.	30-35
12.	Electricity Consumption (secondary Treatment)	0.35-0.45	0.12-0.14	0.50-0.60	0.35-0.45	0.85-0.9	Less than 0.05	0.40-0.55

S. No.	Description	Extended Aeration	CSBT	MBBR	SBR	MBR	Waste Stabilization Pond	UASB+EA
	KWH/KL/day							
13.	Electricity Consumption KWH / KL/day (For Tertiary Treatment)	0.15-0.25	0.01-0.02	0.15-0.25	0.15-0.25	Tertiary Treatment Not Required	Full Plant shall be required, hence not advised for present scenario.	0.15-0.25
14.	O&M cost per KL/day Excluding the cost of capital and Depreciation	7-8	2-4	8-9	7-8	12-14	2-4	8-9

Table 8.4: Life Cycle cost for 5 MLD STP Plant

Life Cycle cost for 5 MLD STP Plant						
Sl.No	Assessment Parameter	UASB+EA	MBBR	SBR	MBR	SBT
1.0	Performance after secondary treament					
1.1	Effluent BOD, mg/lit	< 20	< 30	<10	< 5	< 30
1.2	Effluent SS, mg/lit	< 30	< 30	<10	< 5	< 30
1.3	Faecalcoliform removal, log unit	upto 2< 3	upto 2< 3	upto 3< 4	upto 5< 6	upto 2< 3
1.4	T-N Removal Efficiency, %	10-20	10-20	70-80	70-80	10-20
2.0	Performance after Tertiary treament					
2.1	Effluent BOD, mg/lit	< 10	< 10	< 10	< 10	< 10
2.2	Effluent SS, mg/lit	< 5	< 5	< 5	< 5	< 5
2.3	Effluent NH_3N, mg/lit	< 1	< 1	< 1	< 1	< 1
2.4	Effluent TP, mg/lit	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
2.5	Effluent Total coliforms, MPN/100 ml	10	10	10	10	10

3.0	Capital Cost	67,500,000.00	82,500,000.00	67,500,000.00	112,500,000.00	50,000,000.00
	Depression of Civil Items	-27,000,000.00	-33,000,000.00	-27,000,000.00	-45,000,000.00	-17,500,000.00
	Depression of Electro-Mechanical Items	-40,500,000.00	-49,500,000.00	-40,500,000.00	-67,500,000.00	-32,500,000.00
4.0	Land Cost	11,138,613.86	8,044,554.46	8,044,554.46	6,188,118.81	9,900,990.10
5.0	O & M Cost	12,957,500	15,968,750	14,508,750	25,550,000	9,581,250
	2nd year	13,605,375	16,767,188	15,234,188	26,827,500	10,060,313
	3rd year	14,285,644	17,605,547	15,995,897	28,168,875	10,563,328
	4th year	14,999,926	18,485,824	16,795,692	29,577,319	11,091,495
	5th year	15,749,922	19,410,115	17,635,476	31,056,185	11,646,069
	6th year	16,537,418	20,380,621	18,517,250	32,608,994	12,228,373
	7th year	17,364,289	21,399,652	19,443,113	34,239,444	12,839,791
	8th year	18,232,504	22,469,635	20,415,268	35,951,416	13,481,781
	9th year	19,144,129	23,593,117	21,436,032	37,748,987	14,155,870
	10th year	20,101,335	24,772,772	22,507,833	39,636,436	14,863,663
	11th year	21,106,402	26,011,411	23,633,225	41,618,258	15,606,847
	12th year	22,161,722	27,311,982	24,814,886	43,699,171	16,387,189

	13th year	23,269,808	28,677,581	26,055,630	45,884,129	17,206,548
	14th year	27,375,000	31,025,000	29,200,000	51,100,000	18,066,876
	15th year	28,743,750	32,576,250	30,660,000	53,655,000	18,970,220
6.0	Total Life cycle cost	₹ 68,852,818.77	₹ 79,504,819.88	₹ 79,956,755.03	₹ 139,933,708.18	₹ 51,167,915.15
	Cost per day	₹ 12,575.86	₹ 14,521.43	₹ 14,603.97	₹ 25,558.67	₹ 9,345.74
7.0	NPV at Present Day Discounted @8% for 15 year O&M per KL is	₹ 1.26	₹ 1.45	₹ 1.46	₹ 2.56	₹ 0.93

CHAPTER 9
RECOMMENDED TECHNOLOGY FOR SEWAGE TREATMENT

9.1 General Review

Based on the review, analyses of the various sewage treatment processes explained in previous chapters, the following conclusions can be drawn.

- Waste stabilization ponds asks for very lower maintenance & operating cost with huge land requirement in contrast to the activated sludge & extended aeration process which asks for higher energy costs, comparatively higher space requirements. Treating Higher the volumes of sewage larger areas, capital high investment on land, high maintenance cost are unavoidable. Hence waste Stabilization Ponds are suitable for very small communities where in development is saturated.
- ASP/Extended Aeration Schemes shall be allowed for communities where in power related constraints are not there
- UASB plants even though ask for very lower maintenance cost, requires very high capital investment and skilled operation.
- SBR technology requires comparatively much lower areas with same efficient results as that of extended aeration. However the energy cost is slightly lower than the extended aeration process.
- IDEA works on the principles of SBR. But its usage is confined to smaller plants.
- CASP has logistic control operators with special sensors for Dissolved Oxygen Measurements and there by fixing hours of operation of reactors which work in parallel. They require much lower area (50% reduced area of Extended Aeration) and have high biomass loading efficiencies meeting desired quality parameters.

9.2 STP for Machilipatnam Town

The population of Machilipatnam Town is expected to be close to 1.80 lakhs by 2018 which is likely to grow to about 2.80 lakhs by 2048. The corresponding sewage flows expected will be 26.97 MLD in year 2033 to 33.18 MLD in year 2048. Considering budget allocation, land availability with ULB in near future and capacity of STP plant, Zone 1 is selected for proposing STP

- Zone 1: Anticipated Sewage Generation in zone 1 for Base year (2018) is about 4.06 MLD, for Intermediate year (2033) is about 4.91 MLD and ultimate year (2048) is about 5.96 MLD.

Therefore the 5.0 MLD Capacity Sewage Treatment plant is proposed for Zone 1 under AMRUT scheme 2016-2020 considering land required for about 1.5 acres will be acquired by ULB. The capacity of the sewerage treatment plant will be required to enhance up to 5.96 MLD in the year 2048 to cater ultimate stage anticipated Sewage flow.

As the STP will be built on DBOT Basis, the bidder can submit the bids on EA or any other technology which the ULB can run efficiently with lesser Operation and Maintenance cost for next 10 years.

9.3 Location of Proposed STP

Identification of the land is done for STP in consultation with the ULB officials and location of the STP is shown in Google map in figure 9.1. From the discussion held with the ULB officials, the Government land available at proposed location of STP is 1.0 acre.

Figure 9. 1 : STP Location on Google Map

The general arrangement for inceptor drain at proposed STP is shown in schematic diagram in Figure 9.2

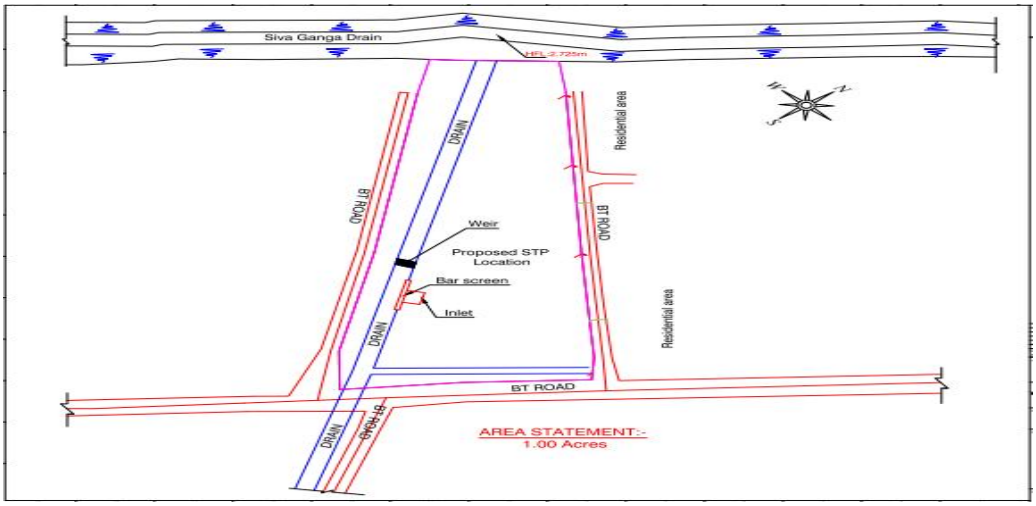


Figure 9. 3 : Schematic Diagram of Inceptor drain at Proposed STP

9.4 Design of STP

- Brief Note on Treatment Scheme

The treatment scheme proposed is split into three distinct parts:

- Pre-treatment: this comprises of Screening, Grit Removal.
- Biological treatment: this is comprised of removal of organic (biodegradable) pollutants.
- Sludge Handling: this comprising the thickening, Dewatering and dispose of biological sludge produce in biological treatment.
- Filtration as Treatment to meet the required disposal standards.

- Characteristic of Raw Sewage

The Raw domestic sewage generated due to residential, commercial and other activities shall have the following characteristics.

Table 9. 1: Characteristics of Raw Sewage (Ref: Normal Municipal Domestic Sewage parameters in India)

S.No.	Parameters of Raw Sewage	Values	Unit
1.	BOD5	250 - 300	Mg/l
2.	COD	500 - 600	Mg/l
3.	Suspended Solids	300 - 350	Mg/l
4.	pH	6.5 – 8.5	
5.	Total alkalinity as CaCO3	300 - 400	Mg/l
6.	Chlorides	250 - 300	Mg/l
7.	Sulphate	100 - 150	Mg/l
8.	Total Kjeldahl nitrogen	45 -50	Mg/l
9.	Ammonical Nitrogen	35 - 40	Mg/l
10.	Total Phosphorus	5 – 7	Mg/l
11.	Temperature	15 – 35	^{0}C

- Treated Water Characteristics

The treatment plant shall be designed to treat the sewage as per the following standards to make it suitable for discharge after filtration the parameter shall be guaranteed in as follows:

Table 9. 2: Characteristics of Treated Sewage (Recycled water standard)(Ref: CPCB/ USEPA standards)

S.No.	Parameters of treated Sewage	Values	Unit
1.	BOD_5	<10	Mg/l
2.	COD	<50	Mg/l
3.	TSS	<10	Mg/l
4.	TKN	<10	Mg/l
5.	Ammonical Nitrogen	<5	Mg/l
6.	Total Nitrogen	<10	Mg/l
7.	pH	6.5 – 8.5	Mg/l

8.	Fecal Coliform	230 MPN/ 100 ml	

- Selected of Technology for Sewage Treatment plant

The most suitable technology for the sewage treatment is the Extended Aeration for following reasons.

- Due to the nature of project, effluent is required for disposal to meet the above standards.
- Modular Approach for provision of Electro – Mechanical units will reduce the initial investment.
- Capable to treat shock loads
- Low sludge generation
- Relatively uncomplicated design hence ease in O&M

Most suited technology used for municipal plants

- The method is, therefore, well suited specially for small and medium size communities and zones of a larger city
- As for usual municipal sewage, up to 85% of nitrogen removal can be expected in this process
- This process allows controlling the discharge of nitrogen to the receiving natural waters, which could create eutrophication problems.

9.4.1 Design basis for units of Sewage Treatment Plant

The various units of this sewage treatment plant shall be designed for maximum efficiency within certain flow ranges and water characteristics. Sewage treatment plant consists of the following equipments/units

Table 9. 3: Design Basis for Units of sewage treatment plant

Sl. No	Name of the Unit	Design parameter
1.	Coarse Screen	Velocity at low flow : 0.3/sec Velocity at Peak Flow : 1.2 M/s Clear Spacing : 25 mm Type of screen: Mechanical Bar screen Angle of Inclination: 76 to 80 Degree
2.	Wet Well	HRT 10minutesatpeakflow (Minimum) 30 Min. for Average flow (Maximum)
3.	Stilling Chamber	HRT 60 Second at peak flow
4.	Fine Screen	Velocity at low flow : 0.3/sec Velocity through the screen at Peak Flow : 1.2 M/s Clear Spacing : 6 mm

		Type of screen: Step screen
5.	Mechanical Grit Chamber (Detrius type)	Type - Mechanical Grit Chamber Surface overflow rate – 960 m^3/m^2/day HRT > 60 sec on average flow
6.	Anoxic Tank	HRT: Minimum 2 Hrs. Mixing Arrangement : Submersible Mixer Power requirement in Anoxic zone shall be 8-13 KW/10^3 m^3
7.	Aeration Tank	F/ M – 0.1 – 0.18 kg BOD/kg MLSS/d Design MLSS : 3000 – 5000 ppm MLSS/MLVSS: 0.6 HRT: 12-24 hrs SRT min. 10 days O_2 Requirement for BOD removal – 1.2 Kg/kg of BOD O_2 Requirement for TKN removal – 4.6 kg O2 per kilogram of ammonia Operating Dissolved Oxygen > 2 ppm Aeration – diffused aeration Diffusers : PU/ Silicon membrane Fine Bubbles retrievable/ fixed type Air Blower : Root type/ Turbo Blower BOD Removal >95%
8.	Secondary Clarifier	Surface Loading rate: not greater than 15 m3/m2/day on average flow 25-35 m3/m2/day on peak flow Weir loading not greater than 185 m3/m/day Weir plates of Aluminium
9.	Disinfection System	Vacuum chlorinator Dosing Rate: Up to 5 PPM
10.	Sludge Sump and with Pump House	HRT : 4 Hours
11.	Sludge Dewatering Units	Centrifuge Machine Nos. & Capacity: as per requirement Solid concentration Inlet: 1.5 – 2% Outlet: 18 – 20% Solids removal : > 95%
12.	Polyelectrolyte Dosing System	Solution concentration of polyelectrolyte – 0.1% Polyelectrolyte Dosing Rate – 1.5-2Kg./1000 kg. of Dry Solids
13.	Gravity Filter	Filtration rate (N-1) : 4.8-6 m3/m2/hr

		Back washing is Conjunctive with air 45-50 m/hr and water note more than 15m/hr. Surface wash equal to rate of filtration Depth of water over the sand bed 1-1.5 m Depth of Sand- 0.6-0.75 m Free Board 0.5 m

- Piping works in Sewage Treatment Plant

Table 9. 4: Material of construction for piping works for various application

Sl. No.	Material	Duty	Code	Application Area
1.	Ductile Iron CC lined	K9	IS 8329 IS 9523	Treated Sewage
2.	Stainless Steel (SS 316)			Air pipe line in contract with sewage
3.	Ductile Iron	Class K9 S/S & DF	IS 8329 IS 9523	Sludge pumping and sludge gravity pipe Recycling the sludge Raw Sewage
4.	UPVC/ CPVC	Class 4	IS 4985	All chemical dosing system

9.4.2 Treatment Scheme

The treatment scheme offered is aerobic biological treatment using Extended Aeration. Excess aerobic biological sludge generated will be aerobically digested in a Sludge Tank and dewatered in centrifuge before disposal to designated land fill/use as organic manure.

The treatment scheme proposed is split into three distinct parts:

Pre-treatment: this comprises of coarse, fine screening and grit removal tank. After pre-treatment the sewage shall be taken to biological treatment plant at the uniform rate.
Biological treatment: comprising anoxic tank and aeration tank. The sludge from the secondary clarifier will be recycled back to anoxic tank for denitrification.
Sludge Handling and disposal: Excess sludge produced in biological treatment process shall be collected in sludge tank and digested aerobically. The Excess sludge dewatered in centrifuge and finally disposed or used as organic manure.

Domestic sewage will flow through Bar Screen and collected in raw sewage sump. Large floating particles will be removed by the coarse bar screen. The raw sewage from the raw sewage sump shall be pump to the stilling chamber to pass through the fine screen and followed by grit removal. After grit removal the sewage will be taken to anoxic tank followed by aeration. From anoxic tank denitrified sewage overflow into aeration tank for the removal of BOD and nitrification. The air in the aeration tank shall be provided through an air diffused aeration system of SS-316. The sewage from aeration tank overflows into the Secondary Clarifier. The sludge from Secondary Clarifier shall be recycled back to anoxic tank for denitrification. The sewage from Secondary clarifier shall be filtered through gravity filter to meet the disposal standards.

Depending on the MLSS to be retained in the Biological reactor the sludge is wasted. The wasted sludge is collected in sludge sump equipped with the mixer and then sludge shall be fed to centrifuge where sludge shall be collected in the form of cake for manure use & permeate shall be send back to raw sewage sump to be recycled.

9.4.3 Process Units

- Receiving Chamber

The receiving chamber shall receive the sewage from deep gravity out fall sewers. The chamber shall consist of sluice gates on downstream for the flow regulation.

Table 9. 5: Receiving Chamber

Design Parameter	5 MLD STP
Number	1
Material of Construction	RCC
Design Flow (average)	5 MLD
Design Flow (Peak)	12.50 MLD
Dimension of Stilling Chamber	2 x 2 x 1.5 m
Free Board	Suit at site

- Coarse Screen Channels

The flow of Sewage from the receiving chambers shall then enter the mechanical coarse screens with one manual screen for the removal of floating and oversize materials coming with raw Sewage. The screen channels shall be designed for peak flow. Gates shall be provided at the upstream and downstream ends of the channel to regulate the flow. The conveyor belt and chute arrangement shall be provided to take the screenings from chute in to the wheel burrow container. The mechanical screen shall be operated with level transmitter.

Table 9. 6: Coarse Screens

Design Parameter	5 MLD	unit
No. of Mechanical Screens	2	Nos.
No. of Manual Screens	1	Nos.
Average Flow	5	MLD

Peak design flow	12.5	MLD
Clear Spacing of screen bar	25	m/sm
No. of Inlet and outlet Gate of each screen	1	Nos.
Mechanical Screen		
Inclination of Screens	75 – 80	Degrees
Material of Construction of Screens	SS316	
Manual Screen		
Inclination of Screens	45	Degrees
Material of Construction of Screens	SS316	
Conveyer Belt		
No. of units	1	no.

- Wet well and Sewage Transfer Pump House

After removal of floating materials through the screens, the flow of Sewage shall enter into the wet well of the pumping station. The capacity of sump shall be for detention of Minimum 10 minutes at peak flow. The pumps shall be the non-clog submersible type. The pumped flow from the pumping station shall be taken to the Stilling chamber of the sewage treatment plant through a pipe line.

Table 9. 7: Wet Well and Sewage Transfer Pump House

Design Parameter	5 MLD	Unit
Number of wet well	1	no
Material of Construction	RCC	
HRT at Peak Flow	10	Minutes
Design Flow (Peak)	22.5	MLD
Dimension of Stilling Chamber	6.80 m Dia x 2.50 m	m x m
Free Board	Suit at site	M
Volume Provided	90.75	m^3
Nos. of Pump	6	Nos
Nos. of Working Pump	4	Nos.
Capacity of Pump	135	m^3/hr.
Head of Pumps	15	M
Type of Pumps	Submersible Non-Clog with Impeller of SS-316	
Flow Measurement	Through Flow meter	
Pumphouse / superstructure	In RCC Construction	

- Stilling Chamber

The Stilling chamber will be constructed in RCC that receives flow from the raw sewage from raw sewage pumping station via raw sewage transfer pumps. From stilling chamber by gravity it will be conveyed to fine screen through an RCC channel.

Table 9. 8: Stilling Chamber

Design Parameter	5 MLD	Unit
Number	1	no
Material of Construction	RCC	
Design Flow (average)	5	MLD
Design Flow (Peak)	12.5	MLD
Stilling Chamber	2.45x2.45X1.5	Cum
Free Board	Suit at site	M

- Fine Screen Channels

The flow of Sewage from the stilling chambers shall then enter the mechanical fine screens with one manual screen for the removal of floating and oversize materials coming with raw Sewage. The screen channels shall be designed for peak flow. Gates shall be provided at the upstream and downstream ends of the channel to regulate the flow. The conveyor belt and chute arrangement shall be provided to take the screenings from chute in to the wheel burrow container. The mechanical screen shall be operated with level transmitter.

Table 9. 9: Fine Screens

Design Parameter	5 MLD	Unit	
No. of Mechanical Screens	2 (1W+1S)	Nos.	
Average Flow	5	MLD	
Peak design flow	12.5	MLD	
Free Board	Suit at site	M	
Clear Spacing of screen bar	6	Mm	
No. of Inlet and outlet Gate of each screen	1	Nos.	
Mechanical Screen			
Inclination of Screens	75	Degrees	
Material of Construction of Screens	SS316		
Conveyer Belt			
No. of units	1	1	1
Type	Horizontal		
Capacity	To handle screenings of peak flow To handle screenings of peak flow		

- Mechanical Grit Chamber (Detrius type)

Total 2 Nos. grit chambers shall be provided to remove the grit from the raw sewage. The sewage after the screen shall be received in to the grit chamber. The grit shall be settled in to the grit chamber and withdrawn with the help of grit pump and organic return pump.

Table 9. 10: Grit Chambers

Design Parameter	5 MLD	Unit
Nos. of Grit Chamber	2	Nos.
Average Flow to each chamber	2.5	MLD
Peak design flow to each chamber	6.25	MLD
Surface Loading rate	960	m3/m2/d
Area of Grit Chamber	6.75	m2
Free Board	0.3	M

- Biological Treatment Unit

The biological treatment units shall have the anoxic tank for denitrification, aeration tank for BOD removal and nitrification. The sludge from Secondary Clarifier shall continuously pumped to biological unit through RAS pumps in to the anoxic tank for denitrification.

Anoxic Tank

There shall be two numbers of anoxic tanks shall be provided. The anoxic tank shall be equipped with the submersible mixer to keep the suspended solids in suspension. The raw sewage after grit removal shall be received in the anoxic tank and mixed with the return sludge from secondary clarifier.

Table 9. 11: Anoxic Tank

Design Parameter	5 MLD	Unit
Material of Construction	RCC	
Design Flow	5	MLD
Nos. of anoxic tank	2	
Free Board	0.5	M
HRT	2	Hrs.
Volume of each Anoxic tank Provided	210	m3
Nos. of Mixer, one in each tank	2	

Aeration Tank

There shall be two numbers of aeration tanks. The sewage from the anoxic tank shall be overflow to the aeration tank where it will be treated in the present of microbes for BOD removal and Nitrification. The aeration tank shall be equipped with fine bubble diffusers for the diffused aeration. The air will supplied by twin lobe air blower. The overflow of aeration tank shall be received in to the Secondary Clarifier. The process employs low organic loading, long aeration time, high MLSS concentration and low F/M. The BOD removal efficiency is high. Because of long detention in the aeration tank, the mixed liquor solids undergo considerable endogenous respiration and remain well stabilized. The excess sludge does not require separate digestion and can dewatered directly.

Table 9. 12: Aeration Tank

Design Parameter	5 MLD	Unit
Material of Construction	RCC	
Design Flow	5	MLD
F/M ration	0.11	Kg BOD/Kg MLSS/day
Design MLSS	4000	Mg/l
Nos. of aeration tank	2	
Dimension	24x12x5	M
Free Board	0.6	M
HRT	14	Hrs.
Process Air Blower		
No. of Air Blowers	3	
No. of Air Blowers	2	
Capacity of Air Blower	1250	m^3/hr.
Head of Air Blower	6.25	M
Return Activated Sludge Pumps		
No. of Pumps	2	
No. of Working Pumps	1	
Capacity of Pump	125	m^3/hr.
Head of Pumps	8	M
Type of Pumps	Horizontal Centrifugal Non-clog Pumps	
Internal Recirculation Pumps		
No. of Pumps	3	
No. of Working Pumps	2	
Capacity of Pump	210	m^3/hr.
Head of Pumps	8	M
Type of Pumps	Horizontal Centrifugal non-Clog Pumps	

- Secondary Clarifier

The floor bottom of the clarifiers is scraped by mechanical scrapers in order to divert the sludge to the central sludge pit. These scraper arms and the squeegees are constantly immersed in sewage and are not subjected to severe corrosion because they are not exposed to the air.

Table 9. 13: Secondary Clarifier

Design parameter	5 MLD	Unit
No. of units	2	
Design Flow to each Clarifier	2.5	MLD
Surface Loading Rate at average flow	15	m3/m2/day
Dimension	15.5	m dia

Surface Loading Rate at peak flow	33.14	m3/m2/day

- Sludge Sump and Pumps

The sludge sump shall be provided to receive the surplus sludge from the clarifier via RAS pump. From here, the sludge shall be pumped to the centrifuge with the help of two nos. of sludge pumps (one working + one standby).

Table 9. 14: Sludge Sump and Pumps Tank

Design parameter	5 MLD	Unit
No. of Sump	1	hr.
Dimension Provided	4x4 x 2.5	m x m x m
Free Board	0.5	
Number of pumps	2	Nos
Working	1	No
Standby	1	No
Capacity of Pump provided	10	m^3/hr.
Head	15	M

- Centrifuges

The solid bowl type centrifuge machine will be to dewater the thickened sludge into sludge cakes for final disposal. The polyelectrolyte dose at the inlet of centrifuge is to increase the efficiency of dewatering. The dewatered sludge as cakes from the centrifuge is collected in a dumper and disposed off elsewhere. The centrate from the centrifuges is conveyed to the raw sewage sump.

Table 9. 15: Centrifuge

Design parameter	5 MLD	Unit
Number	2.00	Nos.
Working	1.00	Nos.
Standby	1.00	Nos.
Flow to each centrifuge	10.00	m^3/hr
Consistency of incoming sludge	1.5-2%	
Consistency of cake expected	18 – 20%	
Hours of working	12	Hrs

- Poly-Electrolyte Dosing System

Two numbers of polyelectrolyte solution preparation tanks shall be provided for preparation and dosing of polyelectrolyte solution. Each tank will provide with feed water lines, over flow drain and outlet lines. The Polyelectrolyte tank is provided with level transmitter and level indicator with low and high alarm for sensing in the level in the tank. All the running pumps are tripped automatically at low level.

Each tank is also equipped with agitator for dissolving poly electrolyte. The polyelectrolyte solution from the solution preparation tanks shall be dosed to Centrifuge with the help of dosing Pumps.

All PE Metering pumps shall be equipped with Electric operated diaphragm valve in suction and discharge line for operation at auto mode.

Table 9. 16: Poly-electrolyte Dosing System

Design parameter	5 MLD	Unit
Polyelectrolyte dosing rate	1.5-2	kg/ ton of dry solids
Concentration of polyelectrolyte solution	0.20	%
Polyelectrolyte dosing Pumps		
Number	2	Nos.
Working	1	Nos.
Standby	1	Nos.

- Rapid Gravity Filters

Table 9. 17: Gravity Filters

Design parameter	5 MLD	Unit
Number	2.00	Nos.
Flow to each filter	5.00	m^3/hr
Filtration rate	4.8	$m^3/m^2/hr$
Size of each filter bed	6 x 4.5	M
AIR BLOWERS		
Air Scouring Rate	45	$m^3/hr\ /m^2$
Capacity of blowers	1020	m^3/hr
Blowers	2.00	Nos.
Working	1.00	No.
Stand By	1.00	No.
Pressure	3500	mm Hg
Filter Media Detail		
Sand Depth	700.00	Mm
Gravel Depth	400.00	Mm
Total Media Depth	1100	Mm
Effective Size of Sand	0.70	Mm
Under Drain System	False floor with PVC Nozzles	
Nos. of Nozzel	50.0	50.0 50.0 Nos./ m2
	FILTER BACKWASH PUMPS	
Type of Backwash	Conjunctive	
Filter Backwash Pumps	2.00	Nos.

Working	1.00	No.
Stand By	1.00	No.
Capacity of each Filter Backwash Pump	350	m^3/hr.
Head	15	M
FILTER BACKWASH SUMP		
Size	75	m^3

- Chlorine Contact Tank and Chlorination System

The objective of chlorination of water is to reduce organic matter, algae growth etc.

One no. chlorine contact tank shall be provided for the disinfection treated sewage. The water from the filtered water sump shall be transfer in to the chlorine contact tank via gravity. The chlorine shall be dose in the chlorine contact tank.

2 Nos (1W+1S) each of chlorinators will be provided. All the chlorinators are installed in the chlorination building.

Chlorinators consist of tonner manifold automatic gas feeder, vacuum regulator, pressure reducing valve, vacuum relief valve, controller and ejector. Liquid chlorine is withdrawn from the tonners and is conveyed to vacuum regulator. Thereafter chlorine is conveyed to chlorinator. The required vacuum is created by pumping water under pressure to the injector assembly with the help of 2 Nos. (1W+1S) booster pumps for each chlorinator. The chlorine gas is then mixed with water in the injector and the chlorine solution thus formed is dosed to respective dosing point.

Adjacent to the chlorine contact tanks a pump house shall be provided to house the service water pumps, filter backwash pump and air scoring blowers. Pump house shall be provided material handling equipment like EOT/HOT etc.

Table 9. 18: Chlorination System

Design Parameter	5 MLD STP	Unit
No. of Chlorine contact tank	1	
Volume of tank	108	m^3
Post Chlorinators		
Pre-Chlorination Dose	2.00	
Provided	5	Kg/hr
Nos. of Chlorinators	2	
Booster Pumps	2	Nos.
Working	1	Nos.
Standby	1	Nos.
Chlorination Building		

Nos. of Building	1	
Storage of tonners	4	Nos
SERVICE WATER PUMPS		
Service Water Pumps	2.00	Nos.
Working	1.00	No.
Stand By	1.00	No.
Capacity of each Pump	25	m^3/hr.
Head	Suitable	

- Laboratory and SCADA building

The Laboratory SCADA building shall be located at a suitable place. The building shall be R.C.C. framed structure. It shall bear a good architectural look. The quality of raw water, clarified Water and filtered water will be monitoring in the laboratory. The laboratory shall be well equipped to analyses of water parameters.

- Building in the STP premises

Following building shall be provided within the Plant.

- ❖ MCC Room
- ❖ Work shop
- ❖ Administration Building
- ❖ Security Cabin
- ❖ Transformer Yard and substation

9.5 Design of Inlet Channel and Pressure Main Diameter

The following tables show design of inlet drain to STP and outlet pipe from STP to the outfall.

Table 9. 19: Inlet drain from lead drain to STP

Inlet drain from lead drain to STP			
Sl.No	**Description**	**Value**	**Units**
1	Flow	5	MLD
		0.06	m^3/sec
2	Velocity assumed	0.8	m/s
3	area	0.07	m^2
4	Depth assumed	0.3	m
5	Breadth	0.24	m
6	Freeboard	0.15	m
7	Proposed Size	450 X 450	mm
8	Length of the channel	50	m

Table 9. 20: Diameter calculation for outlet pipe from STP to outfall drain

Diameter calculation for outlet pipe from STP to outfall drain			
Sl.No	**Description**	**Value**	**Units**
1	Flow	5.00	MLD
		208.33	m^3/hr
	From Hazen & Williams Formula		
	Q	1.292x10-5 c $d^{2.63}$ $S^{0.54}$	
	V	4.567x10-3 C $d^{0.63}$ $S^{0.54}$	
	where, d in mm, Q in Cum/Hr and V in m/sec		
2	Pipe Material	DI K9	
	C=	140	
	s=	0.0040	
3	Diameter of the pipe	261.11	
4	Diameter of pipe proposed	300.00	mm
5	Actual velocity	1.18	m/s
6	Length of pipe required	50.00	m

CHAPTER 10

PROJECT EXECUTION, MANAGEMENT & MONITORING

10.1 Project Management

PMU (APUFIDC/ULB/PDMC) will be responsible for overall monitoring of the project, in order to ensure that there are no undue delays in project implementation. The PMU setup will be empowered to take decisions, which are technical and procedural in nature. The PMU/PIU setups will co-ordinate the following activities relating to implementation:

- Finalisation of technical scheme
- Finalisation of tender documents for construction
- Co-ordination of the entire process of identification of contractors for undertaking the works
- Assist for Mobilisation of financial resources
- Assist for Land acquisition and transfer
- Technical/statutory approvals
- Progress monitoring and assist in payments to contractors, and
- Regular reporting of project status to the ministry, in the form of Quarterly Progress Reports.

10.2 Operation &Maintenance of the plant

The Minimum Operation & maintenance shall include but not limited to the following

- Continuous Operation of the Plant delivering the specified Effluent Quality at 20% to 100% of the Hydraulic and biological loads specified.
- Preventive and breakdown Maintenance including servicing & procurement of Spare parts.
- Testing of the Parameters like Inlet and outlet water quality for BOD5/COD/TSS/TKN / TN, TP, Colour etc. testing for MLSS etc.
- Maintaining the records of the all the operating data on hourly/ Daily/Weekly/ Monthly basis.
- Procurement and storage of Chemicals, Consumables etc. but Necessary approval for storage of Chemicals shall be provided by ULB.
- Conducting Safety audit on routine basis.
- Maintaining Clean and Hygienic Conditions around the Pant
- To Maintain and irrigate the landscape of the Garden on the allotted land by ULB (Min Area of 500 Sq. Meter)
- To Store the sludge and transportation to an Area within 5 Km from the Plant.
- To avoid any rusting of the Hand Rails or any other Carbon Steel surfaces with in the pant.
- To Correct any Concrete structure/ Surface with the Plant
- To submit Report on the Performance of the plant to the ULB on Weekly Basis.
- To display Safely instructions around the Plant

- Maintenance of all parts of STP and should ensure safe proper running of STP to the required effluent characteristics.
- Maintenance of road, surface drains, Chain link fencing, landscaping, buffer zone, lab room, office room, fencing, gates and other allied works of STP such as Generators etc.

CHAPTER 11
ENVIRONMENTAL ASSESSMENT

11.1 Introduction

The present project is to be implemented to treat the sewage generated of 5 MLD in Machilipatnam Town.

The environmental impact assessment study pertains to the sewage treatment plant proposed.

Purpose: The purpose of impact assessment study is to identify potential adverse and beneficial environmental impacts, and to document the mitigation and monitoring measures that would be incorporated in project to eliminate or minimize the adverse impacts.

Scope: The components of this project include construction of a new sewage treatment plant. The study is based on field surveys, secondary data and design data.

11.2 Description of the Project

Need of the project: The proposed project will provide Sewage Treatment in Zone-01 of Machilipatnam Town.

Location: The project location is at survey No 186 near Kendriya Vidyalaya, the available space of an area of 1.0 acres

Coverage: As the estimated average flow for proposed zone-1 of Machilipatnam town for intermediate stage (2033) is 5 MLD.

11.3 Applicable Environmental Regulations

Applicable environmental regulations for proposed project are mentioned in details below

- Disposal of sewage generated during construction phase will attract the provisions of the Water (Prevention and Control of Pollution) Act, 1974 and requires consents to establish and operate from the Andhra Pradesh Pollution Control Board.
- Installation of generators and concrete mixture plant by the contractor during the construction stage of the project would require NOC from the Andhra Pradesh Pollution Control Board as per the Air (Prevention and Control of Pollution) Act, 1981.
- The proposed project in construction phases may attract the provisions of Noise Pollution (Regulation and Control) Rules, 2000 if the noise level from the construction machinery and equipment is high.

11.4 Baseline Environmental Profile

11.4.1 Physical Resources

Air Quality: No major sources of air pollution were identified during the field surveys; the traffic flow is expected to have some impact on air quality.

Noise Levels: With the existing road carrying traffic passing through busy commercial areas, the noise levels of the region seems to be high.

11.4.2 Ecological Resources

As the project area highly urbanized, presence of wildlife or endogenous species is very unlikely. In addition, within the project area there are no forests, protected areas, costal resources or fisheries.

11.4.3 Economic Development

Land Use: Predominant land use in the project area is outside the CDP.

Water Supply: Water supply in the STP location is presently is dependent on ground water

Sewerage and Drainage: Project area is not having drainage system. The area is served by surface drains.

Transportation: There is an access road to the location. However, this road is an earth road and mostly non motorable during rainy season.

Electric Power: Project area falls inside the service area of AP TRANSCO.

11.4.4 Environmental and other significant features

There are no significant environmental and other significant features in the location. The land has been identified in the existing STP site premises, which is under the possession of Machilipatnam Town.

11.5 Potential Environmental Impacts and Mitigation Measures

The proposed project influences environment in two distinct phases.

- During Construction phase which would be temporary and short term effects;
- During Operation phase which would have long term effects.

11.5.1 Environmental Impacts during Construction Phase

During the construction phase there would be some impacts on air, noise and water quality. Also there would be some impacts on life due to inconvenience caused to public as a result of construction activity.

Air quality impacts are likely from general construction activities including land clearing, trenching, laying of pipes, construction of foundations, handling and transportation of construction and demolition materials, and from wind erosion of open sites and stock pile areas.

Noise pollution will occur from operation of construction equipment including earth moving and material handling equipment.

Water quality impacts may occur from runoff and waste and sewage generated from construction activity.

Disposal of excavated soils, road crust, and precipitate from drainage channels will not pose a problem; however, disposal of silt may require adequate protection.

Some inconvenience to public may result from restricted access to building and structures and temporary dislocation of civic amenities like water supply, drainage and sewerage, electricity and telephone cables due to relocation or replacement of these facilities.

To avoid the impact on rail movement during construction phase, Trench-less Technology is proposed to be used for laying of pipelines across railway track.

Traffic dislocation, lacks of access to buildings and air and noise pollution caused by construction activities could have some adverse impacts on trade and commerce in the service area.

11.5.2 Environmental Impacts during Operation Phase

During operation period phase the environmental impacts are likely to be positive. However, there could be some adverse impacts due to operation and maintenance or control.

Lack of proper operation and maintenance of the system could cause over flow of sewage and water logging during rainy season, which would be a nuisance and health hazard to public.

Due to lack of control there may be discharge of industrial effluents into the sewer, which can damage the sewer system, or interfere with downstream treatment process or pass through the treatment plant and cause damage to the environment.

There is potential health hazard to workers engaged in sewer maintenance work. These workers are likely to be exposed to toxic gases and hazardous materials present in the sewage and are likely to contract communicable diseases from exposure to pathogens present in the sewage.

11.5.3 Positive Impacts

As a result of providing sewerage facilities, it would minimize water logging and/or flooding in the service area and ensure better sanitation practices. This would lead to:

- Abatement of nuisance and public health hazard in the service area. Improved sanitary conditions would result in reduction in incidences of parasitic infections, hepatitis and various gastrointestinal diseases including cholera and typhoid which occur either through direct contact with faecal material or contamination of water and food;
- Fewer incidence of disruption of transportation;
- Accelerate economic growth as a result of improved quality of life within the service area.
- Improvement of water quality of surface water bodies of the area; and
- Employment for local people during the construction phase.

11.5.4 Mitigation Measures - Construction Phase

Following measures are recommended for mitigation or minimizing the environmental impacts that are likely to occur during the construction phase of the proposed project. The contractor under supervision and direction of super vision consultant shall implement these mitigation measures.

Provision of Erosion

- Construction will be scheduled so that large areas of soil are not laid bare during monsoon.
- Ground disturbances will be phased so that it is limited to workable size.
- Exposed surface will be resurfaced and stabilized as soon as possible.
- Trenches will have adequate backfill to prevent subsequent street settlement. Upon completion of backfill the surface shall be restored fully to the level that existed prior to the construction of the sewer.

Prevention of Dust Nuisance

- On exposed construction surface during dry/windy periods fugitive dust generation will be suppressed by spraying of water or other suitable means.
- Workers working in dust prone areas will be provided with masks and goggles.
- Excavated material transported by trucks will be cover and/or wetted to prevent dust nuisance.

Noise and Emission from Vehicles and Construction Activities

- All construction vehicles will be properly maintained and will have valid "Pollution under Control Certificate".
- Noisy construction activities will be carried out only during normal working hours and local residents will be advised of any unusual or unavoidable noise.
- Where feasible sound barrier will be provided in inhabited areas.

Prevention of Soil, Ground and/or Surface Water Contamination

- Silt after dewatering will be immediately disposed in approved disposal site.
- Excess excavated soil and spoils will be disposed in approved disposal site.

Prevention of Water Logging / Flooding

De-watering during trenching and water testing of new lines will be regulated in a manner so that it does not lead to water logging of the nearby area.

Relocation of Utility Services

- Utility services such as telephone line, electric poles, and water lines etc. That will be impacted by project construction will be identified and prior assistance from concern authorities will be sought to remove, relocate and restore services of these utilities.
- It will be ensured that these utilities are not damaged due to construction activities.

Road Safety and Traffic Management during construction

Corporation in coordination with its consultant will prepare a traffic management plan for approval of Machilipatnam police. The plan will include:

- Measures to be taken to prevent traffic congestion.
- Provision of temporary safe assess to buildings, which will be blocked due to construction.
- Measures to be taken to ensure safety of traffic passing through the construction area including signs, markings flags, lights and flagmen as may be required.

Prevention of Accidents and Damage to Property

All necessary precautions will be taken to prevent accidents and damage to property due to construction activity. Measures taken by contactor will include but not limited to:

- Safe execution of construction work.
- Providing adequate health and safety protection to workers.

Health and Safety of Workforce

- All the occupational, health and safety requirement for workforce will be adhere to.
- Periodic health check-up of workers will be provided.
- First aid kit will be provided at construction worksite.
- During sewer line cleaning operation the line will be adequately vented to ensure that no toxic or hazardous gases are present in the line.
- Workers engaged in cleaning of sewer lines will be provided with proper protection cover including gumboots, rubber gloves and gas masks.

Environmental Health and Safety Considerations at Camp Sites and Construction Worksites

- Camps/compounds will be contained by surrounding the site with a bund or earth mound.
- Camp site will be provided with good quality and sufficient quantity of drinking water and sanitation facilities.
- First aid kit and other safety measures will be provided at camp site.
- Solid waste collection and suitable disposal system provided at camp site.
- Appropriate control measures will be taken to prevent insects/vector diseases.

Mitigation Measures- Operation Phase

- To alleviate the siltation problem it would be necessary for ULB to undertake continual routine maintenance of the system. Periodic preventive maintenance carried out by ULB would prevent flooding or water logging problems.
- Periodic monitoring carried out by APCB to ensure untreated industrial or other waste is not discharged in the proposed sewer system.

11.6 Environmental Monitoring Plan

Effective implementation of the mitigation measures to mitigate or minimize the environmental impacts would require the project to undertake a comprehensive monitoring programme. The objective of the monitoring programme is to ensure that the construction and operation activities are carried out in an environmentally sensitive and responsible manner, and in accordance with the recommendations of EMP. Recommended monitoring activities of the proposed project is presented in Table 11.1

Table 11.1: Environmental Monitoring Programme of construction of STP in Machilipatnam

Monitoring Category	Type of Monitoring	Minimal Frequency	Monitoring Agency
Construction Phase			
Soils			
Excavation and Back Filling	Monitor adherence to contract specifications	Daily	Contractor/ULB
Erosion	Monitor proper management of excavated soils including timely removed material from project site	Monthly	Contractor/ULB
Surface and Ground Water Quality			
Surface runoff management	Monitor measures to 67 channelize surface runoff	Daily	Contractor/ULB
Contamination from waste and sewage generated from construction activities	Monitor measures taken to prevent contamination of ground and/or surface water from waste and sewage generated from construction activities	Daily	Contractor/ULB
Air/Noise Pollution			
Dust emission during site preparation, excavation	Monitor adequacy of dust suppression measures undertaken	Daily	Contractor/ULB
Storage and transportation of construction materials, excavated soil and silt	Monitor adequacy of measures undertaken to prevent fugitive measures	Daily	Contractor/ULB
Noise and emissions from construction vehicles	Monitor 'Pollution under Control' certificate are current for construction vehicles.	Quarterly	Contractor/ULB
Noise pollution from construction activities	Monitor preventive measures being implemented to curb noise.	Daily	Contractor/ULB
Solid Waste			
Disposal of excavated soil and silt	Monitor to ensure excavated soil and silt are being disposed in approved sites	Weekly	Contractor/ULB
Flooding / water logging			
Blockage of drainage due to construction activities	Monitor to ensure construction activities does not cause flooding or water logging at the project site	Weekly	Contractor/ULB
Health and safety of construction workforce			
Health and Safety Requirements	Monitor adherence to all occupational and safety requirements	Weekly	Contractor/ULB
Health Checkup of workers	Monitor adequacy of health checkup services provided including attendance of the physician retained and the extent to which the workforce is availing this service	Monthly	Contractor/ULB/ PDMC

Monitoring Category	Type of Monitoring	Minimal Frequency	Monitoring Agency
Maintenance of Health and Safety records of work force	Review and monitor health and safety records to ensure all project related accidents are being properly investigated and reported	Monthly	Contractor/ULB
Sanitary conditions of construction campsite	Monitor provisions of shelter, water supply, excreta and solid waste management at campsite	Monthly	Contractor/ULB
Road Safety and Traffic Management			
Traffic Management Plan	Obtain approval to traffic management plan from Machilipatnam Traffic police		ULB/NKUSIP/ Contractor
Review road safety records	Review and monitor road safety records to ensure all projects related road accidents are being properly investigated and reported	Fortnightly	ULB/Contractor
Community Life and Economic Activities			
Access to public and private properties	Monitoring impacts of project on dwelling and business in the project area	Daily	Contractor/ULB
Hardship and inconvenience to public and business	Monitor to ensure that communities and business face minimal hardship and inconvenience due to construction activities	Weekly	Contractor/ULB
Operation Phase			
Regular Maintenance of sewer system	Monitor to ensure that free flow of sewage through the sewer pipelines	Weekly	ULB
Discharge of industrial effluent and other wastes into the sewer	Monitor discharge of industrial effluents into the sewer including review of consent to operate forms submitted to the APCB	Ongoing Monthly	ULB

As mentioned in the above table monitoring programme would be strictly implemented to avoid any adverse impacts on surrounding environment due to project activity. Also during construction activity periodically air and noise quality monitoring shall be carried out near the sensitive locations to ensure the pollution status in the service area.

11.7 Conclusion

From the earlier sections it is conclude that the project is not expected to cause any long term irreversible environmental impact. Most of the environmental impacts that are likely will occur for a short duration during the construction phase of the project. Adequate preventive measures have been incorporated to mitigate or minimize these impacts. The project upon completion would realize several positive impacts, most significant of which being reduction of public health hazard as result of improved sewerage conditions in the service area.

CHAPTER 12
COST ESTIMATE AND FUNDING PATTERN

a. Cost Estimate

Cost estimates are prepared based on the quantities arrived. The STP cost arrived based on quotation and remaining detailed cost estimates based on Andhra Pradesh SOR for leading drain, Interception and Diversion works, Site Improvement works, etc. The costs Estimate are enclosed in Annexure-II. The General Abstract of cost estimations is follows.

Capacity:-1 X 5 MLD =5 MLD Plant

Table 12. 1: Cost Estimate for 5 MLD STP

Sl. No.	Quantity	Unit	Description of the Component	Est. Amount (Rs)	IBM Amount (Rs.)	Remarks
CAPEX						
1	5	MLD	Design, Procurement and Construction of STP with all peripheral infrastructure like road, boundary wall, external lighting etc., inclusive of all taxes	67500000	67500000	Based on Quotation
2			Cost of Interception and diversion works	2229000	2229000	
3			Site Improvement works	3118219	3118219	
4			Strenthening of Lead channel to STP	985000.00	985000	
5			Express Feeder Main works	790650	790650	
6			Provisional sum for Deposits for Electricity,Roads(Cr)	5000000	5000000	
7			IBM Value for CAPEX	79622869	79622869	
OPEX						
1	10 years (INCLUDING 2 years DLP)	YEARS	O&M for 10 years consumable and energy charges for O & M period (excluding of power cost)	56355479	56355479	Refer : Table 12.2
			Total IBM Value = (CAPEX + OPEX)	135978348	135978348	
			Provision for Works Contract VAT 5%	3981143		
			Labour Cess 1%	796229		
			Provision for Seigniorage charges @ 0.5%	398114		
			Provision for scrutiny charges 1%	796229		

		Provision for NAC 0.1%	79623		
		Provision for Contingencies 0.5%	398114		
		Total Taxes & LS Provisions outside IBM	6449452		
		IBM of the Scheme (CAPEX + OPEX)	142427801		
		Cost of Power Charges for 10 Years	99038378		
		Total Project Cost (IBM + Taxes & LS Provisions)	241466178		
		Total cost in Cr	24.15		

Note O & M cost will borne by ULB and recovered households on monthly basis

b. Operation and Maintenance Estimate

Plant Capacity	5	MLD			
	5,000	m^3/day			
Plant Running Hours	24	hrs			
Plant average Inlet Flow	208	m^3/hr			
Power Calculations	Refer table 12.3				
Power Consumption per m3/day of average Flow				KWh/m3/day	0.645
Rate of Power per unit/KWH				Rs per unit of power	7
Power Consumption per m3/day of average Flow				Rs/m3/day	4.52
Chemical Calculations					
	kg/d	Rate in Rs	Rs/day		
Chlorine	25	20	500		
(5mg/l) max					
Poly (1.5 kg/t of dry solids)	1	550	550		
Chemical Consumption per m3/day of average Flow				Rs/m3/day	0.210
Manpower Calculations					
	No	Salary per Month	Total Per Month		

Plant Manager	1	40,000	40,000		
Plant Operators	3	20,000	60,000		
Helpers	2	18,000	36,000		
Electricians	3	22,000	66,000		
Gaurds	2	18,000	36,000		
Gardner	1	7,500	7,500		
			245,500		
Manpower required per m3/day of average Flow				Rs/m3/day	1.637
Filter Media for gravity filters-Replacement				Rs/m3/day	0.050
Residual Disposal cost				Rs/m3/day	0.075
Civil, Mechanical and E&I Maintenance inc spares, lubrication				Rs/m3/day	0.600
(1% for civil and 2.5% for E&M)					
Total Operating Cost				Rs/m3/day	7.09
			Say	Rs/m3/day	7.10
Monthly Operating Cost				Rs	1,082,750
Annual				Rs	12,993,000

Table 12. 2: O& M Cost for 10 years

O & M Calculations for Ten Years	
Year	Total per year
First Year	21900000
2nd Year	22995000
3rd Year	24144750
4th Year	25351988
5th year	26619587
6th year	27950566
7th year	29348095
8 th year	30815499
9th year	32356274
10th year	33974088
Total Cost for Ten Years	275455847
Total cost	27.55 Cr

Note: 1) Considered 5 % hike in O & M Cost per year
2) No Fixed Charges considered

Table 12. 3: List of Power driven Equipment for 5 MLD

LIST OF POWER DRIVEN EQUIPMENT FOR 5MLD							
S.NO	PARTICULARS EQUIPMENTS	NO.OF UNITS INSTALLED	NO.OF UNITS IN OPERATION	RATED KW OF EACH MOTOR	NO. OF HOURS OF OPERATION PER DAY (ON A SINGLE UNIT BASIS)	KW CONSUMED/ ABSORBED AT RATED DUTY CONDITIONS BY A SINGLE UNIT	POWER CONSUMED PER DAY IN KWH
1	2	3	4	5	6	7	8
1	Course Screen	2	1	1.1	12	0.90	10.80
2	Belt conveyor	1	1	1.1	12	0.85	10.20
3	Raw sewage Inlet pump(submersible)	3	2	11	20	6.00	240.00
4	Raw sewage Inlet pump(submersible) only to cater to peak flow	3	2	15	4	11.00	88.00
5	Fine Screen	2	1	1.5	12	1.20	14.40
6	Belt conveyor	1	1	1.1	12	0.85	10.20
7	Grit scrapper motor	2	2	1.5	24	0.75	36.00
8	Screw classifier	2	2	1.1	24	0.90	43.20
9	Organic Return pump	2	2	0.75	24	0.50	24.00
10	Anoxic Tank Mixer	2	2	5.5	24	3.00	144.00
11	Blower for aeration tank	3	2	22	24	19.00	912.00
12	Secondary clarifier motors	2	2	1.5	24	0.75	36.00
13	Return sludge pump	3	2	7.5	24	5.00	240.00
14	Internal Recirculation pumps	3	2	15	24	11.00	528.00
15	Sludge Tank mixer	1	1	11	24	7.00	168.00

16	Sludge Pumps	2	1	7.5	12	5.00	60.00
17	Centrifuge Motors	2	1	15	12	12.00	144.00
18	Chlorinators inc. Booster pumps etc	2	1	10	24	7.00	168.00
19	Blower for Filter B/W	2	1	22.5	0.5	15.00	7.50
20	Filter Back Wash Pumps	2	1	30	0.5	24.00	12.00
21	Miss. Pumps/mixers etc/lighting /valves etc	1	1	60	8	40.00	320.00

c. Funding pattern

The programme is proposed to be implemented under AMRUT Scheme by GoI/ Go AP/ ULB (50:20:30 after deducting Grant from AP Pollution Control Board). Also AP PCB control Grant for STP is to be provided to ULB. ULB to contribute 30% balance project cost and O & M cost through Cost recovery mechanism and all inadmissible taxes.

Table 12. 4: Funding Pattern

Sl No	Agencies	Amount in Cr
1	Special assistance from APPCB @ 25% of STP cost	2.44
2	Proportionate Allocation of Rs.100.00 Cr. under budget for Sewerage/Septage	4.55
3	Government of India Share	1.25
4	Government of State Share	0.68
6	ULB Share	0.83
	Total	9.75

ANNEXURE -1
Population Projections

Comparative Statement of Population Projection for MACHILIPATANAM						
Sl. No	Population Projection Method					
		2011	2015	2018	2033	2048
1	Arithmetic Progression Method	169892	175370	179479	200021	220564
2	Geometrical Progression Method	169892	179537	187129	230182	283140
3	Incremental Increase Method	169892	173924	176406	181844	175663
4	Growth Method	169892	183483	193677	244644	295612
5	Graphical Method					
	a) Linear Method	169892	190150	194978	219114	243251
	b) 2nd Order Polynomial Method	169892	177791	178501	175979	163335
	c) 3rd Order Polynomial Method	169892	159091	146636	22359	-233734
	d) Exponential Method	169892	197539	204633	244110	291202

CONCLUSIONS: 1. Machilipatnam Municipality is to be converted into Municipal Corporation and a Major port is going to be constructed at Machilipatnam and expecting the town to see the rapid growth. The decrease in population in year 2011 is due to Migration of some of the residents to the rural area located at the outskirts of the town where they were given house sites.

2. Population projection by Arithmetic & Incremental Increase & Polynomial method gives lower values and Growth method & Exponential method gives very high values. Hence Geometrical progression method is adopted for population projection of Machilipatnam town.

POPULATION PROJECTION FOR MACHILIPATNAM

DATA AS PER CENSUS

Years	Population	Increase in population(X)	Incremental Increase(Y)	Decadal % Increase in population	Compounded Annual Growth
1961	101417				
1971	112612	11195		11.04	1.05
1981	138530	25918	14723	23.02	1.57
1991	159110	20580	-5338	14.86	1.51
2001	179353	20243	-337	12.72	1.44
2011	169892	-9461	-29704	-5.28	1.04
Total		68475	-20656	62	6.61
Average		13695	-5164	15	1.30

Analysis :

1. Arithmetic Progression Method
2. Geometrical Progression Method
3. Incremental Increase Method
4. Growth Method
5. Graphical Methods
   - i) Linear Method
   - ii) 2nd Order Polynomial Method
   - iii) 3rd Order Polynomial Method
   - iv) Exponential Method

1. Arithmatical Progression Method

Sl No	Year	Population
1	2011	169892
2	2015	175370
3	2018	179479
4	2020	182218
5	2030	195913
6	2033	200021
7	2048	220564
8	2050	223303

2. Geometrical Progression Method

Sl.No.	Year	Population
1	2011	169892
2	2015	179537
3	2018	187129
4	2020	192367
5	2030	220844
6	2033	230182
7	2048	283140
8	2050	291066

3. Incremental Increase Method

Sl No.	Year	Population
1	2011	169892
2	2015	173924
3	2018	176406
4	2020	177802
5	2030	181686
6	2033	181844
7	2048	175663
8	2050	173960

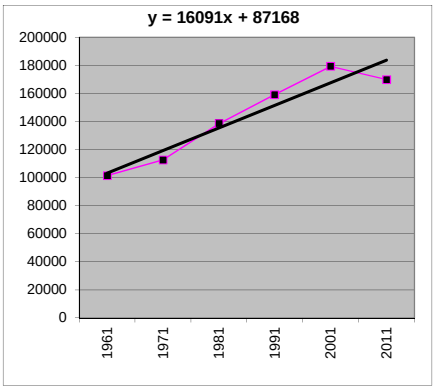
4. Growth Method

Sl No.	Year	Annual Growth Assumed	Population
1	2011	2	169892
2	2015	2	183483
3	2018	2	193677
4	2020	2	200473
5	2030	2	234451
6	2033	2	244644
7	2048	2	295612
8	2050	2	302408

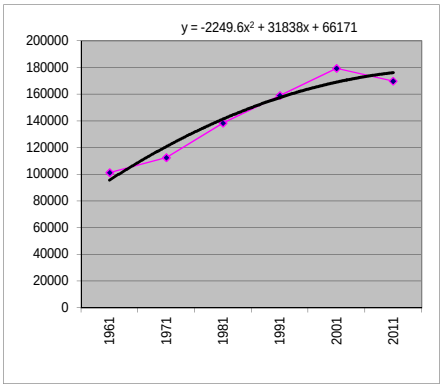
5. Graphical Methods

In Graphical Method population is plotted on log axis (X axis) and year on normal axis (Y-axis). Projected population is finally calculated from the Equation of Trend line shown on the chart.

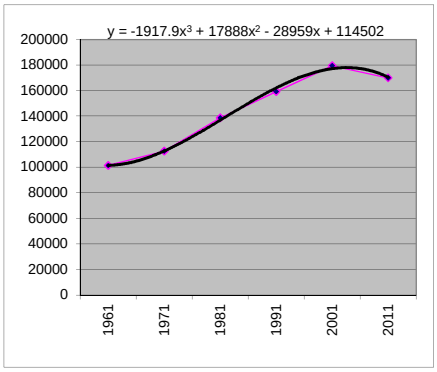
Linear Method		
YEAR	X	Y (Population)
2011		169892
2015	6.4	190150
2018	6.7	194978
2020	6.9	198196
2030	7.9	214287
2033	8.2	219114
2048	9.7	243251
2050	9.9	246469



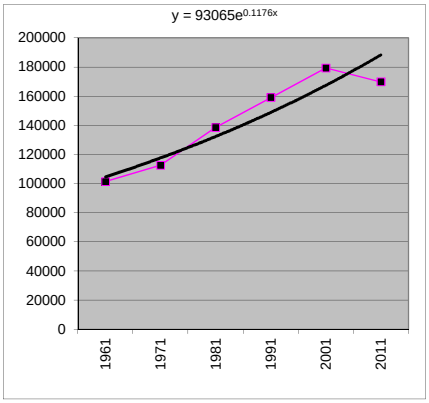
2nd Order Polynomial Method		
YEAR	X	Y (Population)
2011		169892
2015	6.4	177791
2018	6.7	178501
2020	6.9	178750
2030	7.9	177294
2033	8.2	175979
2048	9.7	163335
2050	9.9	160884



3rd Order Polynomial Method		
YEAR	X	Y (Population)
2011		169892
2015	6.4	159091
2018	6.7	146636
2020	6.9	136285
2030	7.9	56516
2033	8.2	22359
2048	9.7	-233734
2050	9.9	-279926



Exponential Method		
YEAR	X	Y (Population)
2011		169892
2015	6.4	197539
2018	6.7	204633
2020	6.9	209503
2030	7.9	235648
2033	8.2	244110
2048	9.7	291202
2050	9.9	298133



Ward no	Ward Area (2011) Ha	Population 2011	Density of population for 2011(pph)	Inverse Density for 2011	Proportionate factor for 2015	Increase in population from 2011 to 2015	Modified Population in 2015	Density of population for 2015 (pph)	Inverse density of population for 2015	Proportionate factor for 2018	Increase in population from 2015 to 2018	Modified Population in 2018	Density of population for 2018(pph)	Inverse density of population for 2018	Proportionate factor for 2033	Increase in population from 2018 to 2033	Modified Population in 2033	Density of population for 2033 (pph)	Inverse density of population for 2033	Proportionate factor for 2048	Increase in population from 2033 to 2048	Modified Population in 2048	Density of population for 2048(pph)	Inverse density of population for 2048
1	73.79	3546	48	0.02	0.072	694.44	4240.44	57.47	0.02	0.06	491.25	4731.69	64.12	0.02	0.06	2626.60	7358.29	99.72	0.01	0.05	2627.97	9986.26	135.33	0.01
2	41.91	4258	102	0.01	0.034	328.46	4586.46	109.44	0.01	0.03	257.96	4844.42	115.59	0.01	0.03	1457.10	6301.52	150.36	0.01	0.03	1742.90	8044.42	191.95	0.01
3	51.86	4661	90	0.01	0.038	371.30	5032.30	97.04	0.01	0.04	290.92	5323.23	102.65	0.01	0.04	1640.86	6964.08	134.29	0.01	0.04	1951.50	8915.58	171.92	0.01
4	49.95	3960	79	0.01	0.044	420.93	4380.93	87.71	0.01	0.04	321.87	4702.81	94.15	0.01	0.04	1788.92	6491.73	129.96	0.01	0.04	2016.39	8508.12	170.33	0.01
5	81.48	4734	58	0.02	0.060	574.38	5308.38	65.15	0.02	0.06	433.32	5741.69	70.47	0.01	0.06	2390.14	8131.84	99.80	0.01	0.05	2625.80	10757.64	132.03	0.01
6	52.75	3625	69	0.01	0.050	485.61	4110.61	77.93	0.01	0.05	362.27	4472.88	84.79	0.01	0.05	1986.32	6459.20	122.45	0.01	0.04	2140.15	8599.34	163.02	0.01
7	30.59	4081	133	0.01	0.026	250.14	4331.14	141.59	0.01	0.03	199.38	4530.53	148.10	0.01	0.03	1137.22	5667.74	185.28	0.01	0.03	1414.39	7082.13	231.52	0.00
8	41.32	3966	96	0.01	0.036	347.68	4313.68	104.40	0.01	0.04	270.41	4584.09	110.94	0.01	0.04	1518.17	6102.26	147.68	0.01	0.03	1774.47	7876.73	190.63	0.01
9	41.28	3742	91	0.01	0.038	368.14	4110.14	99.57	0.01	0.04	283.53	4393.67	106.44	0.01	0.04	1582.43	5976.10	144.77	0.01	0.03	1810.18	7786.28	188.62	0.01
10	35.57	4386	123	0.01	0.028	270.64	4656.64	130.91	0.01	0.03	215.64	4872.28	136.98	0.01	0.03	1229.60	6101.88	171.55	0.01	0.03	1527.64	7629.51	214.49	0.00
11	9.71	4054	418	0.00	0.008	79.93	4133.93	425.74	0.00	0.01	66.31	4200.24	432.57	0.00	0.01	389.37	4589.60	472.67	0.00	0.01	554.43	5144.03	529.77	0.00
12	45.23	4166	92	0.01	0.038	362.31	4528.31	100.12	0.01	0.04	281.97	4810.28	106.35	0.01	0.04	1583.69	6393.97	141.37	0.01	0.04	1853.77	8247.74	182.35	0.01
13	15.76	3748	238	0.00	0.015	140.32	3888.32	246.72	0.00	0.02	114.42	4002.75	253.98	0.00	0.02	663.15	4665.89	296.06	0.00	0.02	885.16	5551.05	352.22	0.00
14	19.46	3688	190	0.01	0.018	176.09	3864.09	198.57	0.01	0.02	142.17	4006.26	205.87	0.00	0.02	818.12	4824.38	247.91	0.00	0.02	1057.06	5881.44	302.23	0.00
15	25.87	4653	180	0.01	0.019	185.54	4838.54	187.03	0.01	0.02	150.94	4989.48	192.87	0.01	0.02	873.28	5862.76	226.62	0.00	0.02	1156.36	7019.12	271.32	0.00
16	17.52	3501	200	0.01	0.017	167.00	3668.00	209.36	0.00	0.02	134.84	3802.84	217.06	0.00	0.02	775.96	4578.80	261.35	0.00	0.02	1002.73	5581.52	318.58	0.00
17	31.38	4565	145	0.01	0.024	229.40	4794.40	152.79	0.01	0.02	184.77	4979.17	158.67	0.01	0.02	1061.47	6040.64	192.50	0.01	0.03	1361.35	7401.99	235.88	0.00
18	10.68	3909	366	0.00	0.009	91.18	4000.18	374.55	0.00	0.01	75.37	4075.55	381.61	0.00	0.01	441.37	4516.91	422.93	0.00	0.01	619.63	5136.54	480.95	0.00
19	16.83	3561	212	0.00	0.016	157.72	3718.72	220.96	0.00	0.02	127.76	3846.48	228.55	0.00	0.02	736.94	4583.42	272.34	0.00	0.02	962.26	5545.69	329.51	0.00
20	12.96	3466	267	0.00	0.013	124.78	3590.78	277.07	0.00	0.01	101.89	3692.67	284.93	0.00	0.01	591.12	4283.79	330.54	0.00	0.01	792.82	5076.62	391.71	0.00
21	21.93	4288	196	0.01	0.018	170.67	4458.67	203.31	0.00	0.02	138.85	4597.52	209.65	0.00	0.02	803.39	5400.91	246.28	0.00	0.02	1064.07	6464.99	294.80	0.00
22	12.51	4211	337	0.00	0.010	99.14	4310.14	344.54	0.00	0.01	81.94	4392.08	351.09	0.00	0.01	479.73	4871.81	389.43	0.00	0.01	672.92	5544.73	443.22	0.00
23	20.28	4386	216	0.00	0.016	154.30	4540.30	223.88	0.00	0.02	126.10	4666.40	230.10	0.00	0.02	731.98	5398.38	266.19	0.00	0.02	984.47	6382.85	314.74	0.00
24	5.82	3471	596	0.00	0.006	55.96	3526.96	606.01	0.00	0.01	46.58	3573.54	614.01	0.00	0.01	274.31	3847.85	661.14	0.00	0.01	396.37	4244.22	729.25	0.00
25	27.39	4279	156	0.01	0.022	213.61	4492.61	164.02	0.01	0.02	172.11	4664.72	170.31	0.01	0.02	988.96	5653.68	206.41	0.00	0.02	1269.58	6923.26	252.77	0.00
26	30.26	3859	128	0.01	0.027	261.68	4120.68	136.18	0.01	0.03	207.31	4327.99	143.03	0.01	0.03	1177.60	5505.58	181.94	0.01	0.03	1440.34	6945.92	229.54	0.00
27	30.36	4371	144	0.01	0.024	231.79	4602.79	151.61	0.01	0.02	186.21	4789.00	157.74	0.01	0.02	1067.75	5856.75	192.91	0.01	0.03	1358.45	7215.20	237.65	0.00
28	24.12	3630	150	0.01	0.023	221.74	3851.74	159.69	0.01	0.02	176.78	4028.52	167.02	0.01	0.02	1008.43	5036.95	208.83	0.00	0.02	1254.90	6291.85	260.86	0.00
29	26.87	4287	160	0.01	0.022	209.16	4496.16	167.33	0.01	0.02	168.71	4664.87	173.61	0.01	0.02	970.15	5635.03	209.71	0.00	0.02	1249.60	6884.63	256.22	0.00
30	15.17	4036	266	0.00	0.013	125.43	4161.43	274.32	0.00	0.01	102.91	4264.34	281.10	0.00	0.01	599.17	4863.51	320.60	0.00	0.02	817.40	5680.91	374.48	0.00
31	12.82	4156	324	0.00	0.011	102.94	4258.94	332.21	0.00	0.01	84.98	4343.92	338.84	0.00	0.01	497.07	4840.99	377.61	0.00	0.01	693.99	5534.98	431.75	0.00
32	20.1	3597	179	0.01	0.019	186.48	3783.48	188.23	0.01	0.02	149.98	3933.45	195.69	0.01	0.02	860.67	4794.12	238.51	0.00	0.02	1098.72	5892.84	293.18	0.00
33	17.98	4073	227	0.00	0.015	147.32	4220.32	234.72	0.00	0.02	120.27	4340.59	241.41	0.00	0.02	697.68	5038.26	280.21	0.00	0.02	935.21	5973.47	332.23	0.00
34	37.5	3973	106	0.01	0.033	314.98	4287.98	114.35	0.01	0.03	246.88	4534.87	120.93	0.01	0.03	1392.77	5927.64	158.07	0.01	0.03	1657.86	7585.50	202.28	0.00
35	21.83	3873	177	0.01	0.020	188.10	4061.10	186.03	0.01	0.02	151.75	4212.84	192.98	0.01	0.02	872.75	5085.60	232.96	0.00	0.02	1124.89	6210.49	284.49	0.00
36	14.67	3663	250	0.00	0.014	133.65	3796.65	258.80	0.00	0.01	109.08	3905.73	266.24	0.00	0.01	632.62	4538.35	309.36	0.00	0.02	847.09	5385.44	367.11	0.00
37	18.48	4087	221	0.00	0.016	150.89	4237.89	229.32	0.00	0.02	123.10	4361.00	235.98	0.00	0.02	713.72	5074.72	274.61	0.00	0.02	954.31	6029.03	326.25	0.00
38	16.98	4133	243	0.00	0.014	137.10	4270.10	251.48	0.00	0.01	112.26	4382.36	258.09	0.00	0.02	652.59	5034.95	296.52	0.00	0.02	883.77	5918.73	348.57	0.00
39	15.36	4092	266	0.00	0.013	125.26	4217.26	274.56	0.00	0.01	102.82	4320.08	281.26	0.00	0.01	598.84	4918.93	320.24	0.00	0.02	818.31	5737.24	373.52	0.00
40	19.34	4066	210	0.00	0.016	158.73	4224.73	218.45	0.00	0.02	129.23	4353.96	225.13	0.00	0.02	748.14	5102.11	263.81	0.00	0.02	993.36	6095.47	315.17	0.00
41	35.79	4524	126	0.01	0.027	264.01	4788.01	133.78	0.01	0.03	211.02	4999.02	139.68	0.01	0.03	1205.84	6204.86	173.37	0.01	0.03	1511.57	7716.44	215.60	0.00
42	22.75	4567	201	0.00	0.017	166.24	4733.24	208.05	0.00	0.02	135.69	4868.92	214.02	0.00	0.02	786.98	5655.90	248.61	0.00	0.02	1054.09	6709.99	294.94	0.00

2011	169892	
2015	179537	9645
2018	187129	7592
2033	230182	43053
2048	283140	52958

note:
geometrical progression method adopted

Zonewise Sewage Calculation for STP												
Zone No.	Wards Covered	Population			Avg Flow in mld			Total Avg flow in mld			Peak Flow in mld		
		2018	2033	2048	2018	2033	2048	2018	2033	2048	2018	2033	2048
1	1P,35P, 37, 38 ,39,40P, 41P, 42P	34609	41883	50874	3.74	4.52	5.49	4.06	4.91	5.96	10.14	12.27	14.90
Institutional Demand -10%		3461	4188	5087	0.12	0.15	0.18						
Total		38070	46071	55961	3.86	4.67	5.68						
Total including Infiltration -5%					4.06	4.91	5.96						
2	1P,2P,3P,41P,42P	13031	17033	21734	1.41	1.84	2.35	1.53	2.00	2.55	3.82	4.99	6.37
Institutional Demand -10%		1303	1703	2173	0.05	0.06	0.08						
Total		14334	18736	23907	1.45	1.90	2.43						
Total including Infiltration -5%					1.53	2.00	2.55						
3	2P,3P ,4,5,6,7,9,10,11,12,14,15,16,17P,19,20,21,22,23,24, 25P,29P,31,33P, 35P,40P,	99345	122533	150905	10.73	13.23	16.30	11.64	14.36	17.68	26.19	32.31	39.79
Institutional Demand -10%		9935	12253	15091	0.36	0.44	0.54						
Total		109280	134786	165996	11.09	13.67	16.84						
Total including Infiltration -5%					11.64	14.36	17.68						
4	25P,26,27,28,29, 30P,31P,32,33P,34P	32582	39988	49310	3.52	4.32	5.33	3.82	4.69	5.78	9.54	11.71	14.45
Institutional Demand -10%		3258	3999	4931	0.12	0.14	0.18						
Total		35840	43986	54240	3.64	4.46	5.50						
Total including Infiltration -5%					3.82	4.69	5.78						
5	17P,18	7561	8745	10318	0.82	0.94	1.11	0.89	1.02	1.21	2.66	3.07	3.63
Floating population -10%		756	875	1032	0.03	0.03	0.04						
Total		8317	9620	11350	0.84	0.98	1.15						
Total including Infiltration -5%					0.89	1.02	1.21						

ANNEXURE -2
Cost Estimate

General Abstract

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1		
GENERAL ABSTRACT		
Sl.no	**Description**	**Amount(Crore)**
1	Sewage Treatment Plant	6.75
2	Site Improvement works	0.31
3	Interception and Diversion works	0.22
4	Strenthening of Lead channel to STP	0.10
5	Express Feedermain works	0.08
6	Provisional sum for Deposits for Electricity,Roads	0.50
		7.96
7	Operation and Maintenance(For 10 years excluding power charges)	5.64
8	Other Charges	
a)	Provision for Seigniorage charges (0.5%)	0.04
b)	Provision for VAT on CAPEX (5%)	0.40
c)	Provision for Labor Cess (1%)	0.08
d)	Provision for Scrutinity Charges (1%)	0.08
e)	Provision for NAC (0.1%)	0.008
f)	Provision for Contegency charges (0.5%)	0.04
	Grand Total	**14.24**
Rupees Fourteen Crore Twenty four lakh Only.		

Detailed Estimate

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1									
Detailed Estimate									
Sl. No	**Description**	**Unit**		**Length**	**Breadth**	**Depth**	**Qty**	**Rate**	**Amount**
I	**Sewage treatment plant-5MLD**	**MLD**					**5**	**1.35**	**6.75**
II	**SITE IMPROVEMENT**								
1	Clearing grass and removal of rubbish up to a distance of 50m out side the periphery of the area as per technical specification class 201 mORD	Sqm	1	115	61.5		7073	2.07	14640.075
2	Supply and filling with gravel from approved quarry including cost and conveyance, watering, tamping including all labour charges	Cum	1	115	61.5	1	7073	413.87	2927076.15
	Sub total								**2941716.23**
	Add 5% VAT								**147085.81**
	Add 1% labour cess								**29417.16**
	Grand Total								**3118219.20**
								In Cr	**0.31**

III.Interception and Diversion works

Sl. No	Specification	Unit	No	L	B	D	Qty	Rate(Rs)	Amount(Rs)
1	RBR-STCL-5 : Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and lead of 1000 m as per Technical Specification Clause 202 MORD / MORTH	Cum	1	9.36	3.5	0.5	**16.38**	1196.23	19594.24
2	Excavation **in all kinds of soil** including boulders **upto 0.3 m diameter** for **canal**, seating of embankment, filter drains / catch water drains etc., including dressing bed and sides to required level and profile, cost of all materials, machinery	Cum	1	9.36	3.5	0.95	31.12		
	For Silt pit(1.5m width and 1m depth)	Cum	1	3.5	1.55	1.35	7.32		
	For Channel	Cum	1	100	1.05	1.35	141.75		
				Sub	**Total**		**180.20**	322.57	58125.74
3	Supply and filling with gravel from approved quarry including cost and conveyance, watering, tamping including all labour charges	Cum	1	100	1.05	0.3	**31.50**	413.87	13036.8185

III.Interception and Diversion works

Sl. No	Specification	Unit	No	L	B	D	Qty	Rate(Rs)	Amount(Rs)
4	Providing and laying **insitu vibrated M-10** (28 days cube compressive strength approved, clean, hard, graded aggregates for bed and side lining of canal(150mm thick) including finishing the junction of bed and sides to required curveture, cost of all materials, machinery, labour, formwork including supports, cleaning, 151batching, mixing, placing in position, levelling, vibrating, finishing, curing etc., cum4489.10complete with initial lead upto 50 m and all lifts. (43 Gr Cement content: 250 kg / cum for use of super plasticiser(0.4% by wt. of cement),CA : 0.90cum, Blending Ratio of CA--50:30:20, FA : 0.40 cum)	Cum	1	9.36	3.5	0.15	**4.91**		
		Cum	1	100	1.05	0.15	**15.75**		
							20.66	4415.07	91233.00
5	Providing and **laying insitu vibrated M-20** (28 days cube compressive strength not less than 20 N / sq mm) grade cement concrete using 20 mm down size approved, clean, hard, graded aggregates for sub-structure / super-structure works including cost of all materials, machinery, labour, formwork, scaffolding,cleaning, batching, mixing, placing in position, levelling, vibrating, finishing, curing etc., complete with initial lead upto 50 m and all lifts.(Cement content: 330 kg / cum with use of super plasticiser(0.4% by wt. of cement),CA : 0.80cum, Blending Ratio of CA--65:35, FA : 0.45 cum)	Cum	1	9.36	3.5	0.5	**16.38**		
	For RCC Rectangular channel	Cum	1	100	0.85	0.2	**17**		
	For RCC Rectangular channel	Cum	2	100	0.2	0.45	**18**		
	RCC Weir	Cum	1	3.5	0.4	1	1.4		

III.Interception and Diversion works

Sl. No	Specification	Unit	No	L	B	D	Qty	Rate(Rs)	Amount(Rs)
	RCC Weir	Cum	2	3.5	0.5	0.6	2.1		
							54.88	8000.189	439050.353
6	Providing, fabricating and placing in position reinforcement steel bars for RCC works including cleaning, straightening, cutting, bending, hooking, lapping, welding wherever required,tying with 1.25 mm dia soft annealed steel wire, including cost of all materials, machinery, labour etc., complete with initial lead upto 50 and all lifts in cluding labour component etc complete.								
	TMT steel for footing @100kg/cum	MT	1				**5.488**	45390.00	249100.32
	54.88X100kg= kg								**870140.47**
7	Filling in foundation / Pipe line trenches with excavated earth as per drawing and technical specification Clause 305.3.9 MORD & 304 (**RBR-FNDN-2 (ii)**)	Cum	1						
	Backfilling qty=180.20-(31.5+20.66+54.38)=107.04						107	24.66	**2639.61**
									1742920.55
	Add VAT 5%								**87146.03**
	Add labour cess 1%								**17429.21**
									1847495.78
	R/A								**-495.78**
									1847000.00
								In cr	**0.18**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1														
III.Interception and Diversion works														
PRPOSED INSTALLATION OF DUCTILE IRON PIPE(K9CLASS) LINE FOR THE OUT FALL AT STP MACHILIPATANAM MUNICIPALITY														
S. N.	**Description of Item**	**No**			**L**	**B**	**D**	**Quantity**		**Rate**	**Per**		**Amount**
	Total EWE Quantity												
	300mm dia DI K9 pipe	1	x	1	50.00	0.90	1.30	58.50					
	Total EWE Qty				**50.00**	**Rmt**		**58.50**	**Cum**				
1	Cutting open BT road surface (as well as asphalt concrete upto 75 mm thick) including water bound macadam and stacking of excavated materials for pipe line trench work. as directed by the departmental officers.												
	300mm dia DI K9 pipe	1	x	1	30.00	0.90		27.00					
					30.00	**Rmt**		**27.00**	Sqm	89.44	1	Sqm	2415.00
2	Cutting open C.C. road surface including stacking of excavated materials for pipe line trench work. as directed by the departmental officers.												
	300mm dia DI K9 pipe	1	x	1	20.00	0.90	0.15	2.70					
					20.00	**Rmt**		**2.70**	Cum	2484.08	1	Cum	6707.00
3	Cutting open water bound macadam road including soiling for pipe line trench work. as directed by the departmental officers.												
	300mm dia DI K9 pipe	1	x	1	10.00	0.90	0.15	1.35					
					10.00	**Rmt**		**1.35**	Cum	305.40	1	Cum	412.00
4	RBR-FNDN-1- (i-B) - In ordinary soils, by Mechanical means Earthwork excavation in all kinds of soil for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and bottom as per Technical Specification 304 MORTH and as directed by the departmental officer including protecting the existing utility services wherever it is possible during the execution and taking all precautionary measures in the restricted areas for laying sewer/water lines including divertion of traffic and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all incidental and operational charges etc., complete for Pipe Lines by mechanical means.												

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1													
III.Interception and Diversion works													
	% of the EWE Quantity	1	x	1	58.50	70%		**40.95**	Cum	93.75	1	Cum	3839.00
5	RBR-FNDN-1- (II-A) Ordinary rock (not requiring blasting) - up to 3.00 Mts. below GL by Manual means: Excavation in Ordinary rock for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and												
	% of the EWE Quantity	1	x	1	58.50	5%		**2.93**	Cum	206.78	1	Cum	606.00
6	RBR-FNDN-1- (i-A) In ordinary soils, by Manual means Earthwork excavation in all kinds of soil for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and bottom as per Technical Specification 304 MORTH and as directed by the departmental officer including protecting the existing utility services wherever it is possible during the execution and taking all precautionary measures in the restricted areas for laying sewer/water lines including divertion of traffic and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50												
	% of the EWE Quantity	1	x	1	58.50	20%		**11.70**	Cum	252.32	1	Cum	2952.00
7	RBR-FNDN-1- (IV) - Hard rock (blasting prohibited) -up to 3.00Mts. below GL: Excavation in Hard Rock in habitant areas where conventional blasting can not be done for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and												
	% of the EWE Quantity	1	x	1	58.50	5%		**2.93**	Cum	1001.77	1	Cum	2935.00

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1														
III.Interception and Diversion works														
8	RBR-FNDN-1 -manual means : Earthwork excavation for structures in all types of soil as per drawing and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material and disposal upto a lead of 50 m, dressing of sides and bottom and backfilling in trenches with excavated suitable material as per Technical Specification 305 MORD													
	Thrust Blocks for bends and													
	Bends of 300mm dia	1	x	2	1.30	1.30	1.30	4.39						
								4.39	Cum	151.99	1	Cu	667.00	
9	PHE-BHLW-26; Barricading, hoarding, lighting and watching etc., for water supply and sewerage works for trenches of depths upto 6'-0" (2 Meter) below G.L													
	For main roads in habitation area	1	x	10	1.00			10.00	Rmt	143.67	1	Rmt	1437.00	
10	BLD-CSTN-2-8 (16): Collection ,Supply and filling of Stone dust from approved quarry to work site and stacking at work site to Dept. gauge for premeasurements including cost and convenyance of all material and all labour charges etc. complete as per standard specifications. Clause 305.3.9													
a	**for Bedding of Pipe line**													
	300mm dia DI K9 pipe	1	x	1	50.00	0.90	0.15	6.75						
								6.75	Cum	437.61	1	Cum	2954.00	
11	Centrifugally cast (spun) Ductile Iron pressure pipes for water, Gas and sewage with socket spigot ends confirming to I.S.: 8329/2000 in standard working lengths of 4,5,5.5 & 6 meterfor classification **K9** suitable for push on joint (													
	300mm dia DI K9 pipe	1	x	1	50.00			50.00	Rmt	4282.60	1	Rmt	214130.00	
12	Manufacture as per bis 12820/89 with S.B.R. quality rubber confirming to BIS: 5382/85, supply and delivery of rubber gaskets suitable for C.I/ D.I. S/S pipes anywhere in A.P. including cost of material, loading, incidental													
	300mm dia DI K9 pipe	1	x	9				9	Nos	369.25	1	Nos	3323.00	

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1														
III.Interception and Diversion works														
13	PHE-LCIS-1: Lowering C.I. / D.I. Pipes (all classes) and specials (fittings) with s/s ends carefully into trenches and laying them true to alignment and gradient including all sundries but excluding cost and conveyance of pipes from source of supply (Ref to specifications. BIS No.3114/1994)													
	300mm dia DI K9 pipe	1	x	1	50.00			50.00	Rmt	121.59	1	Rmt	6080.00
14	PHE-JCIR-4: Jointing the C.I. Pipes, D.I. Pipes & fittings with Rubber Gasket, excluding the cost of the gasket but including all sundries filling with water with a water lead upto 500 m and testing to required pressure etc., complete as per BIS No.3114/85.													
	300mm dia DI K9 pipe	1	x	9				9	Nos	180.39	1	Nos	1624.00
15	PHE-CCIP-23: Cutting C.I./ DI / MS Pipes without water in mains													
	300mm dia DI K9 pipe	1	x	1				1	Nos	255.63	1	Nos	256.00
16	Manufacture, Supply and delivery of DI D/F Gate Valves (Soft Seated) Resilient seated soft sealing gate valves (Sluice valves) with body bonnet of ductile cast iron of grade GGG40/SG- 400/15 or GGG-50/SG-500/7 or equivalent grade as per I.S.3896-part2-1985 and subsequent revisions, wedge fully rubber lined with EPDM food grade quality and seals of NBR and													
	DI. D/F Sluice valves of PN.16	1	x	1				1	Nos	82081.16	1	Nos	82081.00
	300mm dia													
17	**PHE-CISV-15** : Lowering, keeping in position and fixing C.I. sluice valves (with cap / with hand wheel & reflex valves) excluding cost of bolts, nuts, rubber insertion, sluice valve and tail pieces	1	x	1				1	Nos	802.26	1	Nos	802.00
18	Construction of Masonary Sluice Valve pits suitable to the sluice valves of size from 300mm as per TD No. 4/1941	1	x	1				1	Nos	26702.79	1	Nos	26703.00
													359923.00
	Add VAT 5%												17996.15
	Add Labour cess 1%												3599.23
	Total												381518.38
	Rounding off												481.62
	Grand Total												382000.00
										In cr			0.04

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1									
IV. Strenthening of Lead channel to STP									
a. 25m length BEL Company Road									
S.No.	**DESCRIPTION**	**Unit**	**NOS.**	**MEASUREMENTS**			**QUANTITY**	**Rate**	**Amount**
				L	**B**	**D**			
1	Clearing grass and removal of rubbish up to a distance of 50m out side the periphery of the area as per technical specification class 201	Sqm	1	25	3.25		81.25	2.07	168.19
2	Earthwork in excavation in all types of soils for pipeline trenches for water supply lines, Sewer lines, Storm Water drainage as per specification drawings and as directed by the Engineer Incharge and protecting the walls and other structures etc., and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all incidental and operational charges etc.,	Cum	1	25	3.25	1.55	125.94	96.53	12156.7469
3	Providing and laying insitu vibrated M-10(28days cube strength not less than 10kn/sqm)grade cement concrete using 40mm and down size approved clean,hard graded,aggregates for foundation filling including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 220kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.9,Belnding	Cum	1	25	3.25	0.15	12.19	4356.3	53092.7236
4	Providing and laying insitu vibrated M-20(28days cube strength not less than 20kn/sqm)grade cement concrete using 20mm and down size approved clean,hard graded,aggregates for sub structure or super structure works including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 330kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.8,Belnding ratio of CA=65:35,FA=0.45								
	(a) Bottom Slab (200mm thick)	Cum	1	25.00	3.10	0.20	15.50		
	(b) Side walls 200mm thick=	Cum	2	25.00	0.20	1.20	12.00		

							27.50	7385.21	203093.338
5	Supplying, Fitting & placing HYSD bar reinforcement including cutting, bending ,binding shifting to site, tying tand placing in the position including cost of steel & binding wire as per drawing and technical specification etc. complete as per direction of the Engineer-in-Charge.								
	(a) Bottom Slab (200mm thick)	Kg	15.50	90	Kg/Cum		1395.00		
	(b) Side walls 200mm thick=	Kg	12.00	90	Kg/Cum		1080.00		
							2475.00	45.37	112296.072
6	Filling in foundation / Pipe line trenches with excavated earth as per drawing and technical specification Clause 305.3.9 MORD & 304 (**RBR-FNDN-2 (ii)**)								
	Earth workqty-Concreteqty=133.69-(5.81+28.5)=						99.38	24.66	2450.7108
	Total								**383257.78**
	Add 5% for VAT								19162.89
	Add 1% for labour cess								3832.58
									406253.25
	Roudingoff								-53.25
	Total								**406200.00**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1									
IV. Strenthening of Lead channel to STP									
b.7 m length at Sakthi Gudi road									
S.No.	**DESCRIPTION**	**Unit**	**NOS.**	**MEASUREMENT**			**QUANTITY**	**Rate**	**Amount**
				L	**B**	**D**			
1	Clearing grass and removal of rubbish up to a distance of 50m out side the periphery of the area as per technical specification class 201 mORD	Sqm	1	7	3.75		26.25	2.07	54.34
2	Earthwork in excavation in all types of soils for pipeline trenches for water supply lines, Sewer lines, Storm Water drainage as per specification drawings and as directed by the Engineer Incharge and protecting the walls and other structures etc., and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all incidental and operational charges etc.,	Cum	1	7	3.75	1.55	40.69	96.53	3927.56
3	Providing and laying insitu vibrated M-10(28days cube strength not less than 10kn/sqm)grade cement concrete using 40mm and down size approved clean,hard graded,aggregates for foundation filling including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 220kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.9,Belnding ratio of CA=50:30:20,FA=0.4	Cum	1	7	3.75	0.15	3.94	4356.3	17153.03

4	Providing and laying insitu vibrated M-20(28days cube strength not less than 20kn/sqm)grade cement concrete using 20mm and down size approved clean,hard graded,aggregates for sub structure or super structure works including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 330kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.8,Belnding ratio of CA=65:35,FA=0.45								
	(a) Bottom Slab (200mm thick)	Cum	1	7.00	3.60	0.20	5.04		
	(b) Side walls 200mm thick=	Cum	2	7.00	0.20	1.20	3.36		
							8.40	7385.21	62035.78
5	Supplying, Fitting & placing HYSD bar reinforcement including cutting, bending ,binding shifting to site, tying tand placing in the position including cost of steel & binding wire as per drawing and technical specification etc. complete as per direction of the Engineer-in-Charge.								
	(a) Bottom Slab (200mm thick)	Kg	5.04	90	Kg/Cum		453.60		
	(b) Side walls 200mm thick=	Kg	3.36	90	Kg/Cum		302.40		
							756.00	45.37	34301.35
6	Filling in foundation / Pipe line trenches with excavated earth as per drawing and technical specification Clause 305.3.9 MORD & 304 (**RBR-FNDN-2 (ii)**)								
	Earth workqty-Concreteqty=40.69-(3.94+8.4)=28.35						28.35	24.66	699.11
	Total								**118171.18**
	Add 5% for VAT								5908.56
	Add 1% for labour cess								1181.71
									125261.45
	Roudingoff								-261.45
	Total								**125000.00**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1									
IV. Strenthening of Lead channel to STP									
c. 10m length at Nizampeta Road									
S.No.	**DESCRIPTION**	**Unit**	**NOS.**	**MEASUREMENTS**			**QUANTITY**	**Rate**	**Amount**
				L	**B**	**D**			
1	Clearing grass and removal of rubbish up to a distance of 50m out side the periphery of the area as per technical specification class 201 mORD	Sqm	1	10	3.75		37.50	2.07	77.63
2	Earthwork in excavation in all types of soils for pipeline trenches for water supply lines, Sewer lines, Storm Water drainage as per specification drawings and as directed by the Engineer Incharge and protecting the walls and other structures etc., and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all incidental and operational charges etc.,	Cum	1	10	3.75	1.55	58.13	96.53	5610.8063
3	Providing and laying insitu vibrated M-10(28days cube strength not less than 10kn/sqm)grade cement concrete using 40mm and down size approved clean,hard graded,aggregates for foundation filling including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 220kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.9,Belnding ratio of CA=50:30:20,FA=0.4	Cum	1	10	3.75	0.15	5.63	4356.3	24504.334
4	Providing and laying insitu vibrated M-20(28days cube strength not less than 20kn/sqm)grade cement concrete using 20mm and down size approved clean,hard graded,aggregates for sub structure or super structure works including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 330kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.8,Belnding ratio of CA=65:35,FA=0.45								
	(a) Bottom Slab (200mm thick)	Cum	1	10.00	3.60	0.20	7.20		
	(b) Side walls 200mm thick=	Cum	2	10.00	0.20	1.20	4.80		
							12.00	7385.21	88622.548

5	Supplying, Fitting & placing HYSD bar reinforcement including cutting, bending ,binding shifting to site, tying tand placing in the position including cost of steel & binding wire as per drawing and technical specification etc. complete as per direction of the Engineer-in-Charge.								
	(a) Bottom Slab (200mm thick)	Kg	7.20	90	Kg/Cum		648.00		
	(b) Side walls 200mm thick=	Kg	4.80	90	Kg/Cum		432.00		
							1080.00	45.37	49001.922
6	Filling in foundation / Pipe line trenches with excavated earth as per drawing and technical specification Clause 305.3.9 MORD & 304 (**RBR-FNDN-2 (ii)**)								
	Earth workqty-Concreteqty=58.13-(5.63+12)=40.5						40.50	24.66	998.73
	Total								**168815.97**
	Add 5% for VAT								8440.80
	Add 1% for labour cess								1688.16
									178944.92
	Roudingoff								55.08
	Total								**179000.00**
	Rupees One Lakh Seventy Nine Thousand only.								

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1									
IV. Strenthening of Lead channel to STP									
d. 15m length at Narayanapuram Road									
S.No.	**DESCRIPTION**	**Unit**	**NOS.**	**MEASUREMENTS**			**QUANTITY**	**Rate**	**Amount**
				L	**B**	**D**			
1	Clearing grass and removal of rubbish up to a distance of 50m out side the periphery of the area as per technical specification class 201 mord	Sqm	1	15	4.25		63.75	2.07	131.96
2	Earthwork in excavation in all types of soils for pipeline trenches for water supply lines, Sewer lines, Storm Water drainage as per specification drawings and as directed by the Engineer Incharge and protecting the walls and other structures etc., and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all incidental and operational charges etc.,	Cum	1	15	4.25	1.55	98.81	96.53	9538.37
3	Providing and laying insitu vibrated M-10(28days cube strength not less than 10kn/sqm)grade cement concrete using 40mm and down size approved clean,hard graded,aggregates for foundation filling including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 220kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.9,Belnding ratio of CA=50:30:20,FA=0.4	Cum	1	15	4.25	0.15	9.56	4356.326	41657.37

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1									
IV. Strenthening of Lead channel to STP									
d. 15m length at Narayanapuram Road									
S.No.	**DESCRIPTION**	**Unit**	**NOS.**	**MEASUREMENTS**			**QUANTITY**	**Rate**	**Amount**
				L	**B**	**D**			
4	Providing and laying insitu vibrated M-20(28days cube strength not less than 20kn/sqm)grade cement concrete using 20mm and down size approved clean,hard graded,aggregates for sub structure or super structure works including cost of all materials,machinery,labours,form work,cleaning batching,mixing,placing in position levelling,vibrating,finishing curing etc complete with intial lead up to 50m and all liftsCement 330kg/cum with the use of super plastisizer (0.4% by weight of cement)CA=0.8,Belnding ratio of CA=65:35,FA=0.45								
	(a) Bottom Slab (300mm thick)	Cum	1	15	3.60	0.30	16.20		
	(b) Side walls Avg (250+400/2)=325mm thick	Cum	2	15	0.33	1.20	11.70		
							27.90	7385.21	206047.42
5	Supplying, Fitting & placing HYSD bar reinforcement including cutting, bending ,binding shifting to site, tying tand placing in the position including cost of steel & binding wire as per drawing and technical specification etc. complete as per direction of the Engineer-in-Charge.								
	(a) Bottom Slab (300mm thick)	Kg	16.20	90	Kg/Cum		1458.00		
	(b) Side walls Avg (250+400/2)=325mm thick	Kg	11.70	90	Kg/Cum		1053.00		
							2511.00	45.37	113929.47
6	Filling in foundation / Pipe line trenches with excavated earth as per drawing and technical specification Clause 305.3.9 MORD & 304 (**RBR-FNDN-2 (ii)**)								
	Earth workqty-Concreteqty=98.81-(9.56+27.90)=						61.35	24.66	1512.89
	Total								**372817.48**
	Add 5% for VAT								18640.87
	Add 1% for labour cess								3728.17
									395186.53
	Roudingoff								-186.53
	Total								**395000.00**
	Rupees Three Lakh Ninety five Thousand only.								

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

V. Laying dedicated power line from substation to S.T.P site

	Cost data per Km of 33 KV Line with 100 Sq.mm AAA Conductor over 9.1 Mts.				
	PSCC Poles at 80 Mts. Span, 100 Kg/Sq.Mt wind pressure, working load 280 Kgs.				
Sl.No	**Description**	**Unit**	**Quantity**	**Rate**	**Amount**
1	9.1m PSCCpole	each	14	3105	43470.00
2	1.53 m cross arm(channel) without clamps	each	12	1418	17016.00
3	Top clamp with cleat	each	12	375	4500.00
4	Back Clamp	each	12	172	2064.00
5	Stay sets with clamps	each	6	1146	6876.00
6	Bracing Set with double cross arm	each	1	7336	7336.00
7	100 Sq.mm AAA Conductor 3.06	km	3.06	49166	150448.00
8	33 KV Pin - Insulator with Pin	each	39	365	14236.00
9	Strain Insulator set with metal parts	set	6	1013	6078.00
10	Concreting of Pole, Stay sets & Base concreting		L.S		38704.38
11	Misc. Items like coil earthing, pipe earthing, dangerboards,		L.S		6020.00
12	bolts & nuts, etc.				
13	**TOTAL MATERIAL COST**				**296748.38**
14	3%storage & handling charges on items (1) to (9)				7561
15	3% Contingencies on Materials				8902
16	LABOUR				74187
17	transport				14837
18	11% Estt. & Genl. Charges On Materials				32642
19	1% cess				4349
20	Sub total				**439226.38**
21	Add 20% extra towards variation of rates between				
22	1014-15 and 2016-17 SOR rates				87845
23	**TOTAL/KM**				527071.38
					527100
	For 1.5KM Total Cost				**790650.00**
				In Cr	**0.08**

FOR 1.5km distance, Total cost=527100x1.5=790650/-

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1					
VIIa.OPERATION & MAINENANCE					
S.No	**Description of Work**	**Units**	**Qty in cum per annum**	**Unit Rate (Rs.)**	**Amount (Rs.)**
1	Power consumption	Cum/annum	1825000	4.52	0.00
2	Chemicals	Cum/annum	1825000	0.21	383250.00
3	Manpower	Cum/annum	1825000	1.637	2987525.00
4	Filter media replacement	Cum/annum	1825000	0.05	91250.00
5	Residual disposal	Cum/annum	1825000	0.075	136875.00
					3598900.00
6	Civil works at 1%Civil,mechanical,E&I and maintenance works at 2.5%				1095000.00
					4693900.00
	Say				**4693900.00**
	Total				**4693900.00**
	First Year				4693900.00
	Total for 1 year O&M				**4693900**
	Second Year				4881656
	Third year				5076923
	Fourth year				5280000
	Fifth year				5491200
	Sixth year				5710848
	Seventh year				5939282
	Eigth year				6176854
	Ninth Year				6423929
	Tenth year				6680887
	Total 10years O&M including power				**56355479.00**
				Cr	**5.64**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1					
power Supply for Operation and Maintenance					
S.No	**Description of Work**	**Units**	**Qty in cum per annum**	**Unit Rate (Rs.)**	**Amount (Rs.)**
1	Power consumption	Cum/annum	1825000	4.52	8249000
	Second Year				8578960
	Third year				8922118.4
	Fourth year				9279003.136
	Fifth year				9650163.261
	Sixth year				10036169.79
	Seventh year				10437616.58
	Eigth year				10855121.25
	Ninth Year				11289326.1
	Tenth year				11740899.14
	Total 10years O&M including power				99038377.66
				Cr	**9.90**

Rate Analysis

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1					
Rate Analysis					
Sl. No	**Description**	**Unit**	**No**	**Rate**	**Amount**
1	Clearing grass and removal of rubbish up to a distance of 50m out side the periphery of the area as per technical specification class 201 mORD				
	By manual means				
	Unit=10sqm				
	Taking output=1hectare				
	a)Labour				
	Mate	Day			
	b)Mazdoor(Unskilled)	Day	52	350	18200.00
	c)Overheads and contractors profit 13.615%				2477.93
	Rate per Hectare				**20677.93**
	Rate per 10 sqm(a+b+c)/1000)				**20.68**
	Rate per sqm				2.07
2	Clearing and grubbibg of road land including uprooting wild vegetation,grass,bushes,shrubs,saplings and trees of girth up to 300mm removal of stumps of such trees cut earlier and disposal of unservicebale materials and stacking of servicable materials to be used or auctioned up to a lead of 1000m including removal and disposal of up toporganic soil not exceeding 150mm in thickness as per Technical specification clause 201 mORD/MORTH				
I	**By manual means**				
	Unit=10sqm				
	Taking output=1hectare				
A	**In area of Non throny Jungle(light jungle)**				
	a)Labour				
	Mate	Day			
	Mazdoor(Unskilled)	Day	156	350	54600.00
	b)Machinery				
	Tractor with trolley 3t	Hour	1	345	345.00
					54945.00
	c)Overheads and contractors profit 13.615%				**7480.76**
	Rate per Hectare				**62425.76**
	Rate per 10 sqm(a+b+c)/1000)				**62.43**
	Rate for 1sqm				**6.24**
B	**In area of throny Jungle**				
	a)Labour				
	Mate	Day			
	Mazdoor(Unskilled)	Day	208	350	72800.00
	b)Machinery				
	Tractor with trolley 3t	Hour	2	345	690.00
					73490.00
	c)Overheads and contractors profit 13.615%				**10005.66**
	Rate per Hectare				**83495.66**
	Rate per 10 sqm(a+b+c)/1000)				**83.50**
II	**By Mechanical means**				
A	**In area of Non throny Jungle(light jungle)**				

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1					
Rate Analysis					
Sl. No	**Description**	**Unit**	**No**	**Rate**	**Amount**
	a)Labour				
	Mate	Day			
	Mazdoor(Unskilled)	Day	4.16	350	1456.00
	b)Machinery				
	Dozer D50 with attachment or suitable machinery for removal of trees and stumps	Hour	10	1649	16490.00
	Tractor with trolley 2t		1	345	345.00
					16835.00
	c)Overheads and contractors profit 13.615%				**2292.09**
	Rate per Hectare				**19472.09**
	Rate per 10 sqm(a+b+c)/1000)				**19.47**
B	**In area of Throny Jungle**				
	a)Labour				
	Mate	Day	-		
	Mazdoor(Unskilled)	Day	6.24	350	2184.00
	b)Machinery				
	Dozer D50 with attachment or suitable machinery for removal of trees and stumps	Hour	12	1649	19788.00
	Tractor with trolley 2t		1.5	345	517.50
					20305.50
	c)Overheads and contractors profit 13.615%				**2764.59**
	Rate per Hectare				**23587.59**
	Rate per 10 sqm(a+b+c)/1000)				**23.59**
IRR-CCDW-7-2	Providing and filling murum / gravely soil (CNS soil) for foundation or above pipes including breaking clods, spreading in layers of 10 to 15 cm, watering, compaction by power roller to achieve density control of not less than 98 percent etc., complete with lead upto 50 m and all lifts.				
DAT	For 10cum				
	A. MATERIALS:				
	Sl No	10Cum			
	1Murum		12	396.99	4763.88
	Total cost of materials				**4763.88**
	B.Machinery				
	Diesel Road roller 8-10tons	Hour	0.17	197.20	33.52
	Fuel/Energy charges	Hour	0.17	714.00	121.38
	Total hire charges of the machinery				**154.90**
	C.cost of labour				
	1.Operator road roller	Hour	0.17	445.00	75.65
	2.Cartman with double bullock cart	Day	0.5	465	232.50
	3.Work inspector	Day	0.5	450	225.00
	4.Mazdoor	Day	1.5	350	525.00
	Total cost of labour				**1058.15**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1					
Rate Analysis					
Sl. No	**Description**	**Unit**	**No**	**Rate**	**Amount**
	Labour component 20%				211.63
	Labour component				**1269.78**
	ABSTRACT:				
	A. Cost of Materials				4763.88
	B. Hire charges of Machinery				154.90
	C. Cost of Labour				1058.15
	Total cost				**5976.93**
	Add contractors profit 13.615%				813.76
	Total cost for 10cum				**6790.69**
	For 1cum				**679.07**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
RBR-FNDN-1			**Excavation for Pipe Lines & Foundation Trenches**				
	1		Earthwork in excavation for structures as per drawing and technical specifications Clause 305.1 including setting out, removal of stumps and other deleterious material and disposal upto a lead of 50 m, etc complete for pipe line trenches & building				
			Note : Classifications of Earth Work Specification are as per 302.2.1(a) of MORD				
		(I)	**Ordinary soil**				
		(A)	**Manual Means**				
		(i)	**Upto 3 m depth**				
			Unit = cum				
			Taking output = 10 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	3.64	350.00	1274.00
			Add 25% M.A Allownce				318.50
						Sub Total	**1592.50**
			b&c) Overheads & Contractors Profit	13.615%			216.82
			Cost for 10 cum = a+b+c				**1809.32**
			Rate per cum = (a+b+c)/10				**180.93**
		(B)	**Mechanical Means**				
		i	**Upto 3 m depth**				
			Unit = cum				
			Taking output = 240 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	8.32	350.00	2912.00
			Add 25% M.A Allownce				582.40

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
			b) Machinery				
			Hydraulic Excavator 1 cum bucket capacity **(R&B pg No:29 item no:3)**	hour	6.00	2815.90	16895.40
						sub Total	**20389.80**
			b&c) Overheads & Contractors Profit 13.615%				2776.07
			Cost for 240 cum = a+b+c+d				**23165.88**
			Rate per cum = (a+b+c+d)/240				**96.53**
		(II)	**Ordinary rock (not requiring blasting)**				
			(A) Manual Means				
			Upto 3 m depth				
			Unit = cum				
			Taking output = 10 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	5.20	350.00	1820.00
			Add 20 % for M.A.allowance				364.00
						Sub Total	**2184.00**
			b&c) Overheads & Contractors Profit	14%			297.35
			Cost for 10 cum = a+b+c				**2481.36**
			Rate per cum = (a+b+c)/10				**248.14**
			(B) Mechanical Means				
			Upto 3 m depth				
			Unit = cum				
			Taking output = 180 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	6.24	350.00	2184.00
			#REF!				436.80
			b) Machinery				
			Hydraulic Excavator 1 cum bucket capacity	hour	6.00	2815.90	16895.40
						sub Total	**19516.20**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	S. No		Description	Unit	Quantity	Rate Rs.	Amount Rs.
	1		2	3	4	5	6
			c&d) Overheads & Contractors Profit	13.615%			2657.13
			Cost for 180 cum = a+b+c+d				**22173.34**
			Rate per cum = (a+b+c+d)/180				**123.20**
	1		Earthwork in excavation for structures as per drawing and technical specifications Clause 305.1 including setting out, removal of stumps and other deleterious material and disposal upto a lead of 50 m, etc complete for pipe line trenches & building foundations where depth is more than 1.50				
			Note : Classifications of Earth Work Specification are as per 302.2.1(a) of MORD				
		(A)	**Manual Means**				
		(II)	**Ordinary rock (not requiring blasting)**				
			(A) Manual Means				
			Upto 3 m depth				
			Unit = cum				
			Taking output = 10 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	5.20	350.00	1820.00
			Add extra at 75 %				1365.00
			Add 20% M.A				364.00
						Sub Total	**3549.00**
			b&c) Overheads & Contractors Profit	13.615%			483.20
			Cost for 10 cum = a+b+c				**4032.20**
			Rate per cum = (a+b+c)/10				**403.22**
			(B) Mechanical Means				
			Upto 3 m depth				
			Unit = cum				
			Taking output = 180 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	6.24	350.00	2184.00

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate Analysis

Index-code	S. No		Description	Unit	Quantity	Rate Rs.	Amount Rs.
	1		2	3	4	5	6
			Add 20% M.A				436.80
			b) Machinery				
			Hydraulic Excavator 1 cum bucket capacity	hour	6.00	2815.90	16895.40
						sub Total	**19516.20**
			c&d) Overheads & Contractors Profit	13.615%			2657.14
			Cost for 180 cum = a+b+c+d				**22173.34**
			Rate per cum = (a+b+c+d)/180				**123.20**
			Note : 1. Cost of dewatering **upto 5% of a+b** may be added, where required, up to 10 per cent of labour cost. Assessment for dewatering shall be made as per site				
	1		Earthwork in excavation for structures as per drawing and technical specifications Clause 305.1 including setting out, removal of stumps and other deleterious material and disposal upto a lead of 50 m, etc				
			Note : Classifications of Earth Work Specification are as per 302.2.1(a) of MORD				
		(I)	**Ordinary soil**				
		(A)	**Manual Means**				
		(i)	**Upto 3 m depth**				
			Unit = cum				
			Taking output = 10 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	3.64	350.00	1274.00
			Add extra at 75 %				955.50
			Add extra at 20 %				254.80
						Sub Total	**2484.30**
			b&c) Overheads & Contractors Profit	14%			338.24
			Cost for 10 cum = a+b+c				**2822.54**
			Rate per cum = (a+b+c)/10				**282.26**
		(II)	**Ordinary rock (not requiring blasting)**				
			(A) Manual Means				
			Upto 3 m depth				
			Unit = cum				
			Taking output = 10 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	5.20	350.00	1820.00

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
			Add extra at 50 %				910.00
			Add extra at 20 %				364.00
						Sub Total	**3094.00**
			b&c) Overheads & Contractors Profit	14%			421.25
			Cost for 10 cum = a+b+c				**3515.25**
			Rate per cum = (a+b+c)/10				**351.53**
	2		Earthwork in excavation in all types of soils for pipeline trenches for water supply lines, Sewer lines, Storm Water drainage as per specification drawings and as directed by the Engineer Incharge and protecting the walls and other structures etc., and backfilling in trenches with excavated suitable material and disposal of remaining				
		a	**In ordinary soils, by Mechanical means for Pipe line Trenches where depth is less than 1.5 times the width**				
			Up to 3.00 Mts depth below GL				
			Taking Out Put 10.00 Cum				
			Labour				
			Mazdoor (Unskilled)	Nos.	3.64	350.00	1274.00
			Add extra at 20 %	20%			509.6
			Overheads & Contractors Profit @ 14%	13.615%			101.92
			Cost for 10cum				1885.52
			Rate per cum				**188.56**
		i	**Up to 3.00 Mts depth below GL**				
			Taking Out Put 10.00 Cum				
			Labour				
			Mazdoor (Unskilled)	Nos.	3.64	350.00	1274.00
			Add extra for Pipe line trenches where the depth is **less** than 1.5 times the width	75	%		955.5
			Add 20% M.A allowance				254.8
			Sub total				**2484.30**
			Overheads & Contractors Profit @ 13.615%	13.615%			338.24
			Cost for 10cum				**2822.54**
			Rate per cum				**282.26**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
		c	Earthwork in excavation for structures as per drawing and technical specifications Clause 305.1 including setting out, construction of shoring and bracing, removal of stumps and other deleterious material and disposal upto a lead of 50 m, dressing of sides and bottom and backfilling				
			Hard rock (blasting prohibited)				
			Upto 3 m depth including 1.5 m depth in				
			Unit = cum				
			Taking output = 10 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	5.20	320.00	1664
			b) Machinery				
			Air compressor 210 cfm / 250 cfm with 2 jack hammers of pneumatic breaker at 1	hour	6.00	871.40	5228.4
							6892.4
			Overheads & Contractors Profit @ 14%	14%			938.41
			Cost for 10 cum = a+b+c+d				7830.81
			Rate per cum = a+b+c+d)/10				783.09
BR-FNDN-	**1**		Supply and filling with gravel from approved quarry including cost and conveyaance, watering, tamping including				
		II	**Gravel filling**				
			Unit = cum				
			Taking output = 6 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	0.31	350.00	108.5
			Add extra at 20 %	108.50			21.70
			b) Materials	Cum	6.00	342.57	2055.43
							2185.63
			Overheads & Contractors Profit @ 14%	14%			297.58
			Cost for 6 cum = a+b+c			Total	**2483.21**
			Rate per cum = (a+b+c)				413.87

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
BR-FNDN-	**1**		Supply and filling with sand from approved quarry including cost and conveyaance, watering, tamping including all labour				
		II	**Sand filling**				
			Unit = cum				
			Taking output = 6 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	0.31	320.00	99.2
			Add extra at 20 %	99.20			19.84
			b) Materials	Cum	6.00	804.48	4826.88
							4945.92
			Overheads & Contractors Profit @ 14%	14%			673.39
			Cost for 6 cum = a+b+c			Total	**5619.31**
			Rate per cum = (a+b+c)				936.56
BR-FNDN-	**1**		Supply and filling with quarry dust from approved quarry including cost and conveyaance, watering, tamping including				
		II	**Quarry dust**				
			Unit = cum				
			Taking output = 6 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	0.31	320.00	99.2
			b) Machinery	99.20			19.84
			b) Materials	Cum	6.00	538.32	3229.92
							3348.96
			Overheads & Contractors Profit @ 14%	14%			455.97
			Cost for 6 cum = a+b+c			Total	**3804.93**
			Rate per cum = (a+b+c)				634.16
BR-FNDN-	**3**		Filling in foundation / Pipe line trenches with excavated earth as per drawing and technical specification Clause 305.3.9				
		II	**Earth Back filling (R&B -**				
			Unit = cum				
			Taking output = 6 cum				
			a) Labour				
			Mate	day	-		

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate Analysis

Index-code	S. No		Description	Unit	Quantity	Rate Rs.	Amount Rs.
	1		2	3	4	5	6
			Mazdoor (Unskilled)	day	0.31	350.00	108.50
			Add 20% for M.A	108.50			21.70
			b&c) Overheads & Contractors Profit	13.615%			17.73
			Cost for 6 cum = a+b+c			Total	**147.93**
			Rate per cum = (a+b+c)/6				**24.66**
						Total	**24.66**
				Rs.24.66/1 cum			
BR-FNDN-	**1**		Carting of surplus earth including loading , unloading and conveyance upto 10kms				
			Conveyance charges upto 5kms	Cum	84.00		**84.00**
			for 20km	5	12.60		**63.00**
			Deduct intial lead of 1km included in item				**31.50**
			Loading charges by manually including idle				111.00
							226.50
			Cost for 1 cum = a+b+c			Total	**226.50**
HE-CCCP-31		**31**	Curing of CC pavement for 21 days including cost and conveyance of water, labour charges, etc., complete				
			Areas Considered 3 . 5 x 100 mts = 350				
			Units = 1 sqm				
			Mud quantity is required = 14% of CC				
			(a) Labour				
			Man mazdoor (21 x 2).	day	42.00	350.00	14700.00
			Add labour allowance @	20%			2940.00
			b) Machinery				
			Carting earth for 3 kms	cum	2.45	57.90	141.86
			Hire charges for Water Drum (5 x 21	each	105.00	20.00	2100.00
			c) Material				
			Earth Work (100 x 3.5 x 14/100 x .05)	cum	2.45	282.26	691.54
			Supply of Water (240 Lts / cum / day)	L	18900.00	0.090	1701.00
			Sub-total				22274.39
			Overheads & Contractors Profit @ 14%	14%			3032.66
			(d) Total = a+b+c				25307.05
			Rate per sqm =d/350				**72.31**
			Note : 1. When Curing compound is used @ 1.97 kgs/cum, water				

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
			2. This data is for urban areas only				
HE-CSHR-32		**32**	**Cutting sheet rock including stocking of excavated material.**				
			Quality of sheet rock as per stock measurement = 36.53 cumm (taking out				
			(a) Labour				
			Man mazdoor	day	60.00	350.00	21000.00
			Add labour allowance @	20%			4200.00
			b) Machinery				
			Drilling of holes	each	342.00	116.00	39672.00
			Hire charges for JCB	hr	3.00	1650.00	4950.00
			MS Nokkulu	each	10.00	30.00	300.00
			Sub-total				70122.00
			Overheads & Contractors Profit @ 14%	14%			9547.12
			(c) Total = a+b				79669.12
			Rate per cum =c/36.53				2180.92
HE-EXRW-33		**33**	**Excavation in Hard Rock (blasting prohibited)**				
			Excavation for roadway in hard rock (blasting prohibited) with rock breakers including breaking rock, loading in tippers and disposal **with all lifts** and lead upto 1000 metres, trimming bottom and side slopes in accordance				
		(A)	**Manual Means**				
			Unit = cum				
			Taking output = 1 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	1.10	350.00	385.00
			Chiseller (Hammer Man)	day	1.50	375.00	562.50
			Blacksmith	day	0.06	420.00	25.20
			Add labour allowance @	20%			194.54
			b) Machinery				1167.24
			Tipper 5.5 cum capacity, 1 trip per hour	hour	0.18	909.70	163.75
			Credit for excavated rock found suitable for use @ 50 per cent of excavated	cum	0.50	288.00	144.00
			Sundries on Labour				0.62
			Sub-total				1187.61
			Overheads & Contractors Profit @ 14%	14%			161.70
			Rate per cum = (a+b+c+d)				**1349.31**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate Analysis							
Index-code	**S. No**		**Description**	**Unit**	**Quantity**	**Rate Rs.**	**Amount Rs.**
	1		**2**	**3**	**4**	**5**	**6**
			Note : 1. Credit is considered for 50 per cent of quantity of work.				
			2. Loading for disposal will be done manually, being small quantity.				
			3. In case some rock is issued to contractor at site, the item of carriage shall be omitted to the extent of				
		(B)	**Mechanical Means**				
			Unit = cum				
			Taking output = 1 cum				
			a) Labour				
			Mate	day	-		
			Mazdoor (Unskilled)	day	0.29	320.00	92.48
			b) Machinery				
			Hydraulic excavator 0.9 cum with rock breaker attachment @ 6 cum per hour	hour	0.17	2791.00	466.10
			Tipper 5.5 cum capacity tipper, 1 trip	hour	0.18	909.70	163.75
			Credit for excavated rock found suitable for use @ 50 per cent of excavated	cum	0.50	288.00	144.00
			Sundries on Labour				0.56
			Sub-total				866.88
			Overheads & Contractors Profit @ 14%	14%			118.03
			Rate per cum = (a+b+c+d)				**984.91**
			Note : 1. The quality and availability of rock shall be checked before affording				
			2. In case some rock is issued to the contractor at site, the item of carriage				
			3. Being small quantity, manual loading will be economical in this case and has				

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

Sl.No	Reference	Description	Unit	Qty	Rate	Amount
1	AP common SOR Roads and	Earth work excavation by Manual means	**Cum**			
		Taking output-10cum				
		Labour				
		Mate	**Day**	3.64	400	1456
		Add 20% M.A on basic rate				291.2
						1747.2
		b&c over heads & contractor profit 13.615%				**237.88**
		Total cost for 10cum				**1985.08128**
	Total	For 1cum				**198.51**

Sl.No	Reference	**Plain Cement concrete (1:4:8) using 40 mm metal with hand mixing upto Plinth level**	Unit	Qty	Rate	
1	AP common SOR	**Unit = 1cum**				
		A. MATERIALS:				
		Cement	kg	162.00	6.40	1036.8
		Coarse aggregate 40 mm	cum	0.90	0.00	0
		Fine aggregate (Sand)	cum	0.45	0.00	0
		Seigniorage charges for C.A	cum	0.90		0
		Seigniorage charges for F.A	cum	0.45		0
		Water (including for curing)	kl	1.20	103.00	123.6
		B. LABOUR:				0
		Mason 1st class	day	0.10	445.00	44.5
		Mazdoor (unskilled)	day	2.36	400.00	944
		Total				**2148.90**
		b&c overheads &contractors profit @13.615%				**292.57**
		Add M.A				429.78
		Total cost				2871.25

Sl.No	Reference	**Plain Cement concrete (1:4:8) using 40 mm metal with concrete mixture. All work upto plinth level.**	Unit	Qty	Rate	Amount
1	AP common SOR	**Unit = 1cum**				
		A. MATERIALS:				
		Cement	kg	162.00	6.40	1036.80
		Coarse aggregate 40 mm	cum	0.90	1183.99	1065.593304
		Fine aggregate (Sand)	cum	0.45	190.35	85.65845625
		Seigniorage charges for C.A	cum	0.90		0
		Seigniorage charges for F.A	cum	0.45		0

Rate analysis

		Water (including for curing)	kl	1.20	103.00	123.6
						0
		B. MACHINERY				0
		Concrete Mixer 10 / 7 cft (0.2 / 0.8 cum) capacity	hour	1.00	352.5	352.5
		C. LABOUR:				
		Mason 1st class	day	0.10	445.00	44.5
		Mazdoor (unskilled)	day	1.39	350.00	486.5
		Water Charges 1%		-		0.88
		cost of labour				531.88
		Add M.A Allowance 20%				106.376
		Total				3834.28776
		b&c Overhead charges and Contractors profit 13.615%				522.04
		Total cost				**4356.326039**
Sl.No	**Reference**	**FOUNDATIONS, PLINTH, PEDESTALS (Below Plinth)**	**Unit**	**Qty**	**Rate**	**Amount**
1	AP common SOR	**A. MATERIALS:**				
		20mm HBG graded metal	cum	0.900	1703.993	1533.593304
		Sand	cum	0.450	190.352	85.65845625
		Cement	Kgs	400.000	6.4	2560
		Total cost of Material				**4179.25**
		B. LABOUR:				
		1st Class Mason	day	0.133	445.000	59.185
		2nd Class Mason	day	0.267	400.000	106.8
		Mazdoor (Both Men and Women)	day	3.600	350.000	1260
		cost of labour				**1425.99**
		Add 20% M.A Allowance on labour component				285.197
		B. MACHINERY				
		Concrete Mixer 10 / 7 cft (0.2 / 0.83cum) capacity diesel	hour	1.000	352.500	352.5
		Cost of Diesel for Miller	Liters	0.133	79.300	10.5469
		Cost of Petrol for Vibrator(40mm)	Liters	0.667	184.600	123.1282
		Water (including for curing)	kl	1.200	103.000	123.6
		Cost of the machinery				**609.78**
		Total cost				6500.21
		b&c Overhead charges and Contractors profit 13.615%				885.00
		Total cost				**7385.21**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

Sl.No	Reference	Fabrication of TMT bars	Unit	Qty	Rate	Amount
1	**BLD-CSTN-2-19**	**Supplying, fitting and placingTMT bar reinforcement in foundation complete as per**				
		Unit = t				
		(a) Material				
	AP-common sR,Item no 62, Page no.13	TMT bars including 5 per cent for overlaps and wastage	t	1.05	34,500.00	36225.00
		Binding wire	kg	6.00	60	360.00
		(b) Labour for cutting, bending, shifting to site, tying and placing in position				0.00
		Blacksmith / Bar bender	day	2.00	555	1110.00
		Mazdoor (Unskilled)	day	6.40	350	2240.00
						39935.00
		(c) Overheads and contractors profit 13.615% on a+b+c				5437.15025
		Rate per t = a+b+c				45372.15
		Rate per Kg				**45.37**
	Bailing out of water from excavated trenches					
	a)With oil engine driven pumpsets including hire charges, fuel charges and wages for driver and helper**(as per s.no26 a p7 P.H.S.O.R)**	**HP/Hour**	**24**	**53.00**	1272.00	
	Add Contractors profit 13.615%				173.18	
	TOTAL for 24				**1445.18**	
	For 1hour				**60.22**	
	Clearing grass and removal of rubbish up to a distance of 50m					

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

	By manual means				
	Unit=10sqm				
	Taking output=1hectare				
	a)Labour				
	Mate	Day			
	b)Mazdoor(Unskil	Day	52	350	18200.00
	c)Overheads and contractors profit 13.615%				2477.93
	Rate per Hectare				**20677.93**
	Rate per 10 sqm(a+b+c)/1000)				**20.68**
	Rate per sqm				2.07

CANAL LINING WORKS

IRR-CAW-7-6147	**Providing and laying 75 mm thick in-situ M-15 (28 days cube compressive strength not less than 15 N / sqmm) grade cement concrete with 20 mm down size approved, clean, hard, graded aggregates for canal lining using vibrating cylinder type mechanical paver including cost of all materials,**	Sqm	409.90		
	Labour component including contractor profit		32.20		
	curvatures and bends etc.,)				

A. MATERIALS:

Sl.No	**Sl Noparticulars**	**Unit**	**Quantity**	**Rate**	**Amount**
				in Rs.	in Rs.
1	Cement 43 Gr(OPC	kg	23760	6.4	152064.00
2	Coarse aggregate	cum	41.18	0.00	0.00
3	Coarse aggregate	cum	22.18	0.00	0.00
4	Fine aggregate (U	cum	35.64	0.00	0.00

Rate analysis

5	Super plasticiser	kg	95.04	55	5227.20
6	PVC sealing strip	Rm	640	45	28800.00
7	Use rate of paving	sqm	960	0.88	844.80
8	Sundries	LS	5	30	150.00
	Total cost of Materials			Rs:	**187086.00**

B. MACHINERY:

Sl.No	Description	Unit	Quantity	Rate(Rs)	Amount(Rs)
				in Rs.	in Rs.
	1Batching plant	Hour	8	405.40	3243.20
	Lubricants etc @ 5	Hour	8	20.27	162.16
	2Transit mixer 3 M	Hour	24	758.40	18201.60
	Fuel / Energy char	Hour	24	872.70	20944.80
	3Mechanical pave	Hour	8	356.50	2852.00
	Lubricants etc @ 5	Hour	8	17.83	142.64
	4DG set for batch	Hour	8	85.10	680.80
	Fuel / Energy char	Hour	8	952.10	7616.80
	5DG set for paver	Hour	8	65.80	526.40
	Fuel / Energy char	Hour	8	634.70	5077.60
	6Shovel 0.5 cum /	Hour	2	1003.10	2006.20
	Fuel / Energy char	Hour	2	476.00	952.00
	7Water tanker	Hour	8	402.50	3220.00
	Fuel / Energy char	Hour	8	299.90	2399.20
	Pump 5 hp(diesel)	Hour	8	10.2	81.60
	Fuel / Energy char	Hour	8	79.3	634.40
	Sundries (power	LS	5	30	150.00
	Total hire charges of Machinery				**68891.40**

C. LABOUR:

Sl.No	Description	Unit	Quantity	Rate(Rs)	Amount(Rs)
1	1Crew for Batchin	Hour	8	340.60	2724.80
2	2Crew for Transit	Hour	24	283.90	6813.60
3	3Crew for Concret	Hour	8	421.80	3374.40
4	4Crew for DG set	Hour	16	131.80	2108.80
5	5Crew for Shovel	Hour	2	236.60	473.20
6	6Crew for Water t	Hour	8	177.50	1420.00
7	7Crew for PumpH	Hour	16	111.10	1777.60
8	8Mason Class I	Day	2	445.00	890.00
9	9Mechanic	Day	1	475.00	475.00
10	10Fitter	Day	1	475.00	475.00
11	11Electrician	Day	1	515.00	515.00
12	12work inspector	Day	2	450.00	900.00
13	13mazdoor (BP si	Day	5	350.00	1750.00
14	14mazdoor (Pave	Day	10	350.00	3500.00
	Total cost of LabourRs:				27197.40
	Contractors profit @13.615%				**3702.93**
					30900.33

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

	ABSTRACT:		
	A. Cost of Materia	Rs:	187086.00
	B. Hire charges of	Rs:	68891.40
	C. Cost of Labour	Rs:	30900.33
		Total	**286877.73**
	Add for shifting & re-erection of BP @2%		57375.55
	Add for LH / RH shifting & erection of Paver @0.5%		1434.39
	Add for ledge cutting / erection of tracks etc @1%Rs		2868.78
	Total cost		**348556.44**
	Rate persqm(A+B+C+D)/960.0		**363.08**

RBR-FNDN-5	**Brick masonry work in cement mortar in foundation complete excluding pointing and plastering as per drawing and technical specifications Clauses 600,**	Unit = cum			
	Brick masonry in 1:3 cement mortar	**I**			
	(a) Material		**(a) Material**		
	Bricks	Nos.	512	5.20	
	Cement mortar 1:3 (Rate as per	cum	0.2	0.2	
	(b) Labour				
	Mate	day	-		
	Mason (1st Class)	day	0.89	445	396.05
	Mazdoor	day	1.8	350	630
	Add 25% on				
	c&d) Overheads & Contractors Profit				143.65

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

	Rate per cum =				**1169.70**
	Seionarage charges on Bricks		512	38.50	**19.71**
	Seionarage		0.2	40.00	**8.00**
	Rate per cum				**1197.41**
	Sub-analysis				
	Cement mortar 1:3 (1 cement : 3				
	Unit = cum				
	(a) Material				
	Cement	t	0.48	6400.00	3072.00
	Sand	cum	1.05	0.00	0.00
	(b) Labour				
	Mate	day	-		
	Mazdoor	day	0.2	350.00	70
	Add25% on				17.50
	Total material and labour =				3159.50
	Brick masonry in 1:4 cement				
	Unit = cum				
	(a) Material				
	Bricks	Nos.	512	5.20	2662.40
	Cement mortar	cum	0.2	2402.00	480.40
	Rates as per sub-				
	(b) Labour				
	Mate	day			
	Mason (1st Class)	day	0.89	445.00	396.05
	Mazdoor	day	1.8	350.00	630.00
	Add 40% on				410.42
	c&d) Overheads & Contractors Profit				641.1
	Rate per cum =				**5220.37**
	Seionarage charges on Bricks		512	38.50	**19.71**
	Seionarage		0.2	40.00	**8.00**
	Rate per cum				**5248.08**
	Sub-analysis				

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

	Cement mortar 1:4 (1 cement : 4				
	Unit = cum				
	(a) Material				
	Cement	t	0.36	6400.00	2304.00
	Sand	cum	1.05	0.00	0.00
	(b) Labour				
	Mate	day	-		
	Mazdoor	day	0.2	350.00	70
	Add 40% on				28.00
	Total material and labour =				2402.00
	Brick masonry in 1:5cement				
	Unit = cum				
	(a) Material				
	Bricks	Nos.	512	5.20	2.66
	Cement mortar	cum	0.2	1941.20	388.24
	Rates as per sub-				
	(b) Labour				
	Mate	day			
	Mason (1st Class)	day	0.89	445.00	396.05
	Mazdoor	day	1.8	350.00	630.00
	Add 40% on				410.42
	c&d) Overheads & Contractors Profit				255.83
	Rate per cum =				**2083.20**
	Seionarage charges on Bricks		512	38.50	**19.71**
	Seionarage		0.2	40.00	**8.00**
	Rate per cum				**2110.91**
	Sub-analysis				

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

	Cement mortar 1:5 (1 cement : 5				
	Unit = cum				
	(a) Material				
	Cement	t	0.288	6400.00	1843.20
	Sand	cum	1.05	0.00	0.00
	(b) Labour				
	Mate	day	-		
	Mazdoor	day	0.2	350.00	70
	Add 40% on				28.00
	Total material and labour =				1941.20
	Brick masonry in 1:6cement				
	Unit = cum				
	(a) Material				
	Bricks	Nos.	512	5.74	2939.29
	Cement mortar	cum	0.2	1623.50	324.70
	Rates as per sub-				
	(b) Labour				
	Mate	day			
	Mason (1st Class)	day	0.89	445.00	396.05
	Mazdoor	day	1.8	350.00	630.00
	Add 40% on				410.42
	c&d) Overheads & Contractors Profit				639.97
	Rate per cum =				**5340.43**
	Sub-analysis				
	Cement mortar 1:6 (1 cement : 6				
	Unit = cum				
	(a) Material				
	Cement	t	0.24	6400.00	1536.00
	Sand	cum	1.05	0.00	0.00
	(b) Labour				
	Mate	day	-		
	Mazdoor	day	0.2	350.00	70
	Add 25% on				17.50
	Total material and labour =				**1623.50**
	Note : i. To provide 512 Nos Bricks Traditional size 23 x 11 x 7 cms and 520 Nos Modular Bricks				
	ii. Compressive strength of individual Brick shall not be less than 70 kg / cm^2				

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

RBR-SBST-3B	Plastering in Cement Mortor on brick work in substructure as per technical				
	Plastering with CM (1:3), 12mm				
	Unit = 10 sqm				
	A.MATERIALS				
	Cement Mortar	Cum	0.144	3421.81	492.74
	B.LABOUR				
	Mason 1st class	day	0.50	0.00	0.00
	Mazdoor	day	0.54	350.00	189.00
					189.00
	Add 40% on				75.60
	Grand total				264.60
					757.34
	Contractors				106.03
	Seignorage	cum	0.144	40.00	5.76
	Rate per 10 Sqm				**869.13**
	PLASTERING				
	Plastering with CM (1:4), 12mm				
	Unit = 10 sqm				
	A.MATERIALS				
	Cement Mortar	Cum	0.144	2391.50	344.38
	B.LABOUR				
	Mason 1st class	day	0.50	445.00	222.50
	Mazdoor	day	0.54	350.00	189.00
					411.50
	Add 25% on				164.60
	Grand total				164.60
					508.98
	Contractors				69.30
	Rate per 10Sqm				**578.27**
	Rate per 1Sqm				**57.83**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

RBR-SBST-	**PLASTERING**				
	Plastering with CM (1:5), 12mm thick				
	Unit = 10 sqm				
	A.MATERIALS				
	Cement Mortar	Cum	0.144	2365.81	340.68
	B.LABOUR				
	Mason 1st class	day	0.50	445.00	222.50
	Mazdoor	day	0.54	350.00	189.00
	Add 40% on				411.50
					164.60
					576.10
					916.78
	Contractors				128.35
	Seignorage	cum	0.144	40.00	5.76
					1050.89

Cement				
Unit = 1cum				
A.MATERIALS				
Cement Mortar	Kg	360.000	6.40	2304.00
Sand(including 5% wastage)	Cum	1.050	0.00	0.00
B.Machinery				
Nil				
B.LABOUR				
Man Mazdoor for mixing mortar	day	0.20	350.00	70.00
Add 25% on				17.50
Grand total				**2391.50**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1							
Rate analysis							
I	**COMMON DATA**						
Sn.	**Description**	**Quantity**		**Rate**	**Unit**		**Amount**
1	Cutting open BT road surface (as well as asphalt concrete upto 75 mm thick) including water bound macadam and stacking of excavated materials for pipe line trench work. as directed by the departmental officers.						
	Rate as per PH SSR item no 25a, Pg.6	1	Sqm	656.00	10	Sqm	65.60
	Add for Municipal Allowance at	20%					13.12
	Overheads & Contractors Profit	13.615%					10.72
	Total						89.44
	VAT & Labour cess.	0%					0.00
	Rate per 1 Sqm					**Rs**	**89.44**
2	Cutting open C.C. road surface including stacking of excavated materials for pipe line trench work. as directed by the departmental officers.						
	Rate as per PH SSR item no 25b,Pg.6	1	Cum	1822.00	1	Cum	1822.00
	Add for Municipal Allowance at	20%					364.40
	Overheads & Contractors Profit	13.615%					297.68
	Total						2484.08
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**2484.08**
3	Cutting open water bound macadam road including soiling and stacking of excavated materials for pipe line trench work. as directed by the departmental officers.						
	Rate as per PH SSR item no 25 c,Pg.6	1	Cum	224.00	1	Cum	224.00
	Add for Municipal Allowance at	20%					44.80
	Overheads & Contractors Profit	13.615%					36.6
	Total						305.40
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**305.40**
5	**RBR-FNDN-1- (I-B-i) - In ordinary soils up to 3.00 Mts depth below GL by Mechanical means:** Earthwork excavation **in all kinds of soil** for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and bottom as per Technical Specification 304 MORTH and as directed by the departmental officer including protecting the existing utility services wherever it is possible during the execution and taking all precautionary measures in the restricted areas for laying sewer/water lines including divertion of traffic and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all						
	In ordinary soils by Mechanical means for Pipe line trenches						
	up to 3.00 Mts depth below GL	**out put**	**240.0**	**Cum**			
	a) Labour						
	Mate (Labour- R&B-S.N.71)	0	Nos.	400.00	1	Each	0.00
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	8.32	Nos.	350.00	1	Each	2912.00
	b) Machinery						
	Hydraulic Excavator - (Hire charges R & B- S.N.4)	6.00	hours	2815.90	1	hours	16895.40
	Sub total						**19807.40**
	c&d) Overheads & Contractors Profit	13.615%					2696.78
	Cost for 240 cum = a+b+c+d						**22504.18**
	Rate per cum = (a+b+c+d)/240						**93.77**
	VAT & Labour cess.	0%					0.00
a	**Rate per 1 Cum excluding Dewatering**					**Rs**	**93.77**
	Add extra for Dewatering @ 5%	5%					4.69
b	**Rate per 1 Cum including Dewatering**					**Rs**	**98.46**

6	**RBR-FNDN-1- (I-A-ii) In ordinary soils, 3.00 Mts to 6.00Mts. depth below GL by Manual means:** Earthwork excavation **in all kinds of soil** for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and bottom as per Technical Specification 305 MoRD / 304 MoRTH and as directed by the departmental officer including protecting the existing utility services wherever it is possible during the execution and taking all precautionary measures in the restricted areas for laying sewer/water pipe lines including divertion of traffic and backfilling in trenches with excavated suitable material and disposal of remaining earth upto a lead of 50 m, including all incidental and operational charges etc., complete for **Pipe Line trenches by manual means.**						
	Note : Classifications of Earth Work Specification are as per 302.2.1(a) of MORD and 301.2.1 of MORT&H						
	In ordinary soils, by Manual means for Pipe line Trenches						
i	**3.00 Mts to 6.00 Mts. depth below GL**	**out put**	**10.00**	**Cum**			
	a) Labour						
	Mate (Labour- R&B-S.N.71)	0	Nos.	400.00	1	Each	0.00
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	4.68	Nos.	350.00	1	Each	1638.00
							1638.00
	c&d) Overheads & Contractors Profit @	13.615%					223.01
	add extra for pipe line trenches @	75%					1228.50
	Cost for 240 cum = a+b+c+d						**3089.51**
	Rate per cum = (a+b+c+d)/10						308.95
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum excluding Dewatering					**Rs**	**308.95**
	Add extra for Dewatering @ 5%	5%					15.45
b	**Rate per 1 Cum including Dewatering**					**Rs**	**324.40**
10	**RBR-FNDN-1- (II-A) Ordinary rock (not requiring blasting) - up to 3.00 Mts. below GL by Manual means**: Excavation in Ordinary rock for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and bottom as per Technical Specification 305 MoRD / 304 MoRTH and as directed by the departmental officer including protecting the existing utility services wherever it is possible during the execution and taking all precautionary measures in the restricted areas for laying sewer/water pipe lines including divertion of traffic and disposal of rock upto a lead of 50 m, including all incidental and operational charges etc., complete for **Pipe Line**						
	Ordinary rock (not requiring blasting)-Manual Means-Upto 3 m depth						
		out put	**10**	**Cum**			
	a) **Labour**						
	Mate (Labour- R&B-S.N.71)	0	day.	400.00	1	day.	0.00
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	5.20	day.	350.00	1	day.	1820.00
	Sub total						**1820.00**
	c&d) Overheads & Contractors Profit	13.615%					247.79
	Cost for 180 cum = a+b+c+d						**2067.79**
	Rate per cum = (a+b+c+d)/180						**206.78**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum excluding Dewatering						**206.78**

11	**RBR-FNDN-1- (II-B) - Ordinary rock (not requiring blasting) -up to 3.00Mts. below GL by Machanical means:** Excavation in Ordinary Rock for Pipe line trenches as per drawings and technical specifications including setting out, construction of shoring and bracing, removal of stumps and other deleterious material , dressing of sides and bottom as per Technical Specification 305 MoRD / 304 MoRTH and as directed by the departmental officer including protecting the existing utility services wherever it is possible during the execution and taking all precautionary measures in the restricted areas for laying sewer/water pipe lines including divertion of traffic and disposal of rock upto a lead of 50 m, including all incidental and operational charges etc., complete for **Pipe Line trenches by machanical means.**						
	Ordinary rock (not requiring blasting)-Mechanical Means-Upto 3 m depth						
	up to 3.00 Mts depth below GL	**out put**	**180.0**	**Cum**			
	a) Labour						
	Mate (Labour- R&B-S.N.71)	0	Nos.	400.00	1	Each	0.00
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	6.24	Nos.	350.00	1	Each	2184.00
	b) Machinery						
	Hydraulic Excavator - (Hire charges R & B- S.N.4)	6.00	hours	2815.90	1	hours	16895.40
	Sub total						**19079.40**
	c&d) Overheads & Contractors Profit	13.615%					2597.66
	Cost for 240 cum = a+b+c+d						**21677.06**
	Rate per cum = (a+b+c+d)/240						**120.43**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum excluding Dewatering					**Rs**	**120.43**
24	BLD-CSTN-2-8 (16) : Filling with Gravel in trenches, sides of foundations and basement with initial lead in layers not exceeding 15 cm thick, consolidating each deposited layer by watering and ramming including cost and conveyance of water to work site and all operational, incidental, labour charges, hire charges of T & P etc., complete for finished item of work. (APSS NO. 309 & 310)						
		out put	**1.00**	**Cum**			
	Cost of Gravel (C-Mat - Sn.5)	1.00	Cum	284.93	1	Cum	284.93
	Water	0.10	Kl	103.00	1	Kl	10.30
	a) Labour						
	Mate (Labour- R&B-S.N.71)	0.00	Nos	400.00	1	Nos	0.00
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	0.31	Nos	350.00	1	Nos	108.50
							403.73
	b&c) Overheads & Contractors Profit	13.615%					54.97
	Rate per cum = (a+b+c)						**458.70**
	VAT & labour cess	0%					0.00
	Rate per 1 Cum						**458.70**

25	BLD-CSTN-2-9 (17); Filling with useful available excavated earth (excluding rock) in trenches, sides of foundations and basement with initial lead in layers not exceeding 15 cm thick, consolidating each deposited layer by watering and ramming including cost and conveyance of water to work site and all operational, incidental, labour charges, hire charges of T & P etc., complete for finished item of work. (APSS NO. 309 & 310)						
		out put	**6.00**	**Cum**			
	Water	0.72	Kl	103.00	1	Kl	74.16
	a) Labour						
	Mate (Labour- R&B-S.N.71)	0.00	Nos	400.00	1	Nos	0.00
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	3.12	Nos	350.00	1	Nos	1092.00
	b&c) Overheads & Contractors Profit	13.615%					148.68
	Cost for 6 cum = a+b+c						**1314.84**
	Rate per cum = (a+b+c)/6						**219.14**
	VAT & labour cess	0%					0.00
	Rate per 1 Cum						**219.14**
26	Carting of surplus excavated rock from the site to a distance suitable including loading, unloading charges, cost & conveyance, dumping, labour charges, all leads & lifts and other incidental and operational charges etc., complete.						
a	**Rock/CC**						
	Page No.328 of SSR, Conveyance rates - 5.00 Km	1	cum	84.00	1	Cum	84.00
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**84.00**
b	**Earth**						
	Page No.124 of SSR, Conveyance rates - 5.00 Km	1	cum	84.00	1	Cum	84.00
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**84.00**
27	Bailing out water from the pipe line trenches with oil engine driven pump sets, including hire charges, fuel charges and wages for Driver and Helper etc, complete,						
	Basic rate (item No.26/(a)/Pg 6 of PH SSR (PH items)	1	Hp.hr	53.00	1	Hp.hr	53.00
	Total					**Rs**	**53.00**
	Overheads & Contractors Profit	13.615%					7.22
							60.22
	VAT & Labour cess.	0%					0.00
	Rate per 1HPhr					**Rs**	**60.22**
28	RBR-STCL-7 : Dismantling Stone Masonry as per Technical Specification Clause 202 : Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of stone masonry, including disposal of unserviceable material and stacking the serviceable material with all lifts and lead of 1000 m as per Technical Specification Clause 202 MORD / MORTH - Rubble Stone Masonry in Cement Mortar						
	Rubble Stone Masonry in Cement Mortar	**Unit**	**1.25**	**Cum**			
	a) labour						
	Mate	0.000	day	400.00	1	day	0.00
	Mazdoor (Unskilled)	0.780	day	350.00	1	day	273.00
	b) Machinery						
	Tractor with trolley 3t	0.270	hour	415.00	1	hour	112.05
	Total					**Rs**	**385.05**
	C.Overheads & Contractors Profit	13.615%					52.42
	Total for 1.25 Cum						**437.47**
	Total for 1 Cum						**349.98**

	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**349.98**
29	RBR-STCL-5 : Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and lead of 1000 m as per Technical Specification Clause 202 MORD / MORTH						
A	**Lime Concrete & CC upto M10 (Manual means)**	**Unit**	**1.25**	**Cum**			
	a) labour						
	Mate	0.000	day	400.00	1	day	0.00
	Mazdoor (unskilled)	1.040	day	350.00	1	Cum	364.00
	b) Machinery						
	Tractor with trolley 3t	0.270	hour	415.00	1	hour	112.05
	Total						**476.05**
	C.Overheads & Contractors Profit	13.615%					64.81
	Total for 1.25 Cum						**540.86**
	Total for 1 Cum						**432.69**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**432.69**
B	**Dismantling of Cement Concrete M15 & M20 (Manual means)**	**Unit**	**1.25**	**Cum**			
	a) labour						
	Mate	0.000	day	400.00	1	day	0.00
	Mazdoor (unskilled)	1.300	day	350.00	1	Cum	455.00
	b) Machinery						
	Tractor with trolley 3t	0.270	hour	415.00	1	hour	112.05
	Total						**567.05**
	C.Overheads & Contractors Profit	13.615%					77.2
	Total for 1.25 Cum						**644.25**
	Total for 1 Cum						**515.40**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**515.40**
C	**Dismantling of Reinforced Cement Concrete and prestressed Concrete (Manual means)**	**Unit**	**1.25**	**Cum**			
	a) labour						
	Mate	0.000	day	400.00	1	day	0.00
	Black smith	0.400	day	555.00	1	day	222.00
	Mazdoor (unskilled)	3.500	day	350.00	1	Cum	1225.00
	b) Machinery						
	Tractor with trolley 3t	0.270	hour	415.00	1	hour	112.05
	Cost per cu m						**1559.05**
	C.Overheads & Contractors Profit	13.615%					212.26
	Total for 1.25 Cum						**1771.31**
	Total for 1 Cum						**1417.05**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**1417.05**
36	**BLD-CSTN-3-5 (22) -Using Concrete mixture all works up to Plinth Level:** Plain Cement concrete nominal mix (1:4:8) prop (Cement : fine aggregate: coarse aggregate) using 40mm size Hard Granite Machine Crushed Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site , seigniorage charges on all materials, labour charges , for mixing , laying, concrete , ramming in 15 cm layers, finishing top surface to the required level curing etc., complete for finished item of work.for foundation and under flooring						
	Unit : 1cum						

	A. MATERIALS:						
	Cement-(ENC-PH.Memo.No.146/Cement&Steel / T1	162.00	Kg	6.40	1	Kg	1036.80
	Coarse aggregate 40mm graded (C-Mat- S.No-57)	0.90	Cum	1216.65	1	Cum	1094.98
	Fine aggregate (Sand) (C-Mat-S.N.2)	0.45	Cum	266.37	1	Cum	119.87
	Water (including for curing) -M-189-b. irrigation SSR	1.20	Kl	103.00	1	Kl	123.60
	B. MACHINERY						
	Concrete Mixer 10 / 7 cft (0.2 / 0.8 cum) capacity (Hire charges-Irrigation- S.N.16)	1	hour	352.50	1	hour	352.50
	C. LABOUR:						
	Mason 1st class (labour-Irrigation.S.N.11)	0.10	Nos	445.00	1	Nos	44.50
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	1.39	Nos	350.00	1	Nos	486.50
	Grand Total					**Rs**	3258.75
	Overheads & Contractors Profit	13.615%					443.68
	Rate per cu.m.					**Rs**	**3702.43**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**3702.43**

37	**BLD-CSTN-3-10- (27) Hand mixing :** Plain Cement concrete nominal mix (1:3:6) prop (Cement : fine aggregate: coarse aggregate) using 20mm size Hard Granite Machine Crushed Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site , seigniorage charges on all materials, labour charges , for mixing , laying, concrete , ramming in 15 cm layers, finishing top surface to the required level curing etc., complete for finished item of work.for foundation and under flooring bed.						
	Unit : 1cum						
	A. MATERIALS:						
	Water (including for curing) -M-189-b. irrigation SSR	220.00	Kg	6.40	1	Kg	1408.00
	Coarse aggregate 20mm graded (C-Mat-Sn.49)	0.90	Cum	1725.76	1	Cum	1553.19
	Fine aggregate (Sand)	0.45	Cum	266.37	1	Cum	119.87
	Water (including for curing)	1.20	Kl	103.00	1	Kl	123.60
	B. LABOUR:						
	Mason 1st class (labour-Irrigation.S.N.11)	0.10	day	445.00	1	day	44.50
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	2.36	day	350.00	1	day	826.00
	Sub - Total					**Rs**	**4075.16**
	c.Overheads & Contractors Profit	13.615%					554.83
	Rate per cu.m.					**Rs**	**4629.99**
	VAT & Labour cess.	0%					0.00
	Rate per 1 Cum					**Rs**	**4629.99**

38	BLD-CSTN-3-11-(28) Using Concrete mixture up to Plinth Level : Plain Cement concrete nominal mix m-20 (Cement : fine aggregate: coarse aggregate) using 20mm size Hard Granite Machine Crushed Graded Metal including cost and conveyance of all materials like cement, sand, coarse aggregate water etc., to site , seigniorage charges on all materials, labour charges , for mixing , laying, concrete , ramming in 15 cm layers, finishing top surface to the required level curing etc., complete for finished item of work with nomonal reinforcement						
	PCC -M-20						
	Cement-(ENC-PH.Memo.No.146/Cement&Steel / T1	330.00	Kg	6.40	1	Kg	2112.00
	20mm HBG graded metal- (as per Lead S.No-49)	0.90	Cum	1725.76	1	Cum	1553.19
	Sand (C-Mat-Lead statement-S.No.5)	0.45	Cum	266.37	1	Cum	119.87
	Water (including for curing) -M-189-b. irrigation SSR	1.20	Kl	103.00	1	Kl	123.60
	Mason 1st class (labour-Irrigation.S.N.11)	0.10	Nos.	445.00	1	Each	44.50
	Mazdoor (Labour-Irrigation-Unskilled-Sn.3)	1.39	Nos.	350.00	1	Each	486.50
	Concrete Mixer 10 / 7 cft (0.2 / 0.8 cum) capacity (Hire charges-Irrigation- S.N.16)	1.00	hour	352.50	1	hour	352.50
							4792.16
	VAT & Labour cess.	0%					0.00
	BASIC COST per 1 cum					**Rs**	**4792.16**
*	Lowering C.I. Pipes, A class and specials with s/s ends carefully into trench and laying them true to alignment and gradient including all sundries but excluding cost and conveyance of pipes from source of supply. (Reference to specifications. BIS No.3114/94)						
	Assumtion 10 m						
	200 mm dia CI pipes 5m long (class 'A')						
	Weight = 2 x 257 kgs = 514 kgs = 5.14 quintal						
	(a) LABOUR: (including LC)						
	Plumber 1st class	0.102	day	510.00	1	day	52.02
	Plumber 2nd class	0.238	day	400.00	1	day	95.20
	Man mazdoor	1.330	day	350.00	1	day	465.50
	(b) Cost for 10 metres						**612.72**
	Rate per metre = b/10						**61.27**
	Rate for 1 kg = b/514						**1.190**
75	PHE-LCIS-1 : **Lowering C.I. / D.I. Pipes (all classes) and specials (fittings) with s/s ends** carefully into trenches and laying them true to alignment and gradient including all sundries but excluding cost and conveyance of pipes from source of supply (Ref to specifications. BIS No.3114/1994)						
	Note : The Labour charges for cost of Lowering & Laying per 1 kg weight shall be as per sub-analysis made for 200 mm dia CI Pipes S/s ends						
	Details of cost for 5m						
a	**300 mm dia pipe**						
	Weight of 5m length = (412+450+487)/3 = 449.67 kgs						
	(a) Labour charges for laying	449.670	Kg	1.190	1	Kg	535.11
	(b) Overheads & Contractors Profit	13.615%					72.86
	(c) Cost for 5 metres = a+b						607.97
	Rate per metre = c/5						**121.59**
	Rate per 1 Rmt					**Rs**	**121.59**
g	**Jointing 300 mm dia DI pipe**	**300**	**mm dia**				

	a) Labour						
	Plumber 2nd class (including 40% LC)	0.800	day	510.00	1	day	408.00
	Plumber 2nd class (including 40% LC)	1.200	day	350.00	1	day	420.00
							828.00
	b) Material						
	Rubber gasket		each				
	c) Testing						
	Testing of Pipelines with required pressure (as per Sub Analysis 2 A)	50.000	rm	14.88	1	rm	744.00
	(d) Total = a+b+c						**1572.00**
	(e) Add for water charges @ 1% on Labour & Testing Charges						**15.72**
	(f) Total = d+e+f						**1587.72**
	(g) Overheads & Contractors Profit	13.615%					216.17
	(h) Cost for 10 joints (f+g)						**1803.89**
	Rate per joint = h/10						**180.39**
	VAT & Labour cess.	0%					0.00
	Rate per each Joint					**Rs**	**180.39**
h	**Cutting C.I./ DI Pipe - 300 mm dia**						
	(a) Labour						
	Asst. Fitter / Plumber 2nd class	0.300	day	400.00	1	day	120.00
	Man mazdoor	0.300	day	350.00	1	day	105.00
							225.00
	(b) Overheads & Contractors Profit	13.615%					30.63
	Rate per each m						255.63
	VAT & Labour cess.	0%					0.00
	Rate per each cut					**Rs**	**255.63**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Rate analysis

Masonary Sluice Valve Chambers 2016-17

Qty.		Description of Item	Rate	Per	Amount
	5	Construction of Masonary Sluice Valve pits suitable to the sluice valves of size from 300mm as per TD No. 4/1941			
7.730	Cu.m	Earth work in all types of soils	203.33	1 Cu.m	1571.74
1.302	Cu.m	CC (1:4:8) with 40mm HG Crushed Metal	3804.59	Cu.m	4953.57
2.491	Cu.m	Brick Work in CM (1:5)	4486.46	Cu.m	11175.78
6.689	sq.m	Plastering in CM (1:3) 12mm thick	1224.24	10 Sq.m	818.89
0.306	Cu.m	RCC (1:2:4) using 20mm HG Crushed Metal (Pre cast slabs)	5519.36	Cu.m	1688.93
		Add 25% for Isolated works			4659.29
29.38	Kg	Steel (96 KGs/1 cu.m)	62.44	KG	1834.59
					26702.79
		Rate			**26702.79**

		Lowering, keeping in position and fixing C.I. sluice valves (with cap / with hand wheel & reflex valves) excluding cost of bolts, nuts, rubber insertion, sluice valve and tail pieces **PHE-CISP-15**			
		300 mm dia meter			
		(a) Labour			
	kgs	Labour for laying Sluice Valve with cap, with hand wheel & reflex valves - (242.4+257+300)/3=266.46	266.46	2.65	706.119
	13.615%	**Overheads & Contractors Profit**			96.14
		Rate per each			802.26
					0.00
					802.26

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1														
23.S.S. RATES FOR DUCTILE IRON PRESSURE PIPES														
	Based on CSSR 2016-17					**for the month of October 2016**								
A	**Centrifugally cast (spun) Ductile Iron pressure pipes for water, Gas and sewage with socket spigot ends confirming to I.S.: 8329/2000 in standard working lengths of 4,5,5.5 & 6 meterfor classification K7 suitable for push on joint (Rubber Gasket D jointing) with cement mortar lining inside the pipes with out side Zinc coating. Rates are including Transportation, CED and ST etc,. complete.**													
	DI K7 PIPES for 5.50Mts working length					**P2 = P1+ (R2 - R1)/ 1000 x M x 0.96**				**Source-Srikalahasthi**				
Sl No	**Dia of Pipes**	**Basic Rate of Pipe per Rmt**	**Market Rate of Pig Iron / MT**	**SSR Rate of Pig Iron / MT**	**Weight of Pipe per 1 Rmt**	**Actual Rate of Pipe per Rmt**	**Transp't charges /Rmt/Km**	**Total Transport charges for**	**CED @**	**Add ST @**	**Add over heads on pipe & Transport**	**Sub-total**	**Rate per 1Rmt including CP & OH**	
		P1	**R2**	**R1**	**M**	**P2**		**440 Km**	**0.00%**	**0%**	**13.615%**			
1	100mm dia	891.00	22000	26000	13.27	**840.04**	0.22	96.80	0.00	0.00	127.55	**1064.39**	**1064.39**	
2	150mm dia	1233.00	22000	26000	19.64	**1157.58**	0.33	145.20	0.00	0.00	177.37	**1480.15**	**1480.15**	
3	200mm dia	1721.00	22000	26000	25.82	**1621.85**	0.33	145.20	0.00	0.00	240.58	**2007.63**	**2007.63**	
4	250mm dia	2307.00	22000	26000	34.00	**2176.44**	0.44	193.60	0.00	0.00	322.68	**2692.72**	**2692.72**	
5	300mm dia	2965.00	22000	26000	43.09	**2799.53**	0.66	290.40	0.00	0.00	420.69	**3510.62**	**3510.62**	
6	350mm dia	3731.00	22000	26000	53.64	**3525.02**	0.77	338.80	0.00	0.00	526.06	**4389.88**	**4389.88**	
7	400mm dia	4528.00	22000	26000	64.36	**4280.86**	0.88	387.20	0.00	0.00	635.56	**5303.62**	**5303.62**	
8	450mm dia	5447.00	22000	26000	75.82	**5155.85**	1.10	484.00	0.00	0.00	767.87	**6407.72**	**6407.72**	
9	500mm dia	6493.00	22000	26000	89.09	**6150.89**	1.32	580.80	0.00	0.00	916.52	**7648.21**	**7648.21**	
10	600mm dia	8640.00	22000	26000	117.82	**8187.57**	1.87	822.80	0.00	0.00	1226.76	**10237.13**	**10237.13**	
11	700mm dia	11180.00	22000	26000	150.00	**10604.00**	2.75	1210.00	0.00	0.00	1608.48	**13422.48**	**13422.48**	
12	750mm dia	12527.00	22000	26000	166.91	**11886.07**	3.30	1452.00	0.00	0.00	1815.98	**15154.05**	**15154.05**	
13	800mm dia	13843.00	22000	26000	186.55	**13126.65**	5.61	2468.40	0.00	0.00	2123.27	**17718.32**	**17718.32**	
14	900mm dia	16891.00	22000	26000	226.55	**16021.05**	5.61	2468.40	0.00	0.00	2517.34	**21006.79**	**21006.79**	
15	1000mm dia	20020.00	22000	26000	270.55	**18981.09**	5.61	2468.40	0.00	0.00	2920.35	**24369.84**	**24369.84**	
B	**DI K7 PIPES for 6.00Mts working length**					**P2 = P1+ (R2 - R1)/ 1000 x M x 0.96**								

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1													
Sl No	Dia of Pipes	Basic Rate of Pipe per Rmt as per SSR	Market Rate of Pig Iron / MT	SSR Rate of Pig Iron / MT	Weight of Pipe per 1 Rmt	Actual Rate of Pipe per Rmt	Transp't charges /Rmt/Km	Total Transport charges for	CED @	Add ST @	Add over heads on pipe & Transport	Sub-total	Rate per 1Rmt including CP & OH
		P1	R2	R1	M	P2		440 Km	0.00%	0.00%	13.62%		
1	100mm dia	891.00	22000.00	26000.00	13.17	**840.43**	0.22	96.80	0.00	0.00	127.60	**1064.83**	**1064.83**
2	150mm dia	1233.00	22000.00	26000.00	19.50	**1158.12**	0.33	145.20	0.00	0.00	177.45	**1480.77**	**1480.77**
3	200mm dia	1721.00	22000.00	26000.00	25.67	**1622.43**	0.33	145.20	0.00	0.00	240.66	**2008.29**	**2008.29**
4	250mm dia	2307.00	22000.00	26000.00	33.83	**2177.09**	0.44	193.60	0.00	0.00	322.77	**2693.46**	**2693.46**
5	300mm dia	2965.00	22000.00	26000.00	42.83	**2800.53**	0.66	290.40	0.00	0.00	420.83	**3511.76**	**3511.76**
6	350mm dia	3731.00	22000.00	26000.00	53.33	**3526.21**	0.77	338.80	0.00	0.00	526.22	**4391.23**	**4391.23**
7	400mm dia	4528.00	22000.00	26000.00	63.83	**4282.89**	0.88	387.20	0.00	0.00	635.83	**5305.92**	**5305.92**
8	450mm dia	5447.00	22000.00	26000.00	75.17	**5158.35**	1.10	484.00	0.00	0.00	768.21	**6410.56**	**6410.56**
9	500mm dia	6493.00	22000.00	26000.00	88.50	**6153.16**	1.32	580.80	0.00	0.00	916.83	**7650.79**	**7650.79**
10	600mm dia	8640.00	22000.00	26000.00	116.83	**8191.37**	1.87	822.80	0.00	0.00	1227.28	**10241.45**	**10241.45**
11	700mm dia	11180.00	22000.00	26000.00	148.83	**10608.49**	2.75	1210.00	0.00	0.00	1609.09	**13427.58**	**13427.58**
11	750mm dia	12527.00	22000.00	26000.00	165.67	**11890.83**	3.30	1452.00	0.00	0.00	1816.63	**15159.46**	**15159.46**
13	800mm dia	13843.00	22000.00	26000.00	185.00	**13132.60**	5.61	2468.40	0.00	0.00	2124.08	**17725.08**	**17725.08**
14	900mm dia	16891.00	22000.00	26000.00	224.67	**16028.27**	5.61	2468.40	0.00	0.00	2518.32	**21014.99**	**21014.99**
15	1000mm dia	20020.00	22000.00	26000.00	268.17	**18990.23**	5.61	2468.40	0.00	0.00	2921.59	**24380.22**	**24380.22**
	1) Weights of DI pipes based on Table.8 of IS 8329/1994												
DATA FOR DI K9 PIPES													
	Based on CSSR2016-17					**for the month of**		**Jan-00**		**Source-Srikalahasthi**			
C	**Centrifugally cast (spun) Ductile Iron pressure pipes for water, Gas and sewage with socket spigot ends confirming to I.S.: 8329/2000 in standard working lengths of 4,5,5.5 & 6 meterfor classification K9 suitable for push on joint (Rubber Gasket D jointing) with cement mortar lining inside the pipes with out side Zinc coating. Rates are including Transportationand CED and ST etc., complete.**												
	DI K9 PIPES for 5.50 Mts working Length					**P2 = P1+ (R2 - R1)/ 1000 x M x 0.96**							
Sl No	Dia of Pipes	Basic Rate of Pipe per Rmt as per SSR	Market Rate of Pig Iron / MT	SSR Rate of Pig Iron / MT	Weight of Pipe per 1 Rmt	Actual Rate of Pipe per Rmt	Transp't charges /Rmt/Km	Total Transport charges for	CED @	Add ST @	Add over heads on pipe & Transport	Sub-total	Rate per 1Rmt including CP & OH
		P1	R2	R1	M	P2		440 Km	0.00%	0.00%	13.615%		

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1													
1	100mm dia	1061.00	22000.00	22000.00	16.00	**1061.00**	0.22	96.80	0.00	0.00	157.63	**1315.43**	**1315.43**
2	150mm dia	1568.00	22000.00	22000.00	24.18	**1568.00**	0.33	145.20	0.00	0.00	233.25	**1946.45**	**1946.45**
3	200mm dia	1852.00	22000.00	22000.00	32.55	**1852.00**	0.44	193.60	0.00	0.00	278.51	**2324.11**	**2324.11**
4	250mm dia	2746.00	22000.00	22000.00	42.73	**2746.00**	0.55	242.00	0.00	0.00	406.82	**3394.82**	**3394.82**
5	300mm dia	3479.00	22000.00	22000.00	54.18	**3479.00**	0.66	290.40	0.00	0.00	513.20	**4282.60**	**4282.60**
6	350mm dia	4336.00	22000.00	22000.00	67.45	**4336.00**	0.88	387.20	0.00	0.00	643.06	**5366.26**	**5366.26**
7	400mm dia	5228.00	22000.00	22000.00	80.91	**5228.00**	0.99	435.60	0.00	0.00	771.10	**6434.70**	**6434.70**
8	450mm dia	6256.00	22000.00	22000.00	96.36	**6256.00**	1.21	532.40	0.00	0.00	924.24	**7712.64**	**7712.64**
9	500mm dia	7278.00	22000.00	22000.00	112.00	**7278.00**	1.43	629.20	0.00	0.00	1076.57	**8983.77**	**8983.77**
10	600mm dia	8590.00	22000.00	22000.00	147.82	**8590.00**	1.87	822.80	0.00	0.00	1281.55	**10694.35**	**10694.35**
11	700mm dia	12408.00	22000.00	22000.00	188.36	**12408.00**	2.75	1210.00	0.00	0.00	1854.09	**15472.09**	**15472.09**
12	750mm dia	13925.00	22000.00	22000.00	211.45	**13925.00**	3.30	1452.00	0.00	0.00	2093.58	**17470.58**	**17470.58**
13	800mm dia	15365.00	22000.00	22000.00	233.82	**15365.00**	5.61	2468.40	0.00	0.00	2428.02	**20261.42**	**20261.42**
14	900mm dia	18741.00	22000.00	22000.00	283.82	**18741.00**	5.61	2468.40	0.00	0.00	2887.66	**24097.06**	**24097.06**
15	1000mm dia	22215.00	22000.00	22000.00	338.55	**22215.00**	5.61	2468.40	0.00	0.00	3360.64	**28044.04**	**28044.04**
16	1100mm dia	23723.00	22000.00	22000.00	399.09	**23723.00**	5.61	2468.40	0.00	0.00	3565.96	**29757.36**	**29757.36**
17	1200mm dia	27738.00	22000.00	22000.00	471.64	**27738.00**	6.00	2640.00	0.00	0.00	4135.96	**34513.96**	**34513.96**
D	**DI K9 PIPES for 6.00Mts working length**					**P2 = P1+ (R2 - R1)/ 1000 x M x 0.96**				**Source-Srikalahasthi**			
Sl No	**Dia of Pipes**	**Basic Rate of Pipe per Rmt as per SSR**	**Market Rate of Pig Iron / MT**	**SSR Rate of Pig Iron / MT**	**Weight of Pipe per 1 Rmt**	**Actual Rate of Pipe per Rmt**	**Transp't charges /Rmt/Km**	**Total Transport charges for**	**CED @**	**Add ST @**	**Add over heads on pipe & Transport**	**Sub-total**	**Rate per 1Rmt including CP & OH**
		P1	**R2**	**R1**	**M**	**P2**		**440 Km**	**0.00%**	**0.00%**	**13.62%**		
1	100mm dia	1061.00	22000.00	22000.00	15.83	**1061.00**	0.22	96.80	0.00	0.00	157.63	**1315.43**	**1315.43**
2	150mm dia	1568.00	22000.00	22000.00	24.00	**1568.00**	0.33	145.20	0.00	0.00	233.25	**1946.45**	**1946.45**
3	200mm dia	1852.00	22000.00	22000.00	32.33	**1852.00**	0.44	193.60	0.00	0.00	278.51	**2324.11**	**2324.11**
4	250mm dia	2746.00	22000.00	22000.00	42.50	**2746.00**	0.55	242.00	0.00	0.00	406.82	**3394.82**	**3394.82**
5	300mm dia	3479.00	22000.00	22000.00	53.83	**3479.00**	0.66	290.40	0.00	0.00	513.20	**4282.60**	**4282.60**
6	350mm dia	4336.00	22000.00	22000.00	67.17	**4336.00**	0.88	387.20	0.00	0.00	643.06	**5366.26**	**5366.26**
7	400mm dia	5228.00	22000.00	22000.00	80.33	**5228.00**	0.99	435.60	0.00	0.00	771.10	**6434.70**	**6434.70**
8	450mm dia	6256.00	22000.00	22000.00	95.83	**6256.00**	1.21	532.40	0.00	0.00	924.24	**7712.64**	**7712.64**
9	500mm dia	7278.00	22000.00	22000.00	111.50	**7278.00**	1.43	629.20	0.00	0.00	1076.57	**8983.77**	**8983.77**
10	600mm dia	8590.00	22000.00	22000.00	147.00	**8590.00**	1.87	822.80	0.00	0.00	1281.55	**10694.35**	**10694.35**
11	700mm dia	12408.00	22000.00	22000.00	187.17	**12408.00**	2.75	1210.00	0.00	0.00	1854.09	**15472.09**	**15472.09**
11	750mm dia	13925.00	22000.00	22000.00	210.00	**13925.00**	3.30	1452.00	0.00	0.00	2093.58	**17470.58**	**17470.58**
13	800mm dia	15365.00	22000.00	22000.00	232.33	**15365.00**	5.61	2468.40	0.00	0.00	2428.02	**20261.42**	**20261.42**

14	900mm dia	18741.00	22000.00	22000.00	281.83	**18741.00**	5.61	2468.40	0.00	0.00	2887.66	**24097.06**	**24097.06**
15	1000mm dia	22215.00	22000.00	22000.00	336.17	**22215.00**	5.61	2468.40	0.00	0.00	3360.64	**28044.04**	**28044.04**
16	1100mm dia	23723.00	22000.00	22000.00	365.83	**23723.00**	5.61	2468.40	0.00	0.00	3565.96	**29757.36**	**29757.36**
17	1200mm dia	27738.00	22000.00	22000.00	432.33	**27738.00**	6.00	2640.00	0.00	0.00	4135.96	**34513.96**	**34513.96**
	1) Weights of DI pipes based on Table.8 of IS 8329/1994												
DATA FOR DI K9 FLANGED PIPES													
	Dia of Pipes					**for the month of**		**Jan-00**					
C	**Centrifugally cast (Spun) Ductile Iron pressure pipes with flanged (welded) ends for water, gas, sewage conforming to IS: 8329/2000 in standard working lengths of 1,2,3, 4, 5 mts for classification K9 with cement mortar lining inside the pipes with outside zinc coating. ratesareex-factory, excluding transportation, taxes & duties.**												
	DI K9 PIPES for 1.00 Mts working Length					**P2 = P1+ (R2 - R1)/ 1000 x M x 0.96**							

Sl No	**Dia of Pipes**	**Basic Rate of Pipe per each as per SSR**	**Market Rate of Pig Iron / MT**	**SSR Rate of Pig Iron / MT**	**Weight of Pipe per 1 Rmt**	**Actual Rate of Pipe per Rmt**	**Transp't charges /Rmt/Km**	**Total Transport charges for**	**CED @**	**Add ST @**	**Add over heads on pipe & Transport**	**Sub-total**	**Rate per 1Rmt including CP & OH**
		P1	**R2**	**R1**	**M**	**P2**		**440 Km**	**0.00%**	**0.00%**	**13.62%**		
1	100mm dia	4726.00	22000.00	22000.00	51.90	**4726.00**	0.33	145.20	0.00	0.00	663.21	**5534.41**	**5534.41**
2	150mm dia	6718.00	22000.00	22000.00	78.20	**6718.00**	0.44	193.60	0.00	0.00	941.01	**7852.61**	**7852.61**
3	200mm dia	8946.00	22000.00	22000.00	105.40	**8946.00**	0.66	290.40	0.00	0.00	1257.54	**10493.94**	**10493.94**
4	250mm dia	6721.00	22000.00	22000.00	139.80	**6721.00**	0.88	387.20	0.00	0.00	967.78	**8075.98**	**8075.98**
5	300mm dia	11471.00	22000.00	22000.00	178.00	**11471.00**	1.10	484.00	0.00	0.00	1627.67	**13582.67**	**13582.67**
6	350mm dia	17971.00	22000.00	22000.00	217.80	**17971.00**	1.32	580.80	0.00	0.00	2525.83	**21077.63**	**21077.63**
7	400mm dia	22275.00	22000.00	22000.00	259.10	**22275.00**	1.54	677.60	0.00	0.00	3125.00	**26077.60**	**26077.60**
8	450mm dia	26901.00	22000.00	22000.00	307.40	**26901.00**	1.87	822.80	0.00	0.00	3774.60	**31498.40**	**31498.40**
9	500mm dia	32583.00	22000.00	22000.00	356.50	**32583.00**	2.20	968.00	0.00	0.00	4567.97	**38118.97**	**38118.97**
10	600mm dia	44450.00	22000.00	22000.00	473.50	**44450.00**	2.86	1258.40	0.00	0.00	6223.20	**51931.60**	**51931.60**
11	700mm dia	55006.00	22000.00	22000.00	602.70	**55006.00**	4.18	1839.20	0.00	0.00	7739.47	**64584.67**	**64584.67**
13	800mm dia	67811.00	22000.00	22000.00	755.60	**67811.00**	5.06	2226.40	0.00	0.00	9535.59	**79572.99**	**79572.99**
14	900mm dia	80818.00	22000.00	22000.00	908.60	**80818.00**	8.36	3678.40	0.00	0.00	11504.18	**96000.58**	**96000.58**
15	1000mm dia	103720.00	22000.00	22000.00	1089.90	**103720.00**	8.36	3678.40	0.00	0.00	14622.29	**122020.69**	**122020.69**
16	1100mm dia	121749.00	22000.00	22000.00	1290.40	**121749.00**	8.36	3678.40	0.00	0.00	17076.94	**142504.34**	**142504.34**

	RUBBER GASKETS							
E	Manufacture as per bis 12820/89 with S.B.R. quality rubber confirming to BIS: 5382/85, supply and delivery of rubber gaskets suitable for C.I/ D.I. S/S pipes anywhere in A.P. including cost of material, loading, incidental handling with companys standard packing, transportation, unloading & stacking, central excise duty but excluding VAT etc., complete.							
	Rates vide Table,25, Pg.115 of PH items					**Jan-00**		
	Dia in mm	**Basic Rate**	**CED @**	**Add ST @**	**OH & CP@**	**Sub-total**	**Add VAT @**	**Total Rs.**
			0.00%	**0.00%**	**13.6150%**		**0%**	
1	80mm dia	69.00	0.00	0.00	9.39	78.39	0.00	**78.39**
2	100mm dia	108.00	0.00	0.00	14.70	122.70	0.00	**122.70**
3	125mm dia	129.00	0.00	0.00	17.56	146.56	0.00	**146.56**
4	150mm dia	157.00	0.00	0.00	21.38	178.38	0.00	**178.38**
5	200mm dia	143.00	0.00	0.00	19.47	162.47	0.00	**162.47**
6	250mm dia	213.00	0.00	0.00	29.00	242.00	0.00	**242.00**
7	300mm dia	325.00	0.00	0.00	44.25	369.25	0.00	**369.25**
8	350mm dia	411.00	0.00	0.00	55.96	466.96	0.00	**466.96**
9	400mm dia	449.00	0.00	0.00	61.13	510.13	0.00	**510.13**
10	450mm dia	483.00	0.00	0.00	65.76	548.76	0.00	**548.76**
11	500mm dia	670.00	0.00	0.00	91.22	761.22	0.00	**761.22**
12	600mm dia	596.00	0.00	0.00	81.15	677.15	0.00	**677.15**
13	700mm dia	1055.00	0.00	0.00	143.64	1198.64	0.00	**1198.64**
14	750mm dia	1172.00	0.00	0.00	159.57	1331.57	0.00	**1331.57**
15	800mm dia	1405.00	0.00	0.00	191.29	1596.29	0.00	**1596.29**
16	900mm dia	1695.00	0.00	0.00	230.77	1925.77	0.00	**1925.77**
17	1000mm dia	1855.00	0.00	0.00	252.56	2107.56	0.00	**2107.56**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

Sluice valves

Sl.no.	DIA of Sluice valve(PN16) in mm	Unit	Rate as per PH data & SSR	Add MA on LC @	Add CP on Basic Rate + LC @	Sub - Total	Add Transportation @ 5%	Total
				20%	**13.615%**			
c	200mm dia	Each	**25250.00**		3437.79	**28687.79**	1262.50	**32125.58**
d	250mm dia	Each	**1029.00**		140.10	**1169.10**	51.45	**1309.20**
e	300mm dia	Each	**64514.00**		8783.58	**73297.58**	3225.70	**82081.16**
f	350mm dia	Each	**6227.20**		847.83	**7075.03**	311.36	**7922.87**
g	400mm dia	Each	**1478.40**		201.28	**1679.68**	73.92	**1880.97**
h	450mm dia	Each	**13141.59**		1789.23	**14930.82**	657.08	**16720.04**
i	500mm dia	Each	**0.00**		0.00	**0.00**	0.00	**0.00**
j	600mm dia	Each	**341000.00**		46427.15	**387427.15**	17050.00	**404477.15**

Air valves

Sl.no.	DIA of Sluice valve(PN16) in mm	Unit	Rate as per PH data & SSR	Add MA on LC @	Add CP on Basic Rate + LC @	Sub - Total	Add Transportation @ 5%	Total
				20%	**13.615%**			
c	80mm dia	Each	**21000.00**		2859.15	**23859.15**	1050.00	**26718.30**
d	100mm dia	Each	**27250.00**		3710.09	**30960.09**	1362.50	**34670.18**

Sl. No.	Description	Unit	Rate for 2016-17	Add 25%	Total	Total with Contractor Profit 13.615%
	Labour charges for fixing Air Valves including boring the mains and threading the bore fixing nipple etc., complete.					
1	50mm dia	Each	177.00	44.25	221.25	**251.37**
2	65mm dia	Each	188.00	47.00	235.00	**267.00**
3	80mm dia	Each	204.00	51.00	255.00	**289.72**
4	100mm dia	Each	242.00	60.50	302.50	**343.69**
5	125mm dia	Each	376.00	94.00	470.00	**533.99**
6	150mm dia	Each	412.00	103.00	515.00	**585.12**
7	200mm dia					

Lead Statement

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1																	
LEAD STATEMENT FOR THE YEAR 2016-17(Rates as per SEP_2016)																	
SNo	Description of materials	Unit	Source	Lead	Basic Rate	Add seigniorage charges	Total cost	conveyance charges upto 5 km	conveyance charges beyond 5 km upto 30 km @ Rs 12.60/km	Total lead	Deduction of initial lead 1km	Total lead after deduction of intial lead	Deduct 13.615% over heads on coveyance charges	Total	Loading charges	Unloading charges	Total cost
1	2	3	4	5	6	7	8	9	10		12		13	14	15	16	17
1	Cement (sep 2016)	1.00 MT	Local	0.00	6400.00	0.00	6400.00	0.00	0.00	0.00	0.00	0.00	0.00	6400.00	0.00	0.00	**6400.00**
2	Sand for Concreate M-005	1 cum	KR Bed	6.00	95.00	50.00	145.00	84.00	0.00	84.00	31.50	52.50	7.15	190.35	0.00	0.00	**190.35**
3	Sand for Mortor M -006	1 cum	KR Bed	6.00	165.00	50.00	215.00	84.00	0.00	84.00	31.50	52.50	7.15	260.35	0.00	0.00	**260.35**
4	Sand for Filling M-004	1 cum	KR Bed	6.00	95.00	50.00	145.00	84.00	0.00	84.00	31.50	52.50	7.15	190.35	0.00	0.00	**190.35**
5	HBG Metal 6mm SS5 m/c M- 050	1 cum	Kethana konda	26.00	735.00	75.00	810.00	84.00	252.00	336.00	30.40	305.60	41.61	1073.99	0.00	0.00	**1073.99**
6	HBG Metal 10mm SS5 m/c M- 051	1 cum	Kethanak onda	26.00	935.00	75.00	1010.00	84.00	252.00	336.00	30.40	305.60	41.61	1273.99	0.00	0.00	**1273.99**
7	HBG Metal - 13.20 / 12.50mm SS5 m/c M- 052	1 cum	Kethanak onda	26.00	1097.00	75.00	1172.00	84.00	252.00	336.00	30.40	305.60	41.61	1435.99	0.00	0.00	**1435.99**
8	HBG Metal 20mm SS5 m/c M- 053	1 cum	Kethanak onda	26.00	1365.00	75.00	1440.00	84.00	252.00	336.00	30.40	305.60	41.61	1703.99	0.00	0.00	**1703.99**
9	HBG Metal 25mm SS5 m/c M- 054	1 cum	Kethanak onda	26.00	1313.00	75.00	1388.00	84.00	252.00	336.00	30.40	305.60	41.61	1651.99	0.00	0.00	**1651.99**
10	HBG Metal 40mm SS5 M- 055	1 cum	Kethanak onda	26.00	845.00	75.00	920.00	84.00	252.00	336.00	30.40	305.60	41.61	1183.99	0.00	0.00	**1183.99**
11	Aggregates 90 to 45mm graded HBG IRC m/c metal M-039	1 cum	Kethanak onda	26.00	635.00	75.00	710.00	84.00	252.00	336.00	30.40	305.60	41.61	973.99	0.00	0.00	**973.99**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1																	
LEAD STATEMENT FOR THE YEAR 2016-17(Rates as per SEP_2016)																	
SNo	Description of materials	Unit	Source	Lead	Basic Rate	Add seigniorage charges	Total cost	conveyance charges upto 5 km	conveyance charges beyond 5 km upto 30 km @ Rs 12.60/km	Total lead	Deduction of initial lead 1km	Total lead after deduction of intial lead	Deduct 13.615% over heads on coveyance charges	Total	Loading charges	Unloading charges	Total cost
1	2	3	4	5	6	7	8	9	10		12		13	14	15	16	17
12	Aggregates 63 to 45mm graded HBG IRC m/c metal M- 038	1 cum	Kethanakonda	26.00	662.00	75.00	737.00	84.00	252.00	336.00	30.40	305.60	41.61	1000.99	0.00	0.00	**1000.99**
13	Aggregates 13.20 to 0.09mm graded HBG IRC m/c metal M-042	1 cum	Kethanakonda	26.00	798.00	75.00	873.00	84.00	252.00	336.00	30.40	305.60	41.61	1136.99	0.00	0.00	**1136.99**
14	Aggregates 11.20 to 0.09mm graded HBG IRC m/c metal M-041	1 cum	Kethanakonda	26.00	704.00	75.00	779.00	84.00	252.00	336.00	30.40	305.60	41.61	1042.99	0.00	0.00	**1042.99**
15	Stone Crusher Dust finer than 3mm with not more than 10% passing 0.075 sieve M-021	1 cum	Kethanakonda	26.00	357.00	50.00	407.00	84.00	252.00	336.00	30.40	305.60	41.61	670.99	0.00	0.00	**670.99**
16	Aggregates 53 to 22.40mm graded HBG IRC m/c metal M-036	1 cum	Kethanakonda	26.00	872.00	75.00	947.00	84.00	252.00	336.00	30.40	305.60	41.61	1210.99	0.00	0.00	**1210.99**
17	Close graded granular sub base material 9.50 to 4.75mm M-016	1 cum	Kethanakonda	26.00	592.00	75.00	667.00	84.00	252.00	336.00	30.40	305.60	41.61	930.99	0.00	0.00	**930.99**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1																	
LEAD STATEMENT FOR THE YEAR 2016-17(Rates as per SEP_2016)																	
SNo	Description of materials	Unit	Source	Lead	Basic Rate	Add seigniorage charges	Total cost	conveyance charges upto 5 km	conveyance charges beyond 5 km upto 30 km @ Rs 12.60/km	Total lead	Deduction of initial lead 1km	Total lead after deduction of intial lead	Deduct 13.615% over heads on coveyance charges	Total	Loading charges	Unloading charges	Total cost
1	2	3	4	5	6	7	8	9	10		12		13	14	15	16	17
18	Close graded granular sub base material 2.36mm & below M-022	1 cum	Kethanakonda	26.00	438.00	75.00	513.00	84.00	252.00	336.00	30.40	305.60	41.61	776.99	0.00	0.00	**776.99**
19	Aggregate 20mm - 10mm (M 045)	1 cum	Kethanakonda	26.00	1210.00	75.00	1285.00	84.00	252.00	336.00	30.40	305.60	41.61	1548.99	0.00	0.00	**1548.99**
20	Aggregate 10mm - 5mm (M 040)	1 cum	Kethanakonda	26.00	875.00	75.00	950.00	84.00	252.00	336.00	30.40	305.60	41.61	1213.99	0.00	0.00	**1213.99**
21	Aggregate 5.60mm below (M 030)	1 cum	Kethanakonda	26.00	557.00	75.00	632.00	84.00	252.00	336.00	30.40	305.60	41.61	895.99	0.00	0.00	**895.99**
22	Aggregate 13.2mm-10mm (M 044)	1 cum	Kethanakonda	26.00	1029.00	75.00	1104.00	84.00	252.00	336.00	30.40	305.60	41.61	1367.99	0.00	0.00	**1367.99**
23	Aggregate 40mm - 20mm	1 cum	Kethanakonda	26.00	1145.00	75.00	1220.00	84.00	252.00	336.00	30.40	305.60	41.61	1483.99	0.00	0.00	**1483.99**
24	Gravel for sub base M -008	1 cum	Jakkampudi	16.00	103.00	30.00	133.00	84.00	189.00	273.00	30.40	242.60	33.03	342.57	0.00	0.00	**342.57**
25	Cost of Steel HYSD Bars 8 - 40mm dia FE 415	1 MT	Local	0.00	34500.00												**34500.0**
26	MS Angle, Channels etc. item no.62 WRD	1 MT	Local	0.00	37500.00												**37500.0**
27	2 nd class bricks BMT-A-01	1000	Donabanda	27.00	4700.00		4700.00	135.10	446.60	581.70	50.70	531.00	72.30	5158.70	219.10	219.10	**5596.90**
28	Boulders with minimum 300 mm for pitching - M-003	1 cum	Seethanagaram	7.00	164.00	75.00	239.00	84.10	12.60	96.70	30.40	66.30	9.03	296.27	0.00	0.00	**296.27**

Detailed Design Report for Machilipatnam Town 5 MLD S.T.P Scheme in Zone-1

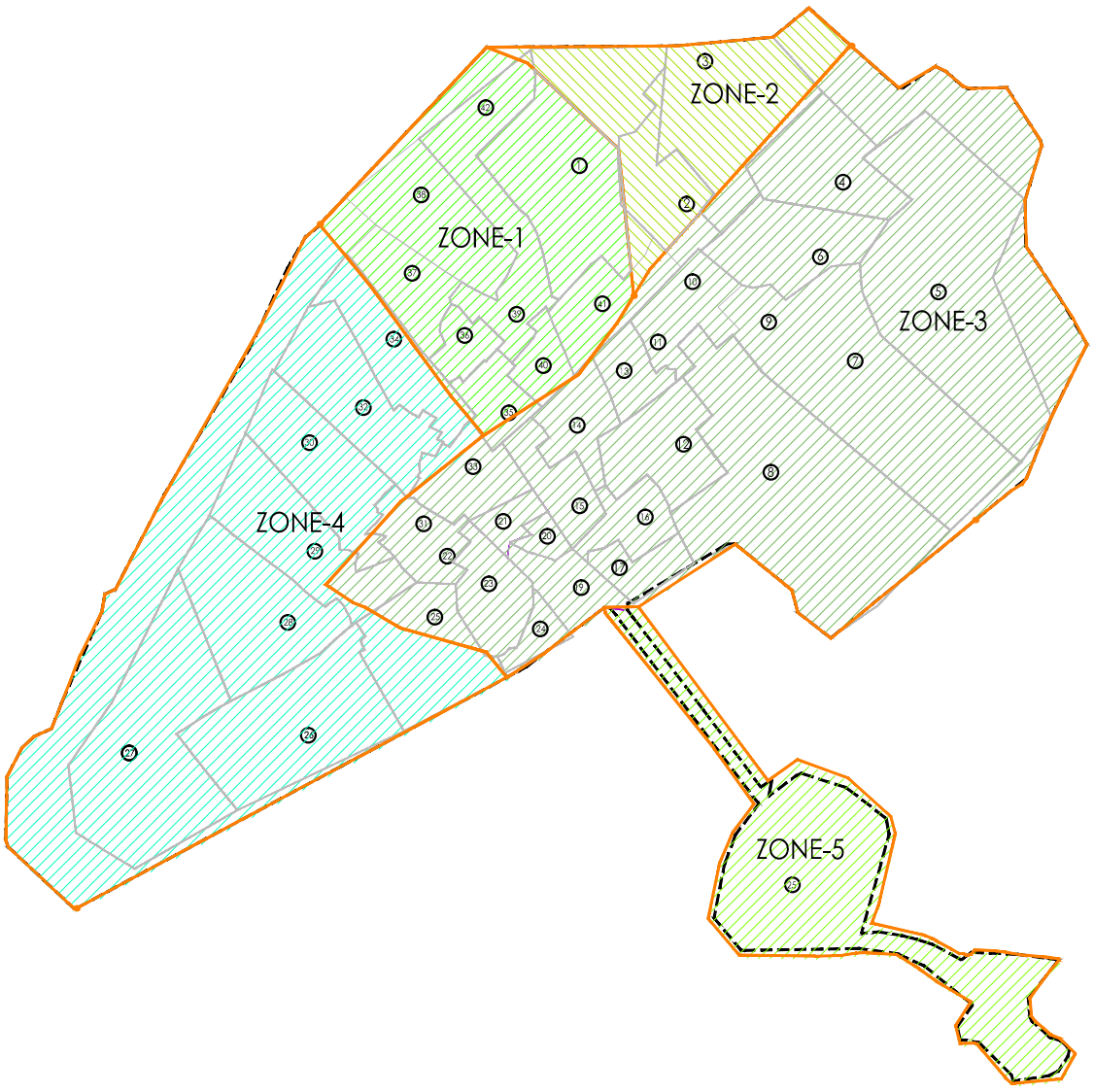
LEAD STATEMENT FOR THE YEAR 2016-17(Rates as per SEP_2016)

SNo	Description of materials	Unit	Source	Lead	Basic Rate	Add seigniorage charges	Total cost	conveyance charges upto 5 km	conveyance charges beyond 5 km upto 30 km @ Rs 12.60/km	Total lead	Deduction of initial lead 1km	Total lead after deduction of intial lead	Deduct 13.615% over heads on coveyance charges	Total	Loading charges	Unloading charges	Total cost
1	2	3	4	5	6	7	8	9	10		12		13	14	15	16	17
29	**Aggregates 20mm graded HBG SS5 m/c metal including seignoiorage, blasting charges, machine crushing charges Unit 1.00 cum**																
	Cost 20mm metal 0.70 Cum	1703.99	1.00 cum	1192.79	Mazdoor		350.00	Mason 2nd class		400.00							
	Cost 13.20 / 12.50mm metal 0.10 Cum	1435.99	1.00 cum	143.60	water KL M 189 -a		103.00										
	Cost 10mm metal 0.10 Cum	1273.99	1.00 cum	127.40	Concrete mixer 300/200 Diesel item -16-hr		352.50	Concrete mixer 600/400 Diesel-hr		471.10							
	Cost 6mm metal 0.10 Cum	1073.99	1.00 cum	107.40	Mason 1st class		445.00										
				1571.19	Black smith		445.00										

Certified that leads mentioned above are correct to best of my knowledge

Note :Municipal area allowance shall be added to labour rates

DRAWINGS



LEGEND

- CITY BOUNDARY
- ZONE BOUNDARY
- WARD BOUNDARY
- WARD NOS.
- ZONES

REV. NO.	DATE	DETAILS	BY	CHKD

CLIENT

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM

9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE

DETAILED PROJECT REPORT FOR SEWERAGE AND SEPTAGE MANAGEMENT UNDER AMRUT

PROJECT NO.

DELD16028

DRAWING TITLE

ZONES AND WARDS PLAN OF MACHILIPATNAM

DRAWING NO

ACM-PDMC1-DPR-MTM-ZWD

REV. NO

0

LEGEND:

- EXISTING ROADS
- PROPOSED S.T.P. LOCATION
- SIVA GANGA DRAIN
- DRAIN

REV. NO.	DATE	DETAILS	BY	CHKD
0	15.10.16	S.T.P LOCATION MARK ON GOOGLE IMAGE	PS	SN

CLIENT

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM

9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

STP LOCATION OF MACHILIPATNAM TOWN IN WARD NO.-1

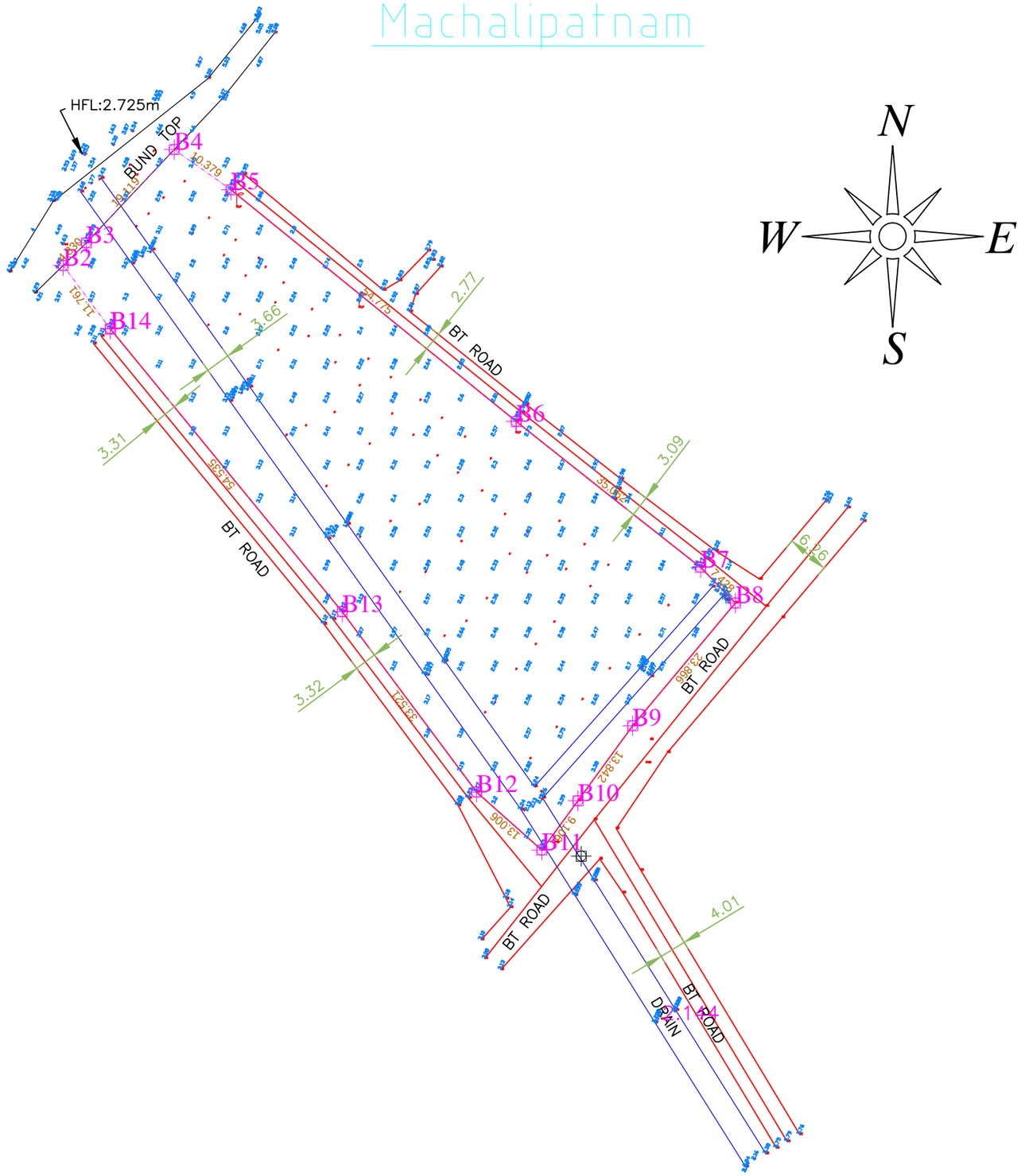
DRAWING NO

ACM-PDMC1-DPR-MTM-STP-01

REV. NO

0

Machalipatnam



LEGEND

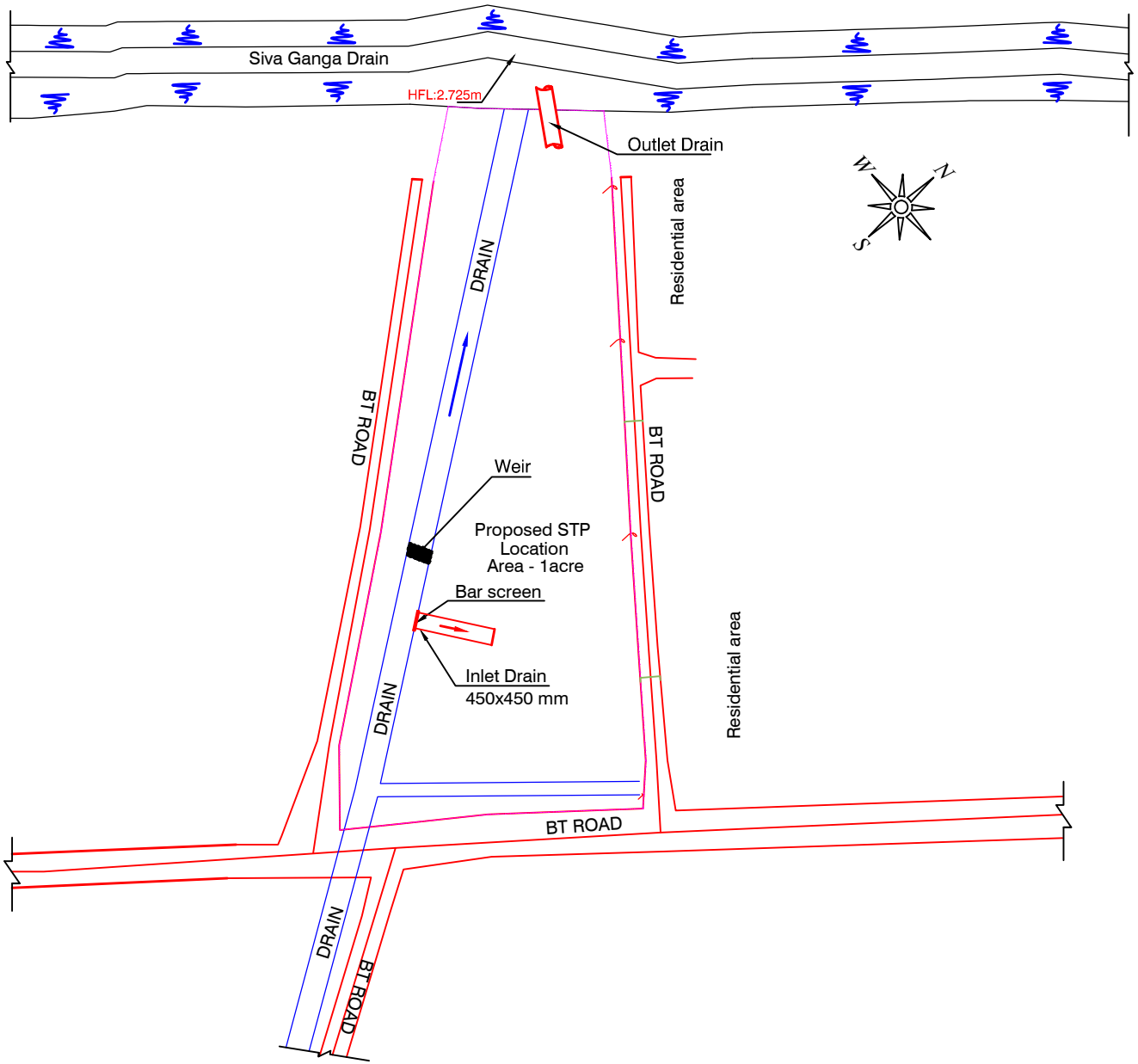
STRUCTURES	CONNECTING LINES	POLES & LINES	CONNECTING LINES
PUCCA BUILDING	3D	TELEPHONE POST	BLOCK
SEMI PUCCA BUILDING	3D	LAMP POST	BLOCK
KACHCHA BUILDING	3D	ELECTRIC POST	BLOCK
TEMPLE	BLOCK	TELE_LINE	2D
CHURCH	BLOCK	ELEC_LINE	2D
MOSQUE	BLOCK	TEL.JN.BOX.	BLOCK
BURIAL GROUND	2D	ELEC.JN.BOX.	BLOCK
RAIL LINE	3D	ELEC.TRANSFORMER	BLOCK
GATE	BLOCK	OFC PILLAR	BLOCK
COMPOUND WALL	2D	HIGH TENSION TOWER	BLOCK
TREES		SIGNAL POST	BLOCK
GIRTH 300mm - 600mm	BLOCK	HIGH TENSION LINE	2D
GIRTH 600mm - 900mm	BLOCK	SEWER LINE	2D
GIRTH 900mm - 1800mm	BLOCK	ONGC LINE	2D
GIRTH ABOVE 1800mm	BLOCK	GAS LINE	2D
SHRUBS	BLOCK	OFC LINE	2D
STATIONS & PILLARS		WIRE FENCING	2D
PERMANENT BENCH MARK	BLOCK	PIPE FENCING	2D
TEMPORARY BENCH MARK	BLOCK	OTHER FEATURES	
STATION POINT	BLOCK	TRAFFIC SIGN	
ROW STONE	BLOCK	KILOMETRE STONE	BLOCK
WELL		HAND PUMP	BLOCK
CONTOUR LINES		HECTOMETRE STONE	BLOCK
DRAIN	3D	WATER TAP	BLOCK
PIPE CULVERT	3D	MAN HOLE	BLOCK
SLAB CULVERT	3D	BUS SHELTER	BLOCK
CART TRACK	3D	TREE GUARD	BLOCK
EXISTING ROAD		POST BOX	BLOCK
CENTER LINE OF C/W	3D	SPOT LEVEL	BLOCK
CARRIAGEWAY EDGE	3D		
PAVED SHOULDER EDGE	3D		
FOOTPATH	3D		
EARTHEN SHOULDER EDGE	3D		
TOE OF EMBANKMENT	3D		
BUND TOP EDGE	3D		
BUND BOTTOM EDGE	3D		
EXISTING RIGHT OF WAY	3D		
PROPOSED RIGHT OF WAY	3D		

B.NO	INCLUDED ANGLE	DIST IN METER	DIST IN FEET	CO-ORDINATE EAST	NORTH
B1	306d42'4"	–	–	513557.737	1791100.214
B2	97d38'35"	11.761	38'–7.0"	513550.708	1791109.644
B3	182d22'22"	4.830	15'–10.2"	513554.162	1791113.021
B4	97d59'45"	19.119	62'–8.7"	513567.270	1791126.939
B5	176d11'52"	10.379	34'–0.6"	513575.743	1791120.943
B6	180d45'38"	54.775	179'–8.5"	513618.257	1791086.406
B7	172d41'55"	35.062	115'–0.4"	513645.761	1791064.661
B8	95d39'51"	7.428	24'–4.4"	513650.956	1791059.351
B9	183d52'29"	23.866	78'–3.6"	513635.625	1791041.060
B10	179d47'41"	13.842	45'–5.0"	513627.471	1791029.875
B11	84d39'10"	9.106	29'–10.5"	513622.081	1791022.535
B12	168d22'8"	13.006	42'–8.0"	513612.362	1791031.178
B13	182d37'43"	33.521	109'–11.7"	513592.317	1791058.046
B14	50d38'48"	54.535	178'–11.0"	513557.737	1791100.214
B1		0.000	0'–0.0"	513557.737	1791100.214

B1 to B2 BEARING:323d17'56"

AREA STATEMENT:–

3985.346 Sq.m (or) 0.985 Acres



REV. NO.	DATE	DETAILS	BY	CHKD

CLIENT

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM

9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II
Gurgaon 122002 Haryana, India

PROJECT TITLE

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

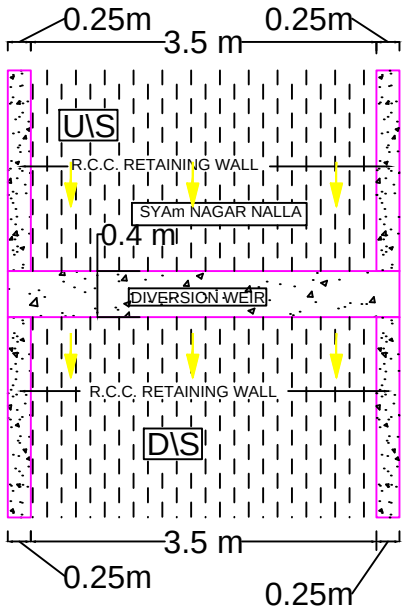
LAYOUT FOR ARRANGEMENT OF INTERCEPTOR DRAINS

DRAWING NO

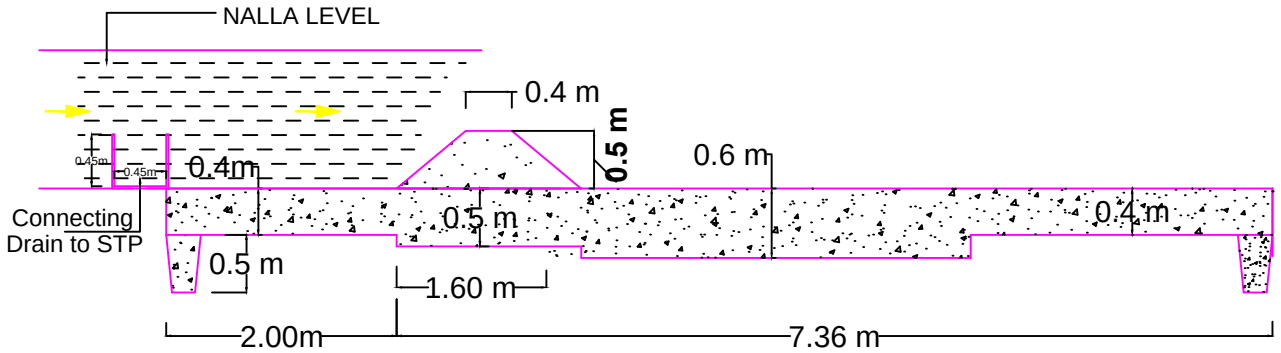
ACM-PDMC1-DPR-MTM

REV. NO

R1



PLAN



SECTION

REV. NO.	DATE	DETAILS	BY	CHKD

CLIENT

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPmENT mANAGEmENT CONSULTANT :-

AECOM

9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE

ATAL mISSION FOR REJUVENATION AND URBAN TRANSFORmATION (AmRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DRAWING TITLE

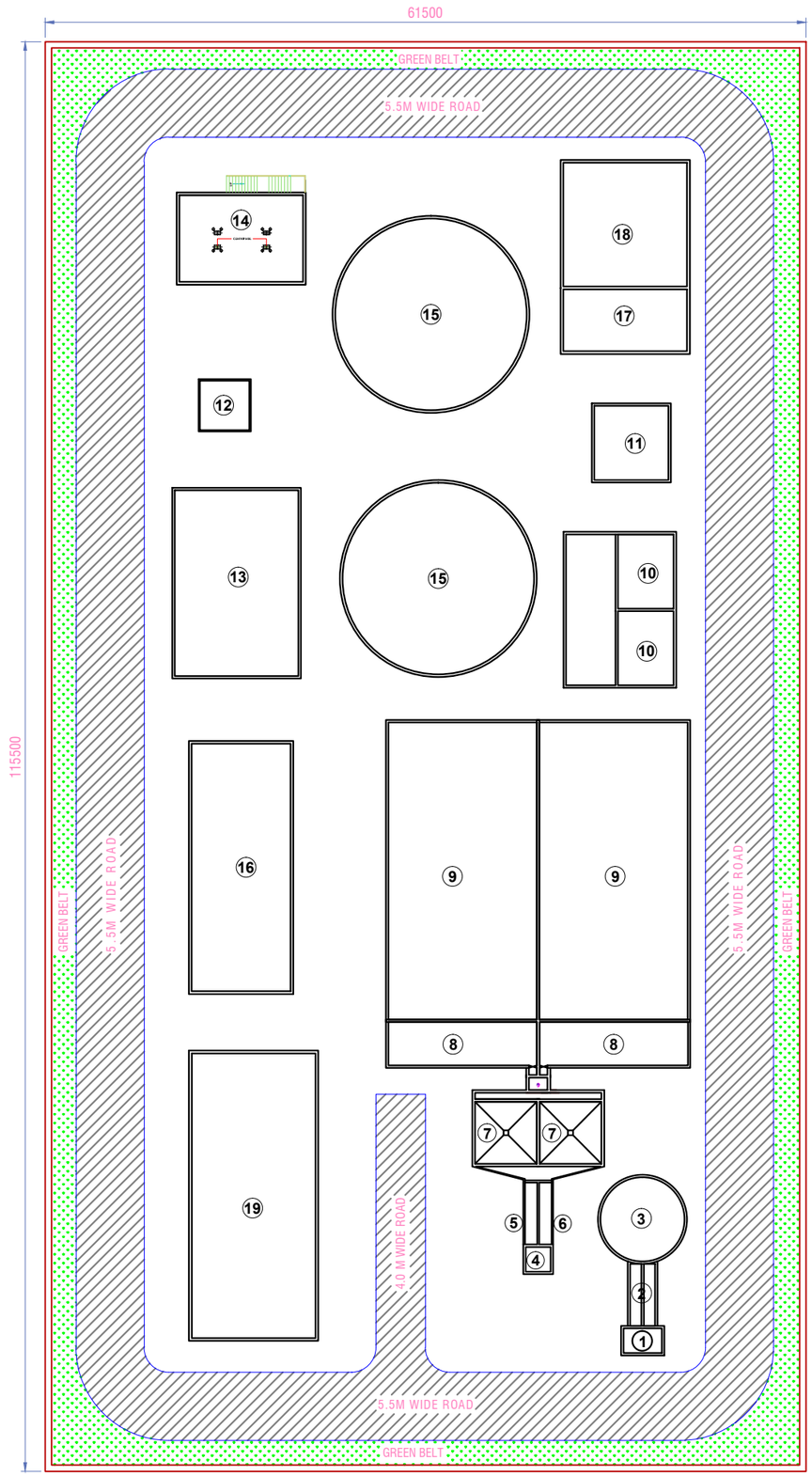
DIVERSION WEIR

DRAWING NO

ACM-PDMC1-DPR-MTM

REV. NO

R1



PLAN

LIST OF UNITS			
SR.NO	DESCRIPTION	QTY	SIZE
1	RECEIVING CHAMBER	01	2.0x2.0x1.5+0.5
2	COARSE SCREEN	03	5.0x0.9x0.8+0.5
3	RAW SEWAGE SUMP	01	Ø6.8x2.5+0.5
4	STILLING CHAMBER	01	2.0x2.0x1.5+0.5
5	MECHANICAL FINE SCREEN CHANNEL	01	5.0x0.9x0.8+0.5
6	MANUAL FINE SCREEN CHANNEL	01	5.0x0.9x0.8+0.5
7	GRIT CHAMBER	02	5.0x5.0x1.0+0.5
8	ANOXIC TANK	02	3.5x12.0x5.0+0.6
9	AERATION TANK	02	24.0x12.0.0x5.0+0.6
10	FILTER	02	4.5x6.0x4.5+0.5
11	CHLORINE CONTACT TANK	01	6.0x6.0x3.0+0.5
12	SLUDGE SUMP	01	4.0x4.0x2.5+0.5
13	CHLORINATION BUILDING	01	15.0x10.0
14	CENTRIFUGE HOUSE (DOUBLE STOREY)	01	10.0x7.0
15	CLARIFIER	02	15.5m DIA
16	AIR BLOWER & RECYCLE PUMP HOUSE	01	20.0x8.0
17	DG SET	01	10.0x5.0
18	SUBSTATION ROOM	01	10.0x10.0
19	ADMIN BUILDING & LAB (DOUBLE STOREY)	01	23.0x10.0

REV.	DATE	DESCRIPTION	
0	12.08.16		

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

LAYOUT PLAN OF 5.0 MLD SEWAGE TREATMENT PLANT

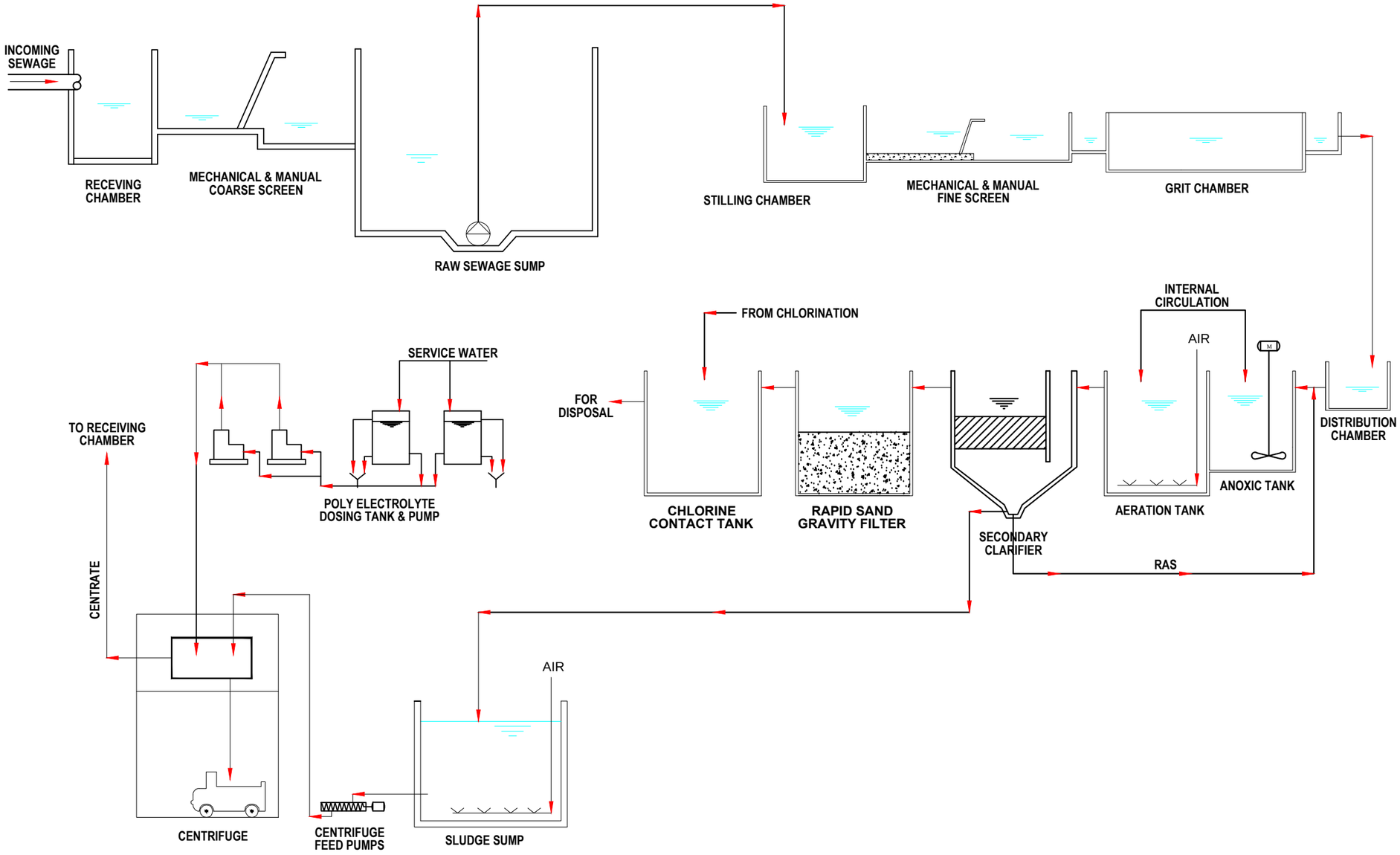
DRAWING NUMBER

ACM-STP-LYP-0001

REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



REV.	DATE	DESCRIPTION
0	12.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

PROCESS FLOW DIAGRAM OF 5.0 MLD SEWAGE TREATMENT PLANT

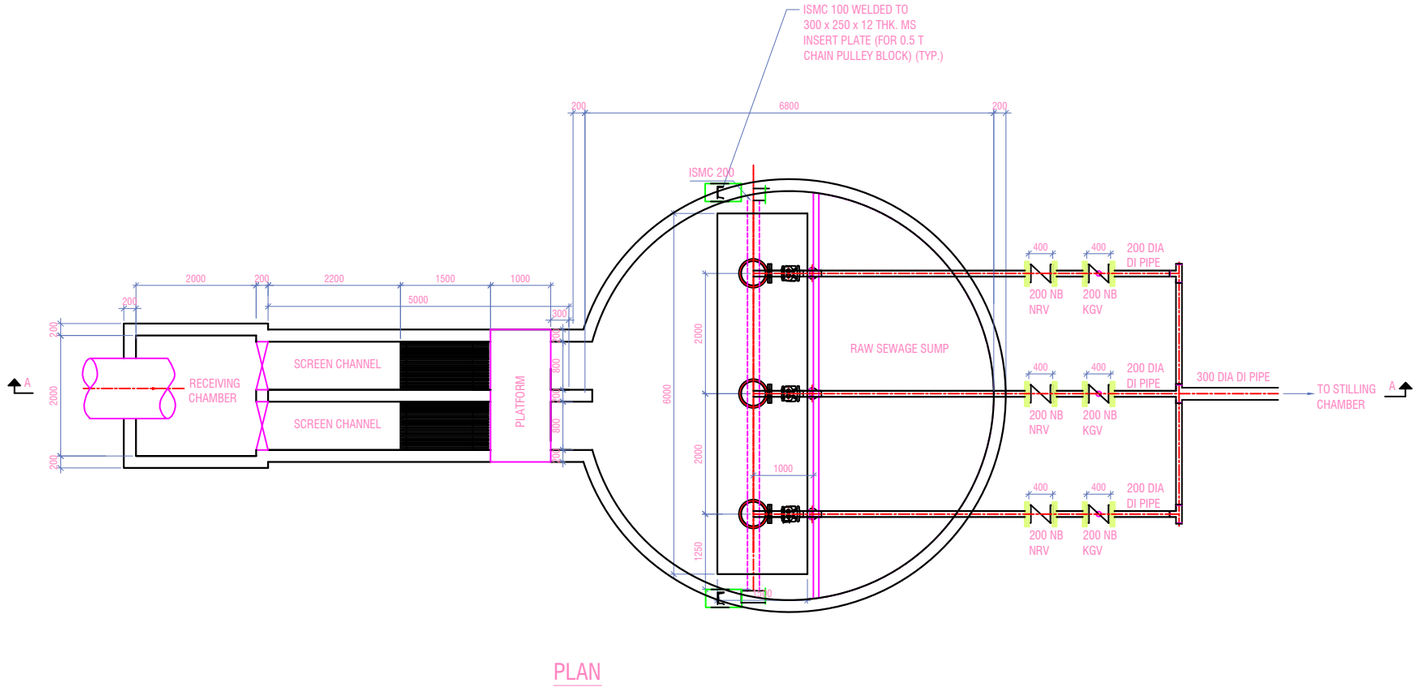
DRAWING NUMBER

ACM-STP-PRS-0002

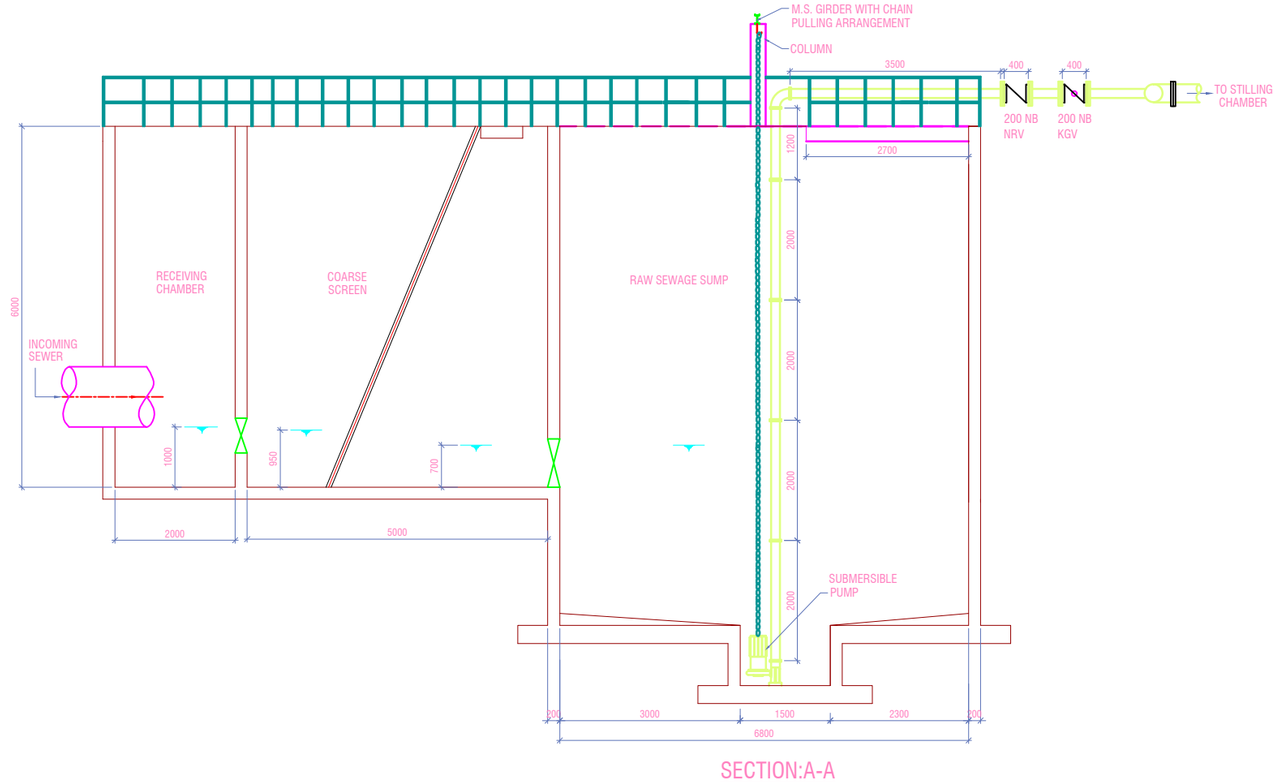
REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



PLAN



SECTION:A-A

REV.	DATE	DESCRIPTION
0	26.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF RECEIVING CHAMBER, SCREEN & RAW SEWAGE SUMP FOR 5.0 MLD SEWAGE TREATMENT PLANT

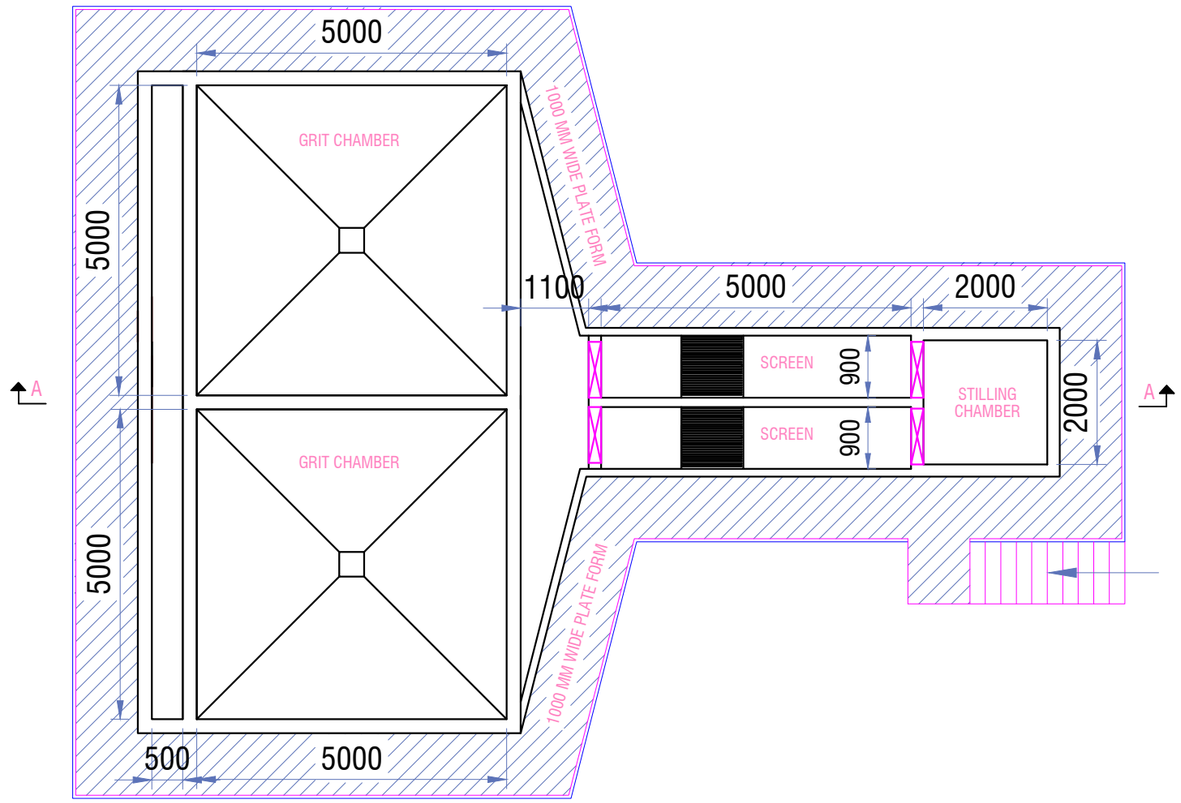
DRAWING NUMBER

ACM-STP-GA-0003

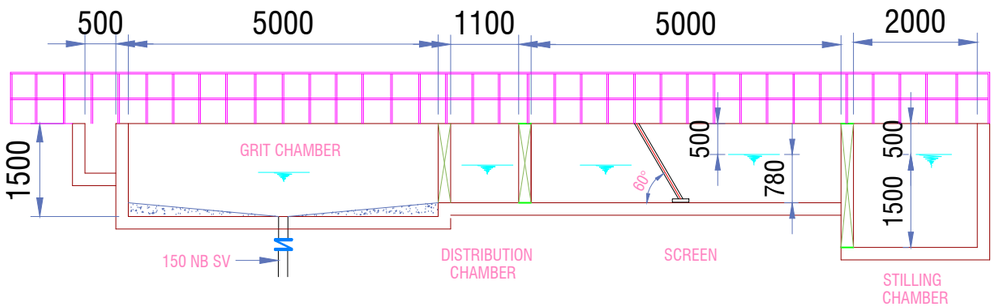
REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



PLAN



SECTION: A-A

REV.	DATE	DESCRIPTION
0	23.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF STILLING CHAMBER, SCREEN & GRIT CHAMBER FOR 5.0 MLD SEWAGE TREATMENT PLANT

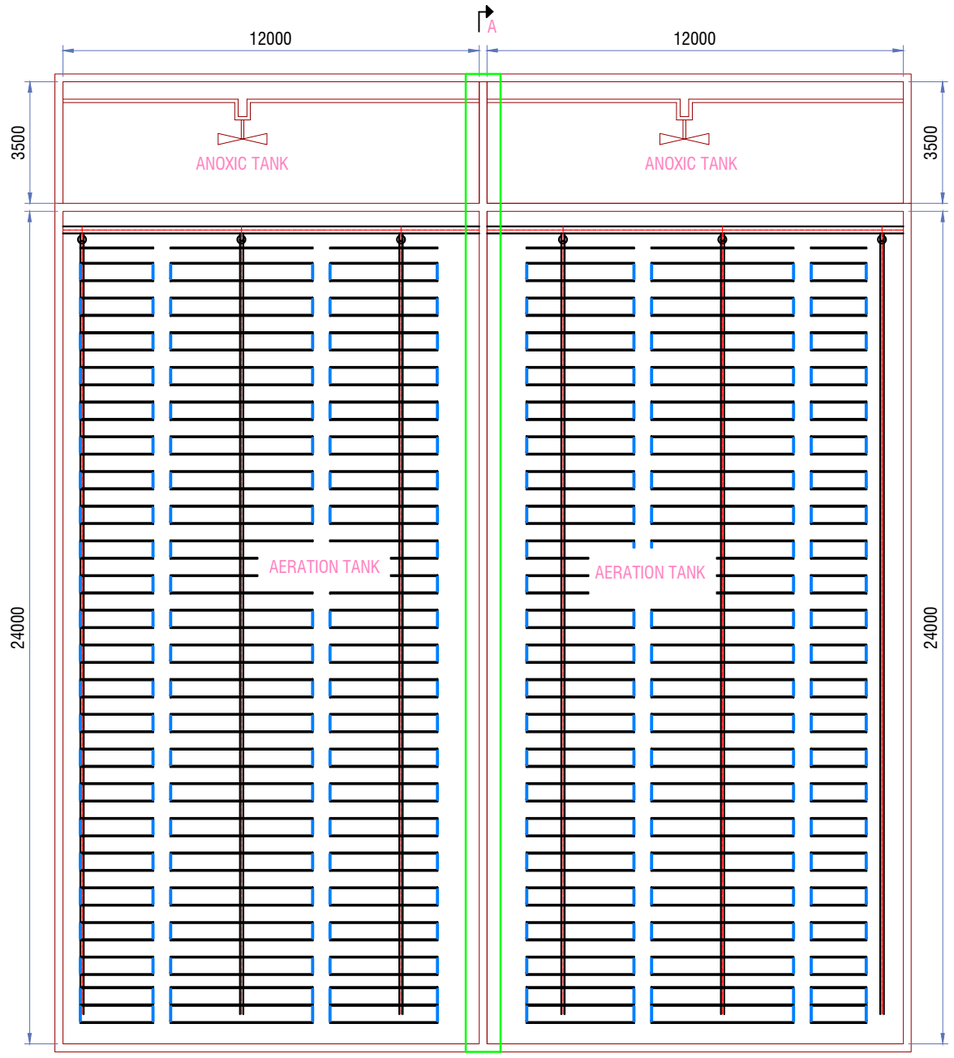
DRAWING NUMBER

ACM-STP-GA-0004

REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



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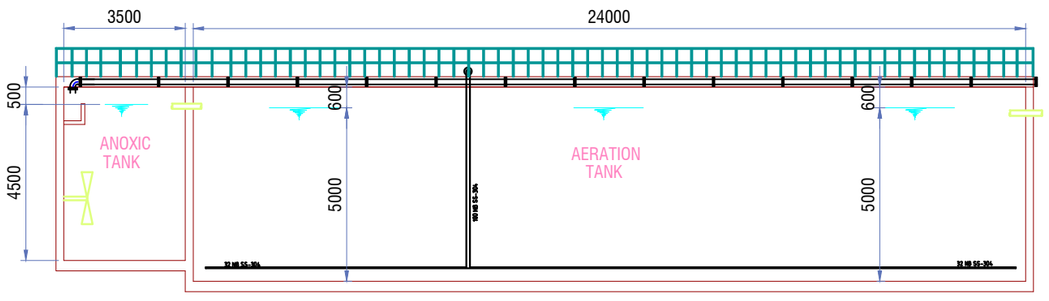
PLAN



SECTION: A-A

REV.	DATE	DESCRIPTION
0	23.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF ANOXIC & AERATION TANK FOR 5.0 MLD SEWAGE TREATMENT PLANT

DRAWING NUMBER

ACM-STP-GA-0005

REV

R1

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CHKD. BY	U.K	SCALE	NTS
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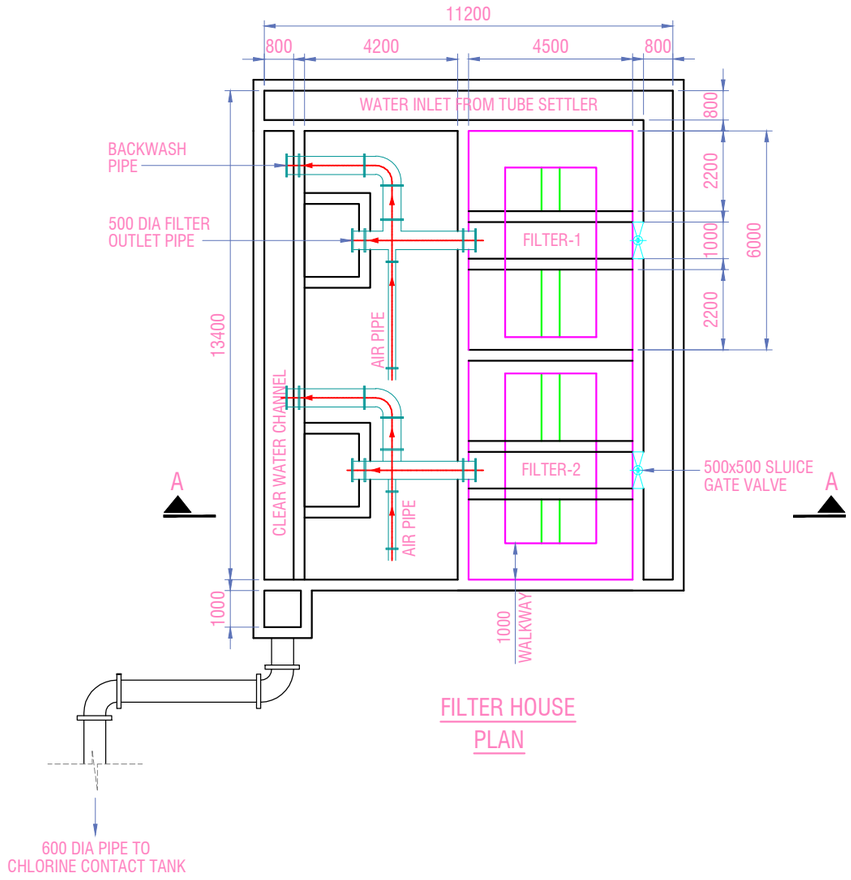
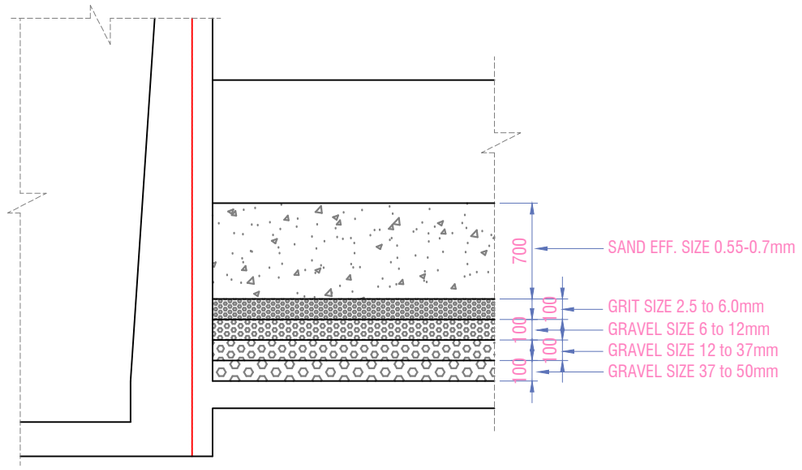
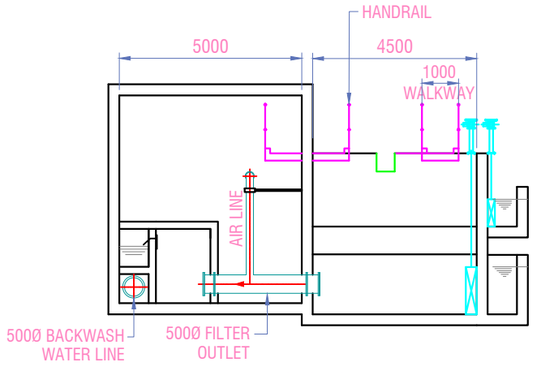


FILTER HOUSE PLAN



DETAIL OF FILTER MEDIA



SECTION: A-A

REV.	DATE	DESCRIPTION
0	26.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF FILTER HOUSE FOR 5.0 MLD SEWAGE TREATMENT PLANT

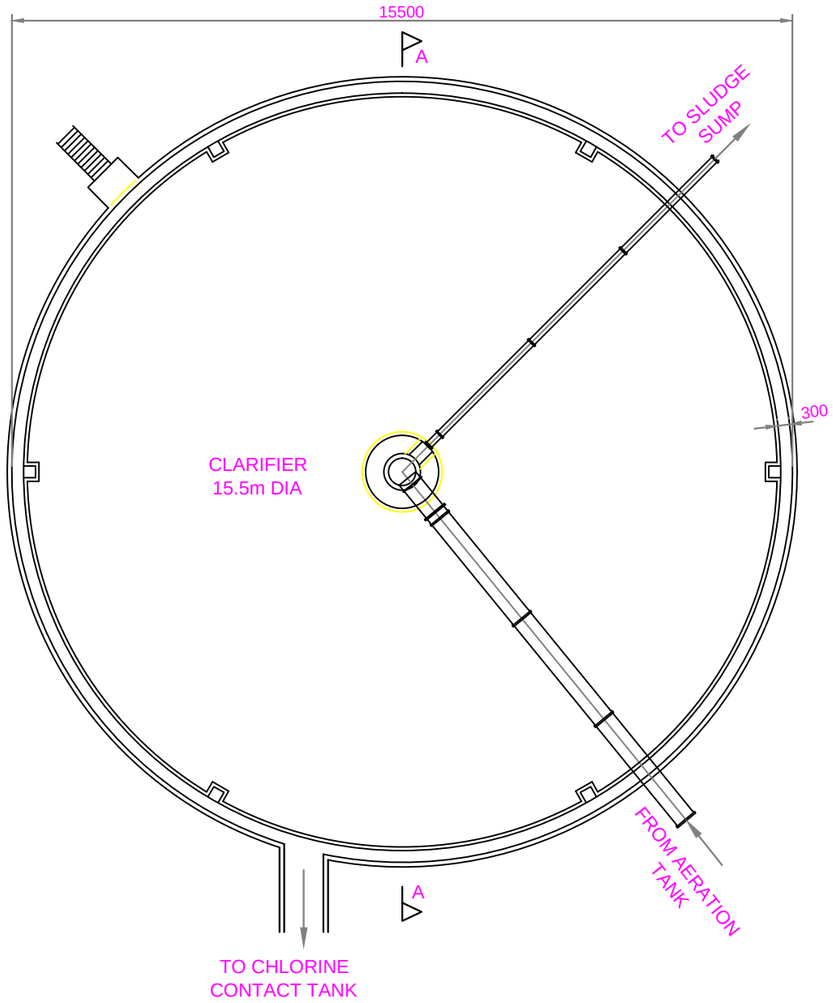
DRAWING NUMBER

ACM-STP-GA-0006

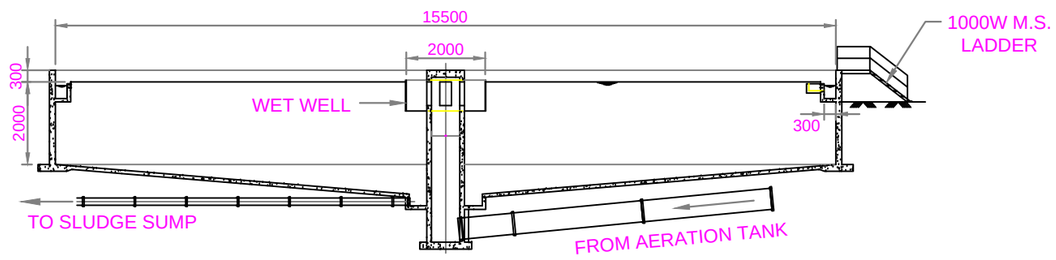
REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



PLAN



SECTION: A-A

REV.	DATE	DESCRIPTION
0	23.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF CLARIFIER FOR 5.0 MLD SEWAGE TREATMENT PLANT

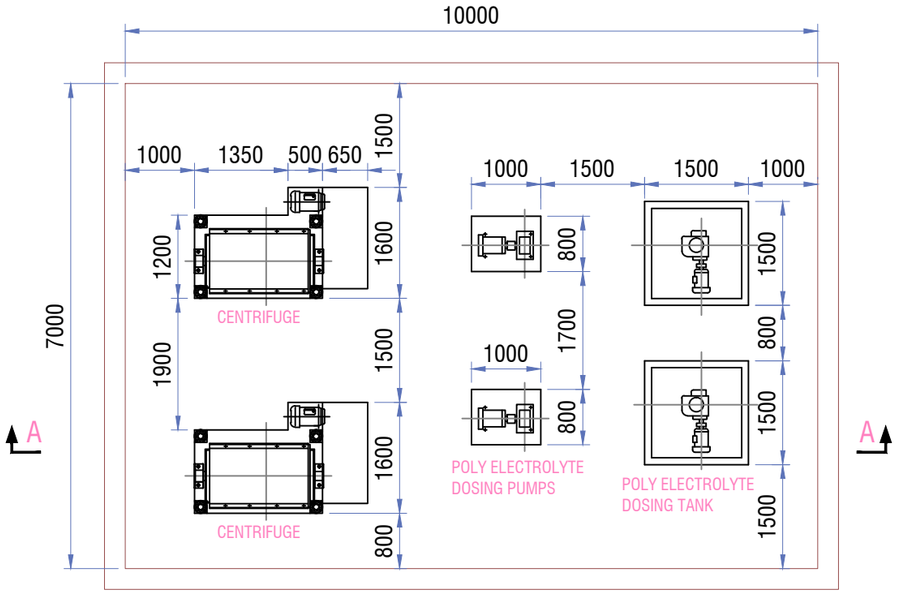
DRAWING NUMBER

ACM-STP-GA-0007

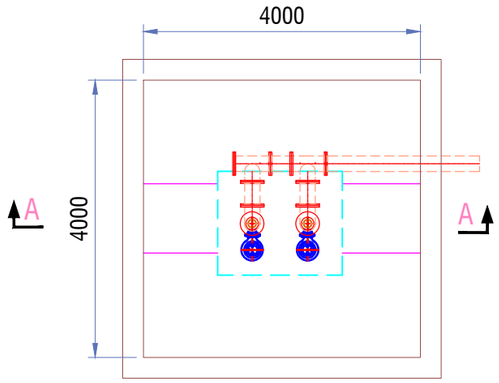
REV

R1

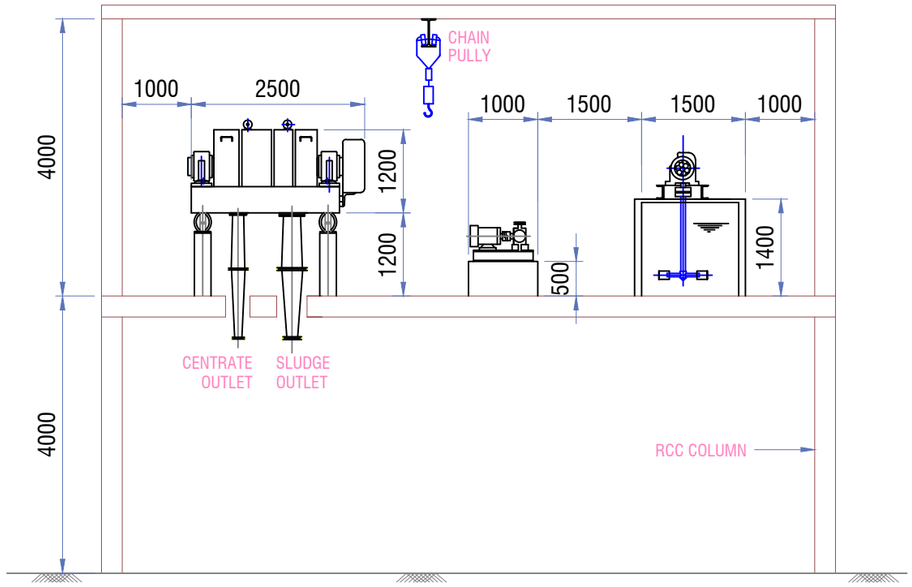
DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



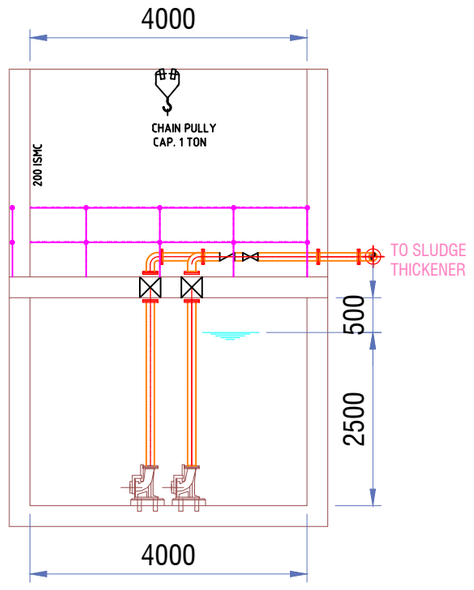
PLAN OF CENTRIFUGE BUILDING



PLAN OF SLUDGE SUMP



SECTION A-A



SECTION: A-A

REV.	DATE	DESCRIPTION
0	23.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF CENTRIFUGE BUILDING & SLUDGE SUMP FOR 5.0 MLD SEWAGE TREATMENT PLANT

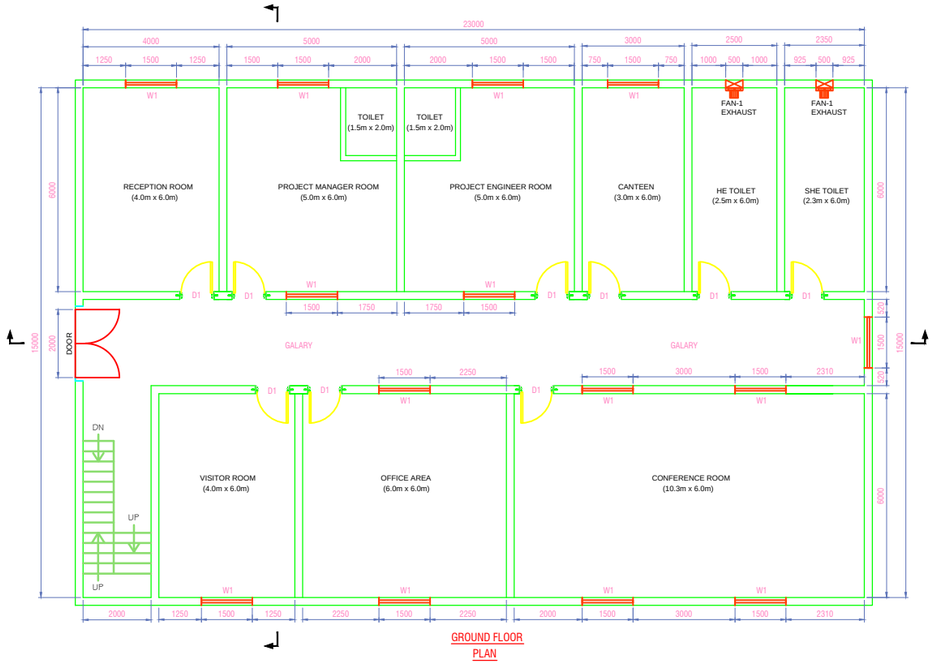
DRAWING NUMBER

ACM-STP-GA-0008

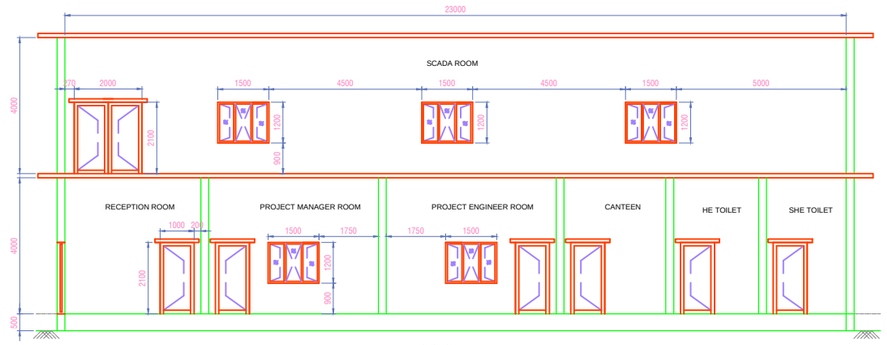
REV

R1

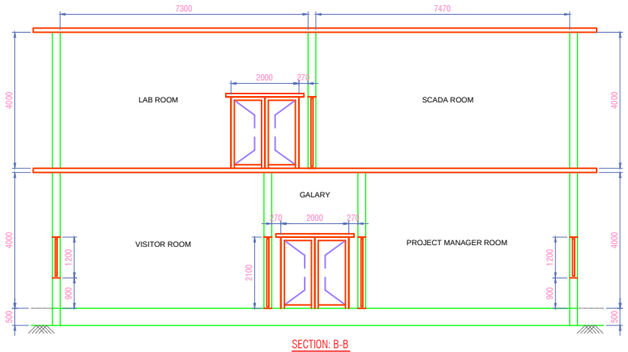
DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



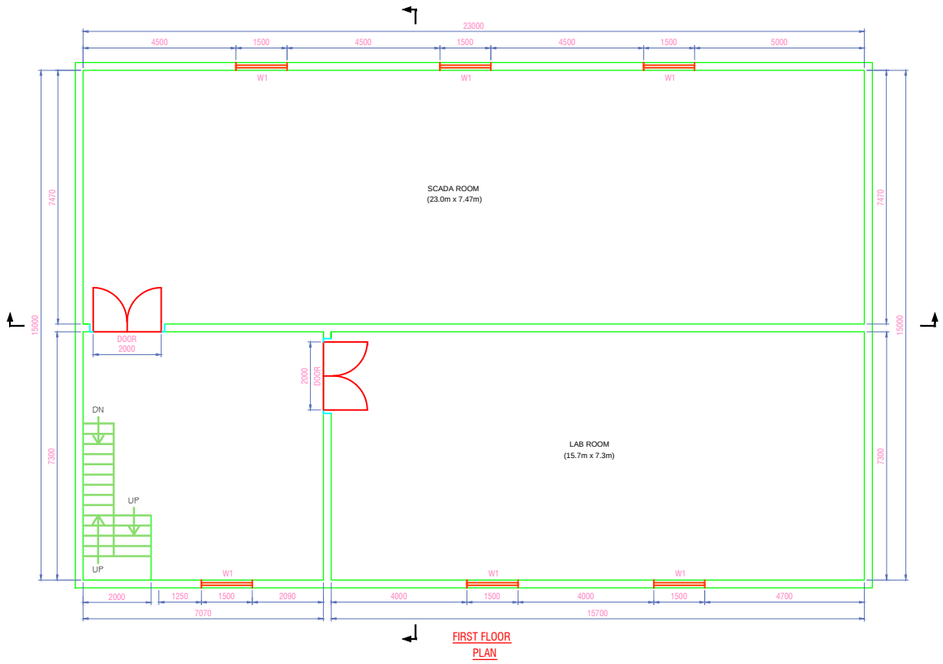
GROUND FLOOR PLAN



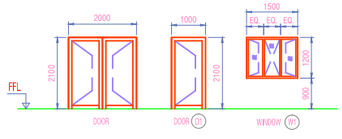
SECTION: A-A



SECTION: B-B



FIRST FLOOR PLAN



REV.	DATE	DESCRIPTION	
0	23.08.16		

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF ADMIN BUILDING FOR 5.0 MLD SEWAGE TREATMENT PLANT

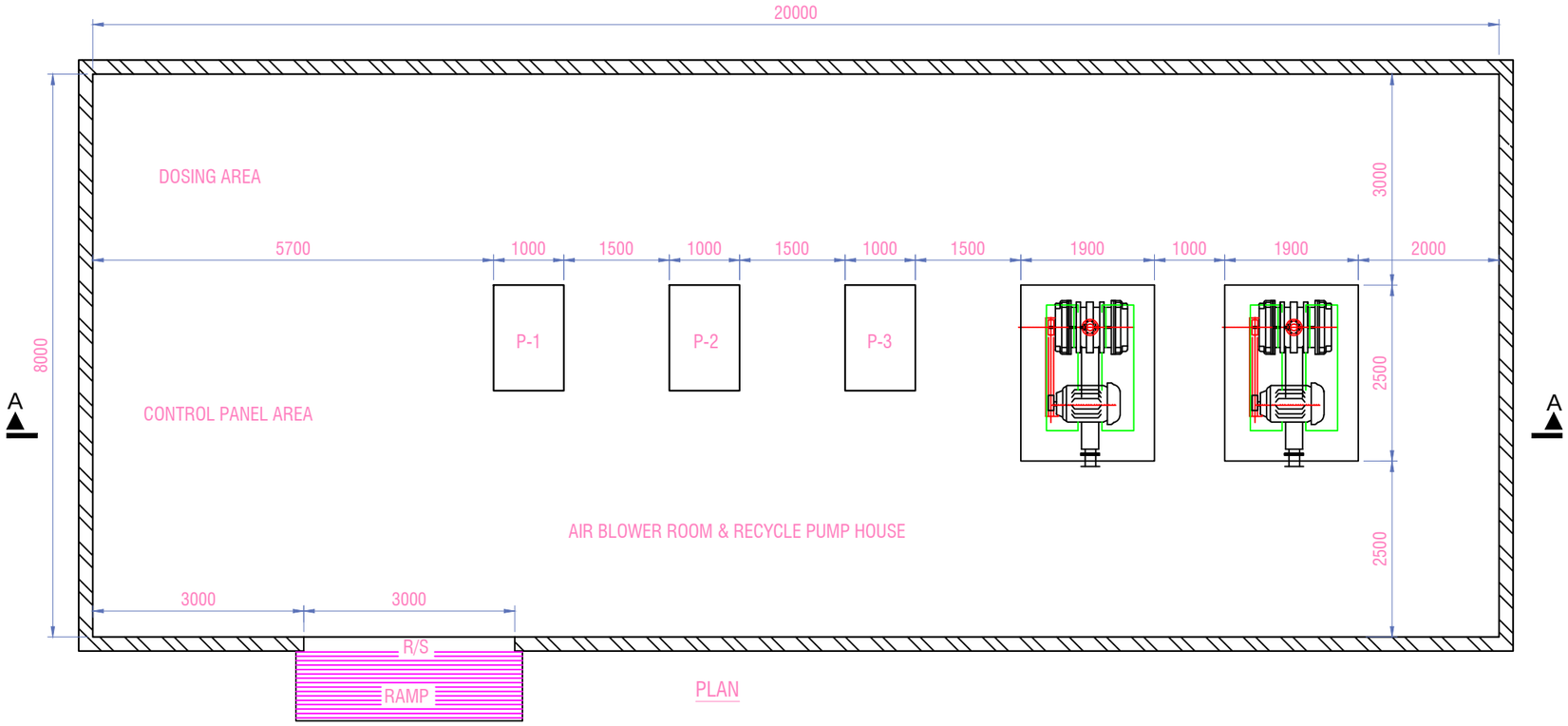
DRAWING NUMBER

ACM-STP-GA-0009

REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



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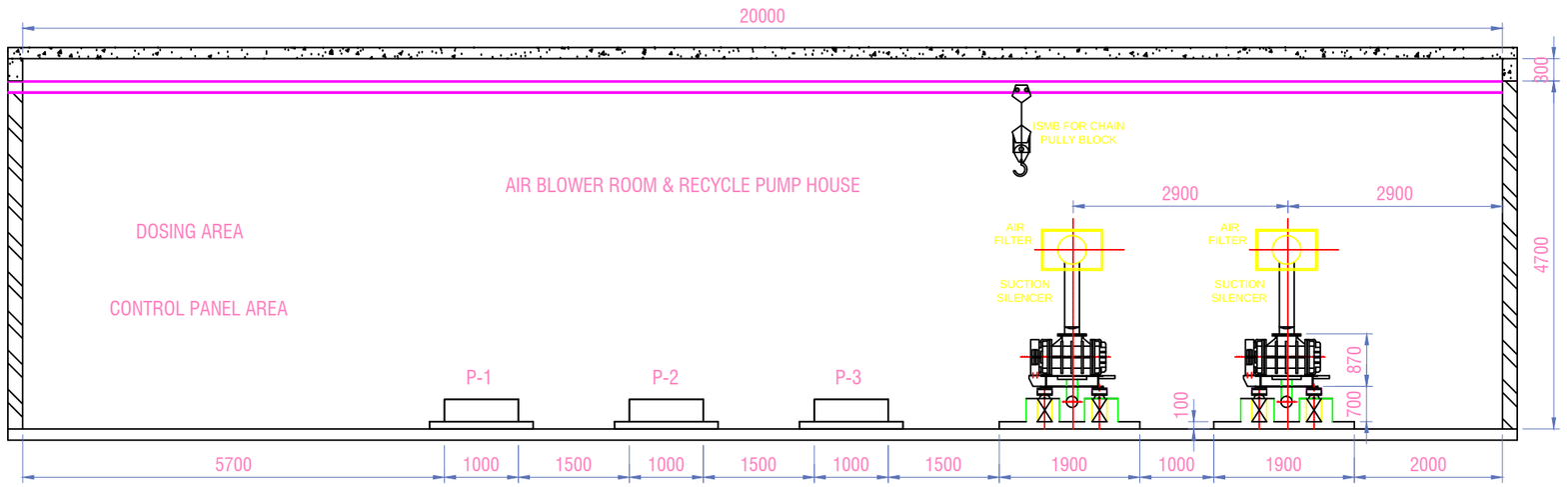


SECTION-AA

REV.	DATE	DESCRIPTION
0	23.08.16	

CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF BLOWER ROOM & RECYCLE PUMP HOUSE FOR 5.0 MLD SEWAGE TREATMENT PLANT

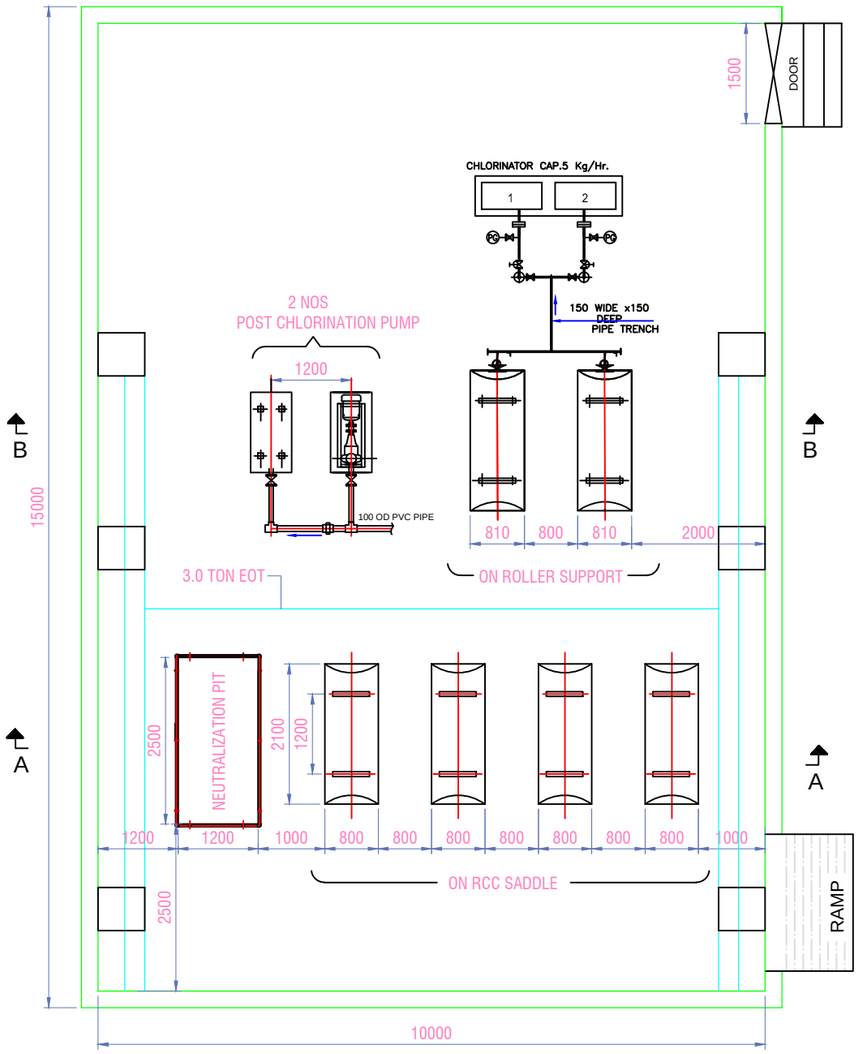
DRAWING NUMBER

ACM-STP-GA-0010

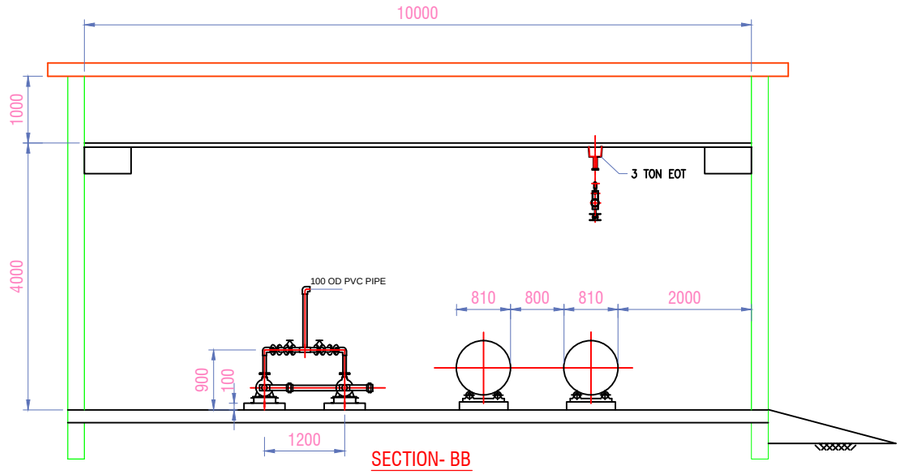
REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-



CHLORINATION BUILDING PLAN



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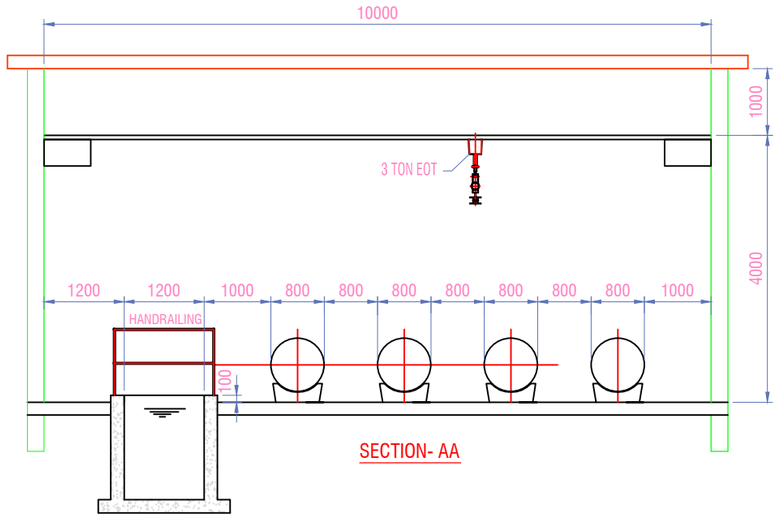

SECTION- AA

REV.	DATE	DESCRIPTION
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CLIENT :-

Andhra Pradesh Urban Finance and Infrastucture Development corporation (APUFIDC)

PROJECT DEVELOPMENT MANAGEMENT CONSULTANT :-

AECOM 9th Floor,Infinity Tower C DLF Cyber City,DLF Phase II Gurgaon 122002 Haryana, India

PROJECT TITLE :-

ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION (AMRUT) FOR TOWNS IN ANDHRA PRADESH

PROJECT NO.

DELD16028

DRAWING TITLE

GA OF CHLORINATION BUILDING FOR 5.0 MLD SEWAGE TREATMENT PLANT

DRAWING NUMBER

ACM-STP-GA-0011

REV

R1

DES. BY	U.K	SHEET NO.	SHEET 1 OF 1
DRN. BY	HSR	SHEET SIZE	A1
CHKD. BY	U.K	SCALE	NTS
APPD. BY	U.K	DIMENSION	-