GOVERNMENT OF MAHARASHTRA

Atal Mission for Rejuvenation and Urban Transformation

DETAILED PROJECT REPORT

FOR

SEWERAGE & SEWAGE TREATMENT

(UNDERGROUND DRAINAGE SCHEME)

VOLUME - I – GENERAL REPORT

LATUR MUNICIPAL CORPORATION
DIST. LATUR, MAHARASHTRA

APR -2023

MANAVSEVA CONSULTANT
94, Netaji Housing Society, Deopur, Dhule, Maharashtra - 24002

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ABBREVATIONS

Acronym	Full Form
ABAS	Accrual Based Accounting System
ARV	Annual Rateable Value
ASP	Activated Sludge Process
ASP	Activated Sludge Process
BOD	Biochemical Oxygen Demand
CAGR	Compound Annual Growth Rate
CC Road	Cement Concrete Road
CI	Cast Iron
COD	Chemical Oxygen Demand
CPHEEO	Central Public Health Environmental Engineering Organisation
CPHEEO	Central Public Health Engineering and Environment Organization
CPT	Consolidated Property Tax
DI	Ductile Iron
DO	Dissolved Oxygen
DPR	Detailed Project Report
DWF	Dry Weather Flow
GI	Galvanized Iron
KLD	Kilo Litres per Day
LMC	Latur Municipal Corporation
LPCD	Litres Per Capita per Day
M & R	Maintenance and Repair
ML	Million Litres
MLD	Million Litres per Day
MUINFRA	Maharashtra Urban Infrastructure Development Company
N & P	Nitrogen and Phosphorous
NGT	National Green Tribunal
O & M	Operation and Maintenance
PVC-U	Poly Vinyl Chloride unplasticized
RCC Pipe NP	Reinforced Cement Concrete Pipe-Non-Pressure
SBR	Sequential Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SOR	Schedule of Rates
SPS	Sewage Pumping Station
SS	Suspended Solids
STP	Sewage Treatment Plant
TSS	Total Suspended Solids
ULB	Urban Local Body
u-PVC	Unplasticized Poly Vinyl Chloride

LIST OF REFERENCES

1. Manual on Sewerage and Sewage Treatment (Second Edition) Central Public Health Environmental Engineering Organization published by the Ministry of Urban Development New Delhi, Govt. of India, 1993.
2. Manual on Operations and Maintenance of Water Supply Systems, Government of India, Ministry of Urban Development, CPHEEO, 2013 and as amended.
3. Various IS Code Provisions relating to Sewage treatment process, mechanical and electrical equipment.
4. SOR's of MJP. Year -2021-22 & Latest amendments
5. SOR of PWD Maharashtra Year 2022-23.

SHORT CHECK LIST FOR CRITICAL POINTS

Name of Scheme – LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR CITY						
Sr. No.	**Parameter**	**Requirement**			**Actual**	**Page No.**
1.	Design Period	**Component**		**Design Period**		
		Conventional Sewers		30	**30**	**31**
		Pumping Main		30	**30**	**31**
		Pumping Station – Civil Work		30	**30**	**31**
		Pumping Machinery		15	**15**	**31**
		Sewage Treatment Plants		15	**15**	**31**
2.	Per Capita Sewage Flow	80% of water consumption, 0.8*177.38=141.91 LPCD (Minimum 100 LPCD)			141.91	**31**
3.	Ground Water Infiltration	**Unit**	**Minimum**	**Maximum**	**5,000**	**63**
		Litres/ha/day	5,000	50,000		
		Litres/km/day	500	5,000		
		Litres/day/manhole	250	500		
4.	Peak Factor	**Contributory Population**		**Peak Factor**		
		Up to 20,000		3.00	**3.00**	**32**
		Above 20,001 to 50,000		2.50	**2.50**	**32**
		Above 50,001 to 7,50,000		2.25	**2.25**	**32**
		Above 7,50,001		2.00	**2.00**	**32**
5.	Design velocities	**Criteria**		**Value**		
		Minimum velocity at initial peak flow		0.6 m/s	**0.6 m/s**	**32**
		Minimum velocity at ultimate peak flow		0.8 m/s	**0.8 m/s**	**34**
		Maximum velocity		3 m/s	**3 m/s**	**34**
6.	Design Depth of Flow	d/D = 0.8			**0.80**	**33**
7.	Minimum Sewer Pipe Size	Base year population of over 1 lakh.		200 mm	**200 mm**	**33**
		However, depending on growth potential in certain areas even 150 mm diameter can also be considered			-	-
		Base year Population of less than 1 lakh		150 mm	-	-
		Minimum Sewer Connection Pipe		135 mm	**135 mm**	
8.	Land Required	Reqd. Land should be in possession of Local Body and 7/12 of the same should be attached in DPR.			**YES**	**97**

CHECKLIST FOR SUBMISSION AND SCRUTINY OF DPR

CERTIFICATE:

This is to certify that that the undersigned have read the contents of the check list fully and have responsibly made the entries true to the best of knowledge and understanding. In case the information furnished in the check list enclosed is found to be incorrect for any reason, whatsoever, the undersigned may be held liable for disciplinary action as per applicable Government rules.

Certified that

The detailed estimates and cost estimates are as per the current schedule of rate and/or rate analysis and latest pro-forma invoices (current market rates).

Signed:
Name:
Designation:

Signed:
Name:
Designation:

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
3. GENERAL COMPONENT		
3.1	Name of the town/city/District for which scheme has been formulated with name of the scheme **(a)** Name of the City/Town: **LATUR** **(b)** Name of the District: **LATUR** (c) Name of the Scheme: **LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR CITY**	**YES**
3.2	(a)Whether Project formulation justification (need for the project) has been furnished in DPR. Please justify the need of the project. Justification: **The sewage generated from City area directly mixed with storm water and finally discharge in to the nallahs. The wells near the Nallah area get contaminated due to sewage which flow along the storm drains and create unhygienic situation, in dry season & wet Season, in nearby areas of nallah. So, there is immediate need of proper sewerage system along with the treatment facility. So that the water after treatment can be used for non-domestic purpose for beautification in garden area and greenery, Irrigation purposes which will reduce the burden on the fresh water demand.** (b) Whether executive summary of the project is furnished in the DPR	**YES** **YES**
3.3	Whether linkages of this scheme have been established with other ongoing sewerage schemes being funded by the Central/State Govt. /other agencies, if any.Pl. Furnish relevant information.	**YES**
3.4	Whether the map showing administrative and political jurisdiction of the project area has been given in DPR. Area within Municipal limit: -32.42 sq.km. Extent of area considered in the DPR: -0.00 sq.km. Additional area (beyond Municipal limit): -0.00 sq.km considered in the DPR	**YES**
3.5	Whether the land use pattern of the city / town / project area as per the approved Master Plan has been given in DPR.	**YES**
3.6	In case proposed pumping main /sewer line is crossing Railway line/ Highway & their bridge (wherever applicable), whether the clearance from concerned authority such as Maharashtra Pollution Control Board	**NO**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	(MPCB),Highways, PWD, Railways authorities has been obtained and copies of the permission and their estimate for the same has been provided in DPR. If not, the present status of action initiated may be furnished below. **Permissions for Railway Dept., Road Dept. & MPCB are under process.**	
3.7	Whether the provision for separate electric feeder line to the sewage treatment plant and pumping station from HT line has been proposed in the DPR. If yes, whether approved principally by Mahadiscom? (Attach copy of letter)	**NO**
3.8	Whether the commitment from Electricity Department for power supply is obtained	**NO**
3.9	Whether the Topographic map of the city/town/project area to the scale has been given in DPR/Zonewise maps to scale showing all streets.	**YES**
3.10	Whether soil investigation report have been forwarded with DPR. Trial pits/bores for proposed depth at 500 m interval for sewer line. Trial pits for STP and Wet well sites – 1 number for every 50 to 100 sqm. depending upon capacity of STP/Wet well.	**YES**
3.11	Whether Contour map of the project area has been annexed with the DPR.	**YES**
3.12	Whether resolution from the ULB for implementation of proposed tariff structure to ensure self-sustainability of the scheme is enclosed in DPR.	**YES**
4. ENGINEERING COMPONENTS		
4.1	(i) Please furnish the details of city/project area, (a) Area of the town/city (municipal limit): -**32.42** sq. km (b) Extent of the project area considered in the DPR: -**0.00** ..... sq. km (c) Additional Area (beyond municipal limit) considered in the DPR: -**0.00** sq.km (d) No. of Households (as per 2011 census): -**74557 Nos.** (ii) Whether population projection has been made as per CPHEEO Manual and given in DPR (a) City population As per 2011 Census: - **3.82** lakhs	**YES** **YES**

<table>
<tr><th>Sr. No.</th><th>Description</th><th>Write 'Yes' or 'No' etc. in the column below
If yes, give Page No. / DPR volume reference. If no, reasons thereof</th></tr>
<tr><td></td><td>
Initial stage: - 5.26 lakhs +floating population (if any) 0.44 lakh 2027 AD) (year of commissioning)
Intermediate stage: - 6.59 lakhs+ floating population (if any)0.55 lakh 2042 AD)
Ultimate stage: 7.90 lakhs+ floating population (if any) 0.65 lakh (2057 AD)
Population growth rate adopted 1.85% to 1.33 % / year
(Based on the past 4-5 decadal growth rate)
Demographic Method adopted and justification
Average of two methods are considered while projecting population for Latur City
Average of Arithmetical Progression Method & Varying Increment or Incremental Increase Method
Above two method Shows Realistic figures.
(b) Whether the population projection has been made in consonance with the Developmental Master Plan
(c) Project Area Population (part or 100% area of the city)
Initial stage: -5.26 lakhs
Intermediate: -6.59 lakhs
Ultimate stage: -7.90 lakhs
Population growth rate adopted 1.85% to 1.43 %/ year
(Based on the past 4-5 decadal growth rate)
(d) Zone wise population (separately)
<table>
<tr><th>Zones</th><th>Initial (lakhs)</th><th>Intermediate (lakhs)</th><th>Ultimate (lakhs)</th><th>Population Density (Pop/hectare)</th></tr>
<tr><td>Zone –I</td><td>1.13</td><td>1.42</td><td>1.70</td><td>184
230
276</td></tr>
<tr><td>Zone –II</td><td>1.74</td><td>2.19</td><td>2.62</td><td>153
192</td></tr>
</table>
</td><td>YES</td></tr>
</table>

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof

				230	
Zone –III				195	
				244	
	2.29	2.86	3.44	292	
Zone –IV				30	
				38	
	0.09	0.12	0.14	45	

(Saturation density as per master plan may be useful for sewer network design)

(e) No. of wards (within municipal limit) : - **62 Wards**

(f) Total projected population to be accommodated in the existing: - **7.90** Lakhs municipal area

(Should be in consonance with master plan and based on saturation density)

(g) Remaining population to be accommodated in the area beyond: - **0.00** Lakhs municipal limit

(Should be in consonance with master plan projection)

(h) Whether population distribution in the municipal area and the area beyond municipal limithas been done in consultation with Town & Country Planning Authority. — **YES**

(i) If yes, whether document is enclosed. — **NO**

4.2	Whether existing details of sewerage system for urban / urban agglomeration has been furnished inDPR. Please furnish details. (a) Total water supply in the town / city (capacity of WTP/tube well separately): Surface Water: -**89.84** MLD Ground Water: -**0.00** MLD (b) Existing per capita water supply (average): - **135 LPCD (Domestic demand) + 23.56 LPCD (Other demand)**	**YES**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	City/town: - **Latur** Project Area: - **Latur City** (c) Existing per capita wastewater generation: - **158.56 LPCD** (d) Total sewage generation in the city - **52.01** MLD (e) Industrial treated effluent (to the desired level) being discharged in the sewer system: -**0.00** MLD (f) Existing capacity of STP & nos. in city /project area: -**32.00 MLD**, MLD (**01 No**.) (g) Capacity Utilization **0.00** MLD (**Under Construction**) (h) No. of pumping stations and capacity **01** (No.) **32.00 (MLD) Avg.** (i) % of population coverage with sewer network in the city : -**0.00** % (**Work under progress**) (j) % of population coverage with sewer network in the project area: -**0.00** % (**Work under progress**) (k) % population coverage of various zones (Zone-wise) Zone- **0.00** % Zone-II: **0.00** % Zone-III: **0.00** % Zone-IV: **0.00** % (l) Existing no. of House service Connections (sewer): **0** no./**0** no. (Residential/commercial)	
4.3	Sewage Generation (a) Per capita sewage generation considered in the DPR: -**141.90** lpcd (80% of water supply) (b) Sewage Generation (City / town) (specify treated industrial effluent if any) Initial stage- **77.53** MLD Intermediate stage – **96.38** MLD Ultimate stage- **115.03** MLD (c) Net capacity of Sewage Treatment Plant required – city / town	

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	Initial stage- **78.00** MLD Intermediate stage- **96.50** MLD Ultimate stage- **115.00** MLD (d) Net STP capacity required – project area Initial stage- **78.00** MLD Intermediate stage- **96.50** MLD Ultimate stage- **115.00** MLD	
4.4	Whether the existing infrastructure of the sewerage system has been taken into consideration in DPR.Please furnish existing component wise details. **I. Sewer Network** (a) Total length of road of city/town: -**More than 600.00** KM (b) Total length of road in project area: -**562.00** KM (c) Total length of sewer network in the town: - **8.21** KM (d) Total length of sewer network in the project area: -**8.21** KM (e) Material and age of the existing pipe: (GSW/NP2/NP3/NP4 etc.) **NP3 2023 AD (Under Construction)** (f) Size and length of existing pipes (size wise): -……mm (dia.) KM (length) (g) Pipe length to be retained in the system: -**8.21** KM (h) Pipe length to be replaced): -**0.00** KM (To be discarded from the existing system **II. Sewage Pumping main** Size and length and material: ……mm, (.....Km) (PSC/MS/DI etc.) **III. Pumping Stations:** Total nos. and Capacity: …… MLD (..... nos.) **IV. Sewage Treatment Plant** (a) Capacity of STP :- **32.00 MLD**	**YES**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	(b) Existing Technology :- **SBR MLD** **(c)** Capacity utilization :-**32.00 MLD (Under Construction)** **(d)** Shortfall in capacity :-**11.50 MLD (for Zone III & IV)** (e) Justification for up-gradation, if any **Construction of New STP of Capacity 11.50 MLD**	

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
4.5	Please furnish the major project components and component-wise estimated cost (Rs. in lakhs)	

SR. NO.	SUBWORK		TOTAL COST (Rs.)
	CIVIL WORKS		
1	**WORKING SURVEY**		**39,33,908**
2	**COLLECTION AND CONVEYANCE SYSTEM**		
A	**Zone I**		
	200 mm - 900 mm Dia., Total Length - 146.11 Km		**1,25,28,31,283**
B	**Zone II**		
	200 mm - 1000 mm Dia., Total Length - 185.65 Km		**1,51,72,94,725**
C	**Zone III**		
	200 mm - 1100 mm Dia., Total Length - 204.14 Km		**1,89,82,28,968**
D	**Zone IV**		
	200 mm - 400 mm Dia., Total Length - 28.63 Km		**28,16,19,767**
3	**SEWAGE PUMPING STATION**		
A	**Zone - I**		
a	Sewage Collection Sump/Wet Well - 10.4 M Dia., 16.11 m Depth		**1,01,93,407**
b	Sewage Pump House - 10.4 M Dia. & Ht. -5.5 M		**29,34,990**
B	**Zone - II**		
a	Sewage Collection Sump/Wet Well - 12.9 M Dia., 6.18 m Depth		**70,04,219**
b	Sewage Pump House - 12.9 M Dia. & Ht. -5.5 M		**36,36,314**

Sr. No.		Description			Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	C	**Zone - III**			
	a	Sewage Collection Sump/Wet Well - 14.8 M Dia., 6.28 m Depth		**83,78,188**	
	b	Sewage Pump House - 14.8 M Dia. & Ht. -5.5 M		**43,76,757**	
	D	**Zone - IV**			
	a	Sewage Collection Sump/Wet Well - 4.5 M Dia., 6.96 m Depth		**21,97,028**	
	b	Sewage Pump House - 4.5 M Dia. & Ht. -5.5 M		**10,51,816**	
	4	**SEWAGE PUMPING MAIN**			
	a	**Pumping main from SPS-1 to STP 53 MLD - 600 mm Dia., L- 3470 M**		**5,93,54,541**	
	b	**Pumping main from SPS-2 to STP 53 MLD - 700 mm Dia., L- 2185 M**		**4,94,32,442**	
	c	**Pumping main from SPS-3 to Colle. Tank - 750 mm Dia., L- 1810 M**		**4,62,10,720**	
	d	**Pumping main from SPS-4 to highest point - 250 mm Dia., L- 3030 M**		**2,02,85,287**	
	e	**Gravity main from Highest point to Collection Tank -300mm dia., L- 1635 M**		**1,48,12,820**	
	5	**GRAVITY MAIN**			
	a	**Collection Tank**		**55,07,005**	
	b	**Gravity Line to STP**			
	i	**1000 mm dia. DI K-7, L = 3540 M**			
	ii	**700 mm dia. DI K-7, L = 460 M**			
	iii	**450 mm dia. DI K-7, L = 585 M**		**13,70,25,466**	
	6	**SEWAGE TREATMENT PLANT**			
	a	**STP 2 for (Zone I & II) - 53 MLD**		**56,47,87,576**	

Sr. No.		Description			Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	b	**STP 2 for (Zone III & IV) - 11.5 MLD**		**17,19,40,465**	
	7	**ALLIED WORKS**			
	a	Approach Road -100 M for 53 MLD STP		**8,71,621**	
	b	Approach Road -500 M for 11.5 MLD STP		**43,58,104**	
	c	Staff Quarter at 53 MLD STP		**44,24,846**	
	d	Compound Wall for 11.5 MLD STP		**66,65,529**	
	e	Compound Wall for 53 MLD STP		**60,64,586**	
	f	Fencing for SPS -1 to 4		**12,77,258**	
	g	Road Reinstating Work - For Zone I		**32,98,26,146**	
	h	Road Reinstating Work - For Zone II		**40,86,91,675**	
	i	Road Reinstating Work - For Zone III		**47,74,12,562**	
	j	Road Reinstating Work - For Zone IV		**7,81,53,988**	
	k	Flood Protection Wall		**1,36,63,502**	
	l	Pipe line along Highway		**1,95,37,770**	
		ELECTRICAL, MECHANICAL & INSTRUMENTATION WORKS			
	8	**ELECTRO-MECHANICAL WORKS AT STP & SPS**			
	a	Electro-Mechanical Work at SPS -1		**2,28,51,400**	
	b	Electro-Mechanical Work at SPS -2		**2,42,30,900**	
	c	Electro-Mechanical Work at SPS -3		**3,21,05,400**	
	d	Electro-Mechanical Work at SPS -4		**1,24,39,600**	
	e	Electrical Connection at SPS -1 -4		**4,85,22,300**	
	f	Electrical Connection at STP 1 & 2		**3,05,13,200**	

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	g SCADA for SPS -1 to 4 — **55,78,000** **h** Coarse Screen & Isolation Gates for SPS 2 to 4 — **2,08,57,359** **i** Jetting Machine (4 Nos.) — **1,29,40,560** **9** **TRIAL & RUN FOR 6 months** — **63,04,397** **TOTAL NET PROJECT COST (A)** — **7,63,03,28,395** Insurance Charges (b) 1% — 1,48,26,003 Technical Scrutiny Charges (c) 1% — 7,63,03,284 Add for GST 18.00% — 1,37,34,59,111 **TOTAL PROJECT COST(TPC) IN RS. (B)** — **9,09,49,16,793** **TOTAL PROJECT COST(TPC) IN RS. LAKHS** — **90,949.17**	
4.6	Whether the design of sewer network, pumping main and stations and STPs of proposed system has been provided in DPR **I. Sewage network** (a) Design period (30 years as per CPHEEO Manual) :**2057** Year	**YES**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	(b) Total length of road of city/town : **More than 600 KM** (c) Total length of road in project area : **More than 600 KM** (d) Total length of sewage network in the town :- **572.68 KM** (e) Total length of sewage network in the project area **572.68 KM** (f) Material and age of the proposed pipe: - (GSW/NP2/NP3NP4) **HDPE DWC, NP3, NP4** / ……. year (g) Size of sewage network in the town(range) :- **200 mm to 1100 mm** (h) Size of sewage network in the project area :- **200 mm to 1100 mm** (i) Total length of proposed line accounted for in the DPR (estimate) :-**564.53 KM** (j) Existing/ proposed length of pipe network : - 8.25 KM/564.53 KM (k) Per capita sewage considered in the design: - **141.90 LPCD** (l) Ground water infiltration based on area/length of network/no. of manhole: **length of Network** (m) Peak factor adopted (2 to 3) based on population as per Manual: - **Yes (from 2.25 to 3.00)** (n) Pipe material of „n" value (coefficient of roughness – 0.011 to 0.050) (as per manual) (specify material): - **0.013 (for RCC Pipe) & 0.011 (for HDPE DWC Pipe)** Minimum velocity considered in the design: -**0.60 m/s** (o) (0.6 m/s as per CPHEEO manual) (p) Maximum velocity considered in design): -**3.0 m/s** (3 m/s as per CPHEEO manual) (q) Actual minimum velocity :-**0.03 m/s** (r) Actual maximum velocity :-**2.98** m/s (s) Whether sewers have been designed to flow 0.8 (d/D) full at ultimate - **YES** peak flow (t) Actual d/D ratio: **0.80** (u) Spacing between manholes (please specify size wise): - **30 M C/C** (30m -300 m depend on size of sewers as per CPHEEO Manual)	

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	(v) Depth of cutting (1m -6m asp per manual) Minimum (Actual): -**1.25 M** Maximum (Actual): -**6.00 M** (please justify, it exceeds 6 m) (w) Total no of layout (networks): - **4 Nos.** (x) Total No. of nodes :- **18536** Nos. (y) Total length of sewer network (zone wise) : -…….KM (z) Proposed pipe sizes : -**200 mm to 1100 mm** (aa) Peak flow from the outlet of trunk sewer as per the design (zone wise) (Zone-I- **55.09 MLD**. Zone-II-**84.74MLD**, Zone-III-**110.86 MLD**, Zone-IV-**6.11 MLD**. (ab) Total peak flow of all the outfall sewers in :- ….MLD/ ……MLD all zones and average flow (ac) Whether the average out flow from all the trunk sewer is matching the ultimate sewage generationof the city/town/project area (please specify): - **Yes** (ad) % of population coverage :- **100 %** (**790459 lakh pop**) (Including existing, ongoing and proposed). (ae) % of area covered in the city :-**100 % (32.42 sq.km)** (Including existing, ongoing and proposed) **II. Pumping Station and Pumping main/gravity main** Design period (30 years for civil structure and 15 years for electro-mechanical items as per CPHEEO Manual) : - **Pumping Station, Pimping Main & Gravity Main – 30 Years** **Electro mechanical Work -15 Years** Main pumping station (please specify nos. and capacity): -4 Nos. (SPS -I- **55.09 MLD**. SPS-II-**84.74MLD**, SPS -III-**110.86 MLD**, SPS -IV-**6.11 MLD**. (a) Types of pumping station based on dry well or wet well (please specify): **Wet Well Type**	

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof

(b) Types of pumps, size of pumps, no. of pumps, capacity or flow rate of each pump, head ofpumping, etc., (please specify): -……

(c) Standby for pump sets (Please specify 50% or 100%) : -……

(d) Total no. of pumps:

S. N.	SPS	Pump Configuration		Type of Pump
		Capacity	W + S	
1	SPS -1	Q=133.82 LPS, H=39.95 M	(4 W + 2 S)	Non - Clog Submersible Pump
2	SPS -2	Q=204.29 LPS, H=27.17 M	(4 W + 2 S)	Non - Clog Submersible Pump
3	SPS -3	Q=267.81 LPS, H=33.84 M	(4 W + 2 S)	Non - Clog Submersible Pump
4	SPS -4	Q=29.61 LPS, H=45.50 M	(2W + 1 S)	Non - Clog Submersible Pump
		Q=20.85 LPS, H=40.53 M	(1W + 1 S)	Non - Clog Submersible Pump

III. Pumping main

(a) No. of pumping mains & capacity: -04 nos./ **600 mm, 700 mm, 750 mm & 250 mm**.

(b) Size and length: -**600 mm, 700 mm, 750 mm & 250 mm Length – 3.470 Km, 2.185 Km, 1.81 Km & 3.03 Km.**

(c) Design period (30 years as per CPHEEO Manual): - **30 Years**

(d) Whether economic size of pumping main has been done using computer software and furnished.

(e) Pipe material used (SWG/NPZ/NP3/NP4): - **D.I – K-9 for Pumping main & D.I. K-7 from Gravity main**

(f) "c" value adopted (as per Manual): -**140**

(g) Pumping hours considered: -**24 hrs**

(h) Pumping Head: - **Mentioned above.**

(i) Pumping efficiency (60% to 80%): -**65. %**

Gravity Main/ Trunk Main

(a) No. of gravity mains and capacity: **04 nos. / 300 mm, 450 mm, 700 mm & 1000 mm**

(b) Size and length: -**300 mm, 450 mm, 700 mm & 1000 mm Length – 1.635 Km, 0.585 Km, 0.460 Km & 3.540 Km**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
	(c) Material: -**D.I. K-7** **(d)** C Value adopted: -**140** **(e)** Available Hydraulic Head: -**1. 1000 mm & 3.54 KM line – Available head 10.576 M for Ultimate Year peak flow** **2. 700 mm & 0.46 KM line – Available head 3.379 M for Ultimate Year peak flow.** **3. 450 mm & 0.585 KM line – Available head 4.544 M for Ultimate Year peak flow.** **4. 300 mm & 1.635 KM line – Available head 4.78 M for Ultimate Year peak flow.** **III. Sewage Treatment Plant** (a) Design period (15 years as per CPHEEO Manual **2042 year** (b) Capacity of STP (existing & proposed): -**32 MLD (Under Construction) /53 MLD + 11.50 MLD** (c) Proposed Technology – **SBR (Cyclic Activated Sludge Process)** (d) Total capacity is meeting the intermediate demand: **YES** (e) Shortfall in capacity, if any to meet the intermediate demand: -**0.00 MLD** (f) Whether hydraulic design of STP has been done for design period of 15 years and furnished in DPR: - **YES** (g) Whether Life-cycle cost assessment of treatment technologies has been furnished in DPR: **YES** (h) Whether a detailed note on performance of existing STP (if considered in the proposal) has been furnished in DPR – **Under Construction** (i) Whether temperature, elevation and location of the town has been taken into account whiledesigning the process of the STP, Main pumping station wherever required and furnished in DPR - **YES** (j) Whether reasons for inadequate performance of existing STP (if considered in the proposal) havebeen furnished in DPR: **Under Construction**	
4.7	House service connection (sewers) (please justify the proposed requirements) : Existing: **0** nos. Proposed: **102438** nos.	
4.8	Whether the proposed scheme envisages Supervisory Control and Data Acquisition (SCADA) arrangement: -	**YES**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
4.9	Whether modular approach has been adopted to facilitate "addition" units to STP at a future date,whenever required: -	**NO**
4.10	Whether computer Aided Design for sewer network has been furnished in DPR: -	**YES**
4.11	Whether the sewage characteristics of source have been tested by State Public Health Engineering Dept./Pollution Control Board/ MOEF authorized laboratory/ State Govt. authorized laboratory and furnished in DPR Please specify BOD_5: - **250** and SS: -**375**	**YES**
4.12	Whether treated sewage shall conform to the effluent standards notified by the respective SPCB/CPCB/NGT. (The proposal for setting up STP shall be submitted to MPCB for approval prior to construction)	**YES**
4.13	Whether permission and consent has been taken from Irrigation department regarding levels of STP with respect to blue, red and yellow lines as per their latest Government Resolution.	**YES**
4.14	Whether surge analysis using computer software for pumping main has been done and furnished in theDPR	**YES**
4.15	Whether Hydraulic Flow Diagram (HFD) with head loss calculation for STP and layout plan of STP withother components has been furnished in DPR	**YES**
4.16	(i) Whether maps of proposed sewer networks indicating RL, Node no, Link no, for all the zones(Project area) are enclosed with the DPR. (ii)Whether L Sections of the proposed pumping main/ gravity main, have been furnished in DPR	**YES**
4.17	Whether the site of the proposed STP has been located as per that earmarked in the Master Plan of the town	**NO**
4.18	Whether the provision of the land for land acquisition for the Sewage treatment plant, pumpingstations/mains, sewer network, if any, has been made as per 30 years requirement and future expansion in the DPR. (a) Total requirement of land for: STP & SPS	

Sr. No.	Components of Project	Minimum Land Required in Sqm	Location	Mouza	Survey No. / Plot No.	Remarks
1	**SPS-1**	20 M X 25 M = 500 SQM	664493.47 m E, 2031543.37 m N	Wasangaon, Latur	17 / 18	Land acquisition is in progress

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below / If yes, give Page No. / DPR volume reference. If no, reasons thereof
	2 | **SPS-2** | 20 M X 25 M = 500 SQM | 668312.79 m E 2032157.08 m N | Sikandarpur, Latur | 88 / 94 3 | **SPS-3** | 20 M X 25 M = 500 SQM | 667863.04 m E 2038140.39 m N | Latur (Rural) | 329/330 4 | **SPS-4** | 20 M X 25 M = 500 SQM | 662222.08 m E 2039322.29 m N | Warwanti, Latur | 30 5 | **STP -1 - 53 MLD** | 17950 SQM | 667162.52 m E 2031819.47 m N | Kavha, Latur | 72 & 80 6 | **STP -1 - 11.5 MLD** | 8333 SQM | 667660.64 m E 2041867.65 m N | Mahapur, Latur | 155/3 STP :-**2.63 Hectares (Total)** Pumping Stations :-**0.20 Hectares (Total)** (b) Whether land in possession with Implementing Agency **Land acquisition is in progress**	
4.19	Whether Bill of Qualities (BOQ) and cost estimates of individual components of sewerage system prepared as per latest SOR. (a) Schedule of Rates adopted (please specify the year)- **2021 -22 & latest Corrigendum** (b) Whether analysis of rate has been worked out for all the items and appended with DPR: - **YES** (c) Whether Bill of Quantities of individual component has been furnished in DPR - **YES** (d) Whether lump sum provision for any item has been proposed, please specify -**NO**	**YES**
4.20	Whether detailed drawing, estimation & detailed BOQ for ancillary works such as boundary wall / fencing,approach & internal road, external electrification, buildings, water supply & drainage, site development / landscaping etc. has been provided in the DPR	**YES**
4.21	Whether provision for road restoration, if any has been made as per CPWD/ State PWD/ Urban Local Bodynorms	**YES**
4.22	Whether detailed Bar Chart showing implementation schedule has been furnished in DPR	**YES**

Sr. No.	Description	Write 'Yes' or 'No' etc. in the column below If yes, give Page No. / DPR volume reference. If no, reasons thereof
4.23	Whether Operation & Maintenance cost and revenue generation details (O & M Framework – existing & proposed) has been furnished in DPR and whether the scheme is self-sustainable (a) Existing sewage cess / charges (in Rs.) Residential – Commercial – Institutions – Industries –	**YES**
	(b) Proposed sewage cess / charges (in Rs.) Residential – **Rs. 885 / month** Commercial – **Rs. 1000 / Month** Institutions – **Rs. 1200 / Month** Industries -- **Rs. 1500 / Month**	
	(c) Annual O & M cost (Rs. in lakhs) (i) Existing (last 5years) (ii) Proposed – **1538.03 (for Base Year) without GST**	1 | 2 | 3 | 4 | 5 | | | | |
	(d) Annual Revenue (Rs. in lakhs) (i) Existing (last 5years) (ii) Proposed – 11259.98 **(for Base Year)**	1 | 2 | 3 | 4 | 5 | | | | |
4.24	Whether project implementation period of project has been furnished in DPR. Specify the implementation period **2027** year	**YES**

<table>
<tr><th>Sr. No.</th><th>Description</th><th>Write 'Yes' or 'No' etc. in the column below
If yes, give Page No. / DPR volume reference. If no, reasons thereof</th></tr>
<tr><td>4.25</td><td>Whether Service Level Benchmarking has been furnished in DPR. Please furnish SLBs of the proposedproject.
<table>
<tr><th>Indicators</th><th>Benchmark</th><th>After implementationof the project</th></tr>
<tr><td>Coverage of Toilets/Latrines</td><td>100%</td><td>100 %</td></tr>
<tr><td>Coverage of Sewerage Network Services</td><td>100%</td><td>100 %</td></tr>
<tr><td>Collection efficiency of Sewerage Network</td><td>100%</td><td>100 %</td></tr>
<tr><td>Adequacy of Sewage Treatment Capacity</td><td>100%</td><td>100% (for Intermediate Stage)</td></tr>
<tr><td>Quality of Sewage Treatment</td><td>100%</td><td>100%</td></tr>
<tr><td>Extent of Reuse and Recycling of Sewage</td><td>20%</td><td>20 %</td></tr>
<tr><td>Extent of cost recovery in waste water management</td><td>100%</td><td>70%</td></tr>
<tr><td>Efficiency in redressal of customer complaints</td><td>80%</td><td>80%</td></tr>
<tr><td>Efficiency in Collection of Sewage Water Charges</td><td>90%</td><td>90%</td></tr>
</table></td><td>YES</td></tr>
<tr><td>4.26</td><td>Whether Environmental and social problem has been furnished in DPR</td><td>YES</td></tr>
<tr><td>4.27</td><td>Whether all the hard copies of the DPR furnished along with soft copies</td><td>YES</td></tr>
<tr><td>4.28</td><td>Period of completion of the project</td><td>30 Month</td></tr>
<tr><td>4.29</td><td>Whether List of Bench marks provided</td><td>YES</td></tr>
</table>

Signed:

Name:

Designation:

Signed:

Name:

Designation:

CERTIFICATE

LATUR MUNICIPAL CORPORATION

LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR

CERTIFICATE

Certified that the 100% Supervisory check has been exercised in this office and the calculations are found correct.

LATUR MUNICIPAL CORPORATION
LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR
CERTIFICATE

1. Certified that the Latur City Municipal Corporation, Latur has passed the necessary Resolution, approving the Sewerage scheme with all its financial implications vide its Resolution No. **70** Dated **14.02.2023**.
2. Certified for DSR

a) Average lead for various materials i.e., sand, metal, cement etc. for this scheme is indicated below.

Material	Sand	Crush Metal	Rubble	Bricks	Steel	Murum
Lead	100	12	12	Local	Local	12

b) Rates adopted in this scheme are as per **Maharashtra Jeevan Pradhikaran Region** DSR *(2021-22) & Latest amendments* & **Public Works Department's** Schedule of Rates (CSR) *(2022-2023).*

3. Certified that the 100 % check on the arithmetical calculations in this estimate has been exercised in this office and all the calculations are found correct.

4a. Certified that the collection systems are checked for provision of suitable diameter of pipes, types of manholes, Chambers, etc. and correct provisions have been made.

4b. Certified that the Design, Estimates, and Drawings have been checked and found correct.

LATUR MUNICIPAL CORPORATION
LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR

LETTER OF UNDERTAKING

Latur Municipal Corporation, Latur has identified land for proposed **LATUR CITY UNDERGROUND DRAINAGE SCHEME** & Land possession has been initiated by Latur Municipal Corporation. Latur Municipal Corporation has given UNDERTAKING that all required lands will have been taken before tender process.

LATUR MUNICIPAL CORPORATION
LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR
NON-DUPLICATION WORK CERTIFICATE

Certified that the **LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR** is not funded in any other State or Central Government Scheme or through any other source. All the works proposed under this Scheme have not been carried previously hence there is no duplication of works.

LATUR MUNICIPAL CORPORATION
LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR
FLOATING POPULATION CERTIFICATE

Certified that the floating population for **LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR** is as given below and is correct.

For Year 2022 floating population of Latur city is **40000 souls /day.**

LATUR MUNICIPAL CORPORATION
LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR
LENGTH OF ROAD CERTIFICATE

Certified that the length of road in the project area for the **LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR** is as given below and is correct.

Sr. No	Road Type	Length in km
1.	Cement concrete	**@ 197.00**
2.	Tar Road	**@ 225.00**
3.	WBM Road	**@ 140.00**
Total road length in Km		**@ 562.00**

LATUR MUNICIPAL CORPORATION
LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR

PROPERTIES IN LATUR CITY

As per Census record 2011, properties in Latur city were 74557. Based on the Population projection made in approved water supply DPR, it is Certified that the total properties in Latur City may increase up to 1 02,438 property.

PROJECT AT A GLANCE

Sr. No.	Particulars	Details		
1.	Name of Project	**LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR**		
2.	Name of Town, District	**LATUR, DIST. LATUR**		
3.	Class of Town	**CLASS – D, MUNICIPAL COPORATION**		
4.	Project Funded Under	**AMRUT 2.0**		
5.	Project Cost (In Crores)	**909.49 Cr.**		
6.	Financial Pattern (In Crores)	**GOI Share (33.33 %)**	**ULB Share (30.00 %)**	**Total**
		GOM Share (36.67 %)		**100 %**
7.	Cost Per Capita (Initial Stage)	**Rs. 17285 / Capita**		
8.	Cost Per Capita (Ultimate Stage)	**Rs. 11506 / Capita**		
9.	Town Location	a. Latitude = **18°23'56.43"N**		
		b. Longitude = **76°34'26.15"E**		
10.	Population as per Census	Year 1981 = **111986 Souls**		
		Year 1991 = **197408 Souls**		
		Year 2001 = **299985 Souls**		
		Year 2011= **382940 Souls**		
11.	Total No of Wards	**62 nos.**		
12.	Area of Town	**32.42 Sq. Km.**		
13.	Total Nos. of Household-2011	**74557 H.H.**		
14.	Present Water Supply Scenario	**135 LPCD Domestic + 23.56 LPCD Other**		
15.	Rate of Water Supply	**135 LPCD Domestic + 42.38 LPCD Other**		
16.	Present Sewerage Treatment Scenario	**No treatment (32 MLD STP Under Construction)**		
17.	Probable period of execution and its date of completion of the proposed project	**36 Months (MAR – 2027)**		
18.	Population Forecast	Year 2027 = **526166 Souls (Initial Stage)**		
		Year 2042 = **659006 Souls (Intermediate Stage)**		
		Year 2057 =**790459 Souls (Ultimate Stage)**		
19.	Sewage Generation (Including Infiltration)	**77.53 MLD (Initial Stage)**		
		96.38 MLD (Intermediate Stage)		
		115.03 MLD (Ultimate Stage)		
20.	Sewerage Zone /Sewer Districts	**4 Zones**		
21.	Sewer Network Length in Km.	**Type of Material** **Zone I – 146.11 Km (Up to 250 mm dia. HDPE DWC Pipe above 250 mm RCC NP3 & NP 4)** **Zone II - 185.65 Km (Up to 250 mm dia. HDPE DWC Pipe**		

Sr. No.	Particulars	Details
		above 250 mm RCC NP3 & NP 4) Zone III – 204.14 Km (Up to 250 mm dia. HDPE DWC Pipe above 250 mm RCC NP3 & NP 4) Zone IV- 28.63 Km (Up to 250 mm dia. HDPE DWC Pipe above 250 mm RCC NP3 & NP 4) Total Length – 564.53 Km (Up to 250 mm dia. HDPE DWC Pipe above 250 mm RCC NP3 & NP 4)
22.	No of Property Connections	**102438 HSC Connections**
23.	Zone wise ManholeDetails	**Zone I – 4490 No. (Brick Manhole up to 5 M Depth), 112 Nos. (RCC Manhole above 5 M depth), 83 Nos. (RCC Manhole along Nalla) Zone II – 5930 No. (Brick Manhole up to 5 M Depth), 85 Nos. (RCC Manhole above 5 M depth), 0 Nos. (RCC Manhole along Nalla) Zone III – 6091 No. (Brick Manhole up to 5 M Depth), 211 Nos. (RCC Manhole above 5 M depth), 97 Nos. (RCC Manhole along Nalla) Zone IV – 823 No. (Brick Manhole up to 5 M Depth), 97 Nos. (RCC Manhole above 5 M depth), 63 Nos. (RCC Manhole along Nalla) Total No of MHs – 17334 No. (Brick Manhole up to 5 M Depth), 505 Nos. (RCC Manhole above 5 M depth), 243 Nos. (RCC Manhole along Nalla) Total – 18082 Nos.**
24.	Sewage PumpingStation (SPS)	**SPS 1- Dia. 10.40 m Depth – 16.110 M Total Depth Below G.L. SPS 2- Dia. 12.90 m Depth – 6.180 M Total Depth Below G.L. SPS 3- Dia. 14.80 m Depth – 6.280 M Total Depth Below G.L. SPS 4- Dia. 4.50 m Depth – 6.960 M Total Depth Below G.L.**
25.	Pumping Main (From to, Material Type, Dia. in mm, Length in km)	**Pumping main** **Pumping main from SPS-1 to STP 53 MLD - 600 mm Dia., L- 3470 M** **Pumping main from SPS-2 to STP 53 MLD - 700 mm Dia., L- 2185 M** **Pumping main from SPS-3 to Colle. Tank - 750 mm Dia., L- 1810 M** **Pumping main from SPS-4 to highest point - 250 mm Dia., L- 3030 M** **Gravity main** **1000 mm dia. DI K-7, L = 3540 M** **700 mm dia. DI K-7, L = 460 M** **450 mm dia. DI K-7, L = 585 M** **300 mm dia. DI K-7, L = 1635 M**

<table>
<tr><th>Sr. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>26.</td><td>Pumping Machinery</td><td>
<table>
<tr><th rowspan="2">S. N.</th><th rowspan="2">SPS</th><th colspan="2">Pump Configuration</th><th rowspan="2">Type of Pump</th></tr>
<tr><th>Capacity</th><th>W + S</th></tr>
<tr><td>1</td><td>SPS -1</td><td>Q=133.82 LPS, H=39.95 M</td><td>(4 W + 2 S)</td><td>Non - Clog Submersible Pump</td></tr>
<tr><td>2</td><td>SPS -2</td><td>Q=204.29 LPS, H=27.17 M</td><td>(4 W + 2 S)</td><td>Non - Clog Submersible Pump</td></tr>
<tr><td>3</td><td>SPS -3</td><td>Q=267.81 LPS, H=33.84 M</td><td>(4 W + 2 S)</td><td>Non - Clog Submersible Pump</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">SPS -4</td><td>Q=29.61 LPS, H=46 M</td><td>(2W + 1 S)</td><td>Non - Clog Submersible Pump</td></tr>
<tr><td>Q=20.85 LPS, H=41.03 M</td><td>(1W + 1 S)</td><td>Non - Clog Submersible Pump</td></tr>
</table>
</td></tr>
<tr><td>27.</td><td>Sewerage Treatment Plant Capacity</td><td>53 MLD & 11.50 MLD</td></tr>
<tr><td>28.</td><td>STP Technology</td><td>SBR (Cyclic Activated Sludge Process)</td></tr>
<tr><td>29.</td><td>Land Required for STP</td><td></td></tr>
<tr><td>30.</td><td>Land Availability for STP (Yes/No, Location)</td><td>YES (For 53 MLD – on Kavha Road, Kavha).
For (For 11.50 MLD – on Mahapur Road, Mahapur</td></tr>
<tr><td>31.</td><td>Effluent Disposable Arrangement</td><td>Disposal in nearby nalla / River</td></tr>
<tr><td>32.</td><td>Electrical Transformer (KVA)</td><td>SPS -1 - 630 KVA
SPS -2 – 630 KVA
SPS -3 – 1000 KVA
SPS -4 – 160 KVA
STP -1 – 1600 KVA (53 MLD)
STP -2 – 400 KVA (11.50 MLD)</td></tr>
<tr><td>33.</td><td>Electrical Transmission Line (Km)</td><td>From substation to SPS -1 – 6 Km
From substation to SPS -2 – 6 Km
From substation to SPS -3 – 6 Km
From substation to SPS -4 – 1 Km
From substation to STP 53 MLD – 6 Km
From substation to STP 11.50 MLD – 6 Km</td></tr>
<tr><td>34.</td><td>Annual Operation & Maintenance Cost (Rs in Lakhs)</td><td>Rs. 1540.68 Lakhs for Base Year
Rs. 31845.25 Lakhs for 15 Years</td></tr>
<tr><td>35.</td><td>Project Preparing Agency</td><td>M/s. Manavseva Consultant, Dhule</td></tr>
<tr><td>36.</td><td>Whether Scheme is prepared as per the guidelines of CPHEEO Manual</td><td>YES</td></tr>
<tr><td>37.</td><td>Details of General Body Resolution(GBR)</td><td>Resolution No 70 Dated 14.02.2023.</td></tr>
<tr><td>38.</td><td>Design Parameters for output effluent discharges (as per NGT order dated 30 April 2019 or as</td><td>
<table>
<tr><th>Sr. No</th><th>Parameter</th><th>Standard</th></tr>
<tr><td>1.</td><td>pH Value</td><td>5.5-9.0</td></tr>
<tr><td>2.</td><td>BOD</td><td>10</td></tr>
</table>
</td></tr>
</table>

Sr. No.	Particulars	Details		
	per any revision)	3.	Total Suspended Solids (TSS)	20
		4.	Chemical Oxygen Demand	50
		5.	Nitrogen Total	10
		6.	Phosphorus – Total (For Discharge into Ponds, Lakes)	1.0
		7.	Fecal Coliform (FC) (Most Probable Number per 100 milliliters, MPN/100 ml)	Desirable 100 Permissible 230

EXECUTIVE SUMMARY

Fifty percent of the Maharashtra state's population stay in urban areas. Therefore, the Government of Maharashtra has decided to implement the Atal Mission for Rejuvenation and Urban Transformation (Amrut) 2.0 in the state for improving the basic services in urban areas. Government of Maharashtra has implemented "AMRUT 2.0 Program" for development & up gradation of infrastructure in Water Supply, Sewerage and Urban Sanitation sector as per Govt. approved standards.

LATUR CITY MUNICIPAL CORPORATION has proposed to implement Sewerage Scheme for Latur city under **AMRUT 2.0**.

Latur City is a city in Latur district in Maharashtra state. It is located in Marathwada region and belongs to Aurangabad Division. Latur city is class "D - Class" Municipal Corporation.

At present there is no regular Sewerage System in the entire town and due to which there is possibility of pollution. Trunk mains from nallas to SPS & 32 MLD capacity STP is under construction stage under AMRUT mission.

Therefore, to capture sewage generated from city area without discharging into nearby nallas. Sewerage system for whole city is necessary and proposed.

Latur City Municipal has authorized M/s. Manavseva Consultant, Dhule for preparation of Detailed Project Report.

The population of town as per census 2011 is **382940**. The projected population for the base year 2027, intermediate year 2042 and design year 2057 are 526163, 659007 and 790452 respectively. Sewage Generation for the immediate year is 96.38 MLD and for design year 115.03 MLD respectively.

Area of town 32.42 sq. km and is divided into 62 wards. Project area is 32.42 sq.km.

City water demand is met from Manjra source and is presently supplied with 135 LPCD. Presently city has 0.00 km of closed drains and 352.00 km of open drains. It has 4 Nos nallas originated from the city.

The road length in city is more than 600 km.

The town is divided in 4 Sewerage zones.

It is proposed to provide SBR based STP.

Estimated cost of proposed Sewerage Scheme is Rs. 909.49 crores.

1. Sewerage System

1.1. Existing Scheme

There is no proper drainage system available in the city. All sewage generated are natural drain or in some area open channel are laid to carry the sewerage from house to the road side drain.

It has been observed that all sewage from city meet in the river which flows from north to south side in western part of town. The present system always gets flooded in rainy season due to insufficient carrying capacity as well as clogging the low line area due to which many natural diseases grown up in areas.

1.2. Storm Water

Storm water is water that originates during precipitation events. Storm water that does not soak in to the ground becomes surface runoff, which either flows directly in to surface waterways or is channeled in to storm drains, which eventually discharge to surface waters.

Storm water is a source of pollution. Pollutants entering surface waters during precipitation events are termed polluted runoff. Daily human activities result in deposition of pollutants on roads, lawns, roofs, farm fields, etc. When it rains or there is irrigation, water runs off and ultimately makes its way to a river, or lake. While there is some attenuation of these pollutants before entering the receiving waters, the quantity of human activity results in large enough quantities of pollutants to impair these receiving waters.

1.3. Proposed Scheme

Necessity of Sewer System

The Latur Municipal corporation do not have their own collection and conveyance network of sewerage system as well as the treatment facility to treat the sewage generated from their own area. 32 MLD STP is now under construction. The Latur Municipal corporation has laid sewage line in some part of area. In some part, the sewage directly mixed with storm water in drains and finally discharge in to the Nallahs in city area. The wells near the Nallah area get contaminated due to sewage which flow along the storm drains and create unhygienic situation in nearby areas of Nallah. So, there is immediate need of proper sewerage system along with the treatment facility. So that the water after treatment can be used for non-domestic purpose for beautification in garden area and greenery which will reduce the burden on the water demand.

Table 1: shows Population, Average Sewage Flows for 2027, 2042 and 2057

Sr. No.	Description	Base	Intermediate	Ultimate
1.	Year	**2027**	**2042**	**2057**
2.	Population	526166	659006	790459
3.	Waste Water in MLD	**77.53**	**96.38**	**115.03**
	Say, MLD	**77.50**	**96.50**	**115.00**

Project cost

LATUR MUNICIPAL CORPORATION		
Project Name : Underground Sewerage Scheme for Latur City		
RECAPITULATION SHEET		
SR. NO.	**SUBWORK**	**TOTAL COST (Rs.)**
	CIVIL WORKS	
1	**WORKING SURVEY**	**39,33,908**
2	**COLLECTION AND CONVEYANCE SYSTEM**	
A	**Zone I**	
	200 mm - 900 mm Dia., Total Length - 146.11 Km	**1,25,28,31,283**
B	**Zone II**	
	200 mm - 1000 mm Dia., Total Length - 185.65 Km	**1,51,72,94,725**
C	**Zone III**	
	200 mm - 1100 mm Dia., Total Length - 204.14 Km	**1,89,82,28,968**
D	**Zone IV**	
	200 mm - 400 mm Dia., Total Length - 28.63 Km	**28,16,19,767**
3	**SEWAGE PUMPING STATION**	
A	**Zone - I**	
a	Sewage Collection Sump/Wet Well - 10.4 M Dia., 16.11 m Depth	**1,01,93,407**
b	Sewage Pump House - 10.4 M Dia. & Ht. -5.5 M	**29,34,990**
B	**Zone - II**	
a	Sewage Collection Sump/Wet Well - 12.9 M Dia., 6.18 m Depth	**70,04,219**
b	Sewage Pump House - 12.9 M Dia. & Ht. -5.5 M	**36,36,314**
C	**Zone - III**	
a	Sewage Collection Sump/Wet Well - 14.8 M Dia., 6.28 m Depth	**83,78,188**
b	Sewage Pump House - 14.8 M Dia. & Ht. -5.5 M	**43,76,757**
D	**Zone - IV**	

a	Sewage Collection Sump/Wet Well - 4.5 M Dia., 6.96 m Depth	21,97,028
b	Sewage Pump House - 4.5 M Dia. & Ht. -5.5 M	10,51,816
4	**SEWAGE PUMPING MAIN**	
a	**Pumping main from SPS-1 to STP 53 MLD - 600 mm Dia., L- 3470 M**	5,93,54,541
b	**Pumping main from SPS-2 to STP 53 MLD - 700 mm Dia., L- 2185 M**	4,94,32,442
c	**Pumping main from SPS-3 to Colle. Tank - 750 mm Dia., L- 1810 M**	4,62,10,720
d	**Pumping main from SPS-4 to highest point - 250 mm Dia., L- 3030 M**	2,02,85,287
e	**Gravity main from Highest point to Collection Tank - 300mm dia., L- 1635 M**	1,48,12,820
5	**GRAVITY MAIN**	
a	**Collection Tank**	55,07,005
b	**Gravity Line to STP**	
i	**1000 mm dia. DI K-7, L = 3540 M**	
ii	**700 mm dia. DI K-7, L = 460 M**	
iii	**450 mm dia. DI K-7, L = 585 M**	13,70,25,466
6	**SEWAGE TREATMENT PLANT**	
a	**STP 2 for (Zone I & II) - 53 MLD**	56,47,87,576
b	**STP 2 for (Zone III & IV) - 11.5 MLD**	17,19,40,465
7	**ALLIED WORKS**	
a	Approach Road -100 M for 53 MLD STP	8,71,621
b	Approach Road -500 M for 11.5 MLD STP	43,58,104
c	Staff Quarter at 53 MLD STP	44,24,846
d	Compound Wall for 11.5 MLD STP	66,65,529
e	Compound Wall for 53 MLD STP	60,64,586
f	Fencing for SPS -1 to 4	12,77,258
g	Road Reinstating Work - For Zone I	32,98,26,146
h	Road Reinstating Work - For Zone II	40,86,91,675
i	Road Reinstating Work - For Zone III	47,74,12,562
j	Road Reinstating Work - For Zone IV	7,81,53,988
k	Flood Protection Wall	1,36,63,502
l	Pipe line along Highway	1,95,37,770
	ELECTRICAL, MECHANICAL & INSTRUMENTATION WORKS	
8	**ELECTRO-MECHANICAL WORKS AT STP & SPS**	

a	Electro-Mechanical Work at SPS -1	**2,28,51,400**
b	Electro-Mechanical Work at SPS -2	**2,42,30,900**
c	Electro-Mechanical Work at SPS -3	**3,21,05,400**
d	Electro-Mechanical Work at SPS -4	**1,24,39,600**
e	Electrical Connection at SPS -1 -4	**4,85,22,300**
f	Electrical Connection at STP 1 & 2	**3,05,13,200**
g	SCADA for SPS -1 to 4	**55,78,000**
h	Coarse Screen & Isolation Gates for SPS 2 to 4	**2,08,57,359**
i	Jetting Machine (4 Nos.)	**1,29,40,560**
9	**TRIAL & RUN FOR 6 months**	**63,04,397**
	TOTAL NET PROJECT COST (A)	**7,63,03,28,395**
	Insurance Charges (b) 1%	1,48,26,003
	Technical Scrutiny Charges (c) 1%	7,63,03,284
	Add for GST 18.00%	1,37,34,59,111
	TOTAL PROJECT COST(TPC) IN RS. (B)	**9,09,49,16,793**
	TOTAL PROJECT COST(TPC) IN RS. LAKHS	**90,949.17**

1.4. Project Cost analysis

The project cost analysis has been worked out for the amount of Rs. **90,949.17** lakh.

1.5. Per Capita Cost

The cost per capita has been worked out considering for the Base year and projected population for the intermediate stage year and ultimate stage year.

Sr. No.	Particulars	Base Year	Intermediate Stage	Ultimate Stage
1.	Year	2027	2042	2057
2.	Population	**526163**	**659007**	**790452**
3.	Cost of Project (Rs. in Lakh)	**90,949.17**	**90,949.17**	**90,949.17**
4.	Per Capita Cost based on Project Capital Cost (in Rs.)	17285	13801	11506

1.6. Cost as per Km of Sewer Length

The cost per length of sewer in km has been worked out considering the total length of collection and conveyance system in whole project area.

Project Cost		Total Length in Km	Cost per meter in Rs.
Rs. in Lakh	In Rs.		
90,949.17	**9,09,49,16,793**	564.53	16110.60

1.7. Sensitivity Analysis

A) Energy Consumption

It is observed that major expenditure of annual operation and maintenance of sewage treatment plant is incurred on the electricity consumption.

B) Benefit Cost Ratio

The Benefit Cost ratio based on the discounting factor of 10% is worked out to **1.08** after considering taxation. This will be further increased if more recycled water is sold for other purposes after enhancing rates for sale of water. The IRR calculation shows that the rate is arrived at **15%** is found to be reasonable considering a period of 15 years for sewerage schemes. This will be further increased if recycled water is sold for irrigation purposes.

C) IEC Strategy for Sustainability of Scheme

The project has to be publicized through the mass media, including local newspapers, radio stations, and TV channels so that the public will be aware of the benefits that will be derived from the project.

D) Capacity Building

In order to train the operative and supervising staff training is required in the form of in house or visiting the field site and operating the equipment or actual carrying out testing in laboratory for which module will be chalked out.

E) Internal Rate of Return (FIRR)

The financial analysis is carried out based on certain assumptions.

F) Monitoring and Evaluation

The Executing Agency and the Implementing agencies will take full responsibility for the internal monitoring to ensure that the project complies with requirements.
An independent monitoring agency will be engaged by the Executing Agency through competitive tendering to undertake supervision, monitoring, and evaluation for the project if found essential.

G) Economic Assessment

The total Capital cost is estimated at **Rs. 90,949.17 Lakh.** The benefit of the project will raise the people's living standards by maintaining good service level, improving the sanitation system improving the health of the people and assuring the good services to the Latur city area and fringe area.

1 INTRODUCTION

1. BACKGROUND OF THE PROJECT

1.1 General

Latur is a city in Maharashtra state, India and is one of the largest cities of the Maharashtra region. It is the administrative headquarters of Latur district and Latur Taluka. The city is a tourist hub surrounded by many historical monuments, including Udgir Fort and Kharosa Caves. The people in Latur are called Laturkar. The most spoken language in Latur is Marathi. The city's quality of education attracts students from all over Maharashtra.

Latur district has an ancient historical background. The King 'Amoghvarsha' of Rashtrakutas developed the Latur city, originally the native place of the Rashtrakutas. The Rashtrakutas who succeeded the Chalukyas of Badami in 753 A.D called themselves the residents of Lattaluru. The ancient name for Latur. Ratnapur is also mentioned as an historic name for Latur. After Indian independence and the Indian annexation of Hyderabad, Osmanabad became part of Bombay Province. In 1960, with the creation of Maharashtra, Latur became part of one of its districts. On August 16, 1982, a separate Latur district was carved out of Osmanabad district.

1.2 Geography and climate

Latur is situated 636 meters above mean sea level, on the Balaghat plateau, near the Maharashtra-Karnataka state boundary.

1.3 Temperature

Temperatures in Latur range from 13 to 41° C, with the most comfortable time to visit in the winter, which is October to February. The highest temperature ever recorded was 45.6° C. The lowest recorded temperature was 2.2°C. In the cold season the district is sometimes affected by cold waves in association with the eastward passage of western disturbance across north India.

1.4 Rainfall

Most of the rainfall occurs in the monsoon season from june to September. Rainfall varies from 9.0 to 693 millimetres per month. Average annual rainfall is 725 millimetres.

1.5 Topography

Latur is in the Marathwada region, the southeast part of Maharashtra State. Parbhani is

located towards the north of the district, Nanded on its northeast, Bidar (Karnataka State) on the east and northeast, Osmanabad towards its south and west and Beed district towards its southeast.

1.6 Demography

The Latur City Municipal Corporation is divided into 62 Ward for which elections held every 5 years. As per the population Census 2011, the total population of LMC is 3,82,940 of which 1,97,737 are males while 1,85,203 are females with total 74,557 families residing.

WARD WISE POPULATION AS PER CENCUS 2011			
SR. NO.	**WARD NO**	**POPULATION AS PER CENCUS 2011**	**NUMBER OF HOUSEHOLDS**
1	**2**	**3**	**4**
1	1	8332	1723
2	2	8137	1553
3	3	3950	587
4	4	8299	1511
5	5	8347	1666
6	6	4835	936
7	7	6831	1289
8	8	9235	1762
9	9	3594	630
10	10	3457	646
11	11	4711	896
12	12	9360	1594
13	13	7499	1389
14	14	3503	640
15	15	5508	966
16	16	4469	776
17	17	4559	715
18	18	3718	680
19	19	6062	1175
20	20	6708	1361
21	21	9606	2014
22	22	6925	1337
23	23	5597	1174
24	24	5735	1194
25	25	6046	1212
26	26	5818	1136
27	27	4441	864
28	28	3859	671
29	29	4918	959
30	30	5093	941
31	31	3591	664
32	32	3637	732

33	33	5075	903
34	34	9487	1637
35	35	3739	650
36	36	4335	743
37	37	9117	1719
38	38	6796	1235
39	39	3944	744
40	40	5290	994
41	41	3465	689
42	42	4211	850
43	43	5008	1048
44	44	5667	1176
45	45	6340	1261
46	46	9057	1803
47	47	2680	549
48	48	15804	3316
49	49	7216	1427
50	50	8905	1866
51	51	5440	1129
52	52	5896	1288
53	53	4706	1032
54	54	5590	1205
55	55	7654	1624
56	56	8215	1697
57	57	6012	1247
58	58	6607	1259
59	59	4149	844
60	60	9270	1815
61	61	8764	1733
62	62	8121	1681
	Total	**382940**	**74557**

1.7 Scope of Work

Preparation of DPR etc.

Sr. No.	Particulars
1.	Data Collection and Preparation – Population Projection for the horizon Years 2027, 2042, 2057
2.	Production of Base Map & Drawings
3.	Surveys & Infrastructure Mapping
4.	Preparation of Auto Cad Drawings

Part - B Project Management and Construction Supervision for Sewerage Scheme

1.1. Objective

- To store and recycle the treated waste water for plantation and gardening purposes in

Latur Municipal Corporation.

1.2. Scope of Study

The broad scope of design & estimation work for the system will comprise.

a) Complete collection system for the, residential / institutional / Hospitals / commercial establishment's waste water and all its components including lift pumping stations if required and connections to the sewage treatment plant.

b) Locate suitable site for sewage treatment plant (STP).

c) Designing various components under SBR.

d) Preparation of detailed BOQ of Civil, Mechanical & Electrical equipment for collection, treatment & disposal of effluent.

1.3. Content of Report

This Detailed Project Report for Sewerage Scheme of Latur Municipal Corporation area" comprises of eight sections (including this section.)

Chapter	Content
1.	Background of the Project (Introduction)
2.	Data Collection & Analysis
3.	Design Approach
4.	Existing Water Supply & Sewerage System
5.	Population Projections
6.	Proposed sewerage system
7.	Proposed Sewage Treatment Plant
8.	Cost of Project
9.	Operation & Maintenance

The Detailed Project Report describes the status of the present water supply, population projections proposed sewerage network, sewage pumping stations and sewage treatment plants required along with various infrastructures and capital investment required, financial pattern, Bar charts, Implementation schedule etc.

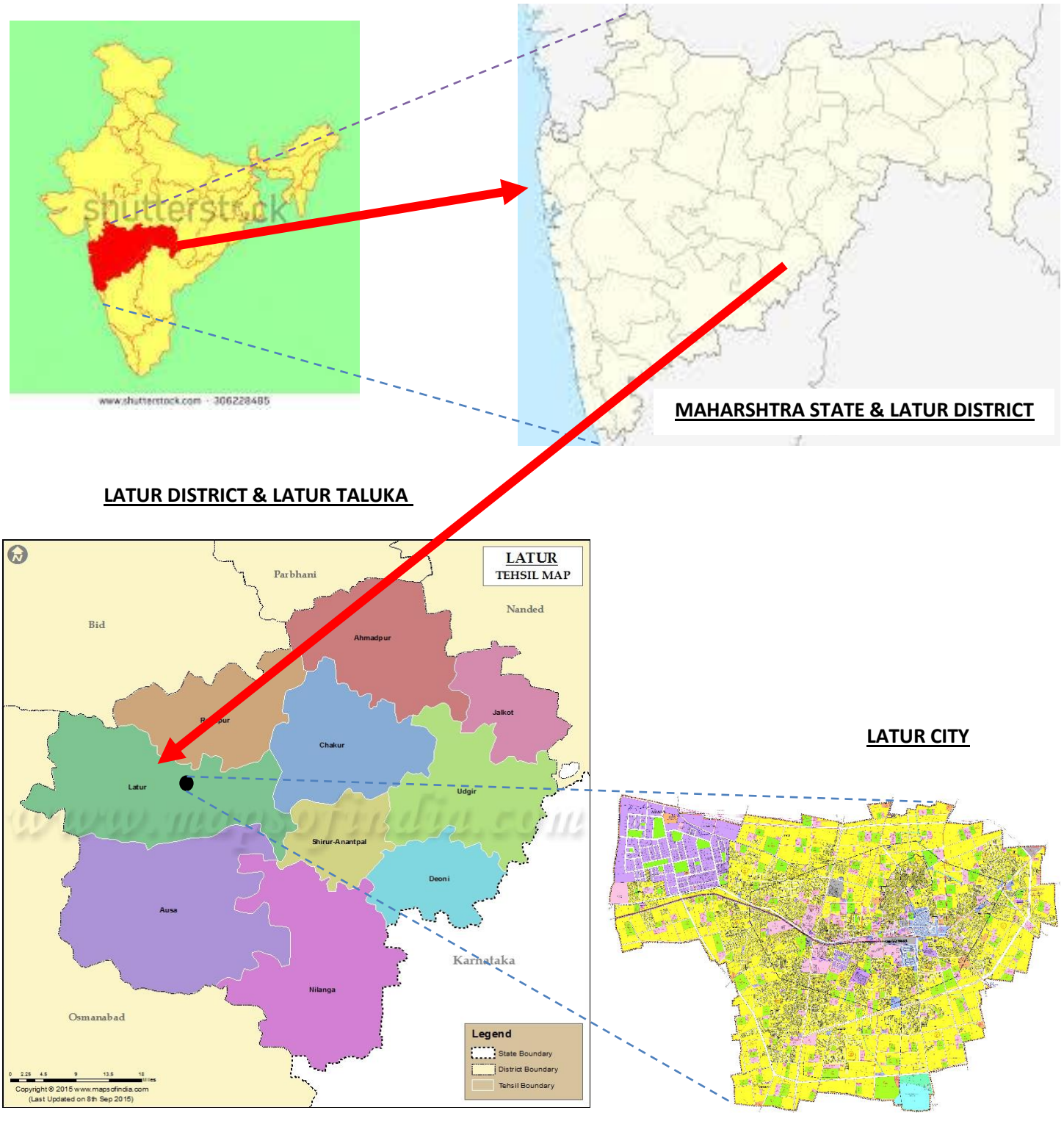


Figure 1-1: Map Showing Location of Latur City (Project Area)

2 DATA COLLECTION & ANALYSIS

2.1 General

Data, Services and Facilities to be provided by Latur Municipal corporation will provide to the consultant access to the records, maps, drawings, reports and other technical data in their possession to assist the consultant in preparation of project report.

The following Maps (hard copy/soft copy) were collected from LMC.

Sr. No.	Description of Maps	Nos.
1.	Proposed Development plan of Latur city	1

2.2 Data Collection and Preparation

a) Production of Drawings

b) Reviewing of the DP maps available with LMC

2.3 Detailed Scope of Work, Approaches and Methodology

There are three distinct stages in this study:

Part – I

Data Collection,

Survey, Geo-technical Investigations**,**

Population Projection

Part - II - Sewerage System Component

Preparation of Inception Report/Base Study Report and DPR.

Comprising of Sewerage system, pumping stations, Pumping main Pumping Machinery and SBR process and final disposal.

2.4 System Planning Criteria

The consultant shall formulate a set of system planning criteria and provide their justification. These criteria shall include, inter alia, hydraulic flow criteria, sewer depth and location, structural codes, sewer pipe and service connection materials selection by size range and so forth. These criteria shall be formulated with particular regard to above paras.

2.5 Population Forecasting

The population forecast need to be done by adopting different standard methods mentioned in the latest manual on water supply and treatment by CPHEEO, duly justifying the particular method of population projection adopted thereon.

Collection of the area-wise population (as per the census from 1981 onwards) for the future horizon year 2027, 2042, & 2057.

The consultant shall assess information and trends of population, future development patterns and physical plans to provide a basis for projecting the future population growth. The consultant is required to prepare decade-wise population density plans, block and area wise and also for the future projected populations for the different horizon years 2042 and 2057.

The Consultant shall review the Master Plan Reports if prepared by the LMC in projecting the sewage flows/ expected for the different horizon years. The consultant shall present any prime facie comments on the contents of these reports to the above extent in the Inception Report- Work Plan required by the TOR.

In short, the population forecasting shall be done considering past record and probable future developments.

2.6 Topographic Survey

Field Surveys whenever necessary shall be carried out for the sewerage in a manner consistent with the following Para. The alignment location of utility infrastructure sewers and their appurtenances shall be determining or confirmed by physical survey.

The leveling surveys, for the determining of contours and for defining the elevation of sewerage and structures, shall be carried out with reference to the Great Trigonometric Survey (G.T.S).

2.7 Collection System

The designing and sizing of the sewer pipeline and hydraulic characteristics shall conform to CPHEEO manual. The minimum number of zones/ shall be formed/planned after detailed survey and investigations. The several alternative pipe materials would, in the opinion of the consultant, be technically suitable for use the sewer shall be addressed in detail.

2.8 Local Collection System Analysis

(Including Minor Pumping Stations and Force Mains)

Using the conclusion of the analysis conducted the consultant shall conduct an analysis of the local sewage collection system for each "District" of the project area. This analysis shall include all the collection sewers which are not included in the trunk system analysis. From this analysis, the consultant shall formulate conclusions and recommendations, as to a phased programmed of works to strengthen the existing local sewage collection system wherever existing, including the replacement of any existing piping which is of smaller diameter than the minimum recommended for use in the future to meet the expected sewage collection system requirements in the horizon years 2042, & 2057.

The consultant shall deduce appropriate sewage flow criteria to be employed in the evaluation of the adequacy of existing system components wherever existing and in the Planning and design of the system. Strengthening improvements found to be required thereon and also for formulation of sewerage system where not existing for the entire project area. These criteria reviewed shall include flows for various defined classes of each of domestic, institutional, commercial consumers the factors for seasonal and hourly demand variations, the allowances for those extraneous flows which cannot be economically excluded including ground water infiltration.

2.9 Sewage Lift Station

Site and layout drawings, description and dimensioned sketch drawings of the proposed works including flow measuring / totaling /indicating/ recording apparatus raw sewage and treated effluent characteristic, monitoring apparatus, chemical use, monitoring and recording apparatus details of any land acquisition requirement and so forth.

Minimum number of sewage lift stations shall be planned and the same shall be located such that more than one zone can be collected.

2.10 Trunk Collection Force Mains, Interceptors, Outfalls, Analysis

On the basis of the information and undertaken, the consultant shall undertake an analysis of the entire collection and interceptor systems for the project area.

The works includes the formulation of conclusions and recommendations as to a phased

program of works to strengthen the trunk system such as to meet the expected trunk system distribution requirements in the horizon years 2042, 2057. The analysis shall determine the capacity, size and location of the works recommended and shall include determination of the reasonable prospect of availability of land where this is indicated to be required plan and profiles with manhole, invert levels, ground levels and other appurtenance locations identified the length and diameter (s) of the works and pipe material choice (s) classification of soils, water table details at subway crossings, details of any land acquisition requirement and so forth.

The analysis shall take in to account the upland areas to arrive the flows, sizes of sewers inverts levels etc. The consultant also should keep in view that once the trunk and main sewers are laid the same should be able to receive & convey the ultimate sewage flows generated in the sewerage project area once the water demand for saturation population is met with i.e. the trunk and main sewer system once laid cannot be duplicated or re-laid in future due to rapid growth of urbanization in the sewerage project area. Techno Commercial Analysis of pipe material shall be carried out considering climatic conditions and other details.

2.11 Sewage Treatment Assessment

The consultant shall evaluate the sewage treatment technology assessment and work out the economics in disposing the said sewage collected i.e., by installing separate sewerage treatment plant with locations depending upon the availability of land.

2.12 Environmental Economic Impact

Environment: Pollution is the introduction of contaminants in to a natural environment that causes instability, disorder, harm or discomfort to the ecosystem i.e., physical systems or living organisms. Pollution can take the form of chemical substances or energy, such as noise, heat, or light. Pollutants, the elements of pollution, can be foreign substances or energies, or naturally occurring; when naturally occurring, they are considered contaminants when they exceed natural levels.

2.13 Cost Estimates and Design

The cost estimate shall be based on MJP SOR/PWD SOR or latest schedule of rates and rate analysis based on market rates. The provision in the cost estimate shall be made for

reinstatement of the road and repairs and replacement of underground utilities which are likely to be damaged during course of execution.

The consultant is required to produce sound final detailed design calculations, final detail drawings, detailed quantities with full item-wise description, cost estimates with detailed specifications, detailed rate analysis with details of each item for the rates adopted with supporting quotations for market rates and with data prepared thereon in arriving the said rates for each item for all the works identified in the works identified in the conceptual design report for the horizon year 2057.

The final design drawings and cost estimates for main trunk interceptors and fall sewers and force mains for the horizon years 2057 shall include drawings details, crossings, stream crossings along the pipeline alignment which shall show nearby roadways, footpaths, drains and all other utilities.

2.14 Summary of Owner's Conceptual Design

Approach paper describing the owner's concept of the objective of the proposed work, method of implementation, the battery limits, the permitted variations, the contractor's obligations to the end product etc.

The body of the report shall give Inter alia for each element a description, preliminary designs; outline specification, preliminary cost estimates.

Detail item wise specifications which describe the owner's concept fully and his expectations from the contractor.

A summary of the land acquisition requirements w.r.t. the various system elements

A summary of data and analysis supporting the conclusions and recommendations shall be prescribed annexure in the report, which is appropriately reflected in the body of the main text.

2.15 Basic Schedule of Rates

The Standard Schedule of Rates (Year 2021-22) of MJP & PWD 2022-23 shall be made applicable along with the specifications. The rates of item will be rescaled to bring it to current year. For non-schedule items, analysis shall be worked out by consultants and rates shall be finalized in consultation with LMC.

The provision in the cost estimate shall be made for reinstatement of the road and repairs

and replacement of underground utilities which are likely to be damaged during course of execution.

2.16 Implementation Schedule

The implementation Schedule is prepared giving reasonable time for activities such as land acquisition, preparation of working plans and estimates, tendering evaluation of offers and the construction period which is normally considered as **3.0** Years.

2.17 Bar Chart

In order to watch the progress of work with specific purpose of taking steps to accelerate the pace of work and also to ensure that progress on any particular component Bar Chart is prepared. This would ensure early utilization of the investment. The various activities involved are therefore identified based on the realistic program for execution.

3 DESIGN APPROACH

3.1 Design Year

The year 2027 AD has been considered as base year. Year 2042 and 2057 been considered for arriving at intermediate and ultimate stage designed capacities respectively.

The various existing project components shall be checked for the design period as noted below:

Collection system	-	30 years
Pumping Mains & Statio	-	30 years
Pumping Machinery	-	15 years
Sewage Treatment Plant	-	15 years

3.2 Design Flow

The rate of water supply is considered as **177.38** LPCD (considering all water demands). The sewage is considered at 80% of the rate of water supply (141.91 LPCD) with infiltration rate as per CPHEEO manual5000 liters/km/day gives total sewage generation for various stages.

3.3 Waste Water Characteristics

Organic load (BOD) of the waste water is taken as 200 to 250 ppm for rural domestic waste. The effluent BOD shall be less than 10 ppm as per standards for discharging it in the natural water course.

Sr. No.	Description	BOD	TSS
1.	For disposal in to moving water body, where there is an intake downstream	10	10
2.	For Disposal in to stagnant water body	10	10
3.	For disposal in to moving water body, where there is no intake down stream	10	30
4.	For disposal on land	20	30
5.	For Disposal in to sea	20	30

3.4 Peak Factor

The ratio of maximum to average flow called peak factor depends upon the contributory population of the drain. This factor is used for the determination of the flow during peak hours and is considered as follows:

Sr. No.	Population	Peak Factor
1.	For population up to 20,000	3.0
2.	20,000 to 50,000	2.5
3.	50,000 to 7, 50,000	2.25
4.	Above 7, 50,000	2.00

3.5 Design of Sewer

Collection & Conveyance system has been designed for 30 years i.e., for the flow of 2057 A. D.

A) The Manning's formula is used considering open channel flow

$V= (1/n \times R^{2/3} S^{1/2})$, for circular conduits

$V= (1/n) \times (3.9688*10\text{-}3) \times D^{2/3} \times S^{1/2}$ and

$Q= (1/n) (3.118 \times 10^{-6}) \times D^{8/3} \times S^{1/2}$

Where,

Q = Discharge in lps

S = Slope of hydraulic gradient

D = internal dia. of pipe line in mm

R = hydraulic radius in m

V = velocity in mps

N = Manning's coefficient of roughness

Sr. No.	Type of Material	Condition	n
1.	Cement Concrete Pipes	Good	0.013
2.	Stone Ware Pipes	Good	0.013
3.	Plastic Smooth	Good	0.011

Maximum depth of flow in sewer not to be exceeded 0.8 D. Minimum velocities to be ensured for peak flow = 0.6 m / sec.

3.6 Design Methodology & Analysis of Sewerage Network

Population distribution has been carried out on present and projected density and same have been distributed per manhole in the area of layout. Special consideration is given to the areas where high rise buildings exist and areas where such type of high-rise buildings are expected in future. Per manhole increase of flow has been calculated and for each sewer section, present average flow, present peak flow, projected average flow, projected peak flow and full flow have been calculated and applied as basic data of hydraulic design of sewer sections of

entire network. Network has been prepared as per actual survey work.

The hydraulic analysis of all sewer sections as collection system has been carried out using Software Sewer Gems Programming.

3.7 Determination of Flows

Having decided on the location of the pumping station, its purpose and the contributory area, the next stage is to calculate average and peak flows for the present day and a point in the future at a set "design horizon'. Whilst in the structural sense, concrete structures are designed for 30-50 years; they are normally sized to deal with the peak flow at a 30-year horizon.

3.8 Minimum Pipe Size

The interceptor sewers and secondary sewers have been designed considering the minimum size of sewer as 200 mm dia. is proposed (as per CPHEEO Manual). The minimum diameter may be adopted as 200 mm for cities having present / base year population over 1 lakh, However, depending on growth potential in certain areas even 150 mm diameter can also be considered.

3.9 Sizing of Pipes and Slopes

The size of pipes and slope is calculated considering flow contributory population with an infiltration flow at 5000 Lit/km/day based on the contributory area and the projected population of the respective area for the design horizon year 2057. The pipe diameter is selected by considering (d/D) ratio of 0.8 (80% bore utilization). The corresponding flattest slope is provided so as to achieve the minimum required self-cleaning velocity with an aim to minimize sewer depth thus ensuring reduced cost.

3.10 Minimum Depth of Cover

The minimum depth of cover of 0.9 m has been considered. The actual depth of cover shall vary, as most of the sewers are planned on proposed roads. While finalizing the depth of initial manhole, care shall be taken so that the secondary sewer lines, when laid, shall be connected to these priority main intercepting sewers.

3.11 Coefficient of Roughness

As pipes deteriorate with age, a roughness coefficient is considered for the design period

assuming fair condition in sewers. The roughness coefficient N is considered the same for all diameters when flowing full and as follows for fair condition.

3.12 Design Capacity of Sewers

Sewers are designed to carry estimated peak flows generated in the design years and will run 80% full at ultimate peak flow as per Page 49, clause 3.4.2.6 of CPHEEO Manual. This is to ensure proper ventilation and prevent simplicity.

3.13 Self-Cleansing Velocities

To ensure that deposition of suspended solids does not take place, self-cleansing velocities using appropriate formula is considered in the design of sewers. The velocity required to transport material in sewers is mainly dependent on the particle size and specific weight and slightly dependent on conduit shape and depth of flow.

The specific gravity of grit was usually in the range of 2.4 to 2.65. As per the above formula, for a minimum velocity of 0.5 mps, all particles of specific gravity 2.685 and size less than 1.0 mm will remain in suspension. Similarly, particles of specific gravity 1.01 and size less than 160 mm will be in suspension. Hence, a minimum velocity of 0.5 mps should be adequate to prevent siltation in sewers during minimum flow conditions.

When considering typical values of particle size and specific gravity, minimum partial flow velocities of 0.6 mps at present peak flows and 0.8 mps at ultimate peak flows are considered desirable, the minimum velocity of 3.00 mps is considered adequate to prevent scouring, where topography permits steep slopes. This is only a limit which has been defined to prevent scouring.

3.14 Selection of Pipe Material

Selection of (DWC) Pipe

In this project sewer of small sizes 200mm & 250mm dia. (OD) have been considered of "Double wall corrugated (DWC) HDPE pipes being economical and rest of in RCC pipes. DWC high density polyethylene pipes are manufactured in India as per ISO-21138-3 and are being used for sewerage scheme for inherent advantages of polymer material along with design factor that ensures high structural strength to take burial load.

3.15 Selection of RCC Pipe

In underground sewerage systems mainly RCC pipes are used for collection system. RCC pipes shall be considered as per IS 458:1998 (reaffirmed in 2001) and bedding shall be considered as per requirement. NP2 class pipes are not advised for depths greater than 3.0 m and pipes greater than 400 mm dia. from structural point of view. NP3 pipes with medium duty are applicable for medium, traffic and for depths up to 6 m. Pipes other than RCC will be considered case by case in consultation with client. Sewer lining shall be recommended for specific sites and will be considered as constraint with cost option.

3.16 Pipe Bedding

If recommendation comes for HDPE and/or Glass reinforced pipes, we need not to take care of the Pipe bedding. However, in case-to-case basis if RCC pipes (coated with Epoxy lining), the bedding of the pipes will be considered on the factors as listed below:

a) Soil strata
b) Super imposed load
c) Depth of backfill
d) Three edge tests of the pipe

Table 2 : Bedding Factors

Sr. No.	Type of Bedding	Bedding Factor
1.	Granular (GRB)	Up to 1.9
2.	Plain Concrete cradle (PCCB)	> 1.9 & up to 2.8
3.	Reinforced Concrete cradle (RCCB)	> 2.8 & up to 3.4
4.	Complete Concrete Encasement (CCE)	> 3.4

3.17 Manhole Chambers

a) Ordinary Manhole

Circular manholes are considered over. The center-to-center distance of Manholes may be adopted as 30 m even for large diameter sewers for ease of maintenance of sewers. The manhole frame and cover shall be of Steel Reinforced Concrete (SFRC) capable of withstanding heavy-duty loads, conforming to the relevant IS codes. Construction of manholes may be done using sewer bricks conforming to IS 4885.

b) Junction Manhole

Junction manholes are to be provided at all junctions of sewers.

c) Vent Shafts

Vent shafts are normally provided at the beginning of each sewer at junctions and along straight stretches of sewer as per situation for ventilation.

3.18 Sewage Pumping Station

Detention time of sump has been kept as per the latest manual 2013 and minimum dia. of well as 4.5 m considering the space required for pumping installation and working space for operative staff. In that case the detention period will be more considering actual dia. of sump, however these are located at the initial of districts will absorb additional loading in peak hours. Circular type wet well for submersible pumping plant is proposed.

The suction and delivery pipes are designed to have maximum velocities of 2.5 mps. The delivery pipes of pumps are connected with the pumps through tapers.

One number sluice valve and one number non-return valve at delivery side will be provided for each pump and one number sluice valve is provided at the common delivery header.

Medium bar screens in duplicate with a clear opening of 20 to 40 mm in between the bars of manually cleaned type shall be provided before all the wet well. Motor Kw will be selected assuming 65% efficiency of the pump sets.

3.19 Layout

The layout of pumping stations will primarily depend upon the local conditions. In general, it can be said that the layout of a pumping station is logic fit of all functions of the station, with sufficient room to move between machinery for erection and maintenance purposes, but without unnecessary empty spaces either in horizontal plane or in vertical plane. In principle, flow lines shall be as short as possible and no unnecessary bends shall be present in the piping. Spaces are required for the following units.

- Inlet chamber
- Screen chamber
- Main collection sump
- Pump house over the Sump

3.20 Sewage Pumping Machinery

4 nos. of pumps are designed for to cater peak flow of intermediate year are proposed at proposed pumping station. The vertical type of submersible pumps and motors are used. While selecting the pump capacity more attention is given while designing pump sets 6 nos. of pumps are proposed to be installed at pumping stations. The pumps will be arranged to start and stop as the sewage level fluctuate in the well.

3.21 Pumping Main

Waste water collected in the proposed sump is to be transported to directly to the STP through the proposed pumping main/ gravity main. The diameter of the pumping main is determined by taking into account the initial cost of pipeline and cost of operation of pumping for different diameters and of different materials like DI, CI, MS etc. The size of pressure main has been calculated for velocity of 1.1 to 1.5 m/sec for designing peak flows with a maximum velocity up to 3.0 m/sec. Each individual case is studied from various aspects such as operation of pumps, the specified limits, availability of land required for duplicating the main in future, etc. DI pipes as per IS: 8329-1994 is corrosion resistant. DI pipes will be joined by rubber gaskets suitable tyton joints.

3.22 Sewage Treatment Plants

The object of sewage treatment plant is to stabilize the decomposable organic matter present in the sewage so as to produce a treated water which can be stored after chlorination can be used for gardening and plantation etc. The sludge can also be disposed of in the environments which do not pose any problems of health hazards or nuisance to the residents.

Our methodology for sewage treatment design is covered under the following heads:

- Reuse of Treated effluent
- Sewage characteristics
- Treatment options
- Sludge handling
- Environmental Impact Report

3.23 Various Options /Technology

The treatment of waste water is already finalized as SBR as such no options are given for information.

3.24 Raw Sewage Characteristics

Since there is no regular sewerage system in operation in the LMC it will not be possible to arrive at the sewage characteristics directly by collection and analysis of sewage samples. The organic characteristics of the sewage (BOD, SS etc.) will be fixed based on generally accepted figures for their per capita contributions under Indian conditions.

In estimating the overall sewage characteristics, we shall pay special attention to parameters such as dissolved solids which will not be affected by sewage treatment but will have a great influence in deciding the final disposal method for the treated sewage.

3.25 Inlet Parameter

The raw sewage characteristics are assumed as given below:

Sr. No.	Parameter	Range
1.	BODs at 20^0	250 mg/l
2.	SS	350 mg/l
3.	pH	7.2 - 8.0

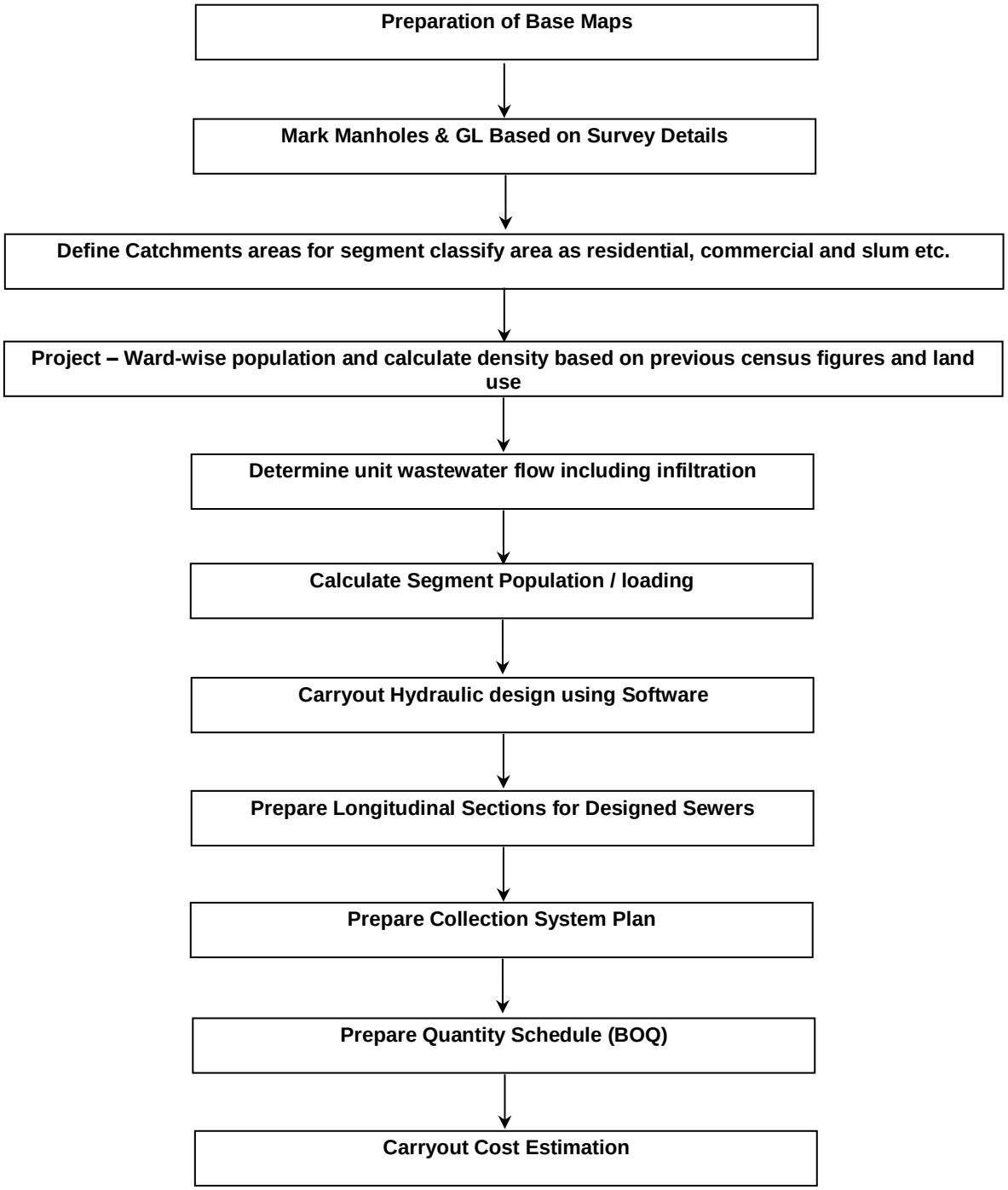
3.26 Outlet Parameter

The outlet parameter of the treated waste water, which is of primarily domestic, as mentioned is as under:

Sr. No.	Parameter	Unit	Permissible limit
1.	Turbidity	NTU	< 2
2.	SS	mg/l	NIL
3.	TDS	mg/l	2100
4.	pH		6.5-8.3
5.	Temperature	C	Ambient
6.	Oil & Grease	mg/l	10
7.	Res Chlorine	mg/l	>1
8.	Total Kjeldhal Notrogen	mg/l	10
9.	BOD	mg/l	10

Sr. No.	Parameter	Unit	Permissible limit
10.	COD	mg/l	As arising
11.	Dissolved Phosphorous	mg/l	2
12.	Nitrate as Nitrogen	mg/l	10
13.	Fecal Coliform	MPN/100ml	NIL
14.	Helminthic Eggs	Count/l	As arising
15.	Color		Colorless
16.	Odor		No foul odor

Flow Chart – Design of Collection System



4 POPULATION PROJECTIONS

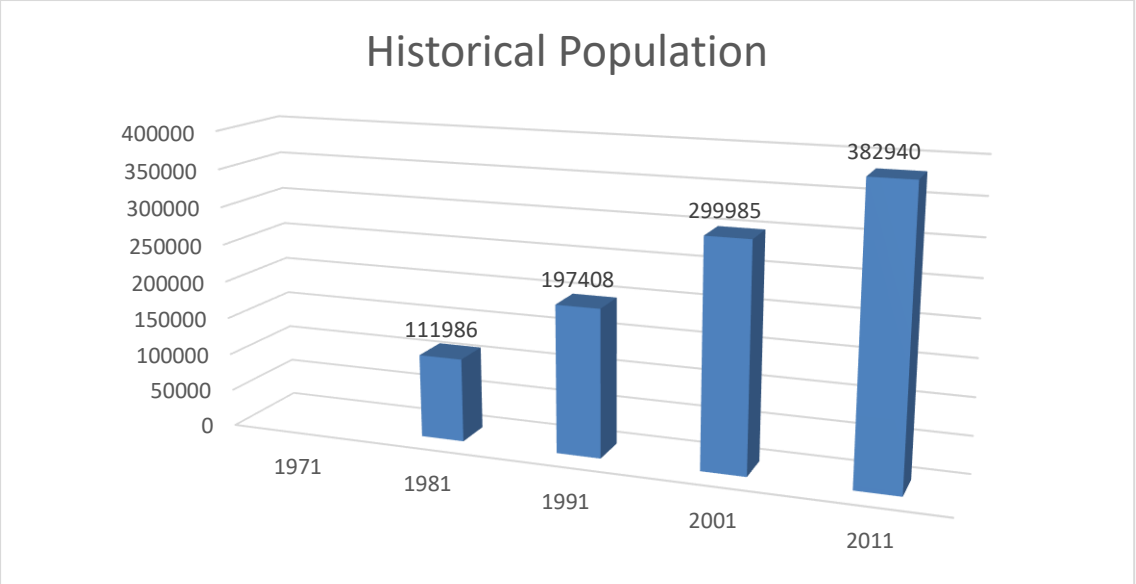
4.1 Census Population

The population of Latur City as per census 2011 is about **382940**. Population of Latur in the past decades from 1981 to 2011 are presented in table 4.1 from census data and density of population is calculated. Bar diagram showing Population **v/s** Census Year is shown in Figure 4.1.

According to the census report, decade wise population of town is as presented in table. The following table also illustrates % Growth per decade for last four years.

Table 4.1: **Historical Population of Latur City**

Year	Area of Town (Sq. Km.)	Population	Increment	Growth rate	Density of Population / Sq. Km.
1981		111986		-	
1991		197408	85422	76.28%	
2001	21.00	299985	102577	51.96%	14285
2011	26.55	382940	82955	27.65%	14423
		TOTAL	**382940**		



From past decadal population it is seen that growth rate of Latur has been decreased from 51.96 % to 27.65% during 2001-2021. The Town is mainly developing in central part of Latur area.

4.2 Methodology Adopted for Population Projection

Population forecasting is carried out by various methods as per the CPHEEO manual for Sewerage and Sewage Treatment. The various methods used for Population Forecasting are as follows.

a) Arithmetical Increase method
b) Geometrical Increase method
c) Incremental Increase method
d) Graphical Method

The population projection methods have been discussed in detail in the following sections.

4.2.1 Arithmetical Progression Method

Arithmetical Increased method is generally applicable to large and old city area. This method generally gives a low value and is suitable for well-settled and established communities.

4.2.2 Geometrical Increase Method

In this method percentage increase is assumed to be the rate of growth and average of the percentage increases is used to find out future increment in population. This method gives much higher value and mostly applicable for growing towns and cities having vast scope of expansion. The % increase in population arrived at by the Geometrical Increase Method is presented in following Table.

4.2.3 Incremental Increase Method

In this method the increment in arithmetical increase is determined from the past decades and average of that increment is added to the average increase. This method increases the figure obtained by the arithmetical increase method.

4.2.4 Graphical Method

In this method the population curve of the project area (i.e., the population vs. Past Decades) is smoothly extended for getting further value. The graph shows the trend line. The computer generates the equation of the trend line by various methods. This equation gives maximum RMS value which shall be selected to arrive at the most logical approximation of the trends of increase in the projected years and is found to be very reliable method.

4.2.5 Population Forecast of Town

Based on decadal populations, the future population has been worked out as per different

prevalent methods such as arithmetical increase, incremental increase, geometrical increase etc. and shown in table 4.3. Considering growth of past decades, development of the town the projected final population has been considered as an average of **arithmetical increase, incremental increase.**

The detailed calculations of the population projection for the city are attached in **Annexure – 2.**

Table 4.1: **Projected Population**

Sr. No.	Year	Arithmetic Increase Method	Incremental Increase Method	Geometrical Increase Method	Average of all	Average of A.I. & I.I.	Projected Final Population
1.	2027	527449	524882	715941	589424	526166	**526166**
2.	2042	662926	655084	1287182	868397	659005	**659005**
3.	2057	798403	782509	2314208	1298373	790456	**790456**

4.2.6 Population Forecast of town as per Water Supply Scheme

Population Projection was carried out by all method mentioned above. As per the guidelines of MJP. Population considered for water supply scheme is finalized for design of scheme. The following population figures are adopted for designing proposed sewerage scheme of LMC.

The Population forecasting considered for water supply scheme is proposed is given in table 4.2.

Table 4.2: **Population Forecast of town as per Water supply scheme**

Year	Population	Stage
2027	526163	Immediate Stage
2042	659007	Intermediate Stage
2057	790452	Ultimate Stage

4.2.7 Population Adopted

Table 4.3: **Population Adopted**

Adopted Population Method	Base Year	Intermediate Year	Ultimate Year
	2027	**2042**	**2057**
	526163	**659007**	**790452**

4.2.8 Population Forecast of wards

Administratively the town has been divided in 12 prabhags and 62 wards. The ward wise population and density of population of the city is presented in the following table 4.4. The Population density in year 2011 has been calculated as area of ward is known.

Table 4.4: **Ward wise Projected Population**

WARD NO.	EQUIVALENT RESIDENTIAL AREA	YEAR 2011		YEAR 2027		YEAR 2042		YEAR 2057	
		POP	DENSITY	POP	DENSITY	POP	DENSITY	POP	DENSITY
1	2	3	4	5	6	7	8	9	10
1	116.25	8332	71.67	11448	98.48	14339	123.34	17199	147.95
2	148.06	8137	54.96	11180	76.00	14003	94.57	16796	113.44
3	128.66	3950	30.70	5427	65.00	6798	52.84	8153	63.37
4	44.11	8299	188.16	11403	190.00	14282	323.82	17131	388.41
5	19.59	8347	426.14	11469	450.00	14364	733.32	17230	879.64
6	29.49	4835	163.97	6643	166.00	8321	282.19	9980	338.45
7	26.00	6831	262.73	9386	271.00	11756	452.15	14100	542.31
8	64.44	9235	143.31	12689	145.00	15893	246.62	19063	295.81
9	8.81	3594	407.83	4938	479.00	6185	701.84	7419	841.87
10	11.98	3457	288.68	4750	308.00	5949	496.78	7136	595.91
11	9.70	4711	485.54	6473	500.00	8107	835.56	9724	1002.22
12	26.31	9360	355.72	12861	425.00	16108	612.18	19321	734.29
13	24.72	7499	303.39	10304	315.00	12905	522.10	15479	626.24
14	19.51	3503	179.53	4813	200.00	6028	308.93	7231	370.58
15	9.59	5508	574.50	7568	600.00	9479	988.68	11369	1185.81
16	7.31	4469	611.15	6140	620.00	7691	1051.76	9225	1261.54
17	7.78	4559	586.37	6264	600.00	7846	1009.13	9411	1210.42
18	45.19	3718	82.28	5109	129.00	6398	141.59	7675	169.85
19	18.31	6062	331.03	8329	336.00	10432	569.67	12513	683.30
20	17.94	6708	373.97	9217	381.00	11544	643.57	13847	771.96
21	80.37	9606	119.53	13199	147.00	16531	205.69	19828	246.72
22	201.04	6925	34.45	9515	41.00	11917	59.28	14294	71.10
23	29.67	5597	188.66	7690	190.00	9632	324.67	11553	389.42
24	28.04	5735	204.55	7880	207.00	9869	351.99	11838	422.22
25	27.69	6046	218.33	8307	222.00	10405	375.73	12480	450.66

26	9.31	5818	624.75	7994	630.00	10012	1075.11	12009	1289.56
27	23.88	4441	186.01	6102	219.00	7643	320.13	9167	383.96
28	29.46	3859	130.98	5302	162.00	6641	225.41	7966	270.38
29	16.29	4918	301.95	6757	388.00	8463	519.60	10152	623.30
30	18.61	5093	273.63	6998	400.00	8765	470.92	10513	564.84
31	7.01	3591	512.27	4934	690.00	6180	881.60	7412	1057.35
32	8.06	3637	451.10	4997	639.00	6259	776.31	7507	931.10
33	7.03	5075	722.42	6973	730.00	8734	1243.27	10476	1491.25
34	47.28	9487	200.66	13035	223.00	16326	345.30	19583	414.19
35	8.78	3739	426.10	5137	450.00	6434	733.22	7718	879.54
36	9.17	4335	472.87	5956	480.00	7460	813.74	8948	976.06
37	101.82	9117	89.54	12527	117.00	15690	154.10	18819	184.83
38	10.39	6796	654.25	9338	680.00	11695	1125.87	14028	1350.47
39	26.63	3944	148.10	5419	200.00	6787	254.86	8141	305.71
40	35.26	5290	150.02	7269	300.00	9104	258.18	10919	309.65
41	15.56	3465	222.65	4761	319.00	5963	383.16	7152	459.57
42	27.58	4211	152.70	5786	216.00	7247	262.79	8692	315.18
43	16.74	5008	299.21	6881	325.00	8618	514.89	10337	617.60
44	18.24	5667	310.73	7787	350.00	9752	534.72	11698	641.43
45	15.34	6340	413.37	8711	421.00	10911	711.39	13087	853.27
46	18.31	9057	494.58	12444	550.00	15586	851.11	18695	1020.89
47	31.29	2680	85.64	3682	99.00	4612	147.38	5532	176.78
48	104.38	15804	151.42	21715	160.00	27197	260.57	32622	312.55
49	29.82	7216	242.03	9915	274.00	12418	416.50	14895	499.58
50	46.01	8905	193.53	12236	202.00	15325	333.06	18381	399.48
51	28.31	5440	192.14	7475	200.00	9362	330.67	11229	396.61
52	66.80	5896	88.26	8101	91.00	10146	151.89	12170	182.19
53	30.81	4706	152.73	6466	220.00	8099	262.85	9714	315.26
54	22.31	5590	250.53	7681	260.00	9620	431.15	11539	517.15
55	36.05	7654	212.32	10517	260.00	13172	365.38	15799	438.25
56	30.47	8215	269.65	11288	323.00	14137	464.04	16957	556.61
57	20.84	6012	288.55	8261	350.00	10346	496.57	12410	595.63
58	14.54	6607	454.48	9078	460.00	11370	782.12	13638	938.13
59	95.13	4149	43.61	5701	96.00	7140	75.06	8564	90.02

60	21.47	9270	431.87	12737	435.00	15953	743.21	19135	891.45
61	251.86	8764	34.80	12042	36.00	15082	59.88	18090	71.82
62	204.36	8121	39.74	11158	50.00	13976	68.39	16763	82.03
	2655.72	**382940**		**526163**		**659007**		**790452**	

5 EXISTING WATER SUPPLY SYSTEM

5.1 PRESENT WATER SUPPLY SYSTEM

5.1.1 Sai Headworks

At present there are three different water sources (Sai Headworks, Nagzari Headworks and Dhanegaon Headworks) to Latur City Municipal Corporation. The following presents the technical details of the scheme along with year of commissioning of said works.

Table 5.1: Sai Headworks Scheme (Original Scheme)

Sr. No.	Particulars	Particulars
1.	Source	K T Weir on Manjra River, height 1.2 Mtr with MS drop gates.
2.	Headworks	Inspection well 4 Nos. 2 Mtr, Dia 450 mm connecting main and 500 mm dia slotted pipe trenches gallery & 5 Mtr dia intake well.
3.	Pumping Machinery	35 HP Vertical Turbine 2 Sets, 150 HP Horizontal split casing centrifugal pumps 2 sets.
4.	Settling Tank	Near Sai Headworks, one tank of capacity 272700 Ltrs. (Not in Use)
5.	Pure water Tank	Near Sai Headworks, one tank of capacity 272700 Ltrs.
6.	Pressure Filter	Near Sai Headworks, Candy type 3 Nos. (Not in working Condition)
7.	Pure Water Raising Main	H/W to Gandhi Chowk GSR) of 450 mm dia CILA of length 8650 Mtr.
8.	GSR	2.27 ML in Stone Masonry of size 20x37.5 Mtr. With 3 Mtr. Height.
9.	Distribution System	RCC & CI pipelines of 300 mm to 80 mm dia total length of 135 Km.

Table 5.2: Sai Headworks Scheme (Work executed under Stage II part I (1970)

Sr. No.	Particulars
1	RCC elevated storage reservoir at Gandhi Chowk, 1.8 ML capacity with staging height of 14.5 Mtr. With water depth of 6.00 Mtr.

Table 5.3: Sai Headworks Scheme (Work executed from Nagzari Headworks (1972) works executed under stage – II Part II

Sr. No.	Particulars
1.	Source: Construction of K T Weir on Manjara River capacity 3.39 M3
2.	**Augmentation Works (Works under Stage III Part I (1983))**
3.	Headworks down stream of Nagzari Weir Intake well of 3 Mtr dia with 700 mm dia Connecting main length of 57.00 Mtr.
4.	Jack Well and Pump House at Nagzari of 9.0 Mtr dia.
5.	Pumping Machinery 250 HP vertical turbine -3 sets.
6.	Raw water Rising Main/Pumping Main from Nagzari Headworks to Warwanti WTP of 600 mm dia C.I. LA class pipe length 5160 Rmt.
7.	Water Treatment Plant at Warwanti village of capacity 19.20 MLD conventional type
8.	Pure water Pumping Machinery at WTP with 350 centrifugal coupled pumps, 2 set discharge cap 8 lakh Ltrs/Hr
9.	Pure water Rising Main from Warwanti 600 mm dia C.I. “A” class pipe WTP to ESR Length of 4700 Rmt
10.	Elevated Storage Reservoir at Barshi Road capacity of 1.4 ML
11.	ESR at Nanded Naka capacity of 1.4 ML
12.	Pure water Gravity Main from ESR at Barshi Road to GSR at Gandhi Chowk 600 mm dia prestressed cement concrete pipe length of 2980 Rmt (this is now replaced by MS and BWSC pipes)

Table 5.4: Sai Headworks Scheme (Work executed from Nagzari Headworks (1972) works executed under stage – III Part II (1988)

Sr. No.	Particulars
1	Replacement of Pure Water Gravity Main from Shivaji chowk to Gandhi chowk, previously 600 mm PSC pipe replaced by 600 mm dia. MS pipe of length of 1580 Rmt.

Table 5.5: Sai Headworks Scheme (scheme executed from Nagzari Headworks (1972) works executed under stage – II Part III (1989)

Sr. No.	Particulars
1.	Improvement to K.T. Weir at Sai, Height of K.T Weir increased from 1.2 Mtr to 2.0 Mtr
2.	Pump house at Sai Headworks, Construction of new Pump House / repairs of old Pump House
3.	Raw Water Pumping Machinery at Sai Headworks, Replaced by 35 HP Pumps 2 sets discharge 4.1 Lakh Ltrs/ Hr
4.	Water Treatment Plant at Arvi (Ambajogai Road), Conventional type 9.84 MLD capacity
5.	Pure Water Pumping Machinery at WTP (Sai) 150 HP Pumps 2 sets centrifugal coupled

Table 5.6: Distribution Works (Works executed under Stage IV Part I (1990)

Sr. No.	Particulars
1	Additional distribution pipeline in Nanded Naka area, above 200 mm dia. C.I. pipe and below 200 mm dia. A.C. pipe distribution lines total length of 35 Km

Table 5.7: Distribution Works (Works executed under Stage IV Part II (1993 to 2001)

Sr. No.	Particulars
1	Pure water Gravity Main from Gandhi Chowk to Dalda factory ESR, 600 mm dia. 450 mm dia. & 400 mm dia. D.I. pipe Length 900 Rmt
2	R.C.C. E.S.R.'s at Ashok Hotel, capacity of 2.1 ML & at Dalda Factory, capacity of 1.75 ML
3	Additional distribution system above 200 mm dia. C.I. pipe and below 200 mm dia. A.C. pipe distribution lines total length of 180 Km
4	Replacement of 35 HP VT pump sets at Headworks

5.1.2 Dhanegaon Head works

Table 5.8: Latur Water Supply Scheme Stage V (2005)

Sr. No.	Particulars	Particulars
1.	Manjra Dam	4 X 6 Mtr Elliptical shape
2.	Connecting Main	1800 mm dia RCC pipe of two parallel pipes of length 92.50 M and beyond approach channel of 660 Mtr of length
3.	Inspection Wells	Elliptical size 6 X 2 Mtr dia 2 Nos.
4.	Approach Bund	Length of 65 Mtr.
5.	Jack Well & Pump House	Elliptical shape, size of 17.15 X 6.35 Mtr and depth of 21.50 Mtr with 23.50 Mtr & 11.50 Mtr. Overhead Pump House with height of 10.75 Mtr.
6.	Raw Water Pumping Machinery	700 HP VT pumps with VSS HT motors 3 sets discharge capacity of 17 lakh Ltrs/hr.

7.	Raw water Raising Main	From Headworks to MS Shaft at Dhabapati 965 mm dia MS pipe of height 3615 Mtr. & MS pipe shaft at Dhabapati, 1500 mm dia. MS pipe of height 5 Mtr.
8.	Raw Water Gravity Main	Upto Harangulphata, 1219 mm dia 7.9 thick MS pipe of length 43.50 m Harangulphata to Harangul WTP, 1118 mm dia 7.9 thick MS pipe of length 3.1 Km Harangulphata to Warwanti, 610 mm dia 7.9 thick MS pipe of length 2.60 Km Warwanti WTP to Arvi WTP, 500 mm dia. K-9 pipe of length 5.40 Km
9.	Water Treatment Plant	At Harangul (bk) village, Conventional type of 80 MLD capacity along with recirculation arrangement.
10.	Pure water Pumping Machinery	442 HP VT pumps with VSSHT motors discharge capacity of 11.23 lakhs Ltrs/hr., 3 sets with 50% standby
11.	Pure water Raising Main	762 mm dia. 9.5 mm thick MS pipe length of 2.22 Km
12.	Master Balancing Reservoirs	Near Harangul Railway Station, 2 Nos. of Capacity of 3.125 ML
13.	Pure Water Gravity Main	MBR to Gandhi chowk ESR, 1158 mm to 1016 mm dia. MS pipe length of 10 Km Shivaji chowk to Saraswathi colony, 457 mm dia. MS pipe length of 625 Mtr Saraswathi colony ESR to Basweshwar colony, 323 90 mm dia. MS pipe length of 1175 Mtr Gandhi chowk to Nanded ESR, 610 mm dia MS pipe length of 860 Rmt 559 mm dia MS pipe length of 1680 Rmt 457 mm dia MS pipe length of 50 Rmt

Sr. No.	Particulars	Capacity	Staging Height
1.	Govt. Qty. Campus	2.2 ML	15.00 Mtr. and water depth of 5 Mtr.
2.	Saraswathi Colony	4.1 ML	13.28 Mtr. and water depth of 5 Mtr.
3.	Basweshwar Colony	2.1 ML	15.00 Mtr. and water depth of 5 Mtr.
4.	Arvi Booster Campus	3.5 ML	23.30 Mtr. and water depth of 5 Mtr.
5.	Nanded Naka	4.0 ML	16.00 Mtr. and water depth of 5 Mtr.

Rehabilitation of Old Water Works

Sr. No.	Particulars
1.	Pumping Machinery at Sai Headworks & Arvi Booster, replacement of 150 centrifugal Pump – 4 Sets
2.	Pumping Machinery at Nagzari Headworks, replacement of 25 HO centrifugal (P/W)
3.	Replacement of PSC line from MJP, 600 mm dia. BWSC pipe length of 1400 Rmt office to Shivaji chowk

5.1.3 Atal Mission for Rejuvenation and Urban Transformation AMRUT (Phase I, Part I)

Table 5.9: **Mechanical Work**

Sr. No.	Particulars
1.	Renovation works of Warwanti WTP
2.	Renovation works of Arvi WTP
3.	Providing & fixing water lubricated V T Pump & allied equipment for Warwanti WTP
4.	Providing & fixing water lubricated V T Pump & allied equipment of Arvi WTP
5.	Providing & Erecting V T Pump set & equipment for Harangul Sump at WTP
6.	Temporary discounted reconnection charges for P/W P/M at Warwanti
7.	Solar Power Plant at Existing Harangul WTP
8.	SCADA & Automation, DMA Meters for reducing NRW

Table 5.10: **Mechanical Works (Recapitulation)**

Sr. No.	Particulars	Amount
1.	Estimate of providing and erecting & Glandless wall of WTP with dismantling existing wall at Harangul WTP	7597982.00
2.	Estimate for renovation of WTP with providing, erecting equipment and repair to existing equipment at Warwanti WTP	5211021.00
3.	Estimate for renovation of WTP with providing, erecting equipment's & repairs allied equipment's & Arvi WTP	3402539.00
4.	Estimate for providing and fixing water lubricated VT pump and allied equipment for Warwanti WTP	7388598.00
5.	Estimate for providing and fixing W/L VT Pump and allied equipment for Arvi WTP	3786057.00
6.	Estimate for providing and erecting VT pump set and equipment's for Sump at Harangul WTP	5718542.00
7.	Estimate for providing and fixing SCADA automation for Headworks, Harangul WTP Pure water, Warwanti & Arvi etc.	8674983.00
8.	Estimate for providing and fixing SCADA automation for Headworks, WTP & Pure Water & Arvi Booster WTP	6912766.00
9.	Estimate of providing and fixing SCADA automation of Headworks, WTP & Pure Water @ Arvi Booster WTP	10638579.00
10.	Temporary disconnected reconnection charges for Pure Water Pumping Machinery @ Warwanti WTP consumer No. 610299001671	6855733.00
11.	**Total**	**6,61,86,800.00**

5.1.4 Atal Mission for Rejuvenation and Urban Transformation AMRUT (Phase I, Part II)

Table 5.11: **Part I Civil Works**

Sr.	Particulars

No.	
1.	Working Survey
2.	ESR capacity 1.5 ML with staging height 19.00 Mtr. backside of Usha Kiran theatre.
3.	Pure water R/M MJP (old) ESR to MJP (New) ESR – 300 mm DI K-9 pipe, length of 1550 Rmt
4.	Remodelling works of Distribution System (DI K-7 > 200 mm dia < HDPE length of 145.23 Km
5.	Replacing existing Air Valves with tamper proof Air Valves on Raw & Pure water Gravity Main
6.	Construction of Sump & Pump House at existing Arvi WTP of capacity of 0.5 ML & 16 M dia.
7.	Construction of Sump & Pump House at existing Harangul WTP of capacity of 0.8 ML & 16 M dia.
8.	Repair of Arvi & Warwanti WTP

Table 5.12: **Part II Civil Works (Recapitulation)**

Sr. No.	Particulars	Amount
1.	Working Survey	937225.00
2.	ESR capacity 1.5 ML with staging height 19.00 Mtr. backside of Usha Kiran theatre.	11983850.00
3.	Pure water R/M MJP (old) ESR to MJP (New) ESR – 300 mm DI K-9 pipe, length of 1550 Rmt	5182300.00
4.	Remodelling works of Distribution System (DI K-7 > 200 mm dia < HDPE length of 145.23 Km	279023400.00
5.	Replacing existing Air Valves with tamper proof Air Valves on Raw & Pure water Gravity Main	1710500.00
6.	Construction of Sump & Pump House at existing Arvi WTP of capacity of 0.5 ML & 16 M dia.	3778600.00

7.	Construction of Sump & Pump House at existing Harangul WTP of capacity of 0.8 ML & 16 M dia.	5343700.00
8.	Repair of Arvi & Warwanti WTP	5343700.00
	Total	**30,96,40,375.00**

Sr. No.	**Particulars**	**Amount**
1	Total Amount Mechanical & Civil Works	37,58,27,175.00
2	Add for PV claim	1,27,96,391.00
	Total	**38,86,23,566.00**
3	Solar Power Plant	8,62,50,000.00
	Total	**47,48,73,566.00**
	Add 3% ETP Charges	1,42,46,207.00
	Grand Total	**48,91,19,773.00**
	Say	**48,91,20,000.00**

This scheme is completed in year 2023

Table 5.13: **Summary of Existing Service Reservoirs**

Sr. No.	**SR Name**	**Type of SR ESR/ GSR**	**SR Status Existing / Proposed**	**SR Capacity Existing (ML)**	**GL (m)**	**LDL (m)**	**FSL (m)**	**STAGING (m)**
1.	Nanded Naka New Existing	ESR	Existing	4.00	633.50	649. 50	654. 50	16.00
2.	Nanded Naka Old Existing	ESR	Existing	1.40	631. 50	647.50	653.50	16.00
3.	Dalda Factory	ESR	Existing	1.75	628.86	649.86	654.86	21.00
4.	Basweshwar Colony	ESR	Existing	2.10	623.25	638.25	643.25	15.00
5.	Sarasvati Colony	ESR	Existing	4.10	634.00	647.28	652.28	13.28
6.	M.J.P. Old	ESR	Existing	1.40	636.00	658.00	664.00	22.00

7.	M.J.P. New Existing	ESR	Existing	1.50	634.55	652.55	656.55	18.00
8.	Government Quarter Existing	ESR	Existing	2.10	637.50	652.50	657.50	15.00
9.	Arvi (Keshav Nager) Existing	ESR	Existing	3.50	623.00	645.00	650.00	22.00
10.	Rajdhani	ESR	Existing	2.10	635.30	650.30	655.30	15.00
11.	Gandhi Chowk Existing	ESR	Existing	3.20	634.00	652.00	657.00	18.00
			Total	**27.15**				

5.1.5 Proposed Scheme under Amrut 2.0

Population of Latur city as per census 2011 is 3,82,940 souls. Considering present stage for this project is year 2027. The population is 5,26,166 souls. Projected population at immediate stage is 6,59,006 souls for the year 2042 and designed stage population at the year 2057 is 7,90,459 souls. All the distribution system proposed in this proposal are designed for ultimate stage population of 790459 souls for the year 2057.

The Proposed works are as below:

Sr. No.	Particulars	Description
1.	Manjra Dam	Intake well in submergence of the dam at 6 Mtr dia.
2.	Connecting Main	1400 mm dia RCC NP-3 pipe of two parallel pipes of length 80 Mtr and beyond existing approach channel of 660 Mtr length
3.	Inspection Well	Size of 6 Mtr dia. 1 No.
4.	Approach Bund	Approach bund of 70 Mtr length
5.	Jackwell & Pump House	Circular shape, size of 15.00 Mtr dia and depth of 21.5 Mtr with 25.00 Mtr with 25 Mtr 15.00 Mtr overhead Pump House with height of 11.00 Mtr.
6.	Raw Water Pumping Machinery	495 HP VT pumps with VSS HT motors (3+2) sets discharge capacity of 10.67 lakh Ltrs/Hr

7.	Raw Water Raising Main	From Headworks to MS Shaft 1000 mm dia. DI K-9 pipe of length 3600 Mtr. From MS Shaft of 1500 mm dia. MS pipe of height 20 Mtr.
8.	Raw Water Gravity Main	From MS Shaft to Harangul WTP 1000 mm dia. DI K-7 pipe of 45.0 Km from Harangul phata to Harangul WTP 700 mm dia. DI K-7 pipe length of 0.7 Km Harangulphata to Warwanti existing 610 mm dia. 7.9 mm thick MS pipe Warwanti WTP to Arvi WTP existing 610 mm dia. pipe of 2.6 Km & 500 mm dia. DI K-9 pipe of length 5.4 Km
9.	Water Treatment Plant	Conventional type 91 MLD capacity along with recirculation arrangement near existing WTP at Harangul.
10.	Pure Water pumping Machinery	495 HP VT pumps with VSSHT motors discharge capacity of 14.84 lakh Ltrs/Hr. (3+2) sets with 50% standby.
11.	Pure Water Raising Main	1000 mm dia. DI K-9 pipe of length 1.5 Km
12.	Master Balancing Reservoirs	2 Nos. of Capacity 1.92 MLD with 27 Mtr. Staging Height near the existing MBR
13.	Pure Water Gravity Main	MBR to all ESR's 1200 mm to 300 mm dia. DI K-7 pipe length of 19.92 Km
14.	RCC Storage Reservoirs	

Sr. No.	**SR Name**	**SR Capacity Existing (ML)**	**STAGING (m)**
1	Nanded Naka	0.70	16.00
2	M.J.P. New	1.00	24.00
3	Government Quarter	1.20	15.00
4	Arvi	0.40	22.00
5	Gandhi Chowk	1.20	18.00
6	Kripa Sadan	1.85 X 2	16.00
7	Labour Colony	1.70 X 2	18.00
8	SSC Board	2.70	22.00

		9	APMC Market	2.20	16.00
		10	Basav Colony	2.40	16.00
15.	Distribution System	700 mm to 350 mm dia. DI K-7 pipe length of 22.37 Km and 315 to 100 mm dia. HDPE pipe length of 301.94 Km			
16.	Smart Metering for one zone 24X7	15 to 25 mm Smart Ultrasonic Water Meters for Rajdhani Water Supply Zone total quantity of 3798 meters with AMI system			
17.	SCADA	Full SCADA system is considered from Headworks to all ESRs			
18.	Augmentation of existing Mechanical Works	Air blowers, wash water pumps, with allied electrical & mechanical equipment's at existing Headworks			

6 ESTIMATION OF SEWAGE GENERATION

6.1 Sewage generation based on rate of water supply

The sewage flow is considered as 80 % of the net water supplied to the consumers. Considering 177.38 lpcd water supply. The rate of sewage generation works out as 141.91 lpcd and same has been adopted.

6.2 Minimum Water Supply Level

As per CPHEEO Manual on Water Supply and Treatment 1999, the recommended minimum values of water supply for domestic and non-domestic purposes are given in Table 6.1 are used for estimation of sewage generation from Latur.

Table 6.1: Recommended Per Capita Water Supply levels for designing schemes

S. No.	Classification of Villages/ Towns/ Cities	Recommended Maximum Water Supply Level (Lpcd)
1	Areas where water is provided through public stand post / rural areas with piped water supply	40
2	Towns provided with piped water supply but without sewerage system	70
3	Cities provided with piped water supply where sewerage system is existing/ contemplated	135

6.3 Ground Water Infiltration

As per CPHEEO manual, systems are designed for peak discharges, allowances for groundwater infiltration for the worst condition is made as per table 6.6 and that infiltration value shall be limited to a maximum of 10% of the design value of sewage flow.

6.4 Peak Factor

Flow in drains and nallas varies hurly and seasonally. However, for design purposes, peak factor may be adopted as per table 6.2. Minimum flow varies from 1/3 to 1/2 of average flow.

Table 6.2: Peak Factors for Contributory Population

Contributory Population	Peak Factor
Less than 10,000	Babbitt Formula = 5 X P^{-02}
Up to 20,000	3.00
20,001 to 50,000	2.50
50,001 to 750,000	2.25
Above 750,001	2.00

Where P is Population in Thousand

6.5 Design Flows

Design flows in design years (Base Year – 2027, After 15 Year – 2042, after 30 year – 2057) worked out on the population projection basis (Average and Peak).

Summary of projected population and sewage flow of town is given in Table 6.3 and Zone wise with infiltration in table 6.3 below respectively.

Table 6.3: Projected Population and sewage flow with infiltration

Stages	Year	Projected Population	Estimated Average Sewage Flow
Immediate	2027	526166	77.53 MLD
Intermediate	2042	659006	96.38 MLD
Ultimate	2057	790459	115.03 MLD

Table 6.4: Projected Population and sewage flow Zone wise

Zone	Covered Area (Hac.)	Year	Projected Population	Average Sewage Flow	Ground water Infiltration (MLD)	Total flow
Zone I	616.56	2027	113328	16.08	0.73	16.81
		2042	141941	20.14	0.73	20.87
		2057	170252	24.16	0.73	24.89
Zone II	1141.16	2027	174721	24.79	0.93	25.72
		2042	218831	31.05	0.93	31.98
		2057	262481	37.25	0.93	38.18
Zone III	1175.67	2027	228786	32.47	1.06	33.53
		2042	286552	40.66	1.06	41.72
		2057	343706	48.77	1.06	49.84
Zone IV	308.61	2027	9328	1.32	0.14	1.47
		2042	11683	1.66	0.14	1.80
		2057	14013	1.99	0.14	2.13
Total	**3242.00**	**2027**	**526163**	**74.67**	**2.86**	**77.53**
		2042	**659007**	**93.52**	**2.86**	**96.38**
		2057	**790452**	**112.17**	**2.86**	**115.03**

6.6 Proposed Sewerage Zone

Configuration in the form of sub zones, Zones etc. will be governed mostly by contours. The network configuration largely depends upon lay of the project area i.e., contours. Sewers should be, as far as possible, laid down by gravity to avoid pumping. By studying GIS maps, Topography and drainage pattern entire Latur city is divided in to 4 major Zones. Zoning is proposed based on the natural drainage system in Latur city. The proposed overall zone map of is shown in drawing.

A) Sewerage Zone 1:

The total area of the sewerage zone 1 (catchment-1) is about 6.16 Sq. Km. and the projected population is 1,70,252 (year 2057) which is 21.54 % of the total projected population.

B) Sewerage Zone 2:

The total area of the sewerage zone 2 (catchment -2) is about 11.41 Sq. Km and the projected population is 2,62,481 (Year 2057) is about 33.21 % of the total projected population.

C) Sewerage Zone 3:

The total area of the sewerage zone 3 (catchment-3) is about 11.75 Sq. Km. and the projected population is 3,43,706 (Year 2057) which is 43.48 % of the total projected population.

D) Sewerage Zone 4:

The total area of the sewerage zone 4 (catchment-4) is about 3.08 Sq. Km. and the projected population of 14,013 Year 2057) which is 1.77 % of projected total population.

Zone wise total discharge calculation of dry weather flow for year 2057 is presented in table no. 6.5 below.

Table 6.5: Zone Wise & Total discharge calculation of Dry weather & Peak flow (Y 2057)

STATEMENT SHOWING ZONE WISE DAILY WATER REQUIREMENT						
	ZONE-1					
			SEWAGE GENERATION			
			2011	**2027**	**2042**	**2057**	
	POPULATION		82480	113328	141941	170252	soul
	LPCD		141.91	141.91	141.91	141.91	lpcd
	SEWAGE DEMAND		11.70	16.08	20.14	24.16	mld
	PEAK FACTOR		2.25	2.25	2.25	2.25	
	PEAK FLOW		26.33	36.18	45.32	54.36	mld
	Add for infiltration as per Table 3.3 of CPHEEO Manual. (5000 Lit/km/day for146.11 km pipe line)		0.73	0.73	0.73	0.73	mld

	AVARAGE FLOW		12.43	16.81	20.87	24.89	mld
	ZONE-2						
			SEWAGE GENERATION				
			2011	**2027**	**2042**	**2057**	
	POPULATION		127160	174721	218831	262481	soul
	LPCD		141.91	141.91	141.91	141.91	lpcd
	SEWAGE DEMAND		18.04	24.79	31.05	37.25	mld
	PEAK FACTOR		2.25	2.25	2.25	2.25	
	PEAK FLOW		40.60	55.79	69.87	83.81	mld
	Add for infiltration as per Table 3.3 of CPHEEO Manual. (5000 Lit/km/day for185.65 km pipe line)		0.93	0.93	0.93	0.93	mld
	AVARAGE FLOW		18.97	25.72	31.98	38.18	mld
	ZONE-3						
			SEWAGE GENERATION				
			2011	**2027**	**2042**	**2057**	
	POPULATION		166511	228786	286552	343706	soul
	LPCD		141.91	141.91	141.91	141.91	lpcd
	SEWAGE DEMAND		23.63	32.47	40.66	48.77	mld
	PEAK FACTOR		2.25	2.25	2.25	2.25	
	PEAK FLOW		53.17	73.05	91.49	**109.74**	mld
	Add for infiltration as per Table 3.3 of CPHEEO Manual. (5000 Lit/km/day for212.29 km pipe line)		1.06	1.06	1.06	1.06	mld
	AVARAGE FLOW		24.69	33.53	41.72	49.84	mld
	ZONE-4						
			SEWAGE GENERATION				
			2011	2027	2042	2057	
	POPULATION		6789	9328	11683	14013	soul
	LPCD		141.91	141.91	141.91	141.91	lpcd
	SEWAGE DEMAND		0.96	1.32	1.66	1.99	mld
	PEAK FACTOR		3.00	3.00	3.00	3.00	
	PEAK FLOW		2.89	3.97	4.97	5.97	mld
	Add for infiltration as per Table 3.3 of CPHEEO Manual. (5000 Lit/km/day for28.63 km pipe line)		0.14	0.14	0.14	0.14	mld
	AVARAGE FLOW		1.11	1.47	1.80	2.13	mld
	Total Average Flow		57.21	77.53	96.38	115.03	
	Total Peak Flow		122.99	168.99	211.66	253.87	

Table 6.6: Infiltration adopted

Ground Water Infiltration			
Parameters		**Calculated infiltration in MLD**	**adopted infiltration in MLD**
1) By Area	= Area in hectare X infiltration rate / 10^6 =	**N.A.**	**2.86 MLD**
2) By sewer Network	=Length of sewer Network in Km X rate of Infiltration / 10^6	**Adopted**	
3) By Manholes	= No. of manholes X rate of infiltration / 10^6 =	**N.A.**	
Note: Design infiltration value shall be limited to a maximum of 10 % of the design value of sewage flow.			

7 SELECTION OF STP TECHNOLOGY & PIPE MATERIAL

7.1 Selection of Pipe Material for Laterals Branch sewer mains and rising main

Different type of pipes are compared for capitalized cost of the pipe and shown in table 5.1 (Detailed calculations of Capitalize cost are given in annexure)

Table 7.1: Comparative statement Capitalized cost of various pipes for sewer lines

RCC Pipe	***Stone ware pipe***	HDPE DWC Pipe	***(Name of Pipe)*** **Pipes**	***(Name of Pipe)*** **Pipes**

7.2 Conclusion

It is proposed to use following pipe material as shown in Table 5.2 for different sewers.

Table 7.2: Proposed Pipe materials

Sr. No.	Type of Sewer	Material of Sewer
1.	Gravity Sewer	HDPE DWC pipe (Up to 250 mm Dia.) RCC Pipe above 250 mm Dia.
2.	Pumping Main	D.I. K-9 for Pumping main D.I. K-7 for Gravity Main
3.	House Sewer Connection	HDPE DWC pipe

7.3 Sewage Characteristics

Treated sewage discharge parameter from STP shall meet the following requirements as shown in table 7.3 as per NGT guideline.

Table 7.3: Treated sewage discharge standard

Sr. No.	Parameter	Standard
1.	pH Value	5.5-9.0

2.	BOD	10
3.	Total Suspended Solids (TSS)	20
4.	Chemical Oxygen Demand	50
5.	Nitrogen Total	10
6.	Phosphorus – Total (For Discharge into Ponds, Lakes)	1.0
7.	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100 ml	Desirable 100 Permissible 230

7.4 Selection from Various Types of Processes for Sewage Treatment

Various sewage treatment technologies are studied & alternatives are considered before finalizing the proposed sewerage treatment for this project and comparative cost of various technologies are given in **Annexure 21 & 22.**

7.5 Conclusion

Comparing different technologies for STP it is proposed to provided SBR based STP as shown in table 7.5

Table 7.4: Selected technology for STP

Sewer Zone	Location of STP	Capacity in MLD	Proposed treatment Process	Remarks
Zone I & II	Kavha Road, Kavha	53 MLD	SBR (Cyclic activated sludge process)	Please refer Chapter No. 9
Zone III & IV	Mahapur Road, Mahapur	11.50 MLD	SBR (Cyclic activated sludge process)	

8 DETAILS OF PROPOSED WORKS

8.1 Sewer Network

The details of zone wise sewer networks proposed are given below.

ZONE I: -

Table 8.1: Derails of Zone I sewer networks proposed

Conduit Description	Concrete (m) NP3	Concrete (m) NP4	Concrete (m)	DWC Pipe (m)	All Materials (m)	HDPE PE 100	Total
Circle - 200.0 mm	3741	663	4,403.90	1,24,549.80	1,28,953.70	855	1,29,809.00
Circle - 250.0 mm	0	67	67.20	4,030.20	4,097.40	0	4,097.40
Circle - 300.0 mm	1662	800	2,461.60		2,461.60	0	2,461.60
Circle - 350.0 mm	3005	402	3,407.10		3,407.10	0	3,407.10
Circle - 400.0 mm	387	322	709.00		709.00	0	709.00
Circle - 450.0 mm	1200	0	1,199.60		1,199.60	0	1,199.60
Circle - 600.0 mm	0	1063	1,062.90		1,062.90	0	1,062.90
Circle - 700.0 mm	249	21	270.30		270.30	0	270.30
Circle - 750.0 mm	0	0	0.00		0.00	0	0.00
Circle - 800.0 mm	1264	1317	2,581.30		2,581.30	0	2,581.30
Circle - 900.0 mm	210	0	209.50		209.50	302	511.70
Total Length	**11717.70**	**4654.70**	**16,372.40**	**1,28,580.0**	**1,44,952.40**	**1,158**	**1,46,109.90**

ZONE II: -

Table 8.2: Derails of Zone II sewer networks proposed

Conduit Description	Concrete (m) NP3	Concrete (m) NP4	Concrete (m)	DWC Pipe (m)	All Materials (m)	HDPE PE 100	Total
Circle - 200.0 mm	2614	408	3,021.50	1,58,317.40	1,61,338.90	161	1,61,499.50
Circle - 250.0 mm	0	229	228.90	6,847.10	7,076.00	0	7,076.00
Circle - 300.0 mm	5303	60	5,363.30		5,363.30	0	5,363.30
Circle - 350.0 mm	2323	109	2,432.40		2,432.40	0	2,432.40
Circle - 400.0 mm	474	0	473.60		473.60	0	473.60
Circle - 450.0 mm	1094	415	1,508.80		1,508.80	0	1,508.80
Circle - 500.0 mm	973	0	973.20		973.20	0	973.20
Circle - 600.0 mm	0	9	9.40		9.40	0	9.40
Circle - 700.0 mm	2148	57	2,204.70		2,204.70	0	2,204.70
Circle - 750.0 mm	0	0	0.00		0.00	0	0.00
Circle - 800.0 mm	1627	1248	2,875.20		2,875.20	718	3,593.20
Circle - 1,000.0 mm	144	155	299.60		299.60	218	517.60
Total Length	**16699.40**	**2691.20**	**19,390.60**	**1,65,164.5**	**1,84,555.10**	**1,097**	**1,85,651.70**

ZONE III: -

Table 8.3: Derails of Zone III sewer networks proposed

Conduit Description	Concrete (m) NP3	Concrete (m) NP4	Concrete (m)	DWC Pipe (m)	All Materials (m)	HDPE PE 100	Total
Circle - 200.0 mm	5010	1010	6,019.80	1,74,765.20	1,80,785.00	1563	1,82,347.70
Circle - 250.0 mm	0	1056	1,055.60	5,841.40	6,897.00	442	7,338.60
Circle - 300.0 mm	2264	921	3,184.20		3,184.20	31	3,214.70
Circle - 350.0 mm	1255	735	1,989.90		1,989.90	263	2,253.00
Circle - 400.0 mm	2371	927	3,298.80		3,298.80	0	3,298.80
Circle - 450.0 mm	1168	111	1,278.40		1,278.40	0	1,278.40
Circle - 500.0 mm	0	561	561.20		561.20	145	706.00
Circle - 600.0 mm	0	650	649.60		649.60	0	649.60
Circle - 700.0 mm	1480	350	1,829.60		1,829.60	1204	3,033.20
Circle - 1,100.0 mm	23	0	22.70		22.70	0	22.70
Total Length	**13569.80**	**6320.00**	**19,889.80**	**1,80,606.6**	**2,00,496.40**	**3,646**	**2,04,120.00**

ZONE IV: -

Table 8.4: Derails of Zone III sewer networks proposed

Conduit Description	Concrete (m) NP3	Concrete (m) NP4	Concrete (m)	DWC Pipe (m)	All Materials (m)	HDPE PE 100	Total
Circle - 200.0 mm	2440	551	2,990.70	19,965.00	22,955.70	548	23,503.70
Circle - 250.0 mm	0	692	692.00	485.80	1,177.80	149	1,326.60
Circle - 300.0 mm	1268	638	1,905.30		1,905.30	618	2,522.80
Circle - 350.0 mm	0	0	0.00		0.00	0	0.00
Circle - 400.0 mm	1218	60	1,278.10		1,278.10	0	1,278.10
Total Length	**4925.30**	**1940.80**	**6,866.10**	**20,450.8**	**27,316.90**	**1,314**	**28,631.20**

8.2 Sewer Manholes

The details of zone wise sewer manholes proposed are given below.

ZONE I: -

Table 8.5: Derails of Zone I sewer manholes proposed

Depth of manholes	Brick Manholes	RCC Manhole at Depth > 5	RCC Manholes along river	Total Manholes
1.5	3111		11	3122

2	642		41	683
2.5	281		24	305
3	173		3	176
3.5	79		4	83
4	82		0	82
4.5	67		0	67
5	55		0	55
5.5		53	0	53
6		14	0	14
6.5		17	0	17
7		7	0	7
7.5		2	0	2
8		1	0	1
8.5		1	0	1
9		0	0	0
9.5		1	0	1
10		1	0	1
10.5		1	0	1
11		1	0	1
11.5		1	0	1
12		2	0	2
12.5		2	0	2
13		1	0	1
13.5		2	0	2
14		3	0	3
14.5		2	0	2
	4490	**112**	**83**	**4685**

ZONE II: -

Table 8.6: Derails of Zone II sewer manholes proposed

Depth of manholes	Brick Manholes	RCC Manhole at Depth > 5	RCC Manholes along river	Total Manholes
1.5	4186		0	4186
2	909		0	909
2.5	336		0	336
3	164		0	164
3.5	131		0	131
4	81		0	81
4.5	86		0	86
5	37		0	37
5.5		16	0	16
6		12	0	12
6.5		16	0	16
7		13	0	13

7.5		5	0	5
8		4	0	4
8.5		5	0	5
9		5	0	5
9.5		3	0	3
10		4	0	4
10.5		2	0	2
	5930	**85**	**0**	**6015**

ZONE III: -

Table 8.7: Derails of Zone III sewer manholes proposed

Depth of manholes	Brick Manholes	RCC Manhole at Depth > 5	RCC Manholes along river	Under Construction (Amrut -1)	Total Manholes
1.5	4039		3	40	4002
2	1027		47	92	982
2.5	432		30	51	411
3	342		10	27	325
3.5	161		7	12	156
4	135		0	6	129
4.5	107		0	5	102
5	88		0	7	81
5.5		62	0	12	50
6		31	0	1	30
6.5		33	0	9	24
7		15	0	2	13
7.5		5	0	2	3
8		3	0	1	2
8.5		9	0	1	8
9		6	0	0	6
9.5		9	0	0	9
10		6	0	0	6
10.5		6	0	0	6
11		9	0	0	9
11.5		9	0	0	9
12		9	0	0	9
12.5		13	0	0	13
13		10	0	0	10
13.5		3	0	0	3
14		1	0	0	1
	6331	**239**	**97**	**268**	**6399**

ZONE IV: -

Table 8.8: Derails of Zone IV sewer manholes proposed

Depth of manholes	Brick Manholes	RCC Manhole at Depth > 5	RCC Manholes along river	Total Manholes
1.5	415		24	439
2	101		21	122
2.5	50		10	60
3	72		6	78
3.5	71		0	71
4	43		0	43
4.5	39		1	40
5	32		1	33
5.5		24	0	24
6		11	0	11
6.5		23	0	23
7		10	0	10
7.5		9	0	9
8		6	0	6
8.5		5	0	5
9		5	0	5
9.5		2	0	2
10		2	0	2
	823	**97**	**63**	**983**

8.3 Trenchless Technology Details

ZONE I: -

Table 8.9: Derails of Zone I Trenchless sewer networks proposed

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)
Trenchless by HDD Method				
ZICO-2873	ZIMH-3570	ZIMH-2788	200	37.4
ZICO-2874	ZIMH-2788	ZIMH-3571	900	29.5
ZICO-2875	ZIMH-3571	ZIMH-3572	900	42.5
ZICO-2876	ZIMH-3572	ZIMH-3573	900	37.2
ZICO-2872	ZIMH-3569	ZIMH-3570	200	35.3
ZICO-2877	ZIMH-3573	ZIMH-3574	900	24.2
ZICO-2878	ZIMH-3574	ZIMH-3575	900	33.1
ZICO-2879	ZIMH-3575	ZIMH-3576	900	40.5
ZICO-2880	ZIMH-3576	ZIMH-2789	900	35.1
ZICO-2882	ZIMH-3577	ZIMH-2789	900	32.4
ZICO-2871	ZIMH-3568	ZIMH-3569	200	30.5
ZICO-2870	ZIMH-3567	ZIMH-3568	200	26.3
ZICO-2881	O-11	ZIMH-3577	900	27.7
ZICO-2869	ZIMH-3566	ZIMH-3567	200	30.1

ZICO-2868	ZIMH-3565	ZIMH-3566	200	33
ZICO-2867	ZIMH-3564	ZIMH-3565	200	32.1
ZICO-2866	ZIMH-3563	ZIMH-3564	200	40.1
ZICO-2865	ZIMH-3562	ZIMH-3563	200	38.3
ZICO-2864	ZIMH-222	ZIMH-3562	200	33
ZICO-2863	ZIMH-3561	ZIMH-222	200	45.5
ZICO-2862	ZIMH-3560	ZIMH-3561	200	37.2
ZICO-2861	ZIMH-3559	ZIMH-3560	200	37.8
ZICO-2860	ZIMH-349	ZIMH-3559	200	23.5
ZICO-1883	ZIMH-2698	ZIMH-2877	200	30.6
ZICO-1884	ZIMH-2877	ZIMH-2878	200	34.6
ZICO-1885	ZIMH-2878	ZIMH-2879	200	32.7
ZICO-2856	ZIMH-3556	ZIMH-349	200	32.1
ZICO-1886	ZIMH-2879	ZIMH-2880	200	31.5
ZICO-1264	ZIMH-2141	ZIMH-3	200	36.7
ZICO-1250	ZIMH-1253	ZIMH-2141	200	37
ZICO-1126	ZIMH-566	ZIMH-1253	200	35.1
ZICO-1058	ZIMH-3	ZIMH-168	200	34.5
ZICO-1077	ZIMH-386	ZIMH-566	200	34.7
ZICO-1887	ZIMH-2880	ZIMH-2881	200	35.7

ZONE II: -

Table 8.10: Derails of Zone II Trenchless sewer networks proposed

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)
Trenchless by HDD Method				
ZIICO-336	ZIIMH-155	ZIIMH-152	200	30.9
ZIICO-1566	ZIIMH-969	ZIIMH-1957	200	41.3
ZIICO-1884	ZIIMH-417	ZIIMH-3290	1,000	15.4
ZIICO-1885	ZIIMH-3290	ZIIMH-3293	1,000	40
ZIICO-1886	ZIIMH-3293	ZIIMH-3294	1,000	47.4
ZIICO-1887	ZIIMH-3294	ZIIMH-3295	1,000	36
ZIICO-1888	ZIIMH-3295	ZIIMH-3296	1,000	38.6
ZIICO-1889	ZIIMH-3296	ZIIMH-3297	1,000	40.6
ZIICO-2362	ZIIMH-11	ZIIMH-3647	200	43.3
ZIICO-2363	ZIIMH-3647	ZIIMH-969	200	45.1
ZIICO-2660	ZIIMH-426	ZIIMH-3857	800	44.3
ZIICO-2661	ZIIMH-3857	ZIIMH-417	800	38.7
ZIICO-2662	ZIIMH-3858	ZIIMH-426	800	33.1
ZIICO-2663	ZIIMH-3859	ZIIMH-3858	800	31.6
ZIICO-2664	ZIIMH-425	ZIIMH-3860	800	32.8
ZIICO-2665	ZIIMH-3860	ZIIMH-3859	800	28.8

ZIICO-2666	ZIIMH-3861	ZIIMH-425	800	29.9
ZIICO-2667	ZIIMH-3862	ZIIMH-3861	800	29.1
ZIICO-2668	ZIIMH-424	ZIIMH-3863	800	38.7
ZIICO-2669	ZIIMH-3863	ZIIMH-3862	800	27.9
ZIICO-2670	ZIIMH-3864	ZIIMH-424	800	26.8
ZIICO-2671	ZIIMH-3865	ZIIMH-3864	800	32.8
ZIICO-2672	ZIIMH-3866	ZIIMH-3865	800	30.5
ZIICO-2673	ZIIMH-423	ZIIMH-3867	800	35.8
ZIICO-2674	ZIIMH-3867	ZIIMH-3866	800	30.8
ZIICO-2675	ZIIMH-3868	ZIIMH-423	800	26.8
ZIICO-2676	ZIIMH-3869	ZIIMH-3868	800	30.4
ZIICO-2677	ZIIMH-3870	ZIIMH-3869	800	33
ZIICO-2678	ZIIMH-422	ZIIMH-3871	800	37.7
ZIICO-2679	ZIIMH-3871	ZIIMH-3870	800	37.6
ZIICO-2680	ZIIMH-3872	ZIIMH-422	800	28.4
ZIICO-2681	ZIIMH-3873	ZIIMH-3872	800	32.5

ZONE III: -

Table 8.11: Derails of Zone III Trenchless sewer networks proposed

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)
Trenchless by HDD Method				
ZIIICO-18	ZIIIMH-924	ZIIIMH-1220	200	5.5
ZIIICO-37	ZIIIMH-471	ZIIIMH-753	250	6.7
ZIIICO-51	ZIIIMH-795	ZIIIMH-285	250	8
ZIIICO-62	ZIIIMH-1246	ZIIIMH-1811	200	8.9
ZIIICO-65	ZIIIMH-1689	ZIIIMH-1439	200	9
ZIIICO-246	ZIIIMH-1814	ZIIIMH-1246	200	17.1
ZIIICO-248	ZIIIMH-2002	ZIIIMH-1814	200	17.2
ZIIICO-272	ZIIIMH-1062	ZIIIMH-1147	200	18.1
ZIIICO-332	ZIIIMH-1815	ZIIIMH-972	250	19.5
ZIIICO-412	ZIIIMH-850	ZIIIMH-1649	350	21.4
ZIIICO-419	ZIIIMH-1811	ZIIIMH-1689	200	21.5
ZIIICO-440	ZIIIMH-1439	ZIIIMH-1062	200	22
ZIIICO-479	ZIIIMH-1255	ZIIIMH-255	250	22.8
ZIIICO-719	ZIIIMH-749	ZIIIMH-1312	500	39.1
ZIIICO-738	ZIIIMH-1012	ZIIIMH-850	250	27.8
ZIIICO-807	ZIIIMH-1147	ZIIIMH-924	200	28.8
ZIIICO-874	ZIIIMH-753	ZIIIMH-1295	200	29.6
ZIIICO-1099	ZIIIMH-1220	ZIIIMH-1817	200	32.1
ZIIICO-1114	ZIIIMH-596	ZIIIMH-749	350	32.4

ZIIICO-1221	ZIIIMH-972	ZIIIMH-1337	250	34
ZIIICO-1288	ZIIIMH-1817	ZIIIMH-1815	250	35
ZIIICO-1394	ZIIIMH-3617	ZIIIMH-1990	250	36.1
ZIIICO-1437	ZIIIMH-335	ZIIIMH-471	250	36.4
ZIIICO-1557	ZIIIMH-285	ZIIIMH-335	250	37.7
ZIIICO-1612	ZIIIMH-1968	ZIIIMH-2182	700	38.4
ZIIICO-1702	ZIIIMH-2182	ZIIIMH-2183	700	39.6
ZIIICO-1716	ZIIIMH-1824	ZIIIMH-1968	700	39.7
ZIIICO-1765	ZIIIMH-2012	ZIIIMH-833	200	40.8
ZIIICO-1898	ZIIIMH-255	ZIIIMH-1012	250	43.4
ZIIICO-1903	ZIIIMH-313	ZIIIMH-596	350	43.5
ZIIICO-1993	ZIIIMH-1990	ZIIIMH-795	250	45.4
ZIIICO-2070	ZIIIMH-2013	ZIIIMH-2012	200	47.4
ZIIICO-2233	ZIIIMH-500	ZIIIMH-573	700	24.4
ZIIICO-2412	ZIIIMH-3892	ZIIIMH-3893	700	30
ZIIICO-2413	ZIIIMH-3893	ZIIIMH-3894	700	34.4
ZIIICO-2414	ZIIIMH-3894	ZIIIMH-3895	700	35
ZIIICO-2415	ZIIIMH-3895	ZIIIMH-3896	700	40
ZIIICO-2416	ZIIIMH-3896	ZIIIMH-3897	700	35.4
ZIIICO-2417	ZIIIMH-3897	ZIIIMH-1399	700	27.9
ZIIICO-2418	ZIIIMH-316	ZIIIMH-3898	700	40.2
ZIIICO-2419	ZIIIMH-3898	ZIIIMH-3899	700	42.2
ZIIICO-2420	ZIIIMH-3899	ZIIIMH-3900	700	31.9
ZIIICO-2421	ZIIIMH-3900	ZIIIMH-3901	700	34.9
ZIIICO-2422	ZIIIMH-3901	ZIIIMH-3902	700	39.9
ZIIICO-2423	ZIIIMH-3902	ZIIIMH-3903	700	31.9
ZIIICO-2424	ZIIIMH-3903	ZIIIMH-3904	700	34.9
ZIIICO-2425	ZIIIMH-3904	ZIIIMH-3905	700	30.9
ZIIICO-2449	ZIIIMH-3926	ZIIIMH-3927	200	30.5
ZIIICO-2450	ZIIIMH-3927	ZIIIMH-3928	200	27.7
ZIIICO-2451	ZIIIMH-3928	ZIIIMH-3929	200	35.2
ZIIICO-2452	ZIIIMH-3929	ZIIIMH-3930	200	27.9
ZIIICO-2453	ZIIIMH-3930	ZIIIMH-3931	200	25.3
ZIIICO-2454	ZIIIMH-3931	ZIIIMH-3932	200	37.5
ZIIICO-2455	ZIIIMH-3932	ZIIIMH-3933	200	38.7
ZIIICO-2456	ZIIIMH-3933	ZIIIMH-3934	200	38.2
ZIIICO-2457	ZIIIMH-3934	ZIIIMH-2159	200	33.2
ZIIICO-3146	ZIIIMH-573	ZIIIMH-4448	700	37.3
ZIIICO-3147	ZIIIMH-4448	ZIIIMH-4449	700	34.1
ZIIICO-3148	ZIIIMH-4449	ZIIIMH-4450	700	36.1
ZIIICO-3149	ZIIIMH-4450	ZIIIMH-4451	700	28.3
ZIIICO-3150	ZIIIMH-4451	ZIIIMH-4452	700	30.7
ZIIICO-3151	ZIIIMH-4452	ZIIIMH-4453	700	30.7
ZIIICO-3152	ZIIIMH-4453	ZIIIMH-4454	700	29.8

ZIIICO-3153	ZIIIMH-4454	ZIIIMH-4455	700	29.9
ZIIICO-3154	ZIIIMH-4455	ZIIIMH-4456	700	27.9
ZIIICO-3155	ZIIIMH-4456	ZIIIMH-4457	700	27
ZIIICO-3156	ZIIIMH-4457	ZIIIMH-316	700	42
ZIIICO-4449	ZIIIMH-5318	ZIIIMH-25	250	29.5
ZIIICO-4679	ZIIIMH-5476	ZIIIMH-730	500	23.4
ZIIICO-4680	ZIIIMH-5477	ZIIIMH-5476	500	27.6
ZIIICO-4681	ZIIIMH-1312	ZIIIMH-5478	500	25.3
ZIIICO-4682	ZIIIMH-5478	ZIIIMH-5477	500	29.4
ZIIICO-4683	ZIIIMH-5479	ZIIIMH-313	350	37.1
ZIIICO-4684	ZIIIMH-5480	ZIIIMH-5479	350	29.7
ZIIICO-4685	ZIIIMH-1649	ZIIIMH-5481	350	29.3
ZIIICO-4686	ZIIIMH-5481	ZIIIMH-5480	350	32.6
ZIIICO-4693	ZIIIMH-1337	ZIIIMH-5485	250	28.9
ZIIICO-4694	ZIIIMH-5485	ZIIIMH-1255	250	30.4
ZIIICO-4740	ZIIIMH-5512	ZIIIMH-3206	200	26.9
ZIIICO-4741	ZIIIMH-5513	ZIIIMH-5512	200	25.3
ZIIICO-4800	ZIIIMH-2022	ZIIIMH-5552	200	29.6
ZIIICO-4801	ZIIIMH-5552	ZIIIMH-2023	200	30.2
ZIIICO-4802	ZIIIMH-833	ZIIIMH-5553	200	30
ZIIICO-4803	ZIIIMH-5553	ZIIIMH-2022	200	30.9
ZIIICO-4804	ZIIIMH-2023	ZIIIMH-5554	200	30.1
ZIIICO-4805	ZIIIMH-5554	ZIIIMH-2002	200	31.6
ZIIICO-4901	ZIIIMH-1399	ZIIIMH-5622	700	34.5
ZIIICO-4902	ZIIIMH-5622	ZIIIMH-5623	700	30.9
ZIIICO-4903	ZIIIMH-5623	ZIIIMH-5624	700	34.3
ZIIICO-4904	ZIIIMH-5624	ZIIIMH-5625	700	28.1
ZIIICO-4905	ZIIIMH-5625	ZIIIMH-1824	700	29.3
ZIIICO-4906	ZIIIMH-2183	ZIIIMH-5626	700	29.9
ZIIICO-4907	ZIIIMH-5626	ZIIIMH-500	700	31.2
ZIIICO-5165	ZIIIMH-2159	ZIIIMH-5796	200	32.1
ZIIICO-5166	ZIIIMH-5796	ZIIIMH-2167	200	34.2
ZIIICO-5167	ZIIIMH-2167	ZIIIMH-5797	200	25.8
ZIIICO-5168	ZIIIMH-5797	ZIIIMH-5798	200	27.6
ZIIICO-5169	ZIIIMH-5798	ZIIIMH-2168	200	29.4
ZIIICO-5170	ZIIIMH-2168	ZIIIMH-5799	200	25.4
ZIIICO-5171	ZIIIMH-5799	ZIIIMH-5800	200	28
ZIIICO-5172	ZIIIMH-5800	ZIIIMH-2157	200	31.4
ZIIICO-5173	ZIIIMH-2157	ZIIIMH-5801	200	25.1
ZIIICO-5174	ZIIIMH-5801	ZIIIMH-5802	200	34.8
ZIIICO-5175	ZIIIMH-5802	ZIIIMH-2169	200	37.7
ZIIICO-5176	ZIIIMH-2169	ZIIIMH-5803	200	25.1
ZIIICO-5177	ZIIIMH-5803	ZIIIMH-5804	200	32
ZIIICO-5178	ZIIIMH-5804	ZIIIMH-5805	200	24.8

ZIIICO-5179	ZIIIMH-5805	ZIIIMH-2170	200	25.6
ZIIICO-5180	ZIIIMH-2170	ZIIIMH-5806	200	24.9
ZIIICO-5181	ZIIIMH-5806	ZIIIMH-5807	200	33.9
ZIIICO-5182	ZIIIMH-5807	ZIIIMH-2171	200	36.1
ZIIICO-5183	ZIIIMH-2171	ZIIIMH-5808	200	33.6
ZIIICO-5184	ZIIIMH-5808	ZIIIMH-2019	200	35.5
ZIIICO-5185	ZIIIMH-2019	ZIIIMH-5809	200	37.5
ZIIICO-5186	ZIIIMH-5809	ZIIIMH-2021	200	39.7
ZIIICO-5187	ZIIIMH-2021	ZIIIMH-5810	200	27.1
ZIIICO-5188	ZIIIMH-5810	ZIIIMH-2013	200	28.6
ZIIICO-5951	ZIIIMH-561	ZIIIMH-6306	350	37.1
ZIIICO-6369	ZIIIMH-6556	ZIIIMH-94	300	30.5

ZONE IV: -

Table 8.12: Derails of Zone IV Trenchless sewer networks proposed

Label	Start Node	Stop Node	Diameter (mm)	Length (Scaled) (m)
Trenchless by HDD Method				
ZIVCO-44	ZIVMH-232	ZIVMH-327	200	30
ZIVCO-76	ZIVMH-325	ZIVMH-326	200	30
ZIVCO-77	ZIVMH-326	ZIVMH-17	200	26
ZIVCO-113	ZIVMH-20	ZIVMH-324	200	19.8
ZIVCO-114	ZIVMH-324	ZIVMH-325	200	30
ZIVCO-127	ZIVMH-327	ZIVMH-328	200	30
ZIVCO-159	ZIVMH-226	ZIVMH-227	300	35.8
ZIVCO-289	ZIVMH-215	ZIVMH-216	300	30
ZIVCO-312	ZIVMH-322	ZIVMH-323	200	30
ZIVCO-313	ZIVMH-323	ZIVMH-20	200	40.2
ZIVCO-342	ZIVMH-321	ZIVMH-322	200	30
ZIVCO-346	ZIVMH-317	ZIVMH-318	250	30
ZIVCO-347	ZIVMH-318	ZIVMH-319	200	30
ZIVCO-400	ZIVMH-969	ZIVMH-352	200	29.7
ZIVCO-442	ZIVMH-221	ZIVMH-222	300	30
ZIVCO-449	ZIVMH-316	ZIVMH-317	250	30
ZIVCO-489	ZIVMH-17	ZIVMH-596	200	12.3
ZIVCO-493	ZIVMH-222	ZIVMH-223	300	30
ZIVCO-509	ZIVMH-319	ZIVMH-320	200	30
ZIVCO-510	ZIVMH-320	ZIVMH-321	200	30
ZIVCO-561	ZIVMH-241	ZIVMH-304	300	22.6
ZIVCO-567	ZIVMH-220	ZIVMH-221	300	30
ZIVCO-591	ZIVMH-596	ZIVMH-597	200	30
ZIVCO-592	ZIVMH-597	ZIVMH-598	200	30
ZIVCO-620	ZIVMH-223	ZIVMH-224	300	30

ZIVCO-628	ZIVMH-763	ZIVMH-774	250	28.8
ZIVCO-654	ZIVMH-328	ZIVMH-329	200	30
ZIVCO-655	ZIVMH-329	ZIVMH-330	200	30
ZIVCO-689	ZIVMH-216	ZIVMH-217	300	30
ZIVCO-726	ZIVMH-230	ZIVMH-231	300	30
ZIVCO-727	ZIVMH-231	ZIVMH-232	300	18
ZIVCO-743	ZIVMH-227	ZIVMH-228	300	24.2
ZIVCO-747	ZIVMH-224	ZIVMH-225	300	30
ZIVCO-748	ZIVMH-225	ZIVMH-226	300	30
ZIVCO-777	ZIVMH-147	ZIVMH-969	300	17.9
ZIVCO-779	ZIVMH-219	ZIVMH-220	300	30
ZIVCO-791	ZIVMH-228	ZIVMH-229	300	30
ZIVCO-792	ZIVMH-229	ZIVMH-230	300	30
ZIVCO-866	ZIVMH-240	ZIVMH-241	300	30
ZIVCO-872	ZIVMH-774	ZIVMH-785	250	30
ZIVCO-873	ZIVMH-785	ZIVMH-796	250	30
ZIVCO-879	ZIVMH-217	ZIVMH-218	300	30
ZIVCO-880	ZIVMH-218	ZIVMH-219	300	30
ZIVCO-907	ZIVMH-146	ZIVMH-147	300	30
ZIVCO-973	ZIVMH-352	ZIVMH-353	200	30
ZIVCO-983	ZIVMH-318	ZIVMH-304	300	19

8.4 Sewage Pumping Stations

The details of zone wise Sewage Pumping Stations proposed are as shown in Table - 8.13

Table 8.13: Zone wise Sewage Pumping Stations details

Zone No	Location	Details	Design Discharge		Diameter (In mm)	Depth (In m)
			Avg.	Peak		
1	SPS-1 Wasangaon	For lifting sewage from SPS -1 to 53 MLD STP	24.16	55.29	10.40	16.10
2	SPS-2 Sikandarpur	For lifting sewage SPS - 2 to 53 MLD STP	37.25	84.54	12.90	6.18
3	SPS-3 D- mart	For lifting sewage SPS - 3 to Collection Tank	48.77	110.80	14.80	6.28
4	SPS-4 Warwanti	For lifting sewage SPS - 3 to highest point	1.99	6.11	4.50	6.96

8.5 Sewage Pumping Machinery details

Table 8.14: Zone wise Sewage Pumping Stations details

Zone No	Location	Purpose	Details of Average Dry weather flow				
			Type	No	Discharge (LPS)	Head (In m)	HP
1	SPS-1 Wasangaon	For lifting sewage from SPS -1 to 53 MLD STP	Submersible Non-Clog Type	6 (4 +2)	**Q=133.82 LPS**	**H=39.95 M**	150
2	SPS-2 Sikandarpur	For lifting sewage SPS -2 to 53 MLD STP		6 (4 +2)	**Q=204.29 LPS**	**H=27.17 M**	150
3	SPS-3 D- mart	For lifting sewage SPS -3 to Collection Tank		6 (4 +2)	**Q=267.81 LPS,**	**H=33.84 M**	275
4	SPS-4 Warwanti	For lifting sewage SPS -3 to highest point		3 (2+1) 2 (1+1)	**Q=29.61 LPS** **Q=20.85 LPS**	**H=46 M** **H=41.03 M**	30 40

8.6 Sewage Pumping Main details

Details of zone wise Rising Mains proposed are given in Table 8.15 below

Table 8.15: Zone wise Sewage Pumping main details

Zone No	Type of Material	Diameter (in mm)	Length (in m)	Purpose
1	D.I. K-9	600	3470	For lifting sewage from SPS -1 to 53 MLD STP
2	D.I. K-9	700	2185	For lifting sewage SPS -2 to 53 MLD STP
3	D.I. K-9	750	1810	For lifting sewage SPS -3 to Collection Tank
4	D.I. K-9	250	3030	For lifting sewage SPS -3 to highest point

8.7 Sewage treatment Plant details

Details of zone wise STP proposed are given in Table 8.16 below

Table 8.16: Sewage Treatment Plant details

Zone No	Technology of STP	Capacity	Red Line Level	Blue Line Level	Yellow Line Level	FSL of STP	LSL of STP
1	SBR	53				606.00	600.50
2	SBR	11.50				589.20	584.20

8.8 Approach road, Compound wall

Details of Approach Road proposed are given in Table 8.17 below

Table 8.17: details of approach Road

Sr. No	Details of Approach Road	Length (km)	Width
1	Approach Road -100 M for 53 MLD STP	0.10	4.50
2	Approach Road -500 M for 11.5 MLD STP	0.50	4.50

Details of Compound Wall proposed are given in Table 8.18 below

Table 8.18: details of approach Road

Sr. No	Location	Type of Masonry	Length (m)	Height (m)
1	STP 53 MLD	Brick	391 M	1.60
2	STP 11.50 MLD	Brick	380 M	1.60

8.9 Road Reinstating

Details of Road Reinstating proposed are shown in Table 8.19

Table 8.19: details of Road reinstating

Sr. No.	Type of Road	Length

1	WBM	140 KM
2	BT	225 KM
3	RCC	197 KM
	Total	**562 KM**

8.10 Procurement of cleaning Machinery

4 nos. of cleaning machineries are proposed to be procure in this scheme.

8.11 Design output data

Zone wise Details of Velocity Range in Collection and Conveyance System.

Table 8.20: details of velocity range in collection & Conveyance system for whole city

Velocity Range (m/s)	Length (Km)	Total Length (%)	Cumulative (%)
V < 0.3	194.967	34.04%	34.04%
0.3 < =V < 0.6	129.87	22.68%	56.72%
0.6 < =V < 0.7	154.895	27.05%	83.77%
0.7< =V < 0.8	17.478	3.05%	86.82%
0.8 < =V < 1.2	44.548	7.78%	94.60%
1.2 < =V < 1.5	19.902	3.48%	98.08%
	11.02	1.92%	100.00%
Total	572.683		

Zone wise Details of Diameter wise Velocity and Depths of Collection and Conveyance System.

Table 8.21: details of Diameter wise Velocity & depths of system for whole city

Sr. No.	Diameter (mm)	Length (km)	Velocity		Depth (Cover) M	
			Maximum	Minimum	Maximum	Minimum

1.	Circle - 200.0 mm	497.352	1.58	0.03	12.89	0.90
2.	Circle - 250.0 mm	19.877	1.72	0.6	11.32	0.90
3.	Circle - 300.0 mm	13.563	1.73	0.64	9.33	0.90
4.	Circle - 350.0 mm	8.153	2.20	0.72	8.93	0.90
5.	Circle - 400.0 mm	7.926	2.30	0.80	4.88	0.90
6.	Circle - 450.0 mm	4.217	2.19	0.87	3.90	0.90
7.	Circle - 500.0 mm	2.396	2.25	0.95	7.52	0.90
8.	Circle - 600.0 mm	2.853	2.14	1.03	5.22	0.90
9.	Circle - 700.0 mm	6.937	2.26	1.15	12.74	0.90
10.	Circle - 800.0 mm	7.029	3.00	1.27	8.90	0.90
11.	Circle - 900.0 mm	0.512	1.14	1.14	13.24	1.07
12.	Circle - 1,000.0 mm	0.517	2.75	1.55	9.07	1.21
13.	Circle - 1,100.0 mm	1.348	3.00	1.65	2.15	0.90
Total		572.68				

9 PROPOSED TREATMENT SYSTEM

9.1 Selection & Recommendation of Technology for Sewage Treatment

9.1.1 General Review

Factors for selection of treatment process

Important Factors considered for selection of a wastewater treatment process

S. N.	Factors	Description / Comments
1.	Process Applicability / prior client experience with technology	Applicability of a process was evaluated on the basis of past experience of the client and data available from other full-scale plants in Maharashtra state. Ability of client to manage the plants and O & M independently and comfort level/ proficiently of the client.
2.	Applicable Flow Range	Process should be able to work for applicable flow rates. Some secondary processes like stabilization pounds are not suitable for large flow rates in highly populated areas.
3.	Applicable Flow variations	Flow variation has to be accounted for and the processes have to be designed to operate over a wide range of low rates. If flow variations are significant then equalization is required for the processes.
4.	Influent Wastewater Characteristics	The Wastewater characteristics (i.e., weak sewage, medium loaded sewage or strong sewage) affect the process to be used for wastewater treatment.
5.	Inhibiting constituents	Constituents in wastewater that may inhibit treatment processes.
6.	Climatic constrains	Temperatures affects the rate of reaction in Wastewater treatment processes (i.e., biological processes) and thus affects the physical operation of the facilities. Warmer temperatures can accelerate odor generation.

7.	Process sizing based on Reaction kinetics	Reactor sizing based on the governing reaction kinetics and kinetic coefficients. Process loading data is usually obtained from experience, published literature and pilot studies.
8.	Process sizing based on mass transfer	Rector sizing based on mass transfer coefficients. Data for mass transfer coefficients are usually derived from experience, published literature and result of pilot studies and prior successful operation of the plant.
9.	Performance	Performance of a plant measured in terms of effluent quality and its variability, which must be consistent with the effluent discharge requirements.
10.	Treatment residuals	Type and amount of solid, liquid and gaseous residuals produced must be known or estimated.
11.	Sludge processing	The selection of sludge processing system should be going hand in hand with the selection of the liquid treatment system.
12.	Environmental constrains	Environmental constrains such as wind direction, noise pollution, traffic may affect selection of treatment plant site and use of certain treatment process.
13.	Chemical requirements	Effluents of chemical addition on characteristics of the treatment residuals and cost of treatment.
14.	Energy requirements	Energy requirements and future energy costs for design of cost-effective treatment systems.
15.	Resource requirements	Additional requirement of resources for successful implementation of the proposed treatment system.
16.	Personnel requirements	Skills required for operations personnel. Training requirements for operation of unit processes.
17.	Operation & maintenance requirements	Spare parts requirements. Special O & M Considerations, their availability and costs.

18.	Ancillary processes	Requirement of any support processes. Any effect on effluent quality etc.
19.	Reliability	Reliability of wastewater treatment process to withstand shock loadings and its effect on effluent water quality.
20.	Complexity	Complexity of wastewater treatment process to operate under the routine and emergency conditions. Training for operators to operate the process.
21.	Compatibility	Can the new process be used successful with existing facilities and expansion accomplished easily?
22.	Adaptability	Adaptability of the process for future treatment modifications.
23.	Economic Life Cycle Analysis	Cost evaluation considering initial capital costs and long-term operation and maintenance costs. The nature of available funding can also significantly affect the selection of treatment process.
24.	Land Availability	Availability of sufficient space for accommodation of current process units and also future modifications and expansion to the treatment process. Availability of buffer zone for landscaping to minimize visual and other impacts.
25.	Experience / record of the Technology provider	Technology provider must be able to take care of any problems or trouble shooting after construction of the plant and after expiry of the defect liability period.

Source: Metcalf and eddy, Table 4-11, page 298-299

Based on the review, 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 on larger areas, capital high investment on land, high

maintenance costs are unavoidable. Hence water 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 constrains 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 the extended aeration process.
- CASP has logistic control operators with special sensors for Dissolved Oxygen measurements and there by fixing hours of operation of rectors which work in parallel. They require lower area (50 % reduced area of extended Aeration) and have high biomass loading efficiencies desired quality parameters.
- requires less capital investment on land.

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

S. No.	Raw Sewage Parameters	Values	Unit
1.	BOD_5	250 - 300	Mg/l
2.	COD	500-600	Mg/l
3.	Total Suspended Solids	300- 350	Mg/l
4.	pH	6.5-8.5	-
5.	Total Alkalinity as $CaCO_3$	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 Phosphorous	5-7	Mg/l
11.	Temperature	$15^0 – 35^0$	^{0} C

Treated Water Characteristics

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

Table 9.2: Characteristics of treated Sewage

S. No.	Raw Sewage Parameters	Values	Unit
1.	BOD_5	< 10	Mg/l
2.	COD	< 50	Mg/l
3.	Total Suspended Solids	< 10	Mg/l
4.	pH	6.5-8.5	-
5.	Total Kjeldahl Nitrogen	< 10	Mg/l
6.	Ammonical Nitrogen	< 5	Mg/l
7.	Total Nitrogen	< 10	Mg/l
8.	Feacal Coliform	< 230	MPN/100 ml

Selection of Technology for sewage treatment plant

The most suitable technology recommended for the sewage treatment is the Sequential Batch rector (SBR) for following reasons.

- Due to the nature of project, effluent is required for disposal to meet the above standards and SBR is able to produce treated effluent which meets the standard.
- The process can be operated and controlled with flexibility for efficient removal of organic matter, suspended solids, nitrogen, Phosphorous under all loading conditions. Provides enhanced phosphorous removal without chemical addition.
- Modular Approach for provision of Electro- Mechanical units will reduce the initial investment. The plant can be expanded and future modules can be added.
- Capable to treat shock loads.
- Low sludge generation and the sludge produced is digested sludge which can be directly dewatered and dried.
- Automated operation with PLC based SCADA control which is easy to monitor, anticipate problems and address proactively.

- Experience in India and Maharashtra as well (plants are operating successfully).
- Least Life Cycle Cost.
- Required less land.
- Tried, Tested and Proven experience of technology provider, post defect liability period.

Conclusion for Technology Selection

Additional reasons for selection of Sequential Batch reactor (SBRs) as treatment process at the new sewage treatment plants (STP) are listed below:

- ✓ SBR systems form one of the most cost-effective solutions.
- ✓ SBR systems can be modified easily for nutrient removal in the future to consistently deliver high quality, low nutrient level effluent. This will help the plant to meet any future regulations as well.
- ✓ Nutrient Removal i.e., biological phosphorous removal and denitrification can be achieved in the biological Rector without chemical addition.
- ✓ SBR systems tolerate wide swings in flow and organic loadings thus offering improved reliability and is tried, tested and proven technology.
- ✓ Energy efficient operations result in reduced energy costs compared other biological treatment processes.
- ✓ SBR process can be used for weak or medium loaded wastewater and are able to maintain required effluent quality at changing inlet parameters. Thus, making it an attractive option for wastewater treatment in new plants.
- ✓ Additionally, SBR processes are controlled from the PLC Panel / units which give the treatment plant operators tremendous flexibility to modify treatment scheme to match changes in influent and loading characteristics.

Conclusion:

In short, SBRs provides an inexpensive wastewater treatment option with low operation, maintenance costs and operational needs. Minimal operator attendance is required and the system is capable of handling shock and hydraulic loadings, and is very effective under all-weather condition. SBR technology has been taken for estimation purpose and recommended for arriving at cost estimates. However, the bidder is free to choose any technology but prior

successful experience, ability to meet final effluent parameters and minimum life cycle costs shall be the key parameters to decide the technology.

9.1.2 Treatment Scheme

Cyclic activated Sludge process (Sequential Bio. Rector) followed by Chlorination

The treatment scheme offered is aerobic biological treatment system. Excess aerobic biological sludge generated will be aerobically digested in the tank itself and dewatered in centrifuge before disposal to designated land fill/use as organic manure. The treated Effluent from biological treatment system passed through Chlorination system for the final disposal.

The treatment scheme proposed is split into four distinct parts:

Pre-treatment: Comprises of course screening at MPS, 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 aeration tanks. The sludge from the aeration tanks will be recycled back to anoxic tank for denitrification.

Chlorination system: Treated effluent from the biological unit will be disinfected by using disinfectant viz. chlorine/ sodium hypochlorite solution before disposal to environment.

Sludge Handling and disposal: Excess sludge produced in biological treatment process will be collected in sludge tank and digested aerobically. The Excess sludge dewatered in centrifuge and finally disposed or uses as organic manure.

Domestic sewage will flow through Bar Screen and collected in raw sewage sump at MPS. Large floating particles will be removed by the coarse bar screen. The raw sewage from the raw sewage sump will 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 aeration tank. The air in the aeration tank will be provided through an air diffused aeration system of SS-316. The sewage from aeration tank overflows into disinfection tank.

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 & centrate will be send back to raw sewage sump.

9.1.3 Process Units

Inlet / Stilling Chamber

Inlet chamber is provided to receive raw sewage from pumping stations through rising mains. Purpose of providing inlet Chamber is to dampen the velocity of sewage coming via rising mains from pumping station so to achieve better efficiency in screening. Retention time in Inlet chamber is 30 – 60 sec. at peak flow.

Fine Screen Channel

Raw sewage from inlet chamber enters into screen channels, having fine screens designed for peak flows. The velocity in the channel shall not be less than 0.3m/s during normal flow conditions and not more than 1.2 m/s during peak flow conditions. Parallel screen channels with 50% design capacity are provided, one channel is provided with mechanical type screen and one with manual cleaning screen. Conveyer belt and chute arrangement is provided for collection of screenings. The fine screens shall remove screenings from the sewage flow exceeding 6mm in size.

Grit Collection & Removal units

After fine screening, sewage flows to grit separator chambers under gravity. The separation of fine grit organic particles of specific gravity above 2.65 and particle size above 150 microns will take place in grit chamber. Grit chambers are complete with grit scrapper mechanism for grit collection, Organic return pump, & rake mechanism.

Parshall Flume

Parshall Flume is an economical and accurate way of measuring the flow of water in open channels. Originally developed to measure surface waters and irrigation flows. Parshall flumes is currently used to measure volumetric flow rate in municipal sewer lines and influent/effluent flows in sewage treatment plants. The Parshall flume accelerates flow through a contraction of both the parallel sidewalls and a drop in the floor at the flume throat. Under free-flow conditions the depth of water at specified location upstream of the flume throat can be converted to a rate of flow.

Sequential Batch Reactor

It is a fill and draw type activated sludge system. In this system, wastewater is added to a single batch reactor, treated to remove undesirable components and then discharged. SBR designs should have a minimum of two basins to allow for redundancy, maintenance, high

flows and seasonal variations. SBR basins shall be designed for respective modular tank capacity. SBR basins to be designed for the average flow.

The aeration tanks shall be a reinforced concrete structure. Each aeration module shall be preceded either by a separate anoxic tank or an anoxic zone. The anoxic zones/tank shall be sized so that a RAS flow rate equivalent to the average design flow of the incoming sewage, the nitrates present in the RAS shall be completely denitrified.

If an anoxic zone is used, it shall be separated from the aerated zone by a baffle. The intrusion of the mixed liquor from the aerated zone to the anoxic zone shall be prevented. The anoxic zones/tanks shall be equipped with mixers to maintain the activated sludge in suspension at all times. Slow mixers shall be used to avoid damaging the sludge flocs. The effluent of anoxic tank shall flow into SBR basins. The portion of activated sludge from the Return activated sludge pumps shall be pumped to the upstream of SBR basins. The return sludge arrangement shall ensure thorough mixing with the inflow into the anoxic zone.

The diffused aeration shall be designed in such a way that sufficient oxygen is provided for carbonaceous treatment, sludge stabilization, nitrification and maintaining the DO at the specified level. Allowance for diurnal variations in the load shall be made. Reduction in oxygen demand due to nitrification in the anoxic zones shall also be taken into account. Fine bubble membrane diffusers are preferable to coarse air bubble aeration. During power failure and on application of standby power through DG set, the blowers are required to be run continuously.

Electro mechanical decanter is mounted in each SBR basin. The decanters are mounted by way of a decanter wall plate seal and bearing ring assembly anchored onto the concrete wall. Each decanter utilizes a connecting rod to an actuator. Each actuator has a motor drive. Effluent flows from the decanters into an outlet pipe through the basin wall.

Chlorination System

After biological treatment, disinfection of treated sewage shall be done by using chlorine gas. A gas chlorination system is provided to dose required quantity of chlorine into the treated sewage. A chlorine contact tank is provided with suitable baffle arrangement to give sufficient contact time and mixing regime for disinfection. Gas chlorine system consists of vacuum type chlorinator, vacuum regulator, gas filters, ejectors, gas piping, solution piping, chlorine tonners, booster pumps, gas leak detection and absorption system, safety equipment etc.

Sludge Handling System

Sludge generated from biological treatment will feed to Gravity thickener & Centrifuge in order to increase sludge consistency.

Overflow from the gravity thickener & centrifuge, the centrate from the Sludge Treatment will be collected in Return Liquor Collection tank and recycle back to inlet/stilling chamber.

10 PROJECT COST

10.1 Capital Cost

The capital cost of the infrastructures components as envisaged as per the project plan and detailed estimates are prepared based on the quantities taken out from the drawings prepared out of the detailed designs. The rate adopted for project costing are based on prevailing SOR of State MJP for Year 2021-22, latest Corrigendum & PWD SOR 2022-23 for standard Items.

The rates which are not available in SOR are either derived based on other prevailing SOR in region or Rate analysis based on market rate or local enquires.

The cost for treatment technology has been taken based on the MJP SOR 2021-22 and latest corrigendum.

The Recapitulation sheet of detailed costing is presented in Table 10.1.

Table 10.1: Project Cost

LATUR MUNICIPAL CORPORATION		
Project Name: Underground Sewerage Scheme for Latur City		
RECAPITULATION SHEET		
SR. NO.	**SUBWORK**	**TOTAL COST (Rs.)**
	CIVIL WORKS	
1	**WORKING SURVEY**	**39,33,908**
2	**COLLECTION AND CONVEYANCE SYSTEM**	
A	**Zone I**	
	200 mm - 900 mm Dia., Total Length - 146.11 Km	**1,25,28,31,283**
B	**Zone II**	
	200 mm - 1000 mm Dia., Total Length - 185.65 Km	**1,51,72,94,725**
C	**Zone III**	
	200 mm - 1100 mm Dia., Total Length - 204.14 Km	**1,89,82,28,968**
D	**Zone IV**	
	200 mm - 400 mm Dia., Total Length - 28.63 Km	**28,16,19,767**
3	**SEWAGE PUMPING STATION**	
A	**Zone - I**	
a	Sewage Collection Sump/Wet Well - 10.4 M Dia., 16.11 m Depth	**1,01,93,407**
b	Sewage Pump House - 10.4 M Dia. & Ht. -5.5 M	**29,34,990**

B	**Zone - II**	
a	Sewage Collection Sump/Wet Well - 12.9 M Dia., 6.18 m Depth	**70,04,219**
b	Sewage Pump House - 12.9 M Dia. & Ht. -5.5 M	**36,36,314**
C	**Zone - III**	
a	Sewage Collection Sump/Wet Well - 14.8 M Dia., 6.28 m Depth	**83,78,188**
b	Sewage Pump House - 14.8 M Dia. & Ht. -5.5 M	**43,76,757**
D	**Zone - IV**	
a	Sewage Collection Sump/Wet Well - 4.5 M Dia., 6.96 m Depth	**21,97,028**
b	Sewage Pump House - 4.5 M Dia. & Ht. -5.5 M	**10,51,816**
4	**SEWAGE PUMPING MAIN**	
a	**Pumping main from SPS-1 to STP 53 MLD - 600 mm Dia., L- 3470 M**	**5,93,54,541**
b	**Pumping main from SPS-2 to STP 53 MLD - 700 mm Dia., L- 2185 M**	**4,94,32,442**
c	**Pumping main from SPS-3 to Colle. Tank - 750 mm Dia., L- 1810 M**	**4,62,10,720**
d	**Pumping main from SPS-4 to highest point - 250 mm Dia., L- 3030 M**	**2,02,85,287**
e	**Gravity main from Highest point to Collection Tank - 300mm dia., L- 1635 M**	**1,48,12,820**
5	**GRAVITY MAIN**	
a	**Collection Tank**	**55,07,005**
b	**Gravity Line to STP**	
i	**1000 mm dia. DI K-7, L = 3540 M**	
ii	**700 mm dia. DI K-7, L = 460 M**	
iii	**450 mm dia. DI K-7, L = 585 M**	**13,70,25,466**
6	**SEWAGE TREATMENT PLANT**	
a	**STP 2 for (Zone I & II) - 53 MLD**	**56,47,87,576**
b	**STP 2 for (Zone III & IV) - 11.5 MLD**	**17,19,40,465**
7	**ALLIED WORKS**	
a	Approach Road -100 M for 53 MLD STP	**8,71,621**
b	Approach Road -500 M for 11.5 MLD STP	**43,58,104**
c	Staff Quarter at 53 MLD STP	**44,24,846**
d	Compound Wall for 11.5 MLD STP	**66,65,529**
e	Compound Wall for 53 MLD STP	**60,64,586**
f	Fencing for SPS -1 to 4	**12,77,258**

g	Road Reinstating Work - For Zone I	32,98,26,146
h	Road Reinstating Work - For Zone II	40,86,91,675
i	Road Reinstating Work - For Zone III	47,74,12,562
j	Road Reinstating Work - For Zone IV	7,81,53,988
k	Flood Protection Wall	1,36,63,502
l	Pipe line along Highway	1,95,37,770
	ELECTRICAL, MECHANICAL & INSTRUMENTATION WORKS	
8	**ELECTRO-MECHANICAL WORKS AT STP & SPS**	
a	Electro-Mechanical Work at SPS -1	2,28,51,400
b	Electro-Mechanical Work at SPS -2	2,42,30,900
c	Electro-Mechanical Work at SPS -3	3,21,05,400
d	Electro-Mechanical Work at SPS -4	1,24,39,600
e	Electrical Connection at SPS -1 -4	4,85,22,300
f	Electrical Connection at STP 1 & 2	3,05,13,200
g	SCADA for SPS -1 to 4	55,78,000
h	Coarse Screen & Isolation Gates for SPS 2 to 4	2,08,57,359
i	Jetting Machine (4 Nos.)	1,29,40,560
9	**TRIAL & RUN FOR 6 months**	63,04,397
	TOTAL NET PROJECT COST (A)	**7,63,03,28,395**
	Insurance Charges (b) 1%	1,48,26,003
	Technical Scrutiny Charges (c) 1%	7,63,03,284
	Add for GST 18.00%	1,37,34,59,111
	TOTAL PROJECT COST(TPC) IN RS. (B)	**9,09,49,16,793**
	TOTAL PROJECT COST(TPC) IN RS. LAKHS	**90,949.17**

11 OPERATION AND MAINTENANCE

11.1 Operation and Maintenance

In the present project, the probable annual expenditure on account of operation and maintenance for Collection & Conveyance system, Pumping Stations and treatment plant is work out.

The operation & maintenance will include the following items.

a) Establishment / Manpower Cost

b) Chemical Cost & Other sundry Items

c) Electricity Cost

d) DG Set Running Cost

e) Waste Disposal Cost

f) Expenditure on Routine Maintenance & Repairs works under Annual Maintenance cost.

The period required for the completion of project is considered as 30 Months and the Operation & Maintenance will start from the APR 2027 and accordingly the expenditures are work out for 15-year period. (Annexure 17)

It is assumed that a certain degree of maintenance is required and also a skilled workforce to perform maintenance and operational duties when needed. The proper maintenance of the chosen system would be a limiting factor in terms of the sustainability of the project at the town level, as it has been seen from past experiences that most often maintenance has not been satisfactory choices should perhaps be directed towards relatively low maintenance systems.

The provision of jetting cum cleaning machinery is considered in this project.

The annual charges of base year for the Operation & Maintenance of Latur City sewerage scheme are given below. Details are given in the Annexures.

STATEMENT OF ANNUAL O & M CHARGES IN Rs. LAKH

(Detail Calculation of A, B, C, D, E and F should be given separately)

A)	Establishment	Rs	99.18
B)	Electricity Charges	Rs.	738.61

C)	Chemical and Materials	Rs.	64.19
D)	Annual Repair Charges	Rs.	371.71
E)	DF Running Charges	Rs.	117.56
F)	Waste Disposal Charges	Rs.	146.79
Hence Annual O & M Charges = (A+B+C+D+E+F)		Rs.	1538.03
		Say, In Rs. Lakh	**1538.03**

12 ENVIRONMETAL AND SOCIAL ISSUES, RIGHT OF WAY AND LAND REQUIREMENT

12.1 Environmental and Social Impacts

The positive impact will be

- The environmental health of Latur city will improve.
- The treated sewage will no more be discharged in Pond and River, Pond and river water quality will improve.
- After secondary treatment, treated water can be reuse for secondary purposes like flushing, industrial colling water makeup, gardening & irrigation purpose the reuse of waste water will help to conserve fresh water due to replacement of fresh water by the treated sewage by Potential users in Latur city or around Latur city.
- The people in Latur city will have more fresh water for drinking / agriculture purpose at their disposal as Potential users will withdraw less water from River.
- Treated Sewage water can be used for Irrigation purposes & by storing treated water in Pond, fishing activities can be improved in area.

The project will have negative impacts during construction phase as below:

- The plying of excavator's, pipe trucks, hydraulic cranes and tippers will have additional traffic along roads of laying pipes.
- There will be slowing of traffic.
- Temporary increase in SPM in air.
- Conflicts between labour and locals.

12.2 Land Requirement

Land required at different location for proposed 4 SPS and 2 STP will have to be provided by the Latur Municipal Corporation and associated cost should be borne by LMC. Detailed statement showing location of proposed structures and area required for SPS and STP is tabulated in table 12.1.

12.1 : STATEMENT SHOWING LAND REQUIREMENT FOR SPSs & STPs FOR PROPSOED LATUR SEWERAGE SCHEME

Sr. No.	Components of Project	Minimum Land Required in Sqm	Location	Mouza	Survey No. / Plot No.	Remarks
1	**SPS-1**	20 M X 25 M = 500 SQM	664493.47 m E, 2031543.37 m N	Wasangaon, Latur	17 / 18	Land availability should be confirmed by LMC with Land Dept.
2	**SPS-2**	20 M X 25 M = 500 SQM	668312.79 m E 2032157.08 m N	Sikandarpur, Latur	88 / 94	
3	**SPS-3**	20 M X 25 M = 500 SQM	667863.04 m E 2038140.39 m N	Latur (Rural)	329/330	
4	**SPS-4**	20 M X 25 M = 500 SQM	662222.08 m E 2039322.29 m N	Warwanti, Latur	30	
5	**STP -1 - 53 MLD**	17950 SQM	667162.52 m E 2031819.47 m N	Kavha, Latur	72 & 80	
6	**STP -1 - 11.5 MLD**	8333 SQM	667660.64 m E 2041867.65 m N	Mahapur, Latur	155/3	

12.3 Permissions

- Permission from Irrigation Department about setting up STP along the bank of Nallas / River
- Permission from Pollution Control Board

13 IMPLEMENTATION PLAN

13.1 Staging of Sewerage Works

The priorities of works shall be followed during execution in sequence as shown below.

(1) Sewage treatment plants

(2) Trunk mains

(3) Sewage pumping stations (if required)

(4) Main sewers

(5) Sub main sewers

(6) Sewers (Laterals)

The works at Sr. No. 1 to 3 mentioned above can be taken simultaneously. However, only after completion of all works from Sr. 1 to 6 mentioned above, the property connections shall be given.

Detailed Bar chart showing implementation schedule has been prepared and shown in Annexure 1 & 2.

13.2 Service Level Benchmarking

Presently there is *no* proper sewerage system in *Latur City.* It is planned to cover the 100% houses and sewage treatment facility for the *Latur City.* It is also planned to reuse the treated sewage *for flushing of manholes and irrigation for the green belt area proposed on the periphery of the STP Locations.*

Existing benchmarks and benchmarks expected to be achieved after implementation of the project are given in Table 13.1 below

Table 13.1: Service Level Benchmarking

Sr. No.	Indicator	Existing Bench mark	Expected Bench marks after implementing the scheme
1	Coverage of Toilets	100 %	100%
2	Coverage of Sewerage Network	-	100%
3	Collection efficiency of Sewerage	-	100%

	Network		
4	Adequacy of Sewage Treatment Capacity	-	100%
5	Quality of Sewage Treatment	-	100%
6	Extent of Reuse and Recycling of Sewage	-	20%
7	Efficiency in redressal of customer complaints	-	80%
8	Extent of cost recovery in sewage management	-	100%
9	Efficiency in Collection of Sewage Charges	-	90%

14 FINANCE FOR COST AND RECOVERY

14.1 Financial Pattern

Latur City Municipal Corporation has taken this ambitious project for increasing living standard of Citizens of Latur city. LCMC will raise fund from his own and part fund will be as soft loan from MUINFRA.

Following table gives details of central, State & ULB share

Table 14.1: Financial Pattern

Financial Pattern in Cr.				
Year	**Expenditure likely to be incurred**	**GOI**	**GOM**	**LCMC**
1	**2**	**3**	**4**	**5**
		33.33%	**36.67%**	**30%**
2024-25	246.05	82.0	90.2	73.8
2025-26	443.20	147.7	162.5	133.0
2026-27	220.24	73.4	80.8	66.1
Total	**909.5**	**303.1**	**333.5**	**272.85**

14.2 Requirement of Fund during construction

Table 14.2: Requirement of Fund

REQUIREMENT OF FUND						
Sr No	**NAME OF PROJECT**	**Construction Period**	**Funds for each Year**			**Total Rs in Cr.**
			2024-25	**2025-26**	**2026-27**	
1	**2**	**3**	**4**	**5**	**6**	**8**
A	**Latur City Underground Drainage Scheme**	36	246.05	443.20	220.24	909.49
	% of Allotment					
	Total	**36**	**27%**	**49%**	**24%**	**100%**

ANNEXURES

ANNEXURE 1 – BAR CHART

Name of Project: -PREPARATION OF DETAILED PROJECT REPORT FOR LATUR CITY UNDERGROUND DRAINAGE SCHEME, LATUR														
Sr. No.	**Particulars of Components**	**Cost Rs in Cr.**	**BAR CHART**											
1	**2**	**3**	**4**				**5**				**6**			
			2024-25				**2025-26**				**2026-27**			
			4-6	**7-9**	**10-12**	**1-3**	**4-6**	**7-9**	**10-12**	**1-3**	**4-6**	**7-9**	**10-12**	**1-3**
			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
1	Collection & Conveyance System	590.48	**59.0**	**59.0**	**59.0**	**59.0**	**59.0**	**59.0**	**59.0**	**59.0**	**59.0**	**59.0**		
					0.1	0.1	0.1	0.15	0.15	0.15	0.15	0.1		
2	Sewage pumping Station	5.40			**0.5**	**0.5**	**0.5**	**0.8**	**0.8**	**0.8**	**0.8**	**0.5**		
								0.15	0.25	0.25	0.2	0.15		
3	Sewage Pumping Machinery	25.04						**3.8**	**6.3**	**6.3**	**5.0**	**3.8**		
							0.15	0.2	0.35	0.15	0.15			
4	Pumping Main	38.99					**5.8**	**7.8**	**13.6**	**5.8**	**5.8**			
						0.1	0.15	0.2	0.15	0.15	0.15	0.1		
5	Sewage Treatment Plant	87.81				**8.8**	**13.2**	**17.6**	**13.2**	**13.2**	**13.2**	**8.8**		
								0.15	0.2	0.25	0.25	0.15		
6	Allied Work	158.70						**23.8**	**31.7**	**39.7**	**39.7**	**23.8**		
									1					
7	Pipe line along Highway	2.33							**2.33**					
													0.5	0.5
8	TRIAL & RUN FOR 6 months	0.75											**0.38**	**0.38**
			59.05	**59.05**	**59.59**	**68.37**	**78.61**	**112.78**	**127.00**	**124.81**	**123.56**	**95.93**	**0.38**	**0.38**
			246.05				**443.20**				**220.24**			
		909.49		**2024-25**			**2025-26**				**2026-27**			

ANNEXURE 2 – IMPLEMENTATION SCHEDULE

	ESTIMATED COST (Rs. in Cr.)	909.49	590.48	93.96	64.03	158.70
			Package - 1	Package - 2	Package - 3	Package - 4
S. NO	ACTIVITIES	PERIOD	Collection System & Outfall Sewer	STP & Pumping Station	Pumping Main /Machinery	Allied Work
1	2	3	4	5	6	7
1	STARTING OF ACTIVITIES		Apr-24	Jan-25	Apr-26	Jul-25
2	PRE-QUALIFICATION CRITERIA FOR EACH PACKAGE	week	1.0	1.0	1.0	1.0
3	ADVERTISING FOR PREQUALIFICATIONS	weeks	1.0	1.0	1.0	1.0
4	RECEIPT OF OFFER FOR PQ	week	0.6	0.6	0.6	0.6
5	EVALUTION & SUBMISSION OF REPORT ON PQ	weeks	0.7	0.7	0.7	0.7
6	APPROVAL OF LOCAL BODY TO PQ BIDDERS	week	0.7	0.7	0.7	0.7
7	FINAL SELECTION OF PQ	week	1	1	1	1
8	TENDERING FROM SELECTED BIDDERS	weeks	1.0	1.0	1.0	1.0
9	RECEIPT OF TENDERS	week	1	1	1	1
10	SCRUTINISING OF TENDER	weeks	1.0	1.0	1.0	1.0
11	RECOMMENDING TO COMMETEE	week	1	1	1	1
12	APRROVAL FORM COMMETEE	week	0.5	0.5	0.5	0.5
13	AWARD OF TENDER	week	0.5	0.5	0.5	0.5
14	DEPOSITION OF SECURITY DEPOSITE	weeks	1	1	1	1
15	WORK ORDER	weeks	1	1	1	1
	TOTAL PERIOD REQUIRED FOR STARTING OF WORK	**WEEKS**	**12**	**12**	**12**	**12.0**
		MONTHS	**3**	**3**	**3**	**3**
16	LINEOUT/LAYOUT	weeks	3	3	3	6
17	CONSTRUCTION PERIOD	weeks	102	79	50	43
18	TESTING	weeks	6	6	6	2

19	COMMISSIONING	weeks	3	3	3	2
20	Trial Run	weeks	0	24	0	0
21	FINAL CERTIFICATE	weeks	3	3	3	2
	TOTAL WEEKS		129	130	77	67
	TOTAL MONTHS		30	30	18	15
	TOTAL YEARS & MONTHS		2 Years 6 Months	2 Years	1 Year 6Months	1 Year 3Months
	END OF ACTIVITIES IN		Sep-26	Mar-27	Sep-26	Sep-26

ANNEXURE 3 – POPULATION PROJECTION

Annexure 1: Population Forecasting

Underground Drainage Scheme, Latur

POPULATION FORECASTING

LATUR				
Preamble				
	Year	**Population**	**Increment**	
	1971			
	1981	**111986**	111986	
	1991	**197408**	85422	76.28%
	2001	**299985**	102577	51.96%
	2011	**382940**	82955	27.65%
		TOTAL	**382940**	

Population Projection for Year **2022** **2027** **2042** **2057**

SOLUTION: -

1. Arithmetical Progression Method

Increase in population from 1981 to 2011
(i.e., in 4 decades) = 382940
\- 111986
270954

or Increse per decade = 1 /3 x 270954
= **90318**

Population in 2022 = Population in 2011 + Increase for 1.1 X decades
= 382940+1.1 x90318
= 382940+99349.8
= **482290**

Population in 2027 = Population in 2011 + Increase for 1.6 X decades
= 382940+1.6 x90318
= 382940+144508.8
= **527449**

Population in 2042 = Population in 2011 + Increase for 3.1 X decades
= 382940+3.1 x90318
= 382940+279985.8
= **662926**

Population in 2057 = Population in 2011 + Increase for 4.6 X decades
= 382940+4.6 x90318
= 382940+415462.8

= **798403**

2. Method of Varying Increment or Incremental Increse Method

In this method a progressively decresing or increasing rather than a constant rate is adopted. This is a modification over the Arithmetical Progression method.

Year		Population	Increase X		Incremental Increase Y
1971		0	0		0
1981		111986	0	+	0
1991		197408	85422	+	0
2001		299985	102577	+	17155
2011		382940	82955	+	-19622
		TOTAL	**270954**		**-2467**
				=	1 / 2 x-2467
	Average =	1 /3x 270954		Y =	**-1234**

X = **90318**

P n = P2011 + n x (x) + n (n+1) x Y / 2

P2022 = P2011 +1.1 x90318 +1.1(1.1+1) x-1234/2

= 382940+ 99350+-1425 99350 -1425

= **480865**

P2027 = P2011 +1.6 x90318 +1.6(1.6+1) x-1234/2

= 382940+ 144509+-2567 144509 -2567

= **524882**

P2042 = P2011 +3.1 x90318 +3.1(3.1+1) x-1234/2

= 382940+ 279986+-7842 279986 -7842

= **655084**

P2057 = P2011 +4.6 x90318 +4.6(4.6+1) x-1234/2

= 382940+ 415463+-15894 415463 -15894

= **782509**

3. Geometrical Progression Method

Rate of growth (r) =

per decade between

1971 and 1981 = (111986-) / =

1981 and 1991 = (197408-111986) /111986 = 0.763 76.28%

1991 and 2001 = (299985-197408) /197408 = 0.520 51.96%

2001 and 2011 = (382940-299985) /299985 = 0.277 27.65%

Geometric mean, r_g = $\sqrt[4]{0*0.763*0.52*0.277}$ = 0.4786

Assuming that the future growth follows the geometric mean for the period 1981 to 2011 rg = 0.4786

Population in 2022 = Population in 2011 x (1 + rg)1.1
= 382940x (1+0.4786) ^1.1
= **588785**

Population in 2027 = Population in 2011 x (1 + rg)1.6
= 382940x (1+0.4786) ^1.6
= **715941**

Population in 2042 = Population in 2011 x (1 + rg)3.1
= 382940x (1+0.4786) ^3.1
= **1287182**

Population in 2057 = Population in 2011 x (1 + rg)4.6
= 382940x (1+0.4786) ^4.6
= **2314208**

ANNEXURE 4 – WARD WISE POPULATION PROEJCTION

LATUR MUNICIPAL CORPORATION									
Project Name: Underground Sewerage Scheme for Latur City									
(UNDER AMRUT 2.0 ABHIYAN)									
WARDWISE POPULATION DENCITY AND POPULATION									
FOR YEAR 2027,2042 & 2057									
WARD NO.	EQUIVALENT RESIDENTIAL AREA	YEAR 2011		YEAR 2027		YEAR 2042		YEAR 2057	
		POP	DENSITY	POP	DENSITY	POP	DENSITY	POP	DENSITY
1	2	3	4	5	6	7	8	9	10
1	116.25	8332	71.67	11448	98.48	14339	123.34	17199	147.95
2	148.06	8137	54.96	11180	76.00	14003	94.57	16796	113.44
3	128.66	3950	30.70	5427	65.00	6798	52.84	8153	63.37
4	44.11	8299	188.16	11403	190.00	14282	323.82	17131	388.41
5	19.59	8347	426.14	11469	450.00	14364	733.32	17230	879.64
6	29.49	4835	163.97	6643	166.00	8321	282.19	9980	338.45
7	26.00	6831	262.73	9386	271.00	11756	452.15	14100	542.31
8	64.44	9235	143.31	12689	145.00	15893	246.62	19063	295.81
9	8.81	3594	407.83	4938	479.00	6185	701.84	7419	841.87
10	11.98	3457	288.68	4750	308.00	5949	496.78	7136	595.91
11	9.70	4711	485.54	6473	500.00	8107	835.56	9724	1002.22
12	26.31	9360	355.72	12861	425.00	16108	612.18	19321	734.29
13	24.72	7499	303.39	10304	315.00	12905	522.10	15479	626.24
14	19.51	3503	179.53	4813	200.00	6028	308.93	7231	370.58
15	9.59	5508	574.50	7568	600.00	9479	988.68	11369	1185.81
16	7.31	4469	611.15	6140	620.00	7691	1051.76	9225	1261.54
17	7.78	4559	586.37	6264	600.00	7846	1009.13	9411	1210.42
18	45.19	3718	82.28	5109	129.00	6398	141.59	7675	169.85
19	18.31	6062	331.03	8329	336.00	10432	569.67	12513	683.30
20	17.94	6708	373.97	9217	381.00	11544	643.57	13847	771.96
21	80.37	9606	119.53	13199	147.00	16531	205.69	19828	246.72
22	201.04	6925	34.45	9515	41.00	11917	59.28	14294	71.10
23	29.67	5597	188.66	7690	190.00	9632	324.67	11553	389.42
24	28.04	5735	204.55	7880	207.00	9869	351.99	11838	422.22

25	27.69	6046	218.33	8307	222.00	10405	375.73	12480	450.66
26	9.31	5818	624.75	7994	630.00	10012	1075.11	12009	1289.56
27	23.88	4441	186.01	6102	219.00	7643	320.13	9167	383.96
28	29.46	3859	130.98	5302	162.00	6641	225.41	7966	270.38
29	16.29	4918	301.95	6757	388.00	8463	519.60	10152	623.30
30	18.61	5093	273.63	6998	400.00	8765	470.92	10513	564.84
31	7.01	3591	512.27	4934	690.00	6180	881.60	7412	1057.35
32	8.06	3637	451.10	4997	639.00	6259	776.31	7507	931.10
33	7.03	5075	722.42	6973	730.00	8734	1243.27	10476	1491.25
34	47.28	9487	200.66	13035	223.00	16326	345.30	19583	414.19
35	8.78	3739	426.10	5137	450.00	6434	733.22	7718	879.54
36	9.17	4335	472.87	5956	480.00	7460	813.74	8948	976.06
37	101.82	9117	89.54	12527	117.00	15690	154.10	18819	184.83
38	10.39	6796	654.25	9338	680.00	11695	1125.87	14028	1350.47
39	26.63	3944	148.10	5419	200.00	6787	254.86	8141	305.71
40	35.26	5290	150.02	7269	300.00	9104	258.18	10919	309.65
41	15.56	3465	222.65	4761	319.00	5963	383.16	7152	459.57
42	27.58	4211	152.70	5786	216.00	7247	262.79	8692	315.18
43	16.74	5008	299.21	6881	325.00	8618	514.89	10337	617.60
44	18.24	5667	310.73	7787	350.00	9752	534.72	11698	641.43
45	15.34	6340	413.37	8711	421.00	10911	711.39	13087	853.27
46	18.31	9057	494.58	12444	550.00	15586	851.11	18695	1020.89
47	31.29	2680	85.64	3682	99.00	4612	147.38	5532	176.78
48	104.38	15804	151.42	21715	160.00	27197	260.57	32622	312.55
49	29.82	7216	242.03	9915	274.00	12418	416.50	14895	499.58
50	46.01	8905	193.53	12236	202.00	15325	333.06	18381	399.48
51	28.31	5440	192.14	7475	200.00	9362	330.67	11229	396.61
52	66.80	5896	88.26	8101	91.00	10146	151.89	12170	182.19
53	30.81	4706	152.73	6466	220.00	8099	262.85	9714	315.26
54	22.31	5590	250.53	7681	260.00	9620	431.15	11539	517.15
55	36.05	7654	212.32	10517	260.00	13172	365.38	15799	438.25
56	30.47	8215	269.65	11288	323.00	14137	464.04	16957	556.61
57	20.84	6012	288.55	8261	350.00	10346	496.57	12410	595.63

58	14.54	6607	454.48	9078	460.00	11370	782.12	13638	938.13
59	95.13	4149	43.61	5701	96.00	7140	75.06	8564	90.02
60	21.47	9270	431.87	12737	435.00	15953	743.21	19135	891.45
61	251.86	8764	34.80	12042	36.00	15082	59.88	18090	71.82
62	204.36	8121	39.74	11158	50.00	13976	68.39	16763	82.03
	2655.72	382940		526163		659007		790452	

ANNEXURE 5 – ZONE WISE POPULATION PROJECTION

LATUR MUNICIPAL CORPORATION														
Project Name: Underground Sewerage Scheme for Latur City														
(UNDER AMRUT 2.0 ABHIYAN)														
WARDWISE POPULATION DENCITY AND POPULATION														
FOR YEAR 2027,2042 & 2057														
WARD NO.	EQ. RESIDEN_TIAL AREA	YEAR 2011			YEAR 2027			YEAR 2042			YEAR 2057			PART
		Part POP	POP	DENSITY	Part POP	POP	DENSITY	Part POP	POP	DENSITY	Part POP	POP	DENSITY	%
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ZONE-1														
42	27.5775	1684	4211	152.70	2314	5786	209.81	2899	7247	262.79	3477	8692	315.18	40
43	16.7375	5008	5008	299.21	6881	6881	411.11	8618	8618	514.89	10337	10337	617.60	100
44	18.2375	5667	5667	310.73	7787	7787	426.98	9752	9752	534.72	11698	11698	641.43	100
45	15.3375	6340	6340	413.37	8711	8711	567.95	10911	10911	711.39	13087	13087	853.27	100
46	18.3125	9057	9057	494.58	12444	12444	679.54	15586	15586	851.11	18695	18695	1020.89	100
47	31.2925	2680	2680	85.64	3682	3682	117.66	4612	4612	147.38	5532	5532	176.78	100
48	104.375	15804	15804	151.42	21715	21715	208.05	27197	27197	260.57	32622	32622	312.55	100
49	29.815	7216	7216	242.03	9915	9915	332.55	12418	12418	416.50	14895	14895	499.58	100
50	46.0125	8905	8905	193.53	12236	12236	265.93	15325	15325	333.06	18381	18381	399.48	100
51	28.3125	5440	5440	192.14	7475	7475	264.02	9362	9362	330.67	11229	11229	396.61	100
52	66.8	5896	5896	88.26	8101	8101	121.27	10146	10146	151.89	12170	12170	182.19	100
53	30.8125	4706	4706	152.73	6466	6466	209.85	8099	8099	262.85	9714	9714	315.26	100
62	204.3625	4077	8121	39.74	5601	11158	54.60	7016	13976	68.39	8415	16763	82.03	50.2
		82480			**113328**			**141941**			**170252**			
ZONE-2														
8	64.4425	7388	9235	143.31	10151	12689	196.90	12714	15893	246.62	15250	19063	295.81	80
9	8.8125	3594	3594	407.83	4938	4938	560.34	6185	6185	701.84	7419	7419	841.87	100
10	11.975	2074	3457	288.68	2850	4750	396.66	3569	5949	496.78	4282	7136	595.91	60
32	8.0625	2182	3637	451.10	2998	4997	619.78	3755	6259	776.31	4504	7507	931.10	60
33	7.025	5075	5075	722.42	6973	6973	992.60	8734	8734	1243.27	10476	10476	1491.25	100
34	47.28	9487	9487	200.66	13035	13035	275.70	16326	16326	345.30	19583	19583	414.19	100
35	8.775	3739	3739	426.10	5137	5137	585.41	6434	6434	733.22	7718	7718	879.54	100
36	9.1675	4335	4335	472.87	5956	5956	649.69	7460	7460	813.74	8948	8948	976.06	100
37	101.8175	9117	9117	89.54	12527	12527	123.03	15690	15690	154.10	18819	18819	184.83	100
38	10.3875	6796	6796	654.25	9338	9338	898.97	11695	11695	1125.87	14028	14028	1350.47	100
39	26.63	3944	3944	148.10	5419	5419	203.49	6787	6787	254.86	8141	8141	305.71	100

40	35.2625	4761	5290	150.02	6542	7269	206.14	8194	9104	258.18	9827	10919	309.65	90
41	15.5625	1836	3465	222.65	2523	4761	305.93	3160	5963	383.16	3791	7152	459.57	53
42	27.5775	2527	4211	152.70	3472	5786	209.81	4348	7247	262.79	5215	8692	315.18	60
54	22.3125	5590	5590	250.53	7681	7681	344.25	9620	9620	431.15	11539	11539	517.15	100
55	36.05	7654	7654	212.32	10517	10517	291.73	13172	13172	365.38	15799	15799	438.25	100
56	30.465	8215	8215	269.65	11288	11288	370.52	14137	14137	464.04	16957	16957	556.61	100
57	20.835	6012	6012	288.55	8261	8261	396.50	10346	10346	496.57	12410	12410	595.63	100
58	14.5375	6607	6607	454.48	9078	9078	624.45	11370	11370	782.12	13638	13638	938.13	100
59	95.13	4149	4149	43.61	5701	5701	59.93	7140	7140	75.06	8564	8564	90.02	100
60	21.465	9270	9270	431.87	12737	12737	593.38	15953	15953	743.21	19135	19135	891.45	100
61	251.8625	8764	8764	34.80	12042	12042	47.81	15082	15082	626.61	18090	18090	71.82	100
62	204.3625	4044	8121	39.74	5557	11158	54.60	6960	13976	443.51	8348	16763	82.03	49.8
		127160			**174721**			**218831**			**262481**			
ZONE-3														
1	116.2525	8332	8332	71.67	11448	11448	98.48	14339	14339	123.34	17199	17199	147.95	100
2	148.0625	8137	8137	54.96	11180	11180	75.51	14003	14003	94.57	16796	16796	113.44	100
3	128.6575	3950	3950	30.70	5427	5427	42.18	6798	6798	52.84	8153	8153	63.37	100
4	44.105	8299	8299	188.16	11403	11403	258.54	14282	14282	323.82	17131	17131	388.41	100
5	19.5875	8347	8347	426.14	11469	11469	585.53	14364	14364	733.32	17230	17230	879.64	100
6	29.4875	4835	4835	163.97	6643	6643	225.28	8321	8321	282.19	9980	9980	338.45	100
7	26	6831	6831	262.73	9386	9386	361.00	11756	11756	452.15	14100	14100	542.31	100
8	64.4425	1847	9235	143.31	2538	12689	196.90	3179	15893	246.62	3813	19063	295.81	20
10	11.975	1383	3457	288.68	1900	4750	396.66	2380	5949	496.78	2854	7136	595.91	40
11	9.7025	4711	4711	485.54	6473	6473	667.15	8107	8107	835.56	9724	9724	1002.22	100
12	26.3125	9360	9360	355.72	12861	12861	488.78	16108	16108	612.18	19321	19321	734.29	100
13	24.7175	7499	7499	303.39	10304	10304	416.87	12905	12905	522.10	15479	15479	626.24	100
14	19.5125	3503	3503	179.53	4813	4813	246.66	6028	6028	308.93	7231	7231	370.58	100
15	9.5875	5508	5508	574.50	7568	7568	789.36	9479	9479	988.68	11369	11369	1185.81	100
16	7.3125	4469	4469	611.15	6140	6140	839.66	7691	7691	1051.76	9225	9225	1261.54	100
17	7.775	4559	4559	586.37	6264	6264	805.66	7846	7846	1009.13	9411	9411	1210.42	100
18	45.1875	3718	3718	82.28	5109	5109	113.06	6398	6398	141.59	7675	7675	169.85	100
19	18.3125	6062	6062	331.03	8329	8329	454.83	10432	10432	569.67	12513	12513	683.30	100
20	17.9375	6708	6708	373.97	9217	9217	513.84	11544	11544	643.57	13847	13847	771.96	100
21	80.3675	9126	9606	119.53	12539	13199	164.23	15704	16531	205.69	18837	19828	246.72	95
23	29.6675	5597	5597	188.66	7690	7690	259.21	9632	9632	324.67	11553	11553	389.42	100
24	28.0375	5735	5735	204.55	7880	7880	281.05	9869	9869	351.99	11838	11838	422.22	100
25	27.6925	6046	6046	218.33	8307	8307	299.97	10405	10405	375.73	12480	12480	450.66	100
26	9.3125	5818	5818	624.75	7994	7994	858.42	10012	10012	1075.11	12009	12009	1289.56	100

27	23.875	4441	4441	186.01	6102	6102	255.58	7643	7643	320.13	9167	9167	383.96	100
28	29.4625	3859	3859	130.98	5302	5302	179.96	6641	6641	225.41	7966	7966	270.38	100
29	16.2875	4918	4918	301.95	6757	6757	414.86	8463	8463	519.60	10152	10152	623.30	100
30	18.6125	5093	5093	273.63	6998	6998	375.98	8765	8765	470.92	10513	10513	564.84	100
31	7.01	3591	3591	512.27	4934	4934	703.85	6180	6180	881.60	7412	7412	1057.35	100
32	8.0625	1455	3637	451.10	1999	4997	619.78	2504	6259	776.31	3003	7507	931.10	40
40	35.2625	529	5290	150.02	727	7269	206.14	910	9104	258.18	1092	10919	309.65	10
22	201.0425	616	6925	34.45	847	9515	47.33	1061	11917	59.28	1272	14294	71.10	8.9
41	15.5625	1629	3465	222.65	2238	4761	305.93	2803	5963	383.16	3361	7152	459.57	47
		166511			**228786**			**286552**			**343706**			
ZONE-4														
21	116.2525	480	9606	82.63	660	13199	113.54	827	16531	142.20	991	19828	170.56	5
22	80.3675	6309	6925	86.17	8668	9515	147.00	10856	11917	148.28	13022	14294	177.86	91.1
		6789			**9328**			**11683**			**14013**			
TOTAL		**382940**			**526163**			**659007**			**790452**			

ANNEXURE 6 – TAXATION PROPOSAL

LATUR MUNICIPAL CORPORATION						
NAME OF PROJECT						
Project Name: Underground Sewerage Scheme for Latur City						
TAXATION PROPOSAL						
1	**Total Project Cost in Rs. Cr.**			Rs.		**909.49**
2	**Financial Forecast**					
	a)	Gross Cost		Rs.		**909.49**
	b)	Design Population			790452	Souls
	c)	Per Capita Cost		Rs.		11,506
3	**Annual Burden**					
		Average per year for establishment, electricity charges, chemical & Materials charges & Annual Repair Charges in Rs. Lakhs (base Year)		Rs.		1,538.03
		Design Population			790452	Souls
		Annual burden per Capita (Base Year)		Rs.		195
4	**Taxation Proposal for Base Year**					
	a.	Population			5,26,163	Souls
	b.	Total No. of Houses @ 5 persons per house			1,02,438	Nos.
	c.	General Waste Water Treatment Tax per house per year.		Rs.		12000
	d.	Total Annual Revenue in Rs. Lakh		Rs.		11,259.98
	e	Benefit Cost Ratio	=	Total Revenue / Annual Burden	1.08	
			=	1.08		

Thus, the scheme is self-Supporting.

ANNEXURE 7 – STATEMENT OF ANNUAL O & M CHARGES

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

STATEMENT OF ANNUAL O & M CHARGES IN Rs. LAKH

(Detail Calculation of A, B, C, D, E and F should be given separately)

A)	**Establishment**	**Rs**	**99.18**
B)	**Electricity Charges**	**Rs.**	**738.61**
C)	**Chemical and Materials**	**Rs.**	**64.19**
D)	**Annual Repair Charges**	**Rs.**	**371.71**
E)	**DF Running Charges**	**Rs.**	**117.56**
F)	**Waste Disposal Charges**	**Rs.**	**146.79**
	Hence Annual O & M Charges = (A+B+C+D+E+F)	**Rs.**	**1538.03**
		Say, In Rs. Lakh	**1538.03**

ANNEXURE 8 – O & M CHARGES FOR ZONE I & II

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

O & M Cost for 53 MLD STP at Road Kavha , Kavha

S.N.	Description	Amount Rs. (For Base Year)	Amount Rs. (For 15 Years)
1	Manpower Cost	56,83,167	12,26,34,576
2	Chemical Cost	52,36,065	9,05,49,455
3	Electricity Cost	5,01,68,410	1,30,13,68,087
4	DG Set Running Cost	53,89,590	8,08,43,850
5	Waste Disposal Cost	1,20,61,608	26,02,72,164
6	Annual Maintenance Cost	1,87,17,933	40,39,06,116
		9,72,56,773	**2,25,95,74,248**
	Physical and financial contingencies (Excluding on power cost) 0%		
	Gst (Excluding on power cost)	1,75,06,219	40,67,234
	Grand Total	**11,47,62,992**	**2,26,36,41,482**

Escalation: 1. 5 % per year on Manpower Cost, Waste Disposal cost & Central Offices Expenses
2. 2 % Per Year on Chemical Cost
3. 5 % per Year on Power cost
4. No Escalation considered on DG Set Running Cost &
5. 5% per Year on Annual Maintenance Cost

Opex for Base Year - 53 MLD STP at Road Kavha , Kavha

1	**Manpower Cost**	Qty.	Unit	Rate	**56,83,167**
a	**STP - 53 MLD**				
1	Project Manager	0.822	No./ Nos.	80,000	7,88,837
2	Plant In Charge	1	No./ Nos.	45,000	5,40,000
3	Plant Operator	1	No./ Nos.	20,331	2,43,972
4	SCADA operator	1	No./ Nos.	20,331	2,43,972
5	Accountant	0.822	No./ Nos.	30,000	2,95,814
6	Electrician	1.643	No./ Nos.	20,331	4,00,946
7	Helper	4	No./ Nos.	15,275	7,33,200

8	Mechanic/ Filter	1.643	No./ Nos.	18,485	3,64,541
9	Gardener	1	No./ Nos.	18,485	2,21,820
10	Chemist	1	No./ Nos.	20,331	2,43,972
11	Lab. Asstt.	1	No./ Nos.	16,804	2,01,648
12	Sweeper	1	No./ Nos.	15,275	1,83,300
13	Security Guard	2	No./ Nos.	15,275	3,66,600
b	**SPS**				
1	Pump Operator at MPS	2	No./ Nos.	20,331	4,87,944
2	Security Guard	2	No./ Nos.	15,275	3,66,600
3	Pump Operator at IPS		No./ Nos.	20,331	-
4	Security Guard at IPS		No./ Nos.	15,275	-
2	**Chemical Cost**				**52,36,065**
1	PAC / Fecl3	6.53	Kg/day	30	71,504
1	DWPE	22.68	Kg/day	450	37,25,190
2	Chlorine	159.00	Kg/day	25	14,50,875
3	Lab testing Chemical	1	LS / month	5,000	60,000
3	**Electricity Cost**				**5,01,68,410**
a	**STP**				
1	Sewage Treatment Plant Including Yard Lighting etc.	13,085.99	KWH/day	6.50	3,10,46,500
2	Demand Charges	2,230	KVA/Month	3.84	1,02,758
b	**SPS**				
1	SPS 1	3,932.33	KWH/day	6.50	93,29,445

2	SPS 2	4,084.18	KWH/day	6.50	96,89,706
4	**DG Set Running Cost**				**53,89,590**
a	**STP**				
1	DG Set	**1600**	**kVA**	**1**	**-**
b	**SPS**				
1	DG Set SPS 1	**625**	**kVA**	**1**	**26,94,795**
2	DG Set SPS 2	**625**	**kVA**	**1**	**26,94,795**
5	**Waste Disposal Cost up to 10 KM**				**1,20,61,608**
a	**STP**				
1	Dewatered Sludge Qty (m3/day) = Sludge (Kg/day) / Consistency (20%)/1000	**56.71**	**Cum/Day**	**500.0**	**1,03,49,575**
2	Fine Screenings @ 45 litres/MLD/Day = Flow (MLD) X 0.045	**2.385**	**Cum/Day**	**500.0**	**4,35,263**
3	Grit @ 0.004 - 0.037 Cum/Mld/ Day =Flow (MLD) X 0.01	**0.530**	**Cum/Day**	**500.0**	**96,725**
b	**SPS**				
1	Course Screenings @ 100 litres/MLD/Day = Flow (MLD) X 0.1	**5.300**	**Cum/Day**	**500.0**	**9,67,250**
2	Grit @ 0.004 - 0.037 Cum/Mld/ Day =Flow (MLD) X 0.022	**1.166**	**Cum/Day**	**500.0**	**2,12,795**
3	Course Screenings @ 100 litres/MLD/Day = Flow (MLD) X 0	**-**	**Cum/Day**	**500.0**	**-**
4	Grit @ 0.004 - 0.037 Cum/Mld/ Day =Flow (MLD) X 0	**-**	**Cum/Day**	**500.0**	**-**
6	**Annual Maintenance Cost**				**1,87,17,933**
1	Civil Work	**Please refer Annexure No.10**			
2	Electro-Mechanical & Instrumentation				
TOTAL OPEX FOR BASE YEAR (With Power Cost)					**9,72,56,773**

	Physical and financial contingencies (Excluding on power cost)	**0%**			**-**
	Gst (Excluding on power cost)	**18%**			**1,75,06,219**
	Grand Total				**11,47,62,992**

ANNEXURE 9 – O & M CHARGES FOR ZONE III & IV

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

O & M Cost for 11.50 MLD STP at Road Mahapur , Mahapur

S. N.	Description	Amount Rs. (For Base Year)	Amount Rs. (For 15 Years)
1	Manpower Cost	42,34,473	9,13,73,849
2	Chemical Cost	11,82,923	2,04,56,772
3	Electricity Cost	2,36,92,417	59,58,60,801
4	DG Set Running Cost	63,65,965	9,54,89,475
5	Waste Disposal Cost	26,17,141	5,64,74,149
6	Annual Maintenance Cost	1,87,17,933	40,39,06,116
		5,68,10,853	**1,26,35,61,162**
	Physical and financial contingencies (Excluding on power cost) 0%	-	-
	Gst (Excluding on power cost)	1,02,25,953	22,74,410
	Grand Total	**6,70,36,806**	**1,26,58,35,572**

Escalation: 1. 5 % per year on Manpower Cost, Waste Disposal cost & Central Offices Expenses
2. 2 % Per Year on Chemical Cost
3. 5 % per Year on Power cost
4. No Escalation considered on DG Set Running Cost &
5. 5% per Year on Annual Maintenance Cost

Opex for Base Year - 11.50 MLD STP at Road Mahapur , Mahapur

1	**Manpower Cost**	Qty.	Unit	Rate	**42,34,473**
a	**STP - 11.5 MLD**				
1	Project Manager	0.178	No./ Nos.	80,000	1,71,163
2	Plant In Charge	1	No./ Nos.	45,000	5,40,000
3	Plant Operator	1	No./ Nos.	20,331	2,43,972

4	SCADA operator	1	No./ Nos.	20,331	2,43,972
5	Accountant	0.178	No./ Nos.	30,000	64,186
6	Electrician	0.357	No./ Nos.	20,331	86,998
7	Helper	4	No./ Nos.	15,275	7,33,200
8	Mechanic/ Filter	0.357	No./ Nos.	18,485	79,099
9	Gardener	1	No./ Nos.	18,485	2,21,820
10	Chemist	1	No./ Nos.	20,331	2,43,972
11	Lab. Asstt.	1	No./ Nos.	16,804	2,01,648
12	Sweeper	1	No./ Nos.	15,275	1,83,300
13	Security Guard	2	No./ Nos.	15,275	3,66,600
b	**SPS**				
1	Pump Operator at MPS	2	No./ Nos.	20,331	4,87,944
2	Security Guard	2	No./ Nos.	15,275	3,66,600
3	Pump Operator at IPS		No./ Nos.	20,331	-
4	Security Guard at IPS		No./ Nos.	15,275	-
2	**Chemical Cost**				**11,82,923**
1	PAC / Fecl3	6.53	Kg/day	30	71,504
1	DWPE	4.92	Kg/day	450	8,08,110
2	Chlorine	34.50	Kg/day	25	3,14,813
3	Lab testings Chemical	1	LS / month	5,000	60,000
3	**Electricity Cost**				**2,36,92,417**
a	**STP**				

1	Sewage Treatment Plant Including Yard Lighting etc.	2,902.42	KWH/day	6.50	68,85,997
2	Demand Charges	560	KVA/Month	3.84	25,805
b	**SPS**				
1	SPS 1	6,515.69	KWH/day	6.50	1,54,58,465
2	SPS 2	557.28	KWH/day	6.50	13,22,150
4	**DG Set Running Cost**				**63,65,965**
a	**STP**				
1	DG Set	**400**	**kVA**	**1**	**17,57,475**
b	**SPS**				
1	DG Set SPS 3	**750**	**kVA**	**1**	**39,05,500**
2	DG Set SPS 4	**160**	**kVA**	**1**	**7,02,990**
5	**Waste Disposal Cost upto 10 KM**				**26,17,141**
a	**STP**				
1	Dewatered Sludge Qty (m3/day) = Sludge (Kg/day) / Consistency (20%)/1000	**12.31**	**Cum/Day**	**500.0**	**22,45,663**
2	Fine Screenings @ 45 litres/MLD/Day = Flow (MLD) X 0.045	**0.518**	**Cum/Day**	**500.0**	**94,444**
3	Grit @ 0.004 - 0.037 Cum/Mld/ Day =Flow (MLD) X 0.01	**0.115**	**Cum/Day**	**500.0**	**20,988**
b	**SPS**				
1	Course Screenings @ 100 litres/MLD/Day = Flow (MLD) X 0.1	**1.150**	**Cum/Day**	**500.0**	**2,09,875**
2	Grit @ 0.004 - 0.037 Cum/Mld/ Day =Flow (MLD) X 0.022	**0.253**	**Cum/Day**	**500.0**	**46,173**
3	Course Screenings @ 100 litres/MLD/Day = Flow (MLD) X 0	**-**	**Cum/Day**	**500.0**	**-**
4	Grit @ 0.004 - 0.037 Cum/Mld/ Day =Flow (MLD) X 0	**-**	**Cum/Day**	**500.0**	**-**
6	**Annual Maintenance Cost**				**1,87,17,933**

1	Civil Work	**Please refer Annexure No.10**			
2	Electro-Mechanical & Instrumentation				
TOTAL OPEX FOR BASE YEAR (With Power Cost)					**5,68,10,853**
	Physical and financial contingencies (Excluding on power cost)	**0%**			**-**
	Gst (Excluding on power cost)	**18%**			**1,02,25,953**
	Grand Total				**6,70,36,806**

ANNEXURE 10 – M & R CHARGES (For Zone I – IV)

M&R Charges

S. No	Components	Cost of Sub works	% of M&R	Amount	Depreciation		
					Life in Years	Factor of Depreciation	Total Depreciation
1	Collection & Conveyance System	590.48	1.5		30.0	0.001	0.53
	(Only 0.25% is considered)		0.25	1.48			
2	Sewage Pumping Stations	5.40	1	0.05	15.0	0.006	0.03
3	Pumping Machinery	25.04	1.5	0.38	30.0	0.005	0.113
4	Pumping Main	38.99	0.25	0.10	60.0	0.010	0.35
5	STP	87.81	1.5	1.32	30.0	0.003	0.237
6	Allied Work	158.70	0.25	0.40	15.0	0.006	0.86
	Net cost Rs in Lakh	**906.41**		**3.72**			**2.12**
	Cost Rs in Crore	**9.06**					

ANNEXURE 11 – LOAD LIST FOR STP & SPS (Zone I & II)

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

Electrical load list - 53 MLD

Sr. No.	Equipment	HP in STD	Number (W)	Number (S)	Total	HP (W)	HP (S)	HP (Total)
1	Mechanical Coarse Bar Screen	3	2	0	2	6	0	6
2	Flat Belt Conveyor	2	1	0	1	2	0	2
3	Raw Sewage Transfer Pumps	150	4	2	6	600	300	900
4	Raw Sewage Transfer Pumps	150	4	2	6	600	300	900
4	Mechanical Fine Bar Screen	3	2	0	2	6	0	6
5	Flat Belt Conveyor	2	1	0	1	2	0	2
6	Grit Removal Mechanism							
	a. Grit Collection Mechanism	3	2	0	2	6	0	6
	b. Grit Washing/Classifier Mechanism	2	2	0	2	4	0	4
	c. Organic Return Pumps	1	2	2	4	2	2	4
7	SBR Air Blowers	300	4	2	6	1200	600	1800
8	RAS Pumps	10	4	0	4	40	0	40
9	Decanters	0.75	4	0	4	3	0	3
10	SAS Pumps	20	4	0	4	80	0	80
11	Auto Valves/Sluice Gates	1	16	0	16	16	0	16
12	Chlorination System							
	a. Water Booster Pumps	3	1	1	2	3	3	6
	b. NaOH Recirculation Pump	2	1	0	1	2	0	2
	c. Air Blower	2	1	0	1	2	0	2
13	Sludge Sump Mixer	5	1	0	1	5	0	5
14	Centrifuges	40	3	1	4	120	40	160
15	Centrifuge Feed Pumps	10	3	1	4	30	10	40
16	Dewatering Polymer Dosing System							
	a. Agitators for Dosing Tanks	1	3	0	3	3	0	3
	b. Dosing Pumps	1	3	1	4	3	1	4
17	Centrate Pump	3	2	1	3	6	3	9
18	Service Water Pumps	5	1	1	2	5	5	10

19	Electrical Hoist with Travelling Trolley							
	a. 3 HP	3	1	0	1	3	0	3
	b. 5 HP	5	3	0	3	15	0	15
20	Plant Area Lighting	30	1	0	1	30	0	30
21	SPS Lighting	15	1	0	1	15	0	15
22	Industrial Exhaust Fan	0.34	12	0	12	4.0	0	4.03
23	Exhaust Fan	0.10	10	0	10	1.0	0	1.01
24	AC	2	4	0	4	8.1	0	8.05
	Grand Total	**775.200**	**103**	**14**	**117**	**2850.12**	**1264.00**	**4114.12**
			Total working HP			**2850.12**		
			Total working kW			**2123.3**	**467.9**	**SPS1 Load**
							467.9	**SPS2 Load**
		SPS -1	**Required Demand kVA**			**540.0**	**1187.6**	**STP Load**
		SPS -2	**Required Demand kVA**			**540.0**		
		STP	**Required Demand kVA**			**1350.0**		
		SPS -1	**Required transformer rating kVA**			**630**		
		SPS -2	**Required transformer rating kVA**			**630**		
		STP	**Required transformer rating kVA**			**1600**		
			Supply voltage kV			**11**		

ANNEXURE 12 – POWER CONSUMPTION FOR STP & SPS (Zone I & II)

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

Power Consumption list - 53 MLD

Sr. No.	Equipment	HP in STD	Number (W)	Number (S)	Total	BKW	hrs/day	KW.hr/day
1	Mechanical Coarse Bar Screen	3	2	0	2	1.79	6	21.48
2	Flat Belt Conveyor	2	1	0	1	1.19	6	7.14
3	Raw Sewage Transfer Pumps	150	4	2	6	72.71	11.58	3367.73
4	Raw Sewage Transfer Pumps	150	4	2	6	72.71	11.58	3367.73
5	Mechanical Fine Bar Screen	3	2	0	2	1.79	6	21.48
6	Flat Belt Conveyor	2	1	0	1	1.19	6	7.16
7	Grit Removal Mechanism							
	a. Grit Collection Mechanism	3	2	0	2	1.79	24	85.90
	b. Grit Washing/Classifier Mechanism	2	2	0	2	1.19	24	57.27
	c. Organic Return Pumps	1	2	2	4	0.60	24	28.63
8	SBR Air Blowers	300	4	2	6	172.26	24	16536.64
9	RAS Pumps	10	4	0	4	4.66	12	223.7
10	Decanters	0.75	4	0	4	0.39	6	9.40
11	SAS Pumps	20	4	0	4	10.96	1.33	58.32
12	Auto Valves/Sluice Gates	1	16	0	16	0.60	0.4	3.82
13	Chlorination System							
	a. Water Booster Pumps	3	1	1	2	1.79	24	42.95
	b. NaOH Recirculation Pump	2	1	0	1	1.19	0	0.00
	c. Air Blower	2	1	0	1	1.19	0	0.00
14	Sludge Sump Mixer	5	1	0	1	2.98	24	71.59
15	Centrifuges	40	3	1	4	24.67	18	1332.06
16	Centrifuge Feed Pumps	10	3	1	4	4.02	18	217.04
17	Dewatering Polymer Dosing System							

	a. Agitators for Dosing Tanks	1	3	0	3	0.60	18	32.2
	b. Dosing Pumps	1	3	1	4	0.60	18	32.2
18	Centrate Pump	3	2	1	3	2.13	18	76.5
19	Service Water Pumps	5	1	1	2	2.98	6	17.9
20	Electrical Hoist with Travelling Trolley							
	a. 3 HP	3	1	0	1	1.79	0	0.0
	b. 5 HP	5	3	0	3	2.98	0	0.0
21	Plant Area Lighting	30	1	0	1	22.37	10	223.7
22	SPS Lighting	15	1	0	1	11.19	10	111.9
23	Industrial Exhaust Fan	0.34	12	0	12	0.25	24	24.25
24	Exhaust Fan	0.10	10	0	10	0.08	24	24.08
25	AC	2.0	4	0	4	1.50	12	13.50
	Grand Total	**775.1997**	**103**	**14**	**117**	**426.123**	**386.89**	**26205.07**

ANNEXURE 13 – ELECTRICITY CHARGES FOR STP & SPS (ZONE I & II)

LATUR MUNICIPAL CORPORATION															
NAME OF PROJECT															
Project Name: Underground Sewerage Scheme for Latur City															
Average Flow and Electricity Charges for 53 MLD STP & SPS															
Sr. No.	Year	SPS - 1	SPS - 2	Avg. Flow in MLD	Power Consumption			Total KWh/day	Rate in Rs.	Amount in Rs. / Day (23.50 Hr.)	Amount in Rs. / Year	Demand Charges Rs/ KVA/ Month	Demand KVA	Demand Charges Rs. Year	Total Electricity Charges (Rs.)
					STP KWh/Day	SPS 1 KWh/day	SPS 2 KWh/day								
1	1st Year	16.81	25.72	42.54	13364.41	4015.99	4171.07	21551.48	6.5	1,37,166.17	5,00,65,651.49	3.84	2230	1,02,758.40	5,01,68,410
2	2nd Year	17.10	26.17	43.27	13773.53	4082.01	4240.28	22095.81	6.83	1,47,770.33	5,39,36,169.61	4.03	2230	1,07,842.80	5,40,44,012
3	3rd Year	17.39	26.62	44.01	14182.64	4148.02	4309.48	22640.14	7.17	1,58,947.95	5,80,16,000.54	4.23	2230	1,13,194.80	5,81,29,195
4	4th Year	17.68	27.06	44.75	14591.75	4214.03	4378.69	23184.47	7.53	1,70,942.03	6,23,93,840.89	4.44	2230	1,18,814.40	6,25,12,655
5	5th Year	17.97	27.51	45.48	15000.87	4280.05	4447.89	23728.81	7.91	1,83,784.56	6,70,81,363.19	4.66	2230	1,24,701.60	6,72,06,065
6	6th Year	18.26	27.96	46.22	15409.98	4346.06	4517.10	24273.14	8.31	1,97,507.51	7,20,90,239.98	4.89	2230	1,30,856.40	7,22,21,096
7	7th Year	18.55	28.40	46.96	15819.10	4412.07	4586.30	24817.47	8.73	2,12,142.86	7,74,32,143.79	5.13	2230	1,37,278.80	7,75,69,423
8	8th Year	18.84	28.85	47.69	16228.21	4478.09	4655.50	25361.81	9.17	2,27,722.59	8,31,18,747.15	5.39	2230	1,44,236.40	8,32,62,984
9	9th Year	19.13	29.30	48.43	16637.33	4544.10	4724.71	25906.14	9.63	2,44,278.69	8,91,61,722.61	5.66	2230	1,51,461.60	8,93,13,184

10	10th Year	19.42	29.75	49.17	17046.44	4610.12	4793.91	26450.47	10.11	2,61,843.13	9,55,72,742.69	5.94	2230	1,58,954.40	9,57,31,697
11	11th Year	19.71	30.19	49.91	17455.56	4676.13	4863.12	26994.80	10.62	2,80,712.21	10,24,59,958.23	6.24	2230	1,66,982.40	10,26,26,941
12	12th Year	20.00	30.64	50.64	17864.67	4742.14	4932.32	27539.14	11.15	3,00,664.26	10,97,42,454.31	6.55	2230	1,75,278.00	10,99,17,732
13	13th Year	20.29	31.09	51.38	18273.79	4808.16	5001.53	28083.47	11.71	3,22,006.23	11,75,32,272.61	6.88	2230	1,84,108.80	11,77,16,381
14	14th Year	20.58	31.53	52.12	18682.90	4874.17	5070.73	28627.80	12.3	3,44,786.09	12,58,46,921.94	7.22	2230	1,93,207.20	12,60,40,129
15	15th Year	20.87	31.98	52.86	19092.02	4940.18	5140.25	29172.44	12.92	3,69,055.73	13,47,05,340.87	7.58	2230	2,02,840.80	13,49,08,182
												Total Electricity Charges for 15 Years			**1,30,13,68,087**

ANNEXURE 14 – LOAD LIST FOR STP & SPS (Zone III & IV)

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

Electrical load list - 11.5 MLD

Sr. No.	Equipment	HP in STD	Number (W)	Number (S)	Total	HP (W)	HP (S)	HP (Total)
1	Mechanical Coarse Bar Screen	3	2	0	2	6	0	6
2	Flat Belt Conveyor	2	1	0	1	2	0	2
3	Raw Sewage Transfer Pumps	200	4	2	6	800	400	1200
4	Raw Sewage Transfer Pumps	40	3	2	5	120	80	200
4	Mechanical Fine Bar Screen	2	1	0	1	2	0	2
5	Flat Belt Conveyor	2	1	0	1	2	0	2
6	Grit Removal Mechanism							
	a. Grit Collection Mechanism	3	1	0	1	3	0	3
	b. Grit Washing/Classifier Mechanism	2	1	0	1	2	0	2
	c. Organic Return Pumps	1	1	1	2	1	1	2
7	SBR Air Blowers	120	2	1	3	240	120	360
8	RAS Pumps	7.5	2	0	2	15	0	15
9	Decanters	0.75	2	0	2	1.5	0	1.5
10	SAS Pumps	10	2	0	2	20	0	20
11	Auto Valves/Sluice Gates	1	8	0	8	8	0	8
12	Chlorination System							
	a. Water Booster Pumps	3	1	1	2	3	3	6
	b. NaOH Recirculation Pump	2	1	0	1	2	0	2
	c. Air Blower	2	1	0	1	2	0	2
13	Sludge Sump Mixer	2	1	0	1	2	0	2
14	Centrifuges	30	1	1	2	30	30	60
15	Centrifuge Feed Pumps	5	1	1	2	5	5	10
16	Dewatering Polymer Dosing System							
	a. Agitators for Dosing Tanks	1	2	0	2	2	0	2
	b. Dosing Pumps	1	1	1	2	1	1	2
17	Centrate Pump	3	1	1	2	3	3	6
18	Service Water Pumps	3	1	1	2	3	3	6

19	Electrical Hoist with Travelling Trolley							
	a. 3 HP	3	1	0	1	3	0	3
	b. 5 HP	5	2	0	2	10	0	10
20	Plant Area Lighting	25	1	0	1	25	0	25
21	SPS Lighting	15	1	0	1	15	0	15
22	Industrial Exhaust Fan	0.34	2	0	2	0.7	0	0.67
23	Exhaust Fan	0.10	2	0	2	0.2	0	0.20
24	AC	2	1	0	1	2.0	0	2.01
	Grand Total	**496.700**	**52**	**12**	**64**	**1355.26**	**646.00**	**2001.26**
					Total working HP	**1355.26**		
					Total working kW	**1009.7**	**613.8**	**SPS1 Load**
							107.2	**SPS2 Load**
		SPS -3			**Required Demand kVA**	**700.0**	**288.7**	**STP Load**
		SPS -4			**Required Demand kVA**	**130.0**		
		STP			**Required Demand kVA**	**330.0**		
		SPS -3			**Required transformer rating kVA**	**1000**		
		SPS -4			**Required transformer rating kVA**	**160**		
		STP			**Required transformer rating kVA**	**400**		
					Supply voltage kV	**11**		

ANNEXURE 15 – POWER CONSUMPTION FOR STP & SPS (Zone III & IV)

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

Power Consumption list - 11.5 MLD

Sr. No.	Equipment	HP in STD	Number (W)	Number (S)	Total	BKW	hrs/day	KW.hr/day
1	Mechanical Coarse Bar Screen	3	2	0	2	1.79	6	21.48
2	Flat Belt Conveyor	2	1	0	1	1.19	6	7.14
3	Raw Sewage Transfer Pumps	200	4	2	6	96.94	11.58	4490.31
4	Raw Sewage Transfer Pumps	40	3	2	5	19.39	11.58	673.55
5	Mechanical Fine Bar Screen	2	1	0	1	1.19	6	7.16
6	Flat Belt Conveyor	2	1	0	1	1.19	6	7.16
7	Grit Removal Mechanism							
	a. Grit Collection Mechanism	3	1	0	1	1.79	24	42.95
	b. Grit Washing/Classifier Mechanism	2	1	0	1	1.19	24	28.63
	c. Organic Return Pumps	1	1	1	2	0.60	24	14.32
8	SBR Air Blowers	120	2	1	3	68.90	24	3307.33
9	RAS Pumps	7.5	2	0	2	3.50	12	83.9
10	Decanters	0.75	2	0	2	0.39	6	4.70
11	SAS Pumps	10	2	0	2	5.48	1.33	14.58
12	Auto Valves/Sluice Gates	1	8	0	8	0.60	0.4	1.91
13	Chlorination System							
	a. Water Booster Pumps	3	1	1	2	1.79	24	42.95
	b. NaOH Recirculation Pump	2	1	0	1	1.19	0	0.00
	c. Air Blower	2	1	0	1	1.19	0	0.00
14	Sludge Sump Mixer	2	1	0	1	1.19	24	28.63
15	Centrifuges	30	1	1	2	18.50	18	333.01
16	Centrifuge Feed Pumps	5	1	1	2	2.01	18	36.17
17	Dewatering Polymer Dosing System							
	a. Agitators for Dosing Tanks	1	2	0	2	0.60	18	21.5
	b. Dosing Pumps	1	1	1	2	0.60	18	10.7
18	Centrate Pump	3	1	1	2	2.13	18	38.3
19	Service Water Pumps	3	1	1	2	1.79	6	10.7

20	Electrical Hoist with Travelling Trolley							
	a. 3 HP	3	1	0	1	1.79	0	0.0
	b. 5 HP	5	2	0	2	2.98	0	0.0
21	Plant Area Lighting	25	1	0	1	18.64	10	186.4
22	SPS Lighting	15	1	0	1	11.19	10	111.9
23	Industrial Exhaust Fan	0.34	2	0	2	0.25	24	24.25
24	Exhaust Fan	0.10	2	0	2	0.08	24	24.08
25	AC	2.0	1	0	1	1.50	12	13.50
	Grand Total	**496.6997**	**52**	**12**	**64**	**271.556**	**386.89**	**9775.98**

ANNEXURE 16 – ELECTRICITY CHARGES FOR STP & SPS (ZONE III & IV)

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

Average Flow and Electricity Charges for 11.5 MLD STP & SPS

Sr. No.	Year	SPS - 3	SPS -4	Avg. Flow in MLD	Power Consumption			Total KWh/day	Rate in Rs.	Amount in Rs. / Day (23.50 Hr.)	Amount in Rs. / Year	Demand Charges Rs /KVA/ Month	Demand KVA	Demand Charges Rs. Year	Total Electricity Charges (Rs.)
					STP KWh/Day	SPS 1 KWh/day	SPS 2 KWh/day								
1	1st Year	33.53	1.47	35.00	2964.18	6654.32	569.14	10187.63	6.5	64,840.03	2,36,66,612.49	3.84	560	25,804.80	2,36,92,417
2	2nd Year	34.11	1.49	35.61	3054.92	6767.32	575.36	10397.60	6.83	69,536.11	2,53,80,678.95	4.03	560	27,081.60	2,54,07,761
3	3rd Year	34.70	1.52	36.22	3145.66	6880.33	581.58	10607.56	7.17	74,471.74	2,71,82,183.52	4.23	560	28,425.60	2,72,10,609
4	4th Year	35.29	1.54	36.83	3236.40	6993.33	587.81	10817.53	7.53	79,759.01	2,91,12,038.86	4.44	560	29,836.80	2,91,41,876
5	5th Year	35.87	1.56	37.44	3327.14	7106.33	594.03	11027.50	7.91	85,410.27	3,11,74,747.43	4.66	560	31,315.20	3,12,06,063
6	6th Year	36.46	1.59	38.05	3417.88	7219.34	600.25	11237.46	8.31	91,437.84	3,33,74,811.70	4.89	560	32,860.80	3,34,07,672
7	7th Year	37.04	1.61	38.66	3508.62	7332.34	606.47	11447.43	8.73	97,854.07	3,57,16,734.13	5.13	560	34,473.60	3,57,51,208
8	8th Year	37.63	1.64	39.27	3599.36	7445.35	612.70	11657.40	9.17	1,04,671.28	3,82,05,017.18	5.39	560	36,220.80	3,82,41,238
9	9th Year	38.22	1.66	39.88	3690.10	7558.35	618.92	11867.36	9.63	1,11,901.82	4,08,44,163.33	5.66	560	38,035.20	4,08,82,199
10	10th Year	38.80	1.68	40.49	3780.84	7671.35	625.14	12077.33	10.11	1,19,558.01	4,36,38,675.04	5.94	560	39,916.80	4,36,78,592
11	11th Year	39.39	1.71	41.10	3871.58	7784.36	631.36	12287.30	10.62	1,27,772.52	4,66,36,969.06	6.24	560	41,932.80	4,66,78,902
12	12th Year	39.97	1.73	41.71	3962.32	7897.36	637.58	12497.26	11.15	1,36,441.46	4,98,01,134.40	6.55	560	44,016.00	4,98,45,150
13	13th Year	40.56	1.76	42.32	4053.06	8010.36	643.81	12707.23	11.71	1,45,701.61	5,31,81,088.62	6.88	560	46,233.60	5,32,27,322
14	14th Year	41.15	1.78	42.93	4143.80	8123.37	650.03	12917.19	12.3	1,55,571.47	5,67,83,585.43	7.22	560	48,518.40	5,68,32,104

15	15th Year	41.73	1.80	43.53	4234.54	8235.02	655.73	13125.29	12.92	1,66,045.89	6,06,06,751.06	7.58	560	50,937.60	6,06,57,689
												Total Electricity Charges for 15 Years			**59,58,60,801**

ANNEXURE 17 – 15 - YEARS O & M & REVENUE GENERATION

STATEMENT SHOWING YEAR WISE ANNUAL OPERATION AND MAINTAINANCE ALONG WITH LIKELY REVENUE GENERATION															
S.No	Year	Man power	Chemical	Energy Charges		DG Running	Waste Disposal	M&R	Direct Charges			Indirect		Total	
				Zone I & II	Zone III & IV				In Lakh	With GST	In Cr	Repay_ment	Depre_ciation	Rs in Lakh	Rs in Cr
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	2027-28														
2	2028-29														
3	2029-30														
4	2030-31														
5	2031-32														
6	2032-33														
7	2027-28	99.18	64.19	501.7	236.9	117.6	146.8	374.36	**1540.68**	**1818.00**	**18.18**	1703.29	215.44	3459.4	34.6
8	2028-29	104.14	65.47	540.4	254.1	117.6	154.1	393.08	**1628.89**	**1922.09**	**19.22**	1703.29	215.44	3547.6	35.5
9	2029-30	109.34	66.78	581.3	272.1	117.6	161.8	412.73	**1721.64**	**2031.54**	**20.32**	1703.29	215.44	3640.4	36.4
10	2030-31	114.81	68.12	625.1	291.4	117.6	169.9	433.37	**1820.32**	**2147.98**	**21.48**	1703.29	215.44	3739.1	37.4
11	2031-32	120.55	69.48	672.1	312.1	117.6	178.4	455.04	**1925.16**	**2271.69**	**22.72**	1703.29	215.44	3843.9	38.4
12	2032-33	126.58	70.87	722.2	334.1	117.6	187.3	477.79	**2036.42**	**2402.98**	**24.03**	1703.29	215.44	3955.2	39.6
13	2033-34	132.91	72.29	775.7	357.5	117.6	196.7	501.68	**2154.34**	**2542.12**	**25.42**	1703.29	215.44	4073.1	40.7
14	2034-35	139.55	73.73	832.6	382.4	117.6	206.5	526.76	**2279.19**	**2689.44**	**26.89**	1703.29	215.44	4197.9	42.0
15	2035-36	146.53	75.21	893.1	408.8	117.6	216.9	553.10	**2411.22**	**2845.24**	**28.45**	1703.29	215.44	4329.9	43.3

16	2036-37	153.86	76.71	957.3	436.8	117.6	227.7	580.75	**2550.70**	**3009.82**	**30.10**	1703.29	215.44	4469.4	44.7
17	2037-38	161.55	78.25	1026.3	466.8	117.6	239.1	609.79	**2699.30**	**3185.18**	**31.85**	1703.29	215.44	4618.0	46.2
18	2038-39	169.63	79.81	1099.2	498.5	117.6	251.1	640.28	**2855.96**	**3370.03**	**33.70**	1703.29	215.44	4774.7	47.7
19	2039-40	178.11	81.41	1177.2	532.3	117.6	263.6	672.29	**3022.41**	**3566.45**	**35.66**	1703.29	215.44	4941.1	49.4
20	2040-41	187.01	83.04	1260.4	568.3	117.6	276.8	705.91	**3199.03**	**3774.85**	**37.75**	1703.29	215.44	5117.8	51.2
21	2041-42	196.36	84.70	1349.1	606.6	117.6	290.6	741.20	**3386.11**	**3995.61**	**33.86**	1703.29	215.44	5304.8	53.0

STATEMENT SHOWING YEAR WISE ANNUAL OPERATION AND MAINTAINANCE ALONG WITH LIKELY REVENUE GENERATION																	
Prope_ rties	Societies	ARV				Sewerage benefit Tax Rs per Month							Total Revenue Rs in Lakh	O&M Cost Rs in Lakh		Surplus/Deficit	
	Assuming 20 flats with 100 residents	7500	10000	15000	Above 15000	Societies Rs 1000 / flat	7500	10000	15000	Above 15000	Revenue Rs in Lakh	Sale of water (Irrigation)		Without Repayment of Loan	With Repayment of Loan	Without Repayment of Loan	With Repayment of Loan
						20000	885	1000	1200	1500							
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	20%	60%	5%	5%	5%	24000	1062	1200	1440	1800							
						28800	1274	1440	1728	2160							
						34560	1529	1728	2074	2592							
102438	1024	61463	5122	5122	5122	2458.51	6527.35	614.63	737.55	921.94	11259.98	0.00	11259.98	1818.00	3459.41	9441.99	7800.58
104285	1043	62571	5214	5214	5214	2502.84	6645.04	625.71	750.85	938.57	11463.01	0.00	11463.01	1922.09	3547.62	9540.92	7915.39
106132	1061	63679	5307	5307	5307	3056.60	8115.28	764.15	916.98	1146.23	13999.24	0.00	13999.24	2031.54	3640.37	11967.70	10358.86
107979	1080	64787	5399	5399	5399	3109.80	8256.51	777.45	932.94	1166.17	14242.86	0.00	14242.86	2147.98	3739.05	12094.88	10503.81
109826	1098	65896	5491	5491	5491	3162.99	8397.74	790.75	948.90	1186.12	14486.49	0.00	14486.49	2271.69	3843.90	12214.80	10642.59
111673	1117	67004	5584	5584	5584	3859.42	10243.54	964.85	1157.83	1447.28	17672.92	0.00	17672.92	2402.98	3955.15	15269.95	13717.77
113520	1135	68112	5676	5676	5676	3923.25	10412.96	980.81	1176.98	1471.22	17965.22	0.00	17965.22	2542.12	4073.07	15423.10	13892.15
115367	1154	69220	5768	5768	5768	3987.08	10582.38	996.77	1196.13	1495.16	18257.52	0.00	18257.52	2689.44	4197.92	15568.08	14059.60
117214	1172	70328	5861	5861	5861	4861.10	12903.85	1215.27	1458.61	1822.91	22261.75	0.00	22261.75	2845.24	4329.95	19416.52	17931.80
119061	1191	71437	5953	5953	5953	4937.70	13107.19	1234.42	1481.60	1851.64	22612.54	0.00	22612.54	3009.82	4469.43	19602.72	18143.11
120908	1209	72545	6045	6045	6045	5014.30	13310.52	1253.57	1504.58	1880.36	22963.33	0.00	22963.33	3185.18	4618.03	19778.16	18345.30
122755	1228	73653	6138	6138	6138	5090.90	13513.85	1272.72	1527.56	1909.09	23314.12	0.00	23314.12	3370.03	4774.69	19944.09	18539.43
124602	1246	74761	6230	6230	6230	5167.49	13717.18	1291.87	1550.55	1937.81	23664.91	0.00	23664.91	3566.45	4941.14	20098.47	18723.77
126449	1264	75869	6322	6322	6322	5244.09	13920.52	1311.02	1573.53	1966.53	24015.70	0.00	24015.70	3774.85	5117.76	20240.85	18897.94
128301	1283	76981	6415	6415	6415	5320.90	14124.40	1330.22	1596.58	1995.34	24367.44	0.00	24367.44	3995.61	5304.84	20371.83	19062.60

ANNEXURE 18 – REPAYMENT SCHEDULE

Long term planning							
works to be undertaken during the period of 2024-27							
Project Cost		909.49	Cr.			909.49	Cr.
Ratio of Loan				Central Govt	33.33%	303.13	Cr.
				State Govt	36.67%	333.51	Cr.
PMC liability				SMC Share	30.00%	272.85	Cr.
Construction period		2024	2027				
Yearly Expenditure		**Expenditure**	**Central Govt**	**State Govt**	**LCMC**	**Own Source**	**Loan**
2024-25	27%	246.05	82.01	90.23	73.82	36.91	36.91
2025-26	49%	443.20	147.72	162.52	132.96	66.48	66.48
2026-27	24%	220.24	73.41	80.76	66.07	33.04	33.04
Total	**100%**	**909.49**	**303.13**	**333.51**	**272.85**	**136.42**	**136.42**
Repayment of Loan start from				**April 2027**			
Loan Amount in Lakh during 2024-2027					**FOR LCMC Contribution**		
Share for First year				2024-25	27%	36.91	Cr.
Share for Second Year				2025-26	49%	66.48	Cr.
Share for Third Year				2026-27	24%	33.04	Cr.
Repayment Calculations for Loan amount						**136.42**	Lakh
Rate of Interest on10% Loan						10.00%	
Period of Repayment						15	Years

Sr.No	Payment Due	Loan for 10%	Six Monthly Interest on loan at 10%	Yearly Interest on Soft loan at 10%	Principal Amount Due (In Cr.)	Loan Given (In Cr.)	Total Liability (in Cr.)
1	2	3	4	5	6	7	8
	1-Apr-24	**18.45**	**0**		**0**	**18.45**	**18.45**
	1-Oct-24	**18.45**	**0.92**		**0**	**18.45**	**19.38**
	1-Apr-25	**33.24**	**0.92**	`	**0**	**33.24**	**34.16**
	1-Oct-25	**33.24**	**1.66**		**0**	**33.24**	**34.90**
	1-Apr-26	**16.52**	**1.66**		**0**	**16.52**	**18.18**
	1-Oct-26	**16.52**	**0.83**		**0**	**16.52**	**17.34**
	1-Apr-27	**0.00**	**0.83**		**0**	**0.00**	**0.83**
	1-Oct-27	**0.00**	**0.00**		**0**	**0.00**	**0.00**
			0.00		**0**	**0.00**	**0.00**
	Total	**136.42**	**6.82**			**136.42**	**143.24**
1	1-Apr-28	143.24	**7.16**	**14.09**	4.77	**143.24**	11.94
2	1-Oct-28	138.47	**6.92**		4.77		11.70
3	1-Apr-29	133.70	**6.68**	**13.13**	4.77		11.46
4	1-Oct-29	128.92	**6.45**		4.77		11.22
5	1-Apr-30	124.15	**6.21**	**12.18**	4.77		10.98
6	1-Oct-30	119.37	**5.97**		4.77		10.74
7	1-Apr-31	114.60	**5.73**	**11.22**	4.77		10.50
8	1-Oct-31	109.82	**5.49**		4.77		10.27
9	1-Apr-32	105.05	**5.25**	**10.27**	4.77		10.03
10	1-Oct-32	100.27	**5.01**		4.77		9.79
11	1-Apr-33	95.50	**4.77**	**9.31**	4.77		9.55
12	1-Oct-33	90.72	**4.54**		4.77		9.31
13	1-Apr-34	85.95	**4.30**	**8.36**	4.77		9.07
14	1-Oct-34	81.17	**4.06**		4.77		8.83
15	1-Apr-35	76.40	**3.82**	**7.40**	4.77		8.59
16	1-Oct-35	71.62	**3.58**		4.77		8.36
17	1-Apr-36	66.85	**3.34**	**6.45**	4.77		8.12
18	1-Oct-36	62.07	**3.10**		4.77		7.88
19	1-Apr-37	57.30	**2.86**	**5.49**	4.77		7.64
20	1-Oct-37	52.52	**2.63**		4.77		7.40
21	1-Apr-38	47.75	**2.39**	**4.54**	4.77		7.16
22	1-Oct-38	42.97	**2.15**		4.77		6.92
23	1-Apr-39	38.20	**1.91**	**3.58**	4.77		6.68

24	1-Oct-39	33.42	**1.67**		4.77		6.45
25	1-Apr-40	28.65	**1.43**	**2.63**	4.77		6.21
26	1-Oct-40	23.87	**1.19**		4.77		5.97
27	1-Apr-41	19.10	**0.95**	**1.67**	4.77		5.73
28	1-Oct-41	14.32	**0.72**		4.77		5.49
29	1-Apr-42	9.55	**0.48**	**0.72**	4.77		5.25
30	1-Oct-42	4.77	**0.24**		4.77		5.01
	Total		**111.01**	**111.01**	**143.24**		**254.26**
			7.40		**9.55**		**16.95**

Indirect charges / Annum in Cr.		**16.95**	**16.95**

ANNEXURE 19 – INTERNAL RATE OF RETURN (IRR)

LATUR MUNICIPAL CORPORATION

NAME OF PROJECT

Project Name: Underground Sewerage Scheme for Latur City

IRR CALCULATION

S. No	Year	Outflow	Discounting at10%	Discounting at 2%	Inflow	Discounting at10%	Discounting at 2%	Net Amount
		Capital cost / O&M Cost			Revenue			
1	2	3	4	5	6	7	8	9
			0.1	0.02		0.1	0.02	
1	2024-25	246.05	223.7	241.2		0.0	0.0	-246.1
2	2025-26	443.20	366.3	426.0		0.0	0.0	-443.2
3	2026-27	220.24	165.5	207.5		0.0	0.0	-220.2
4	2027-28	18.15	12.4	16.8	112.60	76.9	104.0	-88.6
5	2028-29	19.19	11.9	17.4	114.63	71.2	103.8	58.8
6	2029-30	20.28	11.4	18.0	139.99	79.0	124.3	67.1
7	2030-31	21.44	11.0	18.7	142.43	73.1	124.0	61.6
8	2031-32	22.68	10.6	19.4	144.86	67.6	123.6	56.6
9	2032-33	23.99	10.2	20.1	176.73	75.0	147.9	64.4
10	2033-34	25.38	9.8	20.8	179.65	69.3	147.4	59.1
11	2034-35	26.85	9.4	21.6	182.58	64.0	146.8	54.2
12	2035-36	28.41	9.1	22.4	222.62	70.9	175.5	61.5
13	2036-37	30.05	8.7	23.2	226.13	65.5	174.8	56.4
14	2037-38	31.80	8.4	24.1	229.63	60.5	174.0	51.8
15	2038-39	33.65	8.1	25.0	233.14	55.8	173.2	47.4
16	2039-40	35.61	7.7	25.9	236.65	51.5	172.4	43.4
17	2040-41	37.69	7.5	26.9	240.16	47.5	171.5	39.8
18	2041-42	33.81	6.1	23.7	243.67	43.8	170.6	36.4
			897.62	1198.68	2825.47	971.54	2233.99	
	Return On Investment= (Discounted Benefits – Discounted Costs) / Discounted Costs							
	Return On Investment					7.61%		
	Benefit Cost Ratio					**1.08**		
	IRR=	**((2*(10-2)*2400.42)/2400.42+3038.36))/100**				**14.93%**		
	10%	(7501.88-4708.68)	**73.92**					
	2%	(12160.33-9030.5)	**1035.31**					
	Economic Analysis is concerned with the total return or productivity or profitability to the whole economy of all the resources committed to the project regardless of who in the society contribute them and regardless of who in the society receives the benefits							

ANNEXURE 20 – TRIAL PIT DETAILS

LATUR MUNICIPAL CORPORATION								
Project Name: Underground Sewerage Scheme for Latur City								
TRIAL PITS								
S. N.	Trial Pit No.	Road	Soft Soil	Hard Murrum	Hard Murrum & Boulders	Soft Rock	Total Depth	Road Type
1	2	3	4	5	6	7	8	9
1	TP-1	0.3	0.19	0.21	0.2	0.45	1.35	RCC
2	TP-2	0.3	0.21	0.21	0.3	0.41	1.43	RCC
3	TP-3	0.3	0.26	0.24	0.28	0.4	1.48	RCC
4	TP-4	0.3	0.27	0.22	0.27	0.43	1.49	WBM
5	TP-5	0.3	0.25	0.23	0.26	0.65	1.69	WBM
6	TP-6	0.3	0.19	0.19	0.2	0.5	1.38	BT
7	TP-7	0.3	0.20	0.19	0.25	0.45	1.39	BT
8	TP-8	0.3	0.22	0.21	0.2	0.65	1.58	BT
9	TP-9	0.3	0.19	0.21	0.23	0.7	1.63	RCC
10	TP-10	0.3	0.22	0.20	0.2	0.6	1.52	BT
11	TP-11	0.3	0.19	0.19	0.2	0.5	1.38	WBM
12	TP-12	0.3	0.20	0.19	0.25	0.75	1.69	BT
13	TP-13	0.3	0.22	0.21	0.2	0.45	1.38	RCC
14	TP-14	0.3	0.19	0.21	0.23	0.65	1.58	BT
15	TP-15	0.3	0.22	0.20	0.2	0.85	1.77	BT
16	TP-16	0.3	0.14	0.16	0.15	0.68	1.43	WBM
17	TP-17	0.3	0.16	0.16	0.25	0.55	1.42	BT
18	TP-18	0.3	0.21	0.19	0.23	0.6	1.53	RCC
19	TP-19	0.3	0.22	0.17	0.22	0.7	1.61	BT
20	TP-20	0.3	0.20	0.18	0.21	0.65	1.54	BT
21	TP-21	0.3	0.14	0.16	0.15	0.44	1.19	BT
22	TP-22	0.3	0.16	0.16	0.25	0.75	1.62	RCC
23	TP-23	0.3	0.14	0.16	0.15	0.45	1.20	WBM
24	TP-24	0.3	0.16	0.16	0.25	0.8	1.67	WBM
25	TP-25	0.3	0.21	0.19	0.23	0.55	1.48	BT
26	TP-26	0.3	0.22	0.17	0.22	0.65	1.56	RCC
27	TP-27	0.3	0.20	0.18	0.21	0.45	1.34	WBM
28	TP-28	0.3	0.14	0.16	0.15	0.5	1.25	BT
29	TP-29	0.3	0.16	0.16	0.25	0.7	1.57	BT

30	TP-30	0.3	0.21	0.19	0.23	0.65	1.58	WBM
31	TP-31	0.3	0.22	0.17	0.22	0.47	1.38	RCC
32	TP-32	0.3	0.2	0.18	0.21	0.7	1.59	BT
33	TP-33	0.3	0.16	0.16	0.25	0.45	1.32	RCC
34	TP-34	0.3	0.21	0.19	0.23	0.65	1.58	WBM
35	TP-35	0.3	0.22	0.17	0.22	0.8	1.71	RCC
36	TP-36	0.3	0.20	0.18	0.21	0.55	1.44	WBM
37	TP-37	0.3	0.14	0.16	0.15	0.5	1.25	BT
38	TP-38	0.3	0.16	0.16	0.25	0.68	1.55	WBM
39	TP-39	0.3	0.21	0.19	0.23	0.55	1.48	RCC
40	TP-40	0.3	0.22	0.17	0.22	0.6	1.51	BT
41	TP-41	0.3	0.20	0.18	0.21	0.7	1.59	BT
42	TP-42	0.3	0.16	0.16	0.25	0.8	1.67	RCC
43	TP-43	0.3	0.21	0.19	0.23	0.75	1.68	WBM
44	TP-44	0.3	0.22	0.17	0.22	0.65	1.56	RCC
45	TP-45	0.3	0.20	0.18	0.21	0.65	1.54	RCC
46	TP-46	0.3	0.21	0.19	0.23	0.65	1.58	BT
47	TP-47	0.3	0.22	0.17	0.22	0.75	1.66	WBM
48	TP-48	0.3	0.14	0.16	0.15	0.7	1.45	RCC
49	TP-49	0.3	0.16	0.16	0.2	0.6	1.42	BT
50	TP-50	0.3	0.21	0.19	0.18	0.75	1.63	BT
51	TP-51	0.3	0.22	0.17	0.17	0.6	1.46	WBM
52	TP-52	0.3	0.2	0.18	0.16	0.65	1.49	RCC
53	TP-53	0.3	0.14	0.16	0.15	0.65	1.40	RCC
54	TP-54	0.3	0.16	0.16	0.25	0.54	1.41	WBM
55	TP-55	0.3	0.21	0.19	0.23	0.75	1.68	BT
56	TP-56	0.3	0.22	0.17	0.22	0.65	1.56	WBM
57	TP-57	0.3	0.14	0.16	0.2	0.75	1.55	RCC
58	TP-58	0.3	0.16	0.16	0.25	0.67	1.54	RCC
59	TP-59	0.3	0.21	0.19	0.23	0.73	1.66	RCC
60	TP-60	0.3	0.14	0.16	0.2	0.67	1.47	BT
61	TP-61	0.3	0.16	0.16	0.25	0.55	1.42	WBM
62	TP-62	0.3	0.14	0.16	0.15	0.65	1.40	BT
63	TP-63	0.3	0.16	0.16	0.2	0.7	1.52	RCC
64	TP-64	0.3	0.21	0.19	0.18	0.8	1.68	WBM
65	TP-65	0.3	0.22	0.17	0.17	0.75	1.61	BT
66	TP-66	0.3	0.2	0.18	0.16	0.75	1.59	WBM
67	TP-67	0.3	0.14	0.16	0.15	0.68	1.43	BT

68	TP-68	0.3	0.16	0.16	0.25	0.65	1.52	RCC
69	TP-69	0.3	0.21	0.19	0.23	0.7	1.63	BT
70	TP-70	0.3	0.22	0.17	0.22	0.65	1.56	BT
71	TP-71	0.3	0.14	0.16	0.2	0.6	1.40	WBM
72	TP-72	0.3	0.16	0.16	0.25	0.68	1.55	BT
73	TP-73	0.3	0.21	0.19	0.23	0.75	1.68	RCC
74	TP-74	0.3	0.14	0.16	0.2	0.6	1.40	BT
75	TP-75	0.3	0.16	0.16	0.25	0.75	1.62	RCC
76	TP-76	0.3	0.14	0.16	0.15	0.65	1.40	RCC
77	TP-77	0.3	0.16	0.16	0.2	0.65	1.47	WBM
78	TP-78	0.3	0.21	0.19	0.18	0.75	1.63	BT
79	TP-79	0.3	0.22	0.17	0.17	0.7	1.56	BT
80	TP-80	0.3	0.2	0.18	0.16	0.65	1.49	WBM
81	TP-81	0.3	0.14	0.16	0.15	0.6	1.35	BT
82	TP-82	0.3	0.16	0.16	0.25	0.55	1.42	RCC
83	TP-83	0.3	0.21	0.19	0.23	0.6	1.53	BT
84	TP-84	0.3	0.14	0.16	0.15	0.5	1.25	RCC
85	TP-85	0.3	0.16	0.16	0.2	0.65	1.47	RCC
86	TP-86	0.3	0.21	0.19	0.18	0.6	1.48	BT
87	TP-87	0.3	0.22	0.17	0.17	0.5	1.36	WBM
88	TP-88	0.3	0.2	0.18	0.16	0.6	1.44	BT
89	TP-89	0.3	0.14	0.16	0.15	0.65	1.40	RCC
90	TP-90	0.3	0.16	0.16	0.25	0.67	1.54	BT
91	TP-91	0.3	0.21	0.19	0.23	0.65	1.58	BT
92	TP-92	0.3	0.22	0.17	0.22	0.75	1.66	RCC
93	TP-93	0.3	0.14	0.16	0.2	0.55	1.35	WBM
94	TP-94	0.3	0.16	0.16	0.25	0.65	1.52	BT
95	TP-95	0.3	0.21	0.19	0.23	0.5	1.43	WBM
96	TP-96	0.3	0.14	0.16	0.2	0.75	1.55	RCC
97	TP-97	0.3	0.16	0.16	0.25	0.75	1.62	BT
98	TP-98	0.3	0.14	0.16	0.15	0.74	1.49	WBM
99	TP-99	0.3	0.16	0.16	0.2	0.7	1.52	RCC
100	TP-100	0.3	0.21	0.19	0.18	0.65	1.53	BT
101	TP-101	0.3	0.22	0.17	0.17	0.6	1.46	RCC
102	TP-102	0.3	0.2	0.18	0.16	0.65	1.49	WBM
103	TP-103	0.3	0.14	0.16	0.15	0.5	1.25	RCC
104	TP-104	0.3	0.16	0.16	0.2	0.6	1.42	BT
105	TP-105	0.3	0.21	0.19	0.18	0.69	1.57	RCC

106	TP-106	0.3	0.12	0.17	0.17	0.6	1.36	WBM
107	TP-107	0.3	0.14	0.16	0.15	0.65	1.40	BT
108	TP-108	0.3	0.16	0.16	0.15	0.75	1.52	RCC
109	TP-109	0.3	0.21	0.19	0.18	0.7	1.58	RCC
110	TP-110	0.3	0.14	0.16	0.15	0.65	1.40	BT
111	TP-111	0.3	0.16	0.16	0.2	0.68	1.50	RCC
112	TP-112	0.3	0.21	0.19	0.18	0.65	1.53	WBM
113	TP-113	0.3	0.22	0.17	0.17	0.7	1.56	BT
114	TP-114	0.3	0.14	0.16	0.15	0.5	1.25	RCC
115	TP-115	0.3	0.16	0.16	0.2	0.8	1.62	BT
116	TP-116	0.3	0.21	0.19	0.18	0.6	1.48	RCC
117	TP-117	0.3	0.22	0.17	0.17	0.6	1.46	BT
118	TP-118	0.3	0.14	0.16	0.15	0.65	1.40	WBM
119	TP-119	0.3	0.16	0.16	0.2	0.5	1.32	RCC
120	TP-120	0.3	0.21	0.19	0.18	0.65	1.53	WBM
121	TP-121	0.3	0.22	0.17	0.17	0.6	1.46	BT
122	TP-122	0.3	0.2	0.18	0.16	0.65	1.49	RCC
123	TP-123	0.3	0.22	0.17	0.17	0.55	1.41	BT
124	TP-124	0.3	0.14	0.16	0.15	0.6	1.35	RCC
125	TP-125	0.3	0.14	0.16	0.15	0.65	1.40	BT
126	TP-126	0.3	0.16	0.16	0.2	0.56	1.38	BT
127	TP-127	0.3	0.21	0.19	0.18	0.6	1.48	WBM
128	TP-128	0.3	0.22	0.17	0.17	0.75	1.61	RCC
129	TP-129	0.3	0.2	0.18	0.16	0.65	1.49	BT
130	TP-130	0.3	0.14	0.16	0.15	0.7	1.45	WBM
131	TP-131	0.3	0.16	0.16	0.2	0.65	1.47	RCC
132	TP-132	0.3	0.21	0.19	0.18	0.7	1.58	BT
133	TP-133	0.3	0.15	0.17	0.17	0.6	1.39	RCC
134	TP-134	0.3	0.16	0.16	0.15	0.75	1.52	WBM
135	TP-135	0.3	.1.	0.16	0.2	0.65	1.31	BT
136	TP-136	0.3	0.21	0.19	0.18	0.7	1.58	RCC
137	TP-137	0.3	0.14	0.16	0.15	0.66	1.41	BT
138	TP-138	0.3	0.16	0.16	0.2	0.55	1.37	BT
139	TP-139	0.3	0.21	0.19	0.18	0.65	1.53	RCC
140	TP-140	0.3	0.22	0.17	0.17	0.6	1.46	WBM
141	TP-141	0.3	0.14	0.16	0.15	0.6	1.35	RCC
142	TP-142	0.3	0.16	0.16	0.2	0.65	1.47	BT
143	TP-143	0.3	0.21	0.19	0.18	0.7	1.58	RCC

144	TP-144	0.3	0.22	0.17	0.17	0.6	1.46	BT
145	TP-145	0.3	0.16	0.16	0.2	0.6	1.42	RCC
146	TP-146	0.3	0.21	0.19	0.18	0.65	1.53	BT
147	TP-147	0.3	0.22	0.17	0.17	0.65	1.51	RCC
148	TP-148	0.3	0.15	0.16	0.19	0.6	1.40	WBM
149	TP-149	0.3	0.14	0.15	0.15	0.6	1.34	BT
150	TP-150	0.3	0.19	0.19	0.18	0.65	1.51	WBM
151	TP-151	0.3	0.14	0.15	0.2	0.65	1.44	WBM
152	TP-152	0.3	0.19	0.14	0.23	0.65	1.51	BT
153	TP-153	0.3	0.16	0.17	0.25	0.54	1.42	BT
154	TP-154	0.3	0.17	0.17	0.21	0.66	1.51	WBM
155	TP-155	0.3	0.12	0.19	0.2	0.65	1.46	BT
156	TP-156	0.3	0.19	0.2	0.19	0.75	1.63	BT
157	TP-157	0.3	0.19	0.14	0.18	0.6	1.41	RCC
158	TP-158	0.3	0.15	0.15	0.17	0.68	1.45	WBM
159	TP-159	0.3	0.12	0.17	0.2	0.5	1.29	BT
160	TP-160	0.3	0.12	0.14	0.18	0.6	1.34	WBM
161	TP-161	0.3	0.2	0.14	0.2	0.65	1.49	RCC
162	TP-162	0.3	0.2	0.19	0.24	0.5	1.43	BT
163	TP-163	0.3	0.21	0.19	0.22	0.65	1.57	RCC
164	TP-164	0.3	0.17	0.15	0.19	0.45	1.26	RCC
165	TP-165	0.3	0.24	0.17	0.19	0.6	1.50	BT
166	TP-166	0.3	0.16	0.15	0.18	0.65	1.44	RCC
167	TP-167	0.3	0.12	0.18	0.2	0.5	1.30	WBM
168	TP-168	0.3	0.19	0.2	0.16	0.66	1.51	RCC
169	TP-169	0.3	0.18	0.23	0.21	0.65	1.57	BT
170	TP-170	0.3	0.19	0.15	0.2	0.7	1.54	RCC
171	TP-171	0.3	0.17	0.17	0.19	0.6	1.43	BT
172	TP-172	0.3	0.17	0.17	0.18	0.65	1.47	BT
173	TP-173	0.3	0.18	0.15	0.19	0.54	1.36	WBM
174	TP-174	0.3	0.19	0.18	0.17	0.7	1.54	BT
175	TP-175	0.3	0.19	0.14	0.23	0.65	1.51	WBM
176	TP-176	0.3	0.14	0.17	0.24	0.75	1.60	BT
177	TP-177	0.3	0.16	0.17	0.2	0.65	1.48	RCC
178	TP-178	0.3	0.16	0.15	0.2	0.6	1.41	BT
179	TP-179	0.3	0.18	0.13	0.17	0.68	1.46	RCC
180	TP-180	0.3	0.16	0.14	0.19	0.5	1.29	BT
181	TP-181	0.3	0.17	0.18	0.18	0.7	1.53	WBM

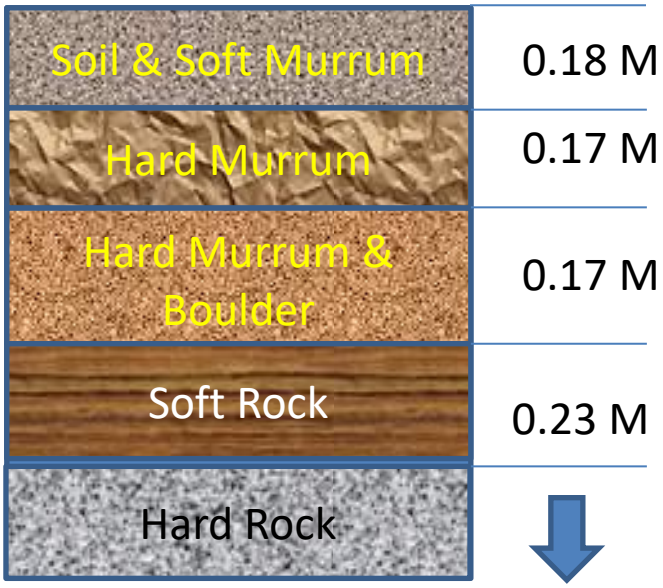
182	TP-182	0.3	0.18	0.19	0.21	0.65	1.53	WBM
183	TP-183	0.3	0.13	0.19	0.2	0.66	1.48	BT
184	TP-184	0.3	0.19	0.17	0.23	0.5	1.39	BT
185	TP-185	0.3	0.19	0.18	0.2	0.6	1.47	RCC
186	TP-186	0.3	0.2	0.17	0.18	0.65	1.50	WBM
187	TP-187	0.3	0.16	0.17	0.17	0.6	1.40	BT
188	TP-188	0.3	0.17	0.2	0.19	0.66	1.52	RCC
189	TP-189	0.3	0.17	0.16	0.19	0.65	1.47	BT
190	TP-190	0.3	0.17	0.16	0.18	0.65	1.46	WBM
191	TP-191	0.3	0.16	0.16	0.17	0.6	1.39	WBM
192	TP-192	0.3	0.19	0.17	0.17	0.68	1.51	RCC
193	TP-193	0.3	0.19	0.19	0.19	0.7	1.57	BT
194	TP-194	0.3	0.17	0.19	0.2	0.65	1.51	BT
195	TP-195	0.3	0.16	0.14	0.19	0.75	1.54	RCC
196	TP-196	0.3	0.15	0.19	0.18	0.65	1.47	WBM
197	TP-197	0.3	0.19	0.15	0.17	0.7	1.51	RCC
198	TP-198	0.3	0.2	0.19	0.18	0.6	1.47	BT
199	TP-199	0.3	0.15	0.18	0.18	0.65	1.46	BT
200	TP-200	0.3	0.2	0.17	0.16	0.54	1.37	RCC
201	TP-201	0.3	0.14	0.18	0.19	0.6	1.41	WBM
202	TP-202	0.3	0.18	0.18	0.2	0.5	1.36	RCC
203	TP-203	0.3	0.15	0.19	0.24	0.65	1.53	BT
204	TP-204	0.3	0.17	0.14	0.26	0.65	1.52	RCC
205	TP-205	0.3	0.22	0.15	0.21	0.7	1.58	WBM
206	TP-206	0.3	0.2	0.15	0.19	0.65	1.49	RCC
207	TP-207	0.3	0.14	0.2	0.2	0.7	1.54	BT
208	TP-208	0.3	0.14	0.16	0.24	0.55	1.39	BT
209	TP-209	0.3	0.22	0.14	0.18	0.75	1.59	WBM
210	TP-210	0.3	0.2	0.15	0.17	0.6	1.42	RCC
211	TP-211	0.3	0.16	0.16	0.2	0.65	1.47	WBM
212	TP-212	0.3	0.2	0.14	0.23	0.7	1.57	BT
213	TP-213	0.3	0.14	0.17	0.26	0.65	1.52	RCC
214	TP-214	0.3	0.18	0.19	0.25	0.7	1.62	WBM
215	TP-215	0.3	0.18	0.12	0.21	0.65	1.46	RCC
216	TP-216	0.3	0.19	0.15	0.23	0.7	1.57	BT
217	TP-217	0.3	0.16	0.17	0.2	0.66	1.49	BT
218	TP-218	0.3	0.14	0.19	0.26	0.75	1.64	WBM
219	TP-219	0.3	0.24	0.16	0.21	0.65	1.56	RCC

220	TP-220	0.3	0.16	0.19	0.24	0.6	1.49	RCC
221	TP-221	0.3	0.22	0.16	0.19	0.6	1.47	RCC
222	TP-222	0.3	0.16	0.19	0.18	0.65	1.48	WBM
223	TP-223	0.3	0.17	0.15	0.2	0.7	1.52	BT
224	TP-224	0.3	0.15	0.16	0.19	0.6	1.40	RCC
225	TP-225	0.3	0.17	0.15	0.27	0.65	1.54	WBM
226	TP-226	0.3	0.2	0.17	0.18	0.56	1.41	RCC
227	TP-227	0.3	0.23	0.18	0.17	0.65	1.53	BT
228	TP-228	0.3	0.18	0.17	0.2	0.6	1.45	WBM
229	TP-229	0.3	0.18	0.14	0.23	0.7	1.55	RCC
230	TP-230	0.3	0.19	0.17	0.26	0.6	1.52	RCC
231	TP-231	0.3	0.16	0.16	0.2	0.65	1.47	BT
232	TP-232	0.3	0.19	0.19	0.2	0.6	1.48	BT
233	TP-233	0.3	0.19	0.16	0.19	0.65	1.49	BT
234	TP-234	0.3	0.2	0.16	0.17	0.75	1.58	RCC
235	TP-235	0.3	0.23	0.14	0.17	0.65	1.49	BT
236	TP-236	0.3	0.2	0.19	0.19	0.65	1.53	RCC
237	TP-237	0.3	0.23	0.16	0.25	0.7	1.64	BT
238	TP-238	0.3	0.18	0.17	0.21	0.65	1.51	RCC
239	TP-239	0.3	0.16	0.18	0.23	0.7	1.57	BT
240	TP-240	0.3	0.16	0.13	0.2	0.65	1.44	WBM
241	TP-241	0.3	0.17	0.17	0.16	0.65	1.45	BT
242	TP-242	0.3	0.14	0.17	0.18	0.7	1.49	RCC
243	TP-243	0.3	0.15	0.18	0.17	0.65	1.45	RCC
244	TP-244	0.3	0.16	0.15	0.19	0.7	1.50	BT
245	TP-245	0.3	0.17	0.19	0.18	0.6	1.44	RCC
246	TP-246	0.3	0.14	0.19	0.16	0.68	1.47	WBM
247	TP-247	0.3	0.18	0.2	0.17	0.85	1.70	RCC
248	TP-248	0.3	0.19	0.14	0.18	0.75	1.56	BT
249	TP-249	0.3	0.14	0.21	0.19	0.65	1.49	RCC
250	TP-250	0.3	0.16	0.17	0.2	0.54	1.37	BT
251	TP-251	0.3	0.14	0.17	0.19	0.75	1.55	WBM
252	TP-252	0.3	0.16	0.19	0.17	0.65	1.47	BT
253	TP-253	0.3	0.17	0.18	0.19	0.65	1.49	RCC
254	TP-254	0.3	0.2	0.18	0.18	0.65	1.51	WBM
255	TP-255	0.3	0.16	0.16	0.17	0.55	1.34	RCC
256	TP-256	0.3	0.16	0.18	0.16	0.65	1.45	BT
257	TP-257	0.3	0.16	0.17	0.17	0.65	1.45	BT

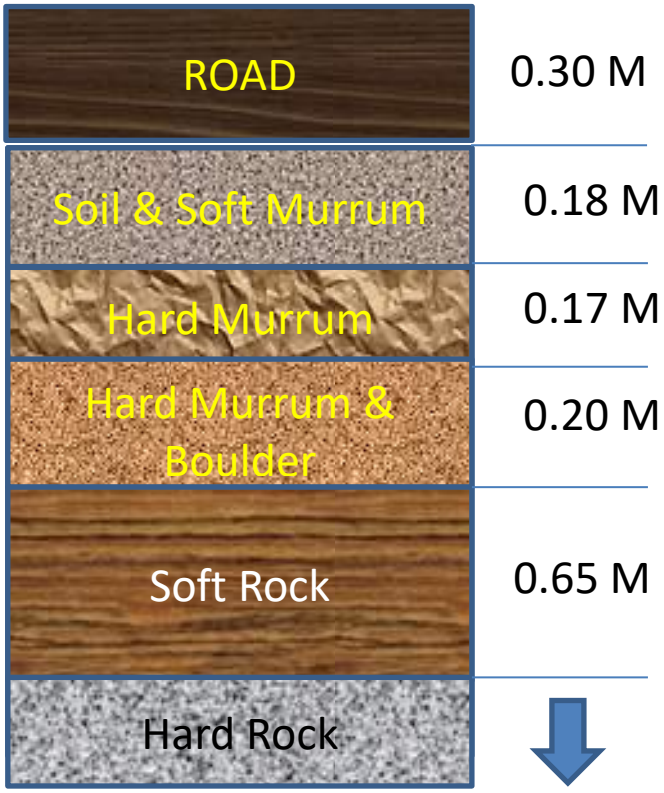
258	TP-258	0.3	0.14	0.2	0.2	0.6	1.44	RCC
259	TP-259	0.3	0.1	0.17	0.19	0.85	1.61	RCC
260	TP-260	0.3	0.18	0.18	0.17	0.8	1.63	BT
261	TP-261	0.3	0.16	0.16	0.17	0.85	1.64	WBM
262	TP-262	0.3	0.14	0.15	0.19	0.6	1.38	BT
263	TP-263	0.3	0.18	0.15	0.16	0.8	1.59	RCC
264	TP-264	0.3	0.19	0.18	0.17	0.75	1.59	WBM
265	TP-265	0.3	0.19	0.15	0.2	0.7	1.54	RCC
266	TP-266	0.3	0.18	0.16	0.19	0.75	1.58	WBM
267	TP-267	0.3	0.14	0.17	0.18	0.6	1.39	BT
268	TP-268	0.3	0.14	0.18	0.17	0.75	1.54	BT
269	TP-269	0.3	0.19	0.17	0.2	0.8	1.66	RCC
270	TP-270	0.3	0.19	0.19	0.23	0.65	1.56	WBM
271	TP-271	0.3	0.22	0.17	0.17	0.7	1.56	BT
272	TP-272	0.3	0.26	0.16	0.17	0.75	1.64	WBM
273	TP-273	0.3	0.2	0.18	0.19	0.8	1.67	BT
274	TP-274	0.3	0.19	0.19	0.18	0.85	1.71	RCC
275	TP-275	0.3	0.18	0.16	0.18	0.7	1.52	WBM
276	TP-276	0.3	0.18	0.16	0.17	0.75	1.56	RCC
277	TP-277	0.3	0.2	0.17	0.17	0.65	1.49	BT
278	TP-278	0.3	0.29	0.18	0.17	0.6	1.54	WBM
279	TP-279	0.3	0.27	0.18	0.19	0.65	1.59	BT
280	TP-280	0.3	0.14	0.18	0.18	0.8	1.60	BT
281	TP-281	0.3	0.14	0.16	0.18	0.65	1.43	RCC
282	TP-282	0.3	0.16	0.19	0.16	0.75	1.56	BT
283	TP-283	0.3	0.19	0.2	0.17	0.7	1.56	RCC
284	TP-284	0.3	0.16	0.21	0.16	0.65	1.48	BT
285	TP-285	0.3	0.17	0.12	0.19	0.6	1.38	BT
286	TP-286	0.3	0.15	0.18	0.17	0.85	1.65	RCC
287	TP-287	0.3	0.18	0.17	0.17	0.65	1.47	RCC
288	TP-288	0.3	0.16	0.21	0.19	0.75	1.61	BT
289	TP-289	0.3	0.14	0.21	0.18	0.7	1.53	BT
290	TP-290	0.3	0.18	0.24	0.2	0.65	1.57	BT
291	TP-291	0.3	0.17	0.21	0.19	0.85	1.72	RCC
292	TP-292	0.3	0.17	0.2	0.17	0.6	1.44	WBM
293	TP-293	0.3	0.14	0.17	0.2	0.76	1.57	RCC
294	TP-294	0.3	0.16	0.18	0.2	0.45	1.29	BT
295	TP-295	0.3	0.18	0.16	0.19	0.75	1.58	WBM

296	TP-296	0.3	0.14	0.18	0.17	0.8	1.59	RCC
297	TP-297	0.3	0.17	0.17	0.17	0.65	1.46	WBM
298	TP-298	0.3	0.16	0.19	0.19	0.65	1.49	BT
299	TP-299	0.3	0.15	0.18	0.24	0.7	1.57	BT
300	TP-300	0.3	0.2	0.17	0.23	0.65	1.55	WBM
	Total	**90.00**	**53.54**	**51.78**	**58.62**	**194.63**		
	Avg.Depth	**0.30**	**0.18**	**0.17**	**0.20**	**0.65**		

Use for Water Supply Scheme



Trial Pit Results for Sewerage Scheme



ANNEXURE 21 – COMPARISON BETWEEN DIFFERENT STP TECHNOLOGIES

Comparison between AEROBIC PROCESS BASED MBR, SBR, Conventional ASP and MBBR STP's					
Sr. No		**MBR**	**SBR**	**Conventional ASP**	**MBBR**
1	Type of process	MBR stands for Membrane bio-Rector. This process is also an activated sludge process; however, the only difference is that the clear treated effluent/sewage is withdrawn through very fine ultrafiltration membranes to remove suspended solids, bacteria and virus. The process is totally dependent on the membranes and heavy instrumentation. This is a new process, wherein there are very few installations worldwide. MBR find application in case the treated sewage is to be recycle via Reverse osmosis system /DM plants for high purity water	SBR process is an advanced aerobic activated sludge process, It provides highest possible treatment in a single step to achieve water quality which can be used for recycle without any further tertiary treatment. Besides BOD, COD and TSS removal the plants are designed for removing N, P and NH3N also which are a major source of bio fouling.	Conventional ASP is also an aerobic process, which uses an aeration tank with diffusers or surface aerators and clarifiers to degrade organics. Treatment efficiencies are around 80 to 85% only and the system requires much higher space and power consumption as compared to advanced ASPs like SBR systems.	It has low treatment efficiency of about 70-80%. It uses PVC media within aeration tanks known as fluidized bed reactors and known as MBBR. The media is kept in a fluidized state. This technology is used mostly in small scale package STPs and also where only partial sewage treatment is envisaged.

		generation wherein high operating costs and replacement costs are acceptable. For this very reason, where reuse is for low end usages like cooling tower makeup, irrigation purpose or in case of sewage disposal, this process has NO benefit. Anaerobic & Anoxic Tanks required before Aeration tank for N and P removal. Also, Ultrafine (2mm) perforation) screens are required before MBR tank.			
2	Established Treatment Records	MBR application for treatment of sewage in India are very few small plants. Not much data is available. As treatment systems based on membrane applications are very sensitive to input conditions the treatment efficiency and	SBR process is tested for Indian conditions. Numerous plants ranging from 1 MLD to 245 MLD are in operation. Outlet quality from SBR plant is BOD < 10 ppm, TSS < 10 ppm, COD < 50 ppm, TN < 10 ppm, TP < 1 ppm is continuously achieved.	Outlet quality from ASP process is BOD < 20 - 30 ppm, TSS: 30 -50 ppm. Normally there is no provision to remove Nitrogen and Phosphorous. In case of ASP tertiary treatment is a must to get recycle quality of sewage.	Retention time within MBBRs is only 45 min to 1.5 hrs; as a result, complete degradation of BOD/COD does not take place. Typical outlet quality is BOD 30 - 40 ppm, TSS 40-50 ppm. Further No N, P removal takes place. There are very few large plants in the country which are working on this process. In case of MBBR tertiary treatment is a must to get

		capacity drastically vary while actual operation of plant.		Along with additional units for removal of Nitrogen and Phosphorous.	discharge standard quality of sewage i.e., BOD < 10, TSS < 20. Pre-Anaerobic & Anoxic Tanks required before Aeration tank for 3removal of Nitrogen and Phosphorous.
3	Peak load	A typical system takes only average flow. In case peak flows are to be handled the flow has to be equalized in extra equalization tanks with mixing provision and pumping provision. This requires extra air blowers, grid piping and pumps which increases the operating costs drastically. Alternatively, if the MBR system itself is designed for peak flow which astronomically increases the capital and replacement costs.	SBR process is designed to handle peak load under all situation, there is no need for any equalization tanks or any other units	This system has no ability to handle peak flow. The system cannot handle varying shock loads, as it is designed for average flow only.	As system is not designed for peak flow, extra equalization tanks are required along with blowers for mixing and 2 stage pumping to meet peak flow requirements.
4	Operating Cost	Very High.	Low	Operating cost is high on account of power, tertiary treatment.	Operating cost is high on account of power, tertiary treatment and media replacement cost.

5	Operation of thesystem	The system depends totally on instrumentation. The entire operation is cumbersome and requires highly skilled manpower.	Very simple automatic operation with no requirement for any backwash, air scouring or chemical cleaning.	Simple to operate, however requires large no of manpower as none of the large capacity plants are onautomation in India.	Most of the plants give operational problems due to sludge accumulation, lack of proper fluidization, media replacement etc and.none of the large capacity plants are on automation in India.
6	Frequent replacement ofparts	Membranes have a life of 3-5 years, after which all membranes need to be replaced. Besides incurring replacement cost, there is prolonged downtime for replacing membranes. Part of the membranes cannot be changed as there will be unequal flow distribution.	No item to be changed	No items to be changed	Media needs to be changed every 4-5 years
7	Technology sourcing	Dependency of foreign suppliers for technology. In most cases contractor does not have trained manpower to lookinto all aspects of the technology.	Indian technology with more than 250 references.	Typical text book design, all contractors can give conventional ASP process	There is no reference or method tocheck system design. Not many working plant data is available.

8	Dependence on one supplier for replacement of components	There is no interchange ability of membranes with other vendors. As the system uses specific membranes which contributes to about 30% of the capital investments, there is no alternative source left with the customer for procurement of these membranes from outside. Customer has to lifelong depend on one vendor, and hence replacement membrane costs cannot be checked.	No dependence on single vendor, as all components areeasily available locally in India from 3-4 reputed vendors. Customer can choose vendor as per own convenience and requirement.	No dependence on one supplier	Dependence on key vendors for media replacement
9	No of Installations inIndia & world wide	There are no known large-scale plants inIndia.	More than 250 plants under Operation in Indian ranging from1 MLD to 245 MLD with area of250m2 per MLD for large plants of over 80 MLD	Many installations in India. However, needs large land area and high operating cost	Not many installations are available on large scale. only 3-4 large installations

ANNEXURE 22 – LIFE CYCLE COST FOR DIFFERENT STP TECHNOLOGIES

LIFE CYCLE COST ANALYSIS FOR DIFFERENT STP TECHNOLOGIES

Per mld, Amount Rs, In Lakhs

Sr. No.	Assessment Parameter/Technology	ASP	MBBR	SBR	UASB+EA	MBR	WSP
1.0	Performance after Secondary Treatment						
1.1	Effluent BOD, *mg/L*	<20	<30	<10	<20	<5	<40
1.2	Effluent SS, *mg/L*	<30	<30	<10	<30	<5	<100
1.3	Faecal coliform removal, *log unit*	Up to 2<3	Up to 2<3	Up to 2<3	Up to 2<3	Up to 2<3	Up to 2<3
1.4	T-N Removal Efficiency, *%*	10-20	10-20	70-80	10-20	70-80	10-20
2.0	Performance After Tertiary Treatment						
2.1	Effluent BOD, mg/L	<10	<10	<10	<10	<10	<10
2.2	Effluent SS, mg/L	<5	<5	<5	<5	<5	<5
2.3	Effluent NH3 N, mg/L	<1	<1	<1	<1	<1	<1
2.4	Effluent TP, mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2.5	Effluent Total Coliforms, MPN/100 mL	10	10	10	10	10	10
3.0	Capital cost						
3.1	Average Capital Cost (Secondary Treatment), Rs-Lacs/MLD	68.00	68.00	75.00	68.00	300.00	23.00
3.2	Average Capital Cost (Tertiary Treatment), Rs-Lacs/MLD	40.00	40.00	40.00	40.00		40.00
3.3	Total Capital Cost (Secondary + Tertiary) Rs-Lacs/MLD	108.00	108.00	115.00	108.00	300.00	63.00
3.4	Civil Works, % of total capital costs	60.00	40.00	30.00	65.00	20.00	90.00
3.5	E & M Works, % of total capital costs	40.00	60.00	70.00	35.00	80.00	10.00

4.0	**Area Requirements**						
4.1	**Average Area, m2 per MLD Secondary Treatment + Secondary Sludge Handling**	900.00	450.00	450.00	1000.00	450.00	6000.00
4.2	**Average Area, m2 per MLD Tertiary Treatment + Tertiary Sludge Handling**	100.00	100.00	100.00	100.00	0.00	100.00
4.3	**Total Area, m2 per MLD Secondary + Tertiary Treatment**	1000.00	550.00	550.0	1100.00	450.00	6100.00

ANNEXURE 23 – ACCOMODATION OF UNTILITIES ALONG & ACROSS NH (POLICY)

GOVERNMENT OF INDIA
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
AN ISO 9001:2008 CERTIFIED MINISTRY

S&R(R) ZONE

IAHE Campus,
A-5, Sector-62,
Noida-201301.

F. No. RW/NH-33044/29/2015/S&R(R) Dated: 22nd November, 2016

To,

1. The Chief Secretaries of all the State Governments/ UTs
2. The Principal Secretaries/ Secretaries of all States/ UTs Public Works Department dealing with National Highways, other centrally sponsored schemes.
3. All Engineers-in-Chief and Chief Engineers of Public Works Department of States/ UTs dealing with National Highways, other centrally sponsored schemes.
4. The Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
5. The Chairman, National Highways Authority of India, G-5 & 6, Sector-10, Dwarka, New Delhi-110 075.
6. The Managing Director, NHIDCL, PTI Building, New Delhi-110001

Subject: Accommodation of Public and Industrial Utility Services along and across National Highways – Policy guidelines regarding.

Sir,

The Government has realized that development of infrastructure across the Country on a sustainable and integrated manner continues to be an imperative for improving the state of economy, enhancing quality of life of the citizens and ensuring equitable development throughout the country.

Land being among the most precious of natural resources available, optimum utilization of land shall play a critical role in integrated development of infrastructure. One of the ways to effect such optimum utilization is leveraging land within National Highway (NH) Right of Way (ROW) for laying utility services. This may be achieved through granting permissions for laying utility services along and /or across the ROW. However, environment and safety of the road users are the prime factors in deciding permission for utility services. Permission may be denied, if it is not feasible to ensure safety and environment through requisite safeguards. The Administration of ROW, has been defined in the National Highway Land and traffic Control Act 2002 and relevant Rules 2004.

Keeping in view the need for consistency and clarity, in supersession of all the instructions contained in the earlier previous circulars on the subject, following guidelines shall apply for accommodation of Utility Services along and across National Highways.

2. Laying of Utility Services along the National Highways:

2.1 There shall be a provision for utility ducts for appropriate categories/combination of utilities in the construction of new/4-6 laning of National Highways. The ducts shall be located at appropriate location preferably as close to the extreme edge of ROW.

2.2 Utility services shall be laid in the utility ducts, if provided for the purpose.

2.3 In stretches where utility ducts have not been provided, the utility services shall be located, beyond the toe line of the embankment and drains, as close to the extreme edge of the RoW as possible. While granting permission, requirement of up-gradation also needs to be kept in view.

2.4 It is to be ensured that at no time there is interference with the drainage of the road land and maintenance of the National Highways. Towards this, the top of the utility services shall be at least 0.6 metre below the ground level.

2.5 No utility service shall be laid over existing culverts and bridges except through the utility ducts where such provision exists. In case of absence of such provisions, the Licensee shall make his own arrangement for crossing of cross drainage structure, rivers, etc. below the bed.

2.6 In exceptional cases, where ROW is restricted the utility services can be allowed beneath the carriageway of service road, subject to the condition that the utility services be laid in concrete ducts, which will be designed to carry traffic on top. The width of the duct in such case shall not be less than one lane. In such cases, it also needs to be ensured that maintenance of the utility services shall not interfere with the safe and smooth flow of traffic. The cost of operation and maintenance will have to be borne by the Licensee as per the agreement.

3. Laying of Utility Services across the National Highway:

3.1 The utility services shall be permitted to cross the National Highway either through structure or conduits specially built for that purpose. The casing / conduit pipe should, as minimum, extend from drain to drain in cuts and toe of slope to toe of slope in the fills and shall be designed in accordance with the provision of IRC and executed following the Specifications of the Ministry.

3.2 Existing drainage structures shall not be allowed to carry the lines across.

3.3 The utility services shall cross the National Highway preferably on a line normal to it or as nearly so as practicable.

3.4 The casing/conduit pipe may be installed under the road embankment either by boring or digging a trench. Installation by boring method shall be preferred.

3.5 In case of trenching, the sides of the trench should be done as nearly vertical as possible. The trench width should be at least 30 cm wider, (but not more than 60 cm wider), than the outer diameter of the utility pipe. Filling of the trench shall conform to the specifications contained here-in-below or as supplied by the Highway Authority.

3.5.1 Bedding shall be to a depth not less than 30 cm. It shall consist of granular material, free of lumps, clods and cobbles, and graded to yield a firm surface without sudden change in the bearing value. Unsuitable soil and rock edges should be excavated and replaced by selected material.

3.5.2 The backfill shall be completed in two stages (i) Side-fill to the level of the top of the pipe (ii) Overfill to the bottom of the road crust.

3.5.3 The side fill shall consist of granular material laid in 15 cm. Layers each consolidated by mechanical tamping and controlled addition of moisture to 95% of the modified Proctor's density. Overfill shall be compacted to the same density as the material that had been removed. Consolidation by saturation or ponding will not be permitted.

3.5.4 The road crust shall be built to the same strength as the existing crust on either side of the trench or to thickness and specifications stipulated by the Highway Authority.

3.6 When utilities are allowed overhead, the horizontal and vertical clearance in accordance with the IRC shall be maintained.

4. Procedure for processing application for granting permission for use of highway land: Any person who intends to obtain permission shall make an application online in the prescribed form to Highway Administration or an officer authorized by Highway Administration on his behalf. The application must mention details the various safety clearances from the respective authorities such as Directorate of Electricity, Chief Controller of Explosives, Petroleum and Explosives Safety Organization, Oil Industry Safety

Directorate, State/Central Pollution Control Board and any other statutory clearances as applicable, which must be obtained by the Applicant before applying to the Highway Administration.

The application shall be put out in the public domain for 30 days for seeking claims and objections (on grounds of public inconvenience, safety and general public interest). The permission for laying utility services is to be normally granted within 30 days from the day of closure of public objections and claims. If no communication is received from the Highway Administration within 30 days from the day of closure of public objections and claims, the permission shall be deemed to be granted. The initial permission would be valid for a maximum of 5 years at a time, which can thereafter be considered for renewal. On payment of additional fee at the time of renewal, the permission shall automatically be renewed, unless defaults exist. In case of renewal, rate prevailing at the time of renewal shall be charged.

5. **Charges for granting licence for use of highway land:** For the purpose of license fee/lease rentals, the utilities have been divided into two categories; i) Public utilities and b) Industrial utilities as per the details given in **Annexure I**.

License Fee/lease rentals described below is for Industrial utilities. The license fee for Public utilities shall be 33% of the fee prescribed for Industrial utilities.

5.1 The following methodology shall be followed for license fees/lease rental determination for utility service lines other than localized infrastructure facilities like towers, repeaters and junction boxes).

License Fees (Rs/sq m/ month) = (Utilized NH land area X prevailing Circle Rate of land per unit area) / (10 x 12) where,

Utilized NH land area = Outer diameter/width of the concerned utility line X length

5.2 The following methodology shall be followed for license fees/lease rental determination for utility services such as towers/repeaters/ junction boxes etc.

License Fees (Rs/sq m/ month) = (Utilized NH land area X prevailing Circle Rate of land per unit area) / (10 x 12) where,

Utilized NH land area = Projection of utility on the ground including area of support system/tower

However, for public utilities, area below the support system/tower shall only be charged.

5.3 Fee shall have to be paid in advance for the period for which permission is granted. In case of renewal, rate prevailing at the time of renewal shall be charged. Delay in deposition of fee shall attract interest @ 15% per annum compounded annually.

5.4 A system to redress grievances and to consider relaxation from the guidelines, in exceptional cases, shall be notified separately and shall be effective from the date of notification.

6. All required restoration, maintenance work subsequent to laying of utility services shall be required to be undertaken by the Licensee at its cost either by itself or through its authorized representative in consultation with the Authority as per predetermined time schedule and quality standards. To process for the granting of permission and prior to signing of Lease agreement, a Performance Bank Guarantee for an amount based on per route metre with a validity of one year initially, in the prescribed format (extendable if required till satisfactory completion of work) shall have to be furnished by the utility service provider/ Licencee, as a security against improper restoration of ground in terms of

filling/unsatisfactory compaction damages caused to other underground installations/utility services & interference, interruption, disruption or failure caused thereof to any services etc.;

Utility services such as pipes etc (rate in per m)	
provided in the ducts already provided	Rs 50
<= 300 mm dia/width	Rs 100
> 300 mm dia/width but < =1000 mm	Rs 250
> 1000 mm	Rs 500
Utility services such as towers etc (rate in Rs per sq m)	Rs 100

In case the Licensee fails to discharge the obligation of making good of the excavated trench/other restoration work, the Authority shall have a right to make good the damages caused by excavation, at the cost of the Licensee and recover the amount by forfeiture of the Bank Guarantee. In case, the Performance Bank Guarantee is invoked as mentioned above, the Licensee shall be required to replenish and reinstate the required Performance Bank Guarantee within one month of such invoking.

Notwithstanding this, the Licensee shall be liable to pay full compensation to the aggrieved Authority/ its designated agency for any damage sustained by them by reason of the exercise of the RoW facility.

7. The Authority shall enter into a License Agreement with the respective utility service provider in the format enclosed (**Appendix**) including any other conditions imposed by Highway Administration, to ensure safe and uninterrupted flow of traffic. Post signing of the agreement, the utility service provider shall be designated as 'Licensee' for the purpose of this project and will be authorized to install and operate utility services within the NH RoW. However, utility services shall be made operational by the Licensee only after a completion certificate to the effect is issued by the Highway Administration.

Encls: As above.

Manoj Kumar

(Manoj Kumar)
Executive Engineer(NFSG) (S,R&T) (Roads)
For Director General (Road Development) & SS

Copy to:

1. All Technical Officers in the Ministry of Road Transport & Highways
2. All ROs and ELOs of the Ministry
3. The Secretary General, Indian Roads Congress
4. The Director, IAHE
5. Technical circular file of S&R (R) Section
6. NIC-for uploading on Ministry's website under "What's new"

Copy for kind information to:

7. PS to Hon'ble Minister (RTH&S)
8. PS to Hon'ble MOS (RTH&S)
9. Sr. PPS to Secretary (RT&H)
10. PPS to DG (RD) & SS
11. PPS to SS&FA
12. PS to ADG-I/ ADG-II
13. PS to JS (T)/ JS (H)/ JS (LA&C)/ JS (EIC)

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Annexure I

Public Utility provider and Industrial infrastructure

A. Public Utility Provider

A **Public Utility Provider** in context of this Guideline shall mean any organization that provides and maintains the infrastructure for a public service like electricity, gas, water supply, telecom cables and sewage disposal subject to applicable regulation.

B. Eligible activities for Industrial Units or 'Industrial Infrastructure'

Industrial Infrastructure in context of this Guideline shall mean any physical infrastructure that is required to facilitate industrial operations and is constructed, operated and maintained along/across Right of Way of National Highways. Such infrastructure shall include the following:

a. Underground & above ground pipelines including provisions for booster pumping facilities, maintenance bays and other required support infrastructure for transport of legally permitted materials for industrial usage by a business entity having valid license for industrial operations.

b. Conveyor Belts including provisions for maintenance bays and other required support infrastructure for transport of legally permitted materials, by a business entity having valid license for industrial operations.

c. Power cables/wires etc. meant for industrial usage by a business entity having valid license for industrial operations.

d. Any other such associated industrial infrastructure facility.

Appendix

Draft

Enclosure to Ministry of Road Transport & Highways letter No. 33044 / 29 / 2015 /S&R(R) dated 22.11.2016.

AGREEMENT REGARDING GRANTING OF RIGHT OF WAY PERMISSIONS

FOR LAYING UTILITY SERVICES ON NATIONAL HIGHWAYS

Agreement to lay Telecom cable / OFC cable / electrical cable / pipe line/ ducts etc. from to Km of land.

This Agreement made this _____ day of_____ (month)_____ of (year) between_____ acting in his executive capacity through_____ (hereinafter referred to as the "Authority" which expression shall unless excluded by or repugnant to the context, include his successors in office and assigns) on the one part, and M/s , a company registered under the Companies Act, 1956 and having its Registered Office at (hereinafter called the "Licensee") which expression shall unless excluded by repugnant to the context, include his successors/administrator assignees on the second part.

Whereas the Authority is responsible, inter-alia, for development and maintenance of lands in Km ..... to .....of NH No.....RoW.

Whereas the Licensee proposes to lay Telecom cable / OFC cable / electrical cable / pipe line / ducts etc. referred to as utility services in subsequent paras.

Whereas the Licensee has applied to the Authority for permission to lay utility services from Km _____ to Km _____ of road/route up to_____ and from km _____ to km _____ of road/route up to _____ .

And whereas the Authority has agreed to grant such permission for way leave on the NH RoW as per terms and conditions hereinafter mentioned.

Now this agreement witnesseth that in consideration of the conditions hereinafter contained and on the part of the Licensee to be observed and performed, the Authority hereby grants to the Licensee permission to lay utility services as per the approved drawing attached hereto subject to the following conditions, namely.

1. RoW permissions are only enabling in nature. The purpose of extending the way leave facility on the National Highway RoW is not for enhancing the scope of activity of a utility service provider, either by content or by intent. Further, enforceability of the permission so granted shall be restricted only to the extent of provisions/scope of activities defined in the license agreement & for the purpose for which it is granted.

2. No Licensee shall claim exclusive right on the RoW and any subsequent user will be permitted to use the RoW, either above or below, or by the side of the utilities laid by the first user, subject to technical requirements being fulfilled. Decision of the Authority in relation to fulfilment of technical requirements shall be final and binding on all concerned parties. In case any disruption/damage is caused to any existing user by the subsequent user, the Authority shall not be held accountable or liable in any manner.

3. The Licensee shall be responsible for undertaking all activities including, but not limited to site identification, survey, design, engineering, arranging finance, project management, obtaining regulatory approvals & necessary clearances, supply of equipment, material, construction, erection, testing and commissioning, maintenance and operation and all other activities essential or required for efficient functioning of their own utility/ industrial infrastructure facilities.

4. The Licensee shall pay license fees @ Rs ...../sq m/month to the Authority. The License fee shall become payable from the date of handing over of RoW land to the Licensee, for laying of utilities/cables/conduits/pipelines for infrastructure/ service provider. As regards Tariff and Terms and conditions for providing common utility ducts along National Highways, there shall be a separate agreement regime.

5. Fee shall have to be paid in advance for the period for which permission is granted for entering into a license agreement. In case of renewal, rate prevailing at the time of renewal shall be charged. Delay in deposition of fee shall attract interest @ 15% per annum compounded annually.

6. Present policy of the MoRT&H is to provide a 2.00 m wide utility corridor on either side of the extreme edge of RoW. In cases where utility ducts with sufficient space are already available along NH, the utility services shall be laid in such ducts subject to technical requirements being fulfilled.

7. The utility services shall be laid at the edge of the RoW. In case of restricted width of RoW, which may be adequate only to accommodate the carriageway, central verge, shoulders, slopes of embankment, drains, other road side furniture etc; the utility services shall be laid beyond the toe line of the embankments and clear of the drain.

8. The Licensee shall make his own arrangement for crossing of cross drainage structure, rivers, etc. below the bed. In case, this is not feasible, the utility services may be carried outside the railings/parapets and the bridge superstructure. The fixing and supporting arrangement with all details shall be required to be approved in advance from the concerned Highway Administration. Additional cost on account of fixing and supporting arrangement as assessed by the Authority shall be payable by the Licensee.

9. In exceptional cases, where RoW is restricted the utility services can be allowed beneath the carriageway of service road, if available, subject to the condition that the utility services be laid in concrete ducts, which will be designed to carry traffic on top. The width of the duct shall not be less than one lane. In such cases, it also needs to ensure that maintenance of the utility services shall not interfere with the safe and smooth flow of traffic. The cost of operation and maintenance will have to be borne by the Licensee.

10. It is to be ensured that at no time there is interference with the drainage of the road land and maintenance of the National Highways. Towards this, the top of the utility services shall be at least 0.6 metre below the ground level. However, any structure above ground shall be aesthetically provided for / landscaped with required safety measures as directed by the concerned Authority;

11. The utility services shall be permitted to cross the National Highway either through structure or conduits specially built for that purpose. The casing / conduit pipe should, as minimum, extend from drain to drain in cuts and toe of slope to toe of slope in the fills and shall be designed in accordance with the provision of IRC and executed following the Specifications of the Ministry.

12. Existing drainage structures shall not be allowed to carry the lines across.

13. The top of the casing/conduit pipe containing the utility services to cross the road shall be at least 1.2m below the top of the sub grade or the existing ground level whichever is lower, subject to being at lease 0.3m below the drain inverts. A typical sketch showing the clearances is given in Attachment-I.

14. The utility services shall cross the National Highway preferable on a line normal to it or as nearly so as practicable.

15. The casing/conduit pipe for crossing the road may be installed under the road embankment either by boring or digging a trench. Installation by boring method shall be preferred.

16. In case of trenching, the sides of the trench should be done as nearly vertical as possible. The trench width should be at least 30 cm. but not more than 60 cms wider than the outer diameter of the pipe. Filling of the trench shall conform to the specifications contained here-in-below or as supplied by the Highway Authority.

    a. Bedding shall be to a depth not less than 30 cm. It shall consist of granular material, free of lumps, clods and cobbles, and graded to yield a firm surface without sudden change in the bearing value. Unsuitable soil and rock edges should be excavated and replaced by selected material.

b. The backfill shall be completed in two stages (i) Side-fill to the level of the top of the pipe (ii) Overfill to the bottom of the road crust.

c. The side fill shall consist of granular material laid in 15 cm. Layers each consolidated by mechanical tamping and controlled addition of moisture to 95% of the Proctor's Density. Overfill shall be compacted to the same density as the material that had been removed. Consolidation by saturation or ponding will not be permitted.

d. The road crust shall be built to the same strength as the existing crust on either side of the trench or to thickness and specifications stipulated by the Highway Authority.

17. The Licensee shall ensure making good the excavated trench for laying utility services by proper filling and compaction, so as to restore the land in to the same condition as it was before digging the trench, clearing debris/loose earth produced due to execution of trenching at least 50m away from the edge of the right of way;

18. All required restoration work subsequent to laying of the cable shall be required to be undertaken by the Licensee at its cost either by itself or through its authorized representative in consultation with the Authority as per predetermined time schedule and quality standards.

19. Prior to commencement of any work on the ground, a performance Bank Guarantee @ Rs. per route metre / Rs per sq m with a validity of one year initially (extendable if required till satisfactory completion of work) shall have to be furnished by the Licensee to the Authority/its designated agency as a security against improper restoration of ground in terms of filling/unsatisfactory compaction damages caused to other underground installations/utility services & interference, interruption, disruption or failure caused thereof to any services etc. In case of the Licensee failing to discharge the obligation of making good of the excavated trench/other restoration work, the Authority shall have a right to make good the damages caused by excavation, at the cost of the Licensee and recover the amount by forfeiture of the Bank Guarantee.

20. In case, the Performance Bank Guarantee is invoked as mentioned above, the Licensee shall be required to replenish and reinstate the required Performance Bank Guarantee within one month of such invoking. In case the work contemplated herein is not completed to the satisfaction of the Authority, which has granted the permission, within a period of 11 months from the date of issue of the Bank Guarantee, the Licensee shall either furnish a fresh guarantee or extend the guarantee for a further period of one year. Notwithstanding this, the Licensee shall be liable to pay full compensation to the aggrieved Authority/ its designated agency for any damage sustained by them by reason of the exercise of the RoW facility;

21. The Licensee shall shift the utility services within 90 days (or as specified by the respective Authority) from the date of issue of the notice by the concerned Authority to shift/relocate the utility services, in case it is so required for the purpose of improvement/widening of the road/route/highway or construction of flyover/bridge and restore the road/land to its original condition at his own cost and risk.

22. The Licensee shall be responsible to ascertain from the respective agency in co-ordination with Authority, regarding the location of other utilities /underground installations/ facilities etc. The Licensee shall ensure the safety and security of already existing underground installations/utilities/facilities etc. before commencement of the excavation/using the existing cable ducts. The Licensee shall procure insurance from a reputed insurance company against damages to already existing underground installations/utilities/facilities etc.

23. The Licensee shall be solely responsible/ liable for full compensation/indemnification of concemed agency / aggrieved Authority for any direct, indirect or consequential damage caused to them/claims or replacements sought for, at the cost and risk of the Licensee. The concerned agency in co-ordination with Authority shall also have a right make good such damages/ recover the claims by forfeiture of Bank Guarantee.

24. If the Licensee fails to comply with any condition to the satisfaction of the Authority, the same shall be executed by the Authority at the cost and risk of the Licensee.

25. Grant of License is subject to the Licensee satisfying (a) minimum disruption of traffic and (b) no damage to the highways. As far as possible, the Licensee should avoid cutting of the road for crossing highway, and other roads and try to carry out the work by trenchless technology. In case any damage is caused to the road pavement in this process, the Licensee will be required to restore the road to the original condition at its cost. If due to unavoidable reasons the road needs to be cut for crossing or laying utility services, the Licensee has to execute the restoration work in a time bound manner at its cost either by itself or through its authorized representative in consultation with the Authority as per predetermined time schedule and quality standards. In case of the Licensee failing to discharge the obligation of making good of the excavated trench/other restoration work, the Authority shall have a right to make good the damages caused by excavation, at the cost of the Licensee and recover the amount by forfeiture of the Bank Guarantee.

26. The Licensee shall inform/give a notice to the concerned agency designated by the Authority at least 15 day in advance with route details prior to digging trenches,

for fresh or maintenance/repair works. A separate performance Bank Guarantee for maintenance/repair works shall have to be furnished by the Licensee.

27. Each day, the extent of digging the trenches should be strictly regulated so that utility services is laid and trenches filled up before the close of the work that day. Filling should be completed to the satisfaction of the concerned agency designated by the Authority.

28. The licensee shall indemnify the concerned agency in co-ordination with Authority, against all damages and claims, if any due to the digging of trenches for laying cables/ducts.

29. The permission for laying utility services is granted maximum for 5 years at a time, which can thereafter be considered for renewal. On payment of additional fee at the time of renewal, the permission shall automatically be renewed, unless defaults exist. In case of renewal, rate prevailing at the time of renewal shall be charged. Delay in deposition of fee shall attract interest @ 15% per annum compounded annually.

30. The permission shall be valid only for the period it is issued and fee deposited. However, the Authority also has a right to terminate the permission or to extend the period of Agreement.

31. That the Licensee shall not undertake any work of shifting, repairs or alterations to the utility services without prior written permission of the concerned agency in co-ordination with the Authority.

32. The permission granted shall not in any way be deemed to convey to the Licensee any ownership right or any interest in route/road/highway land /property, other than what is herein expressly granted. No use of NH RoW will be permitted for any purpose other than that specified in the Agreement.

33. During the subsistence of this Agreement, the utility services located in highway land / property shall be deemed to have been constructed and continued only by the consent and permission of the Authority so that the right of the Licensee to the use thereof shall not become absolute and indefeasible by lapse of time.

34. The Licensee shall bear the Stamp Duty charged on this Agreement.

35. Three copies of 'as laid drawings' of utilities (hard and soft copies) with geo-tagged photographs and geo-tagged video recordings of laying of cables in the trench (with respect to the NH) and after complete restoration shall be submitted to the Authority for verification and record within a month of completion of works.

36. The Licensee shall allow free access to the Site at all times to the authorised representatives of Authority to inspect the Project Facilities and to investigate any

matter within their Authority, and upon reasonable notice, shall provide reasonable assistance necessary to carry out their respective duties and functions.

37. The utility services shall not be made operational by the Licensee unless a completion certificate to the effect that the utility services has been laid in accordance with the approved specifications and drawings and the trenches have been filled up to the satisfaction of the concerned agency in co-ordination with the Authority has been obtained. Notwithstanding anything contained herein, this Agreement may be cancelled at any time by Authority for breach of any condition of the same and the Licensee shall neither be entitled to any compensation for any loss caused to it by such cancellation not shall it be absolved from any liability already incurred.

38. The Licensee shall ensure adherence to relevant Indian standards and follow best industry practices, methods and standards for the purpose of ensuring the safe, efficient and economic design, construction, commissioning, operation, repair and maintenance of any part of the utility lines/industrial infrastructure facilities and which practices, methods and standards shall be adjusted as necessary, to take account of:

    a. operation, repair and maintenance guidelines given by the manufacturers,
    b. the requirements of Law,
    c. the physical conditions at the Site, and
    d. The safety of operating personnel and human beings.

39. The Licensee shall have to provide safety measures like barricading, danger lighting and other necessary caution boards while executing the work.

40. While laying utility services, at least one lane of road shall be kept open to traffic at all times. In case of single lane roads, a diversion shall be constructed. If any traffic diversion works are found necessary during the working period such diversion shall be provided at the cost of Licensee.

41. After the termination/expiry of the agreement, the Licensee shall remove the utility services within 90 days and the site shall be brought back to the original condition failing which the Licensee will lose the right to remove the utility services. However before taking up the work of removal of utility services the Licensee shall furnish a Bank Guarantee to the Authority for a period of one year for an amount assessed by the Authority as a security for making good the excavated trench by proper filling and compaction, clearing debris, loose earth produced due to excavation of trenching at least 50m away from the edge of the RoW.

42. Any disputes in interpretation of the terms and conditions of this Agreement or their implementation shall be referred to the redress mechanism prevailing in the Ministry and the decision of the redress mechanism shall be final and binding on all.

43. For PPP Projects, in case of any financial loss incurred by the respective project concessionaires due to such laying/shifting of utility services by the Licensee, compensation for the same shall be required to be borne by the Licensee in mutual agreement with the respective project concessionaires. MoRT&H/ NHAI/ implementing authorities for the project shall not be liable to the concessionaire in any way in this regard.

This agreement has been made in duplicate, each on a Stamp Paper, Each party to this Agreement has retained one stamped copy each.

IN WITNESS WHEREOF THE PARTIES HERETO HAVE CAUSED THIS AGREEMENT TO BE EXECUTED THROUGH THEIR RESPECTIVE AUTHORISED REPRESENTATIVES THE DAY AND THE YEAR FIRST ABOVE WRITTEN.

SIGNED SEALED AND DELIVERED FOR AND ON BEHALF OF AUTHORITY.

BY SHRI_____

(Signature, name & address with stamp)

SIGNED ON BEHALF OF M/S_____ (LICENSEE)

BY SHRI_____

(Signature, name & address with stamp)

HOLDER OF GENERAL POWER OF ATTORNEY DATED_____
EXECUTED IN ACCORDANCE WITH THE RESOLUTION NO._____
DATED_____ PASSED BY HTE BOARD OF DIRECTORS IN THE MEETING HELD ON_____

IN THE PRESENCE OF (WITNESSES):

1.

2.

Enclosure to Ministry of Road Transport & Highways letter No RW/NH-33044/29/2012)-S(2(G) dated 22.11.16.

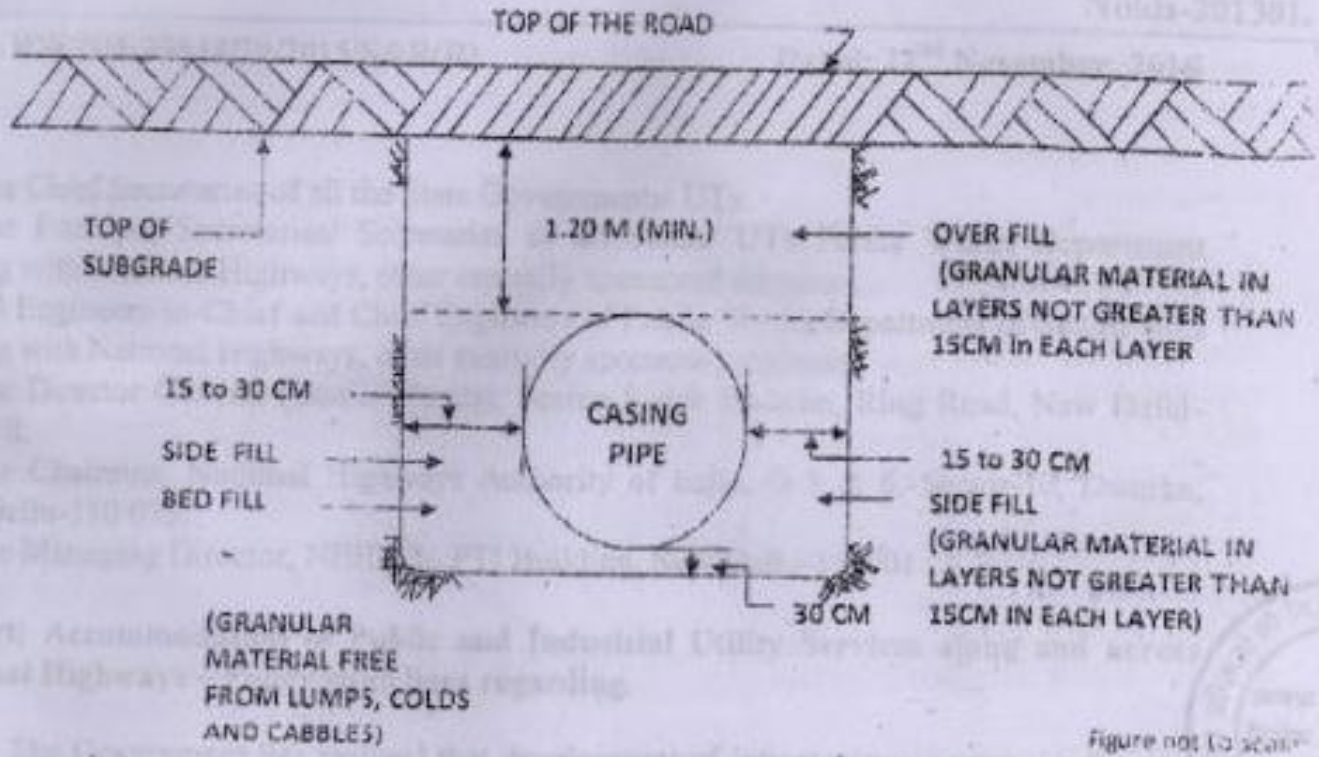

Figure not to scale

FIGURE-1 INSTALLATION OF CASING PIPE FOR CROSSING THE ROAD

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
(सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार)
National Highways Authority of India
(Ministry of Road Transport & Highways, Govt. of India)
परियोजना कार्यान्वयन ईकाई - देहरादून
Project Implementation Unit-Dehradun.
मकान नं-5, लेन नं-4, तेगबहादुर रोड़, देहरादून- 248001
House No.-5, Lane-4, Teg Bahadur Road, Dehradun- 248 001

टेलीफैक्स/Telefax : 0135-2669561
दूरभाष/Phone : 0135-2669562
ई-मेल/e-mail : dehradun@nhai.org
वेबसाइट / Website : www.nhai.org

NHAI/PIU-DDN/22080/Misc./2007/19900

Date 16.12.2019

सेवा में,

श्री. आर. के वर्मा,
उप महाप्रबंधक (एस & एल आर),
गेल (इंडिया) लिमिटेड,
8th फ्लोर गेल जुबली टावर,
बी -55-36, सेक्टर -1, नोएडा (उ.प).

Sub.: Permission for laying. of 8" underground gas pipe line alongwith OFC/DUCT parallel to NH-58 from Ch. 193.855 to Ch. 201.600 (Total length 7.745Km) (Shrishti Garden to Keshav Ashram) (within ROW) Haridwar-Dehradun Gas pipeline project-**reg**

Ref: (i) Your letter no. GAIL/HRDPL/NHAI/NH-58/NOC/Comp/2019 dated 25.11.2019
(ii) RO,NHAI,DDN letter no. 12025 dated 06.12.19

Sir,

Please refer to above mentioned subject & References. In this context, it is to inform that the subjected proposal was forwarded to Competent Authority for approval. Competent Authority vide its letter cited at S.no. (ii) (**copy enclosed**) has accorded its "in-principal" approval subject to following conditions:-

(i) Engineer shall ensure that the applicant has obtained various safety clearances, as may be applicable, from the respective authorities such as Directorate of Electricity, Chief Controller of Explosives, Petroleum and Explosives Safety Organization, Oil Industry Safety Directorate, State/Central Pollution Control Board and any other statutory clearances.

(ii) To process for the granting of permission and prior to signing of Lease agreement, a Performance Bank Guarantee for an amount based on per route meter with a validity of one year initially, in the prescribed format (extendable if required till satisfactory completion of work) shall have to be furnished by the utility service provider/ licensee, as a security against improper restoration of ground in terms of filling/unsatisfactory compaction, damages caused to other underground installations/utility services & interference, interruption, disruption or failure caused thereof to any services etc. as per **Para-6** of Ministry's Circular.

(iii) To obtain the License fee/lease rentals from the applicant as per **Para-5** of Ministry's Circular dated 22.11.2016 for the period for which permission is granted.

(iv) All required restoration, maintenance; work subsequent to laying of utility services shall be required to be undertaken by the Licensee at its cost either by itself or through its authorized representative in consultation with the Authority as per predetermined time schedule and quality standards.

(v) License deed / Agreement shall be as per format specified in Ministry's guidelines and all conditions as therein shall also be applicable for the instant case.

(vi) Engineer may ensure that the laying/crossing of 8" underground gas pipeline shall not obstruct any developmental work of ongoing/proposed widening work.

(vii) This permission is limited to laying/crossing of 8" underground gas pipeline within ROW of NH. All other statutoiy permissions from other agencies shall be obtained by the applicant.

(viii) The utilities shall be laid strictly in accordance with the Ministry's guidelines.

(ix) The utility services shall be made operational by the Licensee only after a completion certificate to the effect is issued by the Highway Administration.

(x) Laying of pipeline by HDD method must have proper safety provisions, if any shortcomings are found later, then the applicant shall take immediate action failing which the subject permission shall be treated as null & void.

(xi) Laying of pipeline laid in land not in possession with NHAI (if any) arises consequences/complications shall be solely attributable to applicant.

(xii) Engineer shall ensure that Consent of relevant Contractors shall be obtained for the subject permission before starting of subject work by the applicant.

(xiii) That in case of any burst or leak of carrying out Trenching work/Trenching work by HDD method in different patches on National Highways the Licensee / licensees shall bear the entire cost of restoration of damage caused to the road.

(xiv) That the licensee/ licensees shall not without the prior permission in writing of the Divisional/-Executive Engineer/ Project Director undertake any work of shifting, repairs or alterations to the said different patches.

(xv) That the Licensee/licensees shall be at all times permit any duly authorized officer or servant of the Government/ NHAI to inspect the said carrying out Trenching work/ Trenching work by HDD method in different patches on National Highways.

(xvi) That the Licensee/ licensee shall be liable for any loss or damage caused to the Government /NHAI by drainage obstruction or any other like cause due to the said carrying out Trenching work/Trenching work by HDD method in different patches on National Highway.

(xvii) That the licensee/ licensees within two months of a notice duly given to him to this behalf by the NHAI/ Government shall at his/their own cost remove the carrying out Trenching work/Trenching work by HDD method in different patches on National Highways and restore the road land to its original condition when required to do so by the government/ NHAI or by any person authorized on its behalf. The licensee/ licensees shall not be entitled to any compensation on account of such removal or restoration.

(xviii) That if the licensee fails / licensees fail to execute any work which he has/ they have agreed to execute under this agreement to the entire satisfaction of the project Director NHAI/ Government.The work shall be executed by the Project Director NHAI/Government at the cost of the Licensee/Licenses and the amount shall be recoverable from the Licensee/Licensees as arrears of land revenue without prejudice to any other remedies which may be open to the Government/NHAI in this behalf.

(xix) That the Licensee/licenses shall not sell, transfer or otherwise dispose of the premises without obtaining the previous consent of the Government/NHAI in writing.

(xx) That this agreement will remain in force for a period of five years from the date of execution in the first instance and be terminated by a notice of two months and the permission may not be renewed after the expiry of the said period. 9

(xxi) That the permission granted by this license shall not in any way to be deemed to convey to the - licensee/licensees any right to or over or any interest in Government land other than what is herein expressly granted. _

(xxii) That during the subsistence of this licence, the carrying out Trenching work/Trenching work by HDD method in different patches on National Highways located on the road shall be deemed to have been constructed and continued only by lapse of time. (xxiii) That the licensee/ licensees shall bear the stamp duty charges on this agreement.

(xxiv) Govt of India/ NHAI will not be responsible for any damage of any kin by what so ever means natural or othen/vise to the underground electrical cable.

(xxv) The carrying out Trenching work/Trenching work by HDD method in different patches on National Highways for laying of utility shall not be brought into use by the licensee/ licenses unless a completion certificate to the effect that the carrying out Trenching work by HDD method in different patches on National Highways have been laid in accordance with the approved specifications and drawings has been obtained from the Project Director NHAI.

(xxvi) The Licensee agree to abide by the directions of the concerned officer of NHAI appointed in accordance with the National Highway Acts 1956 ' and rules in force and no appeal/ correspondence shall be entertained in this regard.

(xxvii) The permission to carry out Trenching work/Trenching work by HDD method in different patches on National Highways is subject to availability of Utility Corridor inside the ROW of NHAI. i.e. If sufficient width is not available inside ROW due to any reason, the applicant/ agency shall have to lay his/ their pipeline outside the ROW of NHAI at their own risk 81 cost. '

(xxviii) This permission is subject to a condition that no claim by applicant would be entertained on any issue/matter related ownership 81 transfer of land and in case of any dispute in this, if arise, the permission to be treated withdrawn.

(xxix) Permission for carrying out Trenching work/Trenching work by HDD method in different patches on National Highways in protected/reserved forest in NHAI ROW or else, to be obtained separately by Licensee from concern department. This aspect is not at all attributable to NHAI.

(xxx) NHAI has acquired land for NH Project & if title/possession of the said land is not transferred in the name of NHAI/MORTH, this permission be not treated valid for those stretches.

(xxxi) Engineer should ensure that there must not be any structure (including its approaches) within 15mts from the crossing of pipeline and in case of parallel laying, it shall be at the edge of ROW and not be less than 15m form centreline of nearest carriageway. -

(xxxii) Engineer ensure that suitable arrangement for clamping method is provided to lay pipeline over the bridge/flyover etc.- and it will not have any deleterious effects on any of the bridge/flyover component and roadway safety of traffic. All other small canals and culverts in route shall be crossed by HDD method.

(xxxiii) The undertakings given by the applicant are to be strictly adhered to.

(xxxiv) The applicant has to submit requisite Bank guarantee for the above said work before signing of the license deed.

(xxxv) Engineer should ensure that the work shall be carried out as per MoRTH and NHAI guideline with all safety measures.

(xxxvi) The agency is to follow the above all guidelines and conditions strictly and to remain in constant touch with the concerned authority/bodies/parties and to ensure the compliance of the same arebeing done.

(xxxvii) The approval is subject to condition that, the proponent agency will not claim any kind of revenue loss/insurance/cost of protection or any other such losses in case of closure of cable due to any damage/shifting at the time of any kind of development maintenance of roadwork.

(xxxviii)Engineer should ensure that the smooth and safe flow of traffic shall be maintained by the proponent agency at the time of execution, and the proponent agency shall be held responsible for any kind of accident occurring due to in sufficient safety measures.

(xxxix) Methodology for laying pipeline will not have any -deterious effects on any of the bridge/structure

2. In context, it is requested to submit following :-

(i) Requisite license fee/lees rental as per para 5 of Ministry Circular dated 22.11.2016 in favor of PD, PIU, Dehradun along with calculation sheet.

(ii) Requisite Performance Bank Guarantee (Latest) as per para 6 of Ministry Circular dated 22.11.2016 with a validity of one year initially, favoring the PD NHAI, Dehradun.

3. In view of the above, it is requested to submit license fee of Rs 7667550/- for 5 years in favour of PD,PIU,Dehradun and Performance bank guarantee of Rs. 774500/- in favour of Project Director, NHAI PIU-Dehradun, so that necessary agreement can be executed for taking further necessary action in the matter please.

4. The permission shall be valid only after realization of license fee, BG & signing of agreement as mentioned above.

Encl: As above

सधन्यवाद।

भवदीय

(विभव मित्तल)
महाप्रबन्धक (तक0) सह
परियोजना निदेशक
पी0आई0यू0—देहरादून

Copy to:

(i) **IE, Shri. Saurav Shekhar,** M/s SA infrastructures Consultants Pvt ltd, 1101A, 11th Floor,Tower A-II, Corporate Park, Plot No. 7A/1, Sector 142,Noida - **for necessary action as given at s.no. (i),(vi),(xii),(xxxi),(xxxii),(xxxv) & (xxxviii).**

(ii) **Authorized signatory,** M/s SAM india builtwell pvt ltd-435,Jagriti Enclave Vikas Marg extension,New Delhi-**for information.**

LICENSE FEE/LEES RENT CALCULATION SHEET FOR LAYING GAIL'S 8"DIA (0.2 Mtr) NATURAL GAS PIPELINE ALONG NH-58

S. No.	Stretches of NH falling in alignment	Area Circle Rate/sqm (max)	Length (Meter)	Dia (OD) of pipe (Meter)	Utilized Area (Sqm)	License fee/month	License fee for 5 years	33% of License fee (INR)
		A	B	C	D	E	F	G
					(BxC)	(DxA/120)	(Ex60)	(Fx33/100)
1	NH-58-from Km 193.855 to 201.600	30000	7745.00	0.2	1549.0	387250.00	23235000.0	7667550.00
	TOTAL		7745.00		1549.0	387250.00	23235000.00	7667550.00
	TOTAL LICENSE FEE TO BE DEPOSITED (Rs.)							7667550.00

AMOUNT CALCULATION FOR PERFORMANCE BANK GUARANTEE

S. No.	Category of Utility	Chainnage of Pipeline (along /across NH-58 &72)		Length (in Mtr.)	Rate (Per Route Meter)	BG Amount based on Per Route Meter	Remarks
		From	To				
1	Public Utility (NH -58)	193.855	201.6	7745	100	774500.00	Rate taken as per MORTH Guidelines letter no. F.No. RW/NH-33044/29/2015/S&R® Dated 22.11.2016
	Total Amount of BG (Rs.)					774500.00	

NOD - SAICPL ROORKEE

T.Kumar
Acting T.L.
NOD-SAICPL(JV)
N.H-58

For GAIL (India) Limited

R. K. Verma
Dy. General Manager (S&LR)