International Journal of Multidisciplinary Academic Studies and Research (IJMASR)
Registered with MSME, Govt. of India: UDYAM-MH-20-0329275
Available at https://ijmasr.org Volume-1, Issue-5, May 2026, Page-59-65.

To Cite This Article
Shubham Digambar Mohod, Dilip L. Budhlani& Laxmi Gupta. (2026). Design and Optimization of Hinganghat Underground Sewerage Scheme under Amrut 2.0. International Journal of Multidisciplinary Academic Studies and Research (IJMASR), 1(5), 59–65. https://doi.org/10.5281/zenodo.21966932

Article Info
Received: 12th May 2026, Accepted: 15th May 2026, Published: 15th May 2026.

Design and Optimization of Hinganghat Underground Sewerage Scheme under Amrut 2.0

Shubham Digambar Mohod [1], Dilip L. Budhlani [2], Laxmi Gupta [3]

[1] Research Scholar, Civil Engineering Department, Swaminarayan Siddhanta Institute of Technology, Nagpur, Maharashtra, India

[23] Assistant Professor, Civil Engineering Department, Swaminarayan Siddhanta Institute of Technology, Nagpur, Maharashtra, India

Abstract- The present study focuses on the "Design and Optimization of Hinganghat Underground Sewerage Scheme under AMRUT 2.0". The main objective of the study is to assess the existing sewerage condition of Hinganghat and develop a suitable underground sewerage system for the remaining areas of the town. The study considers population growth, sewage generation, sewer network design, hydraulic performance, pumping requirements, sewage treatment, environmental aspects and operation and maintenance. The population of Hinganghat is projected to increase from 101,805 in 2011 to 202,156 by 2060. The overall sewage generation is estimated as 16.009 MLD in 2030, 19.730 MLD in 2045 and 24.481 MLD in 2060. The proposed Phase II system includes approximately 102.28 km of sewer network, 3,532 manholes and 9,863 property connections. Hydraulic assessment using SewerGEMS considers pipe diameter, slope, velocity, sewage flow and sewer depth. For the Pimpalgaon Zone, a 7.5 m diameter sewage pumping wet well with 4-duty and 2-standby pumps is proposed along with a 250 mm DI K-9 rising main of 120 m length. A 6 MLD CAMUS-based STP is proposed for sewage treatment. The study also considers treated wastewater reuse, sludge/manure management, solar power, SCADA, environmental protection and financial sustainability. The study concludes that the proposed sewerage scheme can significantly improve wastewater collection, treatment, sanitation and environmental conditions in Hinganghat. Proper implementation, regular maintenance, complete property connections and effective treatment plant operation will be essential for the long-term success of the project.

Keywords: Underground Sewerage System, AMRUT 2.0, Sewer Network Optimization, Hydraulic Efficiency, Pumping Dependency, Sewage Treatment Plant, Urban Sanitation, World Bank Guidelines

I. INTRODUCTION

Sewerage is one of the basic requirements of a healthy and developed urban area. With the increase in population, residential development, commercial activities and water consumption, the quantity of wastewater generated from a town also increases. If this wastewater is not properly collected, transported, treated and disposed of, it can create serious problems related to public health, environmental pollution and urban cleanliness. In many Indian towns, domestic wastewater is still managed through open drains, septic tanks, soak pits and natural drainage channels. Such systems may work for small settlements, but they become insufficient when the population increases and the urban area expands. Untreated or partially treated wastewater may enter nearby rivers, nallahs, agricultural areas and low-lying places. It can also cause bad odour, mosquito breeding, soil pollution and contamination of surface and groundwater. An underground sewerage system provides a planned solution to this problem. In this system, wastewater generated from individual houses, institutions, commercial areas and other establishments is collected through underground sewer pipelines. The collected sewage is conveyed mainly by gravity, and pumping stations are provided only at locations where gravity flow is not possible. The sewage is finally taken to a Sewage Treatment Plant (STP), where pollutants are removed before the treated wastewater is reused or discharged safely. Hinganghat is an important urban centre of Wardha district in Maharashtra. The town has developed around the Wena River and has experienced continuous urban growth. The municipal area is approximately 14.00 sq. km and is divided into 20 wards.

International Journal of Multidisciplinary Academic Studies and Research (IJMASR)
Registered with MSME, Govt. of India: UDYAM-MH-20-0329275
Available at https://ijmasr.org Volume-1, Issue-5, May 2026, Page-59-65.

The 2011 Census population of Hinganghat was 101,805. Considering future development, the project has adopted projected populations of 134,573 in 2030, 165,456 in 2045 and 202,156 in 2060. The existing sewerage infrastructure of Hinganghat has already been developed partly under Phase I. However, the complete town is not covered by an underground sewerage system. The remaining areas require additional sewer networks, property connections, pumping arrangements and sewage treatment facilities. Therefore, Phase II of the Hinganghat Underground Sewerage Scheme has been proposed. The present thesis focuses on the Design and Optimization of Hinganghat Underground Sewerage Scheme under AMRUT 2.0, with particular attention to the remaining sewerage area, hydraulic design, population forecasting, sewage flow estimation, sewer network planning, pumping requirements, sewage treatment, environmental protection, cost optimisation and long-term operation and maintenance.

II. PROPOSED METHODOLOGY

The overall study is carried out in a step-by-step manner. Initially, the existing conditions of Hinganghat town are studied to understand the present sewerage and drainage situation. The existing Phase I infrastructure is then reviewed to identify the areas already covered and the remaining areas requiring additional sewerage facilities. After this, population projections for the design years 2030, 2045 and 2060 are considered. The future population is used for estimating sewage generation at different stages. Domestic wastewater, non-domestic wastewater and infiltration are considered to determine the design sewage flow.

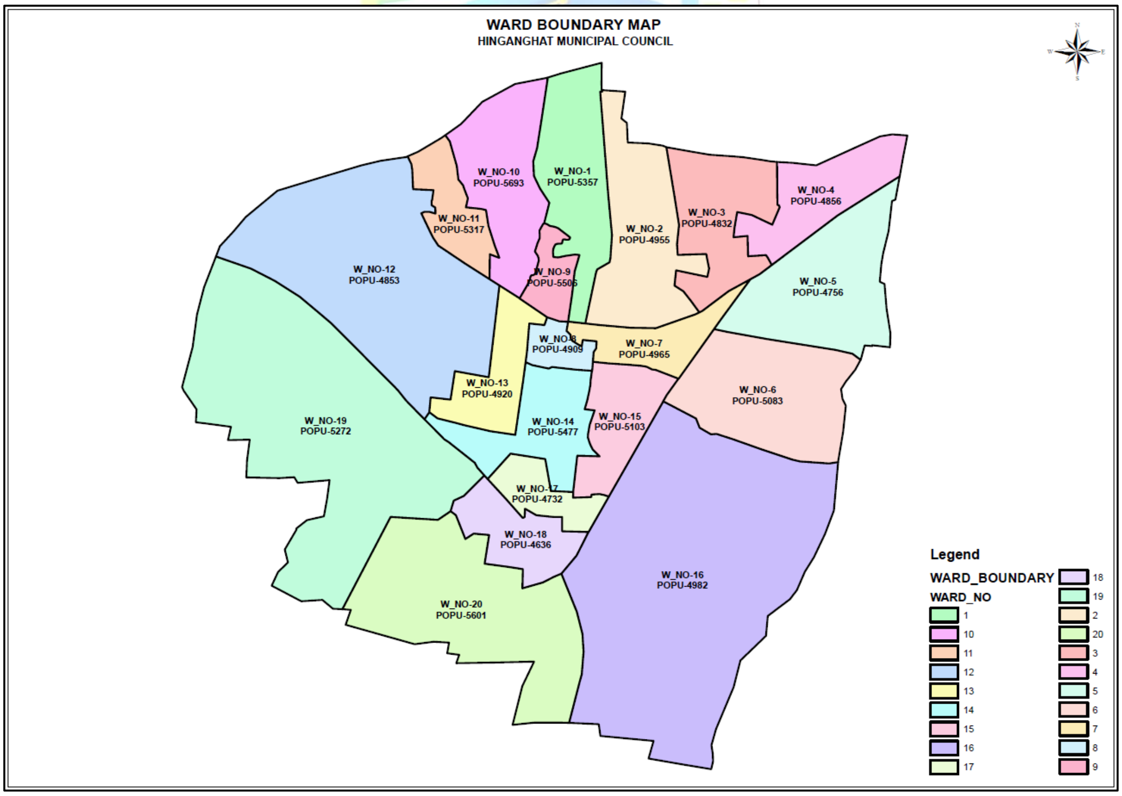

Figure 2.1: Ward Boundary Map of Hinganghat

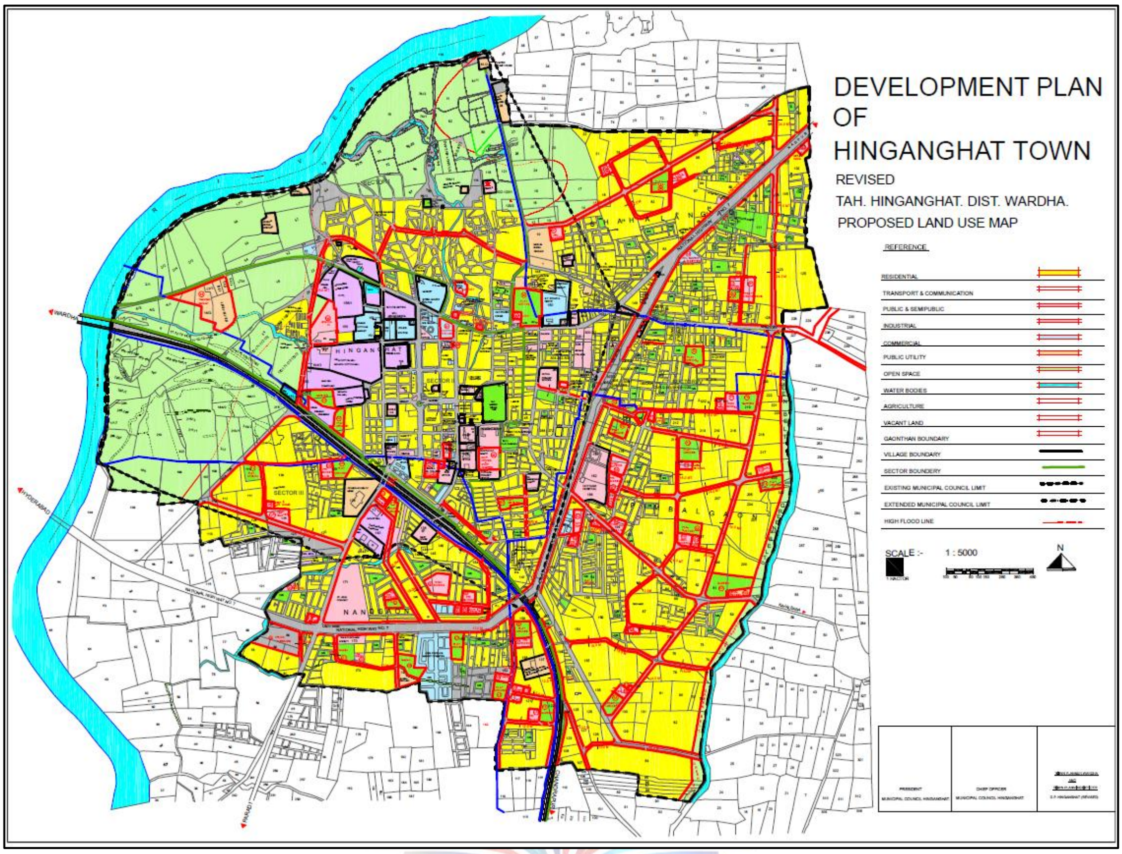

Figure 2.2: Development Plan of Hinganghat

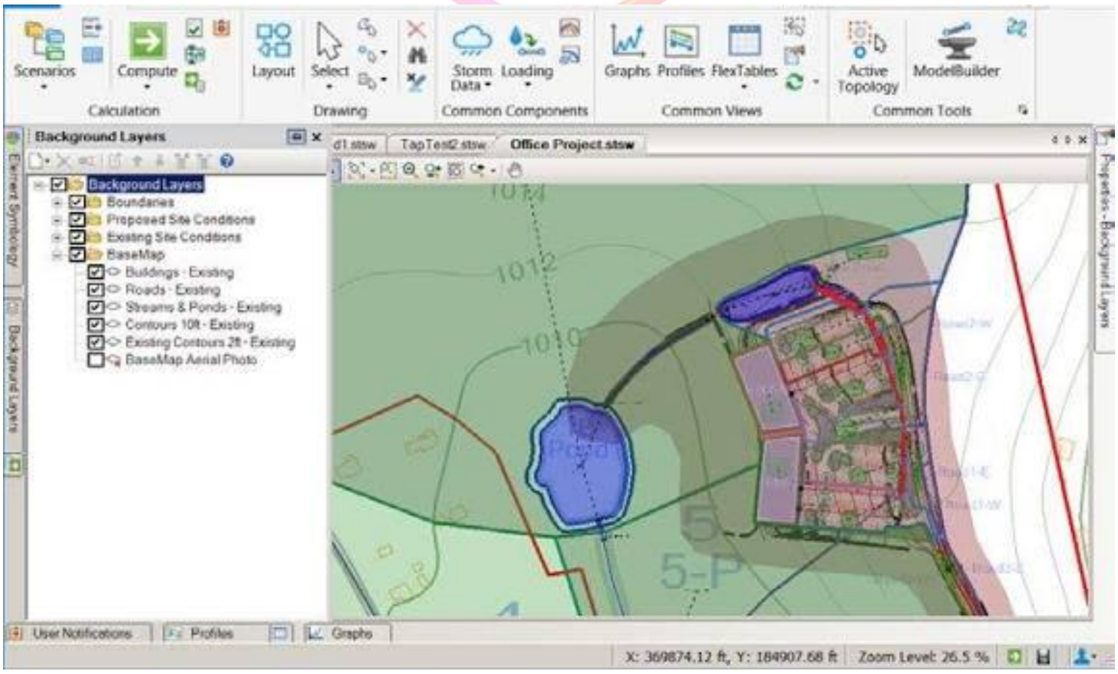

Figure 2.3: Proposed sewer network is assessed using SewerGEMS software

International Journal of Multidisciplinary Academic Studies and Research (IJMASR)
Registered with MSME, Govt. of India: UDYAM-MH-20-0329275
Available at https://ijmasr.org Volume-1, Issue-5, May 2026, Page-59-65.

III. RESULTS AND DISCUSSION

Different pipe diameters are proposed according to the expected flow and hydraulic requirements.

Table 3.1 Selected Sewer Pipe Sizes

Diameter	Main Pipe Type
150 mm	HDPE DWC
200 mm	HDPE DWC
250 mm	HDPE DWC
300 mm	HDPE DWC
350 mm and above	RCC

Table 3.2 Selected Hydraulic Results

Diameter	Minimum Velocity	Maximum Velocity
200 mm	0.06–0.12 m/s	2.19–2.40 m/s
250 mm	0.65–0.66 m/s	1.91–2.19 m/s
300 mm	0.81–0.90 m/s	0.90–1.54 m/s
350 mm	0.70–0.72 m/s	1.61–2.08 m/s
400 mm	0.78–0.83 m/s	0.84–1.73 m/s
500 mm	0.81–0.82 m/s	0.81–0.82 m/s
600 mm	0.00–0.85 m/s	0.00–1.99 m/s

Table 3.3 Distribution of Manhole Depths

Manhole Depth	Number of Manholes	Percentage
0–1.5 m	4,201	84.61%
1.5–3.0 m	629	12.67%
3.0–4.5 m	122	2.46%
4.5–6.0 m	13	0.26%
Above 6.0 m	0	0.00%
Total	4,965	100%

Table 3.4 Proposed 6 MLD CAMUS STP

Parameter	Proposed Value
Treatment technology	CAMUS
Capacity	6 MLD
Location	Satefal Road, Pimpalgaon
Land requirement stated	1.33 acre / 0.54 ha
STP ground level	211.500 m
HFL	212.800 m
Discharge level	220.000 m
Wet well suction level	204.545 m

Table 3.5 Major Phase II CAPEX Components

Component	Amount (₹ lakh)
Working survey	10.00
Sewer collection system + property connections	6,778.79
Road restoration	3,706.16
Utility shifting	100.52
NH push-through crossing	120.49
Wet well + pump house	101.04
Pumping machinery + SCADA	119.98
250 mm DI K-9 pumping main	8.57
6 MLD CAMUS STP	1,168.01
STP miscellaneous works	361.72
Zone I drainage works	456.52
Solar power	117.29
Express feeder	107.97
Other charges	80.74
Trial run	15.54
Phase II CAPEX subtotal	13,253.33

Table 3.6 Major Optimisation Results

Aspect	Optimisation Result
Existing infrastructure	Existing STPs retained wherever suitable
Sewer flow	Maximum possible gravity flow
Pumping	Pumping limited to required low-lying area
Rising main	Short 120 m pumping main
Sewer depth	Majority of manholes within 1.5 m
Pipe material	HDPE DWC for majority of network
Treatment	6 MLD CAMUS for Pimpalgaon
Energy	Solar power provision
Monitoring	SCADA provision
Water management	Treated wastewater reuse
Sludge management	Vermicomposting/manure recovery
Environment	Compensatory plantation
Finance	Phased development and revenue planning
O&M	Preventive maintenance approach

Table 3.7 Existing and Proposed Sewerage System Comparison

Parameter	Existing/Before Phase II	Proposed Phase II
Sewerage coverage	Partial	Expanded to remaining areas
Sewer network	Existing Phase I network	Additional 102.28 km
Property connections	Existing connections	Additional 9,863
Treatment	Existing STPs	Existing STP retained + new 6 MLD STP
Pimpalgaon	Limited sewerage facility	Complete proposed sewer network
Sewage pumping	Limited/existing arrangements	Dedicated Pimpalgaon SPS
Treatment technology	MMBR	CAMUS proposed for Zone II
Treated water reuse	Limited	Planned
Solar energy	Limited	Proposed
SCADA	Limited	Proposed
Sludge management	Existing arrangements	Vermicomposting/manure recovery proposed
Environmental condition	Wastewater management gap	Improved collection and treatment

CONCLUSION

The study confirms the need for an underground sewerage system in the remaining areas of Hinganghat to improve sanitation and environmental conditions. The projected population is expected to increase from 101,805 in 2011 to 202,156 by 2060, with sewage generation increasing from 16.009 MLD in 2030 to 24.481 MLD in 2060. For Phase II, approximately 102.28 km of sewer network and 9,863 property connections are proposed, with suitable hydraulic design and maximum use of gravity flow to reduce pumping and O&M costs. A sewage pumping station at Pimpalgaon, along with a 250 mm DI K-9 rising main and a 6 MLD CAMUS-based STP, is proposed, while the existing 3.5 MLD MMBR STP will continue to be utilised. The scheme also promotes treated wastewater reuse, sludge recovery through vermicomposting, solar energy and SCADA-based monitoring. Environmental impacts can be reduced through controlled sewage collection and treatment, while compensatory plantation is proposed for affected trees. Overall, the proposed scheme provides an integrated, economical and sustainable approach to wastewater collection, conveyance, treatment, reuse, environmental protection and long-term operation and maintenance of Hinganghat.

REFERENCES

1. Bhovate A., Shahare S., Bhongade P., Meshram P., Hydraulic Design of Water Treatment Plant as per AMRUT 2.0 & CPHEEO 2024 Guidelines, International Research Journal of Modernization in Engineering Technology and Science, Vol. 07, Issue 07, July 2025, DOI: 10.56726/IRJMETS81115.
2. Lokhande S., Kalbar P.P., Economic and Environmental Benefits of Natural Treatment Systems for Sewage Treatment: A Life Cycle Perspective, Water Research, Vol. 257, 2024, Article No. 121710, DOI: 10.1016/j.watres.2024.121710.
3. Bhagat R.M., Pande P.B., Raut J.M., Dhengare S.W., Borse A.S., Jasutkar D.B., Optimizing Urban Infrastructure: Design and Analysis of Sewer Networks with SewerGEMS, International Journal of Engineering Trends and Technology, Vol. 72, Issue 10, pp. 225–234, October 2024, DOI: 10.14445/22315381/IJETT-V72I10P122.
4. Raju R., Mohite A., Mohite V., Vichare H., Yedre S., Optimization & Design of Sewage Carrying Network System, VIVA-Tech International Journal for Research and Innovation, Vol. 1, Issue 6, 2023.
5. Mannade R., Sabale M., Satav N., Torane V., Optimization and Innovative Technique to Design, Laying – Sewerage System, International Research Journal of Engineering and Technology, Vol. 06, Issue 06, pp. 196–200, June 2019.
6. Ansari A., Dutt D., Kumar V., Revolutionizing Urban Waste: Eco-Innovation for Saharanpur's Sustainability (Class-II Urban Centers), Waste Management Bulletin, Vol. 2, Issue 1, pp. 184–190, April 2024, DOI: 10.1016/j.wmb.2024.01.006.
7. Tiwari S., Bhorkar M., Design of Under Ground Drainage System for Rural Area, International Research Journal of Engineering and Technology, Vol. 07, Issue 06, pp. 126–130, June 2020.
8. Virde H., Dohare D., A Review: Design of Sewerage Scheme and Evaluation of Proposed Treatment Plant for Saatvik Vihar Phase-II, Indore (M.P.), Current World Environment, Vol. 17, Issue 3, 2022, DOI: 10.12944/CWE.17.3.2.
9. Hulwane V., Mali S., Malvade Y., Mane R., Shirke D., Jadhav A., Design of Underground Drainage System for Kapuskhed Village, International Journal of Innovative Science and Research Technology, Vol. 6, Issue 6, pp. 378–382, June 2021.
10. Bhagat R.M., Pande P.B., Raut J.M., Dhengare S.W., Borse A.S., Jasutkar D.B., Optimizing Urban Infrastructure: Design and Analysis of Sewer Networks with SewerGEMS, International Journal of Engineering Trends and Technology, Vol. 72, Issue 10, pp. 225–234, October 2024, DOI: 10.14445/22315381/IJETT-V72I10P122.
11. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Sewerage and Sewage Treatment (Part A: Engineering), Ministry of Housing and Urban Affairs, Government of India, New Delhi, 2013.
12. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Sewerage and Sewage Treatment (Part B: Operation and Maintenance), Ministry of Housing and Urban Affairs, Government of India, New Delhi, 2013.
13. Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Water Supply and Treatment, Ministry of Housing and Urban Affairs, Government of India, New Delhi, 2019.
14. Ministry of Housing and Urban Affairs, Atal Mission for Rejuvenation and Urban Transformation (AMRUT 2.0) – Guidelines and Framework, Government of India, New Delhi, 2021.

15. World Bank, Design, Construction, and Operation of Municipal Sewerage Systems, World Bank Technical Guidance Note, Washington D.C., USA, 2018.
16. World Bank, Wastewater Management in Urban Areas: Policy and Technical Considerations, World Bank Group, Washington D.C., USA, 2017.
17. World Bank, Energy Efficiency in Wastewater Treatment Plants, Water Global Practice, World Bank, Washington D.C., USA, 2016.
18. World Bank, Urban Sanitation in India: Lessons from World Bank–Assisted Projects, World Bank Group, South Asia Region, Washington D.C., USA, 2019.
19. World Bank, Lifecycle Cost Analysis of Urban Infrastructure Projects, World Bank Infrastructure Series, Washington D.C., USA, 2014.
20. Bureau of Indian Standards, IS 1742:1983, Code of Practice for Building Drainage, BIS, New Delhi, India.
21. Bureau of Indian Standards, IS 2470 (Part 1):1985, Code of Practice for Installation of Septic Tanks – Design Criteria and Construction, BIS, New Delhi, India.
22. Bureau of Indian Standards, IS 2470 (Part 2):1985, Code of Practice for Installation of Septic Tanks – Secondary Treatment and Disposal, BIS, New Delhi, India.
23. Bureau of Indian Standards, IS 458:2021, Precast Concrete Pipes (with and without Reinforcement), BIS, New Delhi, India.
24. Bureau of Indian Standards, IS 783:2018, Code of Practice for Laying of Concrete Pipes, BIS, New Delhi, India.
25. Bureau of Indian Standards, IS 3370 (Part 1–4):2009, Concrete Structures for Storage of Liquids, BIS, New Delhi, India.