Sewerage System of Aurangabad : Review

Rohini S. Wankhede[1], Shivkanya S. Thombre[1], Asmita A. Pawar[1],S. D. Shinde[2], A.S. Pathan[2]

[1,1,1]B.Tech-Civil Students, Deogiri Institute of Engineering & Management studies,

Aurangabad, M.S., India.

[2,2]Assistant Professor DIEMS, Aurangabad, M.S., India

Abstract

Aurangabad (Maharashtra, India) is one of the fastest growing cities in Asia. The development in the Aurangabad City is rapid. This is directly affecting the amenities and facilities provided by the Municipal Corporation. One of the problems faced by the citizens is lacs of disposal system of the main sewers along the nallas. The present population of Aurangabad city is 16.42 lacs. Presently the generation of sewerage is about 107 MLD. The capacity to treat 161 million liters of sewage per day, the sewage treatment plant at Kanchan wadi. City is divided in two basins Kham & Sukhana with 80:20 population distributions. The 7 main sewers along nallas in the Kham basin will generate 240.67 MLD sewerage and Sukhana basin with 2 out- fall sewers about 60.83 MLD sewerage for the ultimate population for year 2045.

Keywords: Sewage, Sewerage System , STP, etc.

INTRODUCTION

Sewage produced by all human communities is often left to compost naturally or it is treated using processes that separate solid materials by settlement and then convert contaminants into biological sludge and into gases such as carbon dioxide or methane. Sewage infrastructure is designed as a safety feature that reduces sewage backups and minimizes public health impacts for residents. The Aurangabad is one of the fast-growing cities in Asia having population of 11.65 lacs in the year 2011. The scheme for the transportation, collection and treatment of sewage was commissioned in early seventies. The Municipal Corporation in 1965 has started the laying of underground sewerage line and completed the first phase in 1972 and second phase in 1976. The population projected at that time for 2001 was 2.0 lacs. The scheme was designed and constructed by Public Health engineering department of Govt. of Maharashtra however sudden increase in population to 4 - 5 times the scheme proved to be insufficient. Presently the generation of the sewerage is about 88 MLD. Only 6.5 MLD sewerage is treated, and remaining wastewater goes to the Kham River and Sukhana river as untreated in Kanchan wadi is working on Sequential batch reactor (SBR), capacity of plant is 161MLD. The Design of Wastewater Treatment Works is one of the most requested Document produced by the New England Interstate Water Pollution Control Commission. Sequential batch reactor (SBR) is becoming popular wastewater treatment option in New England and across the country due to their ability to treat the varying flow rates and allow control flexibility. In addition, they have a small footprint and are comparatively less expensive to construct and maintain. Untreated wastewater generally contains high level of organics material, numerous pathogenic micro-organisms, as well as nutrients and toxic compounds. It is necessary to environmental and health hazards and must immediately be conveyed away from its manmade sources and treated appropriately before final disposals of treated sewage.

METHODOLOGY

Study area: Aurangabad city (Maharashtra State, India) is one of the fastest growing city of India Aurangabad is a headquarter of Marathwada region of Maharashtra state with historic background. Aurangabad is situated at latitude 190 53’ 59’’ north and longitude 750 20’ east the city established on the banks of the Kham River. Topographically it is located in the valley region between the Chauka hills on the north and Satara hills on the south. The valley has a breadth of about 15 km and opens towards the east which has facilitated for the extension and development of the new settlement. Ajantha and Ellora caves have put the city on the tourist map of the world. It is the cultural, religious, educational, and industrial center. The average altitude of the city is about 581 m above mean sea level. Aurangabad is one of the rapidly growing cities in Asia.

Design Equation:

Manning's Formula for Gravity Flow

$$V = \frac{1}{n} R^{2/3} S^{1/2}$$

Where,

V = Velocity of flow in m/sec.

R = Hydraulic mean depth (A/P) = D/4 when pipe is flowing full or half full S = Slope of the sewer

n = Coefficient of roughness for pipes

DESIGN DEPTH OF FLOW

The sewers shall not run full as otherwise the pressure will rise above or fall below the atmospheric pressure and condition of open channel flow will cease to exist. Moreover, from consideration of ventilation, sewers should not be designed to run full. In case of circular sewers, the Manning's formula reveals that: The velocity at 0.8 depth of flow is 1.14 times the velocity at full depth of flow. The discharge at 0.8 depth of flow is 0.98 times the discharge at full depth of flow. Accordingly, the maximum depth of flow in design shall be limited to 0.8 of the diameters at ultimate peak flow.

Hydraulics of sewers flowing under pressure

TYPE OF FLOW

The hydraulic analysis of pumping mains is approached based on turbulent flow conditions to ensure that the suspended matter does not settle during pumping.

Hazen-Williams Formula

$$\boldsymbol{V = 4.567 \times 10^{-3} C D^{0.63} S^{0.54}}$$

For circular conduits, the expression becomes.

$$\boldsymbol{V = 0.849\ C\ R^{0.63}\ S^{0.54}}$$

And

$$\boldsymbol{Q = 1 \cdot 292 \times 10^{-5} C\ D^{2.63} S^{0.54}}$$

Q : Discharge in m3 /hr.

D : Internal diameter of pipe in mm

V : Velocity in m/s

R: Hydraulic radius in m

S: Slope of hydraulic gradient and

C: Hazen – William's coefficient

IMPORTANCE OF SEWERAGE SYSTEM

One of the fundamental principles of sanitation of the community is to remove all decomposable matter, solid waste, liquid or gaseous away from the premises of dwellings as fast as possible after it is produced, to a safe place , without causing any nuisance and dispose it in a suitable manner so as to make it permanently harmless. Sanitation though motivated primarily for meeting the ends of preventive health has come to be recognized as a way of life. In this context, development of the sanitation infrastructure of any country could possibly serve as a sensitive index of its level of prosperity. It is needless to emphasize that for attaining the goals of good sanitation, sewerage system is very essential. While provision of potable drinking water takes precedence in the order of provision of Environmental Engineering Services, the importance of sewerage system cannot be last sight and cannot be allowed to lag behind, as all the water used by the community has to flow back as the sewage loaded with the wastes of community living , unless properly collected , treated, and disposed of , this would create a serious water pollution problem.

NATURAL DRAIN NETWORK IN AURANGABAD

Topographically the area of Aurangabad city is divided in to two natural drainage systems.

Zone A: Comprises of Kham River and its tributaries, nallahs.

Zone B: Comprises of Sukhana River and its tributaries.

The majority of area is having slope towards Kham River basin 75 to 80 % sewage flow can be attributed to Kham River and 20 to 25 % flow drains in Sukhana River. The scheme was taken up for development in piece meal as per availability of funds.

SEWAGE FLOW AND TREATMENT OF SEWER

The population of the Aurangabad city as per census 2001 is 8.73 lacs. The present population of the city is 11.65 lacs. The Aurangabad Municipal Corporation receives 130 – 140 MLD water at Nakshtrawadi master balancing reservoir. And from other schemes city receives about 5 MLD water. The total water received is about 130 – 140 MLD. At

present there is hardly any treatment for the sewage and the same is flowing untreated through nallahs and river.

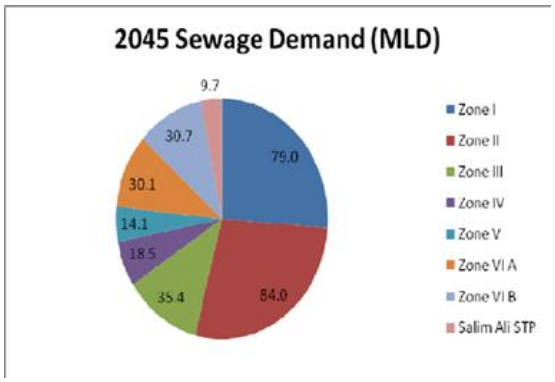

Fig. Chart Showing Zone Wise Sewerage Demand (MLD)

DEVELOPMENT OF NEW SEWERAGE LINES FOR FUTURE DEVELOPED AREAS

The total area under AMC is 138 Sq. Km. Except for small area. Sewerage collection network is available, considering 10% area (i.e., 1380 ha.) from residential Zone will be added to the sewerage collection network under this scheme. The areas which are being developed specifically near Padegaon, nakshatra wadi and satara parishar etc. are taken into consideration for development of new areas. The sewer lines will be laid as per the progress of development. The network in this area will be designed for the population in the year 2045. The main sewers are designed for the ultimate design load of the new areas.

The sewer Pipelines are designed for ultimate year 2045 with a peak factor of 2.25. The hydraulic design is done with the help of latest software with all the design considerations as per CPHEEO manual. The Zone I to Zone V is under the Kham River Basin and Zone VI A & B are under the Sukhana River Basin. The abstract of zone wise pipelines is given below.

Zone I : This zone comprises of the area on the south of Jalna Road up to satara. Sewer Fand sewer K are flowing through this zone.

Zone II, III, IV : The zone II, III, IV are the zones where main sewer B, C, D flows. These three zones are designed combinedly as the C and D sewer joins near Varad Ganesh mandir and then these two sewers join to B sewer at Siddarth Garden.

Zone V : Zone V is the zone where sewer A is proposed. The majority of the areas in the zone V are the of Educational Institutions, University and Padegaon.

Zone VIA and VIB: The zone VIA is the zone comprising of area such as jai Bhavani Nagar, N2 cidco etc. The main sewer line of zone VIA flow to Existing CIDCO STP.

The zone VIB consists of the east portion of Jalgaon road comprises of Jadhav wadi, Masnatpur, Chikhalthana etc. wherein the main sewer line flow up to Existing Zalta STP.

Zone Salim Ali STP: This zone basically comes under the catchment of Kham basin on the upstream of zone II, III. This zone was earmarked due to the proposed STP of 5.5 MLD which is under construction at Salim Ali Lake. Looking at the topography, this zone was designed, to meet the demand of Salim Ali STP.

DEVELOPMENT OF SEVEN MAIN SEWERS IN KHAM RIVER

Main Sewer A: Western part of Bibi Ka Maqbara to University to Padegaon – Length 2798 m

Main Sewer B: Part of Kham River flowing through Himayat Bagh Nallah – Siddharth Garden – Bane wadi – Golwadi. Length 13340m.

Main Sewer C: Majnu Hill – City Chowk - Barudgar Nala- Saraswat Bank-Nageshwarwadi – Varad Ganesh – Siddharth Garden. Length 9009m.

Main Sewer D: Nallah flowing through MGM – Jafar gate -Dalalwadi - S.B. Colony-Nageshwarwadi – Varad Ganesh – Siddharth Garden. Length 3723m.

Main Sewer E: Forest Office – Padampura - Kham River. Length 4286

Main Sewer F: Nallah flowing through St. Francis High School - Tilaknagar – Vedant Nagar– MIT College Length 8829m

Main Sewer K: High court – Gajanan Maharaj Mandir - Jawahar Colony Police Station –

Shahnoorwadi – MIT college – Nath Seeds-Golwadi Length 4403m

Two sewers in Sukhana basin:-

Main Sewer L: - Nallah is flowing through N-2 CIDCO to Sukhana River. Length 5117m

Main Sewer M: - Jadhav wadi - Chikalthana Gaothan – Chikalthana MIDC –Sukhana River. Length 9883m.

The cumulative Length of all the main sewers is 60056 m i.e., 60 Kms. As per the survey conducted, it is found at many places that the nalla are covered with the buildings, slabs, drain covers and temporary constructions.
There is no space available for construction of main sewers. Taking into consideration of such problems, the main sewers at some places are diverted to main roads for ease of construction. Due to the diversion, the depth of excavation is increased, but the laying of pipeline will be feasible.

CONSTRUCTION OF SEWAGE TREATMENT PLANT

Modern Technology for treatment is proposed. Automation will solve day and night uninterrupted running of Plant. Treated wastewater will have following parameters. Daily production of manure cake by centrifuge process will generate revenue. Land requirement will be less. The cost excludes laying of wastewater pipe network up to consumer point. Only supply up to bulk consumer point will be provided. With SBR/MBBR Technology the wastewater will have a BOD around 10 mg/lit and even bulk consumers like MIDC Waluj can buy this wastewater from Nakshatra wadi STP of 136 MLD Capacity. The contractor will run & operate the plant for 5 years including selling the wastewater. Necessary meters will be fixed.

COLLECTION AND CONVEYANCE SYSTEM

The system will include the house sewer connection to the branch and trunk sewer lines connected by manholes and consecutively discharging into the Sewage Pumping Stations (STP) to the Treatment Plant (STP). A Typical collection and conveyance system can be shown in the illustrative figure below:

SEWAGE PUMPING AND TREATMENT

Sewage pumping stations (SPS) are incorporated into the sewage system to lift the sewage in order to overcome the natural ground barriers and also in to restrict the depth of excavation to an acceptable limit. The intermediate pumping stations help in reducing the depth of excavation to a significant extent but add extra operation and maintenance cost along with the capital investment. However, where ground water table is high and construction at higher depth is difficult, provision of intermediate SPS should be thought upon.

The probable treatment options for raw sewage to be evaluated based upon the following criteria:

- Energy efficient technology and treatment for reuse in non-domestic purposes.
- Availability of land at desired location.
- Development in phases, consideration of modular options.
- Having less footprint and economical.
- Causing no nuisance and negative environmental impacts.

SEWAGE TREATMENT METHODS

sewage treatment means removing impurities so that the remaining wastewater can be safely returned to the river or sea and become part of the natural water cycle again. a sewage treatment works separates solids from liquids by physical processes and purifies the liquid by biological processes. processes may vary but the following waste stream is typical.

Preliminary treatment - solids like wood, paper, rags, and plastic are removed by screens, washed, dried and taken away for safe disposal at a licensed waste tip. grit and sand, which would damage pumps, are also removed, and disposed of in a similar way.

Primary treatment - the remaining solids are separated from the liquid by passing the sewage through large settlement tanks, where most of the solid material sinks to the bottom. about 70% of solids settle out at this stage and are referred to as sludge. the sludge is used on farms after further treatment called sludge treatment.

Secondary treatment – this is a biological process, which relies on naturally occurring microorganisms, act to break down organic material and purify the liquid. in a simple sewage treatment process, microorganisms are encouraged to grow on stones over which the sewage is trickled. the microorganisms, which need oxygen to thrive, feed on the bacteria in the sewage and purify the water. these treatment units are called percolating filters. this process can be speeded up by blowing air into tanks of sewage where the micro-organisms float freely and feed on the bacteria. these treatment units are called aeration tanks. following either form of secondary treatment, the wastewater is settled in tanks to separate the biological sludge from the purified wastewater. sometimes, extra treatment is needed to give the wastewater a final "polish". this is known as tertiary treatment.

CONCLUSION

The development in the Aurangabad City is rapid. This is directly affecting the amenities and facilities provided by the Municipal Corporation. One of the problems faced by the citizens is lacs of disposal system of the main sewers along the nallas.The present population of Aurangabad city is 16.42 lacs. Presently the generation of sewerage is about 107 MLD. The capacity to treat 161 million liters of sewage per day, the sewage treatment plant at kanchanwadi is the largest facility in the state barring the one coming up at Navi Mumbai.

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