



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VII Month of publication: July 2021

DOI: <https://doi.org/10.22214/ijraset.2021.36847>

www.ijraset.com

Call:  08813907089

E-mail ID: ijraset@gmail.com

An Approach towards Minimizing Sewage Inflow in Kelo River across Raigarh City

Ashish Pradhan¹, Prof. Tulika Gupta²

¹M.Tech Scholar, ²Assistant Professor, Department Of Civil Engineering O P Jindal University Raigarh, Chhattisgarh 496109.

Abstract: Raigarh is a rapidly growing industrial city situated in the state of Chhattisgarh, spread over an area of 46.54 km². It is characterized by its rising population, mounting urbanization, and motorization. The population, of the city, is 1,66,460 as per the census year 2011 and it will be increased by 2,90,988 till the year 2035. There will be an increase not only economically but also there will be a rise in population along with infrastructure works so there is a basic need at the construction of a sewage treatment plant with a view of sufficient capacity to treat the sewage. The objectives of this study are to review and evaluate sewage treatment technologies and propose a sewage treatment plant to improve Kelo River water.

Keywords: Sewage Treatment plant, Population, Raigarh City, Kelo River, Clean India, Sewage Collection Management.

I. INTRODUCTION

Raigarh city is situated in the Chhattisgarh State of India, it is a district headquarter. The city is known for its mineral as well as silk industries. Its total population over the past two decades increasing from 12,65,529 in 2001 to 14,93,984 in 2011. Raigarh city has a very dense and narrow marketplace and curving road. Raigarh city is a municipal corporation and administrative headquarter of Raigarh district situated in the Indian state of Chhattisgarh. It is a rapidly growing small city. The Kelo River flows through the City, which is one of its main water sources.

Based on population, Raigarh district comes at number seven in Chhattisgarh. Raigarh district is situated in the upper eastern part of Chhattisgarh State. It lies in Bilaspur Revenue Commissioner's division. The district was constituted on the 1st of January 1948. It is bounded on the east by the Sundergarh, Jharsuguda, and Bargarh districts of Odisha. On the north by Jashpur and Surguja districts, on the west by Korba, Janjgir-Champa, and parts of Raipur districts, the south-west, and south by Mahasamund district. It extends from 21° 20' to 22° 47' North latitude and 82° 57' to 83° 47' East longitude. The total geographical area of the district is 7086 sq. km.

The Raigarh city does not have any sewerage system, and neither sewage treatment plant exists. The city does not have any particular type of drainage system. Roadside open drainages are the means of transportations of the wastewater. Also, there is no systematic and organized method to collect and treat waste from the septic tank. Overflow of septic tank effluent directly discharges to the stormwater drains, which ultimately fall into the local channel and finally drain out to the Kelo River. Hence complete sewage treatment plant is required to be developed.

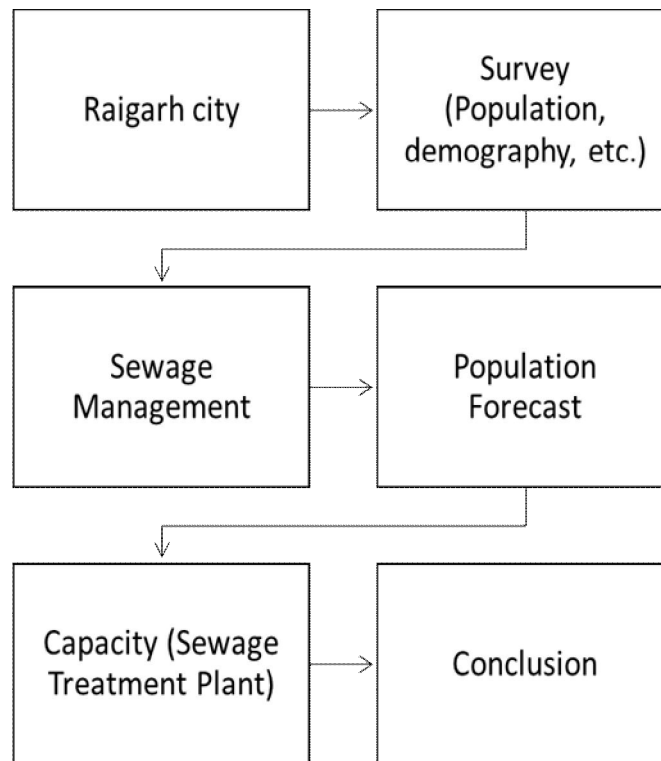
II. NEED OF STUDY

Based on the present sanitation condition of Raigarh city, it was observed that there is no proper sewage collection management and treatment system in the city to name the worth.

There is an immediate need the implementing a lasting solution to the problem of effective handling of sullage and sewage generated by implementing an immediate septage management system and treating them before discharging in Kelo river. Providing sewage treatment plant to take care of the year 2035 requirement and constructing it at suitable locations so that entire sewage can be drained into the plants as far as possible by gravity.

III. SCOPE OF WORK

The scope of work includes the survey of Raigarh city and total sewage generation which meets the Kelo River, and calculate the probable flow of wastewater considering for design horizon of the year 2035. Also, the sewage treatment plant is designed for keeping in mind the future population growth of Raigarh city. The complete study has shown in the flow chart below.



IV. LITERATURE REVIEW

Gupta et.al, 2017. In this paper, the author studied the effluent of wastewater characteristics generated from the college of engineering Roorkee. It involves studies of pH values, total solids, total suspended solids, alkalinity, hardness, acidity, chlorine, BOD, COD, DO, and turbidity. The main objective of this paper is to produce an environmentally treated effluent by using a sewage treatment plant.

Bhavin et al, 2018. In this paper author studied that in India, an estimated 62,000 MLD sewage is generated in urban areas while the treatment capacity across India is 23,277 MLD, or 37% of sewage generated, according to the data released by the government in December 2015, the rest falls directly into rivers causing sewer problem.

Aswathy. M, 2017. In this paper, the author reviewed the sewage treatment plant and described it along with AutoCAD drawing both primary and secondary units. The design period should be taken between 25 to 30 years.

V. POPULATION PROJECTION CONCEPTS AND METHODS

The population of any city has been greatly influenced by various factors like urbanization trends, industrialization, social amenities, and livelihood opportunities, etc. A general understanding of demographic characteristics will provide a guide to select the statistical forecasting methods.

The main guiding principle by the CPHEEO manual.

- 1) Arithmetical increase method
- 2) Geometrical increase method
- 3) Incremental increase method

In the present case, the three methods as per requirements of the CPHEEO manual have been used for trial population projections. The population projection is made based on census data shown in Table 2 and

Table 3.

As per census 2011, Raigarh city has 48 wards covering an area of 46 sq. km. The names and populations of all 48 wards are shown in the Table 1 below.

Table 1 Ward wise population for the Year 2011

| Ward No. | Ward Name | Population Year 2011 |
|----------|-----------------------------------|----------------------|
| 1 | Rajiv Nagar Ward | 3005 |
| 2 | Dhangardipa Rambhantha Ward | 4225 |
| 3 | Ambedkar Ward | 3015 |
| 4 | Jagatpur Ward | 3968 |
| 5 | Dindyal Ward | 3381 |
| 6 | Dhimrapura Ward | 3685 |
| 7 | Indira Nagar Ward | 2920 |
| 8 | Riya Para Ward | 3456 |
| 9 | Chanmari Ward | 3171 |
| 10 | Madhuban Para Ward | 3060 |
| 11 | Jogi Dipa Ward | 3479 |
| 12 | Ramgudi Para Ward | 3491 |
| 13 | Ganja Chauk Ward | 3045 |
| 14 | Gaushala Para Ward | 3011 |
| 15 | Darogapara Ward | 3833 |
| 16 | Baikuthapur Ward | 3200 |
| 17 | Bidpara Sadar Hatari Ward | 3113 |
| 18 | Daroga Para GandhiGanj Ward | 3246 |
| 19 | Bhudeo Ganj Ward | 3414 |
| 20 | Juna Badpara Ward | 2972 |
| 21 | Beladula Ward | 3673 |
| 22 | Chakrdhar Nagar Bangala Para Ward | 2995 |
| 23 | Kaser Para Chakradhar Nagar Ward | 3487 |
| 24 | Vinoba Nagar Ward | 3349 |
| 25 | Kauhakunda Ward | 3321 |
| 26 | Chhote Aantarmuda Ward | 3818 |
| 27 | Naya Aantarmuda Ward | 2731 |
| 28 | Panjari Plant Ward | 3411 |
| 29 | Jell Para Ward | 3789 |
| 30 | Bajirao para Ward | 3586 |
| 31 | Miththumuda Ward | 3282 |
| 32 | Fatahamuda Banjinpali Ward | 2985 |
| 33 | Gandhi Nagar Ward | 2845 |
| 34 | Ambedkar Nagar Ward | 4041 |
| 35 | Zopali Para Ward | 4159 |
| 36 | Rajiv Gandhi Nagar Nava Para Ward | 3931 |
| 37 | Bhajan Dipa Ward | 4220 |
| 38 | Dewar Para Ward | 3542 |
| 39 | Railway Bangala Para Ward | 3332 |
| 40 | Budhu Mai Mandir Ward | 3516 |
| 41 | Chhatamuda sahdevpali Ward | 3759 |
| 42 | Amalibhauna Ward | 3310 |
| 43 | Gorkha. Saraipali .Barmuda Ward | 4683 |
| 44 | Patarapali Ward | 4166 |
| 45 | Bhanwanpur Ward | 3710 |
| 46 | Urdana Krushna Ward | 2925 |
| 47 | Vijaypur Govdharpur Ward | 3283 |

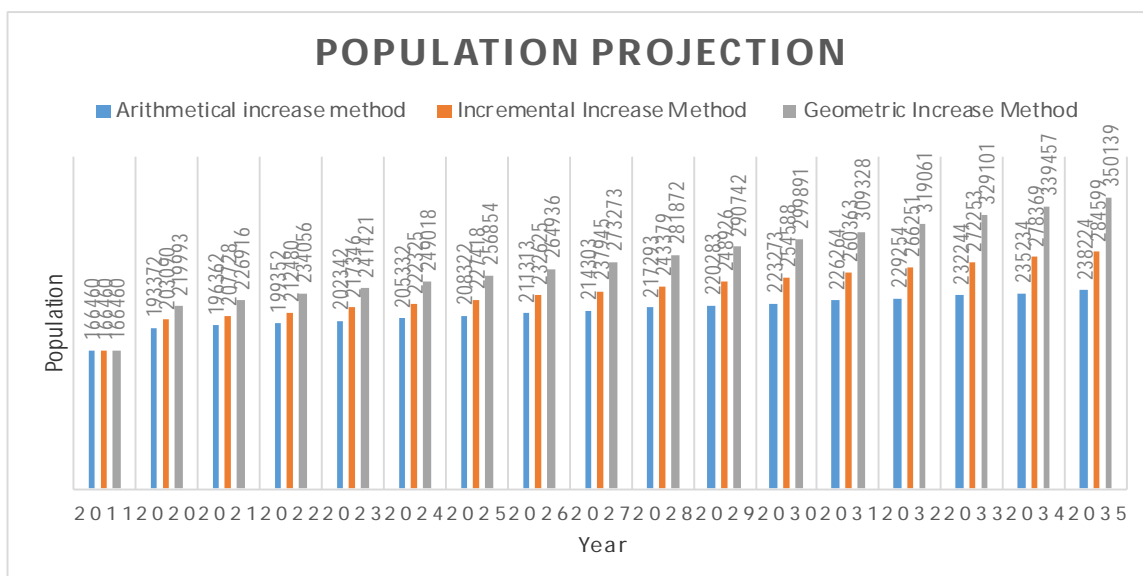
| | | |
|-------|----------------|--------|
| 48 | Boirdadar Ward | 3924 |
| Total | | 166460 |

Table 2 Population Projection by Geometric Increase Method

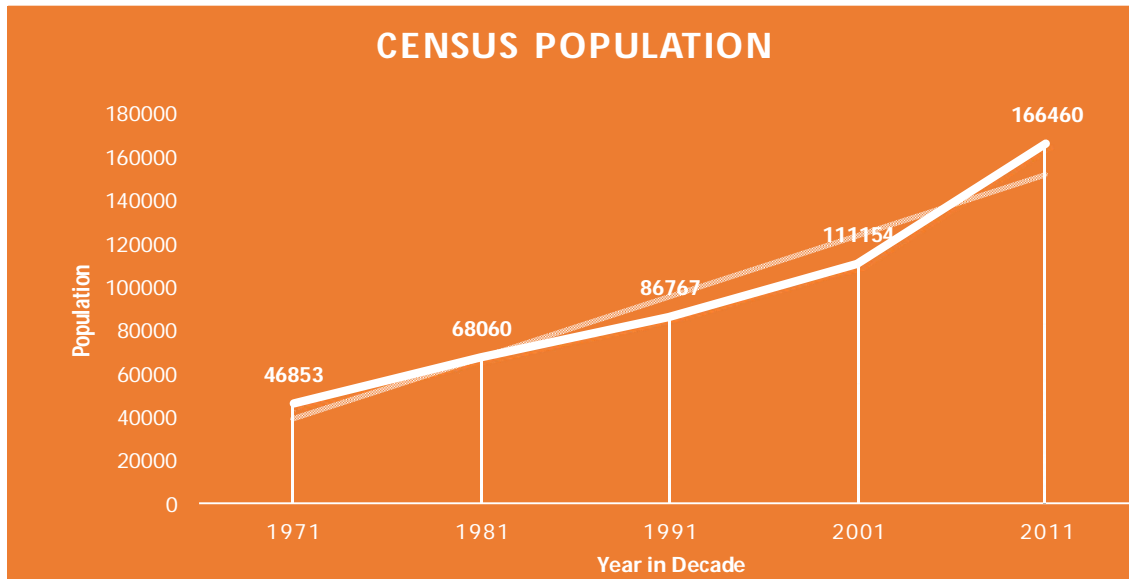
| Year | Census Population | Increment per Decade | Incremental Increase | Growth Rate of city (%) |
|---------|-------------------|----------------------|----------------------|-------------------------|
| 1971 | 46853 | | | |
| 1981 | 68060 | 21207 | | 0.45 |
| 1991 | 86767 | 18707 | -2500 | 0.27 |
| 2001 | 111154 | 24387 | 5680 | 0.28 |
| 2011 | 166460 | 55306 | 30919 | 0.50 |
| Total | 479294 | 119607 | 34099 | 1.51 |
| Average | 95859 | 29902 | 11366 | 0.38 |
| | | Geometric mean | 0.36 | 0.36 |

Table 3 Population Projection Calculation

| Year | Arithmetic Increase | Incremental Increase | Geometric Increase |
|------|---------------------|----------------------|--------------------|
| 2011 | 166460 | 166460 | 166460 |
| 2020 | 193372 | 203090 | 219993 |
| 2021 | 196362 | 207728 | 226916 |
| 2022 | 199352 | 212480 | 234056 |
| 2023 | 202342 | 217346 | 241421 |
| 2024 | 205332 | 222325 | 249018 |
| 2025 | 208322 | 227418 | 256854 |
| 2026 | 211313 | 232625 | 264936 |
| 2027 | 214303 | 237945 | 273273 |
| 2028 | 217293 | 243379 | 281872 |
| 2029 | 220283 | 248926 | 290742 |
| 2030 | 223273 | 254588 | 299891 |
| 2031 | 226264 | 260363 | 309328 |
| 2032 | 229254 | 266251 | 319061 |
| 2033 | 232244 | 272253 | 329101 |
| 2034 | 235234 | 278369 | 339457 |
| 2035 | 238224 | 284599 | 350139 |



Graph 1 Population Comparison between Arithmetical Increase method, Incremental Increase Method and Geometric Increase Method



Graph 2 Census Population Variation

VI. DESIGN OF PROPOSED SEWAGE TREATMENT PLANT

The quantity of wastewater generated, to be transported and treated will depend upon population and per capita water use. The per capita water system for domestic needs is proposed to be 135 LPCD.

The amount of water returned as sewage will be 80-85 % by the CPHEEO manual. This will result in a per capita wastewater flow of 108 LPCD. The sewage flow has been considered as 66 % of the water supply flow for computation of sewage treatment plant capacities.

The city population is determined based on the average of the population obtained by all three methods i.e. Arithmetic increase method, Geometric increase method, Incremental increase method.

Consider Base year = 2020

The design period for a sewage treatment plant is considered 15 years.

Design year = 2035

$$\text{Population} = \frac{\text{Arithmetic Increase method} + \text{Incremental Increase method} + \text{Geometric Increase method}}{\text{Number of forecasting method}}$$

$$= \frac{238224 + 350139 + 284599}{3}$$

$$= 290988$$

$$\text{Total water consumption} = \text{Total population} \times \text{Per capita demand}$$

$$= 290988 \times 135$$

$$= 39.28 \text{ MLD}$$

Total water consumption for Raigarh city has been calculated as 39.28 MLD

As per norms Per capita, wastewater flow is taken as 80-85 % of total water demand.

Therefore, the Total wastewater flow for Raigarh city is 85% of total water consumption.

$$\text{i.e. } 39.28\text{MLD} \times 85\%$$

$$= 33.388 \text{ MLD}$$

Sewage treatment plant capacity has been taken as 66 % of total wastewater flow.

$$\text{i.e. capacity} = 33.388 \text{ MLD} \times 66\%$$

= 22.05 MLD (say 24 MLD)

The analysis shows that the sewage treatment plant will have a capacity of about 24 MLD.

VII. CONCLUSION

The ultimate goal of sewage treatment is the protection of the environment in a manner with public health and socio-economic concerns. Since there is no proper treatment plant for sewage in Raigarh city, it is necessary to construct a sewage treatment plant of 24 MLD for the expected population of the next 15 years. In the study of the sewage treatment plant in Raigarh city, it was concluded that the city has no proper treatment plant exists. As per the current situation in the city, saving the water and making the potential reuse of the treated sewage is much necessary, the idea for the proposed treatment process will be highly beneficial for making reuse of the treated sewage in the city.

REFERENCES

- [1] Ambica, A. (2014) 'Ground water quality characteristics study by using water quality index in tambaram area, Chennai, Tamil nadu', Middle - East Journal of Scientific Research, 20(11), pp. 1396–1401. doi: 10.5829/idosi.mejsr.2014.20.11.257.
- [2] Aswathy.M, H. (2017) 'ANALYSIS AND DESIGN OF SEWAGE TREATMENT PLANT (STP) OF APPARTMENTS IN CHENNAI', International Journal of Pure and Applied Mathematics, 116(13), pp. 157–163.
- [3] Bhavin, B. et al. (2018) 'Study and Modification of Sewage Treatment Plant at Jaspur', International Journal, 4(10), pp. 118–123.
- [4] Census Commissioner, I. R. G. (1996) '1991 Census Hand Book', p. 145.
- [5] CENSUS of India (2001) 'District Poulation', in.
- [6] Chhattisgarh, D. of C. O. (2011) 'District Census Handbook Raigarh', in, p. 283.
- [7] CPHEEO (2013a) 'Chapter 1: Introduction', Manual on Sewerage and Sewage Treatment Systems.
- [8] CPHEEO (2013b) 'Chapter 4: Design and construction of sewage pumping stations and sewage pumping mains', Manual on Sewerage and Sewage Treatment Systems, pp. 4.1-4.31.
- [9] CPHEEO (2013c) 'Chapter 5'.
- [10] CPHEEO 'Manual on Sewerage and Sewage Treatment Systems', (November 2013).
- [11] Gupta, D. et al. (2017) 'Design and Analysis of Sewage Treatment', 2(2456), pp. 30–36.
- [12] IS:800-2007 (2007) 'IS : 800 - 2007, Indian standard code of practice for general construction in steel', Bureau of Indian Standards, New Delhi.
- [13] IS 3370:2009 (Part-1) (2009) 'Code of Practice Concrete Structures for the Storage of Liquids - Part 1 : General Requirements'.
- [14] IS 3370:2009 (Part-2) (2009) 'Code of Practice Concrete structures for the storage of liquids - Part 2: Reinforced concrete structures'.
- [15] IS 456 (2000) 'Concrete, Plain and Reinforced', Bureau of Indian Standards, New Dehli, pp. 1–114.
- [16] Meena, H. A. (2019) 'Design of Sewage Treatment Plant by Act Method', International Journal for Research in Applied Science and Engineering Technology, 7(5), pp. 1399–1403. doi: 10.22214/ijraset.2019.5236.
- [17] Punmia B.C. and Ashok Jain, Environmental Engineering,—Waste Water Engineering. vol. 2, 2nd ed., Laxmi Publication.
- [18] Garg S.K., —Sewage Disposal and Air Pollution Engineering, 23rd ed., Khanna Publisher, November 2010



10.22214/IJRASET



45.98



IMPACT FACTOR:
7.129



IMPACT FACTOR:
7.429



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24*7 Support on Whatsapp)