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TO STUDY AND DESIGN OF A SEWAGE TREATMENT PLANT AT NANAKWADA, VALSAD

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Abstract- Nanakwada is a medium sized municipal town in Valsad District with 2014 census population of 2, 20,000 currently under consideration for developing its sewerage system. As a suitable sewage treatment plant and disposal facilities will be needed immediately on completion of the conveyance system, it is intended to develop an appropriate design of a sewage treatment plant for the town to be developed in phases. The treatment process envisaged is a conventional one which will be robust and easy to operate to obtain desired quality of treated sewage for disposal into a farming land nearby with a bypass arrangement to a natural drain.

(key words: Sewage Treatment Plant, Conventional, Nanakwada)

I. INTRODUCTION

Many settlements in India are not served by public sewers. Residents in these areas are therefore required to provide their own sewage treatment facilities. Piped sewage conveyance. Systems are being developed gradually in many areas with the help of private designers and consulting engineers. It is therefore desirable that engineers who have the right education and interest in the subject come forward and provide necessary assistance to the nodal agencies in developing suitable treatment plants in the above project area. The function of an STP is for treating collectively any wastes of the kind that are ordinarily discharged from toilets, water closets, baths, showers, sinks, basins and other sanitary and kitchen fitments.

It is unhealthy for humans, pets, and wildlife to drink or come in contact with surface or ground water contaminated with wastewater. Inadequate treatment of wastewater allows bacteria, viruses, and other disease-causing pathogens to enter groundwater and surface water. Hepatitis, dysentery, and other diseases may result from bacteria and viruses in drinking water. Disease-causing organisms may make lakes or streams unsafe for recreation. Flies and mosquitoes that are attracted to and breed in wet areas where wastewater reaches the surface may also spread disease. Inadequate treatment of wastewater can raise the nitrate levels in groundwater. High concentrations of nitrate in drinking water are a special risk to infants. Nitrate affects the ability of an infant's blood to carry oxygen, a condition called methemoglobinemia (blue-baby syndrome).

The specific objectives of the project were as follows:

- Treating only domestic sewage.
- Designed the treatment plant of capacity = 51 mld
- Mechanical equipment which is critical to functioning of the STP should be provided with online standby units.
- Excessive quantities of grease and oil may cause malfunction of an STP. A properly designed grease trap should be provided where the restaurant or garages are to be served by the STP.

II. METHODS & MATERIALS

The survey was conducted to know the problems and also to find feasible way for design of Sewage Treatment plant. Also population study was done for,how much capacity of treatment plant will be designed? For this, the Plan Map of Nanakwada was collected and then obtained data were analyzed. Data was also collected from the Nanakwada Nagarpalika and GUDCL for making rough estimate about the treatment plant . This data gives information about various types of TSS ,populations, bod, cod, pH etc . Also it gives information about waste water characteristics . From this data, we came to know that, how the situation of perticular area was e xists and how much sewage came from various areas? After this, design of basement for plant structure was done. The methodology adopted in this project has been shown below through the Flow-chart.

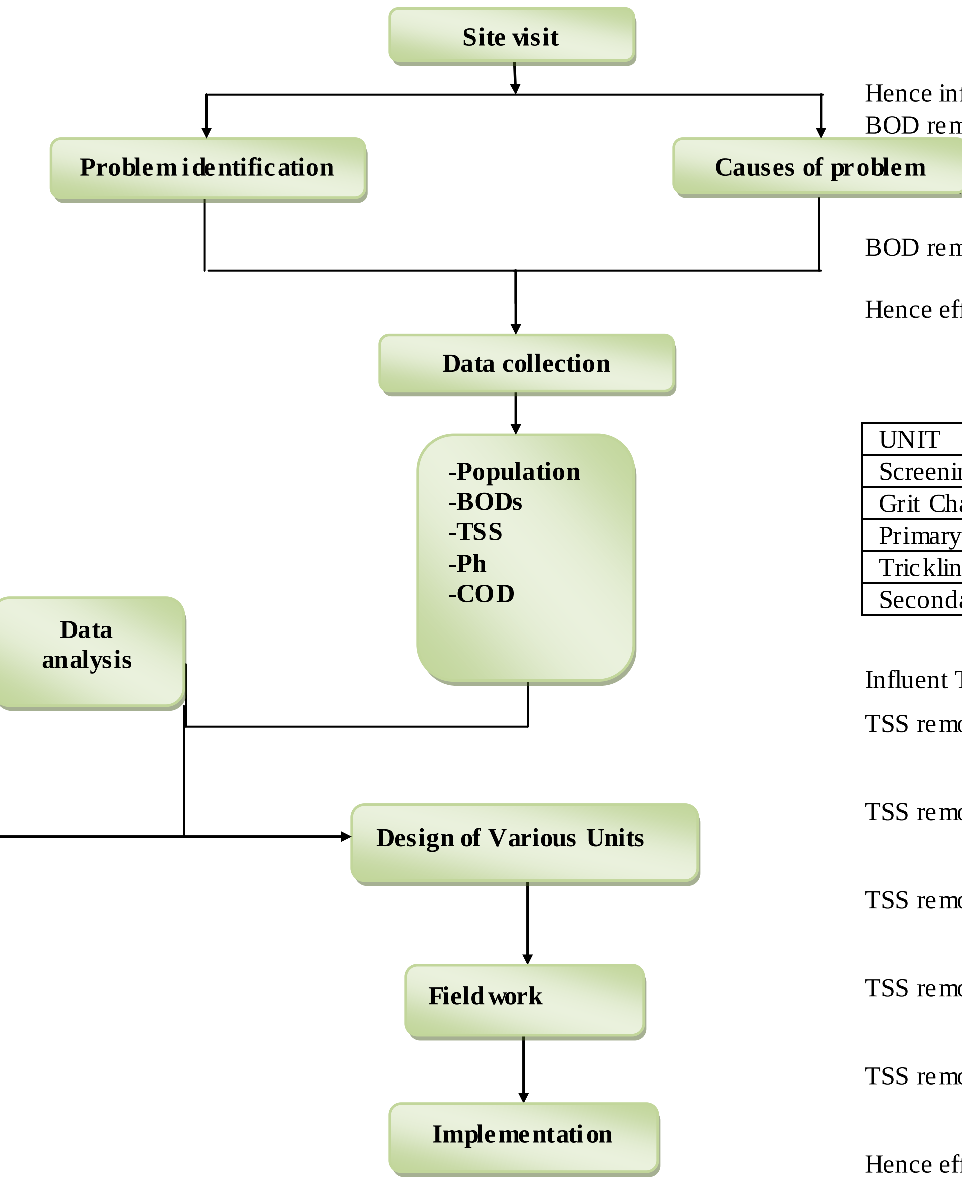

Figure 1. Flowchart of Methodology

III. RESULTS AND DISCUSSION

After completing the site inspection and survey, other relevant data were collected and analyzed. Based on this, the design of the sewage treatment plant was made.

Table -1
Showing BOD Removal efficiency

Unit	BOD%
Screening	5
Grit Chamber	5
Primary treatment	20
Trickling filter	75
Secondary treatment	25

Hence influent BOD=200mg/l

BOD removed after primary treatment=200-(0.30×200)
=140 mg/l

BOD removed in trickling filter = 140-(0.75×140)
= 35 mg/l

BOD removed after secondary treatment = 35-(35×0.25)
=26.5 mg/l

Hence effluent BOD = 26.5 mg/l

Table- 2 Showing Suspended Solids Removal

UNIT	SS%
Screening	10
Grit Chamber	15
Primary treatment	35
Trickling filter	20
Secondary treatment	40

Influent TSS = 180 mg/L

TSS removed after screening = 180-(0.10×180)
= 162 mg/l

TSS removed in Grit Chamber =162 -(0.15×162)
=137.7 mg/l

TSS removed in primary treatment = 137.7-(0.35 ×137.7)
= 89.50 mg/l

TSS removed in trickling filter = 89.50-(0.2×89.50)
= 71.6 mg/l

TSS removed in Secondary treatment = 71.6-(0.4×71.6)
= 43 mg/l

Hence effluent TSS=43mg/l

Plant has only been processed designed and sizing of the unit without detailed design and equipment specification. No cost estimation has been carried out.

3 .1 Waste water characteristics

- Temperature:

  Observation of temperature of sewage is useful in indicating the solubility of oxygen which affects oxygen transfer capacity of aeration equipments and rate of biological activity. Normally the temperature of domestic and municipal sewage is slightly higher than that of the water supply.

- pH:

  The pH of fresh domestic sewage is slightly more than that of the water supply to the community. However, the onset of septic conditions may lower the pH while the presence of industrial wastes may produce extreme fluctuations.

- Nitrogenous Constituents:

  The principal nitrogenous compounds in domestic sewage are proteins, amines, amino acids and urea. Nitrogen may be present in different forms such as (i) organic nitrogen, (ii) albuminoidal nitrogen, (iii) ammonia nitrogen, (iv) nitrite nitrogen, (v) nitrate nitrogen, depending on the condition of sewage. The determination of various forms of nitrogen helps in the selection of proper biological treatment units.

- Chlorides:

  Chloride ion may be present in combination with one or more of the cations of calcium, magnesium, iron and sodium. Chlorides of these minerals are present in water because of their high solubility in water. Each human being consumes about six to eight grams of sodium chloride per day, a part of which is discharged through urine and night soil. Thus, excessive presence of chloride in water indicates sewage pollution. IS value for drinking water is **250 to** 1000 mg/L.

- Color and odour:

  Fresh domestic sewage has slightly soapy and earthy odour and cloudy appearance depending upon its concentration. With the passage of time, the sewage becomes stale, darkening in colour with a pronounced smell due to microbial activity.

- Carbonaceous constituents:

  Carbonaceous constituents are measured by BOD, COD or TOC analyses. While the BOD has been the common parameter to characterize carbonaceous material in wastewater, COD is becoming more common in most current comprehensive computer simulation design models.

- Biochemical Oxygen Demand:

  The BOD test gives a measure of the oxygen utilized by bacteria during the oxidation of

  Organic material contained in a wastewater sample. The test is based on the premise that all the biodegradable organic material contained in the wastewater sample will be oxidized to CO_2 and H_2O, using molecular oxygen as the electron acceptor. Hence, it is a direct measure of oxygen requirements and an indirect measure of biodegradable organic matter.

- Chemical Oxygen Demand*:*

  The COD test is based on the principle that most organic compounds are oxidized to CO_2 and H_2O by strong oxidizing agents under acid conditions. The measurement represents the oxygen that would be needed for aerobic microbial oxidation, assuming that all organics are biodegradable.

- Total Organic Carbon:

  The total carbon analyzer allows a total soluble carbon analysis to be made directly on an aqueous sample. In many cases TOC can be correlated with COD and occasionally with BOD values. As the time required for carbon analysis is generally short, such correlations are extremely helpful when monitoring treatment plant flows for efficiency control.

- Solids:

  Total solids include both the suspended solids and the dissolved solids which are obtained by separating the solid and liquid phase by evaporation. Suspended solids are a combination

  of settle able solids and non-settleable solids,

  which are usually determined by filtering a wastewater sample through a glass fiber filter contained in a Gooch crucible or through a membrane filter

  Toxic Metals:

  Some heavy metals and compounds such as chromium, copper, cyanide, which are toxic may find their way into municipal sewage through industrial discharges. Determination of these.

3.2 Unit Operations

The unit operations and processes commonly employed in domestic wastewater treatment, their functions and units used to achieve these functions are given in the following table:

Table- 3 Showing Unit Operations/Processes, Their Functions and Units Used for Domestic Wastewater Treatment

Unit Operations/Processes	Functions	Treatment Devices
Screening	Removal of large floating, suspended and settleable solids	Bar racks and screens of various description
Grit Removal	Removal of inorganic suspended solids	Grit chamber
Primary Sedimentation	Removal of organic/inorganic settleable solids	Rectangular tank
Aerobic Biological Attached Growth Process	same as above	Trickling filter
Secondary clarifier	Final removal of sludge and desired effluent quality	Circular tank
Sludge drying beds	Dewatering and drying secondary sludge	Rectangular sand and gravel media beds with porous under drains

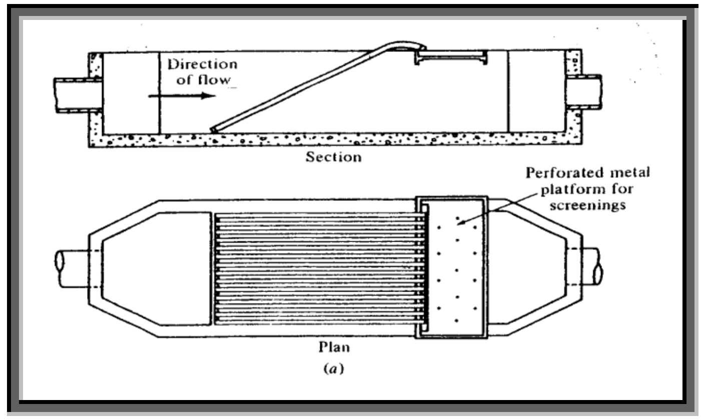

Figure 2. Showing the process in Bar screen

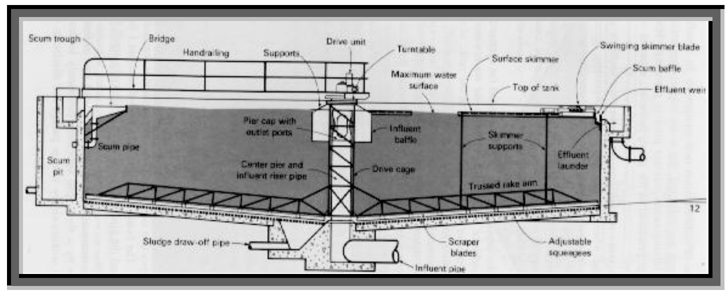

Figure 3. Showing the details of Primary clarifier

Recycling of sludge from clarifier is necessary because of the following reasons:
(i) Sludge contains active bacterial culture which is in log phase (means they rapidly grow and multiply). So such bacterial mass gets the chance of growth when sludge is recycled.
(ii) Addition of active bacterial mass through sludge recycle expedites aerobic decomposition.
From secondary clarifier, 20-30% is recycled to trickling filters. And from the same clarifier, some part of sludge is going to drying bed.

IV.CONCLUSION

This study has led to the following conclusions:

- In order to solve the sewage problems at civil hospital Nanakwada, construction of sewage treatment plant was thought appropriate
- A survey of the site was conducted for making a design of the proposed sewage treatment plant. After this, the design of the treatment plant was

made using the data collected and obtained from various other sources.

- The proposed design is cost effective and safe for the people of Nanakwada.

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