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DESIGN OF WATER TREATMENT PLANT FOR DAVANGERE CITY

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Abstract - *The primary element that supports life on earth is water. variable locations have variable water resources. The quantity and quality of water obtained in some areas are not up to par. Due to the population boom, water demand reached its maximum level, which in turn caused a water shortage. Urbanization, industrialization, and rising populations are to blame for environmental damage. Our water environment is polluted by contemporary socioeconomic practices, primarily industrial and transportation operations. Changes in the design of water-treatment facilities typically stem from the necessity to alter treatment procedures, the desire to enhance operating performance, the want to take advantage of new technology, or the desire to lessen the effect of rising construction costs.*

***Key Words*: Intake Structure, Cascade Aerator, Clariflocculator.**

1.INTRODUCTION

The necessity for wastewater purification on earth has been caused by the dwindling supply of freshwater. Because there is a booming demand for fresh water and a limited supply, water purification is crucial for the planet. The following examples demonstrate the importance of water treatment.

Health protection is crucial because hazardous chemicals, metals, and other toxins found in water pose a threat to both human health and the health of other living things on the earth. These toxic compounds cause a variety of health issues, including cholera, diarrhoea, asthma, cancer, skin conditions, and even death. As a result, this will lower the yearly fatality rate from drinking polluted water.

It helps to restore the water -With this process, water is reintroduced back to the cycleof nature.

To protect the environment - Water treatment is very much helpful for the environment. It helps to balance the water cycle by maintaining groundwater and surface water.

1.1 Demographic Information Of Davangere

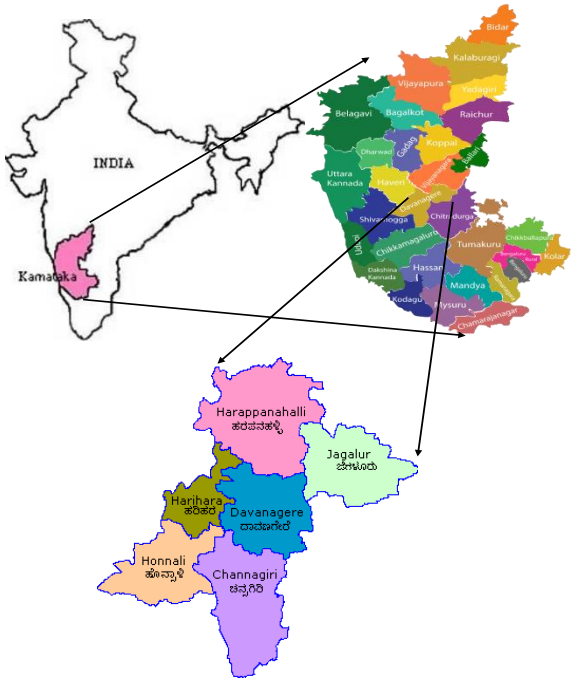

Fig 1: Davangere District Map

Geographic Information and Description of the Area

1. Name of the Taluk and District: Davanagere
2. State: Karnataka
3. Altitude: 602.5 meters from MSL(Mean Sea Level)
4. Latitude: 14°28′ N and Longitude: 75°59′ E
5. Annual Normal Rainfall: 626mm
6. Main Source of Water is from River Tungabhadra
7. It is roughly 275 kms from Bangalore
8. Types of Soil Present: Black soil and Red sandy soil

Table 1: Population Growth- Davangere

Year	Polulation (Nos)	Decadal Growth Rate (%)
1991	287,233	-
2001	363,780	26.6
2011	435,128	19.6

Sex Ratio: Males constitute 52% of the population, and females 48%.

1.2 Objectives

- Population Forecasting and Determination of Aqua Demand in MLD.
- Designing of Primary Treatment Units.
- To understand the workability of the Primary Treatment Units.
- To summarize the design outputs/results of Intake structure, Cascade Aeration Unit and Sedimentation aided with Coagulation /Flocculation Unit (Clariflocculator).

2. WATER TREATMENT PLANT

Functions of Water Treatment Plant Unit

The Water Treatment Plant have several units in which each unit has its own function that ismention in the below Table

Table 2: Functions of Water Treatment Plant

Unit Treatment	Function (Removal)
Aeration, Chemicals use	Colour, Odour, Taste
Screening	Floating matter
Chemical methods	Iron, Manganese etc
Softening	Hardness
Plain Sedimentation	Suspeneded matter
Sedimentation with Coagulatin	Suspended matter, a part of colloidal matter and bacteria
Filteration	Remaining colloidal dissolved matter, bacteria
Disindection	Pathogenic bacteria, Organic matter and Reducing substances

Karnataka Urban Infrastructure Development and Finance Corporation, (KUIDFC) Government of Karnataka for the Asian Development Bank:

The primary objective of the KIUWMIP is to improve water resource management in urban areas through a comprehensive and sustainable approach, adhering to the principles of Integrated Water Resources Management (IWRM).

Currently, Davangere city receives only 80 MLD (Million Liters per Day) of water from River Tungabhadra. However, an assessment indicates a deficit of 9 MLD of water at present, and this deficit is expected to rise to 40 MLD and 77 MLD by the years 2031 and 2046, respectively.

To address the water supply issues, the subproject designed under this Investment Program includes several components:

i) Construction of a new intake and jack well with a capacity of 120 MLD.

ii) Building a new Water Treatment Plant (WTP) with a capacity of 40 MLD at Bathi.

iii) Laying a 13.405 km raw water transmission main from the intake to the WTP.

iv) Constructing an RCC bridge of 150 m to facilitate pipeline crossing over Sulekere nallaha.

v) Establishing a clear water reservoir and pumping main of 612 m MS pipe with a diameter of 1118 mm.

These measures are aimed at improving the Aqua supply system and addressing the projected water deficit in Davangere in the coming years.

3. RESULTS

3.1 Design Summary of Intake Structure

Particulars	Measurements
Design Capacity	130 MLD
Overload	20 %
Retention Time	1 min
Volume of Intake Chamber	130 m^3
Depth of Intake Chamber	3 m
Area of Intake Chamber	44 m^2

Diameter	7 m
Effective Depth of Intake Chamber	6.5 m
Total Head	3.35 m
Area of Sluice vent	0.3 m^2
Diameter of Vent	0.7 m
Area of Jack well	130 m^2
Diameter of Jack well	13 m

3.2 Design Summary of Cascade Aerator

Particulars	Measurements
Design Capacity	130 MLD
Shaft Diameter	600 mm
Surface Loading Rate	0.03 $m^3/\ m^2/\ h$
Area Required for Cascade Aerator	195 m^2
Area of Central Shaft	0.6 m^2
Diameter of Central Shaft	0.9 m
Outer Diameter of Central Shaft	1.2 m
Total Surface Area	196 m^2
Area of Collection Launder	0.6 m^2
Width of Launder	0.4 m
Depth of Launder	1.5 m
Effective Depth	1.7 m
Diameter of Raw Water Channel	1.5 m
Diameter of 1^{st} Cascade	1.5 m
Diameter of 2^{nd} Cascade	2.1 m
Diameter of 3^{rd} Cascade	2.7 m
Diameter of Side Circular Channel	3.5 m
Area of Side Circular Collecting Channel	9.5 m^2

3.3 Design Summary of Clariflocculator

Particulars	Measurements
Design Capacity	130 MLD
Velocity	0.25 $m\ /\ s$
Vertical Shaft Diameter	3.4 m
Thickness of Wall	0.15 m
Volume	2340 m^3
Depth	4 m
Area of Flocculator	520 m^3
Diameter of Flocculator	26 m
Surface Flow Rate	60 $m^3/\ m\ /\ d$
Surface Area	3120 m^2
Diameter of Clarifier	68 m
Detention Time	1.8 h
Length of Weir	214 m
Weir Loading Rate	263 $m^3\ /\ h$

4. CONCLUSIONS

The design of water treatment plant for Davangere City has been completed. Design of treatment plant consist of Intake Structure, Cascade Aerator and Clariflocculator.

With this project the utilizable water scarcity and related issues of the people of Davangere City has been nullified.

The intake of 130 MLD and a population of 8,63,660 were used in the design of WTP for future of 4-Decades, i.e., from the year 2023 to year 2063. The outputs of the calculations and the details of the WTP units were tabulated.

Based on the obtained calculations and details it is concluded that, the study can be used as a base reference for the future works and to design of any WTP units. A number of factors such as age of WTP, maintenance, economical and political situations, technical problems, and water demand had a great impact on the removal efficiency of the WTP units.

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