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"EVALUATION OF EXISTING WATER SUPPLY SCHEME FOR A VILLAGE"

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ABSTRACT

Water from the main reservoir is distributed across the village using piping networks in several settlements. Every village has a primary source of storage, such as a well or water tank, where water is kept and distributed across the entire community. But they frequently fall short of satisfying the demand of the village due to bad policies and subpar technique. A lack of water supply is caused by a number of factors, including water pressure, pipe diameter, and village population. In order to maximise the amount of water delivered to the village in a sufficient manner, this project of evaluation of the existing pipeline network suggests a logical technique for scheduling the supply in such network.

Due to the village's rapid population increase and the ensuing need-based development of the water distribution network to keep up with the rate of the expansion of water demand in various parts of the village, the water supply system in the community is affected by a number of issues.We made the decision to take a radical and all-encompassing strategy that outlined the key ideas that would be developed in the current project in order to meet the requirements of the villagers and solve their difficulties.

INTRODUCTION

Sanitation and access to clean water are basic human rights and universal needs. In actuality, water scarcity is a problem that affects people all around the world. The earth's surface is made up of about 70% water, with 3% of it being fresh water. However, of this, 99% can be found below the surface. Surprisingly, the majority of this water is largely useless. According to UNDP, one quarter of the world's population, or 700 million people, reside in developing nations and experience water scarcity. Of them, a large majority are in sub-Saharan Africa. People all across the world were compelled to use contaminated water for drinking and other domestic purposes due to the water shortage.

Around 94% of the world's diarrheal illness burden and 10% of all disease burden, according to reports, are caused by inadequate sanitation and bad hygiene habits.

WATER DISTRIBUTION NETWORK

Within the project area's network of streets and roads is the water distribution system for the public water supply. The goal of the water distribution network is to deliver safe (treated) drinking water to the consumers at convenient locations in sufficient quantity and at a suitable residual pressure. Depending on the lengths of the streets and roads to be covered in the project region, the water distribution system typically accounts for 40 to 70% of the water supply system's capital cost. As a result, the network's right architecture and layout are crucial.

The type of distribution network is determined by factors like as the street layout, topography, and position of service reservoirs. For the system to operate and be maintained properly and efficiently, the pipelines must be laid up correctly, and different types of valves and specialties must be placed in the right places. The primary hydraulic consideration for the distribution system is having enough residual pressure during peak demand.

WATER DEMAND

Projections of water consumption are based on consumers using 55 litres of water per day (LPCD). According to the CPHEEO guideline, the losses are calculated higher for gross demand predictions. The PCMC's water districts statistics are used to calculate the water demand at the distribution system's nodes.

ABOUT NIMBHALE VILLAGE

The Nimbhale hamlet is located in Maharashtra's A-Nagar district in the Sangamner Tehsil. According to sensor data from 2011, Nimbhale village has a population of 1357 people and is located between the geographic coordinates of 19° 32' 1.05" N and 74° 14' 10.69 E. The township is located 500 metres above sea level. Nimbhale hamlet obtains its water for drinking, agriculture, and daily needs from the Pravara River and annual rains. One well already exists in the village, and two water tanks with capacities of 80,000 and 30.000 litres have also been built there. The water tank stores water from the adjacent Pravara River before supplying the entire hamlet. There are also two hand pumps in the village. However, there are a number of issues with water distribution.

PROBLEMS OF EXISTING WATER SUPPLY SCHEME

The supply of drinking water is a particularly challenging duty for the city administration, including the water supply department. The following list of significant issues with the water delivery system is provided.

(1) Uneven Terrain: There are several undulating surfaces throughout the city terrain. The elevation variation in the landscape is between 605 and 644 metres. Because the system lacks a pressure management component, the pressures in the various areas of the community are uneven.
(2) Water Contamination from Intermittent delivery: One of the major drawbacks of the current intermittent water delivery is that the water is contaminated during non-supply hours by contaminants from the outside that enter the pipeline through leaky joints and vacuum in the pipeline.
(3) Supply Hours: The village's water supply's main issue is that residents only receive water for one hour each day. The hours of supply are irregular. Due to the unpredictable and irregular timing of the supply, people must stay awake both during the day and at night. Because of this difficulty, several residential connections and public faucets are left open, wasting valuable water resources.

(4) Numerous Valves: The village water supply must employ a zoning system for daily operation due to the intermittent nature of the water supply.

(5) Inappropriate Operation Zones: Each elevated service reservoir's (ESR) serving area or zone was not built to accommodate it. Despite the servicing area's disorder, haphazardly installed pipelines have been discovered. As a result, the people receive water at lower pressure. Multiple tanks are used to establish the operational zones. Tanks have a standard inlet and output. However, when the 24/7 system is implemented, there will be fluctuations since the width of the tanks varies.

OBJECTIVE OF PROJECT

1. To evaluate the current coverage and state of rural water supply with a focus on the coverage of underprivileged groups and places.
2. To assess the availability of safe water in a village where poor water quality was a serious issue.
3. To suggest a 30-year water distribution network for the village of Nimbhale.
4. To track and assess public opinion and responses to rural sanitation and water supply coverage, as well as community participation in the design and execution of water delivery programmes.
5. To assess the water supply schemes' current state of operation and maintenance.
6. Offer an appropriate and cost-effective solution to the Nimbhale Village Water Supply Scheme's issues

METHODOLOGY

i. Preliminary survey
ii. Discussion And Problem Analysis
iii. Final Topographical Survey Using DGPS/Total station .
iv. Design of Topographical Survey Drawing
v. Design of technical things in Water Supply scheme
vi. Population Forecasting Methods
vii. Water Demands Calculations
viii. Design of Water Tank
ix. Pump Design
x. Design of Raising Main
xi. Design of Gravity Main
xii. Distribution system

PRELIMINARY SURVEY

Gathering geographical information about the intended route and the project's demands for data outputs are part of the preliminary survey. This includes marking the projected route on the ground and determining the position of topography and other physical elements (both man-made and natural).

A) Site selection

We go to the village of Nimbhale to get information about the community's current water supply system. We observed the state of the current water supply tank, piping systems, raising main, etc. We go to the village's grampanchyat office, meet the sarpanch, and get information about the current water supply system there.

DISCUSION AND PROBLEM ANYALYSIS

We Discussion with village authorities like Hon.Sarpanch, Gramsevak, and other Grampanchayat Faculty regarding their problems of running Water Supply Scheme And listening their expected solutions. As follow,

- **EXISTING STRUCTURE DETAILS :**

a) Existing Percolation Well :

Dia – 6 M
Depth – 15 M
Year of construction – 1985.

b) Pump :

Capacity – 5 BHP

c) Elevated Source Reservoir (ESR) :

A. ESR NO 1 AT GAVTHAN
Capacity- 80000 Ltr
Staging Hight – 9 M
Year Of Construction – 2001.

B. ESR NO 2 AT GAIKWAD WASTI
Capacity- 30000 Ltr
Staging Hight – 6 M
Year Of Construction – 2012.

d) RISING MAIN

A. RM-1

Location – Well To Gavthan Esr 1
Distance – 300 M
Year Of Construction – 2001.
Dia And Material – 75 Mm Pvc / 6kg Sqcm

A. RM-2

Location –Gavthan Esr 1 To Gaikwad Wasti Esr 2
Distance – 2100 M
Year Of Construction – 2012.
Dia And Material – 75 Mm Pvc / 6kg Sqcm

e) DISTRIBUTION SYSTEM

A. Gavthan- 65 MM GI / Aprrox 700 M
B. Gavthan- 75 MM PVC / Aprrox 900 M

- PROBLEMS;
  a. Source is not sufficient during summer season.
  b. Pump is in under maintenance.
  c. There are frequent leakages found in rising main from well to elevated source reservoir.
  d. Elevated source reservoir is falls incomplete for current population.
  e. Population settlement have expanded far and wide distribution pipe line is insufficient .
  f. Major problem is existing well have dirty and polluted water .and it can not be drinkable.

- SOLUTIONS ;
  a. Need Of Proposed Percolation Well At Pravara River
  b. Submersible Pump Is Required
  c. Rising Main Pipe Line Condition Is Too Bad We Must Have To Proposed New Rising Main.
  d. From The Current Population Status Data Given By Grampanchayat Office And Preliminary Survey Analysis New Elevated Source Reservoir Is Required On Parbat Wasti At Highest Elevation Of Village .
  e. For Expanded Population New Distribution About 8 To 9 Km Approx .Is To Be Proposed.
  f. We Proposed New Percolation Well For Avoide Polluted Water Problem

FINAL TOPOGRAPHICAL SURVEY USING DGPS/TOTAL STATION .

Geodetic surveying. By measuring horizontal lengths, changes in elevation, and directions, one can determine the relative locations of points (locations) on the surface of the globe. Topographic maps are used as base maps because they provide the positions of places (observable characteristics).

DESIGN OF TOPOGRAPHICAL SURVEY DRAWING

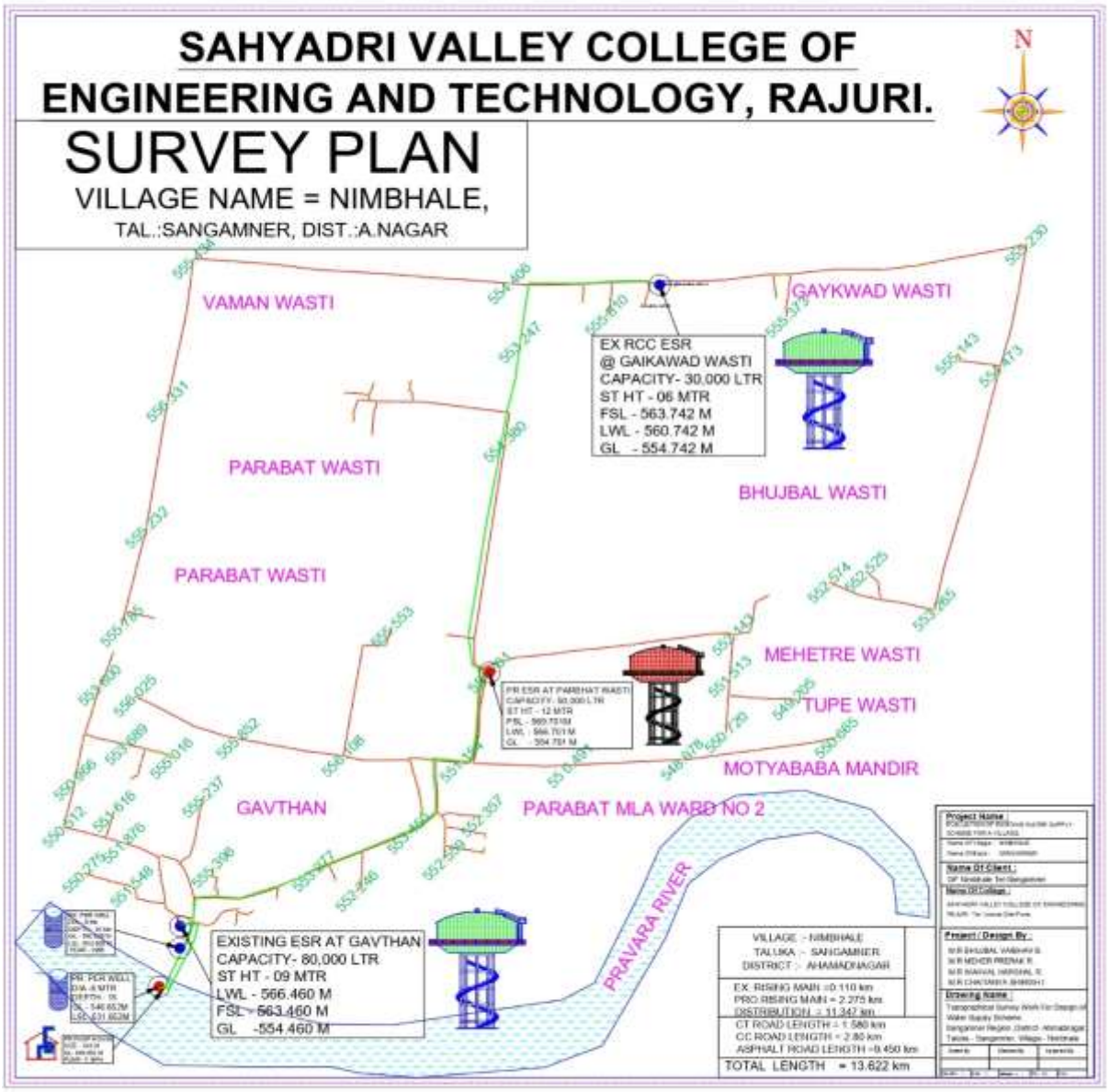

FIG 1: SURVEY PLAN OF NIMBHALE VILLAGE FOR W.S.S

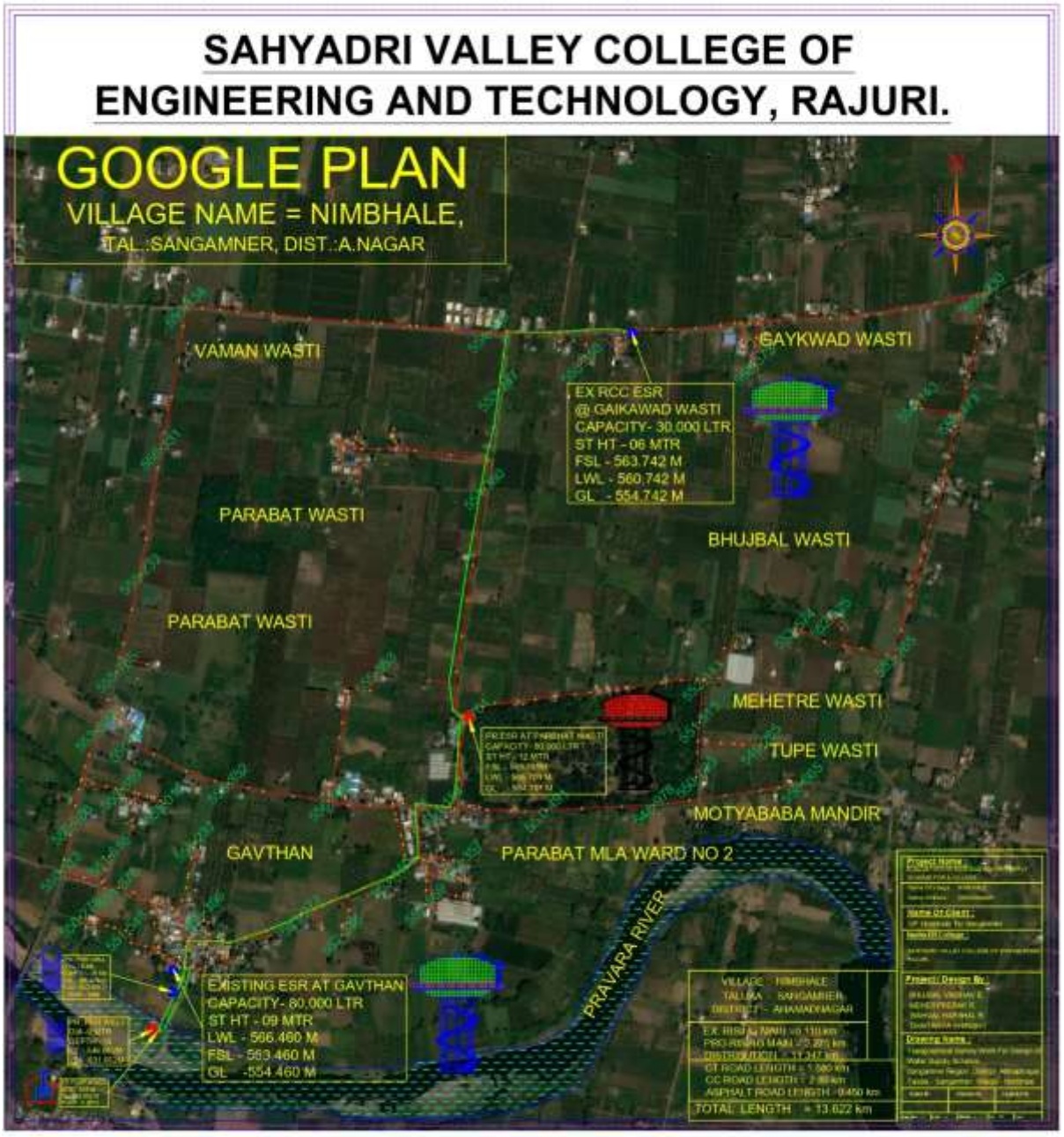

FIG II : GOOGLE PLAN OF NIMBHALE VILLAGE FOR W.S.S

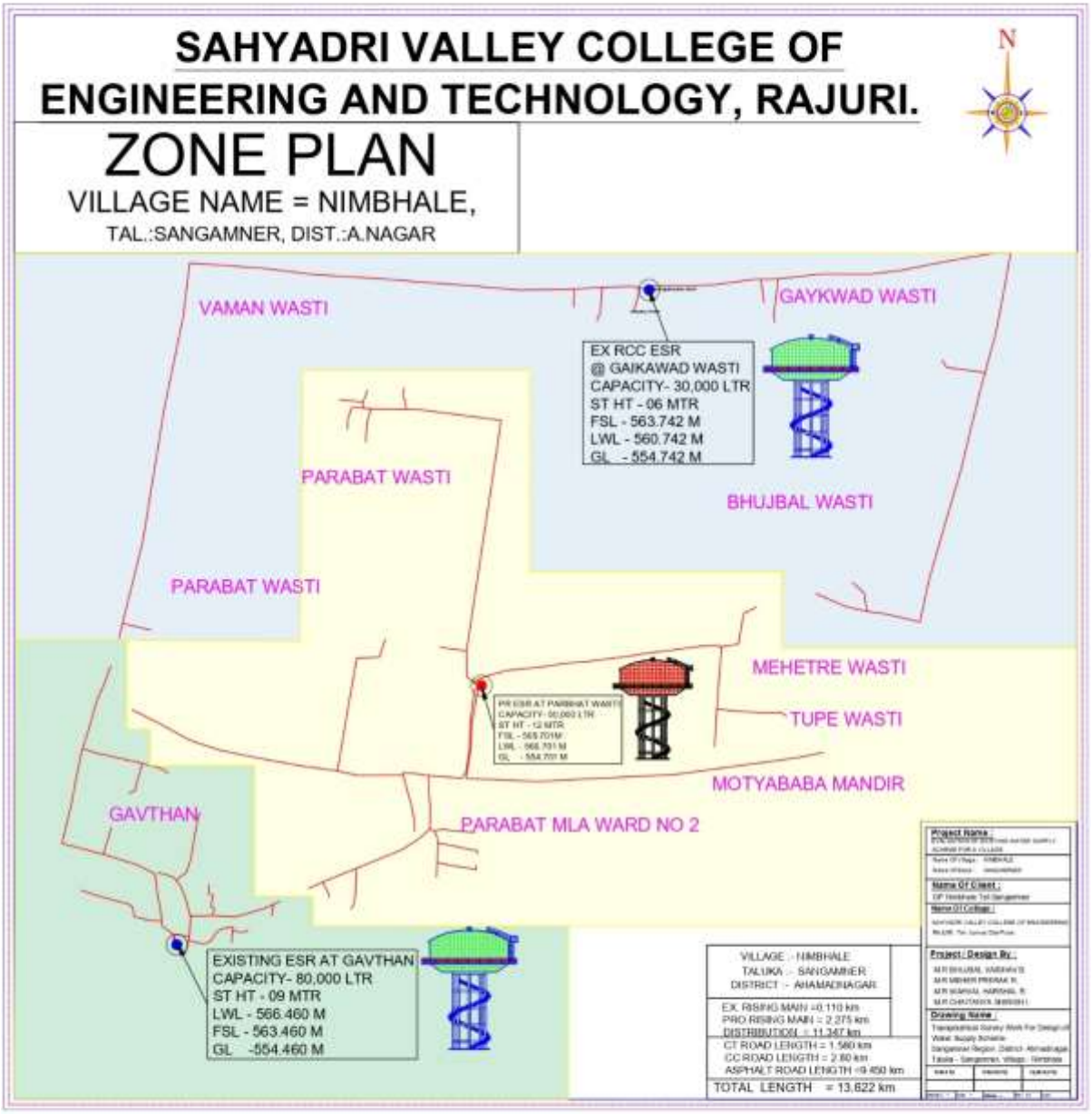

FIG III : ZONE PLAN OF NIMBHALE VILLAGE FOR W.S.S

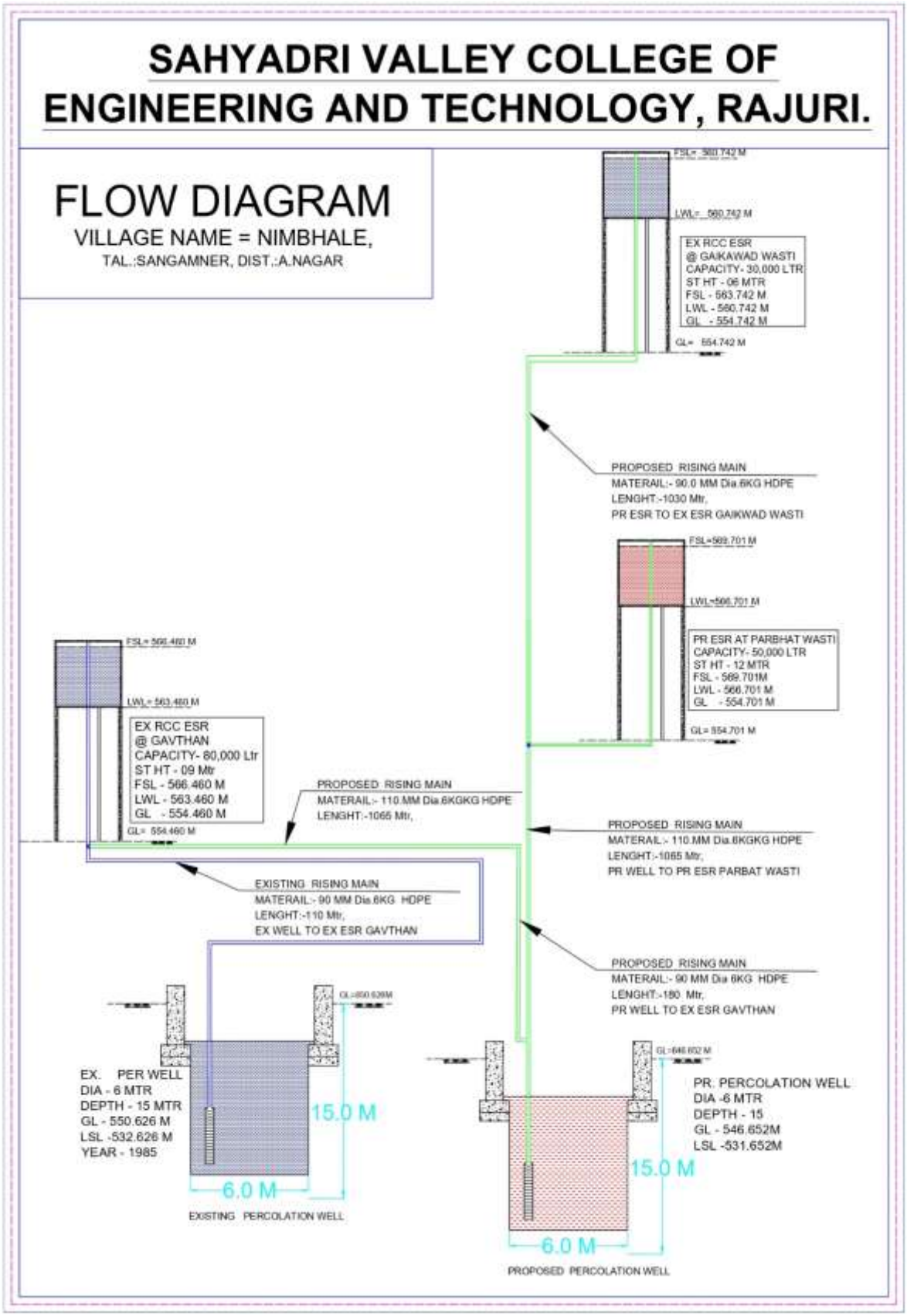

FIG IX : FLOW PLAN OF NIMBHALE VILLAGE FOR W.S.S

DESIGN OF TECHNICAL THINGS OF WATER SUPPLY SCHEME

POPULATION FORECASTING METHODS

1 - Arithmetic Increase Method

$$Pn = Po + nX'$$

2 -Geometric Progression Method

The method is used for the condition dP/dt = Kg. P. Where, Kg is called as the geometric constant, P is the population.

Kg = [(LnP'' -LnP')/(t'' - t')] (Eq.2)
Then the future population Pn is given by,

Ln Pn = Ln Po + K'$_g$(tn - to); (Eq.3)
K'g is Average of Kg which is equal to below relation.

$$\overline{Kg} = \frac{\sum_{i=1}^{x} Kgi}{x}$$

3- Iller Bankasi Method or Geometric Increase Method

$$Pn = Po\left(1 + \frac{r}{100}\right)^n$$

WATER TANK

Water tanks are provided for the purpose of balancing the constant supply rate from the water source or treatment plant with the fluctuating water demand in the distribution area. The storage volume should be large enough to accommodate the cumulative differences between water supply and demand and in case of breakdowns between source and tanks. If there would be no storage of water in the distribution areas, the source of supply and the treatment plant would have to be able to follow all fluctuations of the water demand of the community served. This is generally not economical and sometimes not even technically feasible. For that purpose, a water tank is provided. It also helps to maintain adequate pressure in the distribution.

PUMP DESIGN

Abbreviations and Acronyms

- BEP – best efficiency point
- BHP – brake horse power
- fps or ft/sec – feet per second (velocity)
- FM – force main • gpm – gallons per minute (flow)
- H – Head (feet)
- HP – horsepower
- n – rotational speed
- NPSHA – net positive suction head available
- psi – pounds per square inch (pressure)
- Q – Flow Rate (gpm, mgd, cfs…)
- rpm – revolutions per minute
- TDH – total dynamic head

Basics of Pump Operation

- A pump lifts fluid from one elevation to another
- Work is needed to lift fluid
- Work is independent of type
- Human Power
- Animal Power
- Wind Power

• Steam Power
• Electrical Power
• Pump can lift continuously or in increments
• Take-away:
• Higher lift requires more work
• Faster work requires more power

Pressure head

• Pumps deliver fluid against pressure
• Pressure = Force / Area (psi)
• Head (feet) is commonly used to express pump operating pressure
• A 2.31 foot high column of water exerts a pressure equal to 1 psi
• i.e. Car tires ~ 35 psi = 81 feet of head

Closed Conduit Flow (Q)

• Volume of fluid passing per time (gpm, mgd, cfs…)
• Q (cfs) = Area (ft2) x Velocity (fps)
• For a given flow, the smaller the conduit the larger the velocity.
• Higher velocity translates into increased frictional headloss

TOTAL DYNAMIC HEAD

• TDH is the total amount of head a pump must operate against to deliver wastewater to a desired location
• TDH = Static Head + Head Loss (HL)
• Static Head – exists when pump is on or off
• Head Loss – exists only when fluid is pumped.

DESIGN OF RISING MAIN

The rising main should be as far as possible be laid with an even gradient with a minimum of sharp bends and curves. It should be laid in a trench with a minimum of 0.6m of earth cover, and if brought above ground for any reason should beheld firmly by clamps to concrete blocks. It may be necessary, where pressures are high to anchor the pipe at bends' even if under the ground, and again this is usually done by means of concrete blocks.

In the trench the pipe should be supported along its barrel and not on its joints. This means deeper excavation at every joint, sufficient only to have the bottom of the joint not resting on the trench bottom. In rocky trench it is advisable to lay the pipe on prepared bed of sand.

GRAVITY MAIN

A gravity main is of course the most preferable in respect of economy in construction, operation and maintenance. The main shall always be of such a size that the total quantity required for the future projected peak day demand is able to flow through the pipe in 24 hours.

The gravity main should be as far as possible on a constant falling gradient, avoiding high points and low valleys. Where the static pressure exceeds the allowable pipe pressures a break pressure tank with ball valve should be installed. Excessive high points should be avoided and at no account should the pipeline be laid higher than the hydraulic gradient (negative pressure).

Where it is unavoidable, for the pipeline to be laid above ground the pipe need to be fixed freely on concrete supports and held in place by metal ring brackets which are set into the concrete support. The pipe need to have free movement within the ring bracket. Pipes above ground can only be of galvanized steel or ductile iron. The pillars should be placed at length of the pipe.

DISTRIBUTION SYSTEM

After having treated the raw water in water treatment plants, to the required standards, the last and final stage of water supply schemes comprises distribution of water to the consumers. The main purpose of the distribution systems is to develop adequate water pressure at various points i.e. depends upon the topography of the area of distribution and its elevation with respect to the location of the water treatment plants. The distribution system may be classified into three categories.

(i) Gravity system
(ii) Pumping system without storage
(iii) Dual system with storage

COST ESTIMATION

Estimation is the process of finding an estimate, or approximation, which is a value that can be used for some purpose even if input data may be incomplete, uncertain, or unstable. Estimation determines how much money, effort, resources, and time it will take to build a specific system or product.

PROJECT OUTCOMES

- Encourage technological innovation by boosting water utilities' usage and access to satellite data: Cutting-edge technologies will be incorporated into a novel, value-added service line, such as delivering satellite data to consumers to alert them to water incidents to improve responses.
- Enhanced utility operations by giving treatment plant operators anticipated data on water amount and quality: enables water managers to take quicker decisions at the operational level when source water changes throughout the short to medium term.
- Using a combination of satellite, in-person, simulated, and citizen observations to better understand particular environmental challenges: Understanding the dynamics of sediment movement and deposition in reservoirs, patterns of algae blooms, and their patterns enables utilities to proactively control upstream risks.
- Assist in protecting water resources meant for human consumption to support policy implementation: provides watershed areas with more water quality information than is currently available from routine monitoring programmes and suggests a strategy for determining danger upstream.

CONCLUSION

- We came to the conclusion that we should evaluate the current coverage and state of rural water supply with a focus on the covering of underprivileged groups and places.
- We get to the conclusion that a village with a serious drinking water quality issue has a safe water supply coverage.

- We suggest building a water delivery system for the community of Nimbhale over the next 30 years and providing a cost estimate.
- We monitor and evaluate the people's response and perceptions about the coverage of rural water supply and sanitation and to evaluate community involvement in the planning and implementation of water supply schemes
- We concluded that evaluate the operation and maintenance status of the water supply schemes.
- We concluded that monitor current knowledge, attitude and practices in rural areas with regards water supply.

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PROJECT GUIDE

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