''WATER SUPPLY SCHEME FOR SHIMLA CITY FOR NEXT 30 YEARS"

A REPORT

Submitted in partial fulfilment of the requirements for the project presentation of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

By

Anshul Sharma(131711)
Taranveer Singh Brar (121064)

Under the Supervision of

Dr. Ashok Kumar Gupta

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

WAKNAGHAT SOLAN – 173 234

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CERTIFICATE

This is to certify that the first project report entitled "WATER SUPPLY SCHEME FOR SHIMLA CITY FOR NEXT 30 YEARS" is a bonafide record of the work carried out by Mr. Anshul Sharma and Mr. Taranveer Singh Brar under my supervision and guidance. This report is submitted in partial fulfilment of the Project Part-1 for the award of B-Tech at Jaypee University of Information Technology.

Mr. Ashok Kumar Gupta

Department of Civil Engineering
Jaypee University of information Technology

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ABSTRACT

In a developing country like India, the problem of availability of funds for the first investment is sometimes very difficult to be solved, as money is required for financing various other important projects such , as those of flood control, education , defence , health , etc. Inspite of such handcaps, the Indian government has done fairly well by spending about 1-3% of their total plan outlays on 'Water Supply and Sanitation sector". As a result of such investment, India has been able to cover about 84% of its Urban Population (which is about 30% of total population of the country).Population forecast of the city was done by the arithmetic mean method, geometric mean method and incremental increase method. Result from incremental increase method for Population of 2041 i.e.469699 was used for further calculation and design purpose. Results of the Water tests performed for the water sample in the study came out to be acceptable.

CONTENTS

Chapter-1

Introduction

Water is a chemical compound and may occur in a liquid form or in a solid form or in a gaseous form. All these three forms of water are extremely useful to man, providing him the luxuries and comforts, in addition to fulfilling its basic necessities of life. Everyone of us know how important and precious the water is. Whenever there is no water in taps, we become helpless. No life can exist without water, since it essential as air. It has been noted that two-third of human body is constituted of water. Water is absolutely essential not only for survival of human beings, but also for animals, plants and all other living beings. Further, it is necessary that the water required for the needs must be good, and it should not contain unwanted impurities or harmful chemical compound or bacteria in it. Therefore, in order to ensure the availability of sufficient quantity of good quality water, it becomes almost impervative in a modern society, to plan and build suitable water supply schemes, which may provide potable water to the various sections of community in accordance with their demands and requirements. The provision for such a scheme shall ensure a constant and reliable water supply to that section of the people for which it has been designed. Such a scheme shall not only help in supplying safe wholesome water to the people for drinking, cooking, bathing ,washing etc. so as to keep the disease away and thereby promoting better health, but would also help in supplying water for fountains, garden etc. and thus helping in maintaining better sanitation and beautification of surroundings, thereby reducing environmental pollution. Besides promoting overall hygiene and public health, it shall ensure safety against fire by supplying sufficient quantity of water to extinguish it. The existence of such a water supply scheme shall further help in attracting industries(since industries require large amount of water) and therby helping in industrialisation and modernisation of the society, cosequently reducing unemployment and ensuring better living standards. Such schemes shall, therefore, help in promoting wealth and welfare of the entire humanity as whole.

1.2 Objective of Study

The objective of our project is to design the water supply scheme for shimla(urban) for next 30 years. Designing the water supply scheme will ensure the quality, quantity of water to the upcoming population in next 30 years. Objective of the study is to design Intakes, screens, aerated grit chamber, rapid and slow sand filter.

Chapter-2

Literature review

A number of weakness such as lack of sustainability of constructed infrastructure, difficulty for targeting the poor and inadequate internal information system , low quality of water services that continue under mining strategies for poverty eradication. recommendation include new paradigms for the provision of water rural supply ass a service that is monitored and supported by the government and need based allocation of projects at community level. J inenez A, and Perez-forguetA (2010) .

the greatest development failure of 20th century is to provide save drinking water and adequate sanitation services to all people is reported by Nath K.J. 2002 . provided save drinking water and sanitation to 1 billion unserved people in the next decade will be more critical challenge for humanity, and for the national government in developing country.

Community involvement in rural water supply of Sri Lanka and advantages such as feel of ownership, decision making amongst benefitial, concerns for non revenue water etc. and the disadvantage such as time consuming activity, non participations in Labour contribution, non accaptance for chlorination for the traditional habits Santhastri H.K.S and Wijesooriya R., (2004).

A merit good concept of water has been developed by Roth G. (1987) save drinking water is taken as a good merit in the sense that people who revives supply of save water from it to a greater extent than they themselves believe

the health effect of some contaminants in drinking water are not well understood but the presence of contaminant of drinking water are not well understood but the presence of contaminant does not mean that are health will be harmed is observed by Zaslow and Herman (1996).

Water is life and a basic need of human being is examined by Patanaik K.B.(2009).Fundamental right of the individual is to access to save drinking water in both quality and quantity . the endeavor of every nation is to provide save drinking water to all.

Analytic study on the provision of drinking water to Hyderabad city was made by Maria and Arial (1997).

India's urban water supply system have been declining due to factors like high rural - urban migration , regional dispachapter opens with a broad look in water supply sources and low priority status have been observed by the study of Bowonder B. and Rahul Chettrik (1984).

Value of water in different sectors with each chapter opens with a broad look at the components of water demand and economic determinants of the demand is examined by Gibbons,Dianna C.(1986)

To promote good health ,welfare of the people and provision of safe drinking water and to ensure rural drinking water supply is adequately taken care was observed by Verma Manisha (2009).

CHAPTER-3

Population Data and Population Forecast

3.1.1 Population Data for Shimla(Urban)

S.No.	Year	Population
1.	1991	100000
2.	2001	141000
3.	2011	201354

Table.1.

3.1.2 Population Forecast:-

Population forecast is important factor for designing of water systems, so it should be estimated. Estimated Population of Shimla for the next 30 years(2041):-

3.1.2.1 Arithmetic Mean Method:-

S.No.	Year	Population	Inc. in Population
1.	1991	100000	
2.	2001	141000	41000
3.	2011	201354	60354

Table.2.

In this method ,assumption is made that population increases at constant rate.

P(2041)=P(2011)+n*x

From Table.2.

x=[41000+60334]/2=50677

P(2041)=201354+3(50677)=353385

3.1.2.2. Geometric Mean Method:-

In this method , assumption is made that population growth rate(r) or the per decade percentage increase.

S.No.	Year	Population	Inc. in Population
1.	1991	100000	
2.	2001	141000	41000
3.	2011	201354	60354

Table.3.

P(2041)=P(2011)[1+r/100]^n

From Table .3.

r= (25.06*61)^1/2=39.2

P(2041)=201354(1+39.2/100)^3

=543146

3.1.2.3 Incremental Increase Method:-

In this method, the per decade growth rate is progressively increasing or decreasing, depending upon whether the average of the incremental increases in the past data ia positive or negative .

S.no.	Year	Population	Increase	R
1.	1991	100000		
2.	2001	141000	41000	41%
3.	2011	201354	60354	37.4%

Table.4.

P(2041)=P(2011)+n.x+n.n+1.y/2

From Table. 4.

x=50677

P(2041)=201354+3(50677)+3(3+1)19354/2

=469509

CHAPTER-4

4.1. Water Sample and Water Test:-

4.1.1 Water Sources for Shimla(Urban):-

Water Sources of Shimla are 1. Ashwani Khad

2. Churat Nalha

4.1.2 Water Tests:-

4.1.2.1 Turbidity Test:-

The presence of large number of individual particles that are invisible to naked eye like smoke which cause cloudiness or haziness. It is done to determine quality of water. Turbidity is measured NTU.

S.NO.	Sample	Turbidity
1.	Ashwani Khad	0
2.	Churat Nalha	0

Table.5.

4.1.2.2 pH test:-

pH ranges from 0 to 14 . pH is the hydrogen ion concentration in water. Ph values less than 7 indicate acidity and value more than 7 is alkalinity .

S.NO.	Sample	pH
1.	Ashwani Khad	7.4
2.	Churat Nalha	7.9

Table.6.

4.1.2.3 Total Dissolved solids:-

Total dissolved solids are organic matter dissolved in water in small amount and inorganic salts of calcium, magnesium, sodium, potassium, bicarbonates, chlorides and sulphates. It is useful to determine the estimation of total dissolved solids to know water is suitable drinking agriculture and industrial purpose.

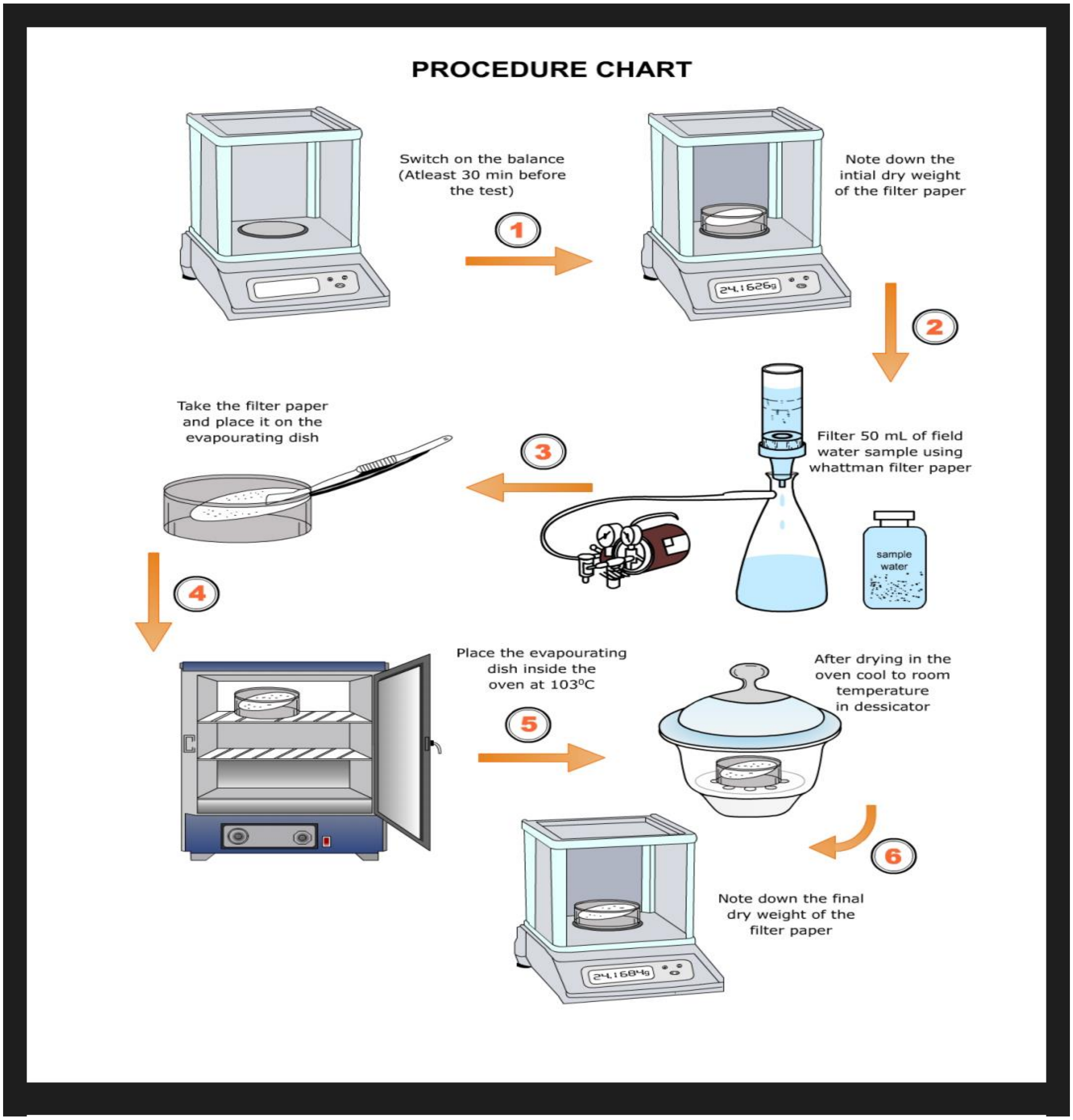

Fig.1.

S.NO.	Sample	Total Dissolved Solids(mg/l)
1.	Ashwani Khad	550
2.	Churat Nalha	520

Table.7.

4.1.2.4 Total Hardness:-

Calcium Hardness + Magnesium Hardness = Total Hardness.. Hardness is the property of water hard water is the water that has high mineral contain .Hardness is of two type- temporary hardness and permanent hardness.

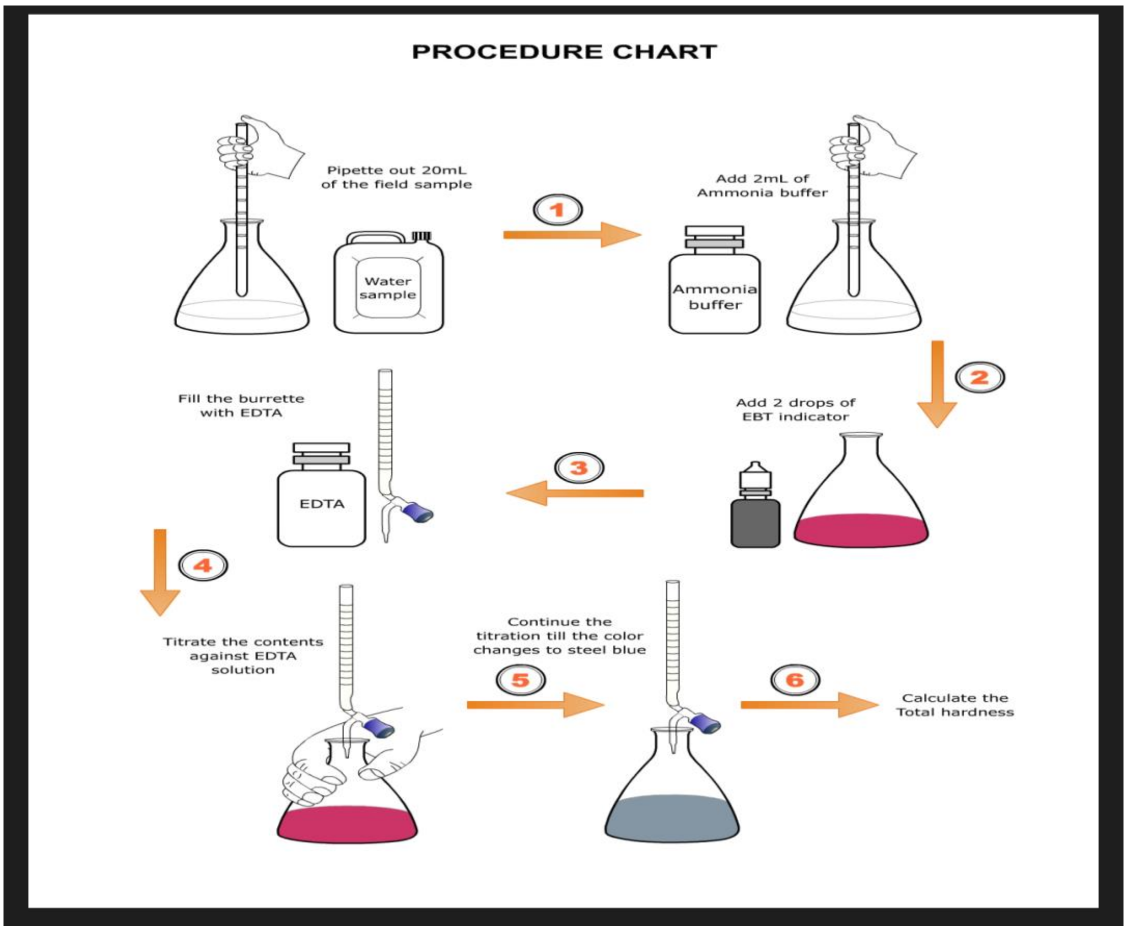

Fig.2.

S.NO.	Sample	Total Hardness(mg/l)
1.	Ashwani Khad	240
2.	Churat Nalha	260

Table.8.

4.1.2.5 Alkalinity Test:-

Alkalinity test is a way of measuring acid neutralising capicity of water. .Alkalinity helps in determining the acidic water that is harmful to human wildlife and aquatic animals water having large amount of alkalinity imparts bitter taste.

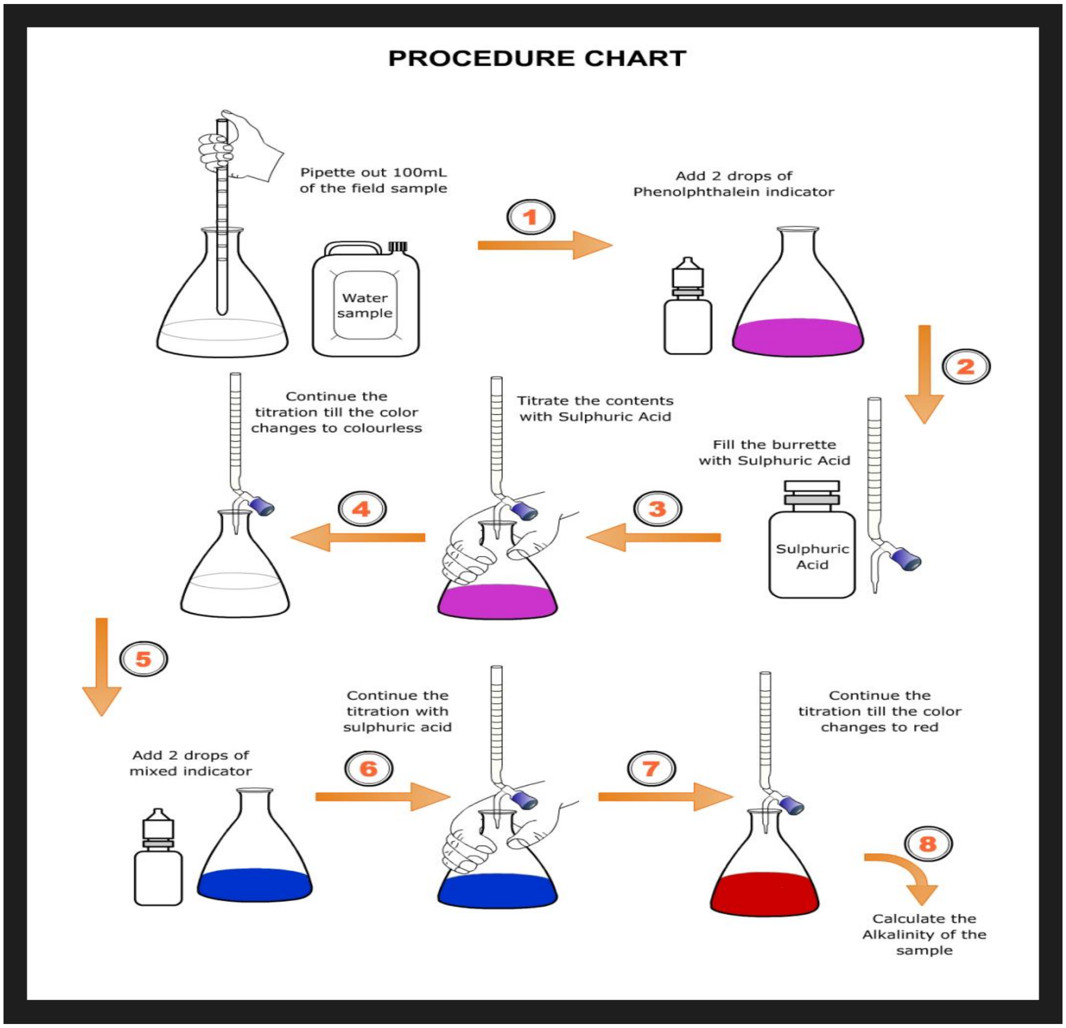

Fig.3.

S.NO.	Sample	Alkalinity(mg/l)
1.	Ashwani Khad	180
2.	Churat Nalha	220

Table.9.

CHAPTER -5

5.1 Design

Intakes

Population of Shimla(2041) =469509

assume, Avg. water demand=100MLD

Maximum water demand=1.8*100=180MLD

assume; pumping to take place 16 hrs a day.

the discharge to be pumped=180*10^6/10^6*16*60*60=3.125m/s

use oblong shaped inlet well with opening provided at 3 level,1 layer of opening shall we kept below RL, and the other may be kept below HFL stage . a middle layer of pores can be provided just below the normal water level .

these opening shall be fitted with bar screens made of 2000mm DIA steel bars of 5000mm opening. Let the velocity through the bar screen be limited to 0.16m/s.

the area of opening require for each level =Q/v=3.125/0.16=19.5m^2

Provide 1m height of screen opening. than the clear length of opening required=19.5m

no. of openings required =19.5/.5=39

no of bars=38

Length occupied by 2000mm bars=38*.2=7.6m

Total length of screen=19.5+7.6=27.1m

Provide two pores at each level. the size of each port be 10*14m. in all there will be 6 screened ports, two at each of the three levels two screen will thus be provided with in the well steining having 14m length between lowest RL .Two other screened ports shall similarly be provided between normal RL. and other two between HFL.

the inlet well can be sunk in to the river bed by 3m below the river bed, as to provide space for accumulation of sand and silt.

also let us provide a free board of 2m over the river HFL to fix the bottom level of the roof of the well

Screens

Assume, average flow= 100MLD

maximum flow =1.8*10^2=180

=180*10^6/(24*60)=208.33

Assume that the velocity through the screen is not allow to exceed 0.8m/s

Net area of screen openings required=208.33/.8=260.41m^2

Using rectangular steel bars in the screens having 1cm width and placed at 5cm clear spacing

the gross area of the screen required = 260.41*6/5=312.5m^2

assuming the screen bars is placed at 60degree to the horizontal

the gross area of screen needed =312/(3)^1/2*2=360.84m^2

hence a coarse screen 360.84 m^2 area is required .

The head loss through the cleaned screen and half-cleaned screen, can be computed as follows:

velocity through screen=0.8m/sec

velocity above screen=0.8*5/6=0.67m/sec

Head loss through the screen=.0779(V^2-v^2)=0.0729(.8^2-.7^2)=.0134m

When the screen opening get half clocked than

Velocity through the screen=v=0.8*2=1.6m/s

Head loss=0.0729*(1.6^2-0.67^2)=0.1538

this shows that at when the screen is totally clean, the head loss is negligible that is about 1.37m only whereas the head loss shoots up to about 15cm at half the clogging the screen should therefore be clean frequently as to keep the head loss within the allowable range.

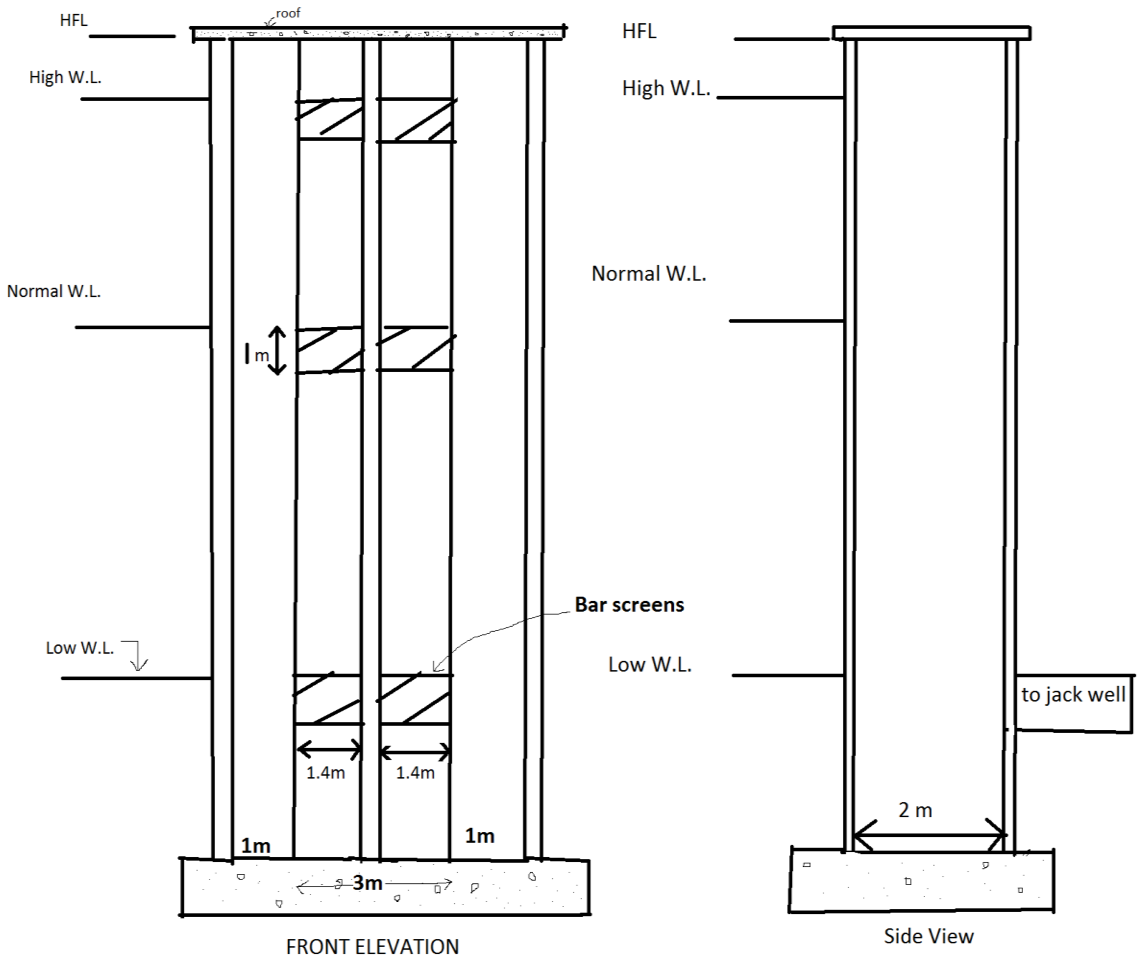

FIG.1.

Aerated grit chamber

Depth=4m

Assume; peak flow rate=1.5m^3/s

Liquid detention time=180s

Erator vol.=1.5*180=270m^3

in order to drain the channel periodically for routine cleaning and maintenance, use Two chambers.

Volume of one erated channel=270/2=135m^3

Width of channel=Depth*2=4*2=8

Length of channel=135/4*6=5.625m

Increase the length by about 20% to account for inlet and outlet conditions

provided length =5.625*1.2=6.75= approx. 7m

hence use two chamber each of size=7m*4m*8m

Sedimentation Tank

Assume Average Water Demand=100MLD

Detention Period=6hours

velocity of flow=0.2m/min

water depth=4m

free-board=0.5m

Max. daily demand=1.8*100=180

Length of Tank required=0.2*t=0.2*6*60=72m

volume=180*10^6*6/24=45000cu.m.

Cross Sectional Area=45000/72=625m^2

Width=625/water depth=625/4=156.25m

Overall depth=4+0.5=4.5m

Slow Sand Filter

Population=469509 (result from Incremental Increase Method) assume; flow=100 MLD

rate of filteration= 180 l/hr./m^2

avg. daily demand=469509*100

=469.509*10^6L/day

maximum daily demand=1.8*469.509*10^6

=845.11*10^6L/day

Total surface area=845.911*10^6/rate of filteration per day

=845.11*10^6/180*24=190000m^2

let 6 units to be used ,

area of each filter=1/6*190000=3166.6m^2

L=length of each unit , B=breadth of each unit

L=2B

L*B=3166.6

B approx. = 40m

L approx.=20m

Rapid gravity filter

P(2041)=469509

assume; Flow=100MLD

Rate of filteration=180L/Hr/M^2

Maximum water demand/Day=4695059*1.8*100

=84.5Million Liter

Water demand/Hr=84.5*10^6/24

=3.52*10^6L/Hr.

Area of filter beds=3.52*10^6/180*24

=814/81

Assume 2 units to be used;

Area of each unit=814.81/2=407.40m^2

L=1.5B

L*B=407.40

B approx.=16m

L approx.=25m

one additional unit may also be provided for breakdowns repair or clinic operation.

Chapter 6

6.1 Conclusion

In planning a water supply scheme, it is essential, to first of all, search a source of water in vicinity of the town or the city for which the scheme is to be designed. Further it may be an underground well, or it may be a river, stream or a lake. It is, therefore ,necessary to seek out all the possible sources and evaluate each in terms of quantity ,quality and cost, and then to take a final decision regarding the utilisation of a particular source or sources and the water demand of the town or the city. Suitable system should then be designed for collecting, transporting and treating this water. The treated water is finally distributed to residents and industries depending upon their requirements, through a network of distribution system. The essential elements of a public water supply scheme may, therefore, consist of intakes and reservoirs , a water treatment plant having screening, sedimentation , filteration , disinfection units , etc. elevated tanks and stand pipes which provide storage to meet peak demands occuring for limited periods , valves which control the flow of water in the pie system , hydrants which provide a connection with the water in the mains for fighting fires, flushing street , etc. , mains , sub- mains and branch line which carry the water to the streets , services which carry water to the individual homes etc etc.

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A & R Department, Kasumpati ,Shimla