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Design of Water Treatment Plant for Atigre Village

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Abstract: Water treatment is a process which is being done on the Panchaganga River water to change its quality for potable drinking water and domestic uses. The raw water treat take place in water treatment plant. There are two sources for this Water treatment plant which includes Panchanganga River and Atigre Lake. The Water treated will be provided for the residents of Atigre village. Population till the year 2047 has been forecasted and water treatment plant has been design accordingly. Various Components of the treatment plant has been designed according to the quality of water and necessary provisions required for the water treatment plant to ensure good quality of water has been made. This should be design under different circumstances. These criteria's will be considered in these literatures while designing the water treatment plant.
***Keywords*: Population forecasting, Lift Irrigation, Treatment plant capacity design, design treatment unit.**

I. INTRODUCTION

Water is a very important need of mankind. Providing safe and adequate quantities of the same for all rural and urban communities is perhaps one of the most important undertakings, for the public works department. Indeed, the well planned water supply scheme and well monitored water purification system is a prime and vital element of infrastructure of the country as it is directly related to the health of the peoples.

The population in India is round about 128 crores, which is second biggest population in the world. Nearly 40% of the total population in India is settled in the urban areas. This suggests that there is very big and increasing demand of the water for industrial, domestic and commercial sectors .Hence identification of sources of water in convenient area is of paramount importance. The water supplied should be "potable and wholesome". Absolute pure water is never found in nature, but invariable contains certain suspended Colloidal and dissolved impurities (organic and inorganic in nature especially solids), in varying degree of concentration depending on the source. Hence treatment of water to mitigate and/ or absolute removal of these impurities (which could solids, pathogenic micro-organisms, odour and taste generators, toxic substance etc.) become indispensable. Untreated or improperly treated water becomes unfit for intended use may prove to be detrimental for life.

The designed water treatment plant has the perennial river source as the main water source. The type of the treatment to be given depends upon the given quality of water available and the quality of water to be served. However such extensive survey being not possible in the design water treatment plant. It is assumed that all kinds of treatments processors are necessary.

The design of water treatment plant for Atigre situated in district Kolhapur, of Maharashtra state has been done. Atigre is located on the bank of Shahu Talav. There are no any industries are present in this area.

Atigre
Tehsil → Hatkanangle
District → Kolhapur
State → Maharashtra
About Atigre

According to Census 2011 information the location code or village code of Atigre village is 567303. Atigre village is located in Hatkanangle Tehsil of Kolhapur district in Maharashtra, India. It is situated 13km away from sub-district headquarter Hatkanangle and 19km away from district headquarter Kolhapur. As per 2009 stats, Atigre village is also a gram panchayat.

The total geographical area of village is 662 hectares. Atigre has a total population of 3,729 peoples. There are about 820 houses in Atigre village. Ichalkaranji is nearest town to Atigre which is approximately 10km away.

II. NEED OF STUDY

A. Present Scope

Atigre village is now a day's very vastly growing Village in residential manner. For this the current facilities of water treatment are not available. For serving future increment in population it is necessary to construct plant having sufficient capacity of water treatment. Our project is concerned about surveying the present population and estimating the further increment in population and to suggest a new design of water treatment plant.

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At present condition there is no facility of the water treatment. no facility of testing the water, to check that weather it is potable or not.

FIG.1.1 Present Status Of Atigre Village Drinking Water Supply

III. DATA COLLECTION AND DESIGNING

Table No.1 - Salient Features of Atigre Village

1.	Name of Village	Atigre
2.	District	Kolhapur
3.	Taluka	Hatkangle
4.	Location	At the bank of Shahu Talav
5.	Water source	Shahu Talav & Panchaganga River
6.	Name of the River	Panchaganga
7.	Name of the Lake	Shahu Talav
8 .	Population As per 1991 As per 2001 As per 2011 As per 2017	 1487 2314 3729 5048
8.	No. of Clinic	4
9.	No. of schools	3
10.	Restaurants	6
11.	Hotels	3

IV. POPULATION FORECASTING

Table No.2 –Population Forecasting for Atigre Village

Year	Population
1991	1187
2001	2314
2011	3729
2017	5048

Population Forecasting is done by using Arithmetical increase method

Pn = P + nd

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Population in 2047 will be 8681

V. DESIGN THE PLANT CAPACITY

= 1942999/ 1000000
= 1.94299 MLD
Say = 2 MLD Plant capacity
Assuming Pumping Hours = 20 Hours
Design Discharge Q = 2000000/20
= 100000 lit/ hr
= 100000/(60 * 60)
= 27.77 lit / sec
= 27.77 / 1000
= 0.027 cumec

Hence Design capacity of Treatment Plant is 2 MLD and Design Discharge is 0.027 cumec

VI. DESIGN

A. Design Of Intake Well

R. L .of River bed =525.55M
R. L. of lowest water level =533.02M
R. L. of normal water level=534.185M
R. L. of high flood level =540.220M
Population to be served =8681
Water demand =2MLD
Assuming the pumping take place for 20 hr day the discharge to be
$= 2 * 10^{6} / 10^{3} * 20 * 60 * 60$
Discharge = 0.027 m^3/sec
Design of Inlet Well –

lowest water level and other may be kept below the Normal Water level R. L. 534.185
The opening shall be fitted with Bar screen made of 16 mm Dia. Steel bars Say 20 mm Opening (clear) let the Velocity through the bar screen be limited to 0.16 m/sec
The area of opening required of each level
= Q/V
= 0.0231/0.16
= 0.027/0.16
= 0.1736 m^2

Let us provide 0.3M height of screen opening .then the clear length of the opening required 0.6M
No Of opening requite =40mm
0.1786/0.002
= 8.68
= 9 opening
No Of Bar = 8
Length occupied by 16mm bar
8 x 0.016
=0.12

Total length of screen = 0.6+0.012s
=0.72

Say 0.8M opening
Let as provided I part at each level the each side of part will then be 0.3M height &0.8M length

In all these will 2 screened part one part at each of two level screened part will that provided within the well steaming between R.L =533.02m to 532.72m having 0.8m length other screed port shall be provided between R.L=534018m to 533.88m. This Part can be fitted in an oblong well consisting of rectangular length of 1.2 m provide with circular ends the well can have a width of says 1.2 m. The inlet well can be sunk into the River bed by Say 2 m below the river accumulation of sand & silt so let us keep the bottom of inlet well as R. L. 523.55m. Also let us provide a free board of 0.5 m over the Normal water level. To fix the bottom level of the roof of the well

Hence provide invert level of roof at R. L. 534.185 + 0.5 = 534.685 m

The Height of inlet well will then be = 534.68 – 523.55

= 11.13m

B. Design of Gravity pipe Connecting Intake Well And Jack Well

The Intake pipe shall be designed to flow by gravity at max velocity say 1.2m/sec

$Q = 0.027\ m^3/sec$

$V = 1.2$ m/sec

Area of Pipe Required

$3.14/4 * d^2 = Q / V$

$= 0.027/1.2$

$d^2 = 0.027 / 1.2 * 4/ 3.14$

$d = 0.169$ m

$d = 0.15$ m hence use 15 cm dia. RCC intake pipe giving a velocity of

$= 0.027/0.785 * 0.15^2$

$= 1.18$ m/sec

Using manning's formula we have

$V = 1/n * R^{2/3} * S^{0.5}$

$1.18 = 1/ 0.017 * (0.15/4)^{2/3}\ S^{0.5}$

n = Constant

$(R = A/P = 0.7853*d^2/3.14d)$

$R = d/4$

$S = 0.0389$

Gradient = 1 : 38

Hence lay 0.15m dia. intake pipe at a gradient of 1:38

C. Pump Design

Water changed =2MLD

$= 2*100/10^3$ cubic meter 1 day

$= 2*10^3/24*60*60$

= 0.023 cusec

Further assuming that the pump are working for 20 houses a day to supply full days of demand we have

Maximum Draft

= 0.023 *24/20

= 0.02778 cusec

Now assuming the flow through the pressure pipe to the 0.7 m/s

We have

Are of pipe required = A = Q/V

= 0.02778/0.7

$= 0.3968\ M^2$

Dia. of pipe required

$A = 3.14/4 *d^2$

$d^2 = 0.3968 *4/3.14$

$d = 0.2247$ m

So use 0.23m dia. pipe
Actual area provided
A = 3.14/4 *0.23
= 0.041 m^2
The actual velocity
V= Q/A
= 0.02778/0.041
= 0.67 m/sec
Head loss can now are calculated by using Modified Hazens willams formula
$V = 143.534\ CR * R^{0.6575} * S^{0.5525}$
Where
V = 0.67
CR=1….(For PVC pipe)
B =d/4 = 0.23/4 =0.057
Putting there value in formula
$0.67 = 143.534 * 1 * 0.057^{0.6575} * S^{0.5525}$
$S^{0.5525} = 0.67/143.534 * 1 * 0.057^{0.6575}$
$S^{0.5525} = 0.0306$
$S = 1.82 * 10^{-3}$
Calculating Heal loss
HL/L = S
$HL/8000 = 1.82 * 10^{-3}$
$HL = 1.82 * 10^{-3} * 8000$
HL=14.61m
The head diff between the elevation of sump well & service reservoir 15m
The need loss in supply main
14.61m above calculation
Total lift Required =15+14.61
= 29.61m
The power of more Required
=**r**w.Q.h/n (KN/m) (KW)
Where
rw = unit weight of water
= 9.81 KW/m3
Q = Discharge in m3/sec
H = total head lift required in/ m
n = Efficiency of pump let
HP = **r**w* Q * H/0.735n

VII. DESIGN DIMENSIONS

Sr. No.	Unit	Length (m)	Width (m)	Depth (m)
1.	Intake well	1.2	1.2	11.13
2.	Aerator	3.6 (Diameter)	-	1.6
3.	Sedimentation Tank	12.8	4.2	4
4.	Rapid Sand Filter	7.09	4.66	3.1
5.	ESR	18 (Diameter)	-	4

VIII. CONCLUSION

In this paper regional study was carried out on the design of the storage capacities of water treatment plant for atigre village. The obtained design results made possible the satisfied water demand for forecasted population. The water which is produced from the treatment plant must be safe for the human being. And from that up to 2047 population forecasting will be contributed. also the operational cost to produce the water should be reduced. The problem of insufficient Water in Summer days also reduces

REFERENCES

[1] AWWA (1998) 1998 Residential Water Use Survey ,American Water Works Association, Denver.co.
[2] AWWA (1999) Design And construction of small water system,2nd ed.
[3] Bouwer, H.(1978) Groundwater Hydrology, McGraw – Hill, New York, p.70.
[4] Pinholster, G. (1995) "Drinking Recycled Waste Water," Environmental Science & Technology, vol. 29 pp. 174A – 179A
[5] Rippl, W. (1883) " The Capacity of Storage reservoirs for water supply," Proceeding of the Institution of civil Engineers (London), vol. 71, p. 270
[6] Ministry Of urban Development, New Delhi May, 1999 Manual On Water Supply And Treatment. 3rd ed.