J. Indian Water Resour. Soc.,
Vol. 41, No. 3 & 4, Jul. & Oct., 2021

FINDING DEPENDABLE AND ECONOMICAL SOURCE OF WATER FOR PANCHKULA

R C Taneja*

ABSTRACT

The sub-surface reservoirs are very attractive and technically feasible alternatives for storing surplus monsoon runoff. The sub-surface reservoirs can store a substantial quantity of water. The sub-surface geological formations may be considered as "warehouses" for storing water that comes from sources located on the land surface. Besides suitable lithological conditions, other considerations for creating sub-surface storages are favourable geological structures and physiographic units, whose dimensions and shape will allow retention of a substantial volume of water in porous and permeable formations.

INTRODUCTION

Water is not only the basic need but the LIFE LINE for any City. Source has to be dependable and if possible economical as well.

Panchkula has used its Groundwater for a very long time but it has depleted it badly and had to look for different alternatives. It has invested huge amounts in the construction of DAM and related infrastructure, but of little use. It has also spent its precious resources on bringing the Bhakhra Canal water through Chandigarh. Not only the initial cost of bringing water from Bhakhra Canal is prohibitive but one has to pay from noses the recurring cost on pumping and carriage of water against gravity for long distances.

For any Water Supply Project, the essential elements are:

A) Source of water i.e. Canal, River, Lake, Dam OR Ground Water.

B) Carrier channel OR Pipe Lines for Raw Water and Pumping of Raw Water wherever required

C) Raw Water Storage Tanks

D) Filtration/Treatment Plant.

E) Clear Water Storage Tanks

F) Clear Water Pumping Stations and

G) The Distribution System etc...

Since the topic is the Source hence I shall restrict my discussion on A) to D) only. The infrastructure relating to E) to G) already exists and there should be no problem in utilizing the same.

Source of Water

i) The dependability of Source with ample quantity of water available to fulfil the need of the City round the year is of immense importance.

ii) In case of Panchkula, it has depleted its Ground Water Resource.

iii) River, although flowing through the City, does not have ample discharge and the quality of water (specifically during dry weather) is also not good.

iv) Canal is far away. Due to long distance and elevation difference; huge amount is required to be spent on daily basis for pumping of raw water.

v) There is no Lake around the City and the DAM has not come upto the expectations.

Carrier Pipe Lines for Raw Water and Pumping of Raw Water wherever required:

Once the locations of Raw water Source and the destination is fixed it is a matter of engineering computations to reach at the most economical cost but it cannot be altered much. In case of Panchkula, the cost of carrying the water from Bhakhra Canal must have been very prohibitive. Not only the initial cost, but day to day pumping also cost shell.

Raw Water Storage Tanks

Big raw water storage for the water received from DAM may not be needed but we need sufficient storage (may be for three days requirement) of raw water to be received from Bhakhra Canal keeping in view the long distances involved and the assured supply to be made to the residents.

Filtration/Treatment Plant

The quality of raw water dictates the type of treatment required to be given to make it potable for human consumption. Water from Bhakhra Canal is of good quality but from Ghaggar DAM, it cannot be that good and shall need high degree of treatment.

GEOLOGY OF PANCHKULA

The study of GEOLOGY of Panchkula is extremely important. HSVP/HUDA has exploited a whole lot of ground water by boring about 100 deep tube wells at different locations in original Master plan area, then in Panchkula Extension and Mansa Devi Project. I have been associated with these borings and installation of Tube wells. In the start, T/W's of 250 to 300 feet depth were installed in early Seventies which were virtually failure but later on deep T/W's of 500Ft depth and then upto 1000 Ft

* *Chief Engineer HSVP (RTD), LM IWWA, LM IWRS, LM IRC, LM ICA*

Manuscript No. 1565
Received 9 February 2021; Accepted 12 November 2021

depth were made. These T/W's were successful but Groundwater, unless has some regular recharge, has its limitations.

However, the strata charts of these Tube Wells give a very clear picture of the geology of the terrain. The underground strata of the land in Panchkula is principally comprised of **gravel-boulder and coarse sand, punctuated with layers of hard clayey strata**. Clayey layers are very thin. Clayey strata is hard impervious and non-water-bearing but gravel-boulder and coarse sand is the best water-bearing strata. It has immense capacity to hold and release water. It can very safely be said that it is a very large underground reservoir available to us. This is God-given free Gift that, if utilised intelligently, can solve the problem of water for the Panchkula township. Panchkula has survived on this for a very long time and it can still prove to be a boon.

The advantages of having such an underground Reservoir are:

a) The expenditure on Carrier Pipe Lines for Raw Water and Pumping of Raw Water (B-above) is eliminated.

b) There is no need to have raw water storage (C-above)

c) Normally, there is no need to construct any full-fledged Treatment Plant (D-above)

d) For all purposes this is FREE.

e) Dependability factor is very strong.

There is a slight element of doubt on the level of success but if Benevolence is kept in mind then there is no deficiency at all.

HOW TO UTILISE THE GOD-GIVEN GIFT (UNDERGROUND RESERVOIR)

Rain water Harvesting/recharge is a well-established policy of the Government of Haryana and the Government of India. Although sufficient stress is being laid on adopting the same but we will have to adopt some very rigorous and scientifically planned methodology for the same. It is explained below:

i) The flow of water in the river Ghaggar increases in the rainy season. Because of its large catchment, the discharge is not at all dependant on the local rains but the rains at higher altitudes contribute sufficient water in river Ghaggar. Irrigation Department Haryana keeps regular record of flow not only in river Ghaggar (adjacent to Panchkula) but in its tributaries as well.

ii) The required quantity of raw water can easily be diverted at Burj Kotian bridge to the left or right bank of Ghaggar in the rainy season (June to September) and brought to Panchkula downstream of State highway bridge (Naddha Sahib Bridge) by gravity. Partial and quick treatment can be planned at any suitable place, on the way, to separate the sediments

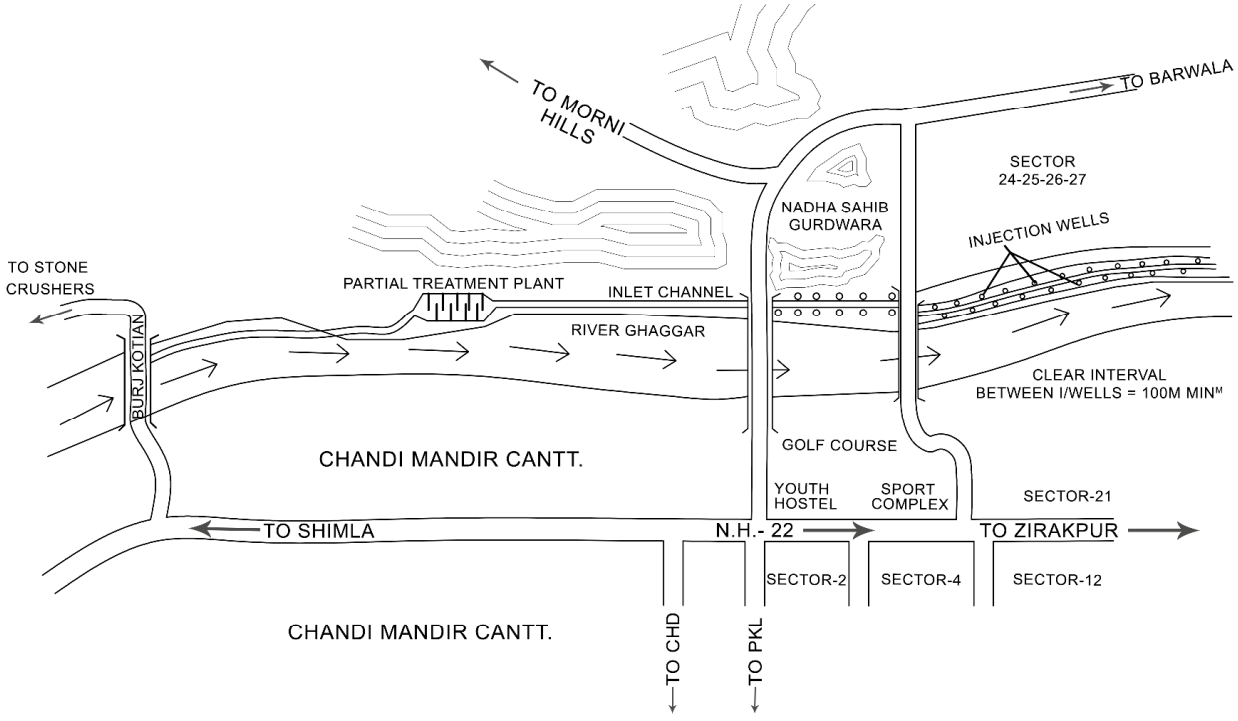


Fig. 1 : Schematic sketch of river Ghaggar, Panchkula and surroundings

and floating impurities. It shall however be required to ensure that the raw water is not polluted by any Industrial effluent

iii) This water is fairly good for injecting into the ground by installing a battery of Injection Wells. Further treatment of water shall be automatic when it shall travel in the strata from point of injection to point of drawl.

iv) Injection Wells shall be properly designed and installed with the same specifications as of Tubewell. Water cannot be created and does not perish, as well. It only changes its form which cannot happen after it has been injected in the Ground. The only possibility is that it may flow away and may not be possible to be trapped by us. After all, it shall be used by somebody and that is the BENEVOLENCE. We have better chances to extract the water by installing tube wells in the vicinity of the Injection Wells.

v) Our calculations are based on the assumption that only 10% of the injected water shall be available to us. Once this process is started then the performance of tube wells shall start improving.

vi) As a matter of fact, the availability of safe potable water is getting reduced day by day and rainwater is the only safe water available in nature. We have to secure every drop of this water under all circumstances otherwise our future is dark.

ACTUAL IMPLEMENTATION

1st Phase for a population of 50000 (Specifically for Panchkula Extn.)

Population to be catered 50000 Nos.

Water Allowance as per Norms of GOI 135LPCD

Daily domestic requirement 6750000 L or 6.75 ML (Demand for horticulture, fire, sanitation etc shall be met from recycled water)

Yearly requirement 6.75 * 365 = 2463.75 ML

Average discharge from the Tube wells in Panchkula Extn.

22500 GPH
OR 85200 LPH
OR 85.2 Cu M/Hour

Assuming that one Injection Well, with similar construction as of any Tubewell, shall be able to inject three times the quantity of water in the ground and only 10% of the water injected shall be possible to be reclaimed:-

Quantity of water required for one year

= 2463.75*1000*10Cum
= 24637500Cum

Capacity of one Injection Well to inject water @ three times the average discharge of a tube well in 100 days working 24 hours = 3*85.2*100*24

= 613440 Cum

No. of Injection wells required to inject 10 times the yearly Demand in100 days

= 2463.75*1000*10/3*85.2*100*24

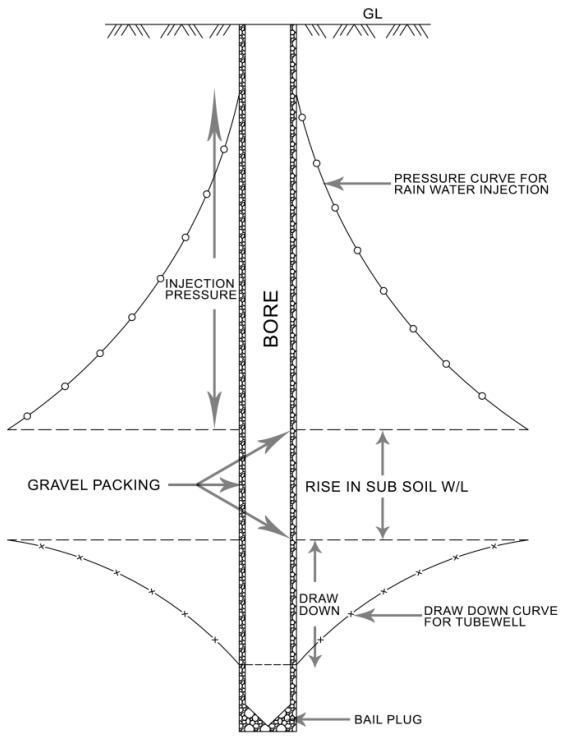
= 40 Nos.

Thus, it will be possible to inject an year's demand of water in the natural underground reservoir with the help of 40 Injection Wells working 24 hrs for 100 days, when there is sufficient discharge in river Ghaggar. Old abandoned tube wells shall also be possible to be used for this purpose; thus the requirement of new Injection Wells will get reduced.

The availability of water from these Injection Wells has been assumed to be only 10%. This availability shall improve with the passage of time as the 90% of undrawn water shall raise the subsoil water level and its flow in other directions will also get reduced

Quantity of water required for feeding these I. wells

= 2463.75*1000*10/100*24*3600
= 2.85 Cumecs or 100 Cusecs



INFLUENCE CURVES FOR T/W & I/W

Let the Inlet channel be constructed to carry double the discharge i.e. 200 c/s to meet with the demand of Phase II as well. Existing infrastructure laid for carrying the water from DAM may also be used.

This partially treated water shall be poured into the Injection wells for 100 days a year. Choice of the strata

shall be made before installation of these I/wells so that there is a good possibility to reclaim the water during the year.

Horizontal flow of this water within the ground shall filter the water scrupulously and it shall be fit for human consumption after chlorination. Once the strata get saturated then the availability of water shall also be assured. Injection of 100 c/s of water at one place shall certainly create impact and the surrounding areas will also find rising of s/s water level.

IMMEDIATE MEASURES TO BE TAKEN

Let all the existing abandoned T/wells be converted and used as Injection wells with immediate effect. These will have to be connected with the existing Storm water drains with some precautionary work at the inlet of the I/well. There must not be any flow of sanitary sewer in this storm water drain and preferably discharge from first shower may not be used for Injection into ground. The quantity of water injected into the I/well, rate of injection and effect thereafter on s/s water level should also be studied closely.

Advantages of Artificial Recharge (As enumerated in "Manual on Artificial Recharge of Ground Water" published by MOUD GOI)

Artificial recharge is becoming increasingly necessary to ensure sustainable ground water supplies to satisfy the needs of a growing population. The benefits of artificial Recharge can be both tangible and intangible. The important advantages of artificial recharge are:

1. Subsurface storage space is available free of cost and inundation is avoided
2. Evaporation losses are negligible
3. Quality improvement by infiltration through the permeable media
4. Biological purity is very high
5. It has no adverse social impacts such as displacement of population, loss of scarce agricultural land etc
6. Temperature variations are minimum
7. It is environment friendly, controls soil erosion and flood and provides sufficient soil moisture even during summer months
8. Water stored underground is relatively immune to natural and man-made Catastrophes
9. It provides a natural distribution system between recharge and discharge points
10. Results in energy saving due to reduction in suction and delivery head as a result of rise in water levels.

REFERENCES:

1. Guide on Artificial Recharge to Water. Ground Water

2. Manual on Artificial Recharge of Ground

3. Manual on Water Supply and Treatment Systems