Infiltration Trench : As a Model for Hydrogeological Artificial Recharge at Bandung City, West Java, Indonesia

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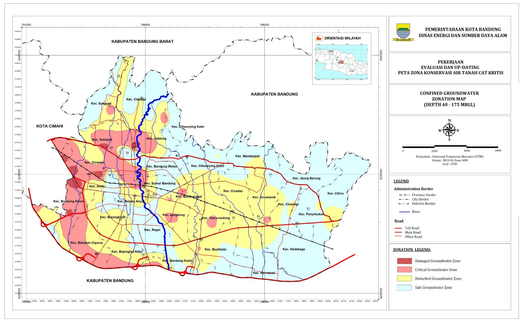
1. Introduction

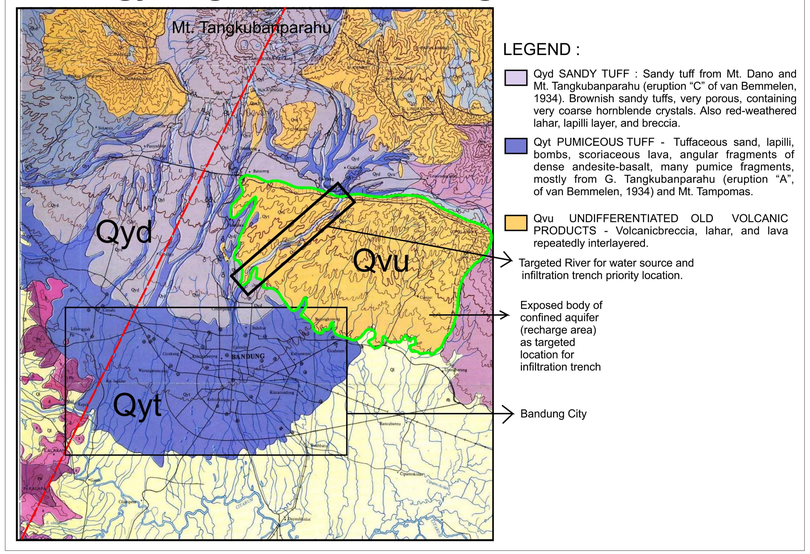
Groundwater reserve is one of the most priceless resource in a city. Nevertheless, based on data from the Ministry of Energy and Mineral Resources in wells around Bandung Station, there has been decreases in groundwater level which is around 80 meters within 20 years. This decrease is caused by population growth that led to the uncontrolled use of groundwater as a main source of domestic and industrial water, it is also caused by a lot of infrastructure development around groundwater recharge area which covered open area and reduced groundwater infiltration. The purpose of this study is to create artificial recharge model in Bandung to optimize groundwater infiltration as part of a groundwater restoration.

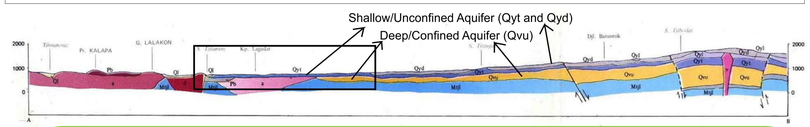


Picture. Confined Groundwater Zonation Map
(Source : Ministry of Energy and Mineral Resources 2015)

Uncontrolled used of groundwater for domestic use and industry, causing serious problem to groundwater level. A recent study about groundwater condition shows that there are a lot of area with damaged groundwater, and much more in critical and disturbed state. Infiltration trench is proposed to address this problem by injecting more water to the aquifer.

Geology Regional of Bandung





2. Location

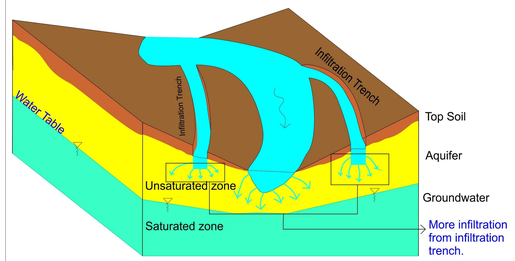
Location for infiltration trench is proposed in recharge area (north from Bandung city). In this area the rock formation that act as confined aquifer (in Bandung city) is exposed. Water that infiltrate in this area is flowing directly to the groundwater aquifer.

Stable water supply is also present in this location primarily from Cikapundung river, even in summer this river still has debit around 10 m3/s.

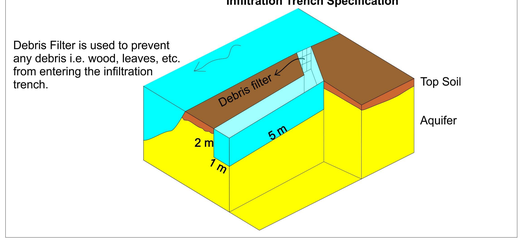
3. Infiltration Trench Model

Infiltration trench is built along side a river that has a stable water flow throughout the year. Infiltration trench is built parallel to the river flow in the left and right side of the river at 25 m interval.

INFILTRATION TRENCH MODEL



Infiltration Trench Specification



The length for the infiltration trench is at least 5 meters, with 1 meter width, and 2 meter deep or until it reach the aquifer.

To prevent any debris i.e. wood, branch, leaves, etc. from entering the infiltration trench, filter is installed in the mouth of trench. The filter is made from mesh wire and wooden or bamboo frame.

This model will work in area that has deep water table, and usually the river is influent river. This condition is met in the proposed location.

4. Capacity

Targeted location is Cikapundung River that has length around 4.5 kilometers (as indicated in the map). With interval at 25 meter between the infiltration trench, and the trench is built on both sides of the river, there are total 360 infiltration trench that can be built.

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As mentioned before, the size of the infiltration trench is 5 meters long, 1 meter wide, and 2 meters deep or more. With this size, there are 5 m x 1 m area of potential infiltration surface (infiltration trench floor). Infiltration trench wall side is not included as infiltration surface due to highly varied water level/depth.

The rock formation in targeted area is mainly tuff, and some breccia and lava. This rock (tuff-unwelded) is usually has high porosity and permeability. The hydraulic conductivity under saturated condition, is estimated around 1 x 10^{-3} cm/s and 1 x 10^{-5} cm/s. For estimating purpose, hydraulic conductivity value is set to 2 x 10^{-5} cm/s.

From this data, we can simply calculated the amount of water that being infiltrated to the aquifer by infiltration trench.

Total infiltrated water = infiltration trench amount x infiltration surface x hydraulic conductivity
= 360 x 50,000 cm2 x 2 x 10^{-5} cm/s
= 360 cm^3/s
= 11,000,000 liter/year

Production cost for 1 unit infiltration trench is relatively cheap and affordable. Because it doesn't need special material and easy to build. From that point of view, infiltration trench is a feasible option for groundwater restoration.

5. Conclusion

a. Targeted location for infiltration trench is part of Cikapundung river with 4.5 kilometer long.
b. Infiltration trench is built with spacing of 25 meter on both sides of the river.
c. Total water that can be added to the aquifer is 11 million liter per year.
d. Infiltration trench is a feasible option for groundwater restoration, because it is relatively cheap and easy to build.

6. Reference

Silitonga, P.H.1973.*Geologic Map of The Bandung Quadrangle, Scale 1 : 100,000*. Bandung : Geological Research and Development Centre.

Ministry of Energy and Mineral Resources .2015. *Bandung City Confined Groundwater Zonation Map*. Bandung.

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