The United Nations Environment Programme (UNEP) on behalf of the Climate Technology Centre and Network (CTCN)

Selection of potential MAR pilots

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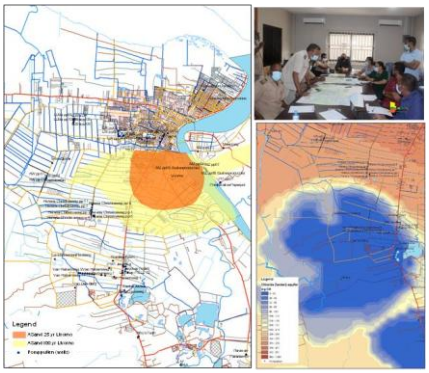

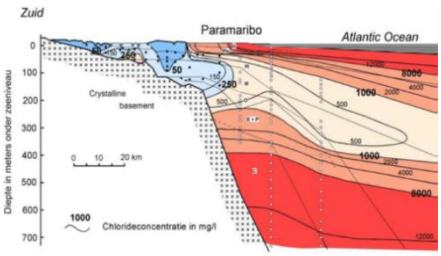

Consultancy services for

Enhance the resilience of Suriname´s water supply system by modelling drought risks and developing a roadmap of prioritized alternatives for aquifer recharge

Acronym: ***ARADIS***

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1 Introduction

The final objective of Fase 2 is a selection of five possible MAR pilots, which will be presented to the SWG during the 2nd SWG workshop on April 15th. The principle of elimination was followed based on the information (possibilities and limitations) from the three underlying studies on 1) drought risks, 2) aquifers and water balances, and 3) MAR techniques. In the end we have presented 6 potential sites.

2 Considerations for elimination and selection

2.1 With respect to the water system

Considering the hydrological system, we can conclude that the effects of droughts on surface water, such as falling water levels and base flows, deteriorating water quality, reduced flow, and salt intrusion, are difficult to mitigate. That is, difficult to mitigate with a civil engineering MAR project, as envisioned in this project. These types of effects require an integrated approach across the entire watershed upstream of the river, creek, swamp, or canal where the problem occurs. Many small-scale interventions, such as reforestation, different agricultural tillage practices, small check dams, and more well-considered spatial planning, would be more effective. Therefore, the effects of drought on soil and groundwater are the determining factor in this study.

Note that in general the are abundant groundwater resources in the coastal plain of Suriname west of Paramaribo (RTI, 2016)

2.2 With respect to the sector

A large number of companies and organizations have an interest in groundwater abstraction. As for drinking water supply, SWM and, to a lesser extent, the Ministry of Natural Resources (DWV) are the largest users. Other smaller users include bottling companies, industries, livestock and poultry farms, eco-resorts, and possibly also farmers who irrigate with groundwater.

MAR is a possible option for the SWM as groundwater extraction in the coastal plain south of Paramaribo is expected to come to an end towards the end of this century (see Annex 5). MAR is not an really a necessity for the other users like farmers and small industries. These users do not abstract a lot of water and will not be the cause of water shortages in future. Most likely they cannot afford complex MAR systems. Only for potential users near creeks and rivers, MAR by bank infiltration (see Annex 6) may be an option.

Irrigated rice cultivation depends on surface water supplies from the Nanni Swamp and the Nickerie River. Salt water intrusion in the Nickerie Rivers and other canals resulting from the decreasing discharge from the large upstream Nanni swamp during droughts complicates water supply for irrigation. However, this encompasses the entire catchments. A MAR system can do little to mitigate these droughts and the resulting effects. Rice cultivation demands large quantities of water. Direct supply of groundwater from a single MAR system could never meet this demand

One option for farms on sand ridges is the construction of shallow drains, as indicated in Annex 6. These can be classified as MAR bank infiltration systems, fed by nearby swamps.

2.3 With respect to the water balance areas (districts)

Geographically, we see that the drinking water supply problems mainly occur in the Commewijne and Paramaribo areas (see Annexes 4 and 5). In the other areas, sufficient groundwater is available in one or more aquifers for the next centuries. Here MAR is not needed.

In Commewijne, the problem is that around the residential centers along the Commewijne River and the Verbindingsweg, the groundwater in all aquifers is brackish, except around Meerzorg, where the A-sand aquifer contains fresh groundwater. The savanna region and possibly the southern part of the coastal plain in Commewijne contain fresh groundwater, but long distance is hampered by the intervening swamps. The options explored during the HACAS study (RTI, 2016) were: 1) extraction of brackish groundwater through desalination; 2) surface water intake, as is currently done at the La Liberte pumping station; 3) drinking water supply across the bridge from Greater Paramaribo; and 4) finally, groundwater extraction from sand ridges south of Tamanredjo.

For Greater Paramaribo, the growing water demand can be met by conventional abstraction at new pumping stations in the Wanica and Lelydorp districts. This would be sufficient to cover the demand until the end of this century. After that, groundwater reovery in the Saramacca District, west of Uitkijk must be considered, where vast ground reserves have been found (RTI, 2016). Another option is groundwater abstraction from the Zanderij aquifer in the savanna region by means of bank infiltration wells (MAR) along the savannah creeks and the Suriname or Saramacca Rivers.

2.4 With respect to technology

In the coastal plain, where clay layers are at the surface, only well injection as a MAR system is possible. However, well injection is not an attractive technology for Suriname due to the expensive pretreatment and supply of the injection water, as well as the intensive management and maintenance of the wells (see Annex 6).

MAR by means of spreading systems (infiltration ponds and canals) in the savanna and dams in the savanna creeks is also not very efficient. These systems would allow little groundwater storage due to the naturally high groundwater levels.

Rainwater harvesting with underground storage could be an option for industrial or agricultural companies having buildings with large roof surfaces. However, capacities are low. A 50 x 50 m roof would effectively produce about 10 m3/day (0.5 m3/hr)

The most suitable MAR technology for the savanna belt and coastal plain are bank infiltration wells (see Annex 6). Conditional is the hydraulic contact between surface water (creeks and rivers) with the underlying Zanderij aquifer. This situation is found in the savanna region and southern part of the coastal plain. Here marine clay layers (Coropina, Commewijne and Mara Formation) are absent or thin to a degree that rivers and creeks cut into the Zanderij aquifer.

A special case of bank infiltration are the mine lakes of the old Lelydorp II and III mines. These deep lakes have been mined for bauxite and reach the Zanderij aquifer (see Annex 6). Bank infiltration wells into the Zanderij aquifer could be placed around the lake. In fact such wells used to dewater the mine while in operation.

Finally a bank infiltration system could also be realized on a the small elongated sand ridges in the young coastal plain. The thickness of the sand ridge aquifer is only 5 to 10 m. Previous studies showed that these sand ridges contains fresh groundwater. Recharge and storage of these small ridges are very limited, however many of these ridges lie within fresh water swamps. Therefore abstraction (long drain galleries) would be compensated by inflow from these swamps. Capacities depend on the gallery length but will be quite small. These systems could be appropriate as supplementary irrigation for farmers located on these ridges.

3 Potential MAR pilot projects

After considering all the factors, we conclude that bank infiltration systems are the most suitable MAR interventions for the coastal plain and savannah area of Suriname. We propose the following potential MAR pilot projects:

1. Bank infiltration along the Para Creek near Hanover
2. Bank infiltration along the Suriname River near La Simplicite
3. Bank infiltration along the Suriname River near Paranam
4. Bank infiltration along the Saramacca River near Pikin Saron
5. Bank infiltration around the Lelydorp III mine
6. Bank infiltration on a sand ridge in the young coastal plain

The locations of the possible projects are shown in Figures 1 through 3.

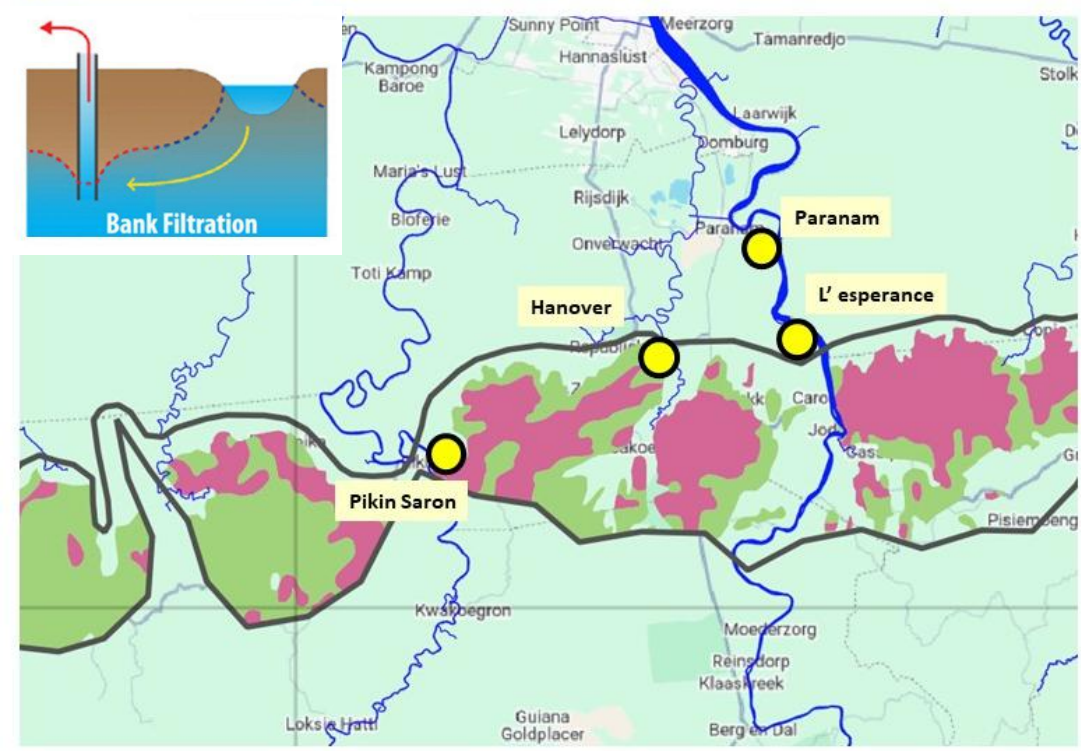

Figure 3-1 Locations of bank infiltration systems in the Para district south of Paramaribo

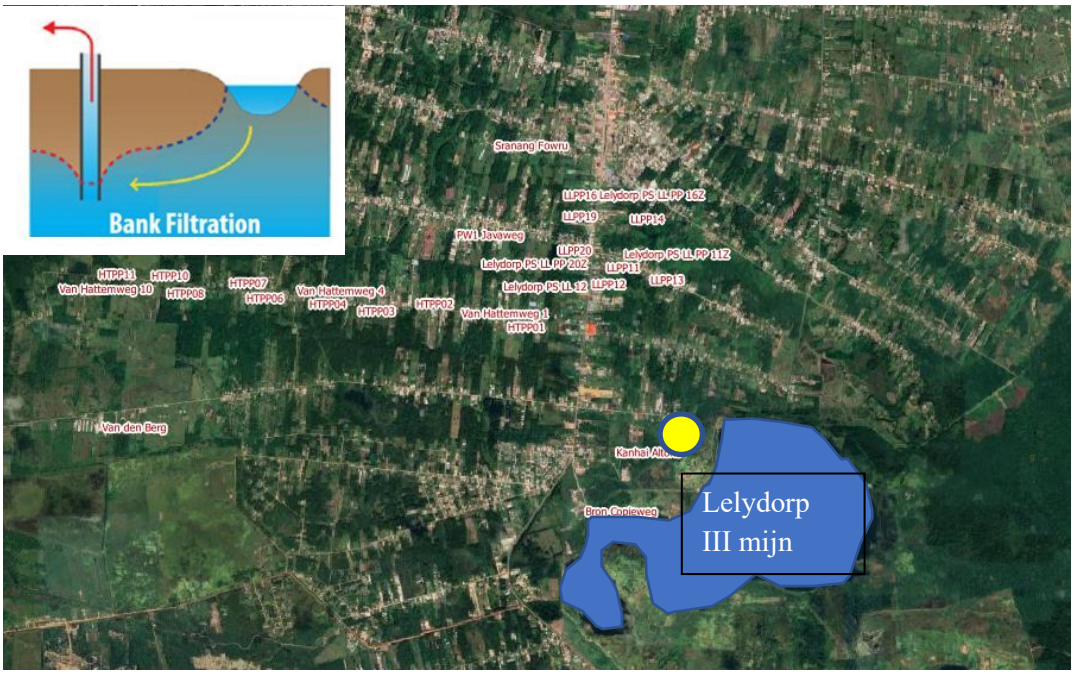

Figure 3-2 Location of bank infiltration system around the Lelydorp II mine lake

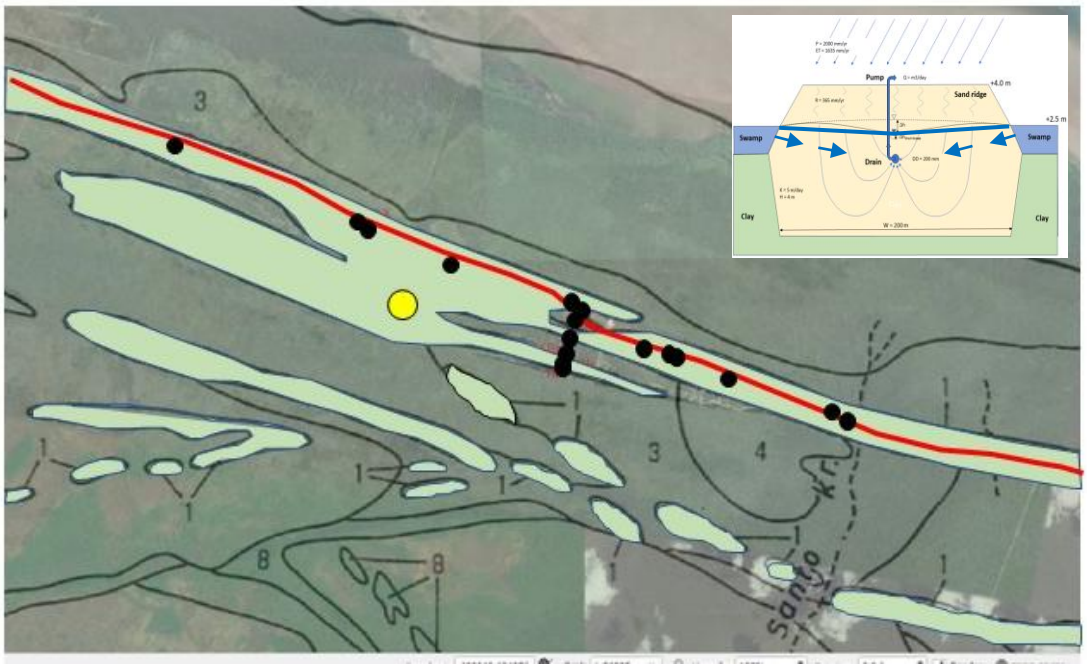

Figure 3-3 Location of an bank infiltration system on a sand ridge in Coronie (between Jenny en Totness). Ligth green are d and shell ridges. Black dots are locations of VES soundings (AdeK University of Suriname, 2023).

After the pilot project has been selected, the next phase III of the ARADIS study will involve further investigation of the hydrogeological situation at the site, and a conceptual design for a MAR system at that site.

4 Colophon

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