Memo

To
Niels de Groot

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Subject
Evaluating different locations for the CRI Pilot

1 Introduction

In this memo we will present the findings of the technical study of the evaluation of different locations for a Creek Ridge Infiltration (CRI) pilot in the Braakman South area. Dow and HZ university of applied science found several interested land owners who are willing to participate in the first stage of the project. In the first stage we will evaluate the suitability of different locations and select the two most promising ones. A combination of different physical characteristics of the subsurface, the practicability of the location, existing infrastructure and the source of fresh water for the pilot are all decisive factors in the evalution of these locations.

1.1 Evaluated Locations

The figure below shows the map of the Braakman South area with the evaluated locations as colored surfaces.

Figure 1-1: Location plots of land from interested land owners.

2 Physical evaluation

2.1 Factors

There are different factors to determine the physical suitability of a location for a CRI pilot. The factors will be explained below. Some factors are essential for a successful CRI pilot, others can affect the efficiency of the system. For each factor a criterion is formulated in brackets below. The ideal location meets all criteria. The criteria are set quite strict in order to find the best location. It should be stated that CRI can be successful if not all criteria are met and that we do not exclude locations based on these criteria.

Factor A: The presence of a sandy elevated creek ridge. (> 1.6 m NAP)

Factor B: The presence of a fresh water lens, the larger the fresh water lens, the higher the chance that CRI is possible. (thickness fresh water lens > 15.0 m)

Factor C: The fresh water lens should be able to grow. In order to grow, there should be sand below the fresh-salt interface. Sediment with a low conductivity (clay or peat) would block the lens from growing. (> 5 meter of sand below the fresh water lens)

Factor D: The sediment which holds the current fresh groundwater should consist of a high percentage of fine to coarse sand. Otherwise, infiltration or extraction of water from that sediment becomes difficult to impossible. (> 70% sand in existing fresh water lens)

Factor E: The top 5 meters of the subsurface should not consist of a thick clay layer. Otherwise, the growth of the fresh water lens could be limited, and the efficiency of the measure would drop. (< 3-meter-thick clay layer in the shallow subsurface)

Factor F: The groundwater level in winter will be increased by CRI. There should be enough space in the unsaturated zone for the growing water level. The acceptable increase of the groundwater level can vary for different land owners. (Thickness unsaturated zone in winter should be > 1 meter)

Factor G: The land should not be within a natural seepage area but within an infiltration area.

2.2 Datasets

In order to evaluate the locations on physical aspects, different datasets were used. The FRESHEM dataset was used to determine the thickness of the freshwater lens. GeoTOP (Stafleu et al., 2012) was used as dataset for the characterization of the subsurface. The AHN3 digital elevation model was used to distinguish elevated areas in the Braakman South region. The results of the Dow TKI study (Mulder et al., 2020) was used to evaluate the locations for infiltration/seepage and the thickness of the unsaturated zone in winter. The cell size of the different datasets varies between 50x50 cm (AHN3) to 100x100 meter (GeoTOP). The datasets can therefor only give a first order estimate on the physical suitability of a location with a resolution of 100x100 meters.

2.3 Results physical evaluation

The figure below shows the area in green where all factors with accompanying criteria are met. The area overlaps different locations. The green area has an erratic pattern. Because of the erratic pattern the figure should be viewed at “fifty thousand foot”. Overall it gives a good first order estimation which locations have the highest potential.

Figure 2-1 Location in green where all criteria of the physical evaluation are met.

3 Field visit

The field visit on the 10th of July gave insight in the practicality of installing a CRI pilot for the different locations. The summary of these findings are:

- Most of the ditches only contain water in winter during peak flow after large precipitation events. So, they are not suitable as a constant source for fresh water. In the summer water in the ditches can be a bit saline. Increasing the stage of the water in certain ditches should therefore be discussed with the waterboard and all stakeholders. This would take time, so finding other sources of fresh water is recommended.

- The canal from Belgium which feeds the Evides Bassins does not always contain water. The water quality is good. If this canal would be used as fresh water source for the CRI pilot, a certain water level should be maintained in the canal to have a constant source of fresh water.

- A possible constant source for fresh water can be found at the corner of the Isabellaweg and the Kruisweg. There is a water inlet to the Isabellakanaal at this location. The average monthly salinity between 2010-2019 of the Isabellakanaal is shown in Figure 3-1. The measurements are taken at the Isabellahaven. The chloride concentration from Januari till March is below 1000 mg/L. From April till December the chloride concentration is > 1000 mg/L. The surface water at the Kruisweg and Isabellaweg should be monitored to find out if this can be used as a constant source of fresh water.

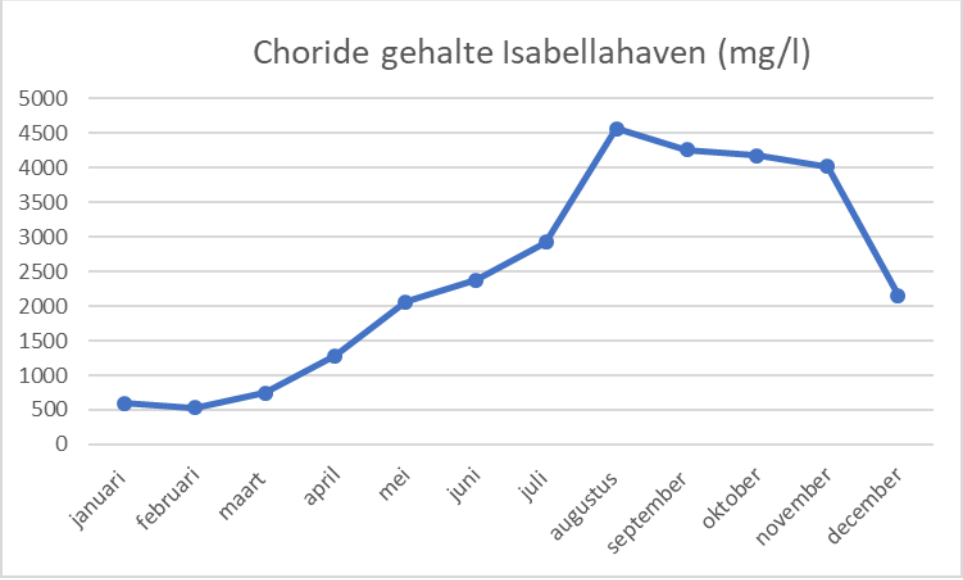

Figure 3-1: Average monthly Salinity development of the surface water near the Isabellahaven. (2010 - 2019)

- Some of the plots directly to the south of a Bassin have a direct connection to the Evides bassin. Using this water for the pilot would be beneficial because there is a constant source and the water quality is good.

4 Select 2 high potential locations

Based on the physical evaluation, the insight gained from contact with land owners and the field visit, 2 locations with high potential for a successful Creek Ridge Infiltration pilot are selected (see Figure 4-1). The locations are marked with a red dashed ellipse.

The location in the North has the benefit that it is close to the Evides Bassin, and thus close to a constant source of fresh water. In order to install a CRI pilot, deepdrains and a controlled drainage system needs to be installed. The disadvantage is that this location does not have deepdrains or a controlled drainage system.

The location in the south already has several deepdrains installed. This could reduce the cost of installing the CRI pilot if they can be integrated in the 1 ha. Pilot. The disadvantage of this location is that the water quality is not constant and varies significantly between months.

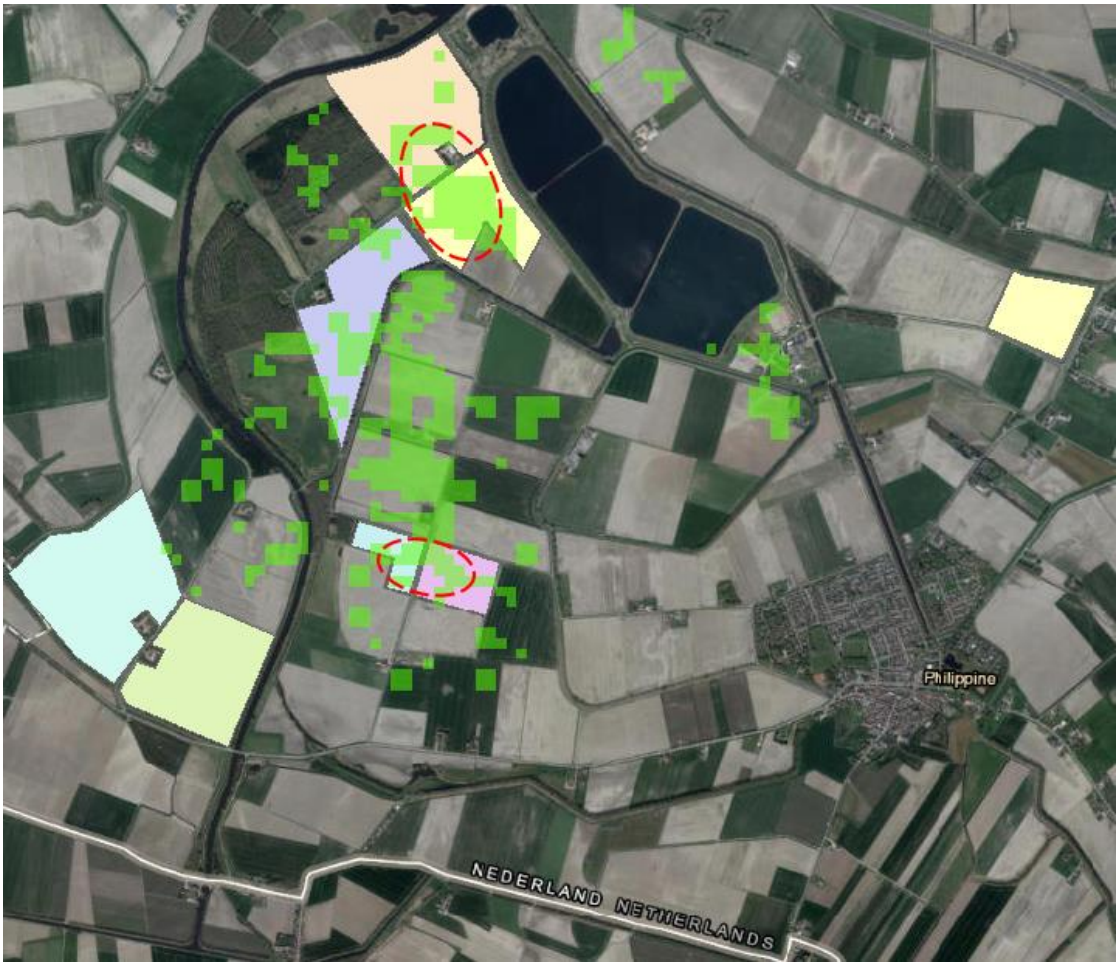

Figure 4-1: 2 selected high potential locations for CRI. The locations are marked by the red dashed circles.