



Identifying optimal locations to install permanent Chinese mitten crab traps in East Flanders

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This bachelor's thesis must be treated confidentially.

Preface

This bachelor's thesis focuses on an evidence-based site selection for the management of the Chinese mitten crab (*Eriocheir sinensis*) in the province of East Flanders. This research was conducted as part of the Environmental and sustainability management program at HOGENT and was completed to obtain the degree of certified environmental coordinator type B.

For three months, I investigated this pressing ecological issue. By utilizing QGIS and adapting a British assessment protocol for the installation of crab traps to the Flemish context, I have identified and mapped the most suitable locations for control measures. With the results of this study, I hope to make a tangible contribution to the management of this invasive alien species, both in Flanders and abroad.

I would like to express my gratitude to the individuals who supported and advised me throughout this process:

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Abstract

The Chinese mitten crab is a widespread invasive alien species. To mitigate its impacts, effective management measures, such as the deployment of permanent traps, are essential. To date, however, an objective method for selecting sites for this costly infrastructure has been lacking. This study aims to objectify the site selection process by systematically evaluating potential locations using an assessment protocol to prioritize the most suitable sites.

A two-tiered approach was implemented for this purpose. First, a macro-level analysis was conducted through data acquisition, a GIS analysis, and the use of a decision tree. The resulting locations were subsequently validated using the assessment protocol to evaluate their local suitability on-site.

The evaluation yielded locations with varying scores. Two sites achieved the maximum 'A' score, indicating they theoretically offer the highest potential for installing permanent traps in the future. No critically poor locations were identified, with a 'C' score being the lowest recorded. This indicates that the pre-study serves as a reliable initial filter. Nevertheless, the field evaluations exposed several contradictions and redundancies within the protocol, particularly regarding parameters such as flow velocity, permitting procedures, and private property access.

In conclusion, combining a GIS pre-study with the (originally British) assessment protocol proves to be an effective methodology for site selection, given that no truly poor locations were identified. Provided that minor adjustments are made to align the protocol with the Flemish context, this workflow offers a good framework. Through this approach, poor site-selection can be avoided, and investments can be made where they are effectively needed.

Glossary

Term	Explanation
Estuary	“An estuary is a partially enclosed coastal body of water that is either permanently or periodically open to the sea and which receives at least periodic discharge from a river(s), and thus, while its salinity is typically less than that of natural sea water and varies temporally and along its length, it can become hypersaline in regions when evaporative water loss is high and freshwater and tidal inputs are negligible” (Potter et al., 2010, para. 1)
Juvenile	Individual that has not yet reached sexual maturity
Setae	Hair-like structures
Carapace	Protective upper shell or armour
Catadromous species	Species that spawn in saltwater and migrate to freshwater to grow up (Zydlowski & Wilkie, 2012)
Abdominal pleopods	An appendage attached to an abdominal segment (Ingle, 1983)
Detritus	Non-living organic material
Riparian vegetation	Plant life existing along riverbanks (Dufour et al., 2019)
Chelae	The claws
Olfactory stimuli	Chemical information that triggers the sense of smell (Islam & Lim, 2022)

List of abbreviations

Abbreviation	Explanation
SSI	Site Suitability Index
ANB	Agentschap Natuur en Bos / Agency for Nature and Forests
INBO	Instituut voor Natuur- en Bosonderzoek / Research Institute for Nature and Forest
GBIF	Global Biodiversity Information Facility
QGIS	Quantum Geographic Information System
IAS	Invasive Alien Species
VMM	Vlaamse Milieumaatschappij / Flemish Environment Agency
VEN	Vlaams Ecologisch Netwerk / Flemish Ecological Network
SBZ	Speciale Beschermingszone / Special Area of Conservation
PCM	Provinciaal Centrum voor Milieuonderzoek / Provincial Centre for Environmental Research

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1. Introduction

1.1 Problem statement and research objective

The Chinese mitten crab (*Eriocheir sinensis*) has managed to establish itself in Flanders over the course of nearly a century (Dittel & Epifanio, 2009). For several years, the Province of East Flanders has been a partner in the European Interreg project CLANCY (Interreg North Sea, 2026a), which focuses on the monitoring and management of this invasive alien species (Interreg North Sea, 2026b).

To minimize local nuisance caused by the crab species, the Province utilizes the so-called 'return crab trench'. Currently, the Province manages three permanent traps located in Merelbeke, Afsnee, and Destelbergen. Previous research by Tamisaft (2025) and Verdievel (2024) demonstrated that the configuration of these trenches has a significant impact and is highly effective. This is why the Province aims to expand the number of locations equipped with a permanent trap.

However, the effectiveness is not consistent across all locations. The trap in Afsnee initially captured a large number of crabs but has remained empty in recent months. In contrast, the trap in Merelbeke, where very large quantities are caught every year during the migration period.

This study seeks to further contribute to the management of the crab species by researching new suitable locations through the application of a British assessment protocol that has not yet been applied in Flanders.

1.2 Research questions

This bachelor's thesis aims to provide an answer to the following research question:

- What are the most suitable locations in the province of East Flanders for the installation of permanent crab traps to manage the Chinese mitten crab population?

To address the primary research question, we subdivide this question into the following sub-questions:

- At which locations are high population densities observed, and where is nuisance (in relation to humans) most likely to occur?
- To what extent are the sites where a permanent trap is currently installed considered suitable?
- Which locations in East Flanders are potentially suitable for the future installation of a permanent crab trap, based on a British assessment protocol?
- What is the feasibility of applying this protocol within a Flemish context?

1.3 Research approach

This research is structured into several phases to provide comprehensive advice for the province of East Flanders. First, a literature review maps the ecological and economic impact of the Chinese mitten crab, its distribution within Flanders (based on existing databases) and the current management options. This serves to frame the challenges related to the species and to highlight the urgency of management.

Subsequently, the methodology chapter describes the steps taken to address the research questions. The focus here lies on applying a decision tree to find suitable locations to install a trap and the use of a more detailed British assessment protocol to assess the feasibility of installing these traps in the Flemish context. Both are employed to achieve a selection of suitable locations for the installation of new permanent traps.

The collected data and the evaluation of these sites are presented in the results section. The bachelor's thesis concludes with a series of policy recommendations for the future management of this invasive alien species within the province of East Flanders.

2. Literature review

2.1 Invasive alien species

Belgium is home to both native and alien plant and animal species. Native species are organisms that have occurred naturally in our region for centuries without human intervention (Ecopedia, 2026c). Alien species, on the other hand, have been introduced by human activity into an area outside their original natural range (Ecopedia, 2026b).

In most cases, these alien species do not cause ecological problems. Often, they cannot survive in this climate, or they integrate into the ecosystem without causing harm, such as the oriental poppy (*Papaver orientale*) (Ecopedia, 2026b).

However, when an alien species successfully establishes itself and has a negative impact, it is referred to as an invasive alien species (IAS). These species cause damage to the local fauna and flora, well-known examples include the Japanese knotweed (*Fallopia japonica*) and the black cherry (*Prunus serotina*) (Ecopedia, 2026b).

The Chinese mitten crab (*Eriocheir sinensis*) is an invasive alien species that has established itself very successfully in Belgium and its surrounding regions (Dittel & Epifanio, 2009). Its impact manifests in several ways, including burrowing damage to banks and the destruction of aquatic vegetation. Additionally, the crab causes significant turbidity in the water column through bioturbation. This is the process by which the crab, through its burrowing and foraging activities, disturbs the riverbed, causing sediment particles to be suspended in the water and leading to a decline in water quality. Finally, predation on native species poses a direct threat to local biodiversity.

2.2 Regulatory framework regarding invasive alien species

Policy regarding the Chinese mitten crab is primarily established at the European level. The cornerstone of this framework is the IAS Regulation (Regulation (EU) No 1143/2014) on the prevention and management of the introduction and spread of Invasive Alien Species (IAS) (European Commission, 2026). They are defined as species that are introduced outside their natural range and pose a threat to biodiversity and ecosystems. The central element of this regulation is the Union list. Species included on this list are subject to strict restrictions concerning import, trade, possession, and release into the environment.

The initial Union List came into effect on August 3, 2016, and is updated periodically. The Chinese mitten crab was included in the very first version. The European regulation operates on three management levels:

1. Prevention to avoid unwanted introduction.
2. Early detection and rapid eradication.
3. Management of widely established species.

In the case of the Chinese mitten crab, the focus is clearly on the third level since its already widespread. Consequently, the strategy focuses on maximizing control and mitigating local nuisance.

At the Flemish level, the Species decree of May 15, 2009 (specifically Chapter 4) provides the legal basis for managing invasive alien species (Het Soortenbesluit, 2009). The restrictions from the European regulation have been incorporated into this decree.

The management of the mitten crab is considered a shared responsibility between (local) authorities and landowners. To support them, the Agency for Nature and Forests (ANB) and INBO published a manual in 2017 to provide a practical framework for local action (Agentschap Natuur & Bos & Instituut voor Natuur- en Bosonderzoek, 2017).

2.3 The Chinese mitten crab

2.3.1 Origin

The Chinese mitten crab (*Eriocheir sinensis*) is native to East Asia, where the species lives in tidal rivers, estuaries, and coastal areas (Dittel & Epifanio, 2009). At the beginning of the twentieth century (1912), the species was probably introduced to Europe via the ballast water of ships, although there is no complete certainty regarding this. The species' rapid dispersal through Europe was facilitated by its early life stage as juveniles, in which it can easily cover large distances in a short time period by drifting with the current (Ecopedia, 2026a). Additionally, the crab's ability to survive out of water for a limited time allowed it to bypass physical obstacles along its route.

In 1933, the Chinese mitten crab was first sighted in Belgium, near Antwerp (Ecopedia, 2026a). Since then, the population has experienced a strong rise in Flanders. However, that rise came to an end in the 1950s (Agentschap Natuur & Bos, Instituut voor Natuur- & Bosonderzoek, 2017). Due to the poor water quality in Flanders, the species had almost completely disappeared. After that period, the crab was able to re-establish itself due to improved water quality. Meanwhile, the species can be found spread throughout Flanders (Figure 1), although populations are most densely concentrated around the Scheldt and its tributaries (Ecopedia, 2026a).

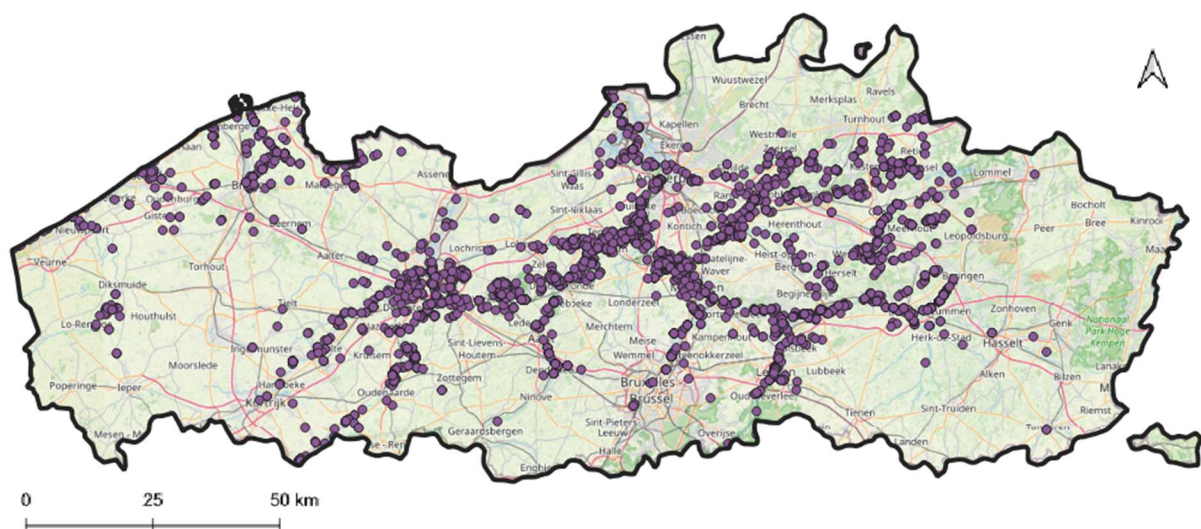


Figure 1 Map with current Chinese mitten crab distribution in Flanders 2016-2026 (occurrence data: GBIF, 2026a)

2.3.2 Morphological characteristics

The Chinese mitten crab (Figure 2) possesses several external characteristics that make the species easy to distinguish from other crab species. As the name suggests, there are hair-like structures on the claws, known as setae (Keirsebelik, 2025). These setae function as a microhabitat for small organisms, also called epibionts. In this way, the crab can play a significant role in the transport of these small organisms between different regions (Normant et al., 2007).



Figure 2 Chinese mitten crab (Van Dijk, 2024)

Aside from their role as a microhabitat, there is to date no conclusive answer to the question of the biological purpose of these setae (Keirsebelik, 2025). However, several hypotheses exist: a sensory role, sexual selection (where males with the most developed setae are preferred during mating) (Kobayashi & Satake, 2017), or the creation of a visual illusion for protection against predation. Under water, the hairs ensure that the crab appears larger than it actually is.

The side of the carapace, as well as the front between the eyes, features four pointed protrusions (Keirsebelik, 2025). This carapace can reach a width of up to 10 cm, although the average is around 8 cm. The carapace generally has an olive-green to brown color.

While the Chinese mitten crab is the most dominant species in Europe, recent research indicates a significant presence of Japanese mitten crab (*Eriocheir japonica*) genetic traits in Belgian waters (Homberger et al., 2022). Since 1998, a specific genetic marker of the Japanese mitten crab has been identified in populations within the Scheldt river basin and near Ostend. This marker acts as a biological barcode that is inherited exclusively from the mother.

The presence of these traits is the result of introgression, a process where the two species have interbred so frequently over many generations that the genetic material of the Japanese mitten crab has become a permanent part of the local Chinese mitten crab population (Homberger et al., 2022). This has significant implications for morphological identification: while adult

specimens are externally indistinguishable from *E. sinensis*, juvenile crabs in Belgium more frequently exhibit hybrid characteristics. For instance, these individuals often possess a more rounded infraorbital region (the area below the eyes) and less pronounced spines on the side of the carapace compared to 'pure' populations.

From above, the distinction between male and female Chinese mitten crabs is difficult to observe. The most reliable method for identification is examining the abdomen (Figure 2). In males, the abdomen is narrow and tapers to a point in a triangular-like shape. The female abdomen is wide and rounded, covering most of the ventral surface and is used for carrying eggs.

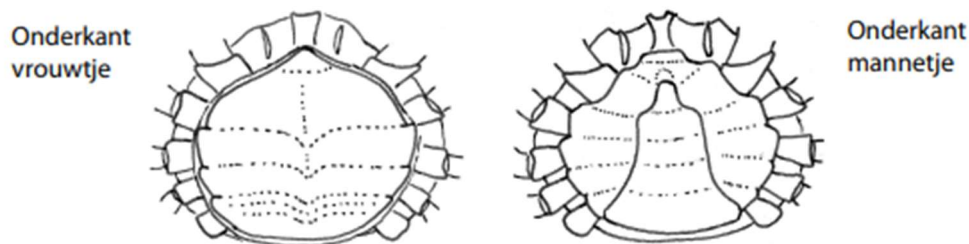


Figure 3 Ventral side of the carapace showing the distinction between female (left) and male (right) (INBO et al., s.d.)

2.3.3 Life cycle

The Chinese mitten crab is a catadromous species (Keirsebelik, 2025). This means that it spends the majority of its life in freshwater but migrates to saltwater to reproduce. Consequently, the crab's life cycle (Figure 4) consists of two major migrations between these two environments. Mating is preceded by agonistic behavior with mate recognition occurring only after direct physical contact and not via long-distance pheromones (Herborg, 2006).

After mating, the eggs are typically laid within 24 hours (Keirsebelik, 2025). These are attached to the abdominal pleopods (swimmerets), and between 20,000 and 1 million eggs can be produced per brood (Anastácio et al. 2018). This number depends heavily on various factors, such as environmental conditions, the size of the female, and the number of broods she produces. Egg-bearing females (Figure 5) are observed between October and June, with temperature variations likely being the cause of this timing. In the early stages, immediately after the eggs are laid, temperature and salinity also have a significant influence on development. After reproduction, the adult crabs have reached their biological goal and die.

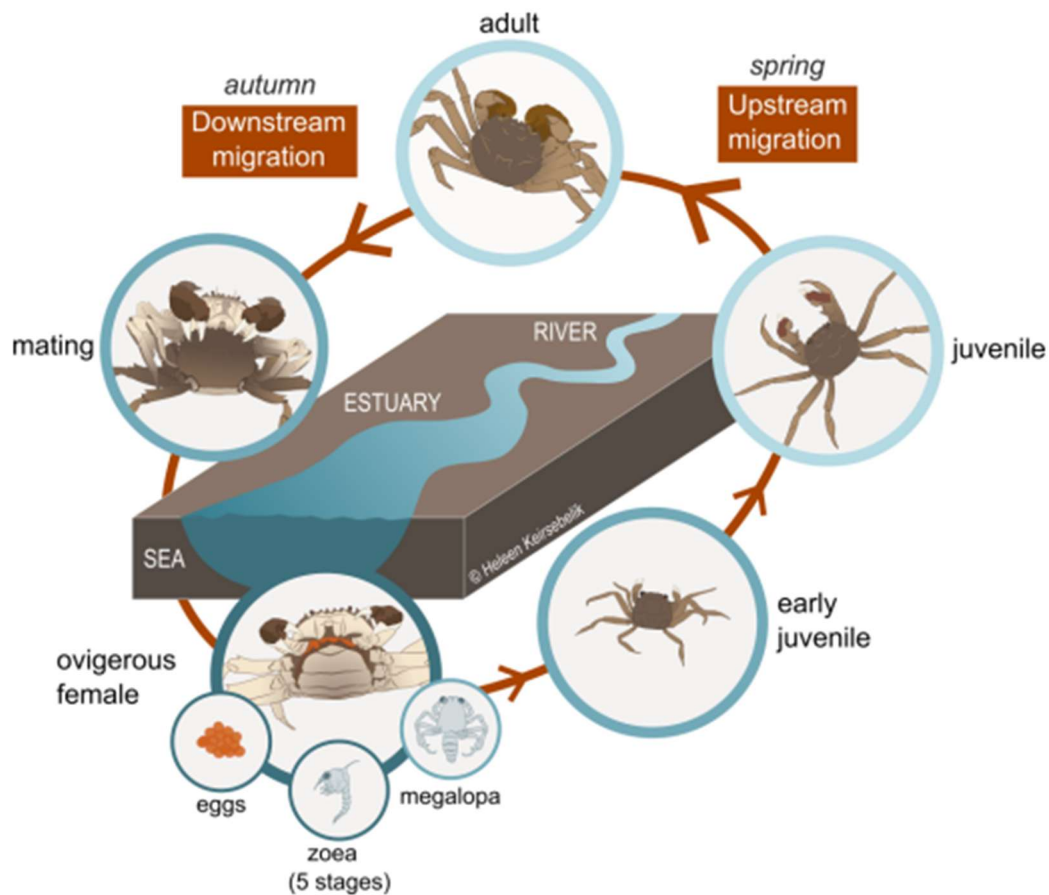


Figure 4 Life cycle of the Chinese mitten crab (Keirsebelik, 2025)

In the spring, the larvae hatch in brackish water. Optimal development occurs at water temperatures between 15 °C and 18 °C (Anger, 1991). Once the larvae have survived the first stage, they transform into young crabs, also known as juveniles. Young juveniles use the current to move. Once they are larger, they possess sufficient strength to move against the current on their own (Keirsebelik, 2025). They seek out a freshwater habitat to establish themselves and reach maturity. Once mature, they begin the return migration, after which the cycle repeats for the newly hatched crabs. On average, it takes a crab one to six years to complete the full life cycle (Hymanson et al., 1999).



Figure 5 An ovigerous Chinese mitten crab (Clarck, 2011)

2.3.4 Impact

The Chinese mitten crab exerts a significant impact across various domains (Keirsebelik, 2025). Since there are no native catadromous crab species in Flanders, it occupies a unique ecological niche within these aquatic systems.

The species consumes large quantities of detritus, which can be defined as dead organic matter derived from plants and animals (Keirsebelik, 2025). This detritus primarily consists of terrestrial leaf litter. The mitten crab consumes this material at a significantly higher rate than native species and also processes riparian vegetation (Doherty-Bone, 2018). Through the rapid conversion of this plant material into fine organic matter, the species can influence nutrient availability within the ecosystem (Rudnick & Resh, 2005). This may lead to a restructuring of the entire benthic food web, which is the complex network of feeding relationships between organisms living on or in the riverbed.

There is a direct correlation between the density of Chinese mitten crab populations and the decline of aquatic vegetation (Schoelynck et al., 2020). Increased crab presence accelerates the disappearance of these plants. Notably, this decline is not primarily caused by the crabs using vegetation as a food source, as herbivory does not result in significant structural damage. Instead, the primary cause of degradation is mechanical damage resulting from their movement and intraspecific interactions. During these activities, the crabs grasp and clip the plant shoots with their chelae, leading to substantial destruction of the vegetation.

Experimental evidence has shown that a density of 0.3 crabs/ m^2 , in combination with light limitation or chemical stress, represents a threshold at which a vegetation patch can be entirely eliminated within just 25 days (Schoelynck et al., 2020). Notably, as this was not a field study, various environmental variables could influence this threshold in a natural setting. Furthermore, since the experiment utilized crabs of a similar size class, results may vary when considering younger or older individuals. Nevertheless, these findings demonstrate that the Chinese mitten crab can have a severe impact on aquatic vegetation.

Another significant observation is the hindered ability of vegetation to recover after being destroyed by the crabs (Schoelynck et al., 2020). Even under restored optimal conditions, regrowth remained inhibited. This is likely due to the crabs' chelae damaging the root systems during their activities. This suggests a 'hysteresis effect,' meaning the crab density threshold required for vegetation recovery is likely much lower than the threshold that caused the initial destruction.

In a laboratory setting, Webster et al. (2015) simulated the feeding behaviour of the Chinese mitten crab toward fish eggs. The study utilized both male and female individuals, primarily sub-adults with a carapace width ranging from 13.8 to 39.1 mm. Four types of eggs were tested: Zebrafish, Lumpfish, Trout, and Pacific Salmon. They represent a diverse range of marine and freshwater species with varying egg diameters.

Among the eggs tested, Zebrafish eggs were the least preferred (Webster et al., 2015). A primary reason for this may be their small size, which results in several consequences. First, the smaller sized eggs lead to a lower encounter rate for the crabs. Second, these eggs are more difficult to manipulate, particularly for larger individuals. Capturing such small prey requires fine muscular movements, often necessitating multiple attempts. Consequently, the net energy gain from consuming Zebrafish eggs is significantly lower, making them a less efficient food source.

In contrast, a broader range of carapace widths was observed among crabs consuming larger eggs (Webster et al., 2015). This trend is likely due to the increased ease of handling associated with larger prey. Furthermore, the higher nutritional value of these eggs makes them more attractive to both small and large individuals. Unlike the smaller Zebrafish eggs, larger eggs represent a more efficient trade-off between energy expenditure and nutrient intake, especially for larger crabs.

In addition to size, other variables likely influenced egg preference (Webster et al., 2015). Factors such as transparency, variations in olfactory stimuli, chemical composition, and nutritional content may all have played a role. However, the impact of some factors, such as transparency, was likely negligible. While smaller eggs are inherently less visible, this is of minor importance as crabs primarily rely on other senses, such as tactile cues, to detect their prey.

It is important to note that these results were obtained in a laboratory environment, and real-world conditions may differ. For instance, many fish species employ defensive strategies, such as hiding their eggs within substrates, which can limit predation (Webster et al., 2015). Furthermore, the likelihood of the Chinese mitten crab causing direct physical harm to healthy, adult fish is considered low. Rudnick et al. (2000) conducted experiments where crabs and fish were co-housed in the same tank and observed no physical injuries to the fish.

In addition to their foraging and predatory behavior, Chinese mitten crabs have a tendency to burrow (Veldhuizen, 2001). Primarily young specimens dig burrows to protect themselves during low tide, particularly in tidal areas (Keirsebelik, 2025). The density of these burrows can reach up to 80 units per m². It is suspected that this behavior promotes erosion and decreases the stability of riverbanks.

Furthermore, the species has a direct impact on human activities, with the fishing industry in particular experiencing significant hindrance (Keirsebelik, 2025). During peak migration periods, fishing nets often become saturated with crabs, leading to damage to both the nets and the catch. This results in a decline in both the quantity and quality of the fish caught. Recreational fishers also experience problems with crabs stealing bait or damaging fishing lines (Houck, 2023).

Finally, crabs sometimes leave the water during migration to bypass obstacles on the riverbed. This behavior can lead to significant public nuisance as the crabs can move through urban or residential areas. A well-known incident occurred in 2016 in Aarschot (Mertens, 2016), where a large population of crabs crawled out of the Demer. The animals climbed the walls of a hotel, with specimens even being spotted in hotel rooms. While the nuisance is usually limited to individual crabs in gardens, large numbers during the migration period can cause considerable disruption. Moreover, specimens that die on land cause significant odor nuisance.

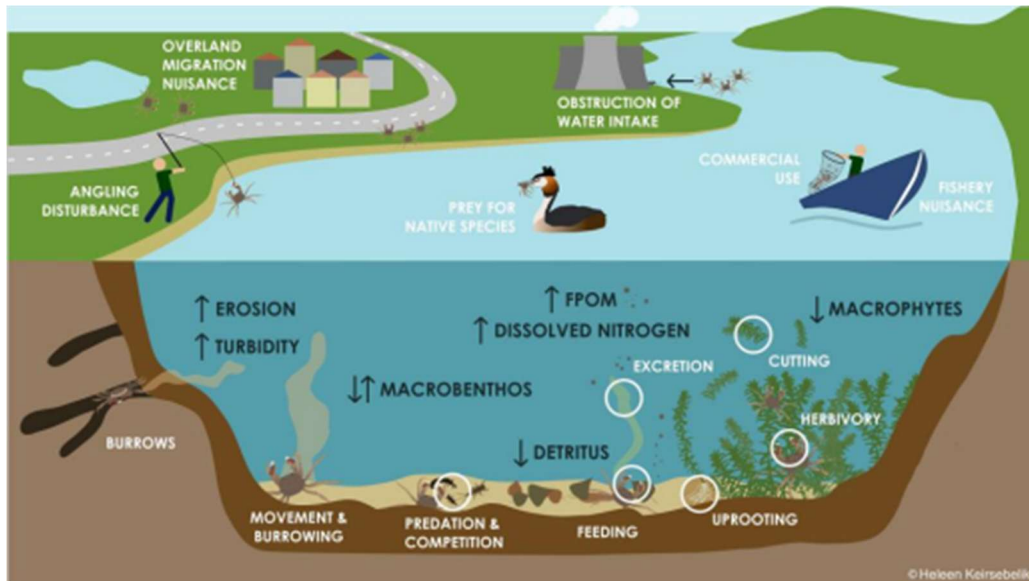


Figure 6 Visualization of the nuisance that the crabs can cause (Keirsebelik et al., 2025)

2.3.5 Management of the Chinese mitten crab

The Chinese mitten crab is featured on the list of '100 of the World's Worst Invasive Alien Species' (Ewers et al., 2023), and its impact is felt across many European countries. Generally, various methods exist for monitoring and managing these crab populations. Firstly, traps or cages can be deployed (Keirsebelik, 2025). These are easy to use and suitable for most locations. Crabs can also be caught using trawling nets at their breeding grounds (Rudnick et al., 2000). However, the major disadvantage of these methods is the inconsistent catch efficiency and the lack of selectivity. Consequently, they are not recommended for large-scale management.

In addition to trapping, several smaller-scale interventions can hinder the dispersal of the Chinese mitten crab. Installing smooth barriers (made of plastic or metal) along riverbanks can prevent crabs from leaving the water and spreading overland in areas where they cause a nuisance (D'hondt et al., 2021). Furthermore, raising public awareness is essential, and collaborating with local fishermen can provide valuable insights and assistance (Hänfling et al., 2011). Finally, legislation plays a key role. Supplementary to the regulations discussed in Section 2.2, the International Maritime Organization (IMO) introduced the Ballast Water Management Convention (IMO, 2004). This convention came into force in 2017 and aims to prevent the introduction of novel organisms through ballast water.

Given the widespread distribution of the species in Flanders, total eradication of the Chinese mitten crab is no longer feasible. Consequently, management strategies have shifted toward mitigating local nuisance. A key instrument in this approach is the permanent crab trap. The Province of East Flanders utilizes a so-called 'return crab trench' (Provincie Oost-Vlaanderen, 2021). This system has already been implemented on the Melsenbeek in Merelbeke, the Rosdambeek in Afsnee, and the Rietveldbeek in Destelbergen (Figure 7).

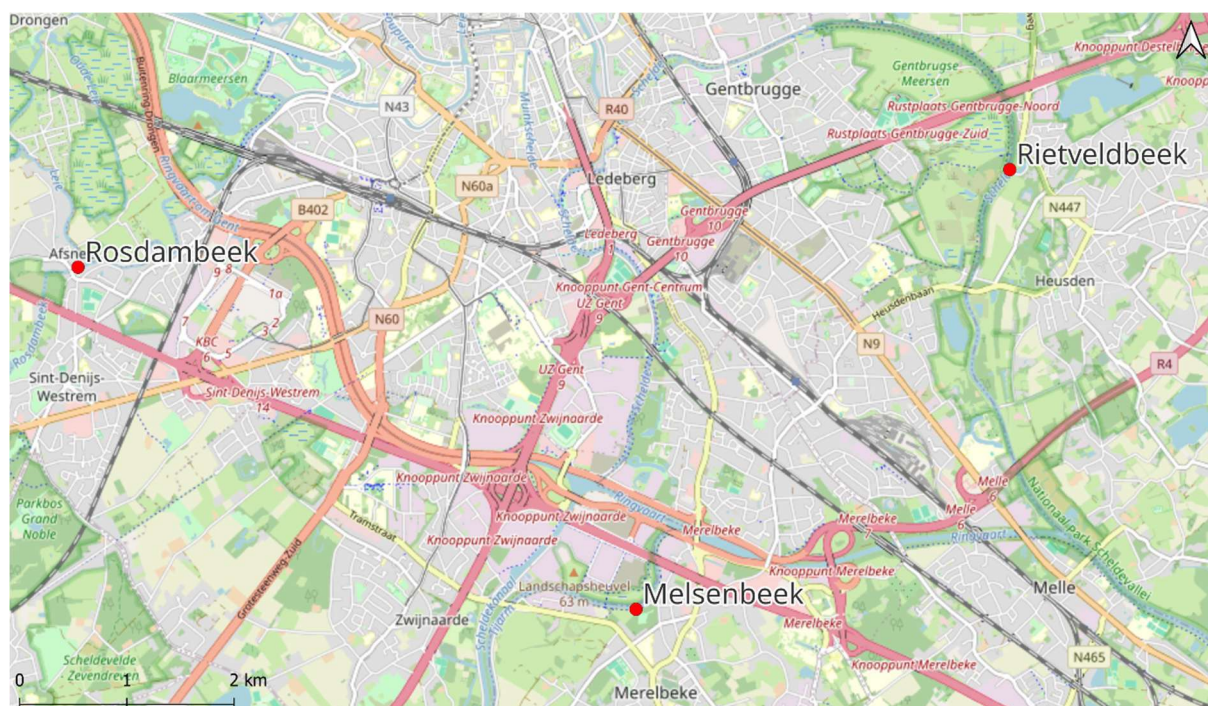


Figure 7 Overview of the current active permanent crab traps managed by the province of East Flanders

The operation of this system is based on a collection trench positioned perpendicular to the current on the bed of the watercourse. Since the Chinese mitten crab moves exclusively along the riverbed and is unable to swim, individuals end up in this trench. Subsequently, the crabs are directed toward the bank, where a piping system routes them 'back' to their original watercourse (Figure 8). For monitoring purposes, this return process can be intercepted. By placing a collection container, crabs can be harvested for further analysis (Figure 9), such as determining weight and carapace width.



Figure 8 Return crab trap on the Melsenbeek (Provincie Oost-Vlaanderen, 2021)

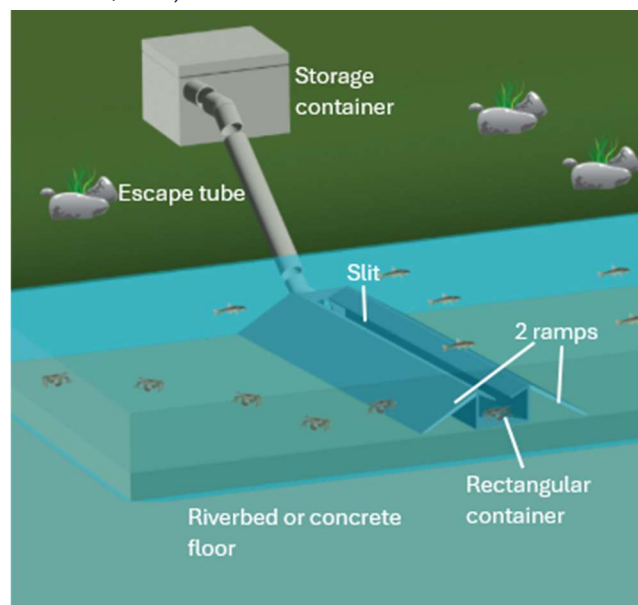


Figure 9 Schematic representation of a permanent crab trap (Interreg North Sea, 2026b)

From the individuals collected in the catchment container, a representative subsample is taken for the previously mentioned analysis. The remaining crabs are weighed on-site to estimate the total population size within that specific catch period, based on the total biomass weight. After on-site weighing, the crabs are released back in front of the installation. This allows the individuals to resume their natural migratory behaviour. They may once again follow the original upstream route, potentially facing re-interception by the system, or they may opt for an

alternative route via the Scheldt (as is the case at the Merelbeke site). In this manner, the crab trenches serve as a strategic instrument to protect ecologically sensitive upstream waterways from the invasive pressure of the Chinese mitten crab.

2.3.6 Project Clancy

The CLANCY project is a collaboration between eight institutions from Belgium, France, Germany, and Sweden (Interreg North Sea, 2026a). Belgium is represented by three partners contributing to the project: the Flemish Environment Agency (VMM), the University of Antwerp, and the Province of East Flanders. Together with the international partners, the objective is to test capture and management strategies that could be implemented at a European level in the future.

3. Methodology

This research follows a non-linear approach in which data acquisition, GIS analysis, and decision tree logic operate simultaneously. Rather than a series of sequential steps, the decision tree provides the framework, while the GIS environment spatially tests these criteria against the current situation in East Flanders.

The methodology utilizes a 'funneling' principle, shifting the focus from a broad provincial screening to a site-specific evaluation (Figure 10). Following the initial selection via GIS and the decision tree, a twofold validation phase is conducted. This involves testing the reproducibility of the method and evaluating its predictive power using historical catch data from the three existing traps. Finally, the British protocol (Section 3.2) will be applied. This protocol provides an objective method for assessing the suitability of potential locations. It serves as a fine filter to map the ecological and technical parameters on-site and to assess a location for its suitability for installation of a permanent trap. This combination of data processing and practical field validation provides a validated foundation for the final prioritization of new trap locations.

During the site assessment, the applicability of the British protocol within the Flemish context is critically evaluated. This evaluation examines whether specific criteria require adjustment, or if certain parameters are redundant or missing when applied to the regional context. Furthermore, assessing the current locations allows for a validation of the protocol's reliability. Since the empirical catch data for these specific sites are already known, clear theoretical expectations can be established regarding their projected suitability scores. Whether or not these predicted scores align with reality provides valuable insights into the strengths and limitations of the selection tool.

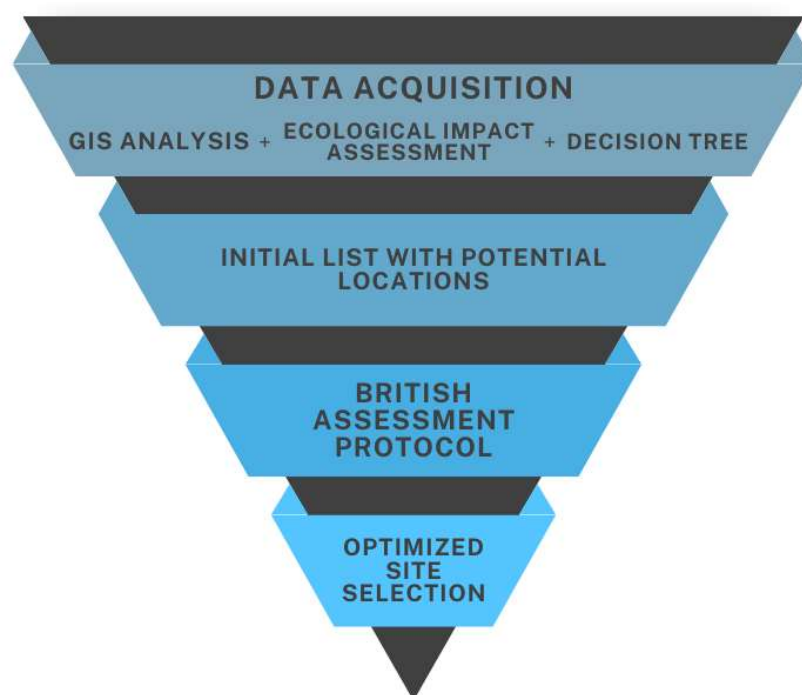


Figure 10 Schematic representation of the research methodology

3.1 Spatial analysis and site selection

3.1.1 Data acquisition

The 'Datavindplaats Vlaanderen' portal

Datavindplaats Vlaanderen is a central portal that provides a comprehensive range of open-access data, spanning categories such as education, transport, and the environment (Vlaanderen, s.d.). The platform ensures data accessibility and reliability, allowing users to apply information in a consistent manner. By centralizing these resources, the portal facilitates access to verified datasets for all users. For this study, several datasets were sourced from this platform and incorporated as layers into the GIS analysis.

GBIF

The Global Biodiversity Information Facility (GBIF) is an international data infrastructure whose primary objective is to provide open access to biodiversity data worldwide (GBIF, 2026b). This database encompasses all life forms, ranging from fungi to plants and animals. The information integrated into the platform originates from diverse sources, including historical museum specimens, modern scientific datasets, and recent photographs from citizen science initiatives. All data are brought together using Darwin Core, a common language for biodiversity data that ensures observations from different sources can be easily exchanged and compared. Data from 'Waarnemingen.be' are integrated into the GBIF database and are thus included in the dataset used for this study. This standardized framework forms the essential basis for the GBIF index.

To ensure the relevance of this study, the data extracted from the GBIF index has been filtered based on geographical and temporal parameter (GBIF, 2026a). The scope of the study is limited to the province of East Flanders. To prevent the results from being outdated, the data have been filtered to cover the past ten years (2016-2026).

Waterinfo platform

Waterinfo is a platform managed by the Flemish government that consolidates various data regarding Flemish watercourses (Waterinfo, 2026). The website provides information on a wide range of topics, including flooding, tides, water quality, and water levels.

For the purpose of this study, the website is specifically utilized to analyse water levels. At the locations where the protocol is applied, historical water levels are examined to identify potential major seasonal fluctuations. Naturally, this analysis is limited to locations where a monitoring station is available.

3.1.2 GIS analysis

To visualize and analyse the collected data, the Quantum Geographic Information System (QGIS version 3.40.15-Bratislava) is used. QGIS is an open-source GIS application that enables the integration and analysis of different data layers and analyses spatial relationships (QGIS, s.d.).

This software was utilized during the desk study phase, primarily to implement the decision tree and generate an initial shortlist of potential locations. After having a pre-selection of potential locations for the installation of a crab trap these sites were subsequently evaluated using the British assessment protocol. In QGIS, a map of East Flanders was created (Figure 11), incorporating several data layers:

- Crab occurrences: This layer contains occurrence data (period: 2016-2026) downloaded from GBIF (GBIF, 2026a), visualized using point displacement or proportional symbols. The size of each point represents the density of recorded sightings at that specific location.
- Aquatic vegetation (source: VMM monitoring of aquatic vegetation): This dataset indicates the presence and density of aquatic vegetation within waterways. The data is categorized by coverage levels, ranging from absent or sparse to submerged vegetation occupying most or all of the water column. Per monitoring site, the most recent data is used.
- VEN and BWK (Vlaanderen, 2015b): This layer identifies areas designated as VEN (Flemish Ecological Network) and includes data from the BWK (Biological Valuation Map). The BWK data was filtered to display only areas classified as 'valuable' to 'highly valuable'.
- Target fish species (Source: GBIF): This layer shows observations of fish species listed under Annex II of the Habitats Directive (period: 2016-2026). These species were included because crab predation on fish eggs may pose a significant threat to their populations.
- Hydraulic structures (Vlaanderen, s.d.): This layer maps infrastructure such as locks, pumping stations, and weirs. These sites are critical as crabs may become trapped or emerge from the water here, potentially causing nuisance or infrastructure blockages.
- Waterways (Vlaanderen, 2016c): A layer representing all waterways managed by the Province of East Flanders. These layers correspond to the three primary criteria of the decision tree: crab presence, ecological value, and nuisance potential. By overlaying these datasets, 'hotspots' were identified, highlighting the most suitable locations for further assessment.

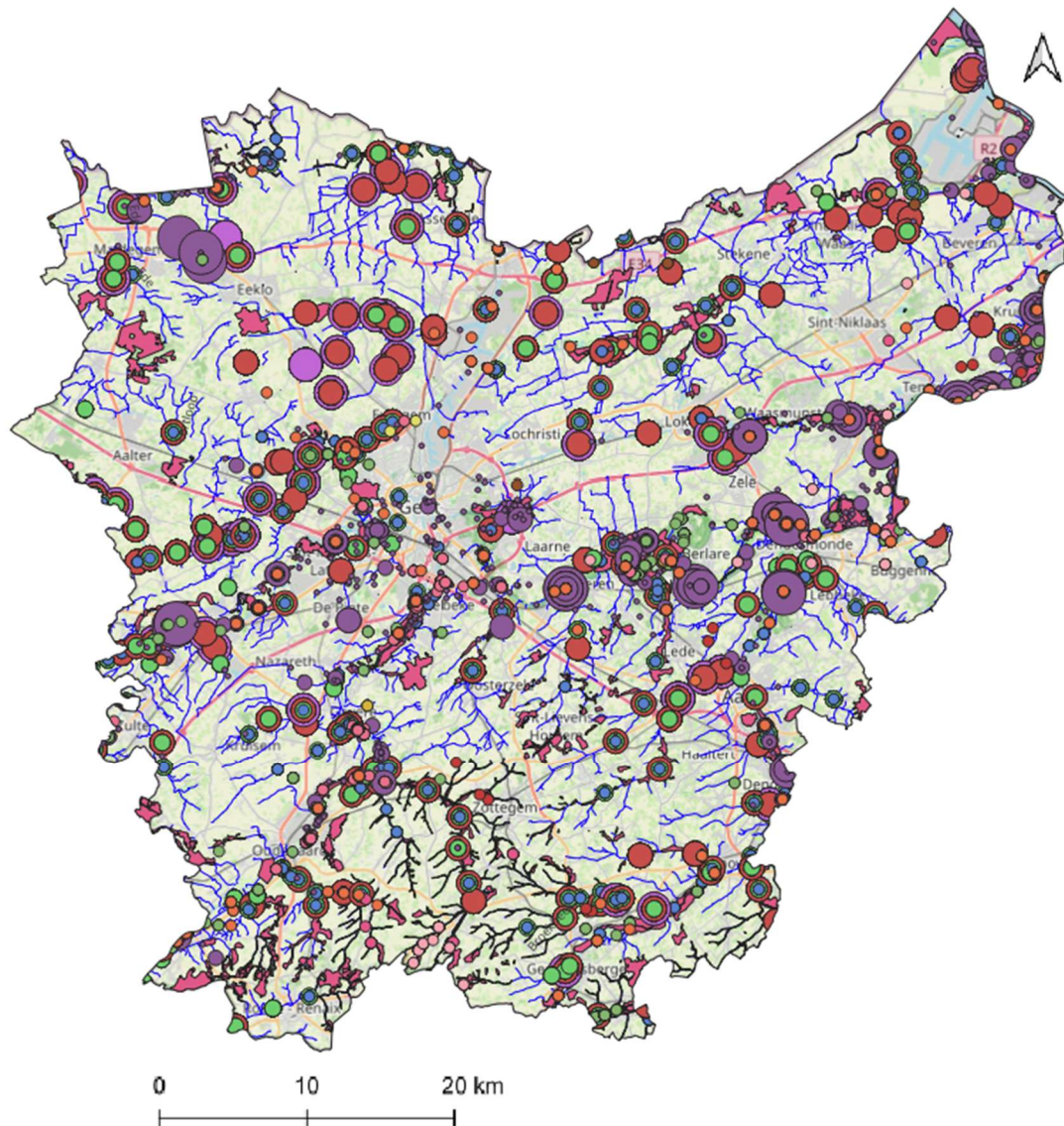


Figure 11 Map of East Flanders with all different data layers activated (BWK is not activated for maintaining clarity as it covers very large areas)

3.1.3 The decision tree as a framework

To narrow down the study area in East Flanders to an initial selection of sites, a decision tree is used as a guiding framework. This process runs simultaneously with the desk research, as the latter provides the necessary data to address the criteria within the decision tree. The tree focuses on three central pillars, starting with the presence of the species at the specific site and in adjacent waterways. Furthermore, the ecological value of the area is evaluated and, in addition, the determination if the species can disperse from the location towards nearby vulnerable natural habitats. This ecological value and dispersal potential are assessed based on the proximity to VEN and SBZ protected areas, the presence of target species, and the abundance of macrophytes within the watercourse. Finally, the factor of nuisance (towards humans) and impact is evaluated based on reports of infrastructure damage, complaints from local recreational fishermen or observations in residential/urban areas by humans.

The evaluation of these criteria results in a prioritization across four distinct levels. A high-priority classification indicates that the installation of a trap is considered necessary, whereas a medium priority suggests that the planning for a trap installation should be initiated. Sites designated as low or no priority do not currently require structural intervention. In these cases, active or occasional monitoring is deemed sufficient (Figure 12). For the purpose of this study, we are exclusively interested in locations designated as 'high priority', given that we are seeking sites that are suitable for the installation of permanent traps.

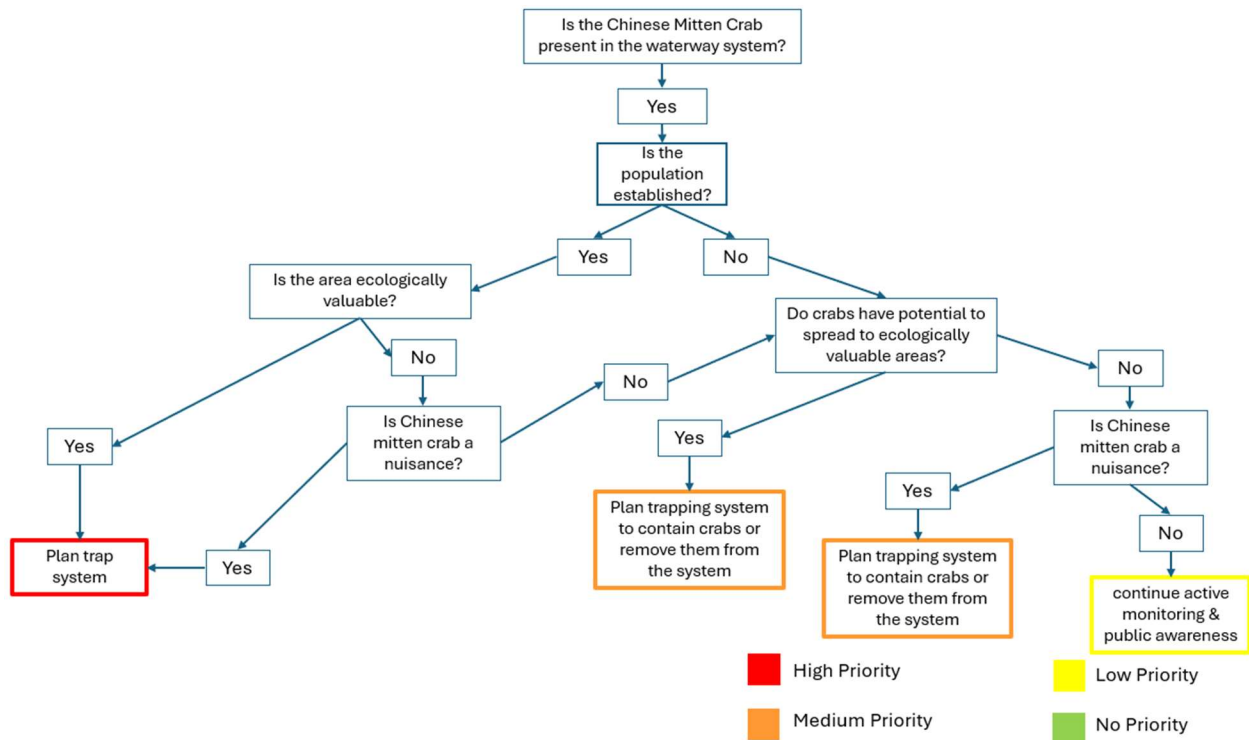


Figure 12 Decision tree to come to an initial site selection (Clancy project workgroup 2 intermediate output, 2025)

3.1.4 Ecological vulnerability assessment

Independent of the initial decision tree, the ecological vulnerability of each site is assessed by assigning a specific impact score. This evaluation is primarily based on the presence of SBZ, VEN, and the occurrence of aquatic vegetation. This scoring provides an additional layer of priority, reflecting the ecological urgency and the potential impact of mitten crab presence on sensitive habitats.

Scoring system

A straightforward scoring system was developed to assess ecological vulnerability (table 1). The presence of a VEN area or SBZ zone is assessed using a binary approach, where a score of 1 is assigned for presence and 0 for absence. However, regarding aquatic vegetation, given that it is considered the primary ecological factor, its assessment is more nuanced. This criterion is divided into five categories, namely: 'filling the entire water column', 'frequent to abundant', 'sparse', 'none', and 'unknown', which are scored 3, 2, 1, 0, and 0, respectively. Consequently, the presence of aquatic vegetation can carry two to three times more weight than the presence of VEN or SBZ areas. This remains a critical criterion because mitten crabs have a direct and significant impact on these plant communities.

The final score is determined by calculating the sum of all individual components, resulting in a scale ranging from 0 to a maximum of 5. A score of 0 indicates negligible ecological vulnerability, while a score of 1 represents limited vulnerability. Scores of 2 or 3 indicate moderate vulnerability, and a score of 4 or 5 signifies high ecological vulnerability.

Table 1 Classification of the ecological vulnerability scores and their corresponding impact levels.

Impactscore						
Score	0	1	2	3	4	5
Potential impact	Negligible	Limited	Moderate	Moderate	High	High

3.2 Site suitability assessment

Following the initial screening via the decision tree, based on data acquisition and GIS analysis, a list of locations has been identified for evaluation using the British assessment protocol.

To go from broad-scale mapping to a site-specific assessment, the British protocol serves as a 'fine filter'. This step is essential to account for various technical and environmental criteria that must be verified on-site. Ultimately, the application of this protocol will yield a prioritized list of potential sites, ranked by their suitability scores, providing an evidence-based foundation for the installation of new traps.

The explanation of the protocol in this section (3.2) is derived entirely from the protocol survey sheet developed by Oscar Norton Jones, the doctoral student from Aberystwyth University in Wales (Appendix A).

3.2.1 Structure of the British protocol

The British assessment protocol employed in this study is structured into two primary parts. This tiered approach is designed to maximize efficiency: by conducting an initial theoretical screening, time-consuming field surveys are avoided at sites that are fundamentally unsuitable for technical or ecological reasons (Norton Jones, 2025).

The first part functions as a first filter for the research. Criteria are assessed based on a pass/fail principle. During this stage, locations can be deemed unsuitable immediately without the need for a site visit (desk study). The criteria are divided into three critical domains:

- **Species assessment:** This sub-section involves more than just verifying the current presence of the Chinese mitten crab through databases. It also investigates the broader ecological context. Specific attention is given to the proximity of ecologically sensitive areas or the presence of protected indigenous species upstream. This assessment is vital for obtaining the necessary permits, as a trap must not obstruct desirable migration or cause damage to local ecosystems.

- **Existing infrastructure:** Checks are conducted to determine whether the presence of underground or overhead utilities (such as existing pipelines) would physically obstruct the installation of a permanent trap.
- **Site access:** Based on cartographic data and satellite imagery, an initial assessment is made regarding whether the site is theoretically accessible for the heavy machinery required for construction.

Locations that successfully pass the first part undergo a comprehensive field inspection. This phase is necessary to validate the theoretical assumptions from the desk study with empirical field data.

- **Installation feasibility:** During the site visit, the bank structure and slope stability are analysed. Additionally, the sediment type is assessed, as soil conditions impact the anchoring of the trap. The hydromorphology of the watercourse is precisely mapped: parameters such as effective water depth, channel width, flow velocity, and tidal influence are scored here. The presence of dense vegetation or debris that could hinder operations is also recorded.
- **Expected trap performance:** This section focuses on the long-term effectiveness of the installation. It accounts for seasonal variations in water levels and the impact of extreme weather conditions. Furthermore, operational safety is a key consideration: is the site safely accessible for maintenance personnel under all conditions?
- **Social and public factors:** A specific focus of this protocol is the vulnerability to external factors. An assessment is made of the risk of unwanted public interference, such as vandalism. Sites with high visibility, for example, require different security measures than those located in remote natural areas.

By combining this extensive set of parameters, the protocol yields a quantitative final score. This score provides the basis for the final recommendation regarding the prioritization of new crab trap locations in the province of East Flanders.

3.2.2 Scoring system

The assessment of the parameters is structured systematically. The desk study operates strictly on a pass/fail basis. No numerical scores are assigned to these criteria, and they are therefore excluded from the final overall score (Norton Jones, 2025). A single 'fail' immediately results in an overall fail, whereas locations with criteria classified as 'unknown' are given the benefit of the doubt and pass this phase.

For the 'installation feasibility' and 'expected trap performance' sections, each parameter is assigned a score ranging from 0 to 3. A score of '0' indicates a significant issue regarding that parameter, whereas a score of '3' signifies that the location is optimal for that specific parameter. If a parameter cannot be assessed due to certain circumstances, it is excluded from the calculation to prevent distortion of the final results.

Upon completion of the protocol, the mean of all assigned scores is calculated (table 2). This final score is then benchmarked against the Site Suitability Index (SSI). The SSI provides a clear representation of a site's suitability for the installation of a permanent trap, facilitating the final prioritization of potential locations.

Table 2 Site Suitability Index as found on the 'Permanent Mitten Crab Trap Location Survey' (Norton Jones, 2025)

Site Suitability Index

Avg Score	<1.5	1.5 – 1.74	1.75 – 1.99	2 – 2.24	2.25 – 2.49	2.5 – 3
Grade	F	E	D	C	B	A

3.3 Reliability assessment of the British protocol

3.3.1 Application on existing permanent traps

To investigate the predictive power of the protocol and to check if it is fit for purpose, it will be applied to the existing traps in Merelbeke, Afsnee and Destelbergen. Comprehensive datasets of historical catch records from recent months and years are already available for these locations.

The objective of this analysis is to verify whether the Site Suitability Index (SSI) correlates with the actual catch data. The traps at these three sites will be scored against all relevant criteria, such as environmental factors, hydromorphology, and technical feasibility. This approach allows us to determine whether locations achieving high scores within the protocol indeed correspond to those with the highest catch yields.

This practical assessment confirms that the assessment protocol is a reliable instrument for screening new potential sites. It demonstrates that the framework is not only theoretically sound but also provides an accurate reflection of catch performance in the field.

3.3.2 Assessment of protocol reproducibility

In addition to implementing the British assessment protocol, it is essential to verify the reproducibility of the results. This entails checking whether independent observers can achieve consistent outcomes. To test this consistency, the protocol will be applied to the trap location in Grobbendonk. This site was previously assessed by Oscar Norton Jones who developed the protocol.

To ensure the highest possible accuracy of this re-evaluation, expert input was obtained from Paul van Loon, the VMM site manager responsible for the Grobbendonk trap. Combining the physical observations from the site visit with his specialized insights provided the most robust basis for a reliable assessment.

The re-assessment will be conducted without prior knowledge of previous results to ensure an objective comparison. The degree of alignment between both final scores serves as an indicator of the protocol's accuracy and robustness. Potential causes for divergent scores are taken into account, for example the subjective interpretation of certain criteria.

4. Results

This chapter presents the research findings using a phased approach. First, the results of the spatial analysis in QGIS, combined with the decision tree, are presented. A selection of these intermediate results is then analysed in greater detail. Subsequently, the findings are evaluated following the application of the British protocol. Next, a prioritized list of locations that offer the greatest potential for the installation of permanent traps is presented. To conclude this chapter the protocol is applied to all existing permanent trap locations and its reproducibility is tested.

4.1 Preliminary site selection through QGIS and decision tree

4.1.1 Spatial selection of permanent traps



Figure 13 Geographical overview of the initial longlist locations identified through decision tree and data analysis

Figure 13 illustrates the spatial distribution of the initial locations identified during the preliminary selection process. These sites result from the translation of the decision tree into a QGIS spatial analysis, representing areas where crab presence, ecological vulnerability and potential nuisance overlap.

Appendix B provides a more detailed inventory of the initial locations. For each site, the decisive factor is identified, accompanied by notes explaining the rationale behind this classification. Furthermore, the impact score (Section 3.1.4) is included for every location, providing an additional indication of the local ecological vulnerability.

Figure 13 shows that a distinct geographical pattern is visible, as the majority of locations are situated along the Scheldt River or its main tributaries, such as the Dender and the Lys. This distribution is directly linked to the life cycle of the mitten crab. Adult crabs migrate along these major river axes toward saline water to reproduce, while juveniles use the same routes to move upstream toward freshwater habitats to mature.

In most cases, ecological factors were the primary drivers for selection, such as the proximity to protected nature reserves or sensitive fish populations. However, other sites were prioritized based on the presence of water infrastructure, reports of Chinese mitten crabs in urban areas, or proximity to fishing ponds. These elements serve as key indicators for potential nuisance toward humans. Despite the visible clustering along river axes, the candidate sites remain well-distributed across the province of East Flanders. These 15 locations conclude the first phase of this research and provide the essential foundation for the subsequent prioritization and scoring using the British protocol.

4.1.2 Detailed analysis of primary locations

This section provides an in-depth analysis of three of the fifteen locations as a showcase. Specifically, it discusses the rationale behind their selection, detailing how these sites emerged as optimal candidates from the GIS analysis and the subsequent decision tree. This analysis was conducted for all fifteen locations. The corresponding maps can be found in Appendix C.

Molenbeek - Melle

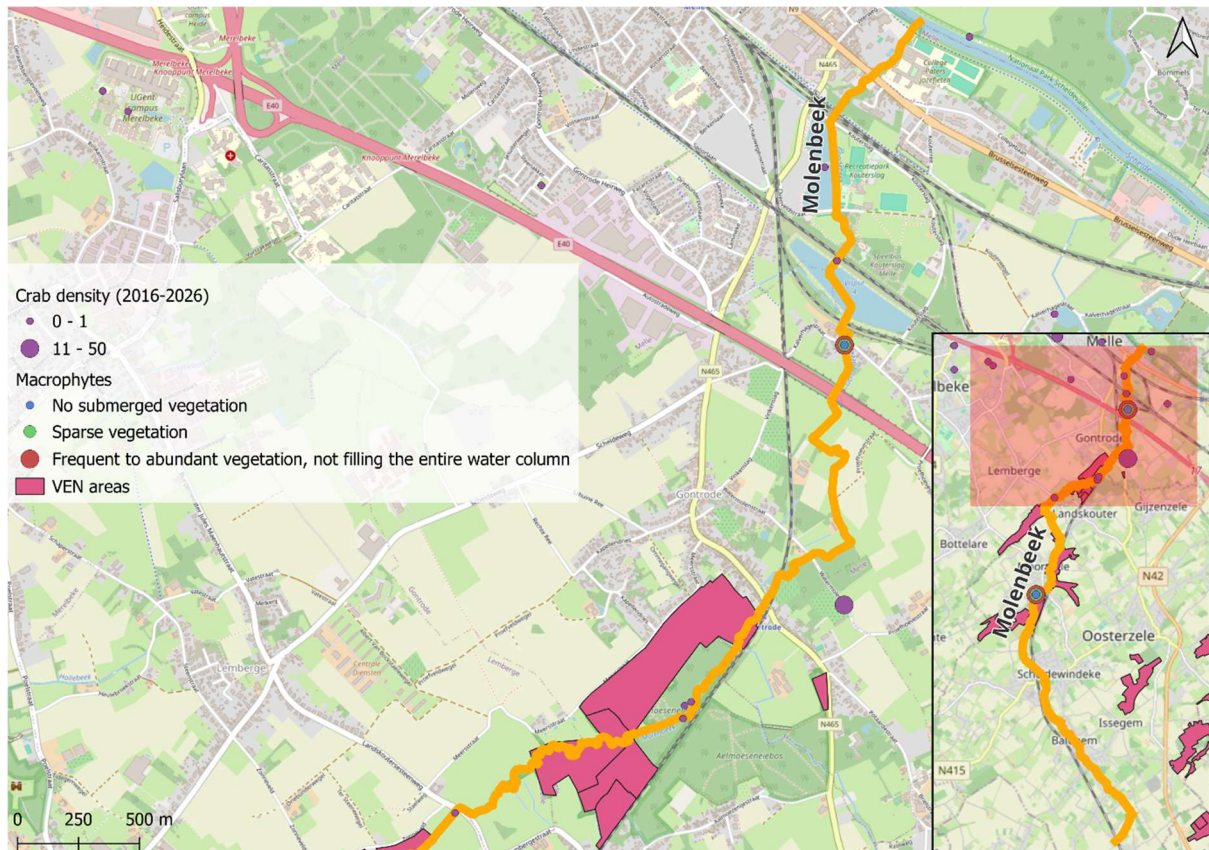


Figure 14 Detailed map and overview map of the Molenbeek in Melle

The combination of high ecological value and the documented nuisance caused by the crabs makes the Molenbeek a potential candidate for the installation of a permanent trap. To objectively substantiate its priority, the location will be further evaluated in the following chapter using the British assessment protocol.

Beerhofbeek/Moerbeek – Nazareth

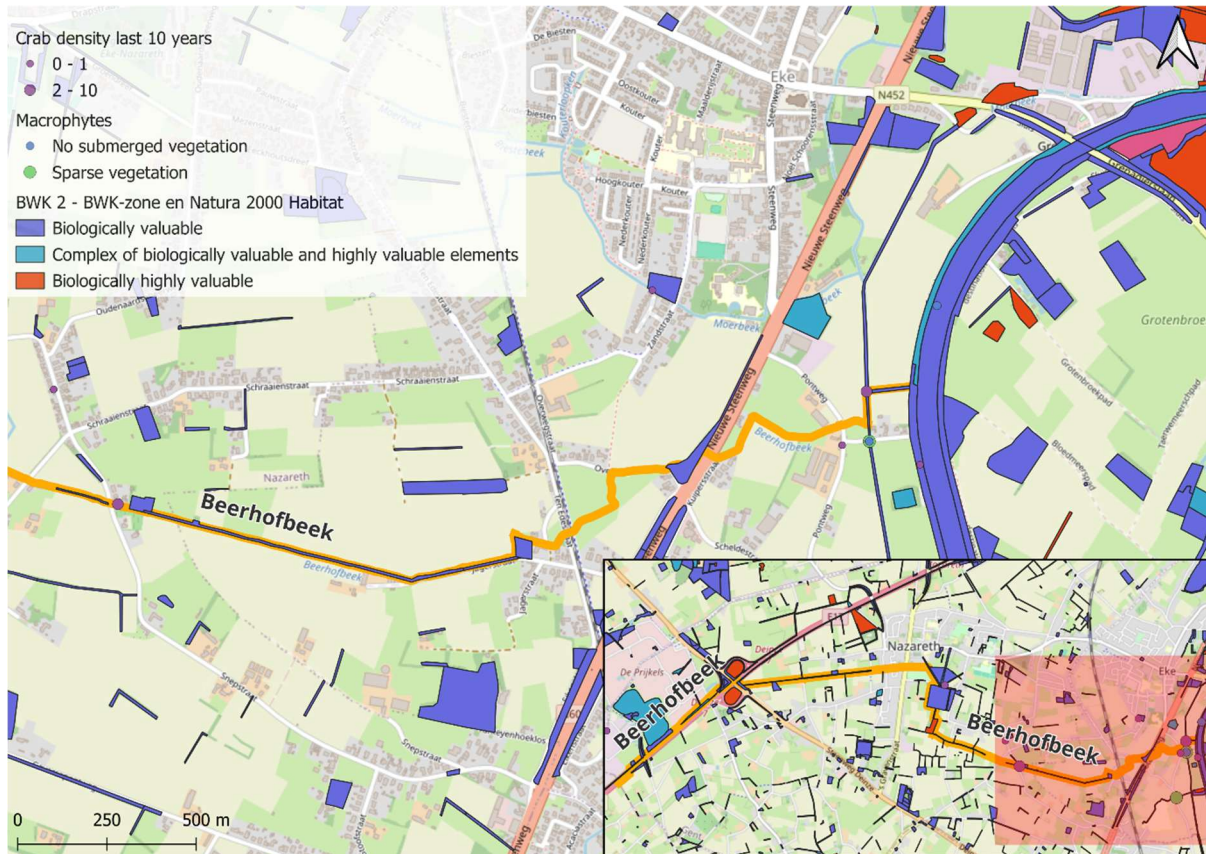


Figure 16 Detailed map and overview map of the Beerhofbeek/Moerbeek in Nazareth

The second location is the Beerhofbeek/Moerbeek in Nazareth (Figure 16). At this site, the Beerhofbeek transitions into the Moerbeek shortly before it converges with the Scheldt.

Multiple observations have been recorded here over several years, some of which occurred outside the watercourse, specifically in residential areas. While this stream does not flow directly through a VEN area, its ecological value is reflected in the BWK. Significant sections of the stream are classified as 'biologically valuable'. Furthermore, monitoring data indicates the presence of macrophytes. Although these aquatic plants are currently sparse, it is vital to protect the existing vegetation to prevent further degradation.

This site is one of the less prominent candidates. However, the combination of field observations, ecological evaluation, and the presence of water vegetation (though limited) justified its selection. Further analysis using the protocol will determine its exact suitability.

Bellebeek – Schellebelle

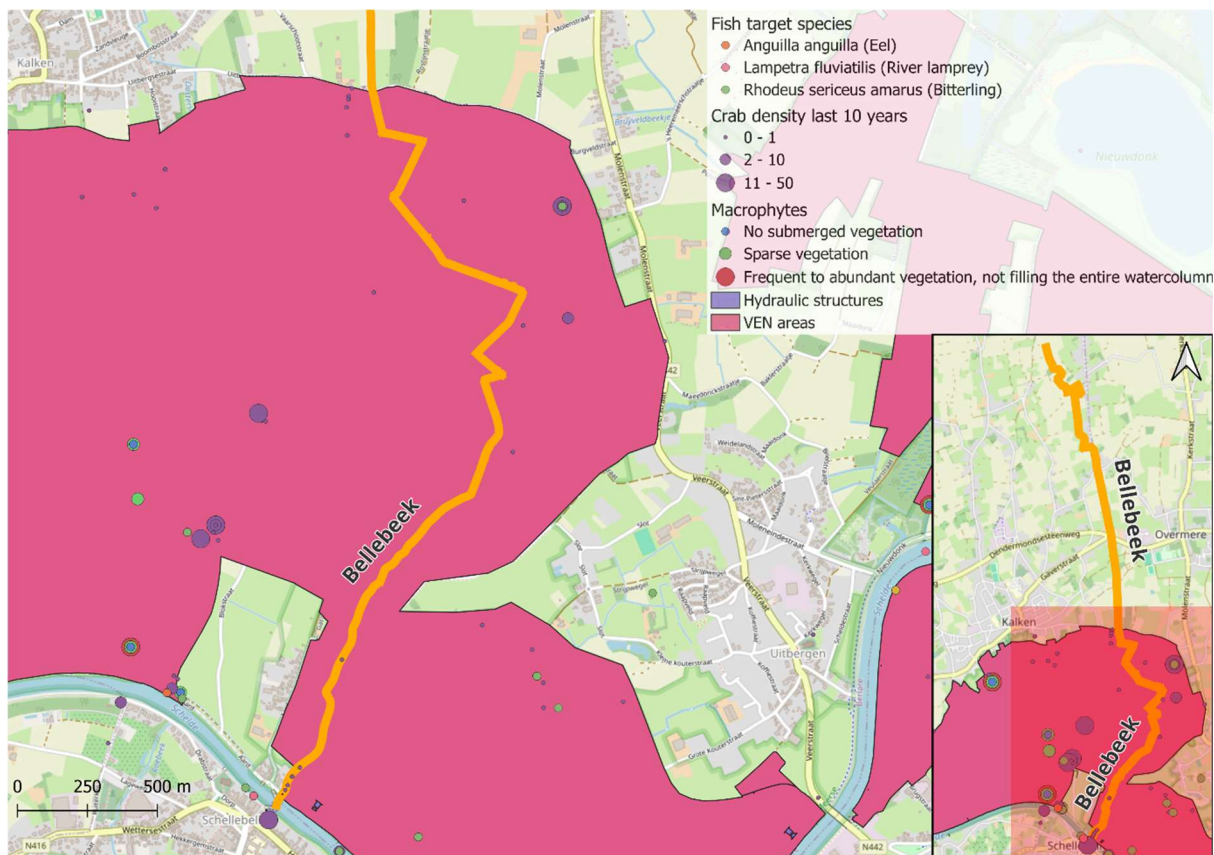


Figure 17 Detailed map and overview map of the Bellebeek in Schellebelle

The final location discussed in detail is the Bellebeek in Schellebelle (Figure 17). An extensive number of sightings have been reported here in recent years, both within the watercourse and in the surrounding area.

A significant portion of the Bellebeek flows through a designated VEN area. Furthermore, hydraulic infrastructure is situated at its convergence with the Scheldt. These structures may act as obstacles, potentially forcing the crabs to leave the water and migrate overland. While no official data is currently available regarding the presence of macrophytes, this remains an objective for site inspection in a later phase of this research. It is important to note that this won't be formal information at this specific location. Furthermore, multiple sightings of fish target species, such as the European eel (*Anguilla anguilla*) and the bitterling (*Rhodeus sericeus amarus*), have been recorded. While these observations were not made within the stream itself, they were documented at the river mouth and in the adjacent waterways.

Current data indicates that the VMM, another partner in the CLANCY project, is already actively trapping crabs in nearby waterways within the same region (tv Oost, 2024). This confirms the high potential of this site for the installation of crab traps and effective population management.

4.2 Application of the British protocol

The initial locations derived from the decision tree form the foundation of this section. The British assessment protocol will now be applied to the sites identified in Section 4.1. As discussed extensively in Chapter 3 (Methodology), this assessment consists of two phases: desk research and on-site evaluation. In total, twelve locations were visited and assessed. Table 3 presents the results for all scored locations. Section 4.3 highlights the top five locations and provides a detailed discussion of the results for one specific site.

Table 3 Overview of all locations assessed according to the British assessment protocol

Location	Installation feasibility score	Expected performance score	Average score	SSI
Moerbeek/Beerhofbeek_Nazareth	2,60	2,30	2,45	B
Bellebeek_Schellebelle	2,30	2,70	2,50	A
Kasteel Sombeke_Elversele	2,20	2,20	2,20	C
Maarkebeek_Oudenaarde	2,30	2,60	2,45	B
Moerbeek_Eke	2,40	2,40	2,40	B
Molenbeek_Melle	1,90	2,50	2,20	C
Torensbeek_Hofstade	2,50	2,30	2,40	B
Kattebeek_Petegem-aan-de-Leie	2,80	2,60	2,70	A
Zwartekobensbeek_Zwijnaarde	2,60	2,40	2,50	A
Roebeek_Schellebelle	2,10	2,40	2,25	B
Molenbeek_Wichelen	2,10	2,30	2,25	C
Molenbeek_Denderleeuw	2,30	2,40	2,35	B

4.3 Prioritized locations

Table 4 presents the five locations with the highest suitability scores according to the British assessment protocol. These sites demonstrate the greatest potential for the installation of a permanent trap system.

Table 4 Overview of the five best-scoring locations

Location	Installation feasibility score	Expected performance score	Average score	SSI
Kattebeek_Petegem-aan-de-Leie	2,80	2,60	2,70	A
Bellebeek_Schellebelle	2,30	2,70	2,50	A
Zwartekobensbeek_Zwijnaarde	2,60	2,40	2,50	A
Maarkebeek_Oudenaarde	2,30	2,60	2,45	B
Moerbeek/Beerhofbeek_Nazareth	2,60	2,30	2,45	B

4.3.1 Case study

To clarify the practical application of the scoring system, this section provides a detailed assessment of a single representative site. The location (Figure 18 and 19) selected for this analysis is the Moerbeek/Beerhofbeek (Location MB, Appendix C-1) in Nazareth. The full assessment protocol is included in Appendix A. For detailed descriptions and definitions of each criterion, please refer to that section.



Figure 18 Perspective of the steep embankments



Figure 19 View of the location from the bridge structure

4.3.1.1 Desk study

As discussed in Chapter 3, this stage of the protocol follows a pass/fail logic. The criteria in this phase are, by definition, evaluated through desk research. Consequently, there is a significant overlap with the decision tree, allowing several criteria for each location to be validated immediately. For location MB specifically, the assessment is as follows:

Species assessment

- **Mitten crab presence:** Pass. Multiple sightings have been recorded in this watercourse over several consecutive years, confirming a stable presence of the species.
- **Upstream importance:** Pass. QGIS analysis indicates the presence of "biologically valuable" to "biologically highly valuable" areas upstream. Furthermore, the Moerbeek (Appendix C-5) contains designated VEN areas further upstream, increasing the ecological vulnerability.

- **Native species present might impact obtaining trap license/permit:** Pass. Obtaining permits does not pose a problem for this study, as the watercourses are under the management of the Province itself.

Existing infrastructure

- **Waterway infrastructure (installation):** Pass. No existing infrastructure was identified that would obstruct the installation of a trap system. However, an on-site inspection is required to provide definitive confirmation.
- **Waterway infrastructure (performance):** Pass. There are no fish ladders or similar bypass structures present that could provide the crabs with alternative migration routes.

Site access

- **Vehicle access:** Pass. The site is accessible via an adjacent road, allowing for efficient transport and maintenance of the trapping equipment (Figure 20).
- **Land ownership:** Pass. As the watercourse is under provincial management, the Province of East Flanders maintains legal access.

4.3.1.2 Installation feasibility

This section focuses on the installation feasibility of a permanent trap system at the specified location. Below, a detailed analysis of the results for location MB is provided:

Infrastructure & accessibility

- **Accessibility:** Score 3. The location is easily accessible via the adjacent road and the Scheldt embankment (Figure 19).
- **Existing infrastructure:** Score 3. The stream bed is concrete-lined. This provides a stable, level foundation for the installation of the trap system.
- **Foliage:** Score 3. Minimal foliage or overhanging vegetation is present, reducing the risk of trap fouling by organic debris.

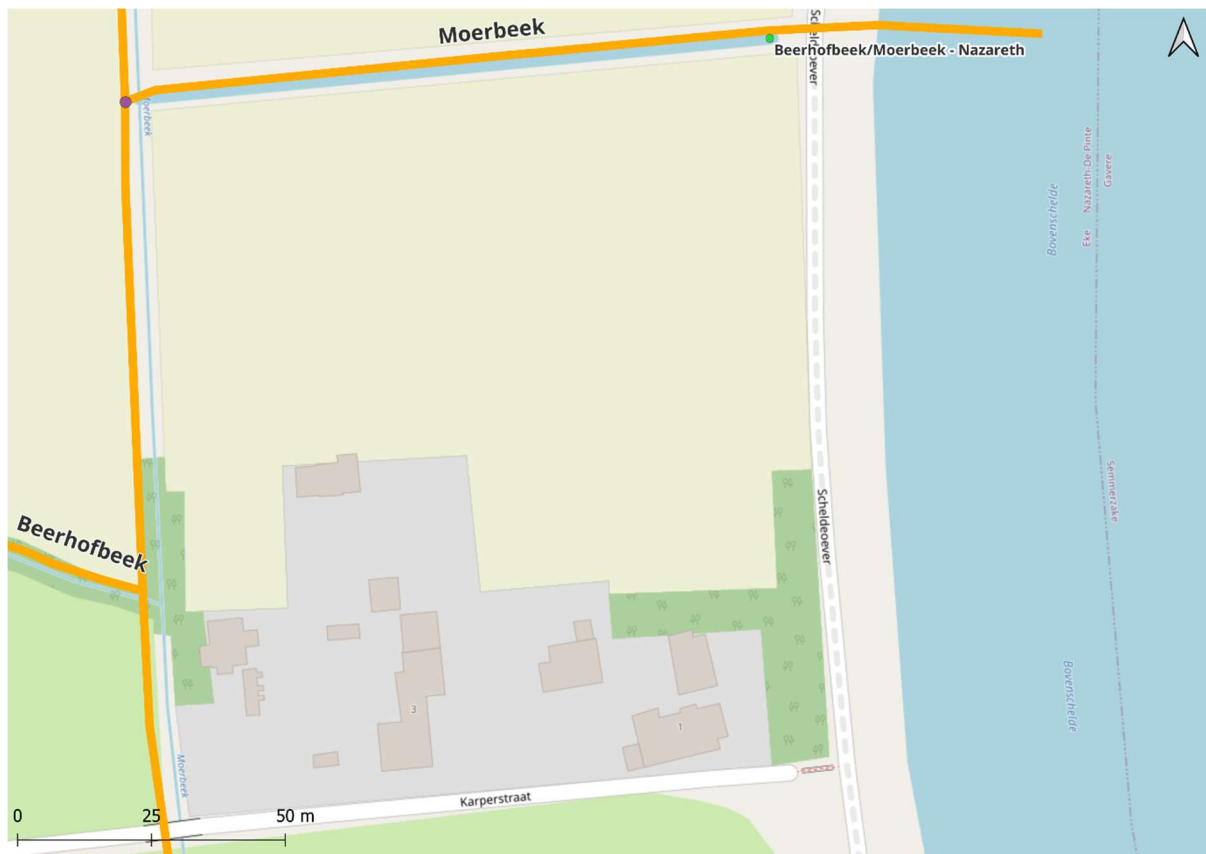


Figure 20 Accessibility via 'Karperstraat' and 'Scheldeoever'

Waterway conditions

- **Water depth:** Score **1**. The water depth was measured at approximately 30 cm at the moment of the visit.
- **Tidal changes:** Score **3**. Tidal influence is not present.
- **Flow velocity:** Score **3**. The flow velocity is low, ensuring safe working conditions during installation and maintenance.

Waterway structure

- **Sediment type:** Score **3**. Concrete bed, approximately 10 cm of sediment has accumulated. This layer requires minor clearing before installation, which does not constitute a major intervention.
- **Riverbed structure:** Score **3**. The concrete lining ensures a flat, uniform bed without obstructive rocks or boulders (Figure 21).
- **Riverbank structure:** Score **1**. The riverbanks are approximately 3 meters high and steep (Figure 18).
- **Width of waterway:** Score **3**. The watercourse is less than 10 meters wide, which simplifies the deployment of the system across the channel.



Figure 21 The flat riverbed structure

4.3.1.3 Expected trap performance

In this section, the focus shifts to the expected performance of the trap system and identifies factors that may influence its overall effectiveness.

Changeability of waterway conditions

- **Width variation:** Score **3**. Due to the concrete riverbanks, the width of the watercourse remains constant.
- **Depth variation:** Score **1**. The water depth is quite low at the moment of the visit. This is a critical point of attention, sufficient space above the trap must be always maintained to prevent the disturbance of non-target species.
- **Changeability due to weather:** Score **3**. The hardened structure of the site ensures high stability. The physical dimensions and bed structure are unlikely to be affected by heavy rainfall or erosion.
- **Seasonal changeability:** Score **3**. While historical data (Waterinfo, 2026) indicates a slight decrease in discharge during the summer months compared to winter, these fluctuations are minimal. The overall waterway conditions are expected to remain stable throughout the seasons.
- **Tidal changes:** Score **3**. Tidal influence is not present.

Accessibility

- **Accessibility to humans:** Score **3**. The location is easily accessible, allowing for efficient and frequent monitoring.
- **Vulnerability to public:** Score **1**. The trap system will be visible to pedestrians using the adjacent Scheldt embankment. This increases the risk of human interference or vandalism.
- **Accessibility for maintenance:** Score **2**. Maintenance access is generally good. Despite the steep riverbanks, the trap remains accessible.

Water flow conditions

- **Flow velocity:** Score **3**. The site has a low flow velocity, minimizing the risk of trap displacement, structural stress or carrying debris at high speeds.
- **Debris and sediment:** Score **2**. A minor layer of sediment (~10 cm) is present. While this does not pose a significant obstruction, occasional checks for debris accumulation are recommended to ensure optimal trap performance.

4.4 Assessment of the existing permanent trap locations

The assessment of existing locations constitutes a critical phase in this research, as it provides a benchmark for evaluating trap efficiency and the predictive accuracy of the protocol. Five established sites were analysed (Table 5), three of which are managed by the Province of East Flanders and two by the Flemish Environmental Agency (VMM). Like the structure in Section 4.2, the table below details the performance results for each specific location.

Table 5 Overview of the existing permanent traps assessed using the British protocol

Location	Installation feasibility score	Expected performance score	Average score	SSI
Rosdambeek_Afsnee	2,60	2,80	2,70	A
Melsenbeek_Merelbeke	2,70	2,40	2,55	A
Kleine_Nete_Grobbendonk	2,90	2,20	2,55	A
Damsloot_Destelbergen	2,60	2,30	2,45	B
Bollaak_Ranst	1,80	1,90	1,85	D

Overall, most locations perform well according to the assessment protocol. However, several observations can be made:

- Merelbeke scores exceptionally high, which is reflected in the annual capture of tens of thousands of crabs (Figure 22).
- Destelbergen scores good. This location has faced issues with vandalism and has only been operational again for the last few months. Nonetheless, several thousand crabs were already caught during this period.
- Afsnee also scores very high. Initially it did show strong results and high catch numbers during the first months. However, crab catches at this location dropped to near zero, although low numbers have been recorded again in recent weeks.
- Grobbendonk and Ranst yield the highest catch rates within the study area. Grobbendonk, in particular, stands out with a record daily capture of approximately 17,000 crabs. However, the operational efficiency at both sites, especially at Grobbendonk, has been compromised by recent incidents of vandalism, which pose a challenge to consistent catchment and trap maintenance.
- Ranst received a relatively low suitability score during the assessment. This result is primarily due to several environmental and technical constraints identified by the protocol. Key limiting factors include periodic low water levels and the influence of tidal movements, both of which affect the consistent operation of the traps. This is because, during low tide the water level can sink below the intake of the trap. Furthermore, the site's score was negatively impacted by a higher risk of vandalism and challenging installation conditions.

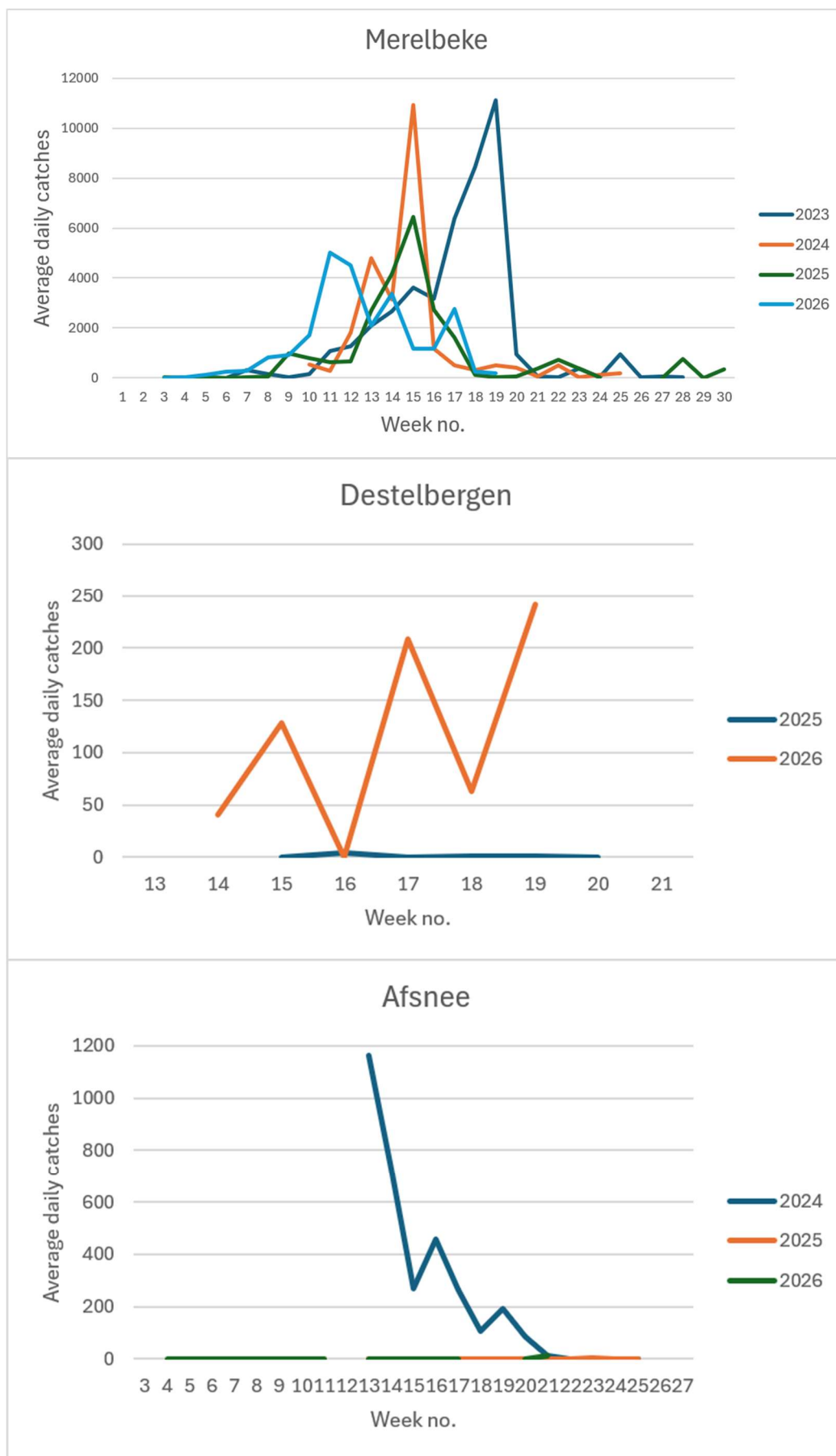


Figure 22 Average daily catch results (2023-2026) for Merelbeke, Destelbergen and Afsnee

4.5 Evaluation of the reproducibility of the protocol

As discussed in Section 3.3.2, the location in Grobbendonk had already been assessed using the protocol by Oscar Norton Jones. To evaluate whether different observers obtain consistent results when applying the protocol, the Grobbendonk site was assessed a second time for this study. Table 6 below presents a comparison of both evaluations.

Overall, there is a high level of consistency between both evaluations, as identical scores were assigned to many of the criteria. This alignment is also reflected in the final scores and the subsequent SSI rating. The final scores are relatively close, with a score of 2.72 obtained by Norton Jones and 2.55 determined in the current study. Consequently, both assessments resulted in an identical SSI rating of 'A'.

Among the criteria that were scored differently, only one major outlier showed a discrepancy of 2 points. For the remaining parameters, the variations were limited to a single point per criterion. Lastly, three criteria were marked as 'unknown' by Norton Jones due to a lack of sufficient data at the time of the initial assessment to support a well-founded score. These criteria were not taken into account when calculating the final score. For this study, however, these criteria were successfully evaluated by incorporating the information provided by Paul van Loon (VMM).

Criteria such as 'changeability due to weather', 'seasonal changeability', and 'debris and sediment' received lower scores in the current study because of the information provided by van Loon. Periods of heavy precipitation lead to increased discharge and a higher amount of sediment, a similar trend occurs during the winter months.

Table 6 Comparison of site assessment scores between Norton Jones and the current

Desk study	Norton Jones	Current study
Mitten crab presence	Pass	Pass
Upstream importance	Unknown ^a	Pass ^b
Native species present	Pass	Pass
Waterway infrastructure	Pass	Pass
Waterway infrastructure	Pass	Pass
Vehicle access	Pass	Pass
Land ownership	Pass	Pass
Installation feasibility		
Accessibility	3	3
Existing infrastructure	2	3 ^c
Foliage	3	2
Water depth	Unknown ^a	3
Tidal changes	3	3
Flow velocity	3	3
Sediment type	3	3 ^d
Riverbed structure	2	3 ^d
Riverbank structure	3	3
Width of waterway	3	3
Expected performance		
Width variation	3	3
Depth variation	Unknown ^a	3
Changeability due to weather	3	2 ^e
Seasonal changeability	3	2 ^e
Tidal changes	3	3
Accessibility to humans	3	3
Vulnerability to public	1	1
Accessibility for maintenance	3	3 ^f
Flow velocity	2	1
Debris and sediment	3	1
Total score	2,72	2,55
SSI	A	A

^a Insufficient data

^b Presence of VEN areas and water vegetation

^c Concrete riverbed provides foundation and the lock can be closed to drain the area completely for installation.

^d Presence of a flat concrete riverbed

^e Increased sediment during weeks with heavy rainfall and the winter months

^f Closing the lock frees up the trap for maintenance

5. Discussion

5.1 Evaluation of the pre-analysis and decision tree

The pre-selection based on the decision tree yielded a list of fifteen potential locations, twelve of which could effectively be evaluated against the protocol. Remarkably, none of the scored locations received a grade below a 'C'. This demonstrates that the extensive desk study, driven by the GIS analysis and the decision tree, filters out the least suitable locations beforehand.

However, this result must be interpreted with caution. While highly encouraging, the limited sample size of twelve scored locations does not justify the assumption that a low-scoring site could never emerge from the decision tree in the future. Data limitation (Section 5.2) also plays a role here. Locations with no reported crab sightings are automatically excluded, even though crabs may potentially be present.

Nevertheless, the approach used in this study demonstrates that the decision tree serves as an efficient raw filter, effectively preventing unnecessary site visits.

5.2 Reflection on dominant decision criteria

The criteria that proved decisive during the application of the decision tree were primarily the presence of ecologically significant areas (e.g., VEN areas) and the potential for public nuisance. To assess this nuisance factor, empirical data derived from public sightings was utilized. While incorporating these citizen science observations provides a highly detailed spatial overview of the occurrence of the Chinese mitten crab (*Eriocheir sinensis*), this methodology inherently introduces an anthropogenic bias into the model (Geldmann et al., 2016).

High densities of reported sightings in urbanized or residential environments do not necessarily correlate with higher ecological abundance or critical migration volumes in those specific watercourses. Instead, they potentially reflect an increased probability of human-crab encounters due to high human population density (Geldmann et al., 2016). Conversely, highly vulnerable and remote ecological zones frequently suffer from data deficiency, as these areas lack continuous human surveillance. A similar observation applies to the parameters concerning water infrastructure. The frequent accumulation of sightings near locks highlights localized migration bottlenecks rather than general regional density.

While the decision tree correctly identifies these locations as migration hotspots suitable for trap deployment, it must be critically noted that this data structure skews spatial prioritization models toward human-dominated landscapes. Consequently, relying heavily on public reporting parameters risks shifting mitigation and management resources toward urban hotspots at the expense of undisturbed, ecological priority zones.

5.3 Alignment between empirical catch data and protocol predictions

The accuracy and operational feasibility of the British protocol were evaluated by applying it to established traps. Since the catch data for these traps are already known, it would be expected that well-performing traps achieve a high score and vice versa. Factors such as accessibility, ease of maintenance and the presence of vandalism should also be reflected in the protocol's score. However, the actual application of the protocol revealed a discrepancy between theoretical expectations and reality. The Grobbendonk and Merelbeke locations score very well

within the protocol, which directly correlates with the historical catch data, that are excellent here.

At the same time, limitations in the predictive nature of the protocol became apparent at locations such as Ranst and Afsnee. Ranst scored relatively low on the protocol. This was the result of a difficult installation and the extensive work that would be necessary to install the trap in the first place. Furthermore, the daily closure of the locks for several hours blocks the crabs' passage, which shortens its operational timeframe. These matters, among others, resulted in a low score for 'installation feasibility' and 'expected trap performance,' and thus a low overall score. However, despite these barriers, empirical performance demonstrates that the operational setup functions highly efficiently, securing substantial yields.

Afsnee scores very high, while very low numbers are caught here, except during the initial months. The reason for this decline is not immediately clear. It is possible that criteria not included in the protocol are the cause of this, making it unreadable within the protocol itself. One of those potential criteria is the attraction flow, which is not taken into account, as discussed in Section 5.4. Another possibility is the fact that the crabs have to climb relatively high to reach the collection box. To address this, like was done in Ranst, a water pump was recently installed. This pump draws water from the river and allows it to flow back down through the return pipe. By doing so, an attraction flow is created within the return pipe, making it more appealing for the crabs to crawl all the way up. At first glance, this approach appears to be effective. During the first week following the installation, a small number of crabs were caught daily for the first time in months. This serves as a clear example of the unforeseen challenges that can arise.

This phase demonstrates that the protocol can operate with high accuracy. At the same time, it shows that certain criteria might be missing, causing locations to score better in theory than they achieve in practice. Additionally, Ranst teaches us that a poor score does not necessarily mean that the location should be discarded. If there is sufficient evidence of the crab's presence and adequate financial resources are available, the location may still be worth the effort and investment if it is technically feasible. Especially if the location is situated in an area of high ecological value (presence of water vegetation, protected areas, etc.).

5.4 Methodological evaluation and contextual applicability of the protocol

The practical application of the protocol across the fifteen new and already existing sites has exposed several bottlenecks. Certain criteria that influence site selection during the desk study prove to be redundant, while the in-situ assessment reveals a potential contradiction.

Firstly, within the desk study, the protocol applies filters regarding the difficulty of obtaining permits and the accessibility of the location. Both criteria are redundant within the Flemish context. Because the deployment of the traps takes place in watercourses that are directly managed by the relevant authorities, administrative permitting procedures do not present a problem. Additionally, Flemish watercourse managers possess rights of access to riverbeds and banks. This ensures that accessing private property to reach the waterway is not an issue. Therefore, both criteria are essentially redundant in Flanders.

Secondly, the criterion regarding flow velocity within the protocol is open to discussion. The protocol awards a higher score to locations with a relatively low flow velocity, as this minimizes

negative impacts on the installation and performance of the trap. However, it is suspected that, similar to fish, crabs are attracted to an attraction flow (Panning, 1938; Keirsebelik, 2015). During migration, they orient themselves toward stronger currents. Consequently, a stream with little to no current will be less attractive to the crabs. For this criterion, a higher flow velocity should instead yield a better score, which stands in contrast to the previously discussed baseline of the protocol.

5.5 Protocol reproducibility and score alignment between observers

Re-evaluating a previously assessed site provided valuable insights into the reproducibility of the protocol. A comparison of both evaluations demonstrated that the final scores were highly aligned, resulting in an identical SSL.

Nevertheless, discrepancies were observed for specific criteria. For several of these parameters, variations stemmed from a lack of sufficient data during the initial assessment by Norton Jones. However, other scores differed due to varying interpretations of the criteria. The 'Flow velocity' criterion serves as a clear example. During the field visit for the current study, the flow was interpreted as high, resulting in a score of '1', whereas Jones assigned a score of '2', indicating an average flow velocity. This highlights how certain terminology within the protocol can be subject to different observer interpretations.

Based on this comparison, the protocol appears reasonably robust. Although this provides an indicative positive signal, the small sample size (limited to a single site) prevents broader generalization. Furthermore, this evaluation demonstrated that incorporating input from a local site manager who is very familiar with the watercourse is highly beneficial. The expertise provided by van Loon likely led to a more accurate and better-founded final score.

5.6 Limitations of the study

This study provides valuable insights into the objective selection of new locations. However, several limitations must be acknowledged.

Firstly, the scope is relatively limited. It consists of fifteen locations, twelve of which were effectively scored. Although this provides a good overview of how different watercourses score, the results cannot inherently be generalized to other regions or countries, as different nuances may come into play that are not present here.

Secondly, as analysed in Section 5.2, this introduces a distinct anthropogenic bias, skewing data density toward high-population urban centers and potentially under-representing critical migration pathways in remote zones.

Finally, the in-situ assessment represents a snapshot in time. Certain factors that are scored, such as flow velocity or bank vegetation, fluctuate. Although huge differences in the final scores of the locations are unlikely to occur, minor variations could arise if the same locations were evaluated at different times of the year.

6. Conclusion

This study evaluated the assessment and selection of potential locations for the installation of permanent traps in East Flanders, aiming to effectively manage the population of the widespread Chinese mitten crab. Based on the results of the research and the subsequent discussion, the research questions can be answered.

6.1 Sub-conclusions

- *At which locations are high population densities observed, and where is nuisance (in relation to humans) most likely to occur?*

Most observations are located along the Scheldt and its largest tributaries. Within these watercourses, locations with infrastructure (e.g., locks) form genuine bottlenecks. These physical barriers cause crabs to accumulate and potentially seek alternative routes, making them more easily observed. Furthermore, a large share of the observations is concentrated in urban areas with high human activity, although this may reflect a higher observation probability rather than a lower crab density elsewhere.

- *To what extent are the sites where a permanent trap is currently installed considered suitable?*

The evaluation of the existing sites indicates that most locations score good to very good (SSI: A or B). However, there are notable exceptions. Ranst has a relatively low SSI (D) but functions well in practice, although the installation was challenging. In contrast, Afsnee achieves a high SSI (A), despite the fact that catches there have generally remained very limited and that access to the trap is relatively challenging as well. In short, the current locations perform well overall, with a few remarkable exceptions.

- *Which locations in East Flanders are potentially suitable for the future installation of a permanent crab trap, based on a British assessment protocol?*

The initial GIS analysis and the use of the decision tree resulted in a selection of fifteen locations, twelve of which were fully evaluated using the British protocol. Of those twelve locations, none scored below a 'C'. This implies that no genuinely unsuitable locations emerged from the pre-selection. Three locations, the Kattebeek, Bellebeek and Zwartekobensbeek, even achieved an 'A' score, which means they theoretically offer the highest potential and suitability for installing a trap.

- *What is the feasibility of applying this protocol within a Flemish context?*

The protocol provides a highly structured foundation for site selection. However, there are a few limitations regarding its full applicability within the Flemish context. Firstly, there is a contradiction concerning flow velocity and the absence of a criterion that evaluates the attraction flow. Furthermore, the criteria relating to permits and access to private property are redundant, given that the watercourse manager in Flanders always has access to their own watercourses.

Consequently, the protocol is already very comprehensive, but a few minor adjustments are necessary to make it fully relevant within a Flemish context.

6.2 General conclusion

What are the most suitable locations in the province of East Flanders for the installation of permanent crab traps to manage the Chinese mitten crab population?

The most suitable locations for installing permanent crab traps in East Flanders are located at critical migration bottlenecks. The highest potential lies where high population densities, human nuisance, and ecological vulnerability intersect. To identify new locations, a two-tiered approach is recommended: a macro-level desktop analysis (desk study, GIS, and decision tree) followed by a local *in situ* analysis using an assessment protocol adapted to the local context. However, as evidenced by the differences between theoretical scores and the known catch data of existing traps, model predictions only tell one side of the story. The protocol serves as an excellent indicator and a crucial safeguard to prevent unnecessary investments in permanent traps, though a critical perspective remains necessary regarding parameters that the protocol cannot fully capture.

7. Recommendations

Based on the conclusions of this study, several recommendations can be formulated for the future. These recommendations aim, on one hand, at achieving the most efficient site selection possible in the future and, on the other hand, at optimizing the protocol within a regional context. The key recommendations are discussed below:

Removing redundant criteria

To ensure the protocol's relevance within the Flemish context, redundant criteria must be omitted. This specifically concerns, as previously discussed, parameters regarding permits and access to private property. In a broader European context, these criteria would indeed be relevant. However, within the specific scope of Flanders, they consistently receive the maximum score because it's never an issue here. Even though these criteria have no impact on the overall ranking of the locations, their inclusion can cause unnecessary clutter. Because the final selection of optimal sites remains identical whether these criteria are included or not, it would be advisable to remove them to avoid confusion and streamline the assessment process within a Flemish context.

Critical evaluation of the flow velocity criterion

As previously discussed, a contradiction exists within the protocol regarding the evaluation of flow velocity. On one hand, a higher flow velocity is detrimental to working conditions and the physical stability of the trap. This is already being evaluated by the protocol. However, a higher flow velocity functions positively as an attraction flow for the crabs. This has not yet been evaluated by the protocol. A critical re-evaluation of this parameter is necessary, with the option to introduce a distinct criterion specifically for 'attraction flow'.

Prioritization of 'A'-locations

The evaluation of the potential sites highlighted two locations that achieved an 'A' score. If a decision is made in the future to expand the network of permanent traps, these locations deserve absolute priority as they theoretically offer the highest potential. By doing so, risks regarding performance and financial investment can be minimized.

Objectification of protocol parameters

To ensure that the protocol can be deployed broadly and used consistently by government personnel, vague terminology must be avoided. Preference should be given to unambiguous and, where possible, quantifiable criteria. Different surveyors will inevitably judge what constitutes a "high" flow velocity differently or disagree on what precisely defines an "alternative route" for the crabs. By making these descriptions concrete and unambiguous, we prevent the final score of a location from depending on the individual carrying out the assessment.

Evaluation of the remaining locations

Due to time constraints, only twelve of the fifteen identified locations could be fully assessed during this study. Because the remaining three sites also emerged from the initial decision tree pre-selection, they theoretically possess high potential as well. It is therefore recommended to evaluate these remaining locations using the protocol in the future.

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Appendix

A. British assessment protocol

Permanent Mitten Crab Trap Location Survey

Survey Information

Overview

This survey can be used to guide decision making when assessing sites for their suitability for the use of fixed traps to catch invasive Chinese mitten crabs (CMC).

A desk study will inform on the current CMC issue in the catchment and general information on the location.

Two on site surveys will assess locations for the feasibility of installing a fixed CMC trap and how well a fixed trap is expected to perform at the location. Each survey is comprised of sub-categories, the average score for these sub-categories will show what aspects make the location suitable and highlight any issues with the location.

This survey does not guarantee a successful fixed CMC trap deployment and is to be used a guidance tool to aid the decision making process when selecting trap sites.

How to Use

The desk study is to be completed prior to visiting any site in person. The desk study consists of key criteria with a location being graded with a 'pass' or 'fail' for each point. This eliminates locations which are not suitable without the need to attend the site. There is no score given for the desk study and this does not contribute to the overall grade.

The in-person survey contains two sections, 'Installation Feasibility' and 'Expected Trap Performance'. Each survey is comprised of sub-sections containing criteria questions. For each criteria point the location is scored from 0 (fail) to 3 where a score of '0' means that there is a significant obstacle in that aspect for a proposed fixed trap installation and a score of '3' means that the location is perfect in that aspect for a fixed trap installation. A score of '1' means that for that aspect the location is not ideal for a fixed trap installation but is still possible, a score of '2' means that for that aspect the location is not perfect but is still suitable for a fixed trap installation.

Circumstances may not allow for certain points to be addressed while completing the survey. The overall scoring is based on the average results, therefore if a score cannot be given the score for that point should be left blank and not included in the final score.

For the most accurate location score aim to score the site for each of the given criteria.

Scoring System

The desk study is 'pass' or 'fail', there is no score generated for this section. The 'Installation Feasibility' and 'Expected Trap Performance' sections are scored from 0 to 3 and an average score for each survey will be generated.

By using the index below, the total average score will generate a site suitability rating for the location, demonstrating whether the site is suitable for the installation of a fixed CMC trap.

Guidance is given on how to mark each criteria, because every location is unique personal judgement must be used to provide a score. For each criteria point a score is given, 0 being the lowest score and 3 being the highest. A 0 is considered a fail, which represents a significant barrier to successfully installing a fixed CMC trap, changes must be made to the location to account for this if a CMC trap was to be installed.

Site Suitability Index

Avg Score	<1.5	1.5 – 1.74	1.75 – 1.99	2 – 2.24	2.25 – 2.49	2.5 - 3
Grade	F	E	D	C	B	A

Location Survey Results

Desk Study
Pass/Fail

Installation
Feasibility
Average Score

Expected
Performance
Average Score

Site Average Score

Site Suitability Rating

Permanent Mitten Crab Trap Location Survey

Location:..... Survey Date:..... Surveyor(s):.....

SCORING SYSTEM (ALL Q's):

Fail

Pass

Unsure

Desk Study

Species Assessment

Mitten Crab Presence: Proximity to confirmed Chinese mitten crab record. For a Chinese mitten crab trap to be necessary invasive crabs must be present in the catchment.

☐
CMC not present in the catchment

☐
Confirmed CMC records in the catchment

☐
No data or unconfirmed catchment data

Upstream Importance: What will the trap protect upstream?
A permanent Chinese mitten crab trap will protect upstream ecosystems, protecting large areas containing a plethora of native species will provide more ecological benefits.

☐
Upstream ecosystem not ecologically significant

☐
Upstream ecosystem home to variety of native species

☐
Upstream ecosystem is unknown

Native Species Present: Will protected species be impacted by a trap?
Licensing applications for a CMC trap may be impacted by the native species present. In locations where a protected species is present restrictions on modifying the site may apply.

☐
CMC trap will negatively impact native species. Trap license likely to be obstructed

☐
CMC trap will not impact native species. Trap license will not be obstructed

☐
Unknown if CMC trap will impact native species

Existing Infrastructure

Waterway Infrastructure: Existing permanent structures can have a positive or negative impact on the installation and performance of CMC traps. Will existing infrastructure inhibit CMC trap installation?

☐
Existing infrastructure will block installation

☐
Any existing infrastructure unlikely to impact trap

☐
Unknown what infrastructure exists

Waterway Infrastructure: Will existing infrastructure harm CMC trap performance? For example, by providing crabs routes to avoid a trap.

☐
Existing infrastructure will harm performance

☐
Existing infrastructure unlikely to harm performance

☐
Unknown what infrastructure exists

Site Access

Vehicle Access: What road links does the site have? Machinery may be needed for installation. Regular visits to the site will be necessary during trap operation.

☐
No vehicle access for >1km

☐
Site easily accessible via road

☐
Unclear what access routes to site are available

Land Ownership: Permission will be needed from relevant landowners to access the site for installation and operation of CMC trap.

☐
Site is on private land where access will not be granted

☐
Permission to access land likely to be granted

☐
Unknown who owns land or if access will be granted

Species Assessment Result

☐

Existing Infrastructure Result

☐

Site Access Result

☐

Desk Study Result

☐

Permanent Mitten Crab Trap Location Survey

Location:..... Survey Date:..... Surveyor(s):.....

SCORING SYSTEM (ALL Q's): **0 (FAIL)** **1** **2** **3**

Installation Feasibility

Infrastructure & Accessibility

Accessibility: Is it possible for vehicles/machinery to access the site? Vehicle access is likely required to transport and/or install the trap.

☐

Inaccessible to all machinery and vehicles

☐

Difficult for most machinery or vehicles to access site

☐

Most machines and vehicles can access site

☐

Site easily accessible

Existing Infrastructure: Structures in the waterway or at the site may help provide a base for a trap or potentially obstruct trap installation. Some structures or lack of will not impact trap installation.

☐

Will completely inhibit trap

☐

Will slightly inhibit a trap

☐

Will not impact a trap

☐

Will aid a trap

Foliage: Foliage, such as thick brambles, may prevent access and inhibit a fixed CMC trap. It may be necessary to clear foliage prior to installation

☐

Thick foliage unable to be cleared

☐

Thick foliage, can be cleared where necessary

☐

Some foliage, unlikely to impact trap

☐

Very little or no foliage.

Waterway Conditions

Water Depth: A higher water depth makes the installation process more difficult. A water depth very low will require modifications to trap design.

☐

Extreme depth conditions: <0.2m

☐

High water depth: 3m < X or low water depth: 0.2m < X < 0.35m

☐

Water depth: 1m < X < 3m

☐

Water depth: 0.35m < X < 1m

Tidal Changes: Tidal changes can impact worker safety and structural stability during installation.

☐

Tidal changes create unsafe working conditions

☐

Tides create difficult working conditions

☐

Tides unlikely to impact working conditions

☐

No tidal impact

Flow Velocity: Flow velocity impacts the working conditions. A higher flow velocity will make installation more difficult and possibly be dangerous.

☐

Very high flow velocity creates unsafe environment

☐

Flow velocity may create difficulty

☐

Flow velocity unlikely to cause issues

☐

Flow velocity not impactful

Waterway Structure

Sediment Type: Unstable sediment may cause structural issues. Solid sediment and rocks may obstruct a trap and are difficult to cut or remove

☐

Extremely unstable or obstructive sediment

☐

Soft sediment creates unstable environment

☐

Sediment is mostly stable

☐

Stable and consistent sediment

Riverbed Structure: A flat riverbed is preferred. The more elevation changes or irregularity the more difficult the installation.

☐

Large elevation changes and rocks

☐

Some rocks and elevation changes

☐

Few rocks or elevation changes

☐

No elevation changes or rocks

Riverbank Structure: A stable riverbank aids the trap structure and collection system. The taller the riverbank the larger the collection tubes, this may increase installation difficulty.

☐

Severely Unstable Riverbank

☐

Tall riverbank, Height > 3m

☐

Riverbank 1.5m < Height < 3m

☐

Riverbank Height < 1.5m

Width of Waterway: A wider waterway creates a more difficult installation process.

☐

Waterway Width > 50m

☐

Waterway 20m < Width < 50m

☐

Waterway 10m < Width < 20m

☐

Waterway Width < 10m

Accessibility Score

☐

Waterway Conditions Score

☐

Waterway Structure Score

☐

Installation Feasibility Total Score

☐

Permanent Mitten Crab Trap Location Survey

Location:..... Survey Date:..... Surveyor(s):.....

SCORING SYSTEM (ALL Q's): 0 (FAIL) 1 2 3

Expected Trap Performance

Changeability of Waterway Conditions

Width Variation: Does the width of the waterway change with an increase in water volume? Width alterations may potentially create gaps around the trap.

☐ Regular large changes in width
☐ Regular changes in width
☐ Some small changes in width
☐ Very little or no width change

Depth Variation: Depth variation is impactful in shallow waterways. Space must be available above the trap for native aquatic species to be able to avoid the trap.

☐ Depth variation >0.5m & depth falls <0.2m
☐ Depth variation & depth falls 0.2m<X<0.4m
☐ Depth variation but depth never falls <0.4m
☐ Depth never falls <0.75m

Changeability Due to Weather: Waterway conditions and accessibility may be negatively affected by weather and an increased water volume.

☐ Extremely vulnerable to weather changes
☐ Impacted by weather changes
☐ Slightly vulnerable to weather changes
☐ Not vulnerable to weather changes

Seasonal Changeability: Do the waterway conditions, such as width, depth or turbidity change due to time of year? Changes in waterway conditions or water volume may negatively impact trap performance.

☐ Waterway suffers dramatic changes
☐ Waterway undergoes large changes
☐ Waterway undergoes slight changes
☐ Waterway remains mostly unchanged

Tidal Changes: The tidal influence in the waterway. Tidal changes may have negative impacts on the waterway conditions and accessibility.

☐ Tidal changes have large negative impact.
☐ Tidal changes impact location
☐ Tidal changes have small impact
☐ No tidal impact

Accessibility

Accessibility to Humans: How easy is it for workers to access the location? Trap will need to be inspected and crabs collected regularly.

☐ Not safely accessible
☐ Difficulty accessing location
☐ Some difficulty accessing location
☐ No issues accessing location

Vulnerability to Public: Is the location accessible and in clear view of well used public footpaths? Members of the public may knowingly or unknowingly damage the trap.

☐ Trap elements will intrude on public footpaths
☐ Trap clearly visible and accessible from public areas
☐ Trap obscured from view of public areas
☐ Trap not accessible from public areas

Accessibility for Maintenance: The trap may need occasional cleaning and/or maintenance. Ease of accessibility will impact the time and effort required.

☐ Trap will be inaccessible
☐ Trap will be difficult to access
☐ Trap will be fairly accessible
☐ Trap will be easily accessible

Water Flow Conditions

Flow Velocity: Higher flow velocity will increase the forces subjected on the trap and carry debris at high speed. High downstream flow may help migrating adult crabs 'jump' the trap.

☐ Extreme flow velocity – White water rapids.
☐ High flow velocity
☐ Standard flow velocity
☐ Low flow velocity

Debris and Sediment: Debris and sediment can become damage or become entangled in the trap. This may reduce trap effectiveness and may require clearing and trap repairs.

☐ Large debris and sediment constantly in waterway
☐ Large debris and sediment regularly in waterway
☐ Sporadic debris and some sediment in waterway
☐ Little debris or sediment in waterway

Waterway Conditions Score

☐

Accessibility Score

☐

Water Flow Conditions Score

☐

Expected Performance Total Score

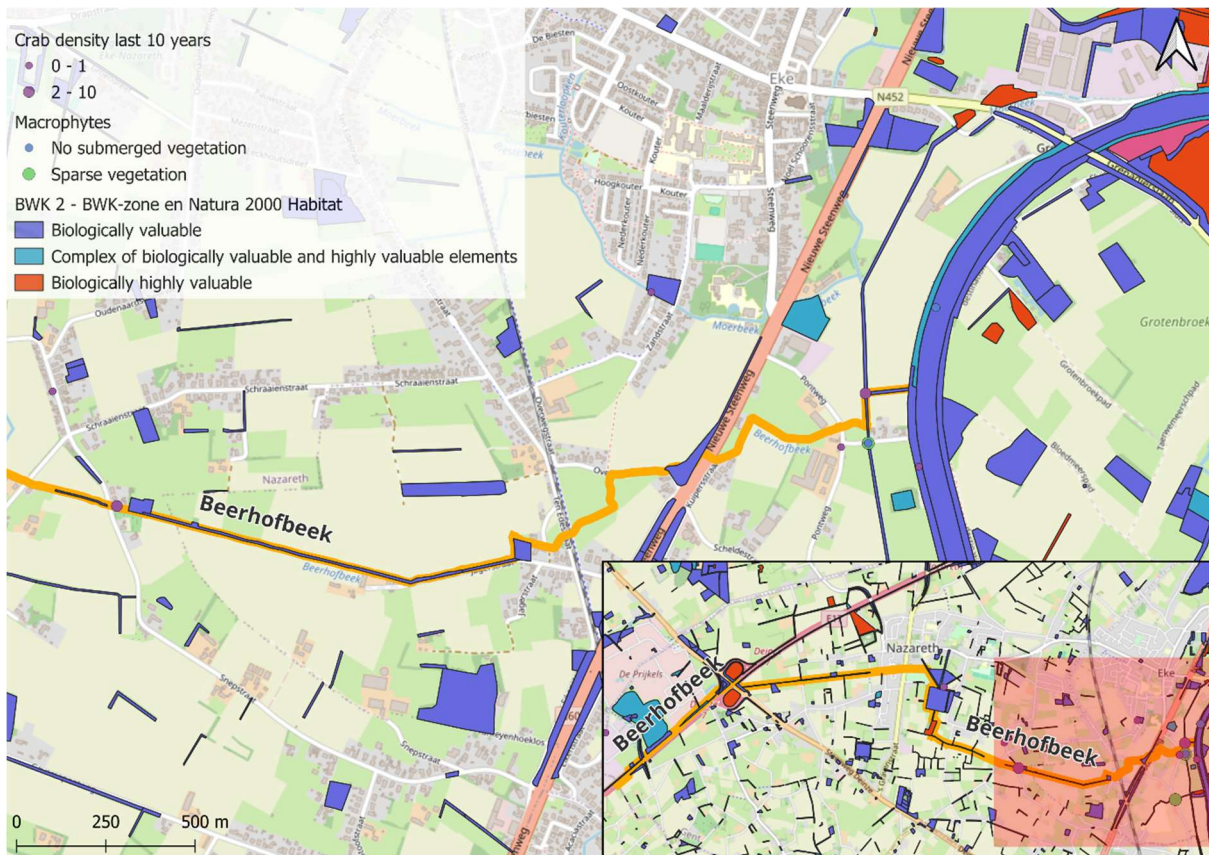
☐

B. Initial list of locations

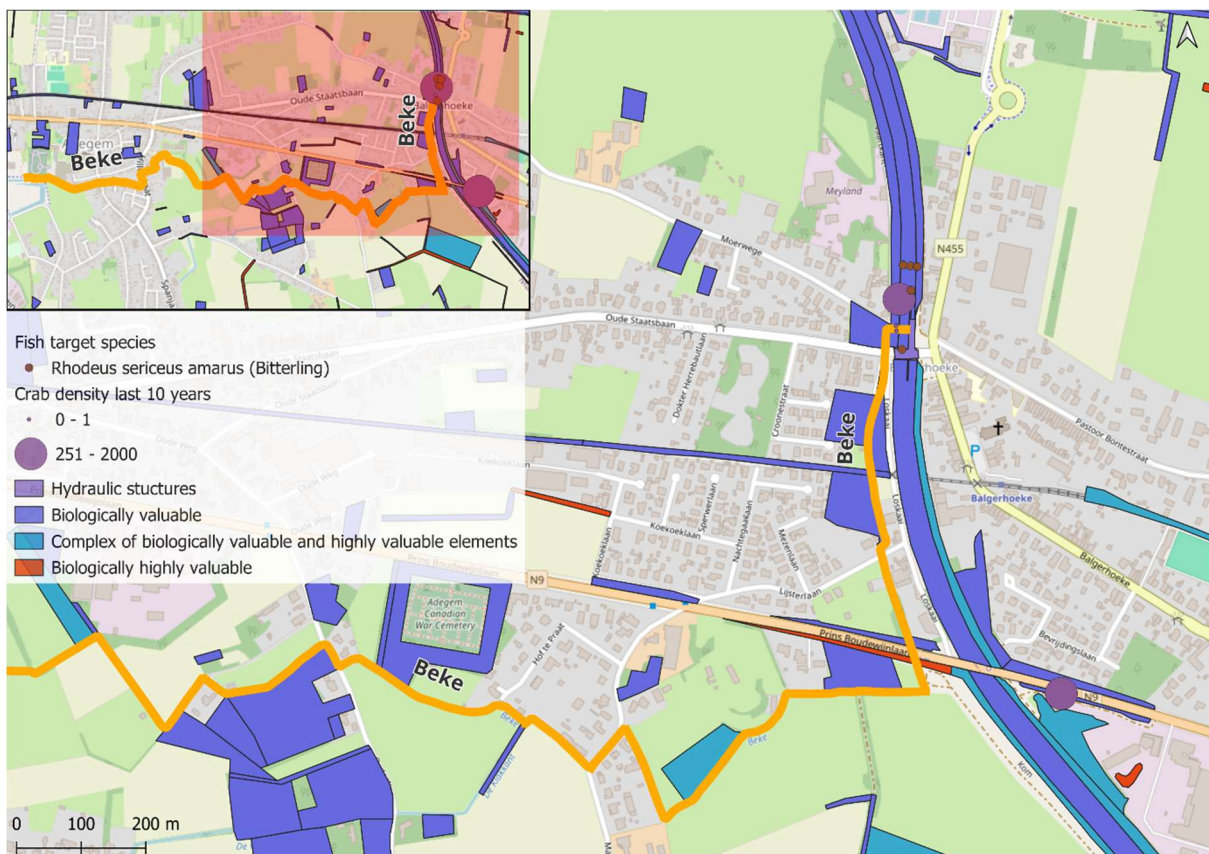
Location	Critical factor	Notes	Result of decision tree	Notes impactscore	Impactscore (0 - 5)
Moerbeek/Beerhofbeek_Nazareth	Nuisance & ecological value	Sightings in gardens, BWK	Plan trap system	VEN and sparse water vegetation	2
Beke_Balgerhoeke	Nuisance & ecological value	Hydraulic structures, urban area, BWK	Plan trap system	/	0
Bellebeek_Schellebelle	Ecological value	VEN areas, target fish species	Plan trap system	VEN	1
Blokkreek_Sint-Laureins	Ecological value	VEN areas	Plan trap system	VEN	1
Kalebeek_Sint-Martens-Leerne	Ecological value	VEN areas	Plan trap system	VEN	1
Kasteel Sombeke_Elversele	Nuisance & ecological value	Sightings in gardens, VEN areas	Plan trap system	VEN	1
Maarkebeek_Oudenaarde	Ecological value	Presence of SBZ, VEN areas, target fish species water vegetation	Plan trap system	SBZ, VEN and frequent to abundant water vegetation	4
Moerbeek_Eke	Ecological value	VEN areas, water vegetation	Plan trap system	VEN and sparse water vegetation	2
Molenbeek_Melle	Nuisance & ecological value	Number of incidents during fishing competitions, VEN areas, water vegetation	Plan trap system	VEN and frequent to abundant water vegetation	3
Torensbeek_Hofstade	Nuisance & ecological value	Sightings in gardens, VEN areas	Plan trap system	VEN	1
Kattebeek_Petegem-a-d-Leie	Nuisance & ecological value	Water vegetation, BWK, runs through urban areas and next to fishing pond	Plan trap system	Water vegetation filling entire water column	3
Zwartekobensbeek_Zwijnaarde	Ecological value	VEN areas	Plan trap system	VEN	1
Roebeek_Schellebelle	Nuisance & ecological value	Sightings in gardens, VEN areas	Plan trap system	VEN	1
Molenbeek_Wichelen	Ecological value	VEN areas, target fish specie	Plan trap system	VEN and sparse water vegetation	2
Molenbeek_Denderleeuw	Nuisance & ecological value	Sightings in gardens, water vegetation, VEN areas	Plan trap system	VEN and frequent to abundant water vegetation	3

C. Detailed view of every location of the initial selection

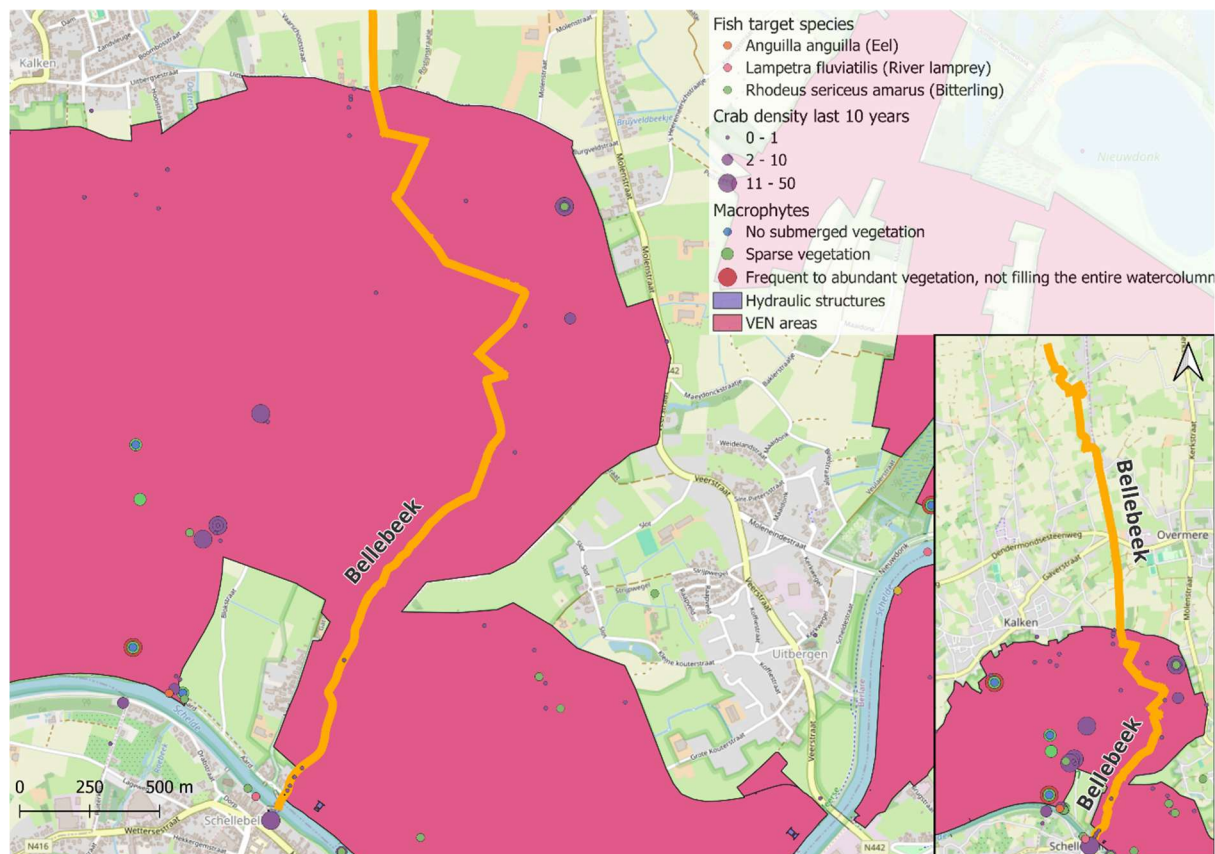
1. Beerhofbeek/Moerbeek in Nazareth



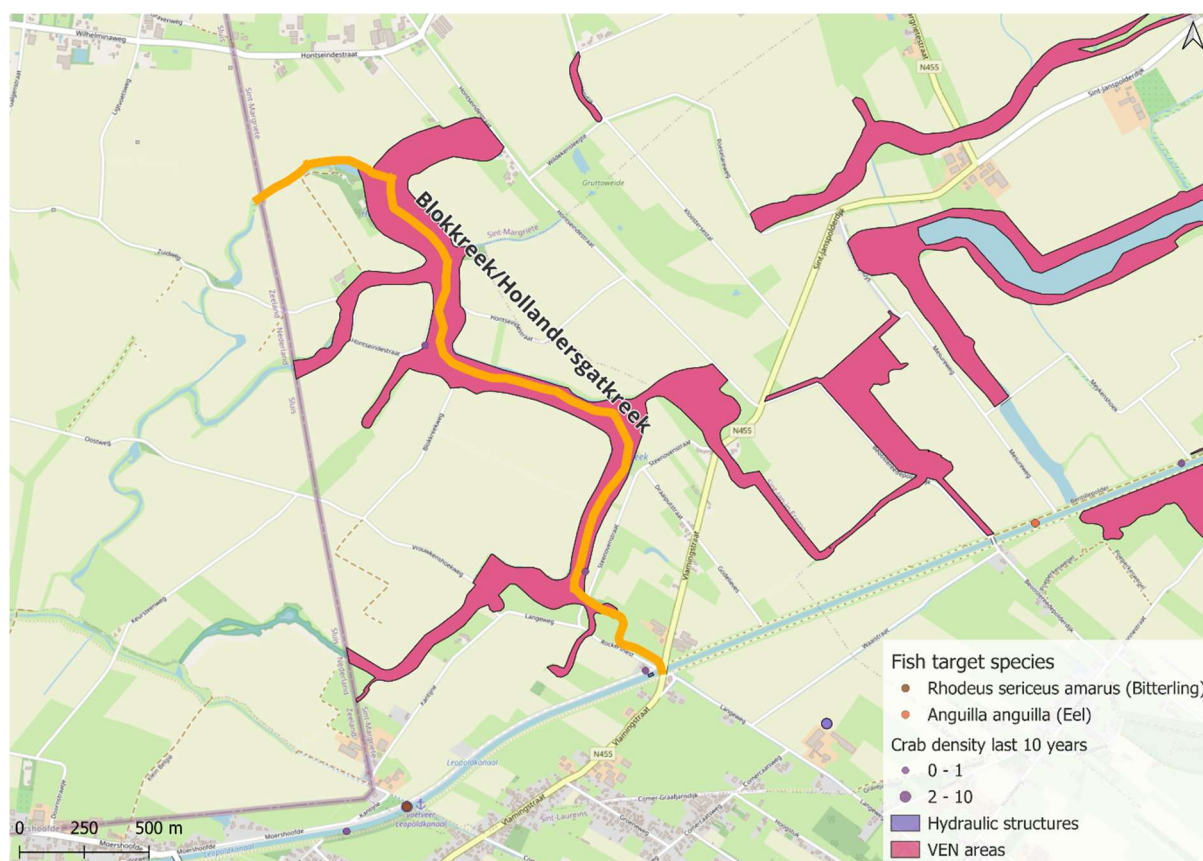
2. Beke in Balgerhoeke



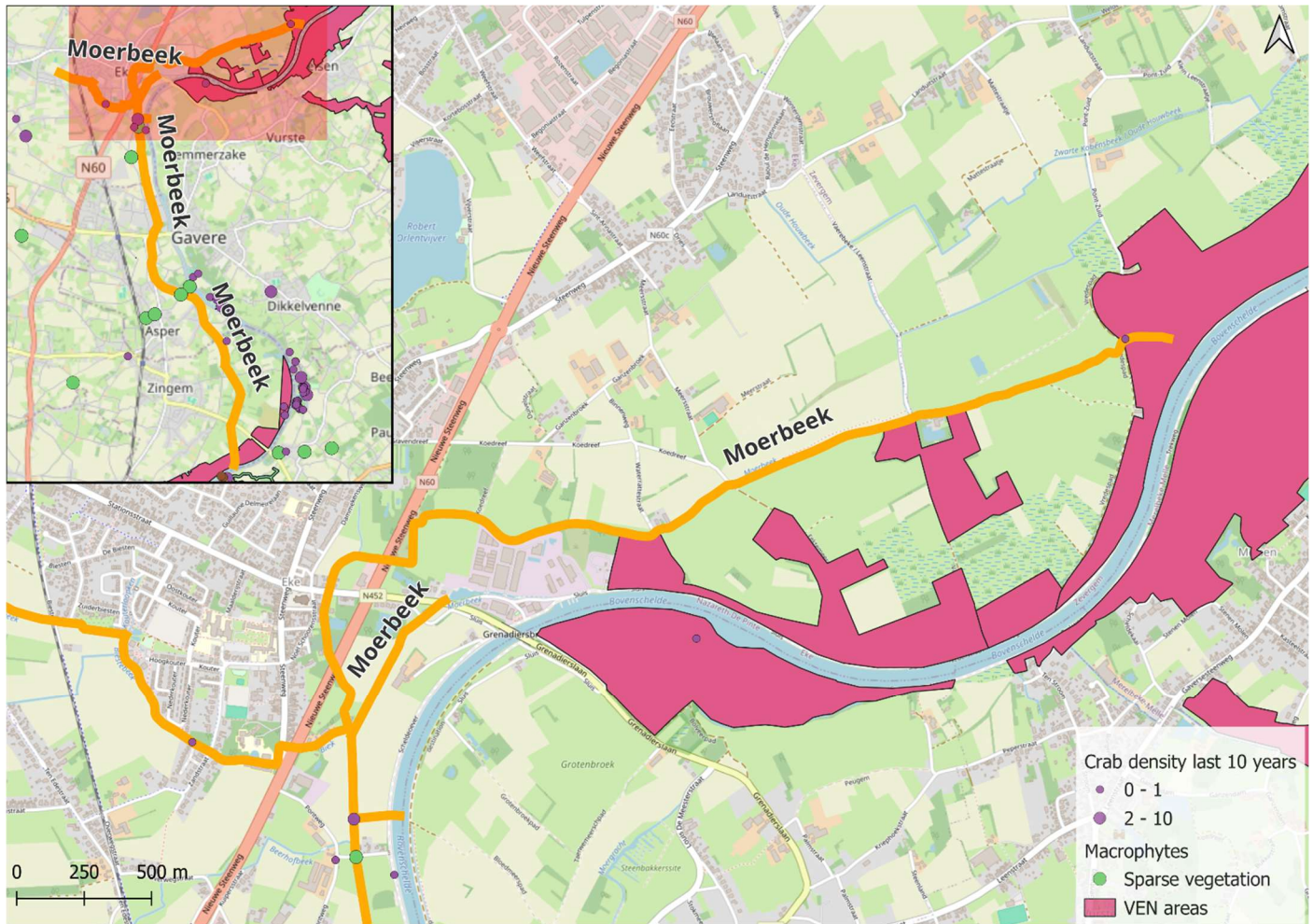
3. Bellebeek in Schellebelle



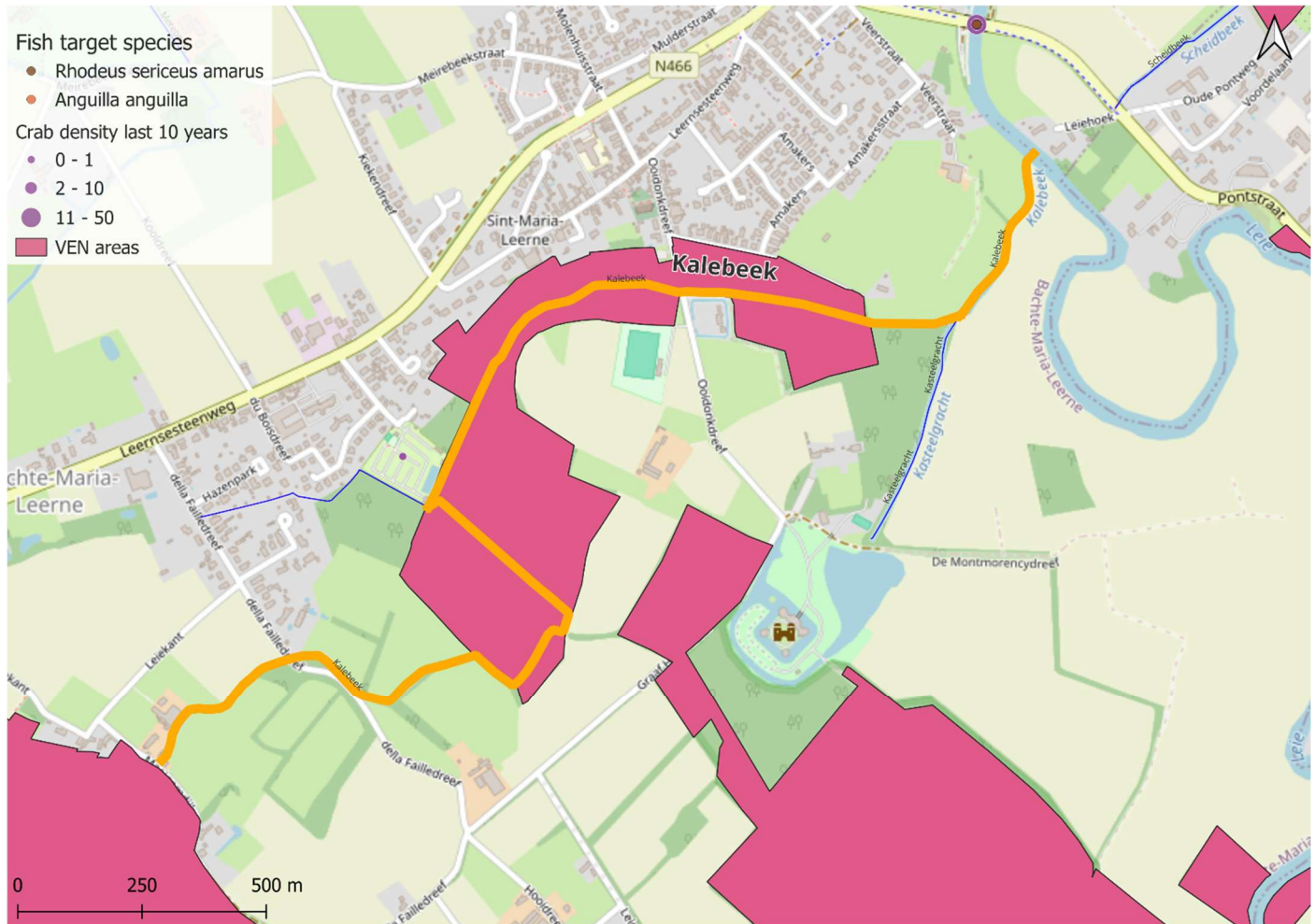
4. Blokkreek in Sint-Laureins



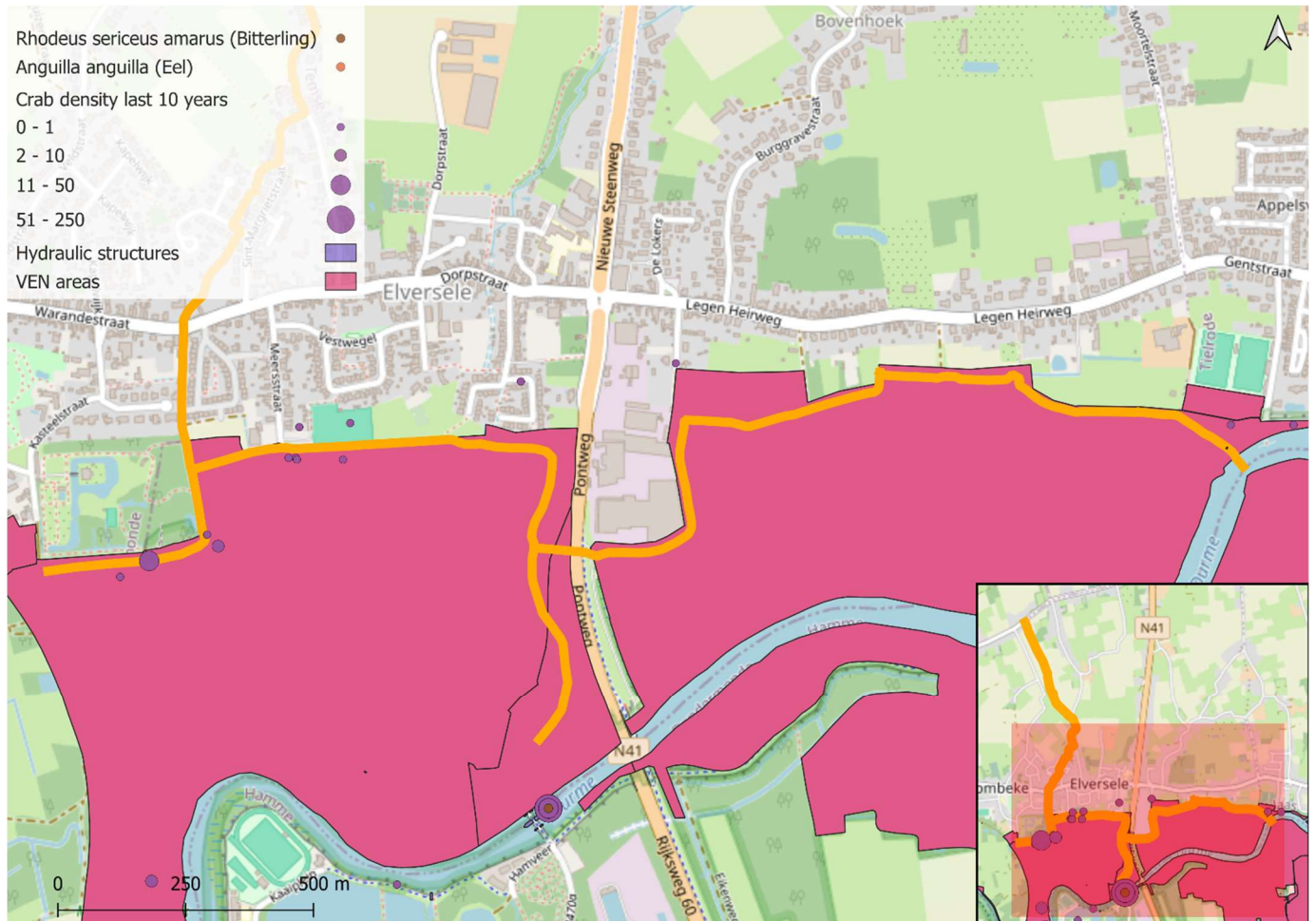
5. Moerbeek in Eke



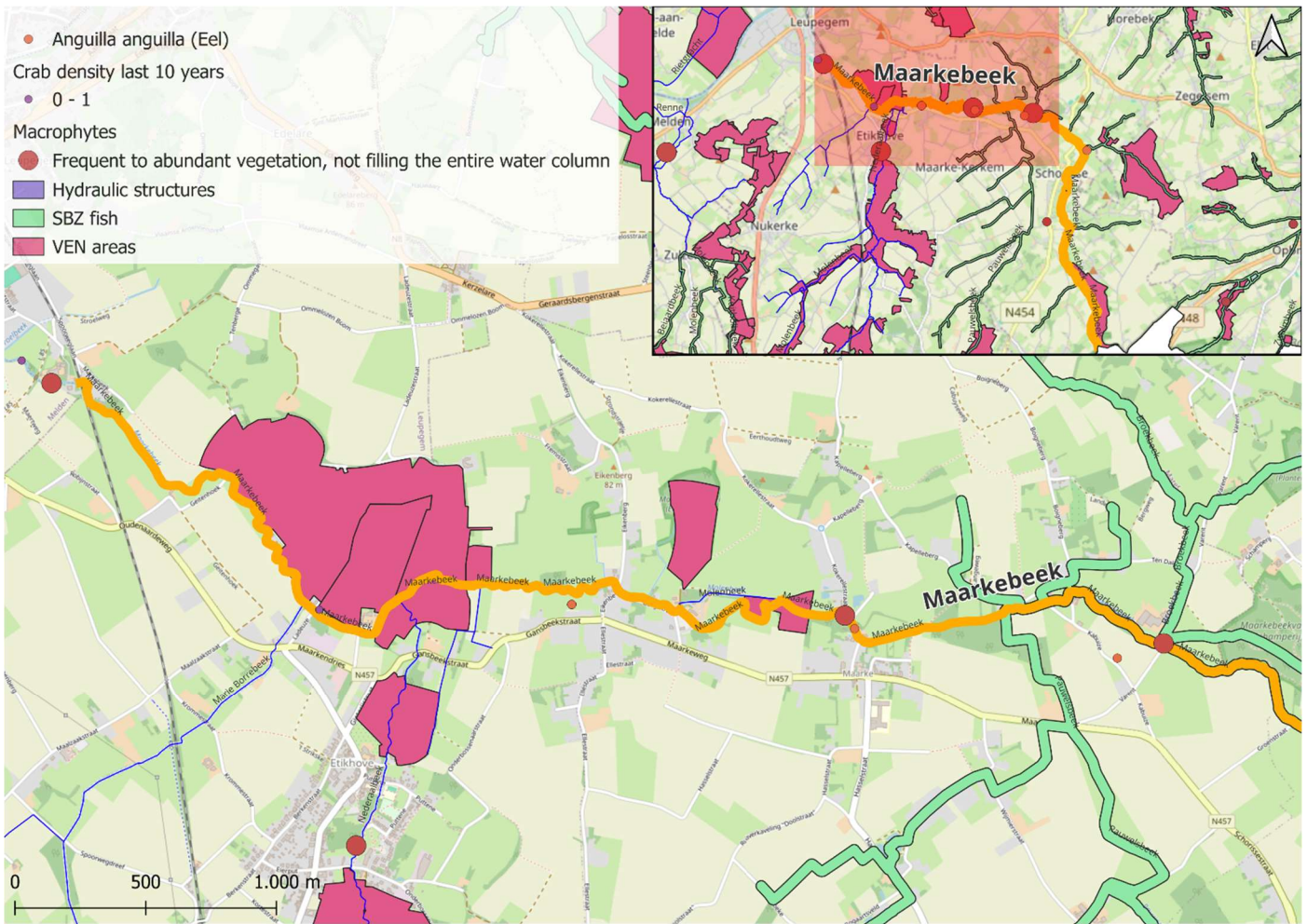
6. Kalebeek in Sint-Martens-Leerne



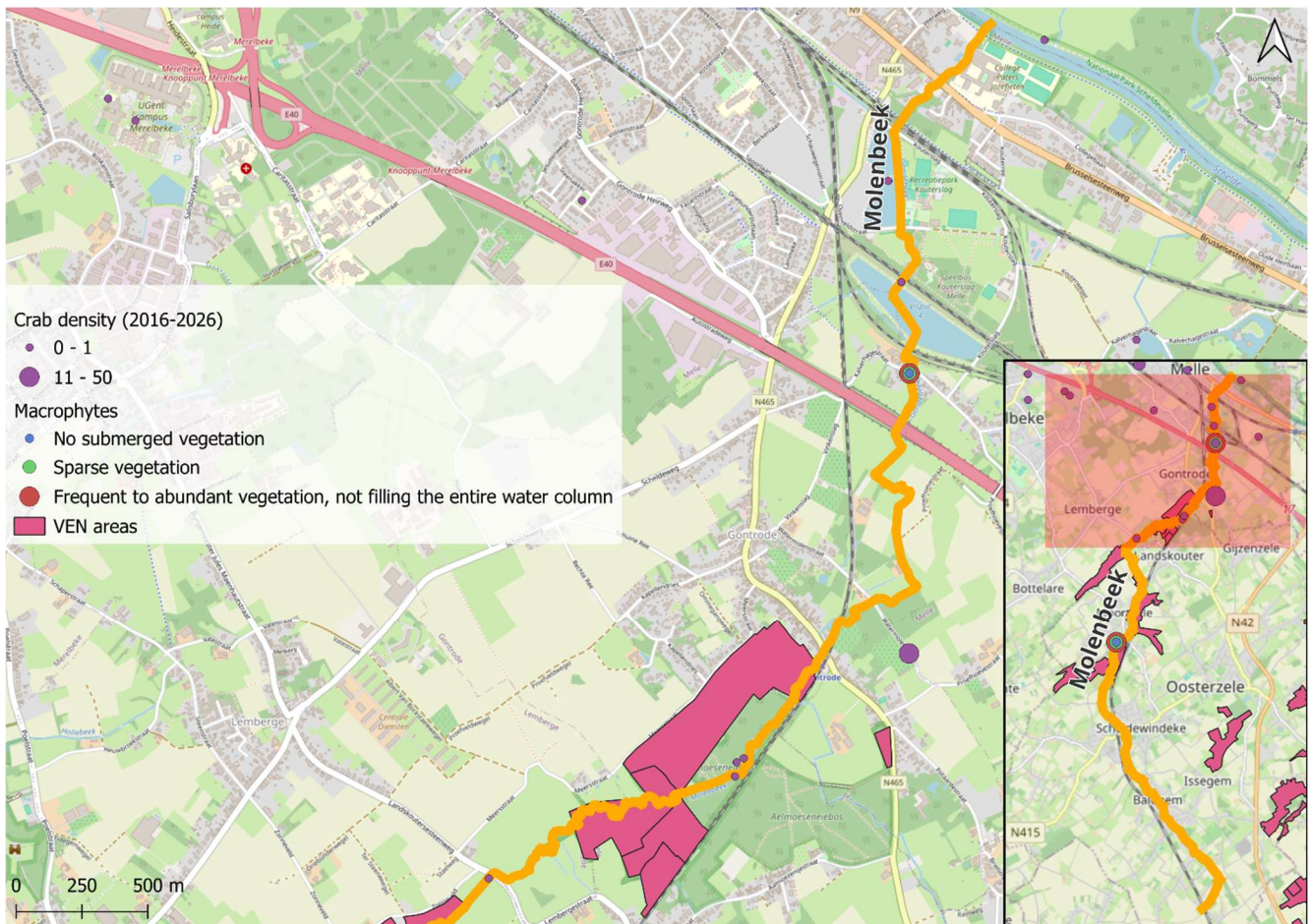
7. Waterway at Castle of Sombeke in Elversele



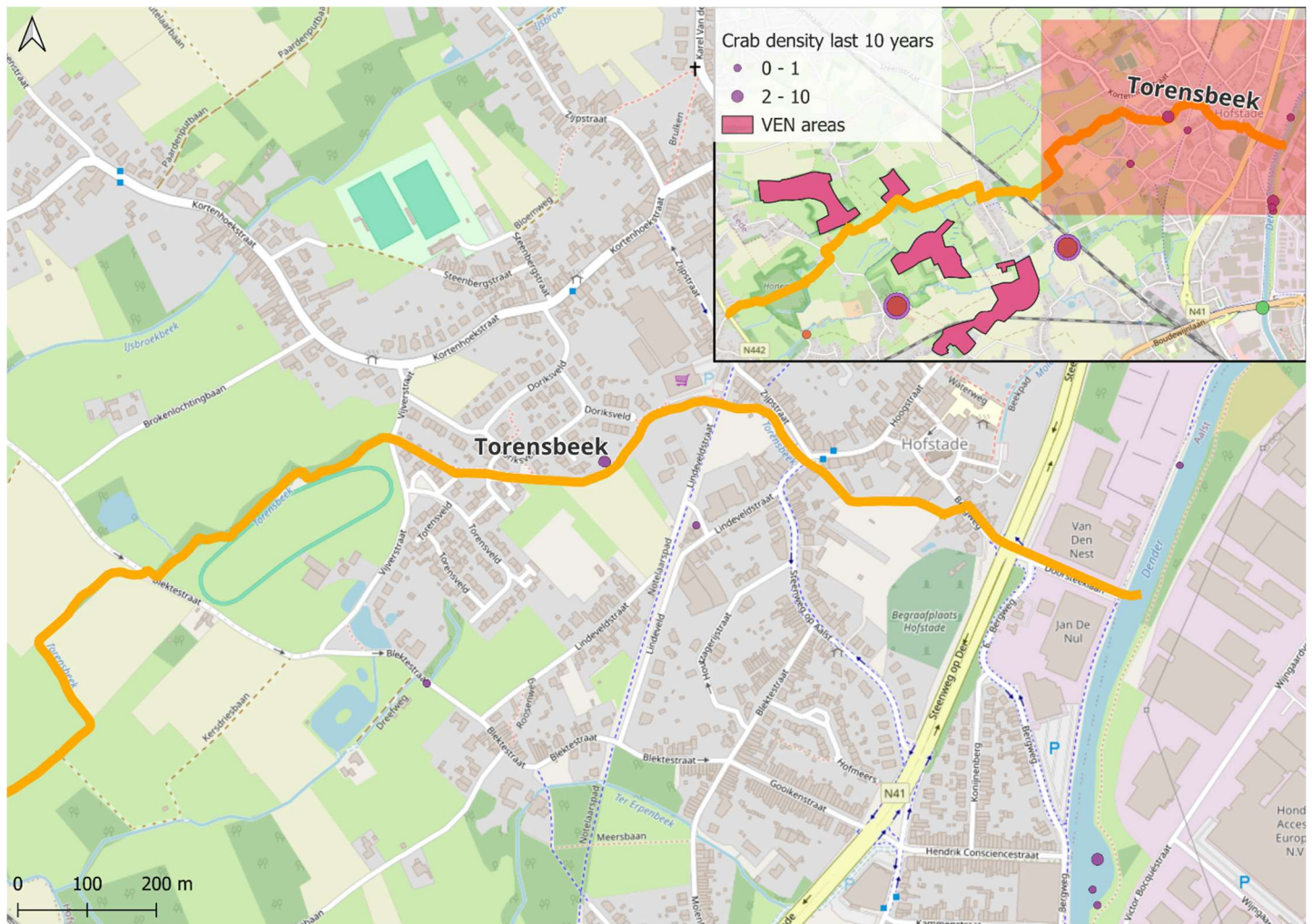
8. Maarkebeek in Oudenaarde



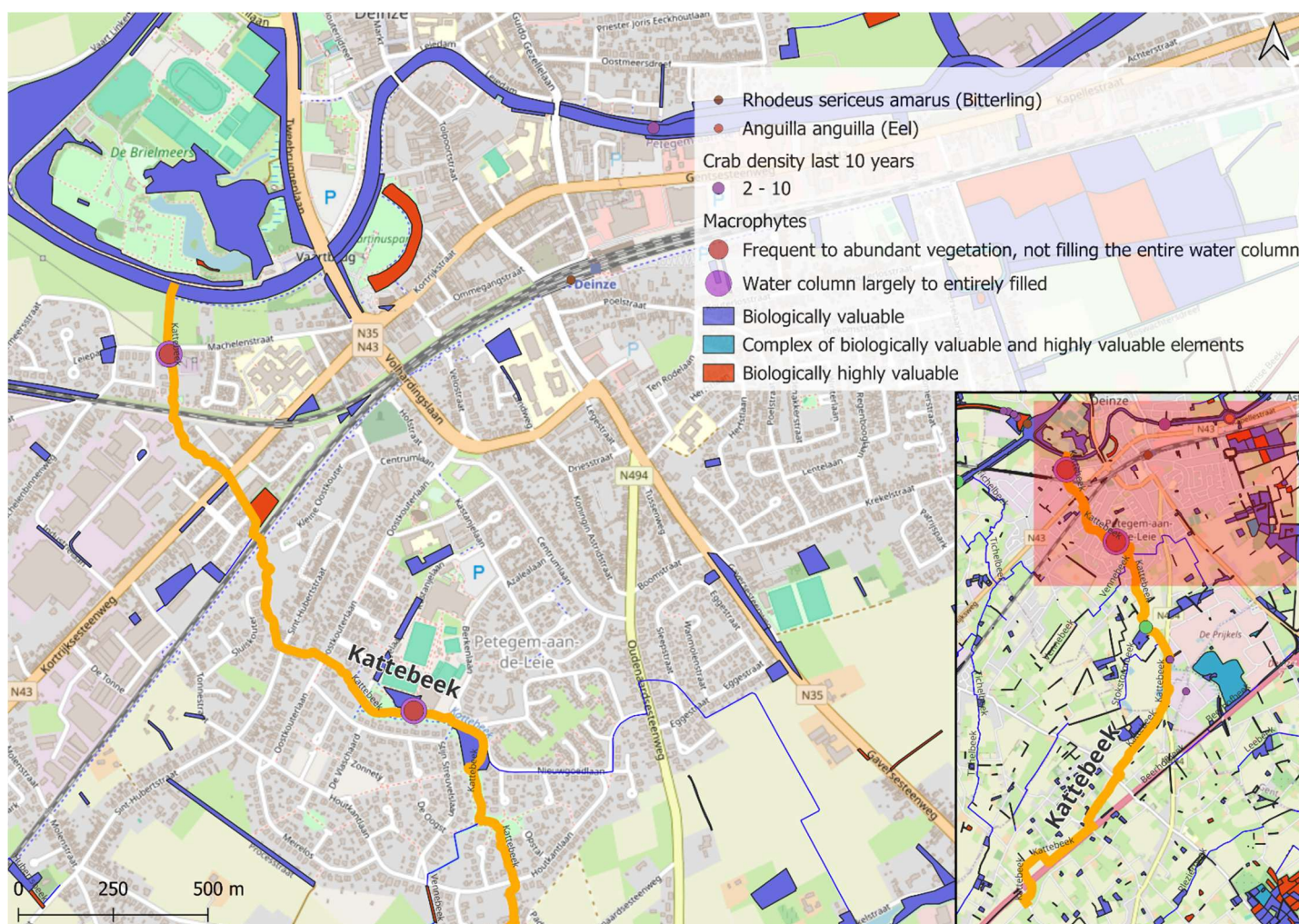
9. Molenbeek in Melle



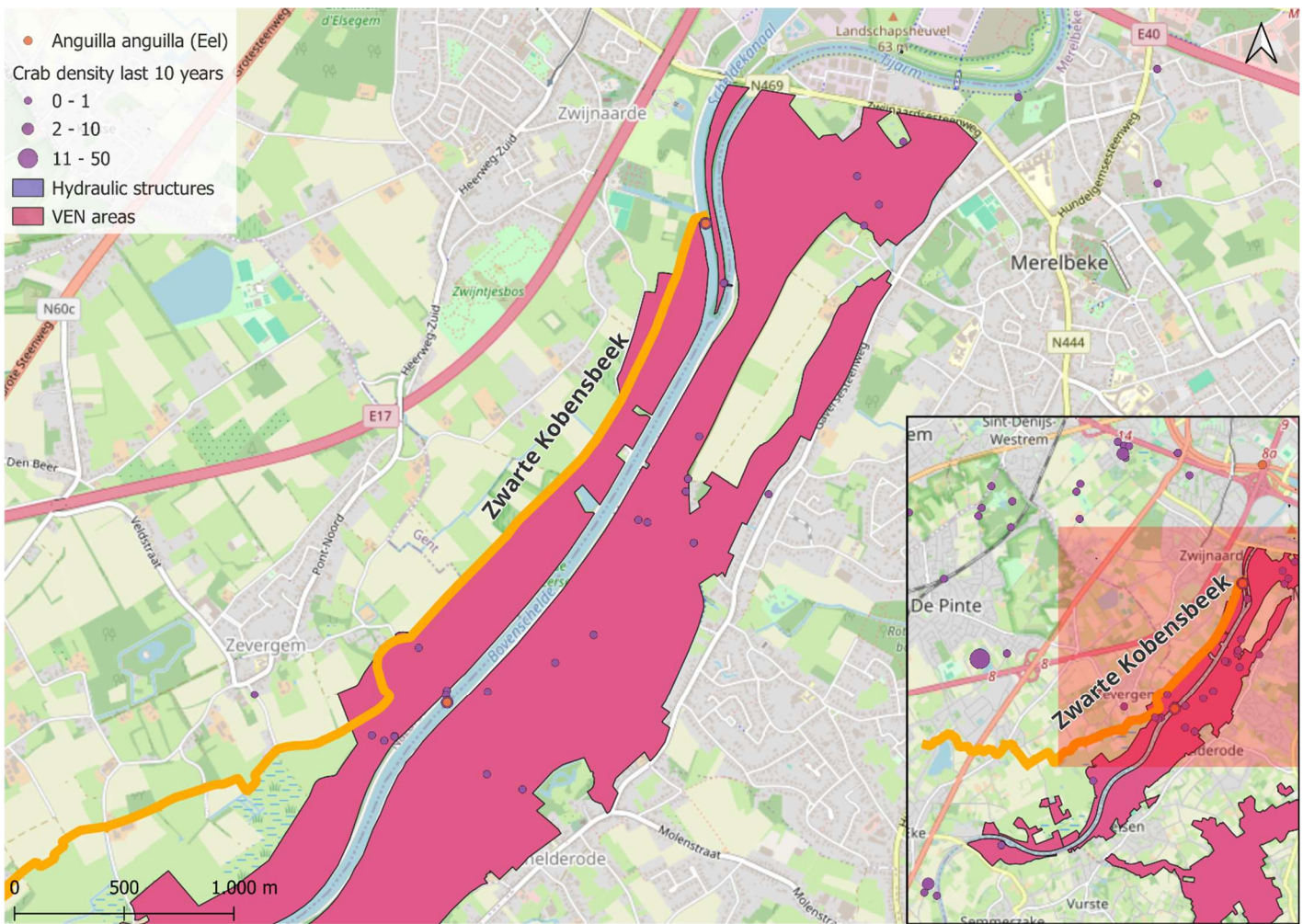
10. Torensbeek in Hofstade



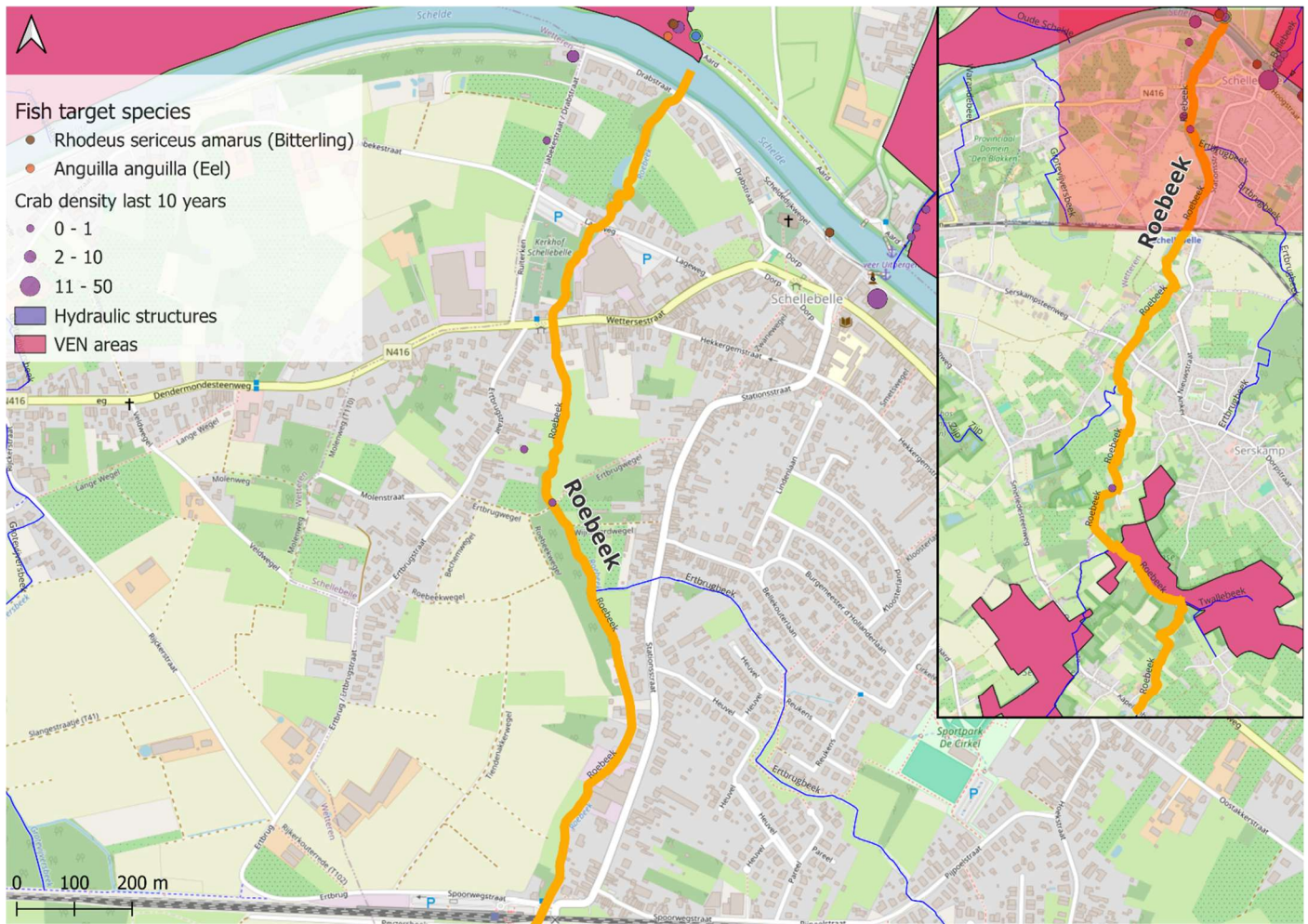
11. Kattebeek in Petegem-aan-de-Leie



12. Zwartekobensbeek in Zwijnaarde



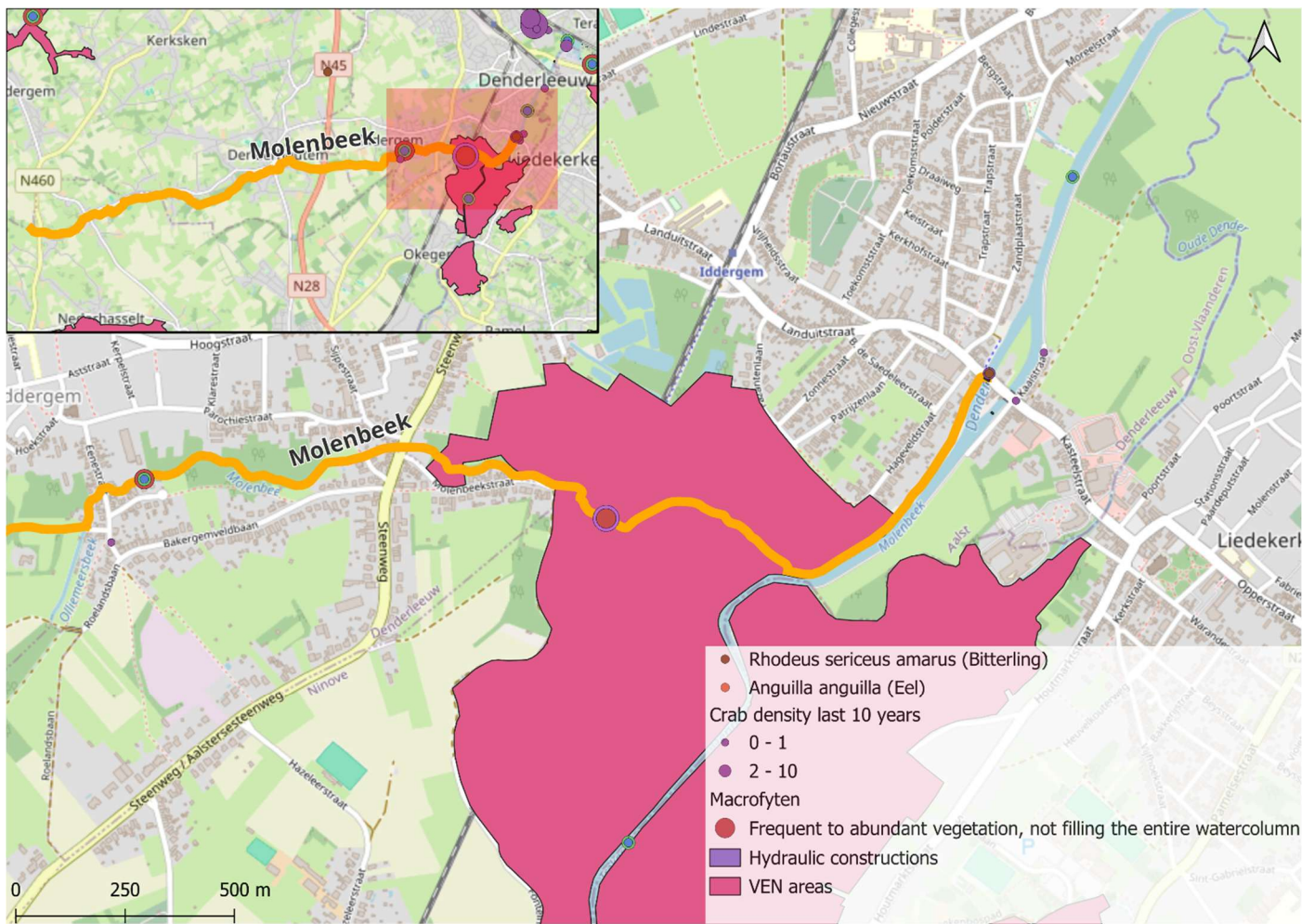
13. Roebeek in Schellebelle



14. Molenbeek in Wichelen



15. Molenbeek in Denderleeuw



D. Use of AI

Transparantiedocument gebruik AI:

Zet een kruisje bij de correcte stelling:

	Tijdens de voorbereiding van dit werk heb ik (en mijn medestudenten) GEEN gebruik gemaakt van hulpmiddelen voor artificiële intelligentie.
X	Tijdens de voorbereiding van dit werk heb ik (en mijn medestudenten) WEL gebruik gemaakt van hulpmiddelen voor artificiële intelligentie.

Indien er WEL gebruik werd gemaakt van artificiële intelligentie, vult de student onderstaande tabel in. In bepaalde situaties moeten ook de gebruikte prompts worden toegevoegd (zie laatste kolom). Dit geldt wanneer het gebruik van AI-hulpmiddelen invloed heeft gehad op de bevindingen, resultaten of aanbevelingen van het ingediende werk.

Tijdens de voorbereiding van dit werk heb ik AI gebruikt om volgende redenen:

		Naam AI-tool(s)	Noodzakelijk om prompts mee te geven?
1	Als zoekmachine	Gemini	Neen
2	Als inspiratiebron	Gemini	Neen
3	Voor het verzamelen van ideeën	Gemini	Neen
4	Als taal assistent	Gemini	Neen
5	Om een tekst tot een hoger niveau te tillen	Gemini	Neen
6	Als hulp bij het samenvatten van bepaalde teksten of documenten	Gemini	Neen
7	Voor het krijgen van feedback op voorlopige versie van werkstukken	Gemini	Neen
8	Voor het analyseren van resultaten (! Let op vertrouwelijkheid van gegevens!)	/	Ja
9	Voor het vergelijken van door AI gegenereerde content met de eigen onderzoeksresultaten.	/	Ja
10	Bronvermelding	Gemini	Indien invloed op je resultaten/aanbevelingen
11	...	/	Indien invloed op je resultaten/aanbevelingen

Na het gebruik van deze tool/service heb ik de inhoud grondig en kritisch bekeken en waar nodig bewerkt, waarbij ik de volledige verantwoordelijkheid opneem voor het eindresultaat.