02 - SITE ANALYSIS

Site Analysis

Author

Jasper Sterrenburg - 5653673

Tutors

Olv Klijn - design tutor

Ruurd Kuijlenburg - building technology tutor

Alejandro Campos Uribe - research tutor

Graduation Studio

Architecture & Dwelling - AR3AD100 - Advanced Housing Design

Date

2 July 2024

Abstract

In many cases, a well-informed design is made up of three factors, a location, a program or project brief, and a concept. This analysis investigates a selected site for a design project in the polder Midden-Delfland close to the city of Vlaardingen, to get grips on the site and its characteristics. A photo report, desk research, scale modeling, and an analysis of maps are used to gain insight into the historical, current, and future state of the site. The analysis has shown that water and soil are elements that will have a big impact on the design decisions. Regular floodings will occur, since the site is part of a water buffer zone, whilst the current polder landscape is gradually transformed into a wetlands area, eventually leading to the landscape to be uninhabitable.

Great care should be given to how a building touches the ground in a non-permanent way, since eventually, the structure has to be moved. The site does however offer a location to dwell within a beautiful and vast polder landscape in which one can come to rest an truly enjoy rural living.

Keywords

Site analysis, Midden-Delfland, polder, wetlands, geomorphology

Table of Contents

Introduction

Together with the concept and program, the location is one of the three essentials for making a complete and suitable design. This document is aimed at getting grips on the chosen site for the design project and to create a basis for the further design and decision-making process. The chosen site is located near Vlaardingen, The Netherlands on a T-crossing between the special ditch the Zweth and the boezem named Vlaardingervaart. In the run-up to this site analysis, a masterplan for the site has been made, which will be in its complete state in the year 2100. The final project that will be partly inspired by the site analysis is placed within this masterplan.

Because a large part of the masterplan is planned for the future, the site has not been analyzed properly in its future state. The past and present have been researched previously but not conveniently documented for the use of a design project. This document therefore aims to bundle the research on the history, current state, and future state of the location. It is the objective to create easy-to-read diagrams, plans, and sections to create an understanding of the future situation.

At first, the present state of the site is documented. This is done through a description, drawings, and photo reportage to give an impression of the site as it is now. Then the history of the site will be researched, through the measure of maps, satellite pictures, and booklets made by historic associations. Once the past and the present have been documented the future will be mapped. Firstly, the masterplan in its whole will be mapped through axonometric drawings, followed by the mapping of the plot the building will be designed. Finally, the site will be shown through a 1:200 site model, containing the most important characteristics of the site.

Current Situation

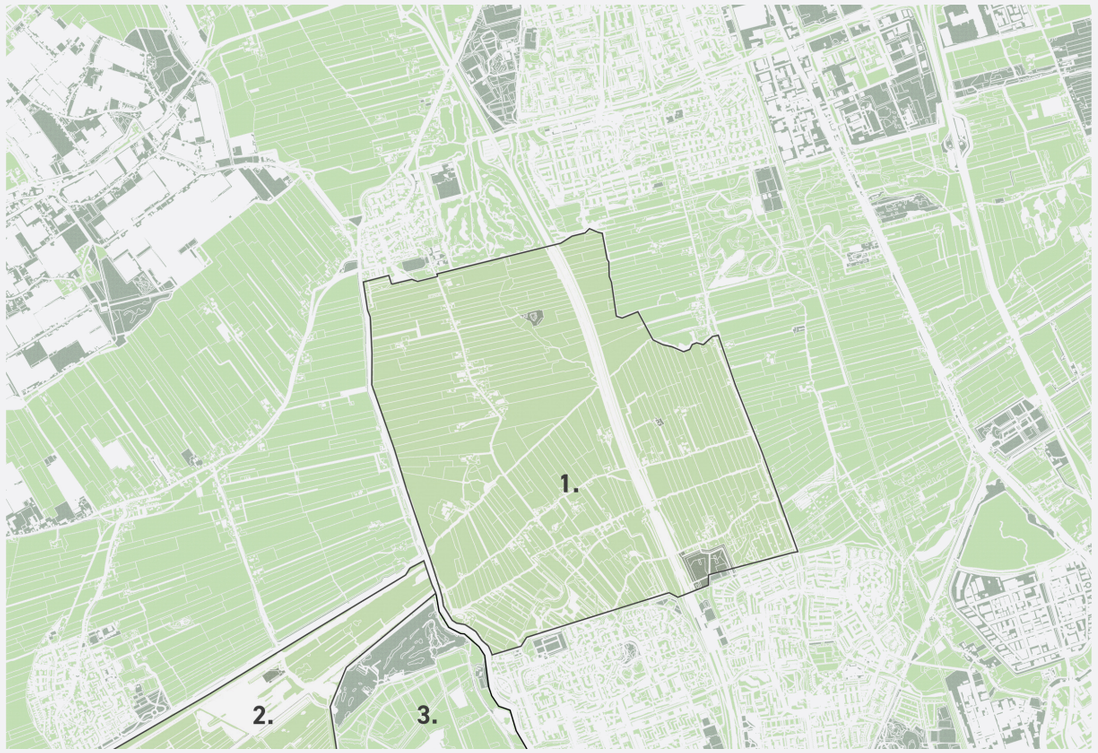
The site is located in the Holierhoekse polder (1.), it also borders the Vlietlanden (2.) and Broekpolder (3.), which are on the opposite side of the Vlaardingervaart. One of the main characters of the Holierhoekse polder is the vast open landscape, especially in the East-West direction. In the North-South direction, the block in the landscape used for the exploitation and drainage of the landscape is still clearly visible. These blocks of land are then bordered by the bigger boezem-systems, like the Zweth and Slinksloot that are inside of the plot.

The road systems that are present in the area all date back to the time that the land was drained and exploited, and almost all still have the same width as they did when they were first constructed. Another thing characterizing these roads is the willow trees that form walls between the road and the bordering ditches on either side. On the other side of these ditches often the old and still inhabited farm buildings are to be found.

On the south side of the polder, near Vlaardingen in the case of the site newly added groups of trees, bodies of water, and natural zones are present. Most of these elements have a recreational purpose but are also added to improve biodiversity.

On the border of the site, the Vlaardingervaart traces to the historic 'trekvaart' are still found. The path running along the edge of the water, now used by cyclists and pedestrians was previously utilized by horses pulling the ships. Recently a new monument was built on the site replicating an old "windas" that was used to pull ships over the dike from the boezem into the sub-boezem[1]. Contributing to the story of the intensive use of the water as a means of transport.

Source: Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolder, 5-6*[2] .



T- figure 01 - Polder overview

B- figure 02 - Windas

Present buildings

Between Vlaardingen and restaurant Vlietzicht many dike-wellings have been built, most of them are semi-detached or rowhouses.

figure 03 - Dike-dwellings next to Vlaardingervaart

Some dyke-dwellings have been built half-way down the dyke, only having a view towards the polder.

figure 04 - Small dwellings halfway the dike

This dyke-dwelling is the newest addition to the site, the building supplies took place from the polderside instead of over the dyke itself. The house is not accessible by car, one has to park on the edge of Vlaardingen to access the house by foot.

figure 05 - Most recently built dike-dwelling

Dike-dwellings backsides

Dike dwellings have been built on the location where previously was a steam-powered pump, only accessible by foot instead of car. The dike-dwellings are often three stories high on the rear facades and two stories high on the boezem-facing side.

figure 06 - Dike-dwelling seen through 'windas'

figure 07 - Rear facades of dike-dwellings

Another dike dwelling almost near the restaurant Vlietzicht. The dwelling has multiple stories, which also jump around when looking at the windows. Interestingly, the building is serviced at the rear facade, based upon the dustbins.

figure 08 - Dike-dwelling next to Vlietzicht restaurant

Farmhouses

figure 09 - Mariahoeve (museum)

Most of the oldest buildings in the area are farmhouses. One of them, the Mariahoeve, which also functions as a museum. Another example of an old farm is seen in figure 10, in which a traditional hayshed has been converted to a dwelling

figure 10 - Farmdwelling with hayshed

figure 11 - Farmhouse near Willemsoordseweg

A lot of farms are found as a ribbon development on higher and more stable ground along the Willemsoordseweg. Because of drainage of water the peat soil is sinking more rapidly than the clay and sandgrounds, on which these farms are built.

Other buildings

Close to the dike a local contractor is situated, the contractor's primary focus is the building of watermanagement systems and infrastructural systems[3].

figure 12 - Building of local contractor

On the edge of the city Vlaardingen oval appartment buildings have been built, on a raised parking deck. These buildings take a prominent stance on the edge of city and polder.

figure 13 - Appartment buildings in Vlaardingen

The Vlaardingervaart is a big recreational area, pleasure craft make up a big part of the recreational use this water has. Close to the city of Vlaardingen a harbour is situated, it has a large crane and boat storage facilities.

figure 14 - Harbour with boatshed

figure 15 - High waterlevels in the Zweth

figure 16 - Partly flooded polders

figure 17 - Building site in winter

Site photographs

With Vlaardingen in the background, it is noticeable that the site is in a very open area, all changes will thus be noticed.

figure 18 - Photograph of site, looking East

Looking towards the east also a vast open landscape is visible, it is to be noted that during the visit there was fog, it this wasn't there the views would have gone much further due to the lack of obstacles.

figure 19 - Photograph of site, looking West

Through the western part of the site a small footbridge is placed, based out of three wide planks. This type of bridging is common in the area, and often used to cross the smaller ditches for pedestrian usage.

figure 20 - Bridge on the west of the site

Site History

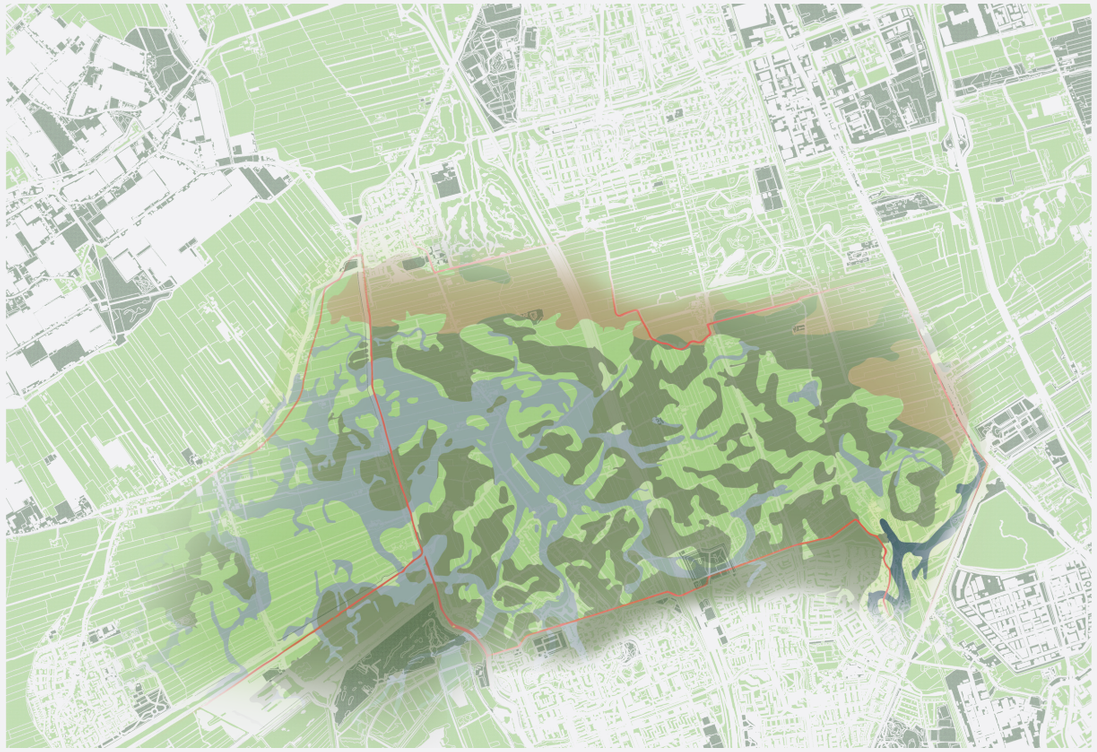
Although the Holierhoekse polder is a landscape we as Dutch inhabitants conceive as the typical landscape, the site has seen many changes over its history. In this paragraph, the history of the site on a couple of topics will be researched, naming: Geomorphology, Water, Administrations, and inhabitants.

Geomorphology

Roughly 5500 years ago the dunes along the coastline of the Netherlands were formed and sheltered the land behind them from the sea. This resulted in a swampy lagoon landscape because the salty seawater wasn't able to break into the landscape. This combined with the supply of fresh water from the rivers made the ground able to grow fresh water plants that eventually built up a peat landscape. Over time the sea found its way back into the land via the Maas and Oude Rijn and created creeks that removed the peat and paced clay layers between the peat. Around 1000 years BC these creeks were closed, resulting in the peat growing over the clay layers again. Later, just before we started counting years, the sea entered the land again, leaving a thin clay layer behind, to be covered with peat in the years to follow again.

During the Middle Ages, the peatlands were being exploited, resulting in the dying out, oxidizing, and sinking of the landscape. This led to the decline of the surface level, resulting in levels matching the ones of 300 BC. The clay- and sand layers that were dropped by the intruding sea remained and declined less drastically, resulting in these elements protruding above the peat landscape. To make the area suitable for agriculture and livestock the area needed to be prepared, implying a drastic change in the landscape. Firstly they dewatered the first layer of peat, after which the natural vegetation was removed and burned. To prevent flooding small ditches were dug to lead the water to natural bodies of water. Because the landscape was being drained for many more years, its surface level declined more and more, requiring new water management systems, working towards the system we have today.

Source: Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolder*, 9–11[4].



Dunkirk 1, soil on top of Hollandveen (Hollandpeat)

Dunkirk 0, soil on top of Hollandveen

Hollandveen (Hollandpeat)

Dunkirk 0 geulafzetting

Dunkirk 1, geulafzetting

figure 21 - Geomorphological overview

Water

Together with the Zouteveense polder the Holierhoekse Polder was a combined unit of water management. The polders were structured in a way that the Vlaarding, Slinksloot, and the Zweth would lead the water to the Vlaardingervaart. During the first two centuries, a relatively small height difference between polder and boezem made the disposal of water easy. During the 15th century problems with the height difference between polder and boezem started to occur due to the oxidization and sinking of the drained peat. In total 6 windmills were needed to drain the polders, of which two were at the Slinksloot and Zweth close to the site. The windmill at the Slinksloot caught fire in 1829 and was destroyed, it was thereafter replaced by another model with two scooped wheels. Later in 1868, the windmill at the Zweth was replaced by a steam-powered gemaal, which had scooped wheels of 8 meters in diameter. After that in 1883 another gemaal was built at the Slinksloot, which resulted in three windmills being demolished. In 1919 this gemaal was electrified, switching from a wheel setup to a pump. The connection of the Zweth to the Slinksloot also meant that this gemaal was now the only one needed resulting in the Zwethgemaal being disregarded and later in 1980 to be demolished. The Slinkslootgemaal was active until 2008, when it was replaced by a new and more efficient gemaal building a couple of hundred meters South.

Besides the need for new methods of draining the peatlands due to oxidation and sinking, transportation over the water also had its new challenges because of the height differences. For a while so called "windassen" were used to pull little ships over the dike using a winch and wooden rollers. This way the farmers were able to transport ships filled with butter and cheese to the market of Delft. The oldest Windas was known to be built around 1555 and demolished in 1884. Nowadays a monument was recently built at the site, as to be read in the current situation.

The Vlaardingervaart had not only the function as a boezem for water management but also was an shipping route that linked Vlaardingen, the polder, and Delft for tradesman. From 1644 to 1920 there was an agreement between Delft and Vlaardingen in which they allowed so called "trekvaart" which is pulling a ship by horse.

Source: Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolder*, 21–27[5].

Structure of the ditches

Sub-Boezem leading to the Boezem (Vlaardingervaart)

Old mil or pumping station

Current Electric pumping station

figure 22 - Water structure & Pumps

Administrational Organisation & Inhabitants

Up until the Middle Ages, there was not a clear organization or administration leading the Midden-Delfland polder area. During the Middle Ages, this changed and the administration of Vlaardinger-Ambacht was in control of the area. Later in 1811 Vlaardinger-Ambacht was combined with Zouteveen and transferred to Vlaardingen. These two Ambachten were never terminated, which resulted in a split 1941. Zouteveen was transferd to Schipluiden, and Vlaardinger-Ambacht was finally merged to Vlaardingen. Since 2004 Schipluiden has been part of the municipality of Midden-Delfland, which indicates the plot is on the border of two municipalities.

The oldest traces of inhabitation of the polder landscape date back to three to four centuries BC. Near the Breeweg (a road close to the plot) the remnants of a farm from the Iron Age were found. The further South one searches the more old farms built on the clay layers were found.

After the floodings in the second and first centuries BC new habitation took place in the time of the Roman Empire. Later the construction of a wooden farm was found, dating back to the second century. After the Roman Empire left the country the whole area turned back into a swamp area with lots of alder forests. During the 12th century buildings were situated along a distance of 100 meters from the Zweth, and farms were built on terps to keep the water out. When the soil sank to far due to oxidation people moved towards the clay ground that was slowly getting visible. After they moved towards the clay ground the location of the buildings has not changed for 700 years.

Source: Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolder*, 17-18[6].

T- figure 23 - Old drawing of Trekvaart

B- figure 24 - Scale model of Iron Age Settlement

1815

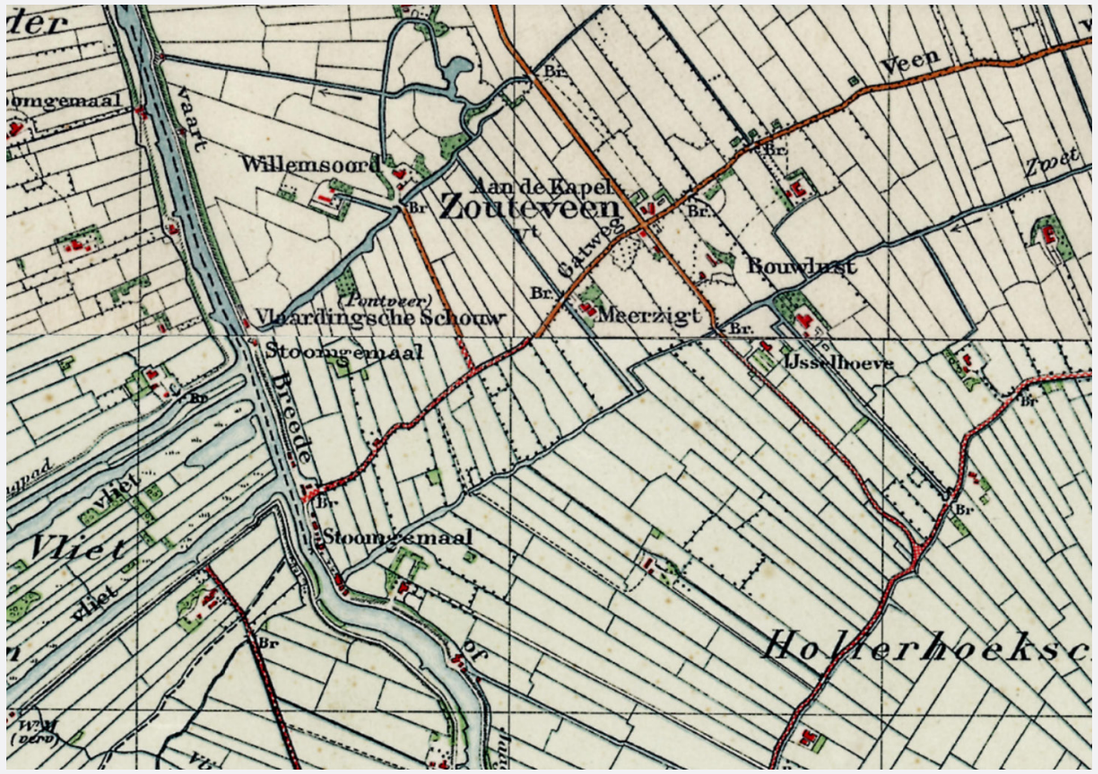
The original drawing dating from 1815 doesn't show a lot of information yet. The water (black lines) and some roads (dotted lines) are indicated, and seem to match the way the infrastructure is layed nowadays. At the crossing of the Zweth and the Vlaardingervaart a windpump is located.

figure 25 - First known map (1815)

1850

The next chart in 1850 is already more detailed, now also showing the polder structure, buildings and names more clearly. A windmill is placed more towards the North, but still connected to the Zweth. There also is a windmill at the Slinksloot and the Vliet.

figure 26 - Site map 1850



1877

This map dating from 1877 is already a lot more clear, with the introduction of colour. Although the landscape hasn't changed a lot the way the water is manage has. The various windmills have now been changed to steam powered pumps. Also multiple bridges of some sort have been added crossing the Zweth, these bridges are probably only accessible by foot.

figure 27 - Site map 1877

1940

Compared to the previous map the two steam powered pumps connected to the Zweth and Slinksloot have been replaces by an electricly powered pump connected on the Slinksloot. Besides this major change in water management a foot ferry is added between the south side of the vlietlande and the site, and countour lines ar added, showing -2.8 meters below NAP for the site.

figure 28 - Site map 1940

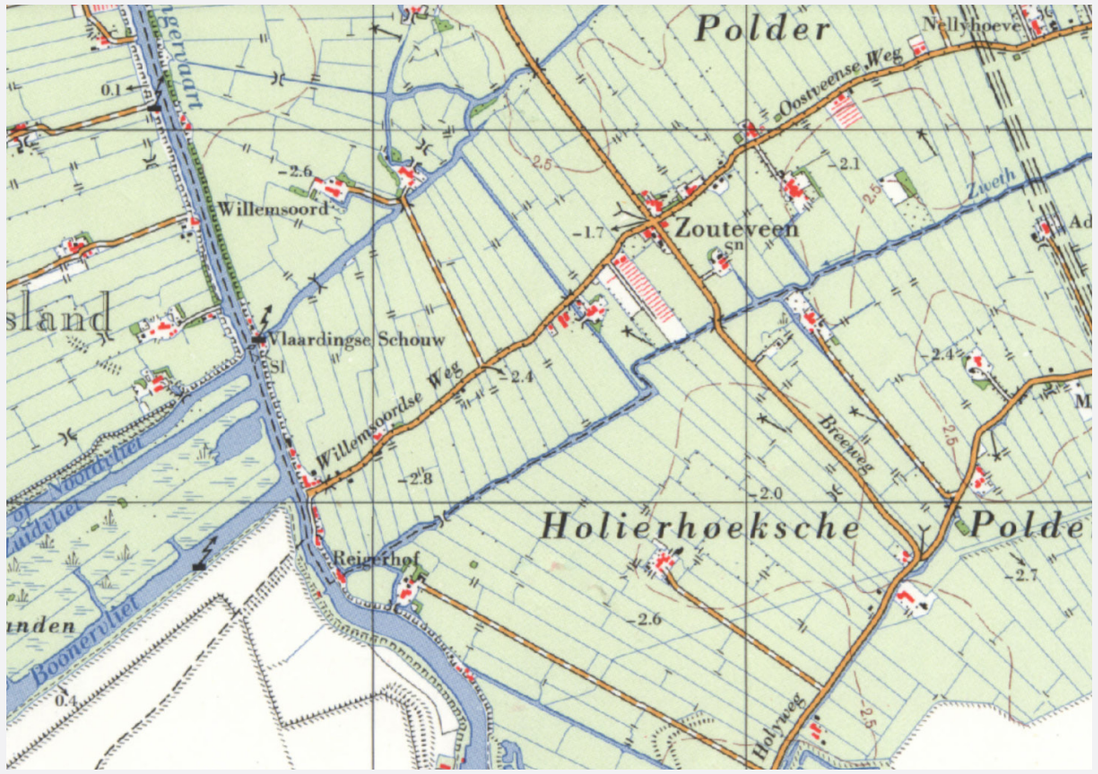


figure 29 - Site map 1963

1963

A lot has changed over time, the most predominant change is the planning of the golf course and expansion of Vlaardingen, South of the location. Also the plans of the A4 highway are now shown in the map (Norht-East)

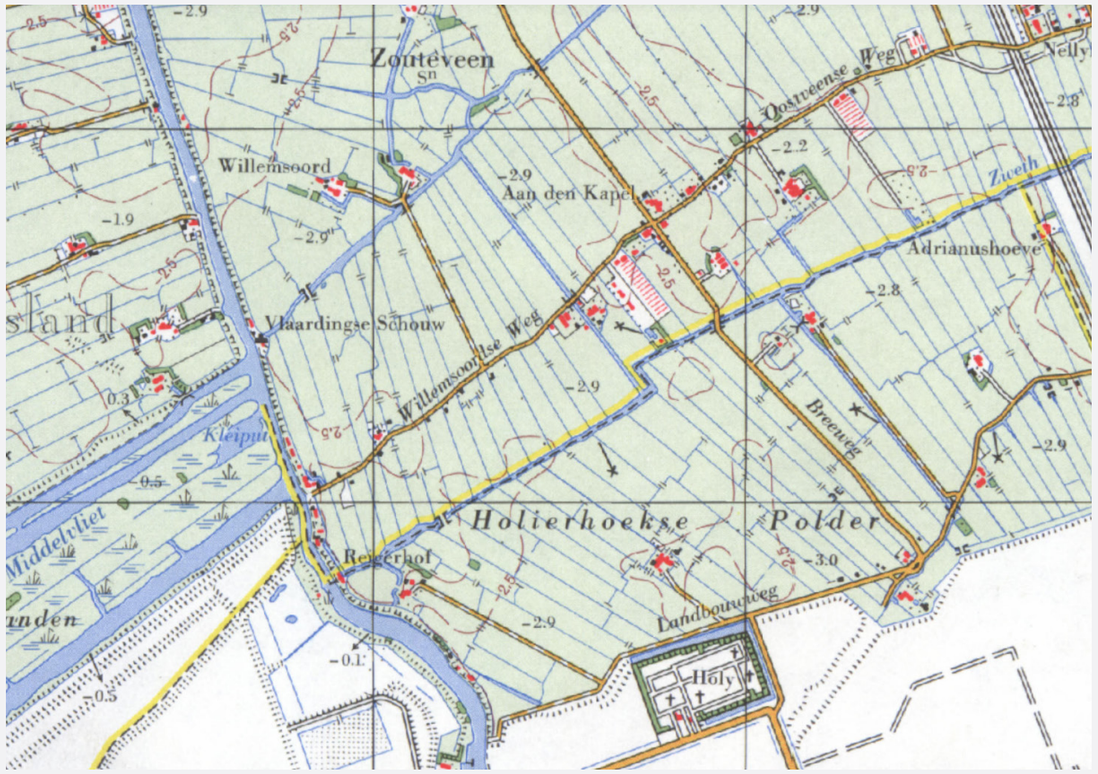
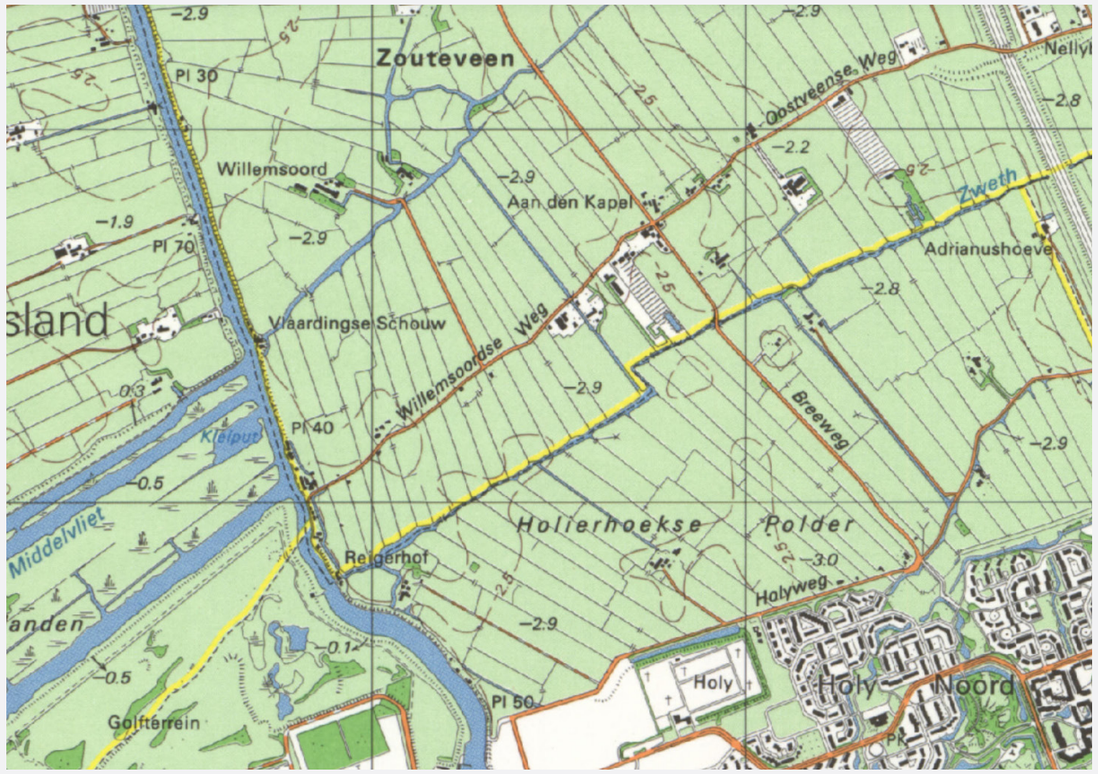


figure 30 - Site map 1974

1974

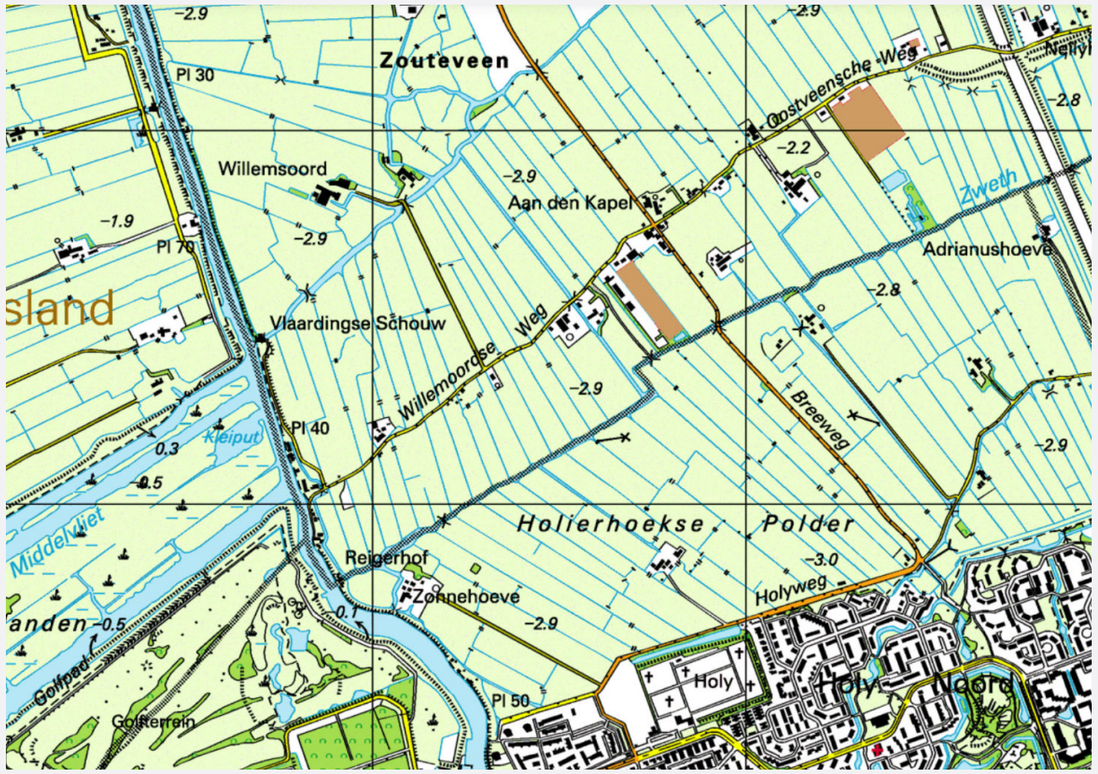
A couple years later and the fist infrastructure of Vlaardingen and the golf course have been built, on the plot slight hight differences are shown, which are parts of the previous intrusions by the sea and ridges of sand in the area.



1986

The golf course and a part of the city of Vlaardingen is now completed, but parts of the expansion area are still to developed. The polder site hasn't changed building wise.

figure 31 - Site map 1986



1998

The golf course and a large part of Vlaardingen-Noord are now finished, work on the A4 still has not started, but the space for the highway is reserved on the map.

figure 32 - Site map 1998

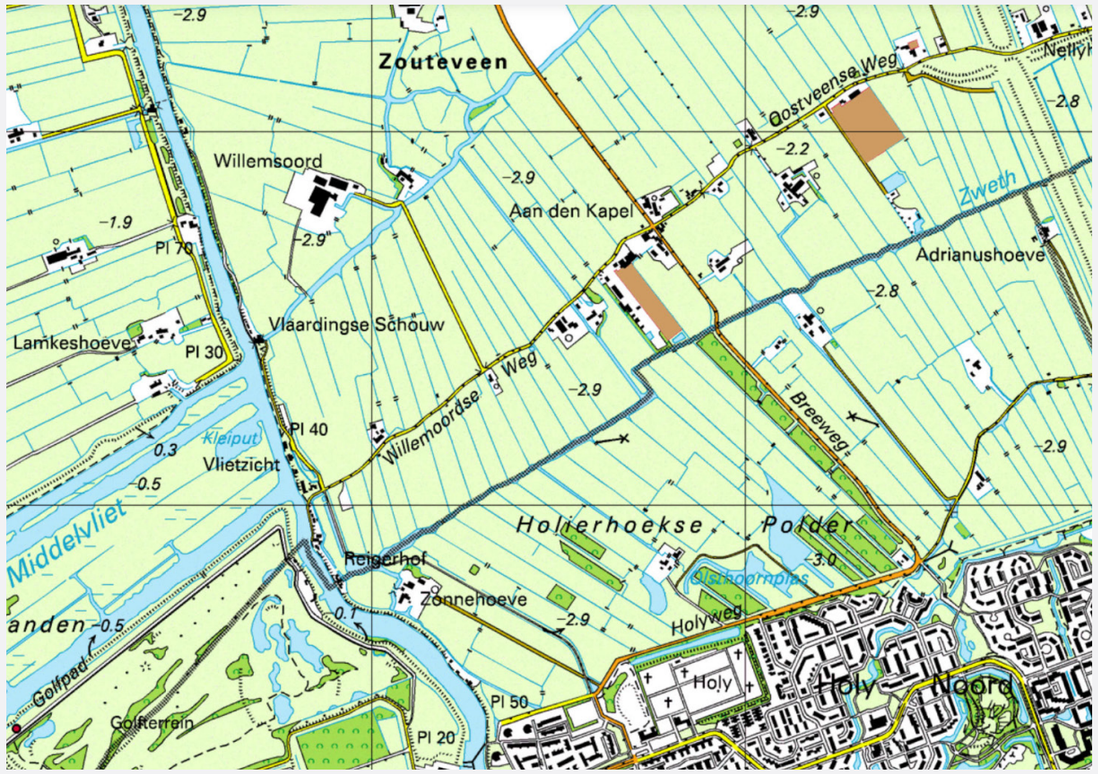


figure 33 - Site map 2007

2007

In 2007 a bicycle lane was built connecting Vlaardingen to the other side of the Zweth. Also a recreational area was built on the south side bordering the polder with the city.

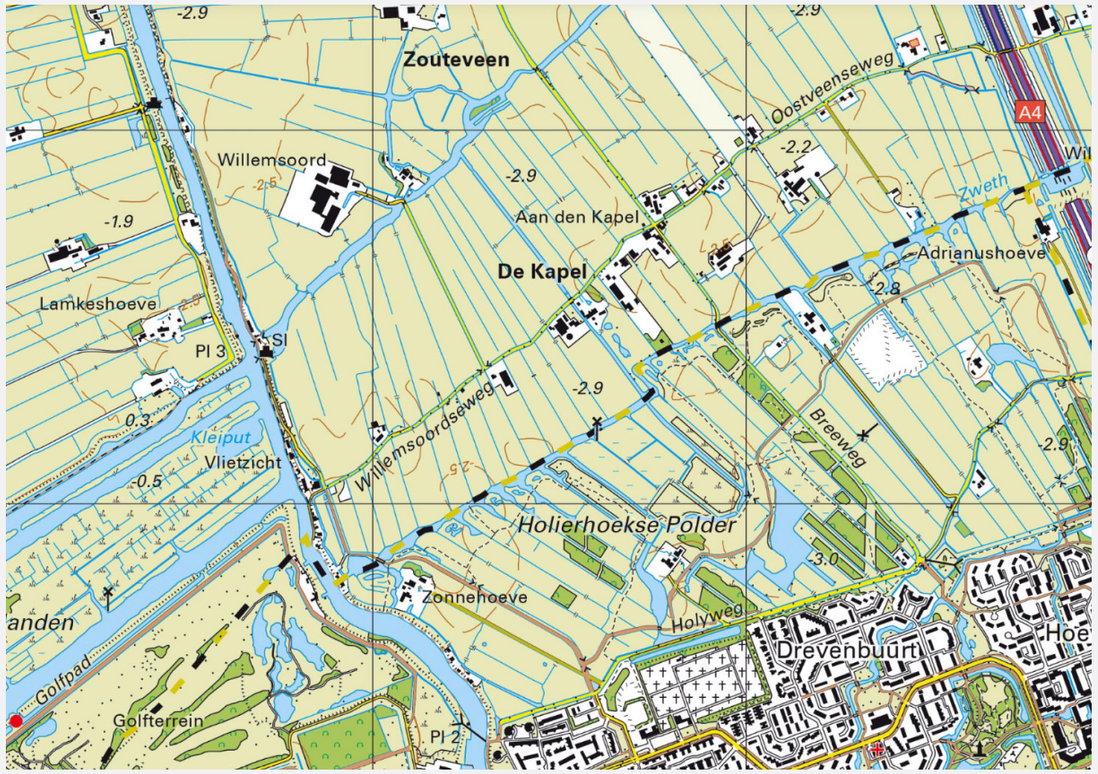


figure 34 - Site map 2010

2010

On this map the completed A4 is finally shown, sitting in its recess below the polder landscape to minimize the impact. Besides this a change in the landscape near the plot is noticed. The blocks of polder structure near the Zweth have been made to unregular shapes, making them look more natural, fitting it to its recreational purpose.

2006

The first images that were taken by satellite were infrared, meaning that they are black and white images. This however highlights the higher and lower areas, especially in the polder area.

figure 35 - Satellite image (2006)

2008

In this first colour image, a change in landscape is visible, the straight edges of the peat landscape left of the Zweth became more irregular, as if it was eaten by the water.

figure 36 - Satellite image (2008)

2011

This year a dike-dwelling is being built on the left (south) side of the Zweth, when comparing to the situation a year later, the temporary road is the most noticeable change in the landscape. Besides this building the satellite image also indicates the higher (lighter green) and lower (darker green) areas in the landscape.

figure 37 - Satellite image (2011)

2012

Compared to the image on the left, the new dike-dwelling is now finished and the temporary road has been removed, indicating that the dwelling is not accessible by car.

figure 38 - Satellite image (2012)

2014

Outside of the plot, near the Vlietlanden a change is happening around the golf-courts. The existing ditches seem to be removed.

figure 39 - Satellite image (2014)

2015

The changes that were happening around 2014 (left image) were an expansion of the water near the Vlietlanden on the side of the golf court.

figure 40 - Satellite image (2015)

figure 41 - Future situation

Future Situation

As seen on the image on this page the site as we know it will drastically change. The illustration shows the new National Productive Park Midden-Delfland around the year 2100. The polder has been transformed and most of the grassland has made a place for new ways of cultivation, like cattail, reed, elephant grass, and flax.

The water level has risen, so that large parts of the polder area at now almost level with water and show signs of flooding. The water of the Zweth has expanded into the existing blocks of cultivated polder landscape and is now the primary means of transpiration of goods from the polder to the city.

The new ways of production in combination with the transportation of these goods lead to a new settlement, that will take the form of a resource-based community. Goods will arrive at the transshipment point connecting the Zweth to the Vlaardingervaart to be processed and transported further.

Farmers, seasonal workers, a care farm, and other inhabitants will settle on a tidal inversion ridge, keeping dry feet whilst still enjoying the rural landscape.

figure 42 - Future situation

Selected Site

The site that has been selected for the development of the design project has many features, mentioned in the introduction of this chapter. It has multiple types of soil conditions, varying from clay to peat to sand, and therefore has varying heights, which will result in parts of the location being flooded. This location can therefore be an example of how to deal with multiple conditions in one plot.

The selected site covers in total an area of 10.750 m² in other words 1.7 soccer fields. The area makes up 6% of the total masterplan area, covering 173.375 m². The ratio of dry- versus wetlands is roughly 1 to 3. According to the masterplan (illustrated in figure 25), buildings can be built on the dry land completing the ribbon development, but also on the peatlands towards the Zweth.

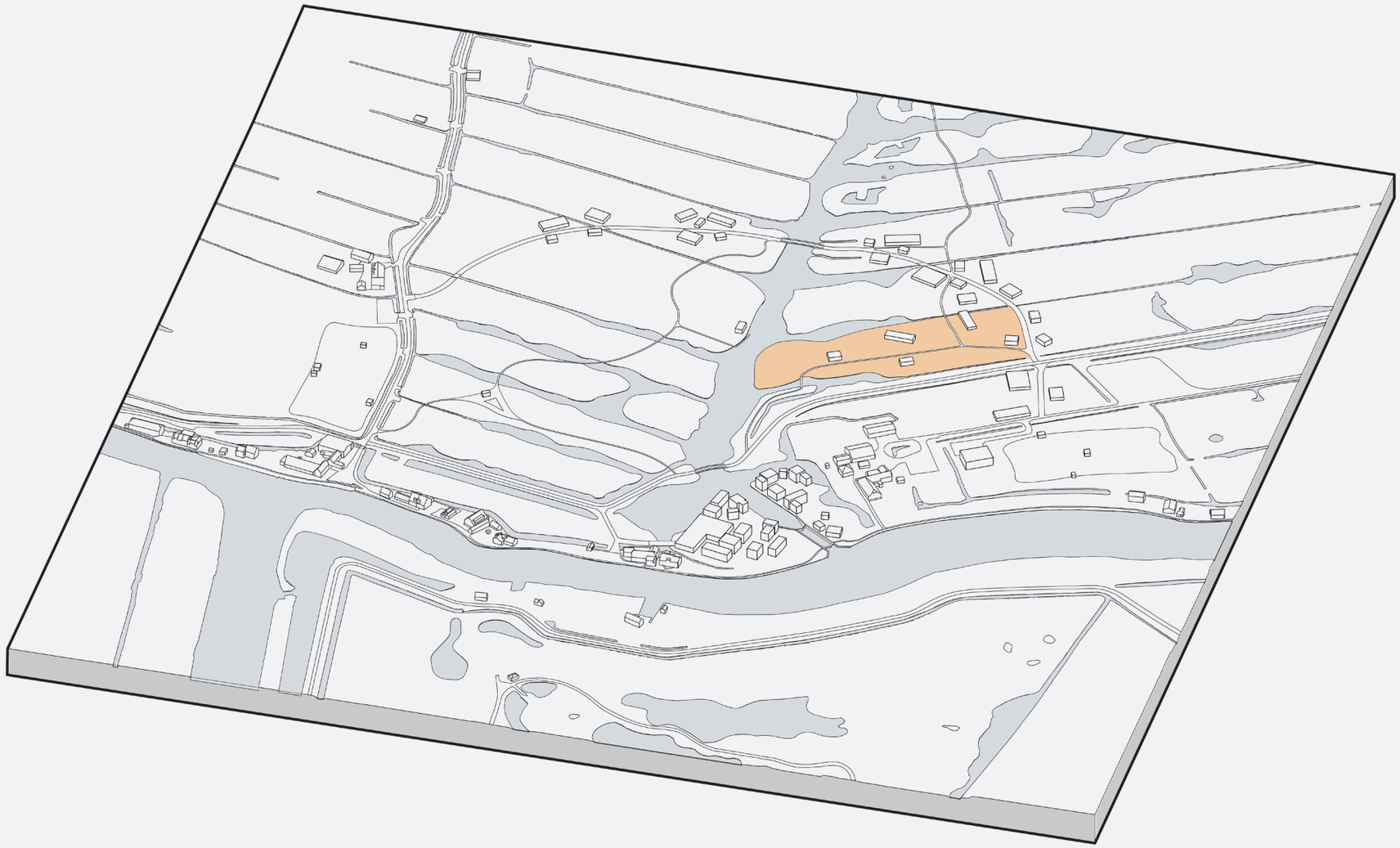


figure 43 - Selected Site

Waterways

Directly bordering the site is the small sub-boezem system called the Zweth, this is a special ditch that was connected to the smaller ditches reaching into the polder blocks. The Zweth runs from the Harreweg to the Vlaardingervaart, spanning a distance of roughly 3400 meters. The Zweth used to be connected to a windmill and later a steam-powered pump, but is now connected to the Slinksloot where a centrally placed electric-powered pump manages the water[7].

Via a lock, the Zweth is connected to the Vlaardingervaart, making the water accessible for barges and leisure craft. The Vlaardingervaart connects Vlaardingen with Delft, via the town of Schipluiden, and has a total length of 15 km. Due to many restrictions, such as bridges and narrowing obstacles, the maximum dimensions of ships are a beam of 3,5 meters, a height of 1,8 meters, a draught of 1 meter, and a length of 21 meters[8].

The lock connecting the two waterways will act as a transshipment point, in which the locally produced resources along the Zweth will be stored and later placed onto bigger ships that take them to Vlaardingen or Delft.

figure 44 - Waterways

Water influence

According to the plan of ZUS, the Zweth is part of a water buffer, designed with a precipitation of 90 mm per hour in mind. The cities around Midden-Delfland will use the boezembuffers for the storage of 8.000.000 m³ of water which is the volume of 3.200 Olympic pools. This amount of water will cover the complete buffer area of Midden-Delfland with 420 mm of extra water, resulting in the Zweth becoming 3 meters under NAP[9]. A large part of the surrounding polder and masterplan will therefore be flooded, as seen in the diagram.

Extreme precipitation such as 90 mm per hour will not often be the case, according to the KNMI situations in which more than 50 mm per hour or 100 mm per day are extreme and only occur once in a century[10]. It is expected by the makers of the masterplan that there will be more extreme weather due to climate change, and an extreme situation will occur once a year or so. Around 60 mm per hour would be possible in that case.

A more common amount of precipitation, 25 mm per hour, classified as a "hoosbui" in Dutch doesn't have any effect on the flooding of the land, because the water won't rise enough.

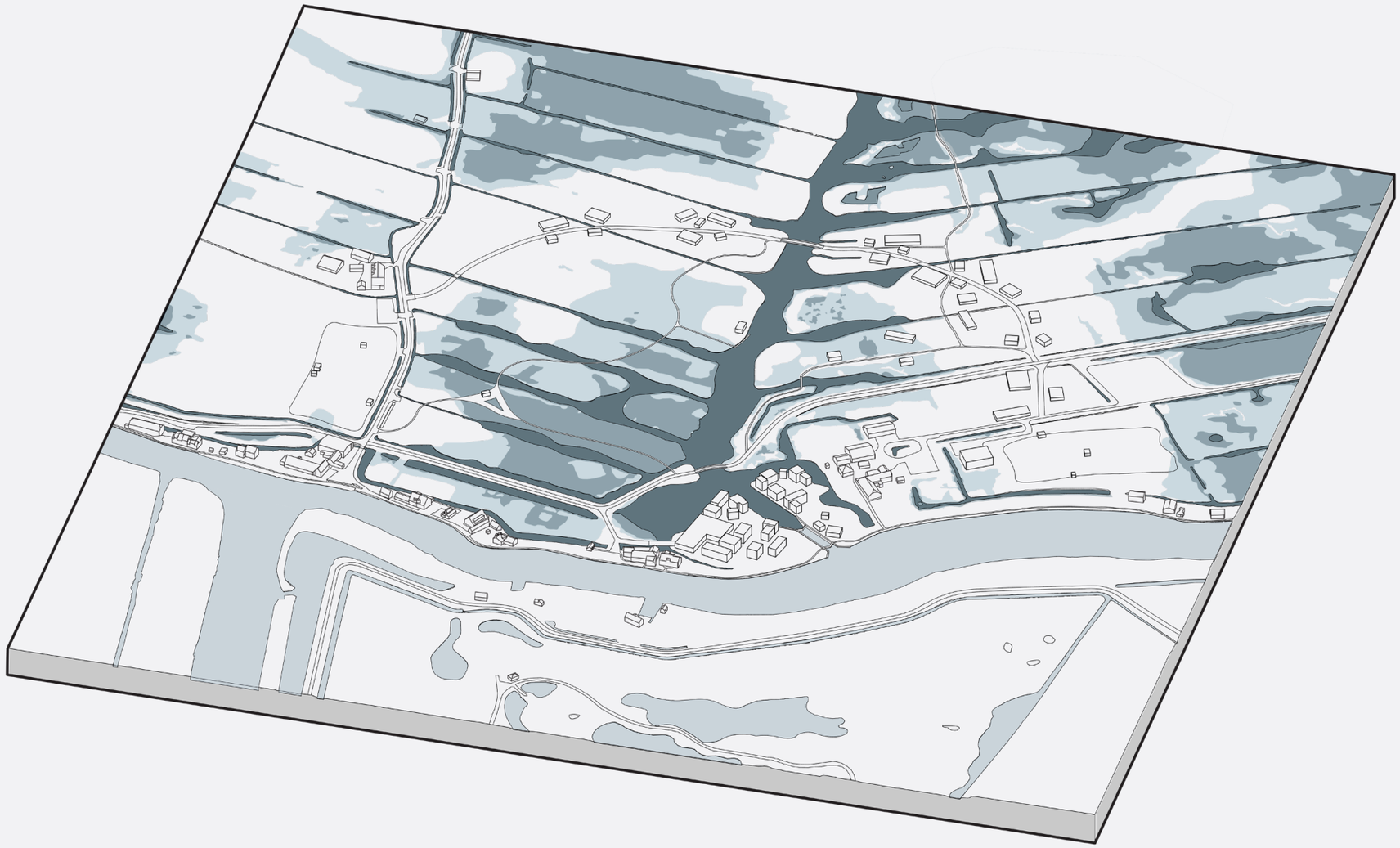


figure 45 - Influence of water during excessive rainfall

figure 46 - High watertevels during winter

Access

Although the site looks quite remote on the render and has floodings on some occasions, the location is relatively easy to reach. Probably the least accessible mode of transport for the location is the car, just like it is now, the car cannot reach further into the area than its edges. New parking lots are added in the masterplan on both sides of the ring, which are accessible by car in case of emergency, moving, or other actions that need a motorized vehicle close to the built environment. From the location all surrounding city centers are reachable within 30 minutes.

Cyclists can utilize almost all roads in the plan except the one running along the Vlaardingervaart and the central area left of the Zweth. Pedestrians have access to all roads on the site, as well as the car roads, which are 60 km/h and low intensity.

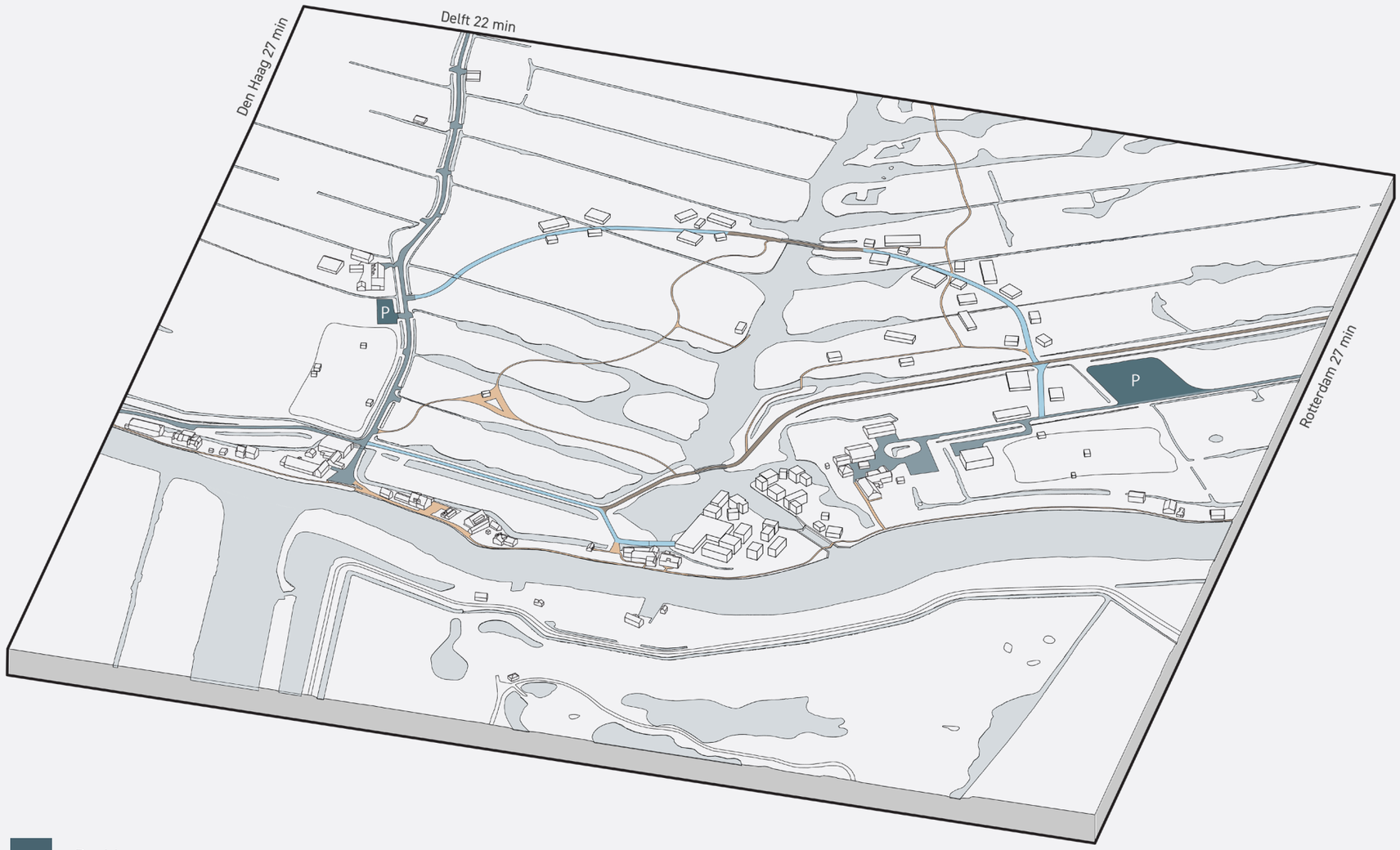


figure 47 - Infrastructure & Access

Building functions

Currently, the predominant function of buildings in the area is dwelling, which has been the case for a long time and also will stay the same in the masterplan. More dwellings are added on top of the already existing ones, which will all be kept as is. Dwellings are added on the ring, which will stay dry during floodings, as well as near the lock in combination with storage and processing of local resources.

Farming is another important function around the plot but will be less intensified in the future. This is why the farmhouses and barns are kept as is. To stimulate recitation in the area a boat/sub rental is added in the central middle of the ring and a local resource shop finds its place next to the busy cycling road.

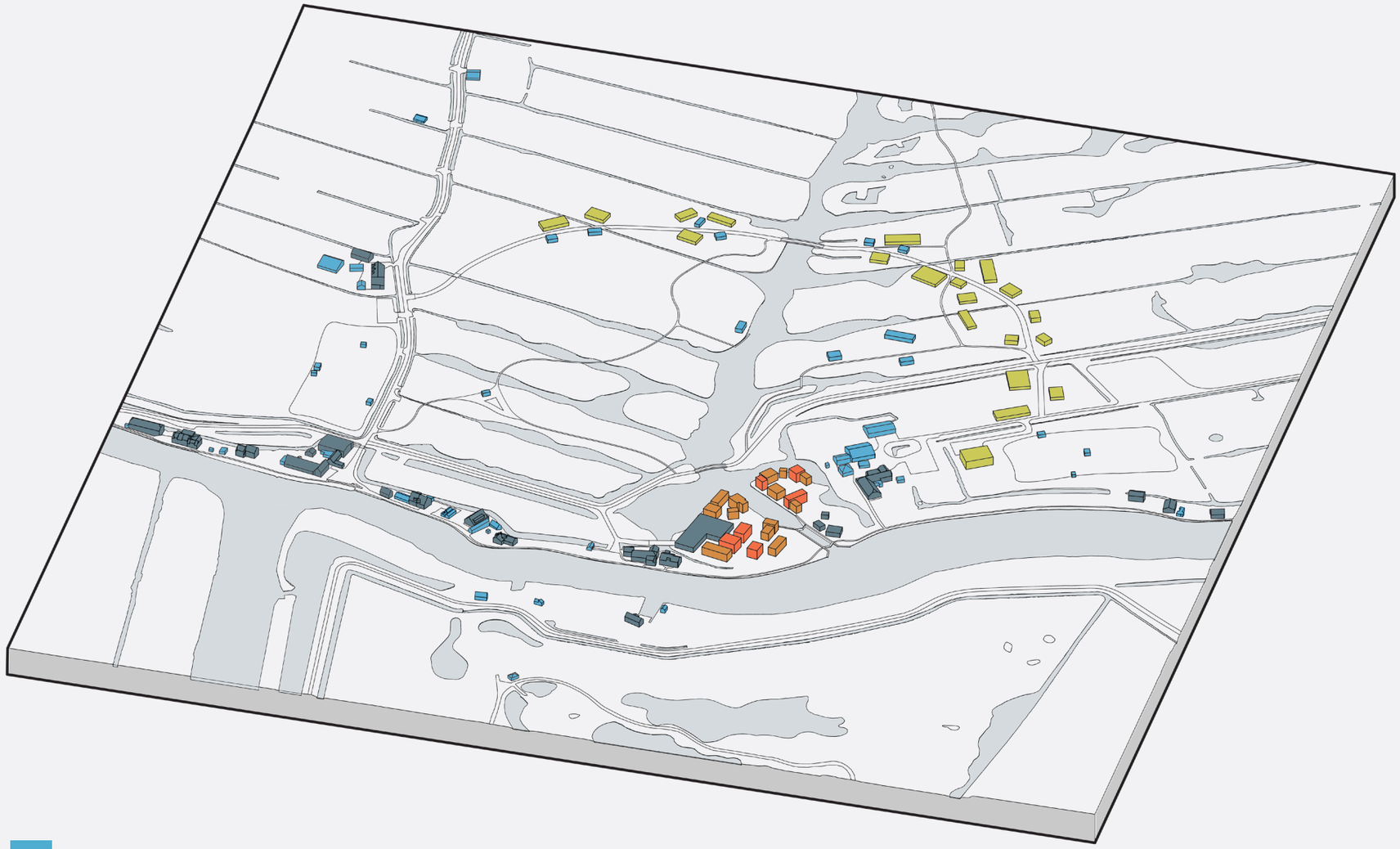
Finally, a care farm is added to the master plan, with an additional community garden bordering it on the remaining higher ground. Care could especially be a good function to combine with the dwelling since the location is relatively remote and calm.

figure 48 - Building functions

Building heights

As to be expected with rural landscapes the buildings are not that tall. Most of the current dwellings have a building height of 2 stories. Additionally, the farms and sheds most of the time just have one story that is slightly higher than the average story of a dwelling.

The newly added buildings join this tradition of low building heights, which is especially the case on the outer ring, which will have building heights of 1 to 2 stories. The more intensively used and denser transshipment area around the lock will have slightly taller buildings varying from 2 to 4 stories, depending on their placement on or off the dyke.



1 story

1-2 stories

2 stories

2-3 stories

3-4 stories

figure 49 - Building Heights

Greenery

As already mentioned in the introduction of this chapter the traditional grasslands as we now know them in the polder will change into a new productive park. The grasslands have largely been replaced by new ways of cultivating the landscape, of which reed, cattail, and elephant grass are the most important ones.

The area in the center of the masterplan, split by the Zweth, is transformed from a grassland into a wetlands park area since the average height of this area is below 3 meters NAP. Alder trees and similar water-resistant species of trees have been added to join the already existing park landscapes on the east side of the plot.

Rows of willows will be along the car roads and bicycle paths, also producing wood for the making of floating islands and other innovative objects.

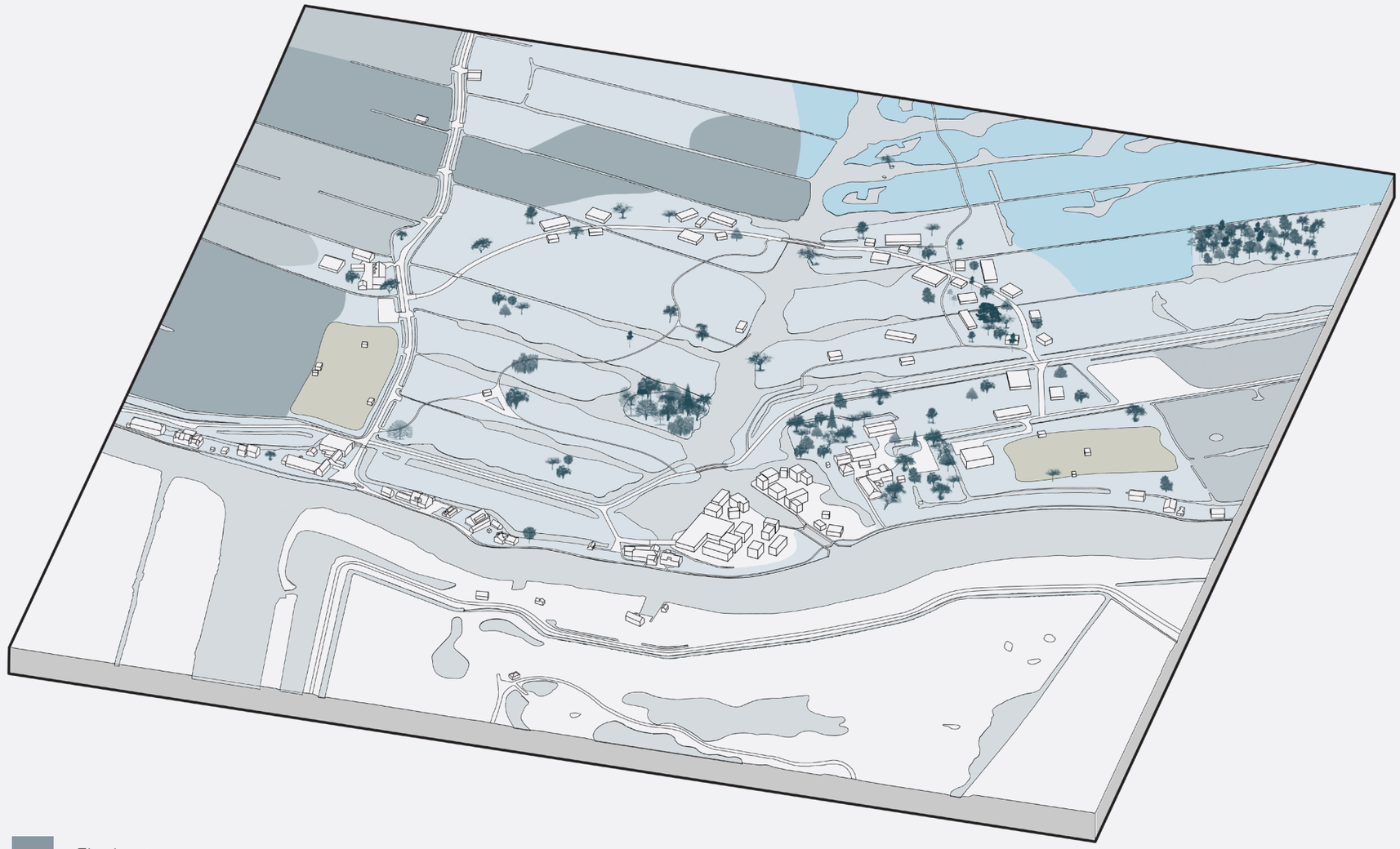


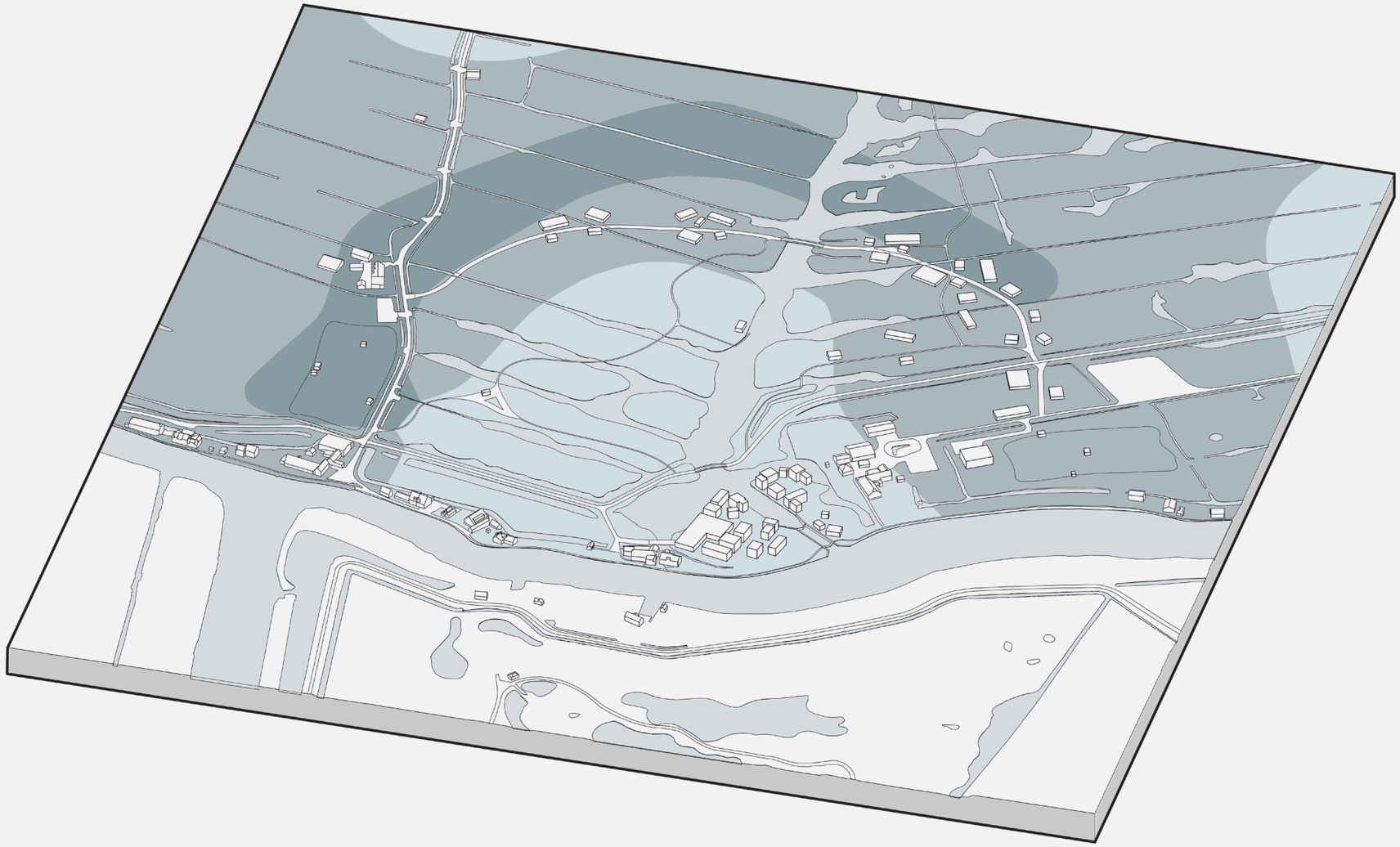
figure 50 - Greenery

Soil Conditions

The area knows three different types of soil conditions, which have a big influence on the landscape, and the way it reacts with rising water levels. Against expectations, a large part of the polder landscape does not exist out of peat. Only the center part, which is also the lowest, consists of the peat landscape that is most prone to sinking.

Bordering this peat soil is the marine-based clay, which is a result of the sea intruding into the landscape and dropping heavy particles, building up a cushion of sturdier ground. This is especially true on the tidal inversion ridge, which also was part of the sea intruding into the land and dropping primarily sand.

It is visible in the landscape that the sinking peat exposes the more robust and less sinking clay and sand, also resulting in places that keep the feet of the inhabitants dry.



Tidal-Inversion ridge

Marine based clay

Peat

figure 51 - Soil Conditions

figure 52 - Height difference due to varying soil types

Plot

Now the masterplan has been analyzed we zoom in once more on the scale of the plot on which the project will eventually be designed. In the previous chapter many organizational elements, such as access, building functions, building heights, waterways, etc. have been analyzed. In this part, more technical and important elements are analyzed which give the design further parameters to take into account or acknowledge in the design.

Starting at the basis the soil conditions will be further investigated, looking into the specific soil types that are present in the selected plot. Different soil types require different types of foundations, which are essential to keep in mind while designing. As also mentioned in the previous chapter are the varying soil types and how they reflect in the landscape, resulting in subtle height differences. These differences are made clear through illustrative diagrams showing the relation between soil and heights. The height differences that result from the soil conditions have, in their term a direct relationship with the influence the water has on the land. In combination with the precipitation researched in the previous chapter, scenarios are made to find out to what extent the land will be flooded during heavy rainfall.

With the soil and their directly related elements covered, we move one layer up, looking at greenery and infrastructure on the site. Locating trees that are already present and ones that are plated in the masterplan is important for the placement of the buildings. The trees, or large bushes, can offer shelter both visually and physically.

In the third layer, the elements are the topic that is looked upon. Especially when mentioning shelter from the elements, this research in conjunction with the greenery can offer valuable insights for building orientation and placement. The most important elements are sunlight and predominant wind.

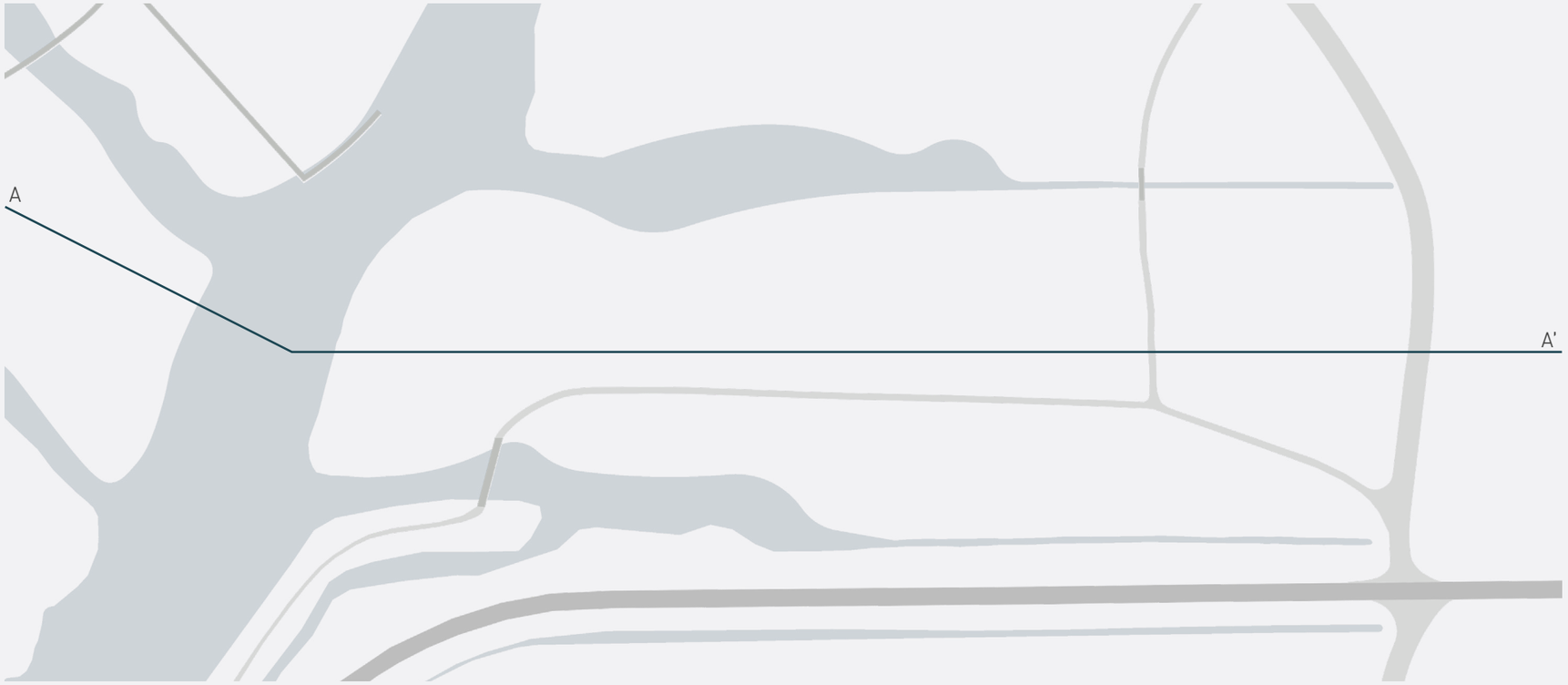
Overall the project site will have many things to offer, multiple soil types requiring different approaches to building methodologies, and the open character of the western part in comparison with the relatively sheltered eastern part requires different approaches for the building design. This all on a small plot of just 10.750 m².

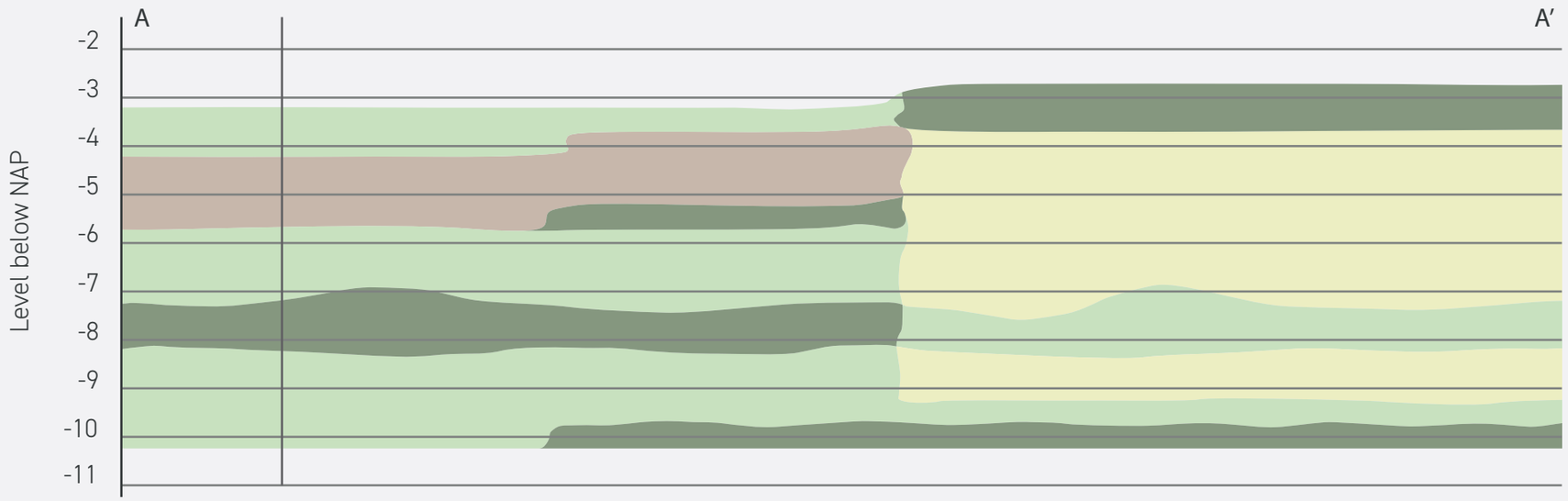
figure 53 - Future scenario of plot

Soil

As already mentioned in the previous chapter, the site consists of at least 2 sub-soil types according to the maps published by the BRO-Loket. The change in the two soil types can be seen in the section on this page, becoming visible through a subtle incline in height, but more importantly the change in soil types.

The mixture of slightly softer sandy clay and peat makes place for a rigid clay layer that covers the tidal inversion ridge, consisting of a rigid layer of sand. This ridge is still clearly visible in the landscape, as seen in the photograph of Figure 34.





Peat

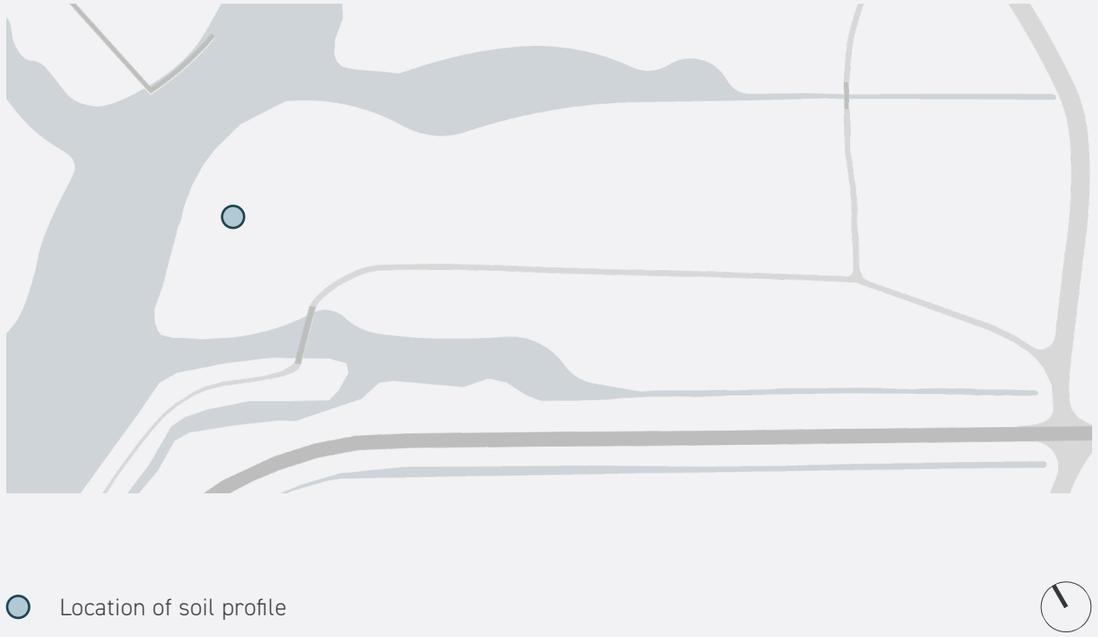
Clay/Sand mixture

Clay

Sand

figure 54 - Soil types section

Soil - profile 1



Location of soil profile

Close to the Zweth, this profile consists of a small layer of clay on the surface with peat directly beneath that layer. This peat soil will most presumably be the layer on which the foundation will be placed, this soil is not capable of carrying big loads.

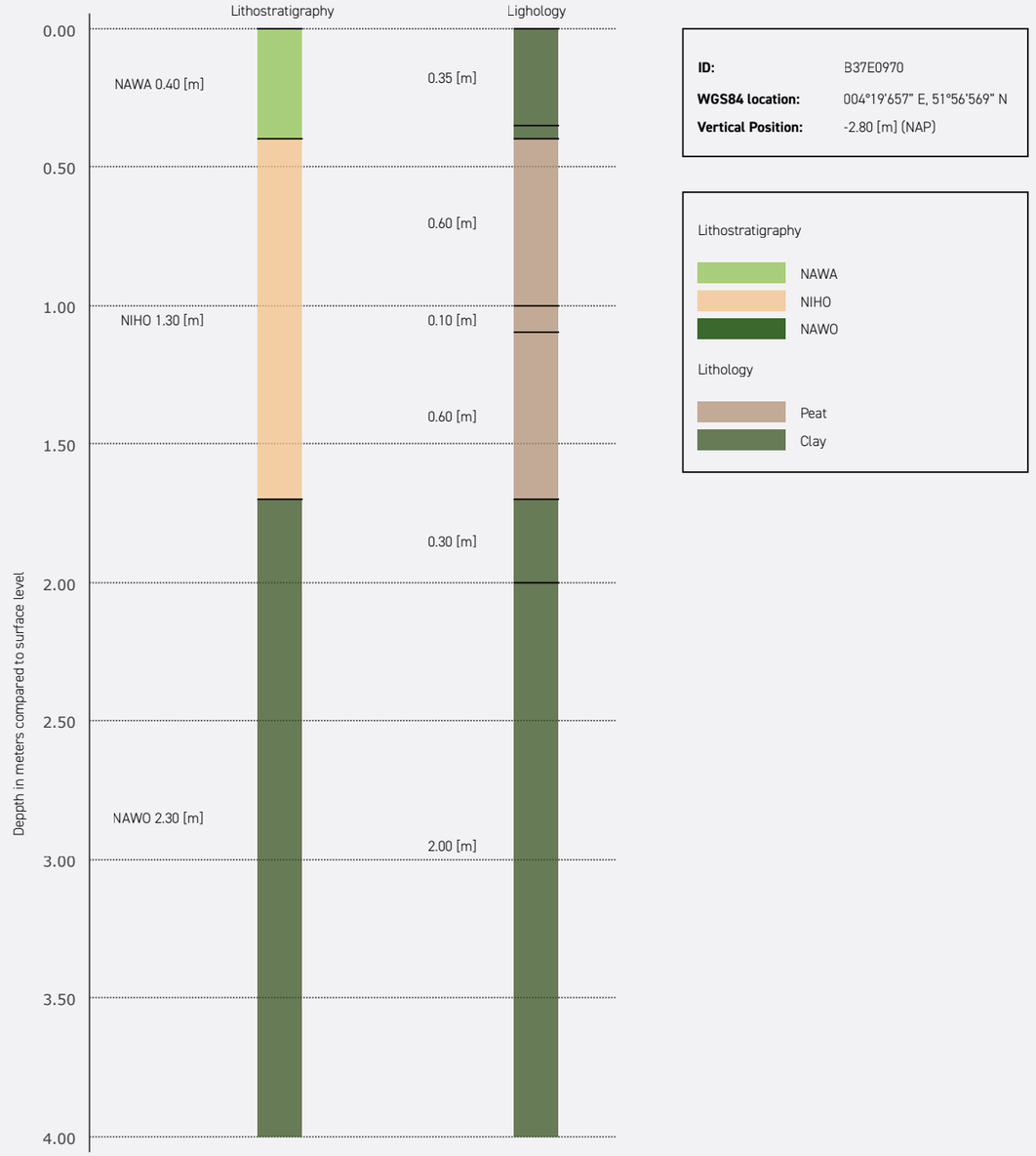
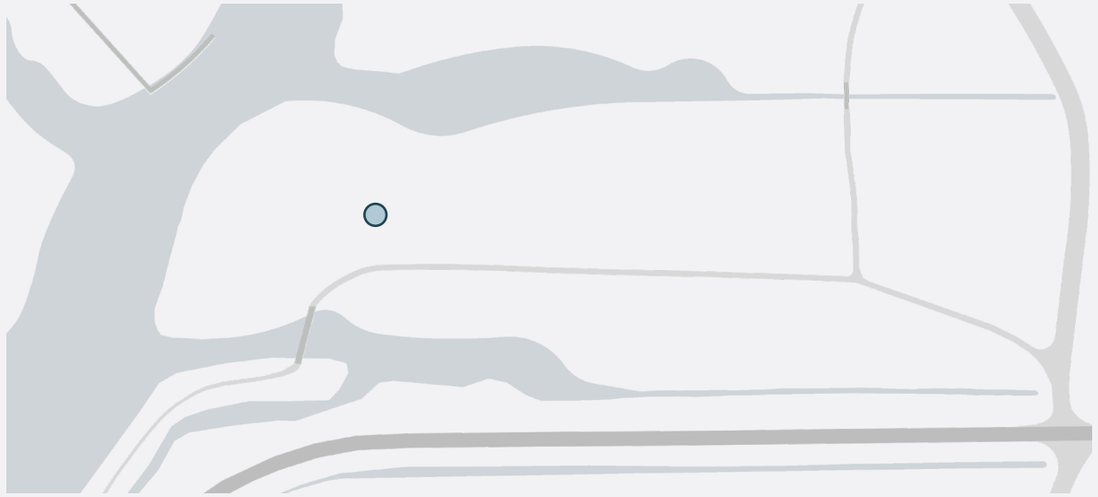


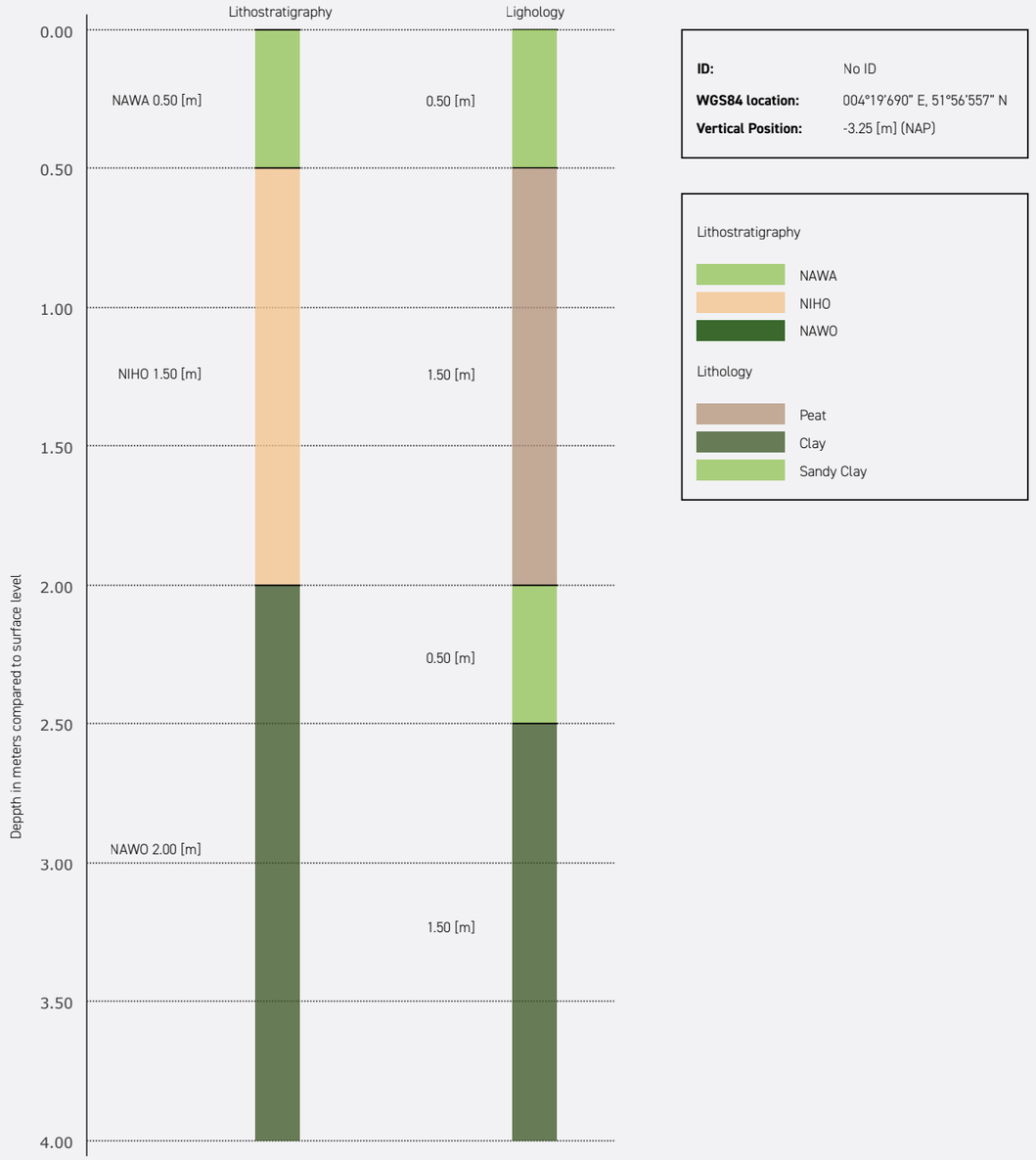
figure 55 - Soil profile 1 - location

figure 56 - Soil profile 1

Soil - profile 2



Location of soil profile

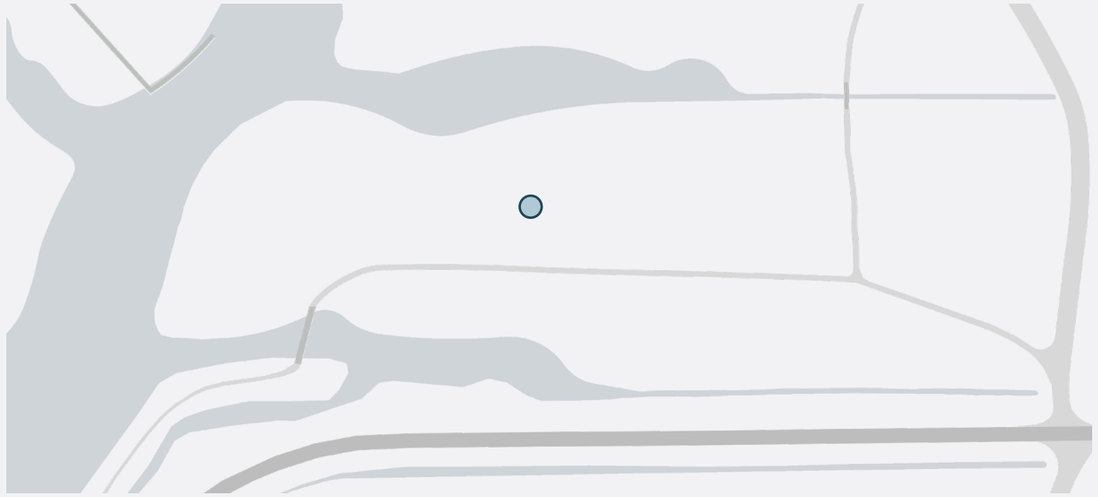


This second layer already starts to get closer to the tidal inversion ridge, which is becoming apparent by the presence of sandy clay just above and below the peat soil, which is roughly in the same place as it was in the first profile. Again the peat soil will not be able to carry a significant amount of load, so measures need to be taken in the foundation of the built structure.

figure 57 - Soil profile 2 - location

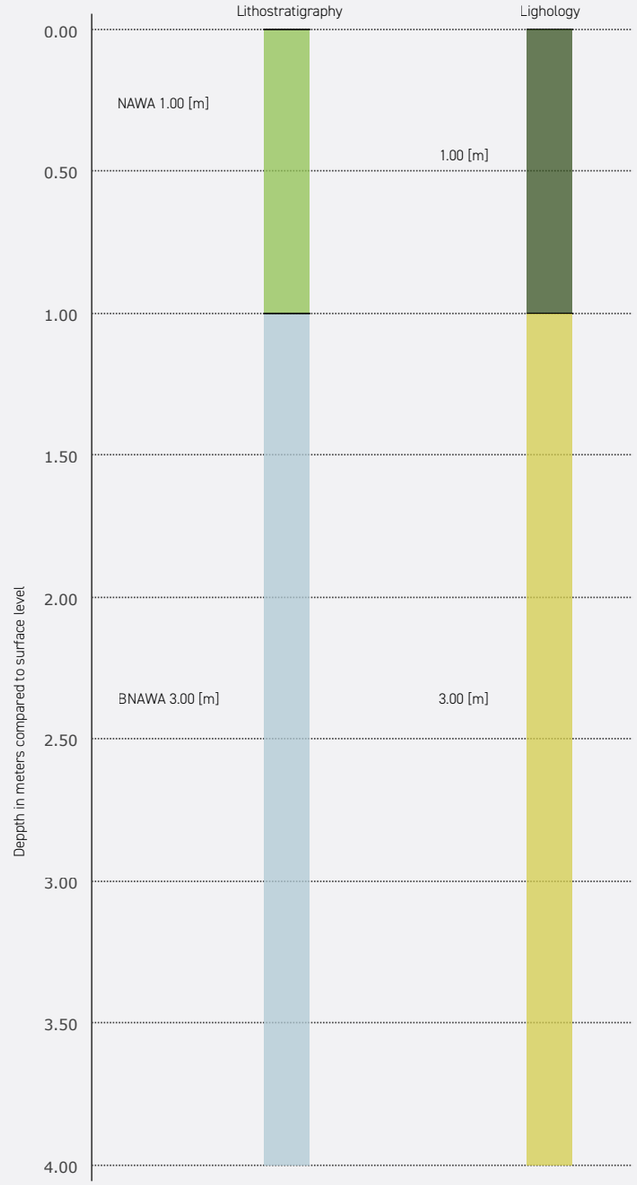
figure 58 - Soil profile 2

Soil - profile 3



Location of soil profile

This third profile is at the beginning of the tidal-inversion ridge, which is seen through a change in the bottom Lithostratigraphy layer. A deep fine sand layer is a result covered by a meter of clay, both would be sufficient for carrying more load, for the heaviest loads the sand layer would be the most suitable.



ID:	No ID
WGS84 location:	004°19'716" E, 51°56'548" N
Vertical Position:	-2.75 [m] (NAP)

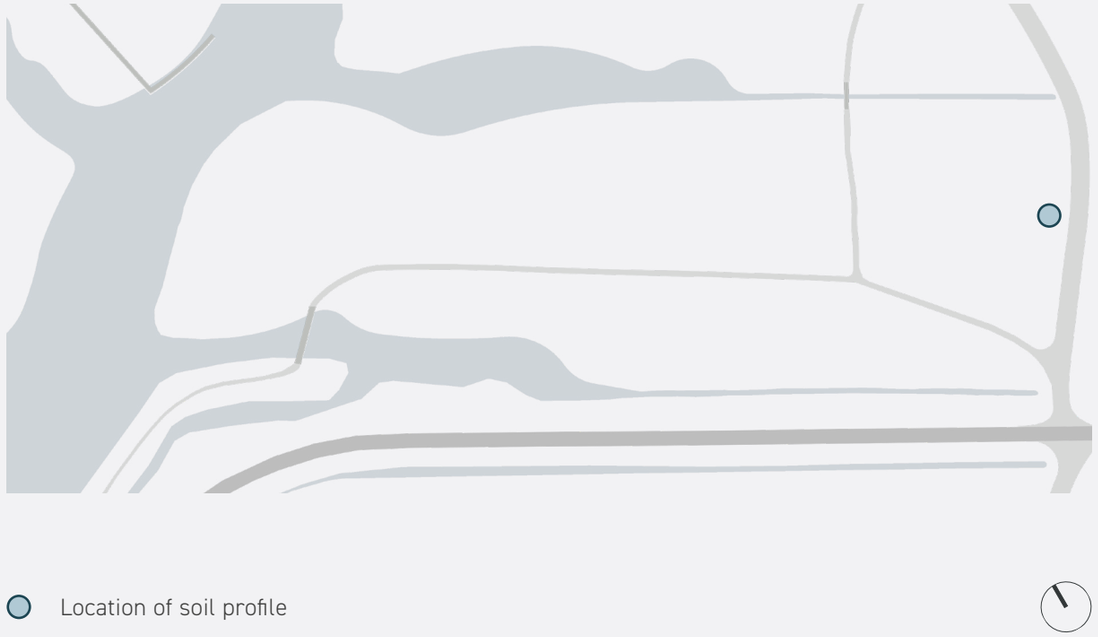
Lithostratigraphy
- NAWA
- BNAWA

Lithology
- Clay
- Sand, fine catagory

figure 59 - Soil profile 3 - location

figure 60 - Soil profile 3

Soil - profile 4



Location of soil profile

Finally, the last profile is based on the tidal-inversion ridge itself, a thicker layer of 1,5 meters of clay covers varying sand layers, based on their category of fineness. On this part of the land, the ground is the most rigid, allowing for slightly higher buildings, without the use of a pile foundation.

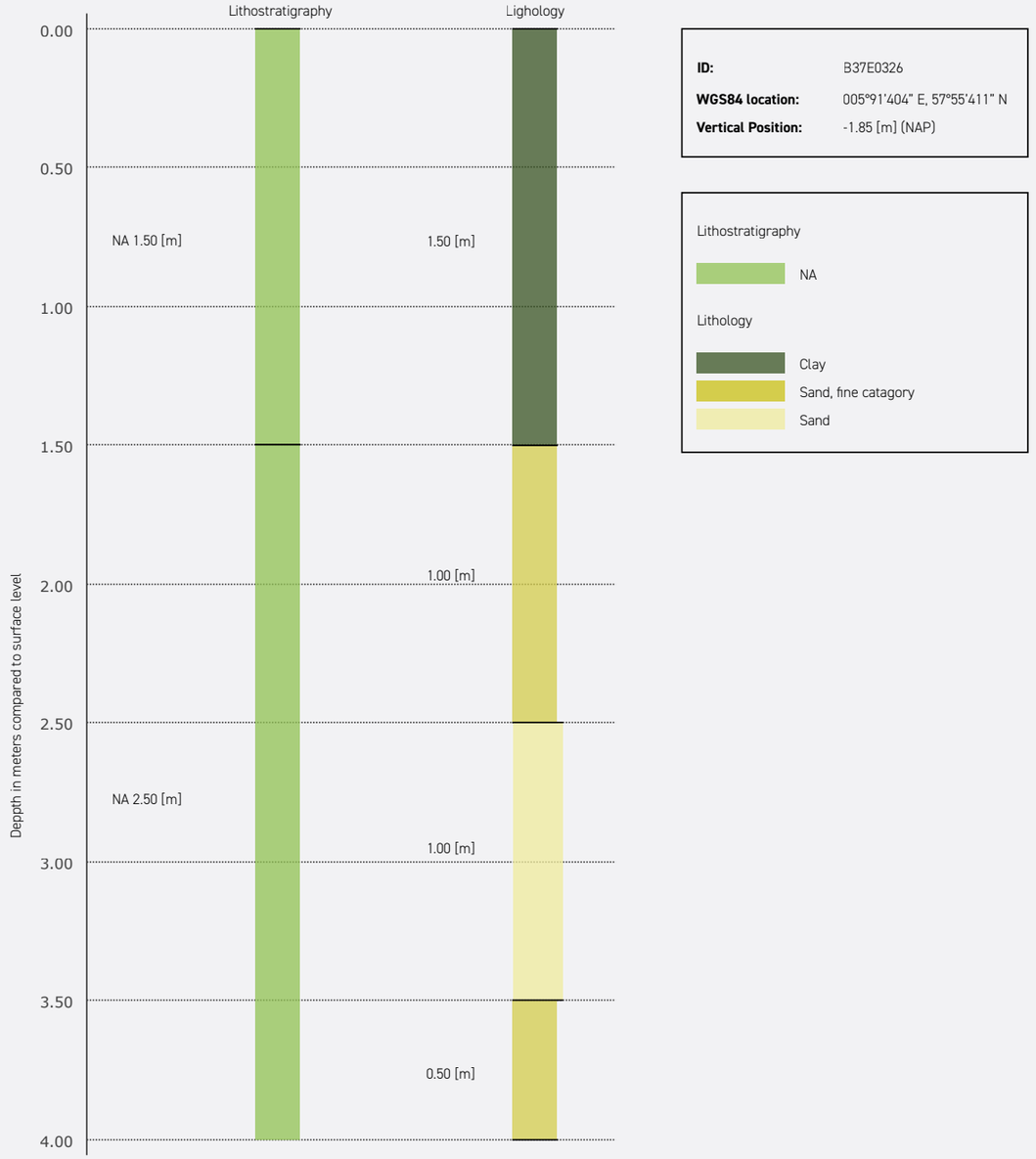
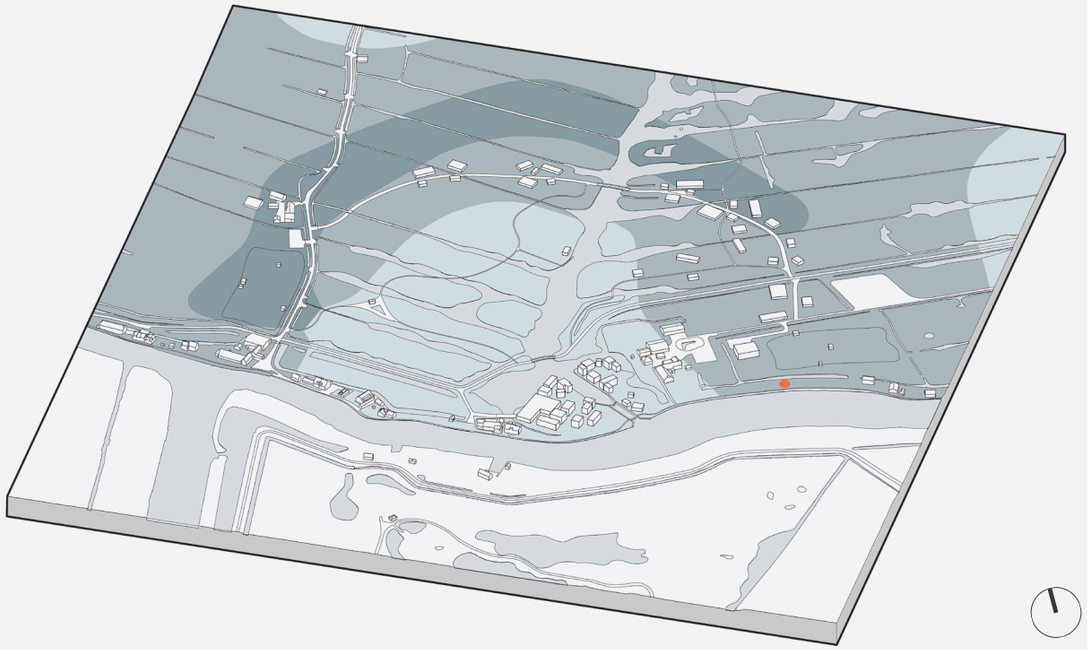


figure 61 - Soil profile 4 - location

figure 62 - Soil profile 4

Soil - Strength Clay



Although there are no cone penetration tests carried out on the direct location, a general image can still be given by tests carried out in similar soil conditions. As seen on the red dot the test that has been carried out is relatively close to the chosen site and is part of the marine clay ground soil. At roughly 75 cm below the surface level a cone resistance of 2 MPa is measured, indicating that the ground can support up to 2 N/mm².

For a foundation of 500 × 500mm the ground would thus be able to support 500 kN's or 50.000 kg's.

figure 63 - Soil test location

BRO-ID: CPT000000015556
Vertical level: -2.130 (NAP)
Local vertical reference point: surface level
Coordinates: 004°19'661" E, N 51°56'263" N

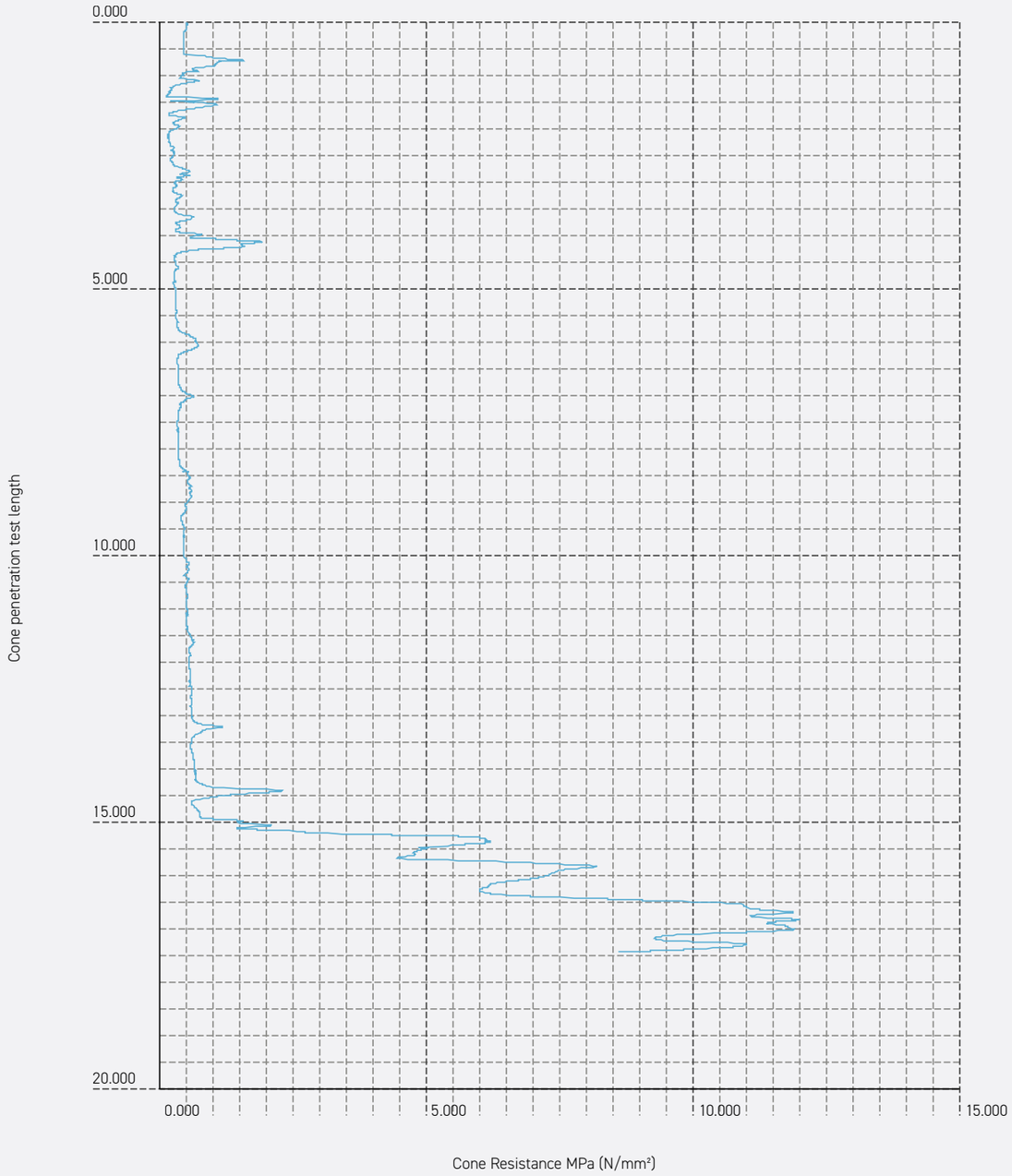
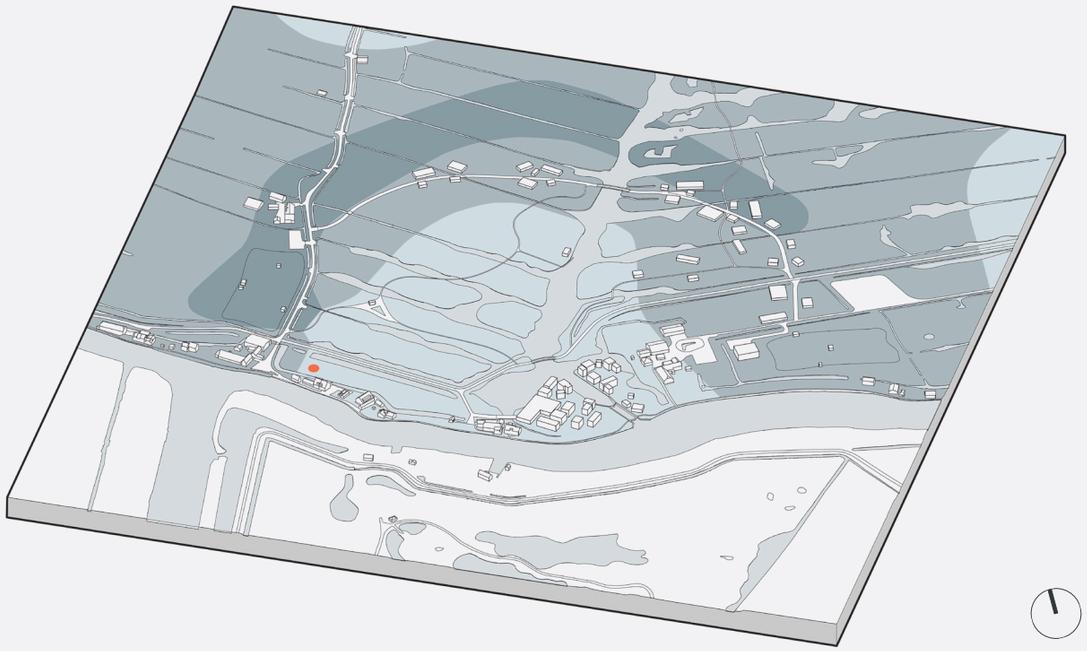
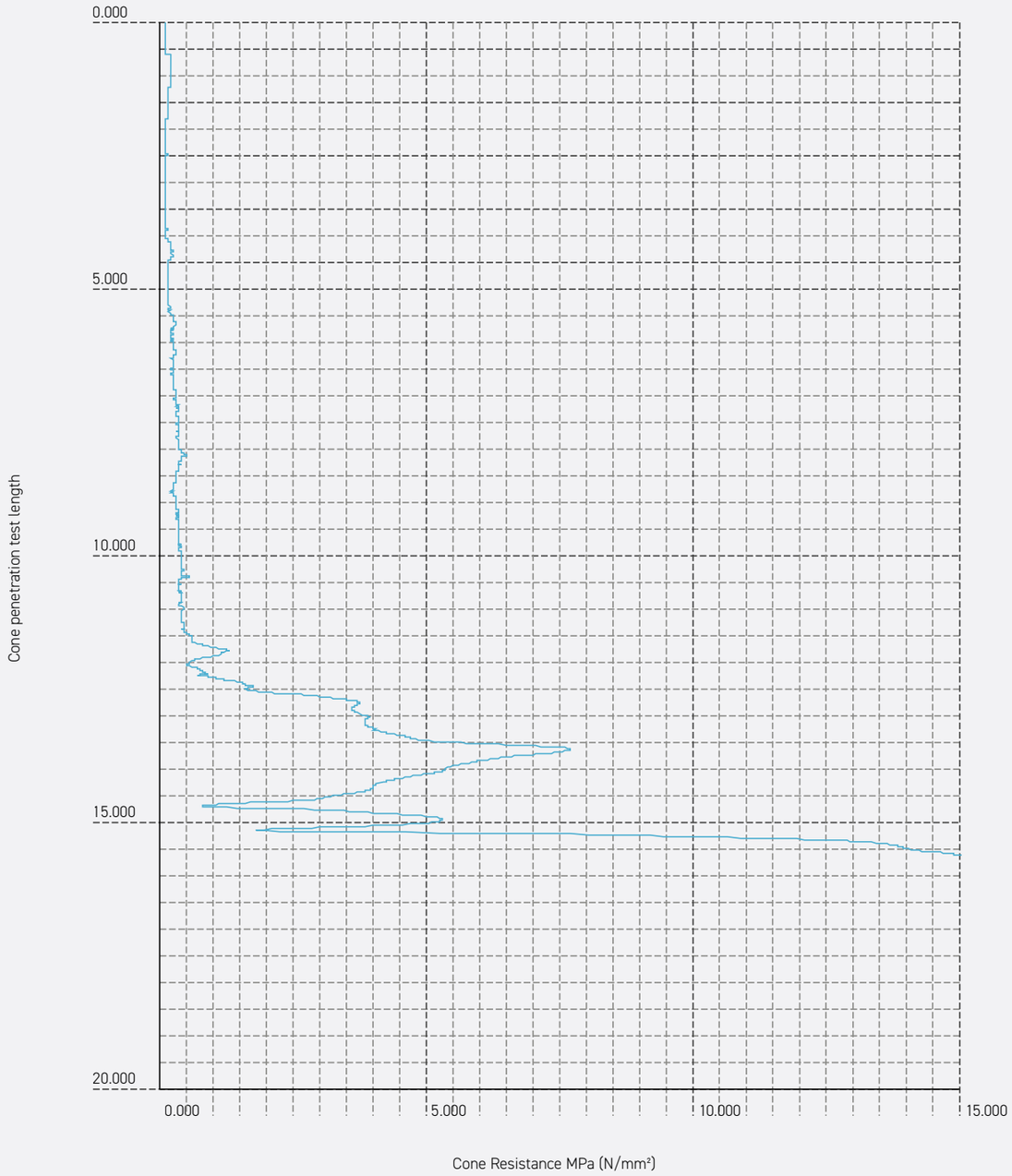


figure 64 - Soil strength clay

Soil - strength peat



BRO-ID: CPT000000011588
Vertical level: -2..750 (NAP)
Local vertical reference point: surface level
Coordinates: 004°19'238" E, 51°56'37.4" N



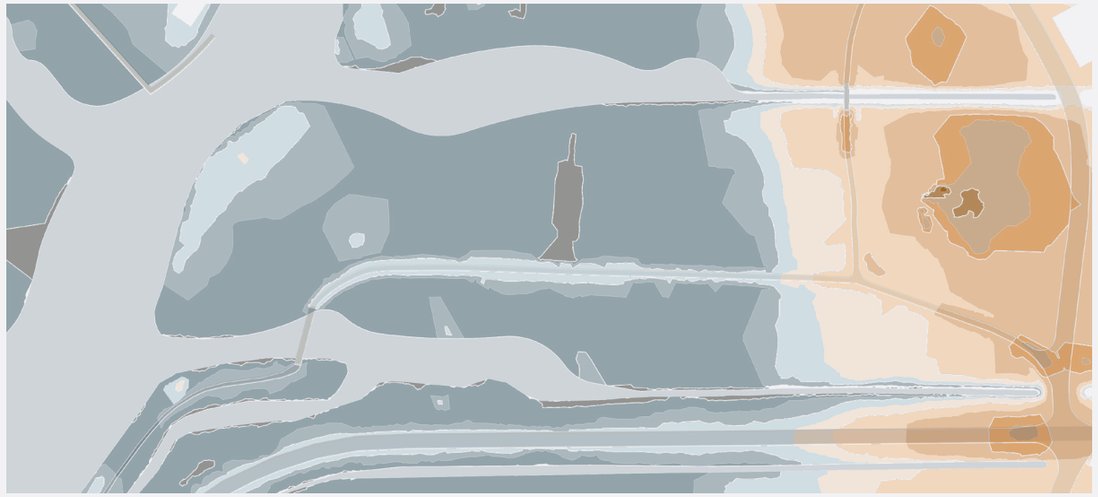
Sadly there are not many tests carried out on known peat soil, except the example shown here. As expected the peat soil can carry a considerable amount of less weight than the clay ground on the previous page. Around 75 cm below surface level, the measured cone resistance is around 0,45 Mpa, translating to 0,45 N/mm².

For a foundation of 500 × 500mm the ground would thus be able to support 112,5 kN's or 11.250 kg's.

figure 65 - Soil test location

figure 66 - Soil strength peat

Landscape Heights



-3200
-3000
-2800
-2600
-2400
-2200
-2000
-1800
-1600
-1400

The different types of soil are now becoming apparent when looking at the heightmap of the selected site. The site has been analyzed with steps of 200 mm according to the AHN4 (Actueel Hoogtebestand Nederland.) The tidal inversion ridge becomes clear when looking at the orange-colored fills, which are almost all 1 meter higher than the lowest point of the peat soil.

figure 67 - Landscape heights

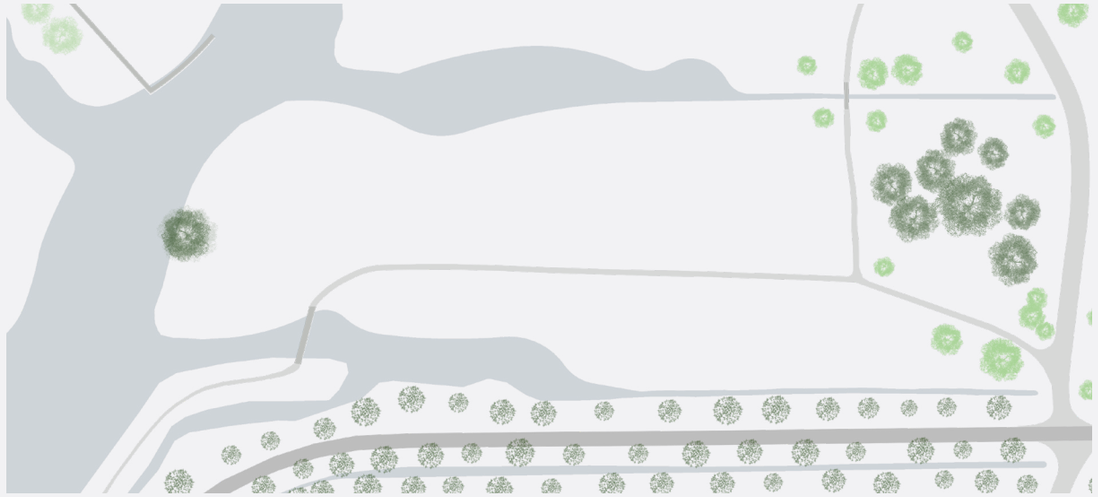
Water Influence

Normal / dry situation
60 mm per hour of precipitation
90 mm per hour of precipitation

Just as reflected by the height map on the left page, many parts of the peat soil will be flooded during heavy precipitation. With the current water level in mind during normal heavy rain (25mm per hour) would keep the land dry, only raising the groundwater level. This means that the land will become soggy and wet, so walking will not be possible anymore. With more rain, such as 60 or 90 mm per hour more parts of the land will be flooded. It is important to acknowledge the fact that in the future the groundwater level will rise and so will the consequences of heavy precipitation on the land.

figure 68 - Water influence on site

Greenery



Existing trees

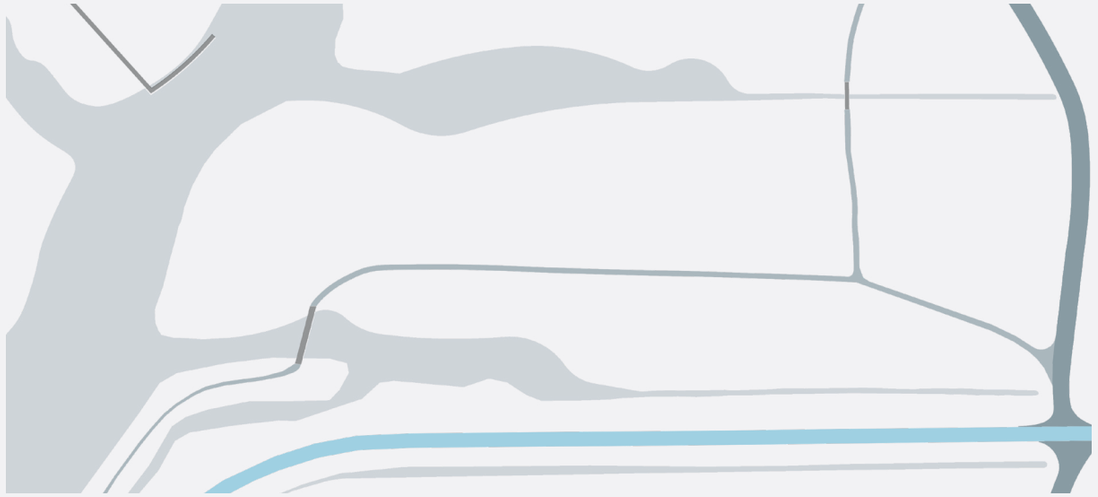
Willows

Newly planted trees

On the plot itself is a group of trees, which has been there since at least 1877 (see also the map on page 29) Furthermore, new trees are planted on the tidal-inversion ridge in the masterplan to shelter the newly built structures. The bicycle road is lined with willow trees, which also function as a production of willow branches, that are stored and processed in the transshipment point. The surface level is almost completely covered with grass, except the roads.

figure 69 - Greenery on the site

Paths



Car accessible roads

Bridges or elevated paths

Pedestrian paths

Bicycle Lane

The main access to the site is the bicycle lane and the main road on the ridge. This road on the ridge is car accessible, but only in case of emergency, moving houses, or supplying the building. As a secondary road the pedestrian paths are connected to the main access systems, and allow the houses to be placed further off the roads.

figure 70 - Pathways around the site

Scale Model

figure 71 - Scale model

Bibliography

1. WOS, "Historische windas opgebouwd langs Vlaardingervaart," February 24, 2023, https://wos.nl/nieuws/artikel/historische-windas-opgebouwd-langs-vlaardingervaart.

2. Epko Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolder* (Stichting Midden-Delfland is Mensenwerk, 2010), 5-6.

3. "John Kester & Zn. | Aannemersbedrijf uit Schipluiden," John Kester & Zn., June 1, 2021, https://johnkester.nl/.

4. Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolde*r, 9–11.

5. Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolde*r, 21–27.

6. Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolde*r, 17–18.

7. Bult et al., *Historie En Landschap van de Holierhoekse En Zouteveense Polder En de Noord-Kethelpolder*, 18–19.

8. waterwegwijzer, "Vlaardingen - Delft," March 25, 2010, http://www.waterwegwijzer.nl/OpenLayers/appl/route/RouteVlaardingenDelft.pdf.

9. ZUS [Zones Urbaines Sensibles], Flux, and Sweco, *National Productive Park Delftland*, 2022, 30, https://www.tudelft.nl/en/2022/tu-delft/five-future-strategies-for-the-dutch-delta-in-2120.

10. KNMI, "Extreme Neerslag: Veelgestelde vragen over extreme neerslag in Nederland," n.d., https://www.knmi.nl/kennis-en-datacentrum/uitleg/extreme-neerslag.

List of Figures

02 - Site Analysis

Hospitable Movement

2024

Jasper Sterrenburg

TU Delft

Advanced Housing Design